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Towards a maintenance-based approach to mode shift: Comparing two cases of Dutch cycling policy using social practice theory

Matthew Bruno[a,b,*], Anna Nikolaeva[b,c]

[a] Department of Industrial Engineering & Innovation Sciences, Eindhoven University of Technology, Eindhoven, the Netherlands
[b] Copernicus Institute of Sustainable Development, Utrecht University, Utrecht, the Netherlands
[c] Department of Geography, Planning and International Development, University of Amsterdam, Amsterdam, the Netherlands

1. Introduction

The transition to sustainable transportation systems has become an important element of long term transportation planning (Bertolini et al., 2008; Miller et al., 2016; Schiller and Kenworthy, 2017). The policies behind this goal often focus on investing in programs intended to change people's attitudes towards sustainable transportation with the belief that this will lead people to drive less and use sustainable modes of transportation more (Domarchi et al., 2008; Kormos et al., 2015; Stradling et al., 2000; Vredin Johansson et al., 2006; Young and Caisey, 2010).

This approach has been criticized by scholars using social practice theory (SPT) (Shove, 2010; Strengers and Maller, 2014). SPT posits that practices are complex and that more than a change in attitude is necessary to alter them (Evans, 2012). Scholars that acknowledge this complexity have argued that change can be achieved through more comprehensive policies that support all the different elements of a practice: materials, meanings and competencies (Evans, 2012; Spotswood et al., 2015; Watson, 2012). This, however, is still difficult, as practices are interlinked, which makes them very hard to change. For example, many people who drive have multiple appointments scheduled close together. They may develop a positive attitude about alternative forms of transportation as well as relevant skills ('meaning' and 'competencies' in the language of SPT), but actually using them would require making difficult adjustments to other activities such as shopping, childcare, social activities, etc. (Berg and Ihlström, 2019; Jeekel, 2011).

Previous studies that applied SPT to sustainability transitions have focused exclusively on cases where the goal is to *replace* a less sustainable practice with a more sustainable one (Cass and Faulconbridge, 2016; Hargreaves, 2011; Sahakian and Wilhite, 2014; Verbeek and Mommaas, 2008; Watson, 2012); in the field of transportation, that has often translated into focusing on how driving can be substituted by cycling (Bjørnaråa et al., 2019; Dill and Carr, 2003; Rowangould and Tayarani, 2016). Our proposition is to use SPT to focus on the possibilities for *maintaining* sustainable practices and thus reducing the number of people that change from a sustainable practice to a less sustainable one. This means articulating a new approach for achieving a mode shift for sustainability purposes, an approach that could compliment the current change based efforts. This shift would occur by reducing the number of people that changed from cycling to driving, for instance as the result of a life event such as a new job, marriage, the birth of a child, or retirement or due to a deterioration of cycling conditions.

The application of this approach might not only bring about an increase in the percentage of people cycling, it would also allow for investments to support existing, desired sustainable practices, ensuring that they are not lost. The alternative approach of only investing in people not currently engaged in a particular behavior means, by definition, not investing in the people who already practice the desired behavior. This approach seems to assume that the existing practices are not vulnerable to change. Yet they are, as, for example, research on the decline of cycling in Europe (Oldenziel et al., 2016) or substitution of walking and using public transit with ride-hailing in the US demonstrates (Clewlow and Gouri, 2017). Our proposed approach to mode shift focusing on *maintenance* of sustainable mobility practices puts this vulnerability and possibility of change at the center of planning sustainable transitions. As the concepts of recruitment and defection are well established elements of SPT (Herington et al., 2017; Shove et al., 2012; Strengers and Maller, 2014; Watson, 2012), using the theory to argue for a focus on the maintenance of existing practices does not require further expanding or developing SPT, but rather giving attention to already present but overlooked elements of the theory as they relate to sustainable transportation goals.

To support our argument, we use the case of cycling in the Netherlands. With over a quarter of all trips made by bicycle, the Netherlands has the highest rate of cycling in the world (Harms and Kansen, 2018). The cycling rates across different ages, however, are not evenly distributed. Children, teenagers, and young adults cycle at much higher rates than middle-aged and older adults, with teenagers between the age of 12 and 19 biking an average of 2000 km a year, double the average of adults in the Netherlands (Centraal Bureau voor de

* Corresponding author at: Department of Industrial Engineering & Innovation Sciences, Eindhoven University of Technology, Eindhoven, the Netherlands.
E-mail address: m.j.bruno@tue.nl (M. Bruno).

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Statistiek, 2015). Thus, in this case the majority of people engage in a sustainable practice from a young age but many move to the less sustainable practice of driving at a later age. If more people maintain their cycling practices instead of changing to driving practices, the ratio of driving to cycling will shift in favor of cycling.

Drawing on two national Dutch cycling policy programs that illustrate two different possible approaches to a mode shift in favor of cycling, we argue that investments in a maintenance-based approach also have the potential to contribute to achieving the modal split goals seen in change-based approaches. Specifically, we compare the Bicycle Master Plan, a comprehensive national investment in cycling promotion that took in place in the Netherlands from 1991 to 1997, and With the Bicycle Less Congestion, a Dutch national program to develop bicycle highways near congested roads that lasted from 2006 to 2009.

While the first program, the Bicycle Master Plan, took a broad approach and considered any element that would improve the chance of increasing cycling rates over the long term, With the Bicycle Less Congestion invested all of its resources in a very specific approach: promoting a shift from driving to cycling by targeting people driving on congestion prone routes and investing in changes that might encourage them to change their behavior and choose to cycle instead.

The contribution of this paper is thus twofold. First, we contribute to the scholarship on sustainability and behavior change that uses SPT with the goal of advising policy-makers. Drawing on the strengths of SPT postulates, we propose that the implications of focusing on the maintenance of sustainable practices has thus far not received attention. This maintenance-based approach could apply to any situation in which a large number of people have a sustainable practice but might change to an unstainable practice (areas with high levels of cycle or transit ridership, for example).

Second, we contribute to the debate on transitions to sustainable transportation by articulating a new approach to achieving mode shift, providing a broader understanding of the policy options available. We do not suggest that no investments should be made in encouraging people to move from driving to cycling; rather, we argue that the maintenance of sustainable transportation practices represents an approach missing from the policy toolkit that could complement and support current investments.

In the sections that follow, we will describe how social practice theory has been applied to sustainability transitions, with a specific focus on cycling. We will give a brief overview of the two Dutch national cycling policies that we will be using as case studies to illustrate our argument. We will then discuss the two policies in relation to social practice theory to show how the two policies reflect two different approaches to mode shift, one based on maintenance and the other on change. Finally, we will conclude with a discussion section that relates some of the limitations of our approach as well as the potential implications and applications of our findings.

2. Research design and methodology

Our article compares With the Bicycle Less Congestion with the Bicycle Master Plan. Rather than evaluating these two cycling policies based solely on outcomes, we analyze both policies through the lens of SPT and compare them to illustrate an approach to mode shift that is supported by existing SPT concepts but has not received attention in the literature that applies SPT to the transition to sustainable transportation systems.

The analysis is based on government documents, consultant reports, and contemporaneous statements from project supporters and detractors. The majority of these documents are in the Dutch language. For the Bicycle Master Plan, this includes three comprehensive reports produced by the Ministry of Transport, Public Works and Water Management: one states the policy of the Bicycle Master, the second evaluates the program, and the third documents what had been accomplished after its conclusion. The analysis of With the Bicycle Less Congestion is based on a government commissioned study conducted by a transportation consulting company that sought to predict the effects of the program, as well as supporting material from project partners that detailed goals, budgets, and implementation plans. We have also gathered and used critiques and commentary on the projects that have been published in Dutch language journals. The references lists the original Dutch names of all the documents consulted along with English translations.

3. Social practice theory and transitions to sustainable transportation

3.1. Social practice theory on behavior change

A transition to sustainable forms of transportation requires changes in people's travel behavior. Over the past two decades, several systematic reviews have been conducted on the effectiveness of various interventions intended to encourage people to switch from driving to more sustainable forms of transportation such as walking or driving (Ogilvie et al., 2004; Pucher et al., 2010; Scheepers et al., 2014; Yang et al., 2010). New approaches have also been articulated, including life oriented travel behavior research that looks at the long term interdependency of life choices and transportation choices (Zhang and Van Acker, 2017) and mobility management campaigns that can include a broad array of approaches form congestion charges to providing personal assistance in the development of individual travel plans (Hiselius and Rosqvist, 2016).

The major contribution of social practice theory (SPT) to this debate on behavior change and transitions to sustainability has been in proposing an alternative to the so-called “ABC framework” of social change as Shove (2010) has labeled it, with ABC standing for attitude, behavior and choice. As summarized by Shove (2010), the ABC framework, based on theories of planned behavior, assumes that social change depends on promoting *attitudes* that will lead to a set of desired *behaviors* that an individual will *choose* so long as key barriers are removed. SPT offers a critique of this behavior change model, arguing that instead of focusing on individual behavior and individual action, transitions to sustainability require focusing on socially shared practices defined as.

a routinized type of behavior which consists of several elements, interconnected to one other: forms of bodily activities, forms of mental activities, ‘things’ and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge. (Reckwitz, 2002, p.249, as cited in Strengers and Maller, 2014).

While the debate over how to conceive of these particular elements of social practice continues, many scholars use the framework developed by Shove et al. (2012) that describes three primary elements that constitute a practice: meanings (ideas, aspirations, values and symbolic interpretations); competences (shared abilities and practical knowledge); and materials (physical things, including technologies, objects and infrastructure) (Strengers and Maller, 2014). These concepts become the foundation for understanding the dynamics of social practices, including their development and change over time (Reckwitz, 2002; Shove and Pantzar, 2007; Shove et al., 2012). In particular, the complexity of practices as comprised of meanings, materials and competencies, means that more than a change in attitude is necessary to alter them (Evans, 2012; Genus and Jensen, 2019; Shove, 2010). Accordingly, SPT scholars suggest that the most effective focus for a policy oriented towards behavior change is an examination of “the social and collective organization of practices – broad cultural entities that shape individual's perceptions, interpretations and actions within the world” (Hargreaves, 2011, p. 79).

Taking cycling as an example, this means that understanding the practices of cycling requires an understanding of the “actions, habits and routines of daily experience” (Watson, 2012, p. 490) of those who cycle. It also requires an understanding of the material elements involved with the practice, including bicycle paths, bicycle repair shops,

and the bicycle itself, among others. These elements of meanings, materials, and competencies are certainly not identical for each individual cyclist, but have wide differences across time and location and can even vary between specific instances of cycling by a single individual. Taken collectively, however, a diverse set of performances of cycling can reveal patterns that provide insights into the practice of cycling and how that practice may be likely to change (Watson, 2012).

According to SPT, a social practice grows when more people are recruited into it than defect from it and declines when more defections occur than recruitments (Shove et al., 2012). This process of defection has received limited attention in studies of mode shift by SPT scholars, as we will discuss in the next section. For our argument, however, this process becomes central as we propose to shift the focus from *change* to *maintenance* in the debate on sustainable transitions and modal shift.

3.2. Social practice theory, sustainability transitions and Cycling

Cycling policy and practice and in the context of transitions to sustainable mobility has been a subject of analysis for a number of SPT scholars. In applying SPT to developing policies designed to increase cycling rates, previous research shares a common approach: examining the meanings, materials, and competencies of the people engaged in the practice of cycling to understand which interventions will be the most effective. Rather than starting with traffic counts or engineering principles, the literature that applies SPT to cycling begins with a statement of the need to understand the performance of cycling as an embodied practice of the people who engage in it. In this paper we draw on the major insights from this literature, yet propose a novel approach that addresses the gaps in the debate. This section provides a brief overview of research that has explicitly addressed the relevance of social practice theory to encouraging cycling as a form of sustainable transportation and describes the connections between their work and our central argument.

Watson (2012) has linked SPT with cycling in order to provide an overview of the types of interventions that support a transition to sustainable transportation systems. Watson frames the rise of the automobile and the decline of cycling as a process of recruitment and defection, with the two modes competing over the same limited resources of time, space and money. Watson (2012) is not arguing that declines in cycling are solely responsible for the rise of automobility, but rather argues that understanding transport as an interconnected system involving bundles of practice allows for points of intervention to be identified that can increase recruitment towards more sustainable forms of transport. We build on this argument, but, unlike Watson (2012), we focus specifically on the how the retention or maintenance of cycling practices can create a mode shift in favor of sustainable transportation.

Shove (2012) does focus on retention, yet she focuses on a context where cycling is marginal. She examines the way that cycling challenges the traditional narrative of innovation by being a transportation technology that many predicted would disappear and yet endures through the practices of cyclists in areas that terms “pockets of persistence” – countries and cities where cycling is no longer practiced by the majority of people but still survives as an active practice among a subset of the population (p. 372). We build on this concept by describing how a transition to a sustainable transportation system can be achieved in a country where cycling is still practiced by the majority of people.

Spotswood et al. (2015) directly employ SPT as a tool for exploring ways to increase cycling rates in the United Kingdom. Noting that the cycling rate has held steady at 2% in the United Kingdom in spite of a large amount of money invested in programs targeting voluntary behavior change at an individual level, they suggest the use of SPT as an alternative approach for both understanding and potentially creating social change. The authors examine not only how the individual components of practices reveal barriers to cycling, but also how these components both have direct connections with each other and are interlinked with the practice of driving: thus, for instance, reducing auto speed limits changes the efficiency meanings attached to driving while increasing the sense of competency for people on bicycles afraid of fast moving traffic. The authors suggest “a range of coordinated legislation, infrastructure, policy and marketing interventions may be required for reconfiguration of utility cycling practice” (Spotswood et al., 2015, p.30) and that employing SPT approach to analyze current cycling practices could help “intervention managers to produce a complex but rigorous web of interrelating factors which can form the basis for a multi-layered behavior change strategy” (ibid). The conclusions are drawn from two studies conducted in the UK, a country with currently low average cycling rates. Our paper draws directly on these conclusions, but applies them to a country with high cycling rates where the practice of cycling may need to be supported but not necessarily reconfigured.

Finally, Larsen (2017) has used SPT to examine a city with high cycling rates in detail, describing the materials, meanings, and competencies that allow cycling practices in Copenhagen to thrive. The article focuses on the complex relationship between existing user practices and the steps taken by planners in the city to recruit people into the regular performance of cycling practices. We examine a country with high levels of cycling and describe the interaction between planners and cyclists across two different policies, but we place our focus on avoiding the defection of existing practitioners rather than on the recruitment of new practitioners.

4. Two dutch national bicycle policies: An overview

In this section we discuss two specific Dutch national programs in the domain of cycling to demonstrate, how a focus on *maintaining* existing cycling practices can help achieve transportation sustainability goals. The first, the Bicycle Master Plan (‘Masterplan Fiets’ in Dutch) was a 32.6 million guilder (approximately 14.8 million Euros) project implemented over seven years in the 1990's to reduce the projected growth in car traffic (Directorate-General for Passenger Transport, 1998). The second, With the Bicycle Less Congestion (‘Met de Fiets Minder File’ in Dutch) had a budget of 31 million Euros over three project stages and was started in 2006 as part of a larger set of congestion reduction strategies (Van Boggelen, 2010). Both of these plans were funded and administered at the national level (Directorate-General for Passenger Transport, 1999; Van Boggelen, 2010). Because bicycle planning in the Netherlands moved largely to the provincial and local level after the Bicycle Master Plan (Ministry of Transport Pubilc Works and Water and Management, 1992), these two projects both reflect what were viewed as a national priorities in cycling policy at the time of their development. Comparing them reveals changes in how the national government approaches cycling policy. While these programs had very similar goals, they developed through different processes and measured their success in different ways. The following section provides an overview of the purpose, development, and implementation of each program (for a summary of the key elements of each program, see Table 1).

4.1. The bicycle master plan

4.1.1. Project background

In 1996, a planned decentralization process began throughout the Dutch government, and one result of this was that provinces and regional entities became responsible for how money would be allocated to bicycle projects (Directorate-General for Passenger Transport, 1997). In September of 1990, in anticipation of this decentralization process, the national government of the Netherlands, under the authority of the Ministry of Traffic and Water Management, formed a project group called Bicycle Master Plan (Directorate-General for Passenger Transport, 1997). The purpose of this group was to encourage provincial and local governments, businesses and institutions, public transportation companies, and national ministries to integrate cycling

Table 1
Summary comparison of the Bicycle Master Plan and With the Bicycle Less Congestion.

	Bicycle Master Plan	With the Bicycle Less Congestion
Time Period	1991–1997	2006–2009[1]
Project Leader	Dutch Ministry of Traffic and Water Management	Dutch Ministry of Traffic and Water Management
Budget	14.8 million Euros	31 million Euros
Goal	A 30% increase in the number of kilometers travelled by bicycle	Reduce highway congestion by 5% in congested areas
Implementation Strategy	112 projects across 4 broad categories: research, pilots, policy and information exchange	Improve bicycle routes between 5 city pairs with high levels of congestion

[1] The initial project evolved into a still active platform that supports the implementation of cycle highways.

policies into their plans and programs. (Directorate-General for Passenger Transport, 1997). More specifically, the project group wanted to make sure that cycling policy, even after it was decentralized, would still receive sufficient attention at other levels of government to make a significant contribution to the goal that the government set in 1986 to reduce the projected growth in car traffic by 50% (Ministry of Transport Pubilc Works and Water and Management, 1992). The Bicycle Master Plan lasted from 1991 to 1997 and during those six years implemented 112 separate bicycle projects (Directorate-General for Passenger Transport, 1997).

4.1.2. Project structure

The structure of the Bicycle Master Plan was relatively simple. The project was directed by a project leader who oversaw the work of a project group. The project group consisted of people with an experience in policy formation from a variety of different departments within the Ministry of Traffic and Water Management. While the ministry was ultimately responsible for determining which projects to implement, they also relied on feedback from a much larger committee made up of members of a wide variety of bicycle interest groups. This committee consisted of representatives from 13 different organizations (Table 2).

These different organizations were particularly active in the early years of the project, providing advice on how the policies and projects formulated by the ministry could obtain the broadest level of support possible (Directorate-General for Passenger Transport, 1997).

4.1.3. Project goals

The initial policy document for the Bicycle Master Plan stated the following as the central goal of the project: “Promote the use of the bicycle while simultaneously increasing the safety and attractiveness of that bicycle use” (Directorate-General for Passenger Transport, 1998, p.15). This single sentence demonstrates a commitment to both new and current users of the cycling system and is stated broadly enough to allow for a wide variety of projects under the policy.

This potential for project diversity was realized in the 112 projects that were ultimately implemented under the Bicycle Master Plan. These projects were broadly categorized as 31 research projects, 41 pilot and model projects, 18 projects related to policy development and 22 information exchange projects (Directorate-General for Passenger Transport, 1997). These projects formed the means by which the policy planned to achieve its stated goal of a 30% increase in kilometers travelled by bicycle between 1986 and 2010 (Directorate-General for Passenger Transport, 1998).

4.1.4. Evaluation

The Bicycle Master Plan project group was formed in 1990 with a goal of completing all of the proposed projects by the end of 1994. The project was ultimately extended until 1996 with the focus in the final year of evaluating the results and communicating them with all of the stakeholders involved (Directorate-General for Passenger Transport, 1997). Both the long term nature of the plan and the diversity of the projects that came under it make providing a simple evaluation of its outcomes difficult. The final report detailing the results listed both the gains that had been made through the project, including the development of new best practice concepts through the research and the successful implementation of approximately half of the pilot projects, and the challenges that still remained, including the integration of bicycle policy with long term city planning goals, the incorporation of bicycle parking with new and existing buildings, and the optimization of public transport and cycling, including improved bicycle parking at bus stops (Fig. 1) (Directorate-General for Passenger Transport, 1999). Throughout the period of the Bicycle Master Plan, cycling rates in the Netherlands remained relatively stable, with the average Dutch adult cycling approximately 2 km per day in both 1990 and 1996 (Van Goeverden and Godefrooij, 2010).

Although cycling rates in this period did not rise substantially, the evaluation produced at the end of Bicycle Master Plan concluded that the project had had a measurable effect on the support Dutch cities provided to cyclists. A consulting group selected 19 Dutch cities of varying size across the Netherlands and reviewed their approach to promoting bicycle use before and after the Bicycle Master Plan. The review found that 16 of the 19 cities were now putting more of a focus cycling policy, including ensuring integrated cycle path networks and developing plans to actively encourage cycling. None of the cities had reduced the amount of attention they gave to cycling (Directorate-General for Passenger Transport, 1998).

4.2. With the bicycle less congestion

4.2.1. Project background

In 2006, the Dutch national government took on a new role in the funding and development of bicycle infrastructure when the Ministry of Traffic and Water Management began the program Congestion Proof (Fileproof in Dutch). The program was created to develop a series of measures that could potentially reduce congestion within a relatively short period of time. The ideas came from government workers, organizational and societal partners of the government, and 16,000 suggestions sent in from readers to the Dutch newspaper *De Telegraaf*. Ultimately, between its inception in 2006 and its conclusion at the beginning of 2009, Congestion Proof implemented 40 different programs intended to reduce congestion (Eurlings, 2009).

One of these programs was With the Bicycle Less Congestion. Developed in cooperation with the Dutch Cyclists' Union, the program focused on developing and improving bicycle routes parallel to highways in order to increase the number of people choosing to bicycle for trips between 5 and 20 km. (Van Boggelen, 2010).

4.2.2. Project structure

The project began in 2006 with the ministry and the Dutch Cyclists' Union selecting five city pairs where the routes between the cities had a high level of congestion. The government then invested in improving these routes for cyclists, building new bike lanes and improving existing ones as well as improving wayfinding signage and reducing spillover traffic from the highway along the bike routes (Fig. 2) (“Over Fiets filevrij,”, 2017).

4.2.3. Project goal

With the Bicycle Less Congestion had a specific policy objective. The

Table 2
Overview of the groups participating in the Bicycle Master Plan consulting committee.

Bicycle Master Plan Consulting Committee Groups[a]		
Dutch Name	English Translation	Group Description
Advocacy Groups		
ENFB (Echte Nederlandse Fietsers Bond)	The Dutch Cyclists' Union	The national advocacy organization for cyclists' interests in the Netherlands, currently known as the Fietsersbond.[b]
ANWB (Koinklijke Nederlandse Toeristenbond)	Royal Dutch Touring Club	A Dutch advocacy organization focused broadly on mobility with a particular focus on supporting people travelling on vacation or recreationally.[c]
SLF (Stichting Landeljik Fietsplatform)	The Foundation for a National Bicycle Platform	A not for profit organization that works with other bicycle advocacy groups to advance the interests of recreational cyclists.[d]
Stichting Fiets!	The Bicycle Foundation!	A non-profit organization that works with consumers and bicycle dealers, certifying bicycle dealers according to standards intended to protect the consumer.[e]
VVN (Veiligverkeer Nederland)	The Dutch Traffic Safety Group	A social organization supported by the government, private companies and volunteers that focuses on improving traffic safety.[f]
Industry Groups		
RAI (Rijwiel en Automobiel Industrie)	The Bicycle Section of the Dutch Union for the Bicycle and Auto Industry	The bicycle section of a lobbying group for manufacturers and importers of vehicles.[g]
BOVAG (Bond van Automobielhadelaren en Garagehouders	The Union of Auto Dealers and Repair Technicians	A general mobility organization that certifies repair shops and other businesses as well as lobbying for the concerns of the businesses it represents, including bicycle sellers.[h]
NCBRM (Nederlandse Christelijke Bond van Rijwiel- en Motorhandelaren)	The Dutch Christian Union of Bicycle and Motorcycle Dealers	An advocacy organization for sellers of bicycles and motorcycles that merged with the bicycle section of BOVAG (Union of Auto Deals and Repair Technicians) in 2003.[i]
NS (Nederlandse Spoorwegen)	The Dutch Railway Company	The company that operates the Dutch train services, including bicycle parking at stations.[j]
VSN (Verenigd Streekvervoer Nederland)	The Union for Regional Transportation	A holding company whose 10 different bus companies, at the time of the Bicycle Master Plan, had a 92% market share of public bus service in the Netherlands.[k]
Fipavo (Fietsparkeervoorzieningen)	The Union of Bicycle Parking Manufacturers	An industry advocacy group focused on the interests of companies that provide bicycle parking in public spaces.[l]
Governmental Groups		
VNG (De Vereniging van Nederalndse Gemeenten)	The Union of Dutch Municipalities	A group that includes every municipality in the Netherlands and that focuses on sharing knowledge between muncipalities, lobbying for municipal interests, and providing services to muncipial administrators.[m]
IPO (Interprovinciaal Overleg)	The Inter-province consulting group	A group that advocates for the concerns of the Dutch provinces and their partners and stakeholders, both nationally and with the European Union.[n]

[a] Directorate-General for Passenger Transport, 1997
[b] Fietsersbond, 2020. Wat hebben wij bereikt? [What have we achieved?] [WWW Document]. URL https://www.fietsersbond.nl/ons-werk/wat-hebben-we-bereikt/ (accessed 3.28.2020).
[c] ANWB, 2020. Over ANWB [About ANWB] [WWW Document]. URL https://www.anwb.nl/over-anwb(accessed 3.28.2020).
[d] Stichting Landelijk Fietsplatform, 2020. Over het Fietsplatform [About the Bicycle Platform] [WWW Document]. URL https://www.fietsplatform.nl/over-het-fietsplatform (accessed 3.28.2020).
[e] Stichting FietsNL, 2020. Visie & Missie [Vision & Mission] [WWW Document]. URL http://www.fietsnl.nl/pagina/Visie_&_Missie (accessed 3.28.2020).
[f] Velig Verkeer Nederland, 2020. Over Velig Verkeer Nederland [About Safe Traffic Netherlands] [WWW Document]. URL https://vvn.nl/over-veilig-verkeer-nederland (accessed 3.28.2020)
[g] RAI, 2020. Over RAI Vereniging [About the RAI Association] [WWW Document]. URL https://www.raivereniging.nl/over-ons (accessed 3.28.2020).
[h] BOVAG, 2020. Over Bovag [About BOVAG] [WWW Document]. URL https://www.bovag.nl/over-bovag (accessed 3.28.2020).
[i] BOVAG, 2003. Wim van Vliet nieuwe voorzitter BOVAG afdeling tweewieler [Wim van Vliet new chairperson of the BOVAG bicyle devision] [WWW Document]. URL https://www.bovag.nl/archief/persberichten/2003/wim-van-vliet-nieuwe-voorzitter-bovag-afdeling-twe (accessed 3.28.2020).
[j] NS, 2020. NS Organisatie [NS Organization] [WWW Document]. URL https://werkenbijns.nl/over-ns/ns-organisatie/ (accessed 3.28.2020).
[k] Trouw, 1996. Jorritsma wil monopolie vervoersmoloch Verenigd Streetkvervoer Nederland breken [Jorritsma wants to break the monopoloy of transport juggernaut VSN] [WWW Document]. URL https://www.trouw.nl/nieuws/jorritsma-wil-monopolie-vervoersmoloch-verenigd-streekvervoer-nederland-breken~b22295cc/?referer=https%3A%2F%2Fwww.google.com%2F (accessed 3.28.2020).
[l] Vereniging Straat Meubilair, 2020. Over ons [About us] [WWW Document]. URL https://straatmeubilair.org/over-ons/ (accessed 3.28.2020).
[m] VNG, 2020. Vereniging [Association] [WWW Document]. URL https://vng.nl/rubrieken/vereniging(accessed 3.28.2020).
[n] IPO, 2020. Over het IPO [About the IPO] [WWW Document]. URL https://ipo.nl/over-het-ipo (accessed 3.28.2020).

goal was to bring about a 5% reduction in highway congestion by improving the bicycle infrastructure near congested areas. The project leaders initially identified five routes with a high potential of commuter trips under 15 km. The congestion reduction could be achieved by convincing people who drove on these routes to bike instead, potentially reducing congestion in the process (Muconsult, 2007).

4.2.4. Evaluation of with the bicycle less congestion

In 2008, the project changed its name to Bicycle Free from Congestion ('Fiets filevrij' in Dutch) (Van Boggelen, 2010). Under this name, the group evolved from developing its own projects to providing project support when funding became available for new cycling highways ("Over Fiets filevrij,", 2017). For example, in 2016 the Bicycle Free from Congestion platform worked with the Ministry of Infrastructure and Water Management to organize discussion sessions with local and regional groups working on cycle highways. The discovered that a majority of the participants found financing to be a major obstacle in implementing their bicycle highway plans (Bot et al., 2016). In 2018, the Ministry of Infrastructure and Water Management dedicated an additional 100 million Euros to support bicycle highway and station

Fig. 1. The Bicycle Master Plan looked at a wide variety of cycling related issues, including how to improve bicycle parking at bus stops. Photo by the author.

bicycle parking projects (Rijksoverheid, 2018a).

Two years after the inception of With the Bicycle Less Congestion, an initial evaluation determined that the new infrastructure resulted in 1% of the drivers along the congested route switching to cycling, much lower than the target goal of 5% (the calculation of this 1% mode switch has been challenged based on its low sample size). Even accepting the 1% change in practices, the effect on congestion reduction was so low as to be within the margin of error (Van Boggelen, 2010). Cycling levels on a whole did rise during the period of With the Bicycle Less Congestion, but they continued along a trend of gradually increasing cycling rates in the Netherlands, with the average percentage of short distance trips (up to 7.5 km) taken by bicycle having risen from 31% to 34% between 2000 and 2016 (Rijksoverheid, 2018b).

5. Comparative analysis of the bicycle master plan and with the bicycle less congestion

While the Bicycle Master Plan took a broad approach and considered any element that would increase the chance of increasing cycling rates over the long term, With the Bicycle Less Congestion invested all of its resources in a very specific approach. It has promoted a shift from driving to cycling by targeting people driving on congestion prone routes and investing in changes that might encourage them to change their behavior and choose to cycle instead. The difference between the Bicycle Master Plan and With the Bicycle Less Congestion does not simply represent a difference in focus, however. Interpreting the policies through the lens of social practice reveals key differences between an approach focused exclusively on change and one that includes the maintenance of existing practices and demonstrates the potential value of the latter. This section discusses differences in how each program considered the practice of cycling in terms of materials, meanings, and infrastructure; how those differences led to differing formulations of project goals; and how those goals reflect a fundamentally different approach to mode shift.

Fig. 2. This high-speed cycling route between Utrecht and Breukelen was one of the five routes constructed under With the Bicycle Less Congestion. Photo by Henk-Jan Dekker; used with permission.

5.1. Differences in developing an understanding of the elements of Cycling practice

Given that an understanding of the complexity of practices and the diverse elements that comprise them is at the core of SPT, any policy focused on behavior change would have to have a means of acquiring knowledge about this diversity in order to be effective. This attempt to understand the practice of cycling in all its diversity is well reflected in the Bicycle Master Plan. The governance structure of the Bicycle Master Plan that provided advice and consultation on the proposed projects involved 13 different organizations, each representing aspects of the meanings, materials or competencies associated with cycling (see Table 1). For example, the material elements of cycling were represented not only by the government agencies that would fund the infrastructure, but also by interests groups representing the business that sold bicycles, repaired bicycles, and provided bicycle parking. Each of these groups would be likely to have insights into the competencies of their clients and how particular investments could support the practices that sustained their businesses. Similarly, people who cycle were not represented by only one advocacy group, but rather four different cycling advocacy groups, allowing for a diversity of perspectives from cyclists through a diverse set of representation on which meanings, materials and competencies associated with cycling deserved attention.

While the Bicycle Master Plan attempted to increase cycling rates by spreading its investments throughout a wide range of projects that intersected with a broad array of elements from the cycling system, the infrastructure developed by the With the Bicycle Less Congestion did not reflect this same degree of complexity in developing an understanding of the practice of cycling. With the Bicycle Less Congestion isolated a single element, the state of bicycle infrastructure near congested highways, and relied on this as its only mechanism for achieving its modal change goal. The focus on a limited group, people who drive on congested roads, seems to have carried over into the resulting infrastructure design: straight, wide bike paths built adjacent to highways. This design reflects the principles that make automobile infrastructure effective, not cycling, as cycling rates correlate with fine grained networks of cycling infrastructure (Marshall and Garrick, 2010). Even if people who drive find the bicycle highway attractive, the policy does not address the cycling experience leading to and from the bicycle highway. It also does not take into account the particular needs of existing cyclists, as will be discussed in detail in section 4.3. The infrastructure is built around the requirements for cycling perceived to be held by people who drive but the policy does not address the bundles and complexes of linked trips made by those who drive that result in car dependency (cf Shove et al., 2015). While the Netherlands is a country of relatively high density, it has been a part of this global trend of increased individual commitments distributed over a wide area but scheduled close together. Schedules that are compressed in time and spread out over space limit people's ability to shift the mode of a single trip type, such as the commute from home to work (Jeekel, 2011).

5.2. Differences in goal formulation

The choice to involve groups that understand the practice of cycling and the systems that support it reflects the overall approach of the Bicycle Master Plan. While the goal of the project was to reduce auto use, the measurement of whether or not that goal was achieved was formulated from the perspective of cycling rather than driving. Specifically, the original policy document for the Bicycle Master Plan stated that the primary goal of the project was to achieve an increase of 3.5 billion (or 30%) kilometers travelled by bicycle between 1986 and 2010. This goal was calculated to be the equivalent of an 8.75% reduction in the total number of auto kilometers travelled (Directorate-General for Passenger Transport, 1997).

This approach meant that the achievement of the goal was not entirely reliant on people who drove shifting to cycling. The 24 year time span also allowed for the goal to be achieved by improving bicycle infrastructure so that fewer people chose to defect from their cycling practice and purchase an automobile. The shift from driving to cycling could therefore also be accomplished through a generational shift in which younger people chose to continue cycling instead of purchasing a car while older individuals drove less as a result of retirement and age related issues.

With the Bicycle Less Congestion defined its goal differently than the Bicycle Master Plan. Rather than attempting to increase the number of kilometers cycled, that stated ambition of the project was to reduce the number of mid-range car trips on the highways near the bicycle infrastructure by 5% (Van Boggelen, 2010). This project goal was reflected in the cost-benefit analysis created by the ministry responsible for With the Bicycle Less Congestion. The tool specifically assigned value to number of people who switched from driving to cycling as a result of the infrastructure, but assigned no value to the retention of existing cyclists (Van Ommeren et al., 2012).

The projects funded and implemented under the policy of the Bicycle Master Plan reflect the broad approach allowed by the governance structure and reveal an orientation towards the practices of current cyclists. Even though a modal shift from driving to cycling was one of the principal objectives of the policy, the actual projects that were implemented under this focal point demonstrate how the project considered supporting the practices of existing cyclists to be a key component of this modal shift goal. While some projects, such as research into how driving trips could be replaced by cycling trips and informational material for employers on encouraging cycling, were focused exclusively on people who currently drove, other projects listed under the modal shift goal were oriented towards simply improving the experience of those who cycled. Projects of this type included research on the economic value of bicycle traffic, research on history of bicycle use and bicycle policy; pilot projects on wind protection for cyclists, wayfinding signs, and streets where bicycles have priority; guidelines for the development of bicycle friendly infrastructure, for the maintenance of bicycle paths, and for the inclusion of local bicycle connectivity planning around transportation infrastructure projects for other modes; and information exchanges on bicycle policy both between Dutch cities and between the Netherlands and other countries interested in Dutch bicycle policies (Directorate-General for Passenger Transport, 1997).

5.3. Differences in acquiring knowledge about the target group

The different way each project had of formulating its end goal carried over into different approaches for how each project acquired the project development knowledge considered necessary to achieve that goal. Because the focus of With the Bicycle Less Congestion was on changing the behavior of drivers, the project used people who drove as the knowledge base for policy considerations. In order to determine the effectiveness of the first five bicycle highways built under the project, an online survey was conducted prior to the construction of the infrastructure that targeted people who drove along the five routes but who could have chosen to bicycle instead. The responses of this group were compared with responses from people bicycling on the route after the improvements were made.

The online survey asked respondents to evaluate 15 different hypothetical trips in which respondent could choose to travel either by bicycle or by car. The purpose of the survey was to evaluate how elements such as crossings, traffic lights, cycle path surface quality, and lighting would affect people's decision to use the bicycle route. Five thousand people responded to the e-mail but only 497 responses were ultimately used in the evaluation of the bicycle infrastructure. The preferences of many respondents were not included in the evaluation because the survey was intended only for people who mostly drove to work and could potentially either start using a bicycle or bicycle more

frequently. Therefore, a person's preferences for bicycle infrastructure would only be included if that person met the following conditions:

- They had a driver's license.
- They had a paid job.
- They lived in the area of one of the bike routes under consideration
- They sometimes drove on the highway along one of the routes under consideration
- They sometimes drove to work during rush hour.
- They had a commute that was occasionally shorter than 20 km in one direction.

If a person did not meet all of these conditions, they were not included in the survey. The largest number of participants from the survey on bicycle highways were rejected because their commute was not likely to be made by bicycle (1891 people), they did not have a driver's license (1178 people) (Muconsult, 2007).

The design and evaluation of the With the Bicycle Less Congestion program reflects its narrow definition of a transition from driving to cycling. Interpreted through the lens SPT, the survey attempts to gain knowledge about what makes the practice of cycling attractive by questioning people who do not engage in the practice and excluding the people that do. One of the challenges of encouraging people to switch to other modes is that people who do not cycle regularly often have a more negative attitude towards cycling (Namgung and Jun, 2019; Oosterhuis, 2015). Their ideas about what would be needed to bring them to cycling might not be reflective of the actual practice of cycling. Perhaps more importantly, one study showed that 95% of the people on new bicycle highways were existing cyclists (Skov-Petersen et al., 2017). By specifically excluding the vast majority of potential users from the survey, the project risks fundamentally misunderstanding what would make the infrastructure attractive to cyclists, the stated goal of the survey.

This stands in stark contrast with the Bicycle Master Plan. While the advisory committee comprised of various stakeholders may have been active primarily in the early years of the project (Directorate-General for Passenger Transport, 1997), their inclusion as part of the project structure from the beginning underscores the difference between the two projects in their approach to acquiring knowledge for policy development. The early focus on existing cycling practices in the Bicycle Master Plan, the project that focused on increasing the number of kilometers cycled, and the absence of interest in existing cycling practices in With the Bicycle Less Congestion, the project that focused on reducing congestion rates, suggests a relationship between how a project formulates its modal split goals and how it develops its policies. How a project conceptualizes model split, therefore, has implications for both theory and practice. In the discussion section that follows, we will explore these implications as well as the limitations of including a focus on practice maintenance in relation to a sustainable transportation transition, with particular attention to possible areas for further research.

6. Discussion

The starting point of this paper is the argument that the current literature does not give enough attention to the maintenance of existing sustainable transportation practices when considering how SPT theory can be applied to achieving sustainable transportation goals. Through comparing two Dutch cycling policies, we have discussed the value of the maintenance of sustainable transportation practices. In this section we consider how specifically a focus on the maintenance of practices could be developed, addressing the limitations of current conceptualizations of mode shift and defining an alternative conceptualization that includes a focus on maintenance. We then briefly discuss how this concept of mode shift could be translated into policy. Finally, we reflect on the implications of our findings outside of a specifically Dutch context and suggest possible areas of further research in relation to other countries and other modes of transportation.

6.1. Incorporating a maintenance based mode shift approach into Cycling investments

When trying to achieve mode shift goals, programs such as With the Bicycle Less Congestion focus on convincing people who drive to cycle instead – a challenging transition given the obstacles associated with car dependency (Jeekel, 2011; Oosterhuis, 2015; Shove et al., 2015). As argued by Spotswood et al. (2015) from the perspective of SPT, shifting from driving to cycling requires identifying the missing breaks in meaning, materials and competencies that create obstacles to the practice of cycling and finding ways to use policy to remove these obstacles. Changes to the cycling experience, however, will not affect people who do not cycle, and therefore may have little influence over their established practices.

By viewing the modal choice of commuters as an individual choice and by viewing a modal shift as consisting solely as a choice to stop driving and start cycling, With the Bicycle Less Congestion restricted itself to relying for its success on a group that may consist largely of car dependent people resistant to change. By viewing modal choice as part of a complex and interconnected series of practices by diverse groups of actors and by viewing modal shift as both a change from driving to cycling and a continuation of existing cycling practices over time, the Bicycle Master Plan created an umbrella program that was able to support an enormous diversity of projects under its policy framework and use the knowledge of those who actively cycle and those directly connected to the cycling system to work towards its goals.

Stated another way, With the Bicycle Less Congestion considered mode substitution only in the form of car trips that could potentially be taken by bicycle, while the Bicycle Master Plan's approach reflected a broader conceptualization of substitution formulated by Piatkowski et al. (2015) in which a person who cycles for all of their trips and does not own a car is substituting all driving trips for bicycle trips.

Because the cost-benefit analysis developed for bicycle infrastructure in the Netherlands does not factor in this latter type of substitution (Van Ommeren et al., 2017), cycling investments are evaluated based only on people who potentially may cycle rather than people who are already engaged in the practice. The cost-benefit analysis, therefore, does not allow for a calculation of the benefits of a maintenance based approach that includes a focus on improving the experience existing cyclists in order to achieve a long term increase in sustainable transportation practices. Future research could explore how this approach could be incorporated into the evaluation of cycling investments.

6.2. Possibilities for practical application of a maintenance based approach to Dutch Cycling policy

In the Netherlands, the elements of cycling practice are established by a large portion of the population at a young age. As people get older, cycling rates generally drop (Centraal Bureau voor de Statistiek, 2018). This statistical drop in cycling was confirmed by a longitudinal study on cycling habits in Netherlands that showed that people under 30 were the most likely to change from a cycling commute to a car commute (Oakil et al., 2016). A possible reason for this decline is suggested by the findings of a government report that found people's decision to purchase a car in the Netherlands is frequently paired with a major life event, such as starting a new job, having a baby, or retiring (Kennisinstituut voor Mobiliteitsbeleid, 2014).

The high cycling rate in the Netherlands, therefore, is not a result of a large number of people having chosen to give up their cars and start cycling instead, but rather the result of people who grew up cycling and who continue to do so. Since cycling rates are highest among younger people, cycling rates can also be increased (and driving rates decreased)

by lowering the number of people who shift from cycling to driving after a major life event.

Whatever the meanings, materials, and competencies that form the practice of cycling are, people who are regularly engaged in the practice of cycling, by definition, possess them. The challenge becomes determining how these elements change during transitional events that lead people to stop cycling. As the approach of the Bicycle Master Plan demonstrated, one way to meet this challenge is by bringing together as many representatives of all the diverse practices involved with the system of cycling and investing in strengthening those practices throughout the system.

The principle of social feedback (Skov-Petersen et al., 2017) suggests that people look to the experience of others when evaluating their own future experience. Improving the cycling experience for commuters that cycle between cities, people with children, or retired people, for example, increases the chances that people who already cycle will have a positive model for adapting their meanings, materials, and competencies when faced with a new commute, the arrival of a child, or their approaching retirement. Focusing on improving conditions for existing cyclists, therefore, also results in better conditions for people evaluating what their cycling experience will be like in relation to their new job, their new child, or their retirement lifestyle and this may also result in a reduction of people changing from cycling to driving. While these events take place at various points in the life cycle, this approach would not necessarily require waiting a generation to see results. If the number of people who would have started driving in a given year but continued to cycle because of an intervention is higher than the number of people who stopped driving and started cycling in that same year, the maintenance based approach would, by definition, be the one providing better short term results.

Further research would be required to determine which interventions would have the most potential at these transition points.

6.3. Adapting a maintenance based approach in other countries and for other modes of transportation

The Netherlands has a significantly higher cycling rate than other countries (European Union Economic and Social Committee, 2011). For example, in the United Kingdom, cycling trips comprise approximately 2% of all trips (Spotswood et al., 2015) and in Australia the rate is closer to 1% (Harms and Kansen, 2018) while in the Netherlands 27% of all trips are made by bicycle (Harms and Kansen, 2018). This could be one explanatory reason for the absence of scholarly attention to maintenance of sustainable transportation practices, particularly in relation to cycling.

However, while the cycling rate may be higher in the Netherlands, life events have been shown to be associated with changing cycling practices in other countries as well. A study in the United Kingdom used interviews with residents in towns with improved cycling infrastructure to show that changes in cycling were often triggered by life events (Chatterjee et al., 2013). An Australian study found that decreases in cycling rates among women were linked to many of the same events listed in the Dutch study of auto acquisition (moving to a new house, starting a new job, and having children)(Bonham and Wilson, 2012).

While the potential benefits of the maintenance of cycling practices is obvious in a country with a high cycling mode share like the Netherlands, investing in the maintenance of practices could also be of benefit in countries with a lower cycling mode share. For example, in Great Britain 1% of all vehicle miles travelled are travelled by bicycle. This 1%, however, is not distributed evenly across the population. Males made 2.5 times as many cycle trips as females and cycled 3.6 times as many miles. Across areas of Great Britain, younger age groups had higher cycling rates than older age groups (Cycling, 2019). This suggests a cycle of recruitment and defection, with a new set of younger male cyclists continuously replacing their older counterparts. While the literature on risk perception and its relationship to cycling remains limited (Wardlaw, 2014), young males have been shown to have higher risk tolerances in other transportation contexts (Hulse et al., 2018; Turner and McClure, 2003) and the decision not to cycle has been linked to perceiving cycling as a dangerous activity (Heinen et al., 2011; Manton et al., 2016). This could potentially be one explanatory factor for the growth in U.S. cycling rates coming almost entirely from men, with cycling rates for women stagnating and those for children dropping substantially (Pucher et al., 2011). To increase cycling rates, policy makers could not only focus on expanding the bicycle network along commuting routes, but also invest in making the existing network safer, decreasing the risk tolerance necessary to cycle. As bicycle safety improvements have already been shown to attract new cyclists (Noland, 1995), safety improvements would also seem likely to reduce the number of people who stopped cycling as their risk tolerance increased with age.

For example, a hypothetical city could have a stable cycling mode share of 2%, but every year have 20% of people cycling for the first time and 20% of people choosing to no longer cycle. If the number of people who chose not to stop cycling was cut in half, the city would double its cycling mode share to 4% within 7 years as 10% more people started the practice than stopped among an ever increasing active group of cyclists.

Further, a maintenance based approach to a sustainable transportation mode shift need not be limited to the practice of cycling. The argument that investing in the maintenance of sustainable transportation practices has value still holds for other modes of transport in other countries. A large body of literature exists examining the effects of programs aimed at convincing people to stop driving and take public transportation instead (Adler and Van Ommeren, 2016; Anderson, 2014; Beaudoin and Farzin, 2015; Duranton and Turner, 2011; Pang, 2017; Salon et al., 2012). While evaluating a modal shift from driving to public transportation in the context of SPT is beyond the scope of this paper, the argument made here that existing cyclists can be part of a mode shift in a country where most of the population begins cycling at a young age could potentially be used to argue for a focus on maintaining current ridership levels in a city, region or country where practices of transit use start at an early age. One key similarity between the Netherlands and the United States, England, Australia and many other countries in Europe is a trend towards acquiring a driving license at a later age (Delbosc and Currie, 2014; KiM, 2014; Le Vine and Polak, 2014; Ortar et al., 2018; Schoettle and Sivak, 2014; Thigpen and Handy, 2018) Future research could expand on an Australian study that examined the multiple reasons millennials were choosing to delay getting driving licenses (Delbosc and Nakanishi, 2017) and explore how maintenance based approaches to not only cycling but also walking, ride sharing and public transit could support the sustainable transportation practices of young adults and further raise the average age at which many young adults shift to driving.

7. Conclusion

While the existing body of literature uses SPT to discuss which policies might support a change to sustainable practices, possibilities to use SPT to understand how existing sustainable practices can be supported to further sustainability goals have not been explored. Addressing this gap, our paper articulates an approach to achieving mode shift in the direction of sustainable transportation through a focus on the maintenance of existing sustainable transportation practices.

Drawing on two national Dutch cycling policy programs that illustrate two different possible approaches to a mode shift in favor of cycling, we have argued that investing in a maintenance-based approach could contribute to achieving the modal split goals set by change-based approaches. Specifically, we compared the Bicycle Master Plan (1991–1997) to With The Bicycle Less Congestion (2006–2009). While the first program, took a broad approach and considered any element that would improve the chance of increasing cycling rates over the long

term, the latter invested all of its resources in a very specific approach: promoting a shift from driving to cycling by targeting people driving on congestion prone routes and investing in changes that might encourage them to change their behavior and choose to cycle instead.

This paper, therefore, both contributes to the scholarship on sustainability and behavior change that uses SPT with the goal of advising policy-makers and to the debate on transitions to sustainable transportation by articulating a new approach to achieving mode shift that can provide a broader understanding of the policy options available.

This maintenance-based approach could apply to any situation in which a large number of people have a sustainable practice but might change to an unstainable practice (areas with high levels of cycle or transit ridership, for example).

We do not suggest that no investments should be made in encouraging people to move from unsustainable to sustainable transportation practices; rather, we argue that the maintenance of sustainable transportation practices represents an approach missing from the policy toolkit that could complement and support current investments.

Specifically, focusing exclusively on a narrow definition of mode shift that only includes people who go from unsustainable to sustainable practices fails to take into account the potential benefits of a broader definition of mode shift, one that includes a focus on the maintenance of existing sustainable transportation practices over the whole life cycle.

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