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Planetary Boundaries

This is an unusual editorial. It is entirely concerned with one book published in 2012 called "The Human Quest" (Note 1). To say this book is important is an understatement. It is hugely important because it shows that the current trajectory of the human species on this planet is on automatic pilot with the self-destruct option initiated. This may sound rather dramatic but the book is based on a very traditional scientific analysis and a strong evidence based logic rooted in the best scientific tradition and especially Swedish scientific traditions. It is a solid, objective, scientific analysis. The book shows that there are "planetary boundaries" that should not be crossed and we have now crossed 3 of them and are in danger of crossing the remainder. The planetary boundaries are illustrated in Figure 1

The inner (green) shaded nonagon represents the safe operating space with proposed boundary levels at its outer contour. The extent of the wedges for each boundary shows the estimate of current position of the control variable. Points show the estimated recent time trajectory (1950–present) of each control variable. For biodiversity loss, the estimated current boundary level of >100 extinctions per million species-years exceeds the space available in the figure. Although climate change, ocean acidification, stratospheric ozone depletion, land-use change, freshwater use, and interference with the phosphorus cycle are boundaries defined as the state of a variable (concentration of atmospheric CO2, aragonite saturation state, and stratospheric ozone concentration, percentage of land under crops, maximum amount of global annual freshwater use, cumulative P loading in oceans, respectively), the remaining boundary, biodiversity loss,

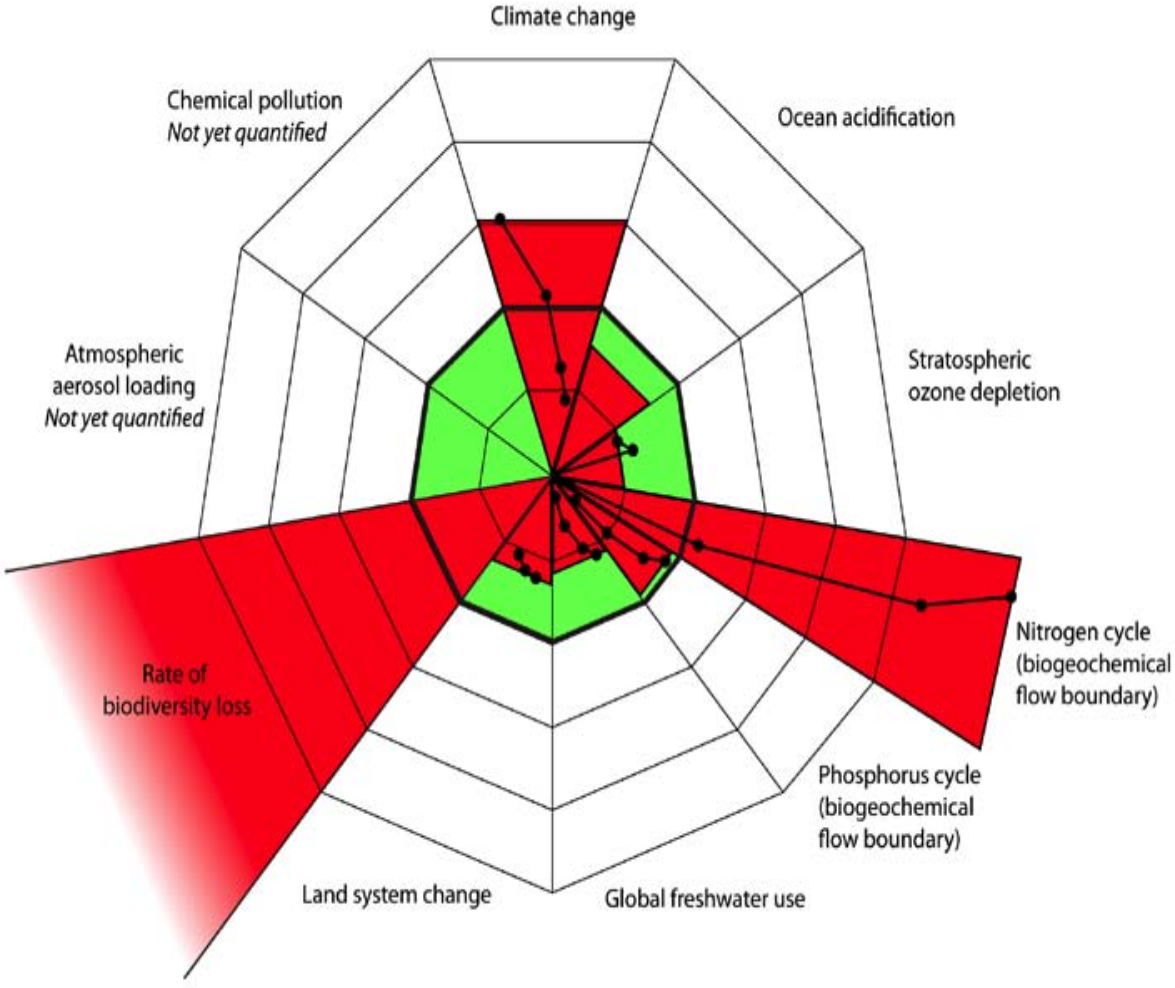

Figure 1: Planetary Boundaries
Source: http://www.ecologyandsociety.org/vol14/iss2/art32/figure6.html

and the component of the biogeochemical boundary related to the human interference with the N cycle are defined by rates of change for each respective control variable (extinctions per million species per year, rate of N2 removed from atmosphere for human use).

The planetary boundaries that we have already crossed are flagged in red and are climate change, biodiversity loss and nitrogen cycle excesses. We await further analysis and information on the other boundaries and the rate at which we approach crossing the boundary and the irreversible damage associated with this crossing.

The publicity accompanying the book emphasises the science and the need for urgent action:

> *The Human Quest combines evidence from the many scientific disciplines that reveal how planet Earth operates and the tenuous relations between the Earth system and humans. Rockström and Klum not only diagnose the problems, but also look at the opportunities and evidence supporting the transition to a sustainable future.*
>
> *"We need to find ways to 'turn' these curves away from such global risks," says Rockström, "and we need to do it now, in what may be the most decisive decade in human history. This book is about deepening the insights of our social-ecological predicament as a source of hope and innovation. We need nothing less than a great transformation of societies in the world, and I believe it is possible."*
>
> *The book highlights that action needs to be taken now.. in what may be the most crucial decade in human history. With a fundamental shift in mindset, humanity can succeed in a transition to global sustainability. The Human Quest can help turn the page to that new paradigm."*

The key messages are:

- We are the first generation to recognize that humanity has become a force capable of undermining Earth's capacity to support our prosperity.
- We live in a globalized phase of environmental change. Our economies and the world as we know it is at risk of undergoing major changes.
- We live in an interconnected world. The stability of the Earth system and its long-term capacity to support our wellbeing has become every nation's and citizen's concern. We must all manage the biosphere as a world community.
- If we keep Earth within the safe operating space of these planetary boundaries, we can all thrive. But if we push these scientifically drawn boundaries, we will trigger catastrophic events.
- Our Human Quest is to change the trajectory of negative global environmental change to support development, as humanity moves toward a population of nine billion people.

What has this got to do with transport?

We are now approaching the 20th anniversary of the journal "World Transport Policy and Practice". In these 20 years we have tracked the enormous damage on people, communities, ecology and the planet that are directly related to increasing levels of automobile dependency, distances travelled, aviation and road freight. We have published approximately 300 articles and the majority of these articles have mapped out practical, implementable strategies and proposals to deliver a sustainable future and to make sure that we do not (in this one sector) transgress planetary boundaries. Transport is a core problem in any discussion of planetary boundaries because the global trajectory is entirely in the wrong direction and every country on the planet (including Sweden) has strongly embedded cultural, professional and fiscal biases towards year on year increases in vehicle kilometres travelled, air miles used and billions of dollars and Euros spent on investments in new infrastructure. We have made it clear in almost every issue of the journal that transport policy everywhere has a deeply embedded strand of DNA that delivers more travel,

more roads, more airports and more high speed rail and is motivated by a strong sense that more is better than less, faster is better than slower and human progress depends absolutely on higher levels of mobility. We think that this is a fundamental error. More importantly still we provide a different perspective and solutions that are ready to go on a Monday morning when politicians and decision makers turn up at work and ask "what shall we do today".

We do not say that transport issues are the biggest issues that have to be addressed on the planet (hunger, poverty, war, disease, torture, violence and rape are also abominations). However if we really want to advance towards a sustainable future we do say that the transport debate is still in very poor shape with little understanding of the need to sort out our relationship with mobility, speed and distance if we are to achieve other declared policy objectives. Put very crudely we have no chance whatsoever of altering paradigms or development trajectories related to planetary boundaries if we do not sort out transport. Even more worryingly those who alert us to planetary boundary trajectories and consequences do not have a lot to offer on the Monday morning question. How do we deliver a new transport future, how do we restructure space and time to reduce vehicle numbers and distances travelled by vehicles by at least 50%? How do we reallocate transport spending to produce a better quality of life for everyone and thereby terminate the building of expensive new transport infrastructure and create a socially and ecologically just society? This is a problem for planetary boundaries especially the climate change and biodiversity boundaries. We are drowning in high quality analyses of the impact of transport on greenhouse gas emissions and the impact of transport infrastructure and fossil fuel exploitation on biodiversity. Even in the small city of Lancaster in NW England a totally useless road, under 5kms in length, costing £120 million is making its way through funding and decision making procedures towards delivery. Amongst many large, negative impacts of this road scheme is the damage it will do to an otter colony on the River Lune (Note 2 and the cover picture on this issue). Biodiversity is such a big issue that it is sometimes difficult to grasp what is going on beyond stories of pandas, polar bears and rare orchids but in Lancaster all levels of government have conspired to reduce biodiversity by ignoring the otters and contributing to habitat loss and their demise. If we scale this up to all the highway plans and high speed rail plans in China, India and Africa we can see where the big red transgressing wedge labelled "biodiversity" comes from.

In this issue of WTPP we once again focus on intelligent solutions to future transport that have the potential to shift us into a way of thinking and doing that avoids transgressing planetary boundaries. Tomas Björnsson draws attention to the urgent need for improved cycling facilities in southern Sweden that cost a small fraction of what is spent on highways. Martin Schiefelbusch shows how rural transport problems can be solved by community transport initiatives. Stephen Knight-Lenihan reveals the extent to which desirable sustainability objectives can be undermined by a lack of will at national level. His account of the situation in New Zealand will resonate strongly with the situation in many other countries. The article by Serena Kang describes a "flexible bus utility model" that has the potential to more closely match the supply of bus services with the demand for those services and thereby increase levels of use of public transport.

As always we welcome feedback on these articles and on our editorial comment.

Professor John Whitelegg
Editor

Note 1:
The book can be accessed from this site:
http://thehumanquest.org/
There is also an article describing the planetary boundaries research and this is available here:
http://www.ecologyandsociety.org/vol14/iss2/art32/

Note 2:
http://www.lancasterguardian.co.uk/news/lancaster-and-district-news/tv-star-backs-m6-link-otters-1-5133129

http://www.lancasterguardian.co.uk/news/business/m6-link-otters-hitch-1-5063345

Road congestion, vehicles emissions and the intention to use public bus services in Malaysia – A flexible bus utility model

Serena A. G. Kang, K. Jayaraman, Keng Lin Soh

Abstract:
The unreliable public transport services of the world have caused dissatisfaction among its commuters. In Malaysia, despite the hefty government subsidy, only 16% of all commuters use the public transport (Government's Performance Management and Delivery Unit, 2011). The increase in the use of private vehicles has caused road congestion and air pollution. The harmful pollutants from vehicular emission significantly impact human health and chronic diseases. This conceptual paper draws upon literature in service marketing, consumer behaviour and social cognitive theories, and the input from the experts of a public bus company. The paper suggests a flexible bus utility model that will be able to meet the variation of demand - in order to fill the gaps between service expectations, perception and satisfaction of bus commuters - to sustain and promote ridership. The bus utility model offers a likely solution to enhance bus ridership and reduce environmental emissions caused by the heavy reliance on private vehicles. The bus utility model may be customized to benefit other developing countries with similar low ridership.

Key words: Car Dependence; Demand Responsive Services; Bus Utilization; Ridership.

Governance and Ecological Sustainability: the case of transport funding in New Zealand

Dr Stephen Knight-Lenihan

Abstract
Since 2003 New Zealand's transport sector has been legally required to contribute to sustainable development outcomes, including environmental sustainability. Attempts by the state's funding agency to identify how transport could contribute to ensuring environmental sustainability have been compromised by central government's narrowing interpretation of the law. This paper explores the difficulty of embedding sound sustainability principles in a democracy lacking strong mechanisms for holding the executive to account, and suggestions are made as to how to overcome this.
Keywords: ecological assessment, sustainability, legislation, transport

Bürgerbus - German experiences in community transport

Martin Schiefelbusch

Abstract:
The paper presents the concept of "Bürgerbus", the main form of voluntary-based community transport in Germany. It sums up the history of the concept, but is mainly based on experiences made by the author during a three-year consultancy project in the German state of Rhineland-Palatinate. Core elements of a Bürgerbus are a minibus, which can be driven with a car licence, the volunteer drivers, and the local knowledge and contacts they bring into the development of the service. However, the process relies also on cooperation with the local authorities, public transport providers, local businesses and other stakeholders. Various models exist to organise this "teamwork". For a successful implementation, it is essential to know and respond to the motivations and interests of the volunteers and to allow space for flexible solutions.
There are currently about 170 Bürgerbus services in Germany. Experience shows that the development process often requires patience and commitment from all parties involved, as the formal framework for public transport is not well suited to small-scale, volunteer-based concepts like this. However, once started, very few schemes have closed for lack of drivers or demand. A Bürgerbus cannot replace mainline public transport, but it provides a low-cost way of filling gaps and catering for specific needs that are otherwise difficult to capture.
Keywords: community transport, volinteers, public transport

A Swedish Bicycle Plan

Tomas Björnsson

Abstract
The Swedish Society for Nature Conservation has compiled a bicycle plan for the southernmost region of Sweden. The plan elaborates the need to build or improve bicycle tracks between the built-up areas in the region to facilitate commuting and to create a complete bicycle network in the region. A comparison with the budget spent on new road construction shows that a mere ten per cent of the current road budget will have to be redirected to new bicycle tracks in order to complete this plan in ten years.
Keywords: Cycling, bicycle tracks, climate change, Sweden, mitigation, peak car

Road congestion, vehicles emissions and the intention to use public bus services in Malaysia – A flexible bus utility model

Serena A. G. Kang, K. Jayaraman, Keng Lin Soh

1. Introduction

The Malaysian government introduced seven National Key Result Areas (NKRAs) for improvement between the duration of 2009 to 2011 in an attempt to transform the country to become a developed nation. One of the NKRAs addresses the need to improve public transport infrastructure and its current low ridership. While the NKRAs introduced in the Malaysian Government Transformation Program (GTP) set the need to improve public transport infrastructures and ridership, the latest annual report (2011) of the Government's Performance Management and Delivery Unit (PEMANDU) showed a modal split of 16:84 ratio between the ridership of public transport and private vehicles. The government has committed USD11.6 billion to build infrastructures to fulfil the need for better public transport services (Ministry of Finance Malaysia, 2009). In spite of the effort, the unfilled service capacity in public transport has left a cumulative loss of USD118 million after tax in the book of 'Prasarana', the wholly owned and government linked public transport company (Syarikat Prasarana Negara Berhad, 2009). The conjoint management between Economic Planning Unit (EPU), Ministry of Transport (MOT), Road Transport Department (RTD), Commercial Vehicles Licensing Board (CVLB) and Prasarana in the past contributed to multiple jurisdictions in the public transport industry and has led to ineffective coordination of public transport system in the country until the establishment of Land Public Transport Commission (SPAD) in 2010.

Besides, car ownership is affordable and encouraged by the economic growth. The habit of travelling in private vehicles has been embedded strongly in society. This habit is aggravated by the relatively low fuel charges even though it has been slightly revised upward lately. While restriction of car ownership is seen in its neighbour country, Singapore, there is no such policy to dissuade car ownership in Malaysia. The alarming statistics produced and published by the Malaysian Road Transport Department (RTD) shows a rise of 11% in the registration of new cars and 28% of motorcycles in the last six years (2005 – 2010). There was also a 26% increase in licenses issued to drivers. The increase of private vehicles on roads amplifies road congestion which is already rampant in urban areas has created severe parking problems and fatal accidents (Table 1 & Figure 1). The Road Safety Department (MIROS) reported an increase of more than 50% of total casualties and fatality rates from road accidents involving private vehicles. A case study in the district of Klang was conducted to assess the usage of private vehicles and occurrence of accidents. The assessment focused on motorcyclists killed and seriously injured (MKI) showing the percentage of MKI and areas involving high MKI. These areas are the residential, industrial, businesses and residential adjacent to school or industrial places.

In 2006, the National Cancer Registry Malaysia registered 2.05 million cases of lung cancer, and it ranked as the second most common cancer among the population in the country (Zainal et al., 2006). Lung cancer has been linked to motor vehicle exhaust emissions (WHO, 2012). Therefore, the commonly believed negative impact of vehicular emissions on health costs and potential risk leading to mortality and chronic diseases should not be ignored. The rationale of this conceptual paper to examine the current policy on freedom of vehicle ownership is therefore legitimised. The poor utilization of public transport has

Area	% of MKI
Residential	32
Industrial	19
Business and service	12
Residential adjacent to school or industrial	11
Institutional	9
Vacant lands	9
Agriculture	5
Others	3

Table 1: Klang District MKI, Source: MIROS, Malaysia (2009)

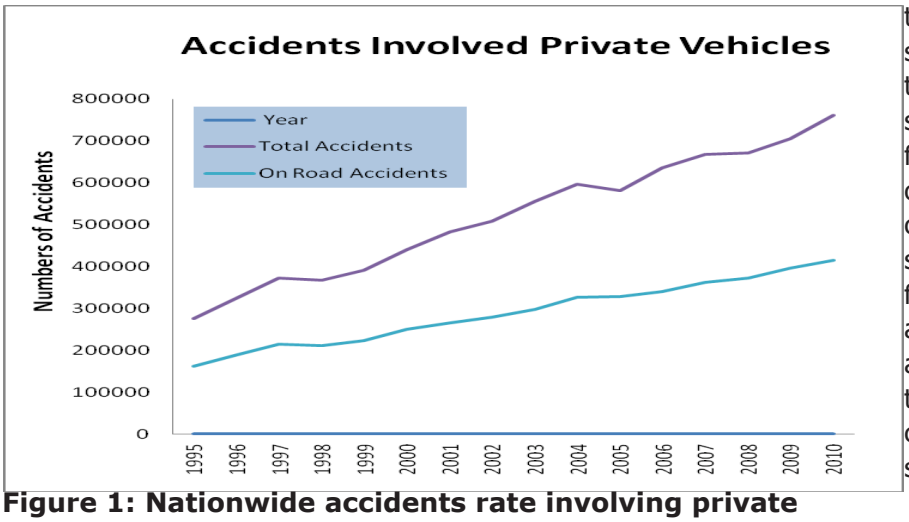

Figure 1: Nationwide accidents rate involving private vehicles
Source: MIROS, Malaysia (1995 -2010)

been speculated to be associated with negative public perception of the services and poor cognition of clean air in the environment among citizens. Although research revealed that people desire to be driven (Diana and Mokhtarian, 2009) when encountering a worsening traffic condition, the continuous use of private vehicles as a daily transport mode remains a trend. While people are also being driven in public buses, public transport companies have not succeeded in persuading higher ridership because of a lack of flexibility in its services. In addition, there is a need to walk more than 400 meters from home to the nearest stops/ stations of the public transport in the absence of park and ride facilities. The distance of walking is partly caused by poor township planning which focused on buildings as landscape (Sulaiman, 2010) instead of transportation and its connectivity with the stops/stations.

2. Urban centres and the sub-sets of urban centres

The integrated national transportation network has been proposed for four conurbations to be developed as integrated regions, with emphasis on levels of importance which take priority as growth zone in the country (Table 2 & Figure 2).

Level 1	National growth conurbation	Kuala Lumpur, Putrajaya, Shah Alam, Klang, Nilai and Seremban
Level 2	Regional growth conurbation	George Town, Johor Bahru and Kuantan
Level 3	Intermediate (connective) growth conurbation	Ipoh and Melaka
Level 4	Urban growth centres	Kota Bahru, Alor Star, Kuala Terengganu and Kangar

Table 2: Levels of conurbation, Source: Adapted from National Physical Plan of Malaysia (2010)

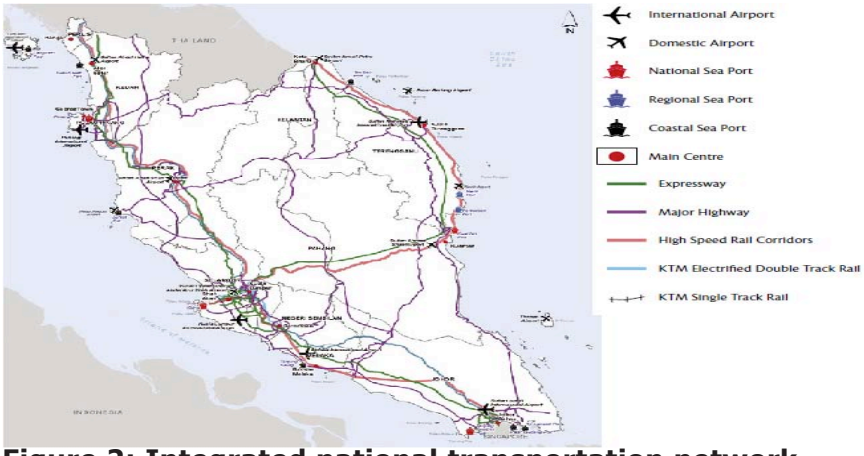

Figure 2: Integrated national transportation network, Source: The Federal Department of Town and Country Planning, National Physical Plan (2010), Ministry of Housing and Local Government, Malaysia.

This study takes a snapshot of level 1 conurbation (Kuala Lumpur) and level 2 conurbation (George Town) to discuss and understand the diminishing modal share of public transport. Although there is an increase in population in the regions, the decline in public transport ridership (Table 3) is apparent. The declining modal share may be related to the increase in highway network supply, changes in household sizes, a rise in household incomes, affordability of cars, and poor quality and unreliability of services offered by the public transport.

Year	% of modal share
1995	34
1999	20
2008	12
2010	13

Table 3: Modal share of public transport
Source: Japan International Co-operation Agency (JICA) – Study on integrated urban transport strategies for environmental improvement

3. Travel pattern and demand

The most common transport vehicles used for regular and short distance trips in urban transport are motorcycles, cars and monorails. In contrast, modes of transport that cater for longer distance trips in intercity transports are usually by way of cars, taxis, chartered buses and trains. Visibly, there are rarely walking and cycling in the country as there are no proper infrastructures such as walkways, cycle lanes and parking built to encourage these activities. Similarly, pedestrian routes, signage, crossing facilities and bridges or subways are minimal. The dual carriageways were generally constructed without off-street parking, pedestrians are not protected from humid weather and subject to risk of massive traffic of the streets. The alternative modes of transportation such as car pooling and sharing are also not popular among the urban commuters. For instance, among the 3 million vehicles in urban centre of Kuala Lumpur (KL), over 65% of these vehicles are travelling as single occupancy vehicles (Rosly, 2010). The urban rail has been recognised as the spine of the transport system in urban centre of KL, particularly in providing the high capacity linkages between the sub sets to the urban centre of KL (Figure 3 & Figure 4). In places not served by rail, public bus services will provide support as feeders to the rail network, specifically on the routes to the centre of KL. The forming of orbital demands in the sub sets of the urban area within KL, especially to areas such as to Petaling Jaya (PJ), Damansara, Serdang, Cheras Gombak or Selayang (Figure 4), are still unexplored and these routes need the services of public buses. In relation to travelling within the sub sets of the urban area, for instance, from Shah Alam to Klang, the destinations are visibly scattered. Although it is lower than the radial demands compared to the centre of KL, this travelling requires better accessibility and good quality of public bus services.

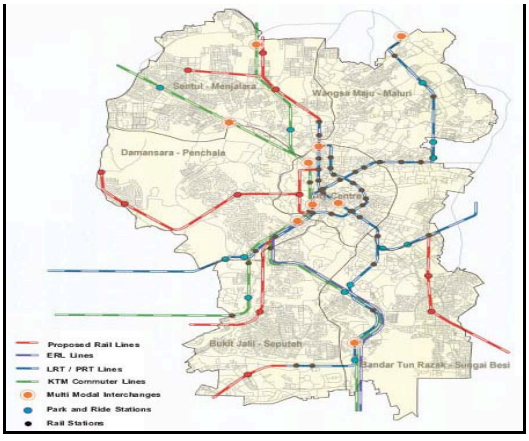

Figure 3: Future structural plan of KL urban centre.
Source: adapted from SPAD (2011).

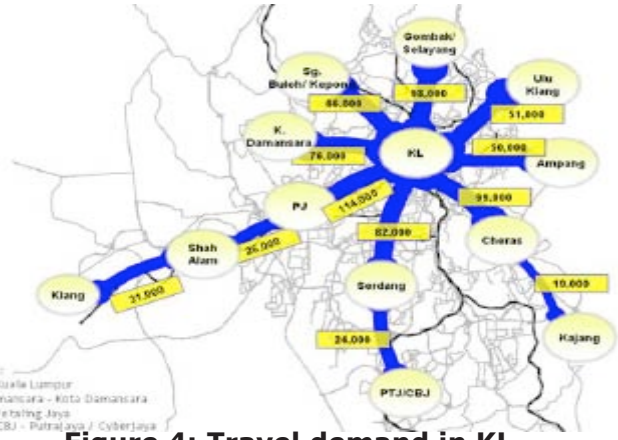

Figure 4: Travel demand in KL, Malaysia.
Source: adapted from SPAD (2011).

In the George Town (GT) urban centre, carriageways had originally been constructed along the east coast of the Penang Island (Figure 5) to be linked to the north of Peninsular Malaysia. While the market and industrial forces have further induced new development along the east coast of the island, there are more commuters travelling to work by private vehicles (as indicated in numeric figures in Figure 6) caused by higher employment opportunities coming from the development. As a result, the GT urban centre has a much higher traffic volume. However, the improvement of carriageways is not keeping abreast with this development, mainly because these dual carriageways cannot be widened despite the increasing traffic volume. Therefore public buses have to make their ways within the narrow and congested streets in order to serve the riders.

Figure 5: Future structural plan of George Town urban centre.
Source: adapted from SPAD (2011).

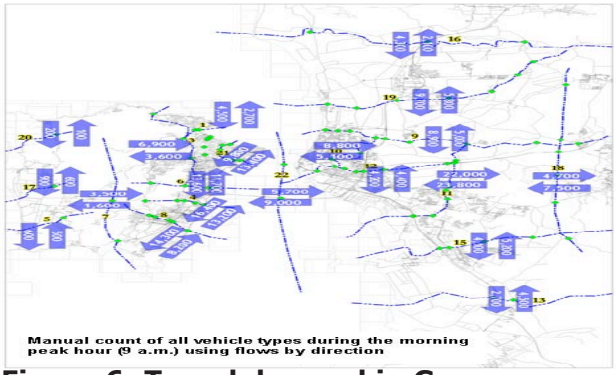

Figure 6: Travel demand in George Town, Malaysia. Source: adapted from Rapid Penang (2011).

4. Government subsidies in public transport

By the beginning of April 2010, the Malaysian government has expended USD550 million in infrastructures of public transport, and provided the highest direct subsidy of USD443 million to the public transport company (Table 4). Rapid Kuala Lumpur and Rapid Penang, being public bus companies and also as subsidiaries of Prasarana, each received 100% capital subsidy and 50% operational subsidy from the Ministry of Finance (Table 4 & Table 5). That funding was used to subsidise 31% petroleum and 32% diesel fuel of Rapid bus in KL and in George Town urban centres respectively (Table 5). While PEMANDU was praised highly on its achievement, the overall performance of the public transport company left a huge loss in the book of Prasarana (Table 6).

Type (year) of allocation	Amount
Infrastructure (2010)	USD0.55 billion
Expenditure (2011)	USD443 million
Additional Budget (2012)	USD40 million

Table 4: Government subsidies in public transport
Source: Budgets Malaysia (2009 – 2012)

Urban centre	*Total riders*	*Type per litre (price versus cost to a rider)*	*Amount (%) of subsidies*
George Town	80,000	**Petroleum/litre** (Actual price - RM2.75, rider pays - RM1.90)	Government subsidises RM0.85 (31%)
Kuala Lumpur	380,000	**Diesel/litre** (Actual price - RM2.66, rider pays - RM1.80)	Government subsidises RM0.86 (32%)

Table 5: Daily ridership of public bus/ Government subsidies in fuel consumption (2010 – 2012)
Source: RAPID Kuala Lumpur, RAPID Penang (2011) and Budgets Malaysia (2009 – 2012)

Financial Year End		*2009*	*2008*	*Financial Year End*		*2009*	*2008*
Balance Sheet Items		**(USD)**	**(USD)**	**Income Statement Items**		**(USD)**	**(USD)**
Non-current assets	:	3,392,642,000	3,180,082,666	Revenue	:	89,802,000	33,328,000
Current assets	:	1,021,663,000	586,068,666	Profit/(Loss) before Tax	:	-122,374,666	-71,653,333
Non-current liabilities	:	3,203,400,333	2,640,333,333	Profit/(Loss) after Tax	:	-122,784,000	-71,726,333
Current liabilities	:	136,833,666	202,295,666				
Share capital	:	1,548,517,667	1,275,184,333				
Reserves	:	-474,446,000	-351,662,000				

Table 6: Financial Statements (Syarikat Prasarana Berhad)
Source: Companies Commission Malaysia (2010)

5. Intention to use public bus and pro-environment cognition

In social cognitive research, intention is assumed to be the immediate antecedent of behaviour (Bamberg et al., 2003). The need to identify the primary cause of not using public bus service and work towards removing the barrier to enhance usage is fundamentally crucial. People may have different needs and expectations which serve to motivate usage of public bus services. At the same time, strategies to attract commuters and provide more information about an improved bus service system may produce higher switching opportunity. While recognizing that there is no 'one size fits all' bus utility model, the overall sustainability of bus services (Kennedy, 2002) in the long run need to be considered. Mesa et al. (2009) had studied robustness on "system that maintains its functionality under perturbations". It was also said that a good bus utility model must be able to absorb unplanned demand and minimize operating costs in lost ridership. In addition, environmentally sustainable buses compared to overcrowded private vehicles need to be encouraged. An effort to investigate health risk awareness caused by transportation related environmental pollution was conducted by Morris and Smart (2012), but showed no significant result. An environmental awareness survey conducted among the four largest cities in the East Asia, namely Beijing, Seoul, Taipei and Tokyo, reported that "riding a public transportation" is believed by most to be environmental friendly (Zheng, 2009). The major findings recently indicated that involvement of the public in direct experiences of pro-environmental activities will catalyse environmental knowledge into a stronger motivating force compared to indirect experiences (Duerden and Witt, 2010). The contribution from research of pro-environmental cognition in promoting decision to take public bus, change in lifestyle and to be less dependent on conventional vehicles need to be stressed by the policy makers.

6. Literature review

This study includes eight domains of service expectations and perceptions of service which are pertinent to bus ridership and will be used to test relationships among the variables. The variables that serve as independent variables are service reliability, service quality, service information, demand responsive services, pricing of ticket, smart ticketing, bus right-of-way and bus image. These variables are used collectively to test the intention to use bus services, the dependent variable, through confirmation of service delivery and satisfaction. The socio economic factor is incorporated to moderate the relationship of the variables. The detailed descriptions of these variables are listed below.

6.1. Service reliability

Commuters may experience longer wait at bus stops if bus bunching occurs due to unreliable service schedules. This causes anxiety during waiting time and probably uncertainty during trips. Bus service reliability is critical in influencing travel decision and researches have been studied on punctuality, time deviation at stops, unevenness on stops as a dimension of service reliability (Chen et al., 2009), route length, service frequency and provision of bus lanes to identify causes of unreliable bus services. Marketing literatures claimed that punctuality or delay of buses impacted overall service quality evaluation (Taylor, 1994), while Transportation research reported that punctuality increases reliability of bus services (Oort and Nes, 2008). Previous researches have recognized service reliability as the key factor which measures performance of bus operations (Benh, 1995). Several methods have been advanced to minimize waiting time, such as offering various types of bus ticket, provide better service information at bus stops, selling advance bus ticket and rounding up fare price to avoid keeping of small change (Dorbritz et al., 2009). Bus punctuality ensures consistency of bus services and is expected to build confidence among commuters towards bus services. Later research using Direct Ridership Model (Cervero et al., 2010), identified bus service frequency as the key service variable to estimate ridership and found that patronage of bus services increases when the frequency of bus services increases. Hensher et al. (2003) through their quality service index, deduced that service frequency is an important attribute in public transport ridership. The same was also stated by Friman and Garling (2001) that absolute frequency is

important in public transport services. In an attempt to grow the bus market, improvement of bus reliability could increase patronage of up to 20% and improvement on smooth riding has the highest impact compared to other improvement.

6.2. Service quality

The level of comfort projected by bus varies widely from its seating arrangement to cleanliness, design, video, audio systems and air conditioning facilities. With a good public transport system and a very low car use in Hong Kong, people still travel in cars citing primarily car usage as "helpful for carry things" (Cullinane and Cullinane, 2003). Fujii and Van (2009) discovered the relationship between perceived quality and intention to use bus services is found to be significant. The thermal comfort and air quality offered by bus is found to increase satisfaction of commuters (Shek and Chan, 2008). An approach used by Singapore government to promote public transport as a more competitive transport mode has ascertained improved commuter travel times, greater comfort and convenience in bus service network helps create positive public perception on public transport and less dependency on private cars. Chen and Chao (2011) revealed that drivers perceive greater inconvenience or difficulty to use public transport compared to private car use. Friman (2004) claimed that the interior design and seat availability in a bus should be given attention compared to other attributes. Travel time and travel cost are also the factors triggering people's intention to shift modes of transportation (Nor et al., 2006). Kato and Fujiu (2007) has also derived the theoretical analysis of the value of travel time savings (VTTSs) observing increases as income increases; the variation of VTTS over income depends on whether the marginal utility is increasing or decreasing with respect to work time.

6.3. Service information

Commuters need information of service hours to decide on regular transport activities such as shopping, travel to work or basic social interaction. A good and timely service information of routes and schedules helps to meet the demand of such activities. Scheduling is a complex process and it consists of matching bus services to passengers' demands subject to various constraints, including time taken for transfers of buses, frequency headways and work rules (Kimpel et al., 2008). Information displayed is found to have impact on bus patronage (Currie and Wallis, 2008). This includes displaying a large route number and destination signage in front, at the side and rear of the bus vehicle. This electronic signage must be easily readable and come also with audio announcement upon arrival at stops, especially to prepare the elderly alight from a bus. Most commuters generally appreciate service information which is accurate and timely in order to travel with a peace of mind, minimum stress and tension, while trying to cope with the competing white collar work and city lives. Molin and Timmermans (2006) showed service information plays a major role in increasing the accessibility of the bus services and commuters are willing to pay more for service information provided if it is useful to them. Khattak et al. (2003) showed similar findings. Dziekan and Kottenhoff (2007) developed a comprehensive framework of the possible effects of "dynamic at-stop real-time information displays" for public transportation and such displays yield better service quality. Bus companies in Japan, the UK and Singapore provide real time information on the expected time of arrival and routing via mobile phones. In the United States, the training given to the elderly to access public transit information has increased their confidence and comfort in using public transport. This confirms the postulation service information could result in a likely change of longer-term travel behaviour.

6.4. Demand Responsive Services

Base on the original idea of Demand Responsive Transport (DRT) (Bakker, 1999), this conceptual paper incorporates flexibility feature as a service design to suit commuters living more than 400 meters away from the bus stops. The demand responsive service is to serve journeys that are currently not well served by the traditional services. The flexible bus utility model will subsequently provide Rapid with insights to improve or reinforce service expectation to align with the perception of people who intend to use the bus services. It is recognised that service routes are to accommodate needs, if not the demands

of commuters, but well planned service routes and feeder services enhance utilization of the services. There are many interesting researches in the field of transportation, but a conceptual utility model of bus services remains unprecedented. No significant research on bus routing strategies has been attempted using the flexible service routes and schedules, along various directional approaches to increase ridership. There are so far, Palma and Lindsey (2001) who adopted an optimal timetable which minimizes the delay of service and cost, while Kageson (2009) debated on the use of preferred travel time of commuters. There is also the stated preference approach (Hensher et al., 2003) which developed a service index based on passengers' perspectives. This is later identified as a strong influence of passenger satisfaction and ridership of bus services. It is reported that a large market exists for flexible bus services both for the seniors and juniors (Alsnih and Hensher, 2003). The different purposes of trips made by active commuters will entail demand on flexible bus services and create challenges to bus operators in meeting the various needs of the commuting population. The experiences gained in India has shown bus operators introduced cut services during office peak hours by truncating the regular distances to reduce commuters waiting time. In Malaysia, commuters expect a larger fleet of buses to serve demand during peak hours and to combat congestion caused by car dependence. The revived initiative on DRT in the UK which enhances traditional bus services is an innovative service designed to address wider transport and environmental policy problem. DRT is recognized as a flexible bus operations tailored for travel from point to point without fixed routes and timetables (Sihvola et al., 2010), but it is based on commuters' travel desires and trip requests to pick and deliver (Cortes and Jayakrishnan, 2002). The different and spatial demand level of bus services could be met by the various improved DRTs which fit well into the responsiveness of bus utility model. This bus utility model has incorporated three forms of DRTs reported by Enoch et al. (2004):

6.4(a) Cut service

A cut service is similar to the normal fixed route service but would skip selected regular stops. Therefore it would continue to service the rest of the regular stops to allow commuters to board or alight. The cut service is notably essential during the morning peak (5.30 am to 8.10 am) and the evening peak (4.30 pm to 7.30 pm) of local time. This would save travel time for commuters. During those peak hours, cut services can be introduced to complement or substitute the normal fixed route for selected routes. Therefore identification of stops along those selected routes with low population density providing strategic opportunity for cut service is crucial.

6.4(b) Selected stop service

Selected stop service targets specific markets and delivers commuters directly to specific destinations such as a high saturated employment hub, popular tourist spots, an airport during peak hour, leisure and festival trips. The bus serves the commuters of specific segments. Timetables may be geared specifically for target markets to meet particular needs. The bus operators plan the stops with the cooperation of the "destined" segments.

6.4(c) Feeder service

The bus serves as a feeder link to traditional bus services. It pools commuters from residential areas, brings them to the main bus hub or station and then takes the commuters by the regular services according to scheduled timetables and service routes. The feeder service may overcome the congestion caused by the over use of private vehicles. It serves the majority of the residential areas leading to the common and frequently visited places such as grocery markets, shopping malls, schools and recreational places (demonstrated in Figure 7).

6.5. Pricing of tickets

Research has proven a higher acceptability and more positive personal outcome expectation in relation to transport pricing policy when it is intended to reduce congestion (Schuitema et al., 2010). Empirical findings also showed that personal outcome expectation is proven to be a good predictor on acceptability of road pricing (Schade and Schlag, 2003). Another finding reported "one-way bus fare" gives rise to a strong negative impact on satisfaction (Hensher et al., 2003). The preliminary

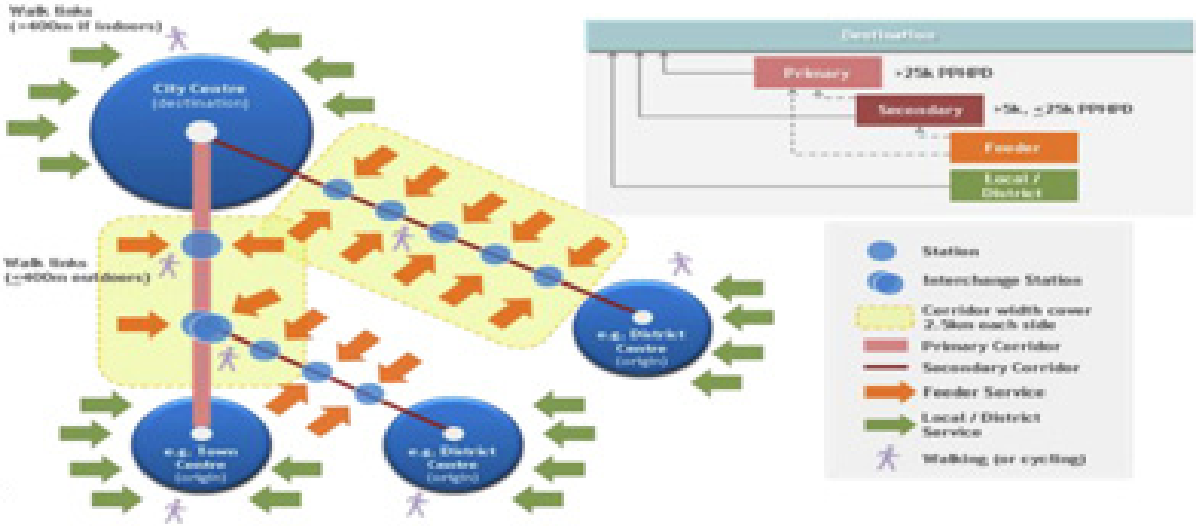

Figure 7: Diagram shows imposed linkages from suburban to city centre using the feeder bus services network. Source: adapting from SPAD, Malaysia (2011).

survey conducted by the Rapid expert and sponsored by the Malaysian Government, confirmed that the price of ticket is a sensitive factor to the Malaysian commuters and it is one of the major factors affecting the demand of bus ridership. Litman (2004) concluded similar findings on fare reduction and service improvements as effective ways to increase bus ridership. The study in four major Swiss cities of Basel, Bern, Geneva and Zurich which introduced cheap season tickets to increase the demand of bus services claimed to have zero marginal trip cost, and another study conducted in the German city of Freiburg was found to have similar outcomes (FitzRoy and Smith, 1999), but added that cheap and attractive bus season tickets must be offered with dense, frequent and fast bus services in order to offset the inherent disadvantages of time and cost factors in public transport. Chen and Chao (2011) suggested to reduce bus fare and to offer free service for a period of time to break the habit of car use. Hensher et al. (2003) identified fares of bus services impacts on user choice of travelling mode. The change in fare levels and change in fare types are both found significant in the study by Gkritza et al. (2011). With these indications, the Penang state government has initiated the free travel incentive pass for six months in 2011 and that incentive has also proven it was effective in attracting a fraction of habitual car drivers to use public transport, especially the workers working in Penang industrial park.

6.6. Smart ticketing

The smart ticketing system deploys integrated ticketing and automatic fare collection system (Government Transformation Program, 2010). The process involves storing the entitlement of passenger to travel electronically on a chip that is usually embedded in a plastic card. The card serves as a smart ticket which is then validated when it is presented to a smart reader and an 'integrated' ticketing system. The valid travel card becomes a legitimate ticket to travel with the bus. Bus service reliability is often affected by variability in time spent due to onboard ticketing and sale (Dorbritz et al., 2009). The proposal to use the smart ticketing system is intended to reduce the time taken to wait for the transaction of purchasing tickets on board and the subsequent journey time of commuters. Henceforth, smart ticketing hopes to stimulate demand and draw more people to use bus services. Empirical research in smart ticketing is lacking to address the concerns of waiting time spent on the ticketing process. A comparison between smart ticketing and onboard ticketing as single server will be undertaken in this study.

6.7. Bus right -of-way

It is evident that drivers are likely to change routes when they receive real-time information relating to traffic congestion and make decision to divert from congestion (Feng and Kuo, 2007). Traffic congestion caused by overwhelming private vehicles on roads contributes to unhealthy stress for drivers. Cullinane and Cullinane

(2003) recommended to increase bus-only-lanes to resolve the congestion. There are many practical ways to implement specific bus lanes. In a similar direction, Nor et al. (2006) also recommended the use of bus lanes, bus gates and information technology system (ITS) to improve the efficiency of bus services, while Cervero et al. (2010) found exclusive lane increases bus ridership. Lastly, it was observed the same provision of an exclusive bus-lane was also recommended other major cities in the world (Table 7).

6.8. Bus image

Waiting has been the symbolic image of public bus transport. The readily available access to a car conveys a higher status of a person who needs transportation. In the Malaysian society, waiting is perceived as a measurement of status. An observation has superiors wait less and in better surroundings than their subordinates. On the other hand, subordinates wait more and sometimes even unnecessarily. Therefore a projection of superior bus image is important, and images relating to the following may be effective in promoting ridership:

City	Population (mill)	Bus Fleet	Population per Bus	Bus Lane (km)	Buses per 1km of Bus lane
Sydney	4.3	1,900	2,260	90	21
Santiago	6.5	4,600	1,400	200	23
London	7.5	6,800	1,100	240	28
Singapore	4.5	3,775	1,200	135	29
Seoul	10.0	7,000	1,428	282	32
Madrid	5.5	2,022	2,720	50	40
Bogota	6.7	1,080	6,200	84	45
Hong Kong	6.8	5,885	1,155	22	267
KL	6.7	1,100	6,090	14	78

Table 7: Bus lane provision of major cities
Source: PEMANDU (2011)

- Bus status – "taking a bus" is no longer meant for only lower income group.
- Bus saves time – commuters wait less because of more punctual bus.
- Bus and efficient workers - travelling as passengers and less as drivers give less tension to commuters and they will be able to multitask while on board of bus such as planning.

6.9. Perception of service

In a study of users satisfaction with public transport, Pedersen et al. (2010) reported that the past biasness derived from negative incidents with public transport affect significantly their future satisfaction. Perez et al. (2007) found that there is a limit in increasing service quality to bring about improvement in intention to use but suggested a proactive enhancement of perception of services in order to improve intention to use bus services. Joewono and Kubota (2007) showed public perception is useful to bridge the differences of perceptions among service users. This is agreed in Ajzen (1991) who concluded that social norm influences on behavioural intention and is also favoured by Schade and Schlag (2003).

6.10. Service delivery

The distance from home to bus stops and the distance from home to work are the factors influencing the usage of bus services and private cars (Nor et al., 2006). Perez et al. (2007) concluded that employee training programs are essential to enhance service quality and delivery. Thorsten (2004) studied customer orientation of service employees and found that employing customer-oriented service personnel is a crucial step towards the economic success of service firm. This is also supported later by Patterson and Mattila's (2008) proposition in service encounter evaluations which stated recruitment and training should be based on "hire for attitude and train for skill". Various researches have acknowledged the evidence of customers' satisfaction when behaviours of employees were given emphasis in the process of service design and delivery (Friman, 2004, Friman et al., 2001, Friman and Garling, 2001). Among the specific attributes which give satisfaction (Friman and Garling, 2001) there is an indication of strong influence on overall satisfaction by employees' reliability and interaction in delivering public transport services. In the quest of creating an overall service quality index (SQI) on commercial bus service attributes, Hensher et al. (2003) identified several bus service attribute levels which contributes substantially towards passenger satisfaction and service effectiveness. Domains included in this study of service

delivery are bus stop facilities and drivers' attitude. Construction of bus stop is based on the number of considerations such as the number of loading areas, design of loading areas, one way or two way traffic, and traffic signals along the road. It is also dependent on whether the bus stop is an off line bus stop or on-the-street bus stop. Zaworski (2003) gave an explanation on design and types of bus stops. The choice of bus stop locations could potentially influence bus utilization. However, the prerequisite to bus capacity planning is to influence the desire to utilize services. Other factors considered in design and choice of bus stop locations will include: shelter for the bus stop, walking distances to bus stop, locations of passenger, driveway locations, physical obstructions, transfer opportunities and dwell time. Since bus stops are the first point of contact between the passenger and the bus service provider (Yang et al., 2009), its service impression on commuters' satisfaction should not be overlooked. There was a suggestion to assess the overall attributes of bus stop design in the satisfaction of commuters (Friman and Garling, 2001).

7. Users perception of traditional bus services

This article reports on an original empirical study conducted by 'Urusbudi Transplan' in 2010 drawing feedback from public bus transport users (n = 10,000) in Klang. Only 38% of bus users found the service provided satisfactory, and 46% of them found it acceptable (PEMANDU, 2010). As at 2011, another feedback survey on users perception of public transport was again conducted (n = 20,000) and revealed a rating of 50% on level of satisfaction, a bus loading factor of 56% in the peak of capacity filling, and a marginal improvement of ridership from 12% to 16% in public transport modal share as compared to private vehicles. In these empirical studies, the key issues identified by the public as hindrance to utilise the public bus services are the overall punctuality, long waiting and travel time, restricted accessibility, poor bus condition, the need of interchange service between stops, poor bus drivers' attitude, and lack of availability of information on service operation (PEMANDU, 2011).

8. Development of conceptual framework

For the purposes of replication, these concerns are taken into the conceptual development of a bus utility model (Figure 8). The conceptual model reveals the following:

- The degree of satisfaction of the traditional users of bus services
- Factors influencing the non users of the bus services
- To make policy recommendations to improve overall utilization of the bus services

The bus transport networks and services differ from country to country. The variables proposed in the framework may be customized to suit generic needs. This conceptual model is related to two well established theories, namely Expectation Confirmation Theory (ECT) (Oliver, 1980) and Theory of Planned Behaviour (TPB) (Ajzen, 1991). TPB supports behaviour that is determined by an intention to produce behaviour, and such intention and actual behaviour have been found to be highly correlated. TPB explained in literature is the perception of service as a form of attitude and overall evaluation of services (Bolton and Drew, 1991). The difference between service expectation and perception of service is of interest in the present article. If this difference is negligible, the confirmation of bus services is ensured, and in turn it leads to the extent of satisfaction. Based on the extent of satisfaction, the frequent commuters will continue to use the bus services while the intention of the occasional commuters of bus services may improve.

Churchill and Surprenant (1982) elucidated expectation as an anticipated behaviour which is characterized as predictive, and satisfaction is an attitude towards the total sum of various attributes of a particular service. Commuters as users of bus services derive satisfaction in using bus services. Satisfaction creates positive effect on commuter's intention to use or continuance intention to use bus services. The satisfaction construct was prominent in marketing researches as the main reason for users to patronize services (Oliver, 2010), which could be equated to a similar context of patronizing bus services. Experiencing the bus services leads to confirmation of service delivery and brings users

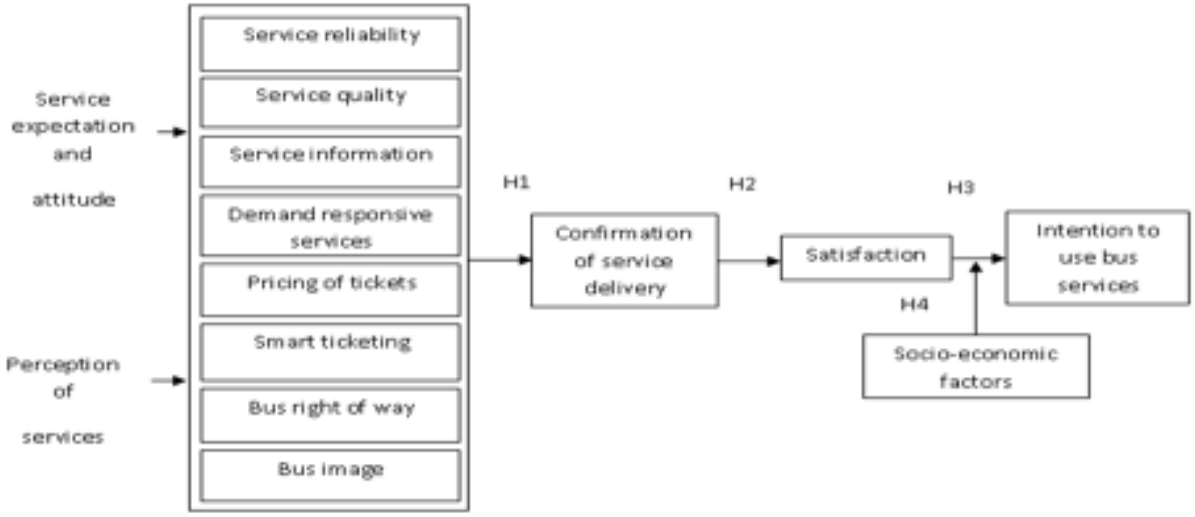

Figure 8: Conceptual framework

to either feel good or otherwise about such services, and further derives positive or negative impact on users' satisfaction. In addition, in the TPB (Ajzen, 1991), it was revealed that attitude is the predictor of the intention to use certain travel mode, and descriptive norm as an added variable is a significant predictor to use bus services (Eriksson and Forward, 2011). Information availability on bus schedules and routes are crucial to intended users irrespective of the diverse objectives of trips. Punctuality of bus arrival and departure at bus stops are hinged to the arrival and departure of its destination and vice versa. Service information made available to users facilitates intention to use and continuance intention to use services. Once users are onboard the bus, other services will become apparent and their impact on usage continues. The intended use and continuance intention to use bus services depend heavily on the inherent characteristics of services and cost of services as an alternative mode of transportation. These characteristics pose a degree of ease or difficulty to use bus services. Moreover, drivers' ethics and location of bus stops are instrumental to the level of satisfaction of bus users. The better the experience of service delivery will give rise to confirmation of both the tangible and intangible performances of bus services. Users of services compare the service delivery and their expectations of bus services. The more satisfied the users, the higher the intention and/or continuance intention to use bus services.

9. Implications for managerial practice

In view of the discussion appended above, it is recognized that effort in reducing emissions, congestion and air pollution requires serious attention to manage the number of vehicles on roads as well as providing an alternative modes of transportation. The introduction of environmental friendly cars may help in resolving the problem but it comes with high research costs. It makes the development of a bus utility model timely and warranted. Both carrots and sticks must be carried out as means for more effective city environmental management. The effective and flexible bus utility model may serve as one of the carrots, while higher taxes to limit car ownership and traffic management being the sticks are expected concurrently to reduce the current heavy dependence on car use. Although Demand Responsive Transport (DRT) provides the benefit as a flexible transport service when encountering changes in travel demand (Jokinen et al., 2011), its implementation requires a thorough understanding of its market segmentation and prudent cost management. The introduction of Feeder Service (FS) is intended to overcome issues on accessibility and connectivity encountered by 63% (Government Transformation Program, 2010) of the Malaysian population who live within the inner city at 400 meters radius from the main bus routes or transfer hubs. In addition, the Cut Service (CS) combats the commuters' cars loading on the road during the peak hours. When the demand warrants additional bus services, Selected

Stop Service (SS) may rightfully serves this purpose. Pricing strategy is crucial in the successful implementation of DRT services. It should be monitored and periodically checked against the costs of car use in order to persuade the needy commuters to use bus services, and eventually embrace the bus as their daily transportation tools. In addition, DRT could be designed with commuters pooling strategy to complement the existing regular service. The selected forms of DRTs introduced in the bus utility model are to tackle the specific and identified issues of bus service utilization in the country. It is worth to mention that whether it is the demand that fluctuates during the service hours or issues about service delivery, it remains contextual. Transport practitioners may consider and require adaptation of the bus utility model to address respective local issues and needs.

10. Conclusions

The global economy is going through difficult times and pinching on the country's competitiveness. The conceptualization of bus utility model is timely to enable the optimal use of bus services, reduce traffic congestion and boosts productivity of workers. The government aims to achieve 25% of public transport ridership by the year 2013, mainly by integrating all rail lines in the Klang Valley into one another to create a seamless travelling experience for commuters. A provisional sum of USD11.2 billion is expended for five years to purchase more buses of different sizes, and create better infrastructure and facilities for bus operations. It is vital to consider four strategic aspects of management of bus services, namely 1) the accessibility and connectivity, 2) the availability and capacity, 3) the reliability and quality of journey time, and 4) the efficiency and status of bus as a transport tool. These aspects have been built in as service designs of the bus utility model. Scholarly, this conceptual model has initiated a wide spectrum of future research in a variety of disciplines. For instance, research in relation to sustainability of flexible transport, service integration of DRT with traditional bus, and specific and effective funding of future projects on public transport. It will be also interesting to predict behaviours across diverse cultural context using the adapted bus utility model.

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Appendix: Glossary of terms

Term	Definition	Synonyms
Bunching	The situation where more than one bus come together at the same time at a single stop on the route. The situation may be caused by reasons as stated below: •bus drivers who are not adhered to the schedules. •traffic congestion along the bus route to its destination. •delay by passengers alighting or on board the bus such as handicap.	
Bus right-of-way	Special bus lane for use of bus only. It is a dedicated bus lane to combat traffic congestion especially during the peak hours.	Dedicated bus lane
Demand Responsive Transport	Transportation options that fall between private car and traditional public bus services. It is usually considered to be an option for less developed countries and originally for niches like elderly and disabled people (Bakker, 1999).	DRT
Cut service	A cut service is similar to the normal fixed route service but would skip selected regular stops during peak hours. This service would however continue to service the rest of the regular stops to allow commuters to board or alight.	Point-to-point, Shuttle service, Express bus
Selected stop	Bus stops only at predetermined place.	Charter bus
Feeder service	Bus service that picks up and delivers passengers to a regional hub at various stations, express bus stop, bus terminal, 'Park-and Ride' or any other transfer facility (adapted from Benh, 1995).	Transferred bus
Peak hours	The period with the highest ridership during the entire service day.	Peak period, Busy hours
Regular service	Bus serves to stop at all predetermined bus stops. The service is sometimes called the local bus or ordinary bus service.	
Schedule	Passenger time table or a document that shows the time of bus trip at each route, through the designated time planned by the service provider.	Bus timetable, Bus operating schedule
Season Ticket	A ticket that is valid for travel over a period of time, such as monthly or yearly.	
Service hours	The span of hours over which service is operated, e g., 6 a.m. to 12 mid night. Service hours may be varied by the day of the week, Saturday, Sunday or even public holiday.	Service span, Service operations
Service route	A planned and established series of streets and turns connecting two terminus locations which the bus serves to pick up and drop passengers.	Service line
Single server	Bus service which operates with bus driver alone. The driver also sells tickets with the help of a ticketing machine installed on the bus. The driver is responsible to ensure commuters in the bus travel with a valid ticket before they are onboard, and alight at their purchased destinations. The driver also helps the handicap to get on and alight before he moves the bus.	
Smart card	A plastic card with a microchip and antenna embedded that can be used to store smart tickets. The most common form of smart media at present.	
Smart ticketing	A system where tickets are loaded electronically onto a microchip and read electronically. Smart ticketing is the term use to mean deploying integrated ticketing and automatic fare collection (AFC) system. It is the process of change from issuing physical tickets to cashless tickets or smart card ticket. In smart ticketing, the passenger's entitlement to travel is stored electronically on a chip that is usually embedded in a plastic card. The card is then validated when it is presented to a smart reader, and 'integrated' ticketing system. The smart tickets, whether in form of paper or plastic card, are valid for travel with the specific bus operator and/or mode of transport. The use of smart ticketing system intends to reduce time taken to wait for the transaction in purchasing tickets onboard of bus in order to use bus services. Few benefits about smart ticketing including faster passenger throughput, improved convenience of usage of services, reduced queuing and waiting, better understanding of travel patterns, and reduced fare evasion [Adapted from Turner and Wilson (2010)].	
Travel card	A generic term for a pass valid across a bus network.	
Truncate	Pass by all stops along the route to arrive at the destination to avoid congestion during specific hours of service.	Re-route

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Governance and Ecological Sustainability: the case of transport funding in New Zealand

Dr Stephen Knight-Lenihan

Introduction

The 1999 New Zealand General Election saw a Labour-led Coalition government replace a nine-year National-led government. The Coalition introduced sustainable development provisions into legislation, in particular the *Local Government Act 2002* (LGA) and the *Land Transport Management Act 2003* (LTMA). This complemented the inclusion of sustainability provisions in the *Resource Management Act 1991* (RMA; Table 1).

The LTMA is a strategic shift away from the previously narrow focus on efficiency and safety (Robertson, 2004), challenging those administering central government-allocated funds to demonstrate how transport programmes address the significantly broader range of outcomes.

Funds are raised through fuel excise and road user charges, vehicle registration, and direct Government contributions. The funds are allocated across the 'activity classes' of road infrastructure and maintenance, public transport, policing, coastal shipping, rail and behaviour change programmes and projects. Funds are administered by the New Zealand Transport Agency, which also manages national transport initiatives such as highways, which are fully funded through the NZTA. Local government manages local transport programmes through a mix of NZTA allocated funds and local funding. Historically an average of 50-60% of local transport initiatives are NZTA funded.

There are currently 11 regional, 61 city/district and six unitary councils in New Zealand, with unitary councils having the combined functions of both local and regional government. Regional councils and unitary authorities develop land transport strategies and programmes, and plan for the funding and delivery of public transport. The latter is governed by the *Public Transport Management Act 2008*. The regional programmes, prepared every three years, are key documents as they describe the activities councils wish to undertake.

Securing state funding for regional and local activities requires consistency with national land transport funding goals identified by Government and realised through the National Land Transport Programme (NLTP). So, for example, a local government applying for cycling infrastructure or demand management projects will be funded if the proposal complies with national priorities. Councils can also fund such initiatives themselves, although as they are commonly part of a package of activities, funding is usually shared.

In summary, the RMA, LGA and LTMA provide the legal framework for integrating land use and transport as part of a process of addressing sustainable development. Funding is a key influence on outcomes, and is substantially controlled (with stakeholder consultation) by central government.

In 2008 there was a change back to a National-led government, resulting in a shift back to emphasising efficiency and safety. The substantive part of this paper offers proof that this National-led Cabinet focus fails to fully account for LTMA sustainable development requirements. The paper also notes that it falls to the Transport Minister (on advice from the Transport Ministry) to decide whether Cabinet's focus reflects legislative intent, and that Cabinet is now proposing the removal of the LTMA sustainable development provisions. The circularity of this process is questioned.
The paper provides a cases study of the difficulties in pursing sustainable development outcomes in a democracy that has minimal controls on the executive. Possible mechanisms for reducing these difficulties are proposed.

Method

A critique is undertaken of how funding allocation takes account of the need to *contribute to ensuring environmental sustainability*. This is used to demonstrate the shifts in focus since 2003 with the passing of the LTMA. As part of the critique, a definition of what *ensuring environmental sustainability* means is provided. In the context of the LTMA, environmental sustainability is taken to mean ecological sus-

Legislation/Policy	Purpose/Objective	Comment
Resource Management Act 1991	Section 5: to promote the sustainable management of natural and physical resources [by] managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while (a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and (b) safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and (c) avoiding, remedying, or mitigating any adverse effects of activities on the environment.	The RMA requires local government to develop local and regional policy responses (plans) to reflect their local environmental conditions, with associated methods (usually in the form of regulatory rules) and monitoring approaches to give effect to the local agreed policy responses. This is the dominant piece of planning legislation managing development and resource use in New Zealand, and is the legislation outlining the process for assessing the environmental effects of any development.
Local Government Act 2002	Section 3, inter alia, provides for local authorities to play a broad role in promoting the social, economic, environmental, and cultural well-being of their communities, taking a sustainable development approach.	Sets out the purpose, role, functions, powers and duties of local government. Enables communities to work with local government to create long term plans reflecting a range of sustainable development outcomes. These are then incorporated into RMA-generated planning processes. Monitoring of outcomes emphasized.
Land Transport Management Act 2003	Sections 14(a)(ii) and 19B(a)(ii)) require national and regional transport programmes to contribute to assisting economic development, safety and security, improving access and mobility, protecting and promoting public health, and ensuring environmental sustainability	None of the economic, social or environmental aspects of sections 14 and 19 are assumed to dominate any other outcome. National and regional transport programmes can integrate with each other, long term plans and district plans, thereby addressing sustainability outcomes across the RMA, LGA and LTMA.
Government Policy Statement on Land Transport Funding 2008	GPS 2008 produced to guide how transport funds should be allocated to realise the LTMA requirements.	Reflects the sustainability requirements in the LTMA.
GPS 2009	Produced following the 2008 General Election and a change in government.	Focuses on economic efficiency.
GPS 2012	Updates the GPS 2009.	Focuses on economic efficiency but with greater emphasis on energy efficiency and alternatives to private motor vehicles.

General Elections & Dominant Party (all are coalition governments under New Zealand's mixed member proportional voting system).

1999 – Labour wins election from National.	2002 – Labour re-elected	2005 – Labour re-elected	2008 – National Party wins election from Labour	2011 – National re-elected.

Table 1 Sustainability provisions in New Zealand legislation of direct relevance to the transport sector, and related policy shifts and elections referred to in text.

tainability, given the broader social and economic aspects of environmental sustainability are incorporated elsewhere in sections 14 and 19 of the LTMA (Table 1). No definition of environmental sustainability is offered in the LTMA.

Ecological sustainability is defined using an ecological assessment matrix (EAM) created by the author (Knight-Lenihan, 2007). This identifies New Zealand's key ecological sustainability trends. The EAM assess the extent to which transport fund-

ing allocation accounts for such trends.

The political critique focuses on the use of government policy statements as a tool to guide transport funding allocation, and whether this circumvents legislative intent.

Ecological Assessment Matrix

Estimating ecological sustainability accounts for the ecological price paid for economic growth and consequent compromising of social-ecological system resilience, adaptability and transformability (MA, 2005; Walker et al, 2004; Walker et al, 2006) as well as the need for a more sophisticated linking between globalised economics and ecological sustainability (eg Kissinger & Rees, 2009).

Ecological sustainability can be defined as a measure of the net gain or loss from human aggregate demand on the Earth's gross ecological capacity to sustain human (Moran et al, 2008) and non-human (WWF, 2010) life.

New Zealand's positive economic performance continues to track declining ecological conditions (MfE, 2007) exemplified by net reductions in water quality (e.g. Scarsbrook, 2006; Verburg et al, 2010) and biodiversity values (DoC, 2011; Green and Clarkson, 2005; Hitchmough et al, 2007). The EAM is a contribution to halting this decline. It identifies key ecological issues to be addressed as part of all development and decision-making. This includes the transport sector. The EAM was created in two steps. The first describes the generic ecological principles underpinning ecosystem functioning (Table 2)[1].

Principle	Description
1. Scale, interaction and complexity	Ecosystems operate at different scales of space and time, and are nested. There is no absolute delineation between systems, and equally, functioning systems rely on interactions with other systems. Complexity is a function of the overlap and interaction at different scales. Many ecosystem-level features arise only as a result of this complexity, and are not necessarily predictable from the component parts.
2. Biogeochemical cycles	Disturbance of biological, geological and chemical cycles can be accommodated within ecological systems. However, cumulative disturbances and/or large-scale disturbances can create profound changes to ecosystem functioning.
3. Specificity of place	The basic biogeochemical cycles operate differently in different places and therefore take on or demonstrate unique aspects associated with those places. Ecological processes and the consequent abundance and distribution of species are influenced by local climate, altitude, longitude and latitude, coastal relationships, hydrology, soil characteristics and geomorphology, as well as biotic interactions (Dale & Haeuber 2001).

Table 2 Ecological principles

Next, country-specific key trends are identified. These fall into two categories: connectivity, and spatial and temporal cycles. The results of this analysis for New Zealand are summarised in Table 3[2]. The conclusion from this analysis is that New Zealand is in net ecological decline.

Ecological sustainability can be defined in the context of the transport sector as follows. In order to contribute to ensuring environmental sustainability in the New Zealand context, it would be necessary to identify how a transport programme could assist in remediating the accumulated effects of disturbance, modification and fragmentation of the natural and physical environment. This would incorporate physical and contaminant accumulation and biodiversity impacts, and would account for contributions to global impacts, primarily climate change. The suggested management responses in Table 3 would be used as a guide. Where remediation were not possible, avoiding exacerbating the trends in Table 3 should be a requirement, with residual unavoidable impacts mitigated.

This framing of the meaning of ecological sustainability would have the following effect. Applications for transport funding would need to demonstrate mechanisms for assessing the direct and indirect ecological impacts of transport initiatives locally, regionally and nationally. This would

1 Full references can be found in Knight-Lenihan 2007 (http://researchspace.itss.auckland.ac.nz/handle/2292/3076) & Harker et al *forthcoming* (available on request).

2 The trends are drawn a broad literature focusing on New Zealand ecosystems (Knight-Lenihan, 2007; Harker et al, *forthcoming*).

Key trend	Description	Suggested management responses: the tools[3] available to decision-makers should enable
Disturbance, modification, fragmentation	Indigenous forest clearance, wetland drainage, loss of riparian systems, river damming, abstraction and channelization, soil erosion, introduction of exotic plants and animals.	An assessment of, and response to, DMF relative to the local situation and in a national context. The assessment of the self-sustainability of remnant ecosystems.
Contaminant accumulation and synergy, and accumulated physical change	Habitat clearance, introducing pest species, changes in soil chemistry, structure and availability, contaminant impacts on water bodies. Cumulative impacts (possibly significantly) underestimated. Non-linear ('tipping point') responses consequently under-appreciated, requiring better assessment of biological and/or structural/functional ecosystem processes. Absence of understanding possibly leading to decisions compounding existing negative trends.	A strategic environmental assessment of 1. cumulative and synergistic effects of development over time and space. 2. where appropriate, ecological capacity (biophysical limits) of local, regional, or national ecosystems or interacting sets of ecosystems to assess their ability to cope with accumulation and synergy. 3. the risk (probability and scale of impact) of triggering 'tipping points', both locally and globally, and the consequent creation of low-value ecosystems. 4. the potential for development with a net ecological benefit, and the creation of high value/highly resilient ecological systems. 5. the establishment of short, medium and long-term monitoring and feedback regimes as part of assessing trade-offs between current decision-making and long-term ecological welfare.
Biodiversity decline	Many areas with the highest biodiversity potential lie outside the conservation estate. Functional biodiversity needs to be better managed to increase the likelihood of improving ecosystem health, integrity and resilience, as well as contributions to ecosystem services. Underfunding for conservation estate management needs to be addressed.	The identification of opportunities to integrate indigenous biodiversity management into coastal, lowland and montane 'working' ecosystems[4]. Focus on habitat protection and rehabilitation plus incorporating indigenous and functionally valuable exotic species into agricultural, commercial and domestic land systems. A process to increase Government capacity for protecting indigenous biodiversity. The designing of a method to estimate the improvement in ecosystem health and associated resilience as a result of the restoration and/or protection of indigenous and exotic biodiversity.

Table 3 Key New Zealand terrestrial and freshwater trends and management responses.

include cumulative impacts on land use (such as stimulating growth at urban limits and whether this was deemed desirable). Full emissions profiles would also be required. In addition, unavoidable residual effects would require compensatory actions to result in a net ecological benefit. Examples of the latter could include contributing to land or water rehabilitation within the same or similar catchments. Off-setting through carbon sequestration would be a secondary option to reducing emissions. The overall effect would be to require transport programmes to demonstrate a net ecologically beneficial outcome as a contribution to addressing New Zealand's net ecological decline.

And the current New Zealand situation? Transport-related, project-by-project environmental effects assessments do involve thorough examinations of local and catchment-wide ecological impacts. Two recent (2010-2012) examples are Wellington's Transmission Gully (TG) and Auckland's Waterview Connection (WC)[5]. Both involved in-depth assessments of ecological values and consequent avoiding or mitigating/offsetting more-than-minor impacts on locally or nationally significant flora and fauna, and compensatory activ-

3 Tools refers to the strategies, policies, legislation, plans or programmes available for the decision-makers to use.

4 Refer Green & Clarkson, 2005.

5 The reports and findings can be found at www.epa.govt.nz.

ity accounting for such things as impacts on waterways and coastlines.

However, atmospheric emissions cannot be considered, primarily as these are accounted for nationally through an emissions trading scheme (discussed further below). Project alternatives are assessed, but are restricted to narrow assessments of the best way to achieve particular transport outcomes. Broader questions of how transport affects long-term land use patterns and ecological sustainability are poorly addressed. There is consideration of cumulative ecological effects over time and space in relevant catchments, but additional impacts on top of existing historical changes are poorly accounted for, as is a project's contribution to regional or national cumulative impacts.

In addition, interpretations of sustainability vary between projects. A 2012 Auckland University Masters student assessment of the TG and WC projects concluded that while the TG application reflects the five sustainability provisions in the LTMA (Table 1) the WC application emphasises economic efficiency and productivity, accessibility, infrastructure security and traffic flow (Murphy 2012).

As discussed below, the current situation reflects both the momentum prior to 2009 towards a more integrated transport, land use and ecosystem assessment and management system, and the loss of such momentum after that date.

Application of the Ecological Matrix to Transport Funding

As noted, central government funding allocation is done according to the National Land Transport Programme (NLTP). The 2007-08 NLTP guidelines identified 13 trends to be addressed to achieve a more sustainable and safer transport system. These were chosen from indicators relating to such things as the need to reduce new roads through, for example, increases in public transport and travel demand management; reducing atmospheric emissions; and moving toward renewable resources (LTNZ, 2006). Combined with LGA-driven long term planning, this raised the possibility of contributing funding to integrated land use and transport infrastructure plans addressing urban, peri-urban and rural form that had a range of sustainability goals.

Potentially, transport funding decisions could take increasing account of critical natural capital (soils, water and air quality for example) and possibly ecological processes and biodiversity values. This could assist transport funders in identifying packages of activities contributing to a range of sustainability outcomes, including more comprehensive ways to mitigate the negative impacts of roads on ecosystems (Spellerberg, 2002) and plan for climate change and peak oil.

Applying the EAM to this period (2003-2008) highlights the following:

- there is a clear legislative framework enabling an integrated approach to achieving ecological sustainability;
- the importance of cumulative effects is recognized, but there is a lack of clarity over how to manage them; synergistic effects, tipping points and resilience are not addressed;
- biodiversity management is enabled but no guidance given as to how this should be addressed through the transport sector.

Partly due to the lack of guidance, the LTMA was amended in 2008 to allow the creation of the first Government Policy Statement on Land Transport Funding (GPS) (Harker et al *forthcoming*), as discussed in the following section.

Government Policy Statements

In 2008, a national transport strategy was released (New Zealand Government, 2008a). The strategy emphasised a 30-year time horizon with actions fitting in with government sustainable development, energy and climate change agendas such as reducing greenhouse gas emissions and single-occupancy vehicle kilometres travelled.

In August that year, the first GPS was released (New Zealand Government 2008b; Table 1). This enables the Transport Minister to provide funding guidelines on how to achieve Crown outcomes and objectives (LTMA s84) via the NLTP. The NLTP, in turn, must contribute to the five sustainability outcomes (Table 1). Hence the

GPS guides the NZTA on how to allocate funds to achieve the outcomes. This first GPS reflected goals in the 2008 transport strategy.

The November 2008 general election saw a change in government and in May 2009, the newly-elected National-led government amended the GPS (Table 1). It required transport funding to focus on stimulating economic development and growth to help address impacts from the global financial crisis (New Zealand Government 2009). It noted a commitment to shifting the way people travelled, but only in so far as this did not compromise economic and environmental efficiency, the latter a term that was undefined.

The document does not require a climate change risk assessment when assessing transport alternatives for funding, and does not require any cross-reference to New Zealand's (then proposed) energy strategy. In reference to oil supply security and price, the document does note oil volatility should be taken into account through (for example) having public transport options to ameliorate household costs. But the 2009 GPS does not give any guidance as to how to assess this risk over the medium to long term when deciding between investments in roads or public transport.

The NZTA must give effect to the GPS through the NLTP (LTMA s19B(a)(iii)) while contributing to local initiatives that may have a range of goals under the LGA and LTMA. Given central government's narrowing interpretation of the sustainability provisions in the LTMA, this can raise tensions between local and central government as each may have different interpretations of not only LTMA requirements but also LGA sustainable development provisions. The tension has contributed to proposed changes in the wording of the LGA and LTMA, as discussed further in the following section.

The third GPS, covering 2012/13 – 2021/22 does pay more attention to the need to reduce the currently high transport energy intensity (New Zealand Government 2011; Table 1). There is a stronger cross-reference to the New Zealand Energy Strategy 2011–2021 and the New Zealand Energy Efficiency and Conservation Strategy 2011–2016. The 2012 GPS includes recognition of the role of walking, cycling, public transport, improving energy efficiency, more efficient freight movements, and promoting the uptake of low carbon fuels and technologies. There is an expectation on local government to ensure integrated travel options through its transport and planning roles. There is also an emphasis on optimizing existing networks, something expected to favour public transport, walking and cycling, as these can reduce congestion, offer more options, and improve safety in a cost effective way.

However, the GPS approach forecasts from existing trends and remains unsophisticated. It 'continues the government's strong focus on removing key bottlenecks in the land transport network, encouraging economic growth and productivity, obtaining value for money and improving road safety' (New Zealand Government, 2011:6).

A contrast can be made with the transport and carbon simulation backcasting model applied to London, which attempts to quantify the effects of a range of policy options relative to emission reductions goals (Hickman et al, 2010; www.vibat.org). The Vibat model contextualises options such as improving energy efficiencies, promoting low carbon fuels, behaviour change and rising fuel costs, and highlights the jurisdictional Gordian knot of international air travel. Application of Vibat has been scoped out for Auckland, New Zealand (Austin et al, 2011), but there has been no local or central government uptake at this stage.

The GPS process should be seen in the context of New Zealand's approach to meeting total atmospheric carbon emission reduction obligations. The current conditional emissions reduction target is 10-20% of 1990 levels by 2020, but it is unlikely conditions for this target will be met by that date (MfE 2011). Meanwhile the Transport Ministry forecasts a 2009-2030 growth in passenger traffic of 14% and road freight of 24% (MoT 2011). As of 2010, emissions from road transport account for 17.4% of all greenhouse gas emissions, having increased 66% since 1990 (MfE 2012a). The

Government's primary tool for managing greenhouse gas emission, the Emissions Trading Scheme, will have a minimal effect on fuel consumption. Even if the current price per tonne of atmospheric carbon increased several-fold to NZ$100, the effect would be to reduce the growth in transport emissions between 2010 and 2030 by about one per cent (MoT 2011).

As of 2012 nationally, with the help of carbon offsets, New Zealand is assessed as being on track to meeting its current Kyoto Protocol net emission target (MfE 2012b). In November 2012 Climate Change Minister Tim Groser announced New Zealand would not sign up to the second commitment period under the Kyoto Protocol, but instead would pledge under the Climate Change Convention Framework. While there is legitimate debate over the real effect on emissions of Kyoto commitments, this decision reinforces a view that Cabinet wants to avoid being bound by the Kyoto approach.

Ultimately, while regional land transport programmes can, and do, identify a range of activities and programmes, any government funding is conditional upon GPS compliance. The 2009 and 2012 GPSs provide limited guidance as to how to address transport emissions, and no guidance on how to assess roading impacts on ecological functioning, or undertake a peak oil risk analysis. Funding applications aimed at addressing such issues can be expected to carry relatively little weight, except insofar as they may contribute to network optimization.
This suggests that both the policy guide and, consequently, funding allocation mechanisms, are biased against many of the sustainability outcomes identified in the LTMA and the current national land transport strategy.

While there remains support for such things as mode shift through behaviour change, moves towards walking and cycling, and public transport, the emphasis on economic growth and value for money reduces options for incorporating such initiatives in transport packages when compared to the situation prior to 2009.

Evidence of the Shift

Funding allocations apparently confirm the shift away from encouraging more sustainable transport (Knight-Lenihan 2011; data provided by Glen Koorey, University of Canterbury, based on analysis of NLTP and GPS projections). Comparisons can be made between national funding allocations for activities that could be expected to contribute to sustainability outcomes (public transport, demand management and walking and cycling) and investment in highways and local roads. The ratio between alternatives to roading and roading shifted from 0.17-0.19 in the 2006-07 to 2009-10 periods to 0.13 for 2010-11 when comparing initial allocations. Indicative allocations out to 2018-19 are steady at 0.15.

The 2012 GPS indicates a funding range that may steadily increase support for public transport beyond 2013, but other funding levels remain little improved through to 2021.

However, such figures can mislead. Funding allocations to state highways and local roads may include such things as cycleways and public transport facilities. In addition, allocations to facilities such as cycleways are less expensive per kilometre, altering benefit-cost ratios and making a dollar metric misleading. Finally, the NZTA has some flexibility in responding to requests for projects identified in regional land transport programmes. Initial allocations normally differ from final allocations. Even under the previous Labour-led administration, actual allocation to roading alternatives declined, suggesting rhetoric failed to match investment.

A more accurate measure of the influence of the GPS would compare how local authorities altered the way they put together funding applications following the passage of the 2003 LTMA (marking a shift from efficiency to sustainability), then following the 2007-08 NLTP (which had associated sustainability trends), and finally after the 2009 GPS (and the move back to emphasising efficiency). As these requirements have changed over time, anecdotal evidence suggests so to have applications[6]. This needs to be verified. Equally, what activities did the NZTA (and its predeces-

sor Land Transport New Zealand) fund over the same time periods, and did this change? This would identify shifts in how funding was allocated between activity classes as a result of policy shifts. Results would need to be coupled with analysis of projects done at different times to assess the relative contribution made to economic, social and ecological outcomes, and the extent to which non-economic outcomes were taken into account. This analysis will form the basis of follow-up research.

Finally, further evidence of an intention to shift the funding focus comes in the form of government intentions to change the LTMA and LGA.

The Land Transport Management Amendment Bill (2012) proposes removing the five sustainability provisions (Table 1) and instead emphasising the need to contribute to an effective, efficient, and safe land transport system that supports the public interest, and makes the GPS more strategically relevant.

The Local Government Act 2002 Amendment Bill (2012) proposes removing the provision for local government to promote sustainable development, and would instead provide for local authorities to play a broad role in meeting the current and future needs of their communities for good-quality local infrastructure, local public services, and performance of regulatory functions.

Just how much discretion remains for councils with such changes is unclear. The intent however is to encourage councils to focus on what the Government sees as their core business. In particular, the proposed LTMA amendments would shift the legislation back towards where it was pre-2003, emphasising efficiency and safety.

In addition, the broader legal framework enabling decision-makers to identify and move towards environmental sustainability is compromised by the 2009 and 2012 GPSs. It is up to the Minister of Transport (on advice from the Ministry) to assesses whether the GPS contributes to the aim of achieving an affordable, integrated, safe, responsive, efficient and sustainable transport system (LTMA s87). The circularity of allowing a Minister to identify transport priorities, decide whether those priorities are legally justified, and be part of a cabinet considering alterations to the legislation which either intentionally or fortuitously make the priorities a better fit, appears legally questionable (Harker et al *forthcoming*).

Conclusion

The paper demonstrates how a government's duty of care and requirement to exercise judgement in the best interests of its citizens can be undermined by what is a legal but arguably unethical use of executive power. In this case, New Zealand has lost momentum towards including meaningful ecological sustainability provisions in the national transport funding allocation process.

In particular, the 2009 and 2012 Government Policy Statements on Land Transport Funding dilute strategies to reduce transport-related greenhouse gas emissions, and pay little regard to empirical evidence showing cumulative ecological decline associated with land use patterns. This contrasts with the first GPS – GPS 2008 – introduced by an earlier administration to provide guidance for addressing non-economic sustainable development outcomes. The current administration now suggests changing the legislation to dilute the need to address these broader issues. Apart from other effects, this would make it easier to justify producing future GPSs that minimise non-economic outcomes.

Operational decisions on funding allocation remain sufficiently flexible to partially compensate for this focus on economic outcomes.

A suggested alternative approach (Harker et al forthcoming) is to consider placing ecological sustainability into entrenched legislation, including New Zealand's constitution[7], against which Parliament would assess ordinary legislation. A national sustainable development strategy should also be formulated. In combination, this would provide the judiciary with a means to hold

6 Based on discussions with regional council transport officers and NZTA officials.

7 New Zealand's constitution is not in one document, but is found in key legislation and documents, common law, and constitutional conventions.

the executive to account. The state could then be a trustee with a fundamental obligation to actively protect ecological systems. Internationally, aspects of environmental trusteeship are already a part of domestic constitutional law, common law and international law[8].

In addition to investigating the legal effect of this idea, further research will examine the extent to which the exercising of existing political power in New Zealand threatens efforts to achieve higher levels of sustainability. Specifically, whether the different versions of the GPS resulted in measurable changes in transport outcomes. The result of this additional research will contribute to how a community might approach central Government when it appears to be moving in a direction contrary to that assumed through legislation. It will also clarify the legal grounds upon which governments could be challenged if the contrary action compromises efforts to increase levels of sustainability.

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Bürgerbus - German experiences in community transport

Martin Schiefelbusch

1. Overview and context

This paper presents findings from a very practice-oriented project on what can be called governance of rural mobility. Readers will learn about issues in the development of "Bürgerbus" services, a type of small-scale public transport service that closes gaps in the network of traditional public transport at much lower cost, thanks to volunteers driving the vehicles and doing part of the other tasks associated with providing a public transport service.

A Bürgerbus ("citizens' bus", plural "Bürgerbusse") builds upon local resources and initiatives, therefore it can be considered as one variation of "community transport", to quote a term more widely known in the English speaking world - but there are differences to the English concept, briefly discussed in section 4. Indeed, the basic concept of volunteer-based public transport has its origins in England, and there are further variants of that basic idea also in some other countries. We will briefly look at these, but then focus on the German situation.

One might think that to set up a Bürgerbus is a planning and administrative task. This is also true, but only part of the story. It is even more a communicative challenge, requiring good knowledge of the local people, social talent, some technical know-how and last but not least a lot of patience. It seems therefore much more adequate to use the term "governance" for the development of such services than just "planning".

By combining these skills and bringing a service to work, a valuable contribution to local community life can be made at modest cost. The Bürgerbus idea has without doubt also its limits, but there are certainly still many places in Germany - and probably also beyond - where such a service could be set up and assist in solving mobility problems. There are also locations where a Bürgerbus actually exists, but in a hidden way, known only to local "insiders" because the difficulties of bringing the service into the framework of formal public transport arrangements is deemed too complicated and out of place.

There are also many variations of the basic idea - to help others in maintaining their everyday mobility - that is behind many Bürgerbus projects. People giving lifts to neighbours or doing car-pooling respond to the same need. They do not have to follow the same rules a Bürgerbus does, but they do not get the same support either. The underlying question of all these different approaches therefore is how to "govern" this part of mobility in a way that allows these initiatives to develop and contribute their part to working communities and a (slightly more) sustainable life.
Over the last three years, the author has been closely involved in consultancy and advice for Bürgerbus initiatives in Germany. This work has allowed good insights into the tasks linked to setting up such a service.

2. Situation of rural public transport and rural mobility

The provision and enhancement of bus and rail services has for long been a key element in strategies to deal with the problems caused by massive car use. But while public transport still can be successful for travel to and within the city centres and on certain intercity corridors, it faces major difficulties on other markets. In particular in rural areas, public transport often caters only for a residual part of travel demand. Small settlements and dispersed patterns of mobility do not permit a viable development of a comprehensive offer, so that even for those remaining "captive" users only a basic service is provided. But a basic level of public transport provision is nevertheless widely considered necessary to cater for the mobility needs of those without access to a car or who are unable to drive.
In many parts of Europe, demographic change - the aging and shrinking of populations - will make the situation worse in the future (EC 2005, EC 2006:4): Fewer potential users will be available, hence the provision of many services (both commercial and in the public sector) will therefore become increasingly difficult (Blümel et al 2007, EC 2009, p 6). However, demands by these users will remain stable or rise,

in particular in health and social services. Transport is one of the sectors affected by this development, and at the same time an important tool to provide continued access to other services. While future senior citizens will have a higher level of car availability and experience than in the past, financial and health limitations will limit their interest in car use at least from a certain age onwards.

3. Bürgerbus - defining the concept

There is no official, generally recognised definition for the German term "Bürgerbus". Hence some services branded as such do not meet the definition provided below; vice versa there are cases where the definition is adhered to under a different name. Considering this, and the complexities of the different formal arrangements described below it is not easy to give a precise figure for the number of implemented Bürgerbus schemes, but a reasonably good estimate is possible. Based on the far majority of applications in Germany, the following definition can be derived:

> *A Bürgerbus is a public transport service which uses unpaid volunteers for most or all tasks, in particular for driving the vehicles. A Bürgerbus makes use of local resources and knowledge and close collaboration with other local stakeholders. The vehicles used are minibuses or large passenger cars.*

This definition includes four key elements. Each of them has its own implications for the kind of service that can be offered:

Public transport service: The Bürgerbus is part of the public transport system. Its existence is published, it is accessible to the general public, it carries different passengers who do not (need to) know each other in one vehicle, it charges the same fares to all passengers, and it operates according to a pre-defined schedule. Not all of these conditions are necessarily adhered to in all cases, however. In particular, services may operate as demand-responsive, hence requiring pre-booking. Some services cater for specific groups and are thus not published widely. Nevertheless, the Bürgerbus is to be distinguished from special, "closed-door" transport tailored to a certain group's needs, such as school buses, patients' and disabled persons' transport.

Volunteers: This is the key feature of a Bürgerbus service. The use of voluntary civic engagement allows substantial savings to be made compared to normal bus operations - drivers' wages and social security fees typically account for 60-70% of operating costs. For volunteers, only fees for a special driving licence and medical examinations are necessary, and even this cost item depends on the local regulations. On the contrary, volunteers need to be recruited and kept, as discussed below, based on their personal motivation, and they are not as available as a paid driver would be.

Local resources and knowledge: The reliance on volunteers - usually recruited from the community in which the bus operates - already links a Bürgerbus much closer to the local community than a traditional public transport service, which is managed by medium or large companies dealing with a large area and with drivers living somewhere else. In this way, the Bürgerbus drivers (and also other activists in the Bürgerbus associations) are close to their customers and are able to respond to specific local needs. Furthermore, the Bürgerbus depends on local cooperation and networking to secure funding and fulfil its role. Support from the local authorities, businesses and civil society organisation is therefore very important.

Vehicles: The exclusive use of small vehicles is linked to the fact that Bürgerbusse are complements to other public transport services and operate in areas of low demand, where these vehicles are sufficient. But the main reason is a practical one: holders of a normal car driving license in Germany[1] are permitted to steer vehicles carrying up to 8 passengers. Beyond that, a full HGV/bus licence is required. To be able to get enough volunteers, it is essential to use vehicles that citizens with the normal driving license can drive.

1 Licencse type B according to the current EU classification, formerly type 3 in the national system.

4. The Bürgerbus story

Evolution

There are today more than 170 Bürgerbus services operating in Germany (figure 1). The idea of using volunteers in the provision of public transport services is reported to have its origins in the UK already in the 1930s. It was re-discovered in England in the late 1960s, exported to the Netherlands in 1977 and first used in Germany in 1985. The first German bus in fact operated in the region of Westphalia on a route close to, and in part crossing the Dutch border. Since then, the number of services has grown steadily with only very few closing down again for lack of users or volunteers.

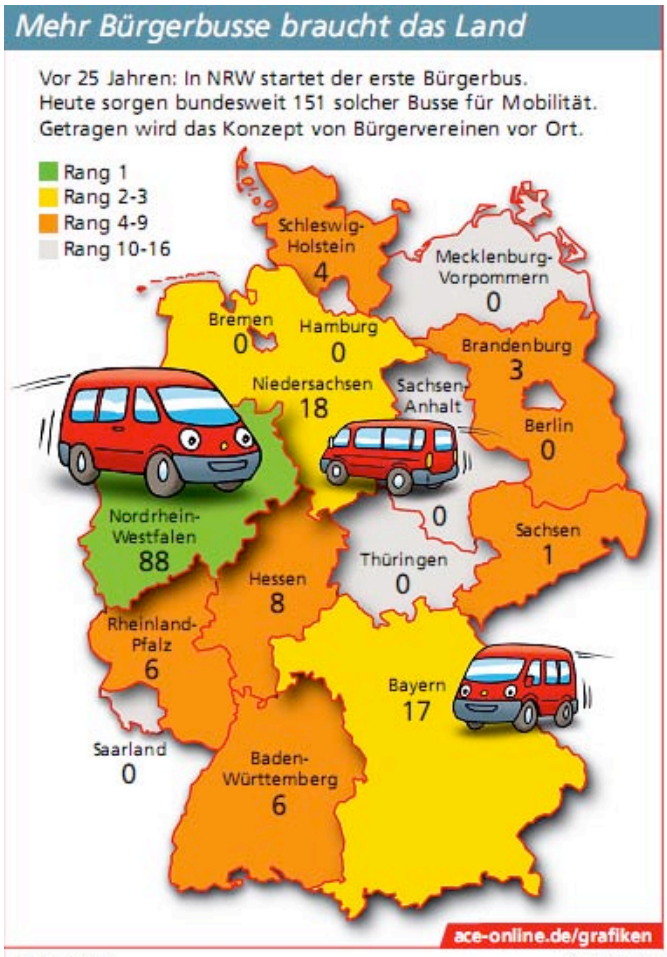

Figure 1: Distribution of Bürgerbus services across Germany - Note: Numbers show situation in 2009, furthermore counting methods in the different sources are inconsistent (source: ACE 2010)

Even today, the geographical distribution can be said to reflect the spread of the idea from North-Western Europe towards the East: The German state of North Rhine-Westphalia has by far the highest number of services (ca. 100), followed by Lower Saxony (ca. 17) and Rhineland-Palatinate (ca. 15).[2] But this is not only due to the idea spreading by communities following their neighbours, it is also a result of political decisions: The state government of North Rhine-Westphalia in particular has supported Bürgerbus initiatives since the 1990s through dedicated funding and support, which has evidently had success in bringing many initiatives to life. On a lower level, the state governments in Lower Saxony and (more recently) Rhineland-Palatinate have also supported initiatives in their area. The other states offer no specific support yet, although local authorities can in part compensate for this.

Service types

Based on the characteristics outlined in section 3, Bürgerbusse fulfil a complementary role in the public transport system and cater for situations of low demand. They can nevertheless be found in a variety of geographical settings and market segments. Two service concepts clearly dominate:

The "urban-rural link" connects a district centre (small or medium-sized town) with the surrounding villages at times or in areas where no other bus service operates (figure 2). The district centre is usually the main destination, but also the place where connections to other bus and train services are provided. About two thirds of the German services follow this model.

The "small city bus" operates within a city or town which is too small for a traditional city bus, but still too big to be served adequately by the regional services present (figure 3). These cities often have housing estates far away from the main roads, shops, leisure establishments and other facilities are scattered over the whole area and/or have moved to the periphery in recent years. They tend to operate over shorter routes, but more frequently than the first type. The bus service links the different parts of town with each other, with the centre and with ongoing public transport services. About half of the Bürgerbus services in Germany follow this model (some combine both).

2 As a comparison: North Rhine-Westphalia covers c.25% of the German population and c.10% of the territory.

Figure 2: urban-rural service in Gransee (source: VBB 2005)

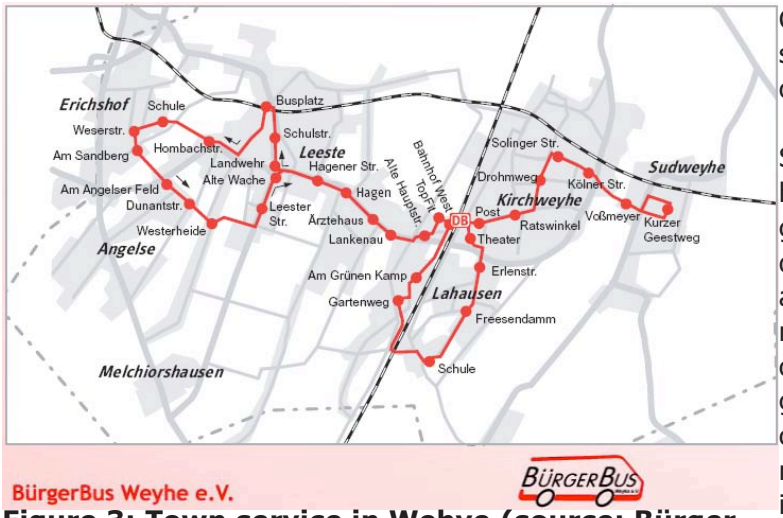

Figure 3: Town service in Wehye (source: Bürgerbusverein Weyhe)

Despite a predominance of schemes in rural settings, there are also some applications in medium and larger cities, where the Bürgerbus usually provides a feeder or inter-borough service in suburban locations.

Further important variations lie in the service concept, service hours and target group. The far majority is run as a traditional bus service with fixed stops, fixed timetables and accessible to everybody. In particular, all services in North-Rhine Westphalia are provided on this basis. A minority offers instead an in part or completely demand-responsive service, where only service hours, corridors or areas of operation are pre-determined and users have to call and book the particular journey. These services may also offer to pick up passengers at home and/or take them directly to the destination rather than a fixed bus stop. The number of such services has grown in the last years as more of the new foundations focus on older people as the main user group.

Most services operate on weekdays during daytime hours, with the number of trips and temporal coverage depending on the type of demand, but also available manpower. The most common arrangement is a service in the morning between about 8am and 1pm. "Bigger" services run also in the afternoon, smaller only on certain days of the week. Only about 10% of the German cases offer additional services in the morning, evening or weekend.

Senior citizens are in fact the by far dominating demographic group, with the share of children, commuters, housekeepers and tourists being more or less marginal. But this also depends on the service concept and the general framework conditions: commuters often cannot be carried due to late start of the service, and journeys to and from school usually require larger capacities and are thus provided by traditional buses.

Beyond Bürgerbus

As mentioned, the Bürgerbus is not a German invention. Even today, the basic idea of volunteers' engagement in public transport is found more often in the UK and the Netherlands, if the number of schemes in proportion to country size is considered. Furthermore, there are some examples in Switzerland and Austria (less than 10 per country, as far as the author is aware) and at least one in Sweden.[3] Britain and the Netherlands are therefore the main areas where the concept is used. But in detail this happens in quite different ways:

There are ca. 250 "buurtbus" (translated "neighbourhood bus") in the Netherlands. They provide traditional fixed-route bus services and are managed by an associa-

3 The author welcomes any information on further examples in these or other countries.

tion in partnership with the local authorities. In the UK, volunteer-based mobility services are part of the range of "community transport" schemes, of which there are at least ca. 1,700 across the country (cf. DfT 2011. But this comprises not only other concepts for rural transport, there is also a greater variety of volunteer-based schemes: There are community buses doing regular journeys according to fixed timetables, partly or wholly flexible variations, but also a number of special services for specific purposes (in particular health-related trips) as well as ride-sharing and lift-giving schemes where private vehicles are used. A good collection of examples is provided by Countryside Agency (no date). Apart from this greater variety, a key difference between British "community transport" and the "Bürgerbus" is that the former uses also paid staff while the latter is relying entirely on volunteer work (cf. section 5, "recruiting").

5. Issues and stakeholders in Bürgerbus development

Bürgerbusse are, as already mentioned, developed in partnership with other stakeholders, in particular on the local level, but also with the other public transport stakeholders (mainly transport authorities and operators), usually organised on a provincial or regional level. There are many differences in detail, but three main players are nearly always present:

- the Bürgerbus association, usually a registered association in which the drivers and other volunteer supporters are members
- the transport provider (bus company) who runs the other scheduled bus services in the region (or one of these if there are more of them)
- the local authority (or authorities) in which the service will operate

The allocation of tasks between these stakeholders varies between locations, but some main types can be identified, which are presented at the end of this section after the discussion of the main conceptual issues in the development of a Bürgerbus service.

Licensing

To get a small bus and set up a small transport service for the local community may seem a simple task - apart perhaps from the need to get funding for the vehicle, to be discussed in the next section. However, to do so in a regular way, for the general public and on a permanent basis a number of regulations come into play. The main areas of legislation are:

- the type of service offered as such
- the professional qualifications of the operator
- health and fitness of staff (drivers)
- insurance of drivers, vehicle and operator
- status of operator regarding taxation

As a rule, a Bürgerbus service is part of the normal transport system and has to find its position according to these frameworks - the fact that it is run by motivated volunteers for altruistic reasons is of little relevance, and there are very few exemptions for small-scale services. Due to space limits, the following section focuses on the first issue - the formal type of service chosen also has implications for the other areas of regulation.

Public transport services in Germany are regulated by the Passenger Transport Act (Personenbeförderungsgesetz), which traditionally conceives this sector as a commercial activity - in spite of the fact that many services have for a long time been loss-making (for a discussion see e.g. Heinze/Kill 2008, Schiefelbusch 2009, 2013). But the market is not deregulated as in much of Britain, instead sub-divided into different functional service types (such as scheduled public services, excursions, taxis, private hire) and, for scheduled services, geographic licenses (concessions), which are usually route-based. Any public transport service, no matter how frequent, is based on such a licence granting the operator an exclusive right to run scheduled public transport over that route. This means that it is very difficult to set up a new service, even when the existing ones are very infrequent as is often the case in rural areas (where buses cater mainly for school journeys).

In this situation, the basic options for Bürgerbus initiatives are:

- to cooperate with the existing bus operator and run services along its routes under the "roof" of the existing licences
- to find a "niche" in the network of licences - a route or area not served
- to choose a different formal service type, such as a service only available for older people, which may be given a licence paralleling other "general public" routes
- to set up the service in a way that it does not fall under the Passenger Transport Act requirements - essentially by running it only with a passenger car and not charging fares

Most of the existing Bürgerbusse follow the first model, which has advantages in that the know-how, status and resources of the main bus operator can be used to deal with some of the other tasks such as vehicle maintenance, revenue management and customer information. On the other hand, this arrangement ties the Bürgerbus initiative to the current service pattern and typology, which may not be ideal for the community's needs. A number of more recent foundation have therefore pursued other ways, and the fourth model in particular has found more favour with them. It remains to be seen, however, if this arrangement can work in the long run in particular regarding economic sustainability.

Funding

As mentioned in section 3, the main economic advantage of a Bürgerbus is the absence of drivers' wages, bringing the service costs to a much lower level. But other costs remain:

In terms of capital costs, the vehicle is the main item - a new minibus (with some minor modifications useful for public services) costs at least 25,000 EUR. More substantial modifications such as full wheelchair accessibility can raise this figure significantly. The replacement of the bus after a service life of usually 7-8 years also needs to be considered.

Operating costs include vehicle maintenance, fuel, insurance, fees for drivers health tests and certificates, revenue management, marketing, management of the Bürgerbus association and the like. These costs typically amount to 4,000 - 8,000 EUR per year.

These figures are low compared to the costs - or subsidies - required for full-size bus services. But as Bürgerbusse operate in addition to "normal" public transport, they do not have access to the same possibilities for deficit compensation. Much of the cost therefore has to be borne by the communities served, for which an expenditure of the size required can already be difficult to manage. The popularity of the Bürgerbus concept in the state of North-Rhine Westphalia is clearly also linked to the fact that the state government pays for the vehicle as well as gives an annual management cost allowance to the Bürgerbus association. In other states, the possibilities for such funding is much more limited. Most schemes therefore have to rely on:

- fares from passengers - these are in proportion evidently more important than for normal bus services, although many initiatives prefer to charge low fares out of social equity considerations
- donations from passengers - as part of the service's links to the community, many users are happy to make donations on top or instead of fares
- sponsoring from local businesses - this is often a significant source of income, depending on the local economy and the association's abilities in approaching potential supporters
- contributions from the local authority (which can also be in kind such as integration of the vehicle in the fleet for maintenance and insurance)
- depending on the formal status of the service, certain tax benefits available to scheduled public transport can also be used by Bürgerbus initiatives

Experience shows that, after the start-up phase, it is possible to cover the majority of operating costs from the first three sources. Some initiatives are so successful that they generate a surplus, which can be used to support social activities of the association, lower fares or help to buy the next vehicle.

Most "older" schemes operate only their scheduled service (which often employ the vehicle on at least five days of the week) and refrain from hiring their bus out or offering excursions. The recent growth of "smaller" schemes has, however, led to a greater interest in vehicle sharing arrangements, also as a means to share the costs. The bus may therefore be used for the public service on some working days, by the local authority for deliveries on others and by the church in the weekend.

Recruiting

The chances of a Bürgerbus project evidently depend to a much higher degree on local interest and engagement than in many other mobility concepts. It is essential that enough people in the community identify themselves with the project and are willing to contribute actively. The possibilities to bring people together and communicate through word-of-mouth, but also the chances to unite and share the idea are much better in small communities than in cities - probably a key reason for the dominance of rural Bürgerbus applications.

the start-up phase before operations actually begin. The time needed to communicate, find support, fulfil the necessary administrative tasks and get approval can be significant (2 years are quite normal). During this period, there is a real risk that people lose interest because "nothing happens" or procedures are perceived as too slow. Experience shows that it is essential to identify persons willing to act as "caretakers" or "ambassadors" for the project. Two or three of them are sufficient, but they have to be convinced and dedicated, accepted in the community, able to spend time on the project, find further support and keep those interested on board.

Once operations have started, the Bürgerbus association has to ensure a reliable service. Members have to take their obligations seriously, hence a sufficient number of drivers has to be available to cover the timetable in a way that is not perceived as a burden. A typical Monday to Friday half-day service should have a pool of about 20 active drivers, so that each of them has to take a turn once or twice a month.

Beyond driving duties, the association's role as a social group is important. To the

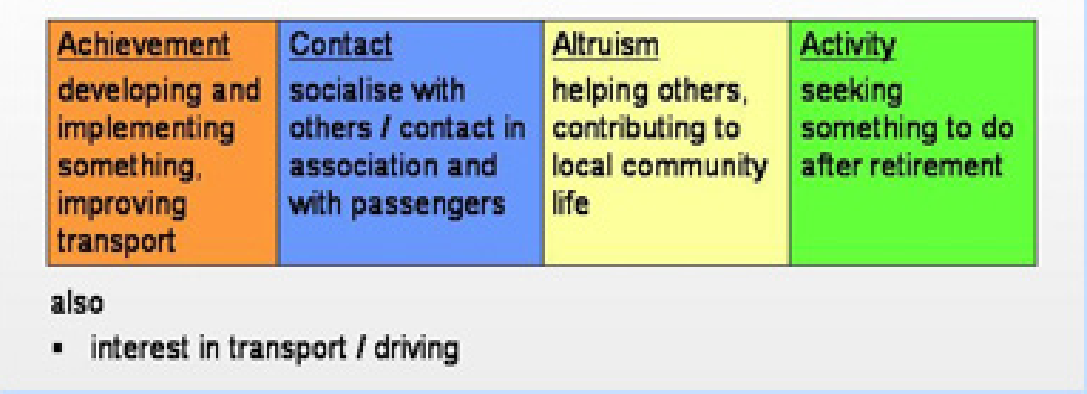

Figure 4: Main reasons for involvement in Bürgerbus activities (source: author)

Motivations to become involved in such a project can be clustered into four main groups, as shown in figure 4. However, the relative importance of these different reasons varies from place to place, and it is essential to find out the specific interests of the people in the community to be successful in getting support. Motivation cannot be created by outside interventions, and usually also not by a mayor's or community council's decision to support such a project.

To find enough volunteers and to keep them on board is a particular challenge in

outside world, members are the "face" of the project, in regular contact with the users as well as sponsors and politicians. In this way, they also get feedback and suggestions for service development. Within the group, the activists can share their experiences and develop their own feeling of community. Social activities like the annual barbecue, funded from passengers' donations, an excursion or the annual Bürgerbus associations' meeting are important and sometimes even a reason to get involved. But again each group has to be free to develop such activities as it fits to its interests.

Once the necessary number of people to start the service has been reached, the volunteers' motivation to stay on board - and the chances to find new drivers to compensate loss of active members - seem not to have caused major problems to continue the operation. On the contrary, very few experiences were made in Germany with mixing volunteers with normal paid workers or other formal types of staff (such as people recruited for socially necessary activities) in the day-to-day running of a Bürgerbus service, and the experiences with such "melanges" were not necessarily positive (cf. Burmeister 2002). While the execution of certain "specialist" tasks such as vehicle maintenance to an operator's paid staff seems to work well, it seems also necessary to leave the volunteers an area of activity where everybody shares the same motivation.

Liaising

The previous remarks have already alluded to the need for communication and networking in the development of a Bürgerbus project. Many of the tasks mentioned can only be solved by getting in touch with others, looking for the right persons to give information and support, by developing a feeling for the specific circumstances of the situation and putting together the various bits and pieces.

In all these tasks, the local activist's point of view is of key importance, as their motivation decides about the future of the project. Community building and the support of "third sector" activities can therefore help to develop the necessary competencies. But the ease with which such initiatives can be developed also depends on the interplay between the voluntary sector and the "world" of administration and "official" public transport planning, where the awareness for the citizens' perspective and way of thinking is not always well developed.

This can be illustrated by the image of "top down" vs. "bottom up" planning in public transport. Although its base are individual travel patterns, professional planning is used to working with aggregate patterns of movement and hierarchical systems of central places, infrastructures and services. In public transport, an integrated system from the long-distance train to the regional bus where the former set the framework for the "lower" levels is a powerful image and ideal. On the contrary, the local citizens and initiatives have specific local knowledge, which may not be present in the professional circles. Both views are legitimate and can in principle complement each other, but to do this, mutual understanding and the right interface have to be developed (cf. Heinze/Kill 2008:308).

6. Discussion - strengths and limits

To conclude, some reflections on the current and potential role of the Bürgerbus (and similar concepts elsewhere) shall be provided, which also need to take account of critique and limitations of the concept.

The main and most fundamental criticism of the Bürgerbus concept focuses on its core - the use of volunteers for tasks that are otherwise provided by professionals who get properly paid. Three arguments are put forward in this respect:

- the public sector should not be allowed to get out of its obligations to provide public transport by devolving this task to civil society organisations
- volunteer-based services are used to save public expenditure - a Bürgerbus may just replace a more costly normal bus service
- these services threaten existing businesses and thus "normal" jobs, not only in scheduled public transport, but also among taxi drivers in the region
- furthermore, it is feared that volunteers cannot provide the same standard of service and maintain their involvement over time in the required way

On a general level, these arguments may have some appeal, but there are so far few indications that these risks exist in practice. Some policy decisions and coordination are nevertheless necessary to ensure that such problems can be avoided.

Even when basic accessibility is maintained, public transport systems outside the big cities usually have times and areas where services can be improved. Bürgerbusse are normally used to close such gaps. Considering the limited customer base and the cost level of traditional pub-

lic transport, but also that of taxi-based demand-responsive solutions makes closing these gaps by other means a very costly and therefore not realistic ambition (cf. Böhler et al 2009). The framework for Bürgerbus development (cf. section 3), in particular the limitations in vehicle size and number of volunteers, also would make it very difficult to replace existing services. The evolution of the services so far shows that, through cooperation with operators and authorities and suitable training, volunteers can fulfil the required tasks reliably. Only few schemes had to close due to lack of drivers (13 so far according to Burmeister (2010), of which some also closed due to lack of customers).

Already today, the deficits of rural public transport are compensated also by informal lift-giving among neighbours, family members and sometimes also on community level with a more or less formalised organisation. This "hidden public transport" is, however, of no use for those not aware of it, requires high levels of coordination and negotiation and is thus less efficient and effective than a more transparent solution. In the future, aging and shrinking populations will put all kinds of services under increasing financial and human resource pressure. It will therefore be inevitable to use voluntary civic engagement where this is available, and to use it in the most productive way.

7. Summary

Practical experience shows that some key requirements and caveats need to be borne in mind in the pursuit of a Bürgerbus project. These are summed up in figure 5.

On the whole, the evolution of Bürgerbus schemes in Germany has so far been positive, and these services make a meaningful contribution to mobility in the communities where they operate. But it is worth noting that the variety of approaches in this field has grown, especially in the more recent years and in the regions outside North-Rhine Westphalia: There is a growing need for low-cost arrangements, flexible services, carpooling with private vehicles and resource-sharing with other organisations. It may also be necessary to find new ways of linking "genuine" volunteering with other kinds of involvement. Such concepts are not necessarily well addressed with the instruments that have governed the Bürgerbus development in the past.

There is no doubt that in each of the four areas discussed in section 5, measures can be taken to facilitate these processes. The current administrative and regulatory framework in particular is not too well suited. The typology of services laid down in the Passenger Transport Act and the license system are not flexible enough to develop the variety of concepts needed for rural settings and specific needs. Funding is too often tied to established solutions and not enough certainty is given to new approaches and intelligent use of resources (such as the shared use of vehicles). Recruitment and liaising possibilities can be supported especially through openness and assistance on the local level. All in all, while Bürgerbus initiatives - by definition - emerge "from below", there is much that planning and policy can do to support such development as one part of future mobility.

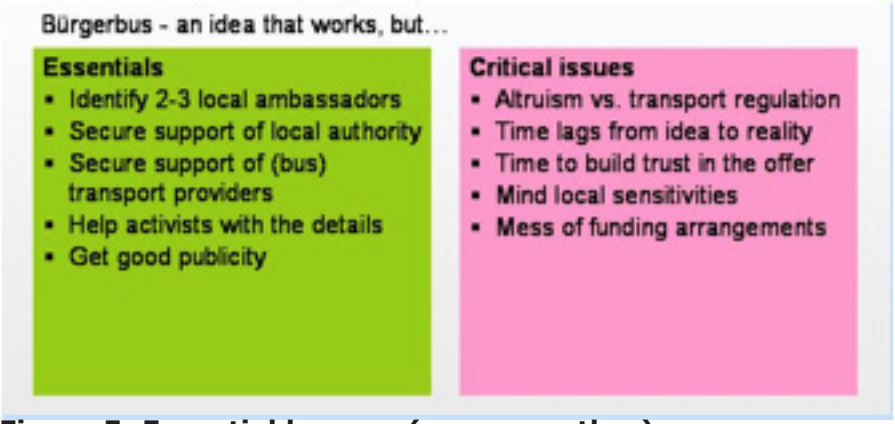

Figure 5: Essential lessons (source: author)

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A Swedish Bicycle Plan

Tomas Björnsson

Introduction

Traditionally, a number of arguments are put forward for enlarging cycling infrastructure considerably: to get more people cycling, to get them to abandon the car, to cycle more often, to go on cycling holidays, and more.

However, with the imminent climate threat and increasingly scarce resources in the world, the main argument may rather be that cycle tracks are an important part of the transition to a sustainable society.

The predicament

Globally we are now facing a very difficult period. Temperatures are not likely to be limited to the widely accepted "no more" than two degrees and we have to accept that[1]. We do not, however, have to accept that nothing can be done or should be done to maximise our efforts to reduce greenhouse gases and to stimulate changes in behaviour that will assist this reduction.

Certainly climate change will affect infrastructure planning. The world faces great upheavals as a consequence of a changing climate and the increasing scarcity of limited resources[2].

In September 2012 the Arctic ice cover reached a new record low[3]. The record was not only broken, it was shattered, in extent, area and volume. Such change has an effect on the weather in the northern hemisphere. The difference in temperature between the Arctic and the mid-latitudes has decreased and so the engine driving our weather is changing, particularly in late summer and a long way beyond autumn. The weather systems can be expected to "get stuck". Once a snowy season or a rainy period starts, it will persist longer[4].

In Europe, we may be able to cope with such variations in weather, but the change is global. In 2012, great parts of the US had a prolonged drought and other areas of the world have been affected similarly with consequent lower crop yield and rising food prices. When countries face food shortages, they focus on feeding their local people, leading to problems in other areas of our global world.

Oil prices are expected to go up. The IEA yearly reports[5] reveal a huge deficit in future oil production, referred to as "fields yet to be found". There has long been disagreement between the geological view that oil resources are finite, and the economic argument that all commodities are replaceable given a demand. A recent report, "The future of Oil: Technology versus Geology" tries to merge these views, concluding that oil supply will continue to increase by one per cent per year, but at a rapidly increasing price. The prediction is "a near doubling of real oil prices over the coming decade"[6]. Although the IEA World Energy Outlook 2012 has optimistic views on oil production in the USA and in Iraq, there is still a gap in the projected demand.

A considerably higher oil price together with climate change is likely to lead to disturbances, for example, in food supply. A report from FAO[7], gives three interpretations of the increase of food prices in recent years: the short term interpretation is to be found in speculation and the use of biofuels (ethanol); the middle term says that agricultural investments have been low for a while and are due to increase when demand rises; the long term is structural: the world food supply may be compared to mining in that we are extracting more from our biological system than it can supply. This view is supported by analysis of the maximum global feeding capacity of sustainable farming.

This may lead to more stringent targets for reduction of greenhouse gas emissions from the countries of the world, but so far, action seems to be too weak and too late.

Emission targets need regular revision[8]. Political leaders and other policymakers tend to use out-of -date figures, ignoring the fact that world emissions are constantly rising.

This denial of urgency matters. In only a few years, the world will be obliged to face the major problem that global warming will not remain under two degrees.

Transport authorities will have to accept that vehicle emissions have to decrease substantially within a few decades in Europe if this part of the world is going to take any lead in mitigating emissions. The Swedish Transport Administration (Trafikverket) writes[9]: "To achieve emission mitigations in the order of 80 per cent by 2030, more efficient vehicles, ships and aircraft, increased share of renewable energy and electrifying road transport will not be enough. An altered direction in the development of society and infrastructure will also be needed." Their conclusion is that alternatives cannot be implemented fast enough to replace the existing fleet of vehicles[10].

It remains an open question whether the volume of traffic in Europe will decrease significantly before 2030, but it seems likely[11], given the above drivers for change.

Even if traffic decreases substantially within the next decade, few would argue that it would mean less demand for a better infrastructure for cyclists. A considerably improved cycle track network may rather be of strategic importance at a point when more than a minority will go out on their bikes for everything from everyday trips to recreational excursions.

The south of Sweden

Skåne is the southernmost region of Sweden. It consists of 33 local municipalities, including the cities of Malmö, Lund, Helsingborg and Kristianstad. The municipalities in Sweden have a planning monopoly which leads to competition, for example, in attracting external shopping centres. They are also responsible for local roads. Roads outside the municipalities are often state roads, where the responsibility lies with the Swedish Transport Administration (Trafikverket, STA).

When cycle tracks are to be constructed outside the built-up areas, it may be argued that the STA should take the full cost of such a project as for the case of a road for motorists. In most cases in the region though, the STA requires the local municipality to pay for half the cost of a new cycle track, arguing that cyclists are mostly local.

This fact puts an uneven burden on the municipalities. Dense cities obviously have more financial muscle for the building of cycle tracks, even outside the built-up area. The less populated municipalities, often covering a vast area, have high demands for a better cycle network, but difficulties funding it.

Reasons for a bicycle plan

The Swedish Society for Nature Conservation, SSNC, is a non-profit organisation and the biggest environmental organisation in the country, counting two per cent of Swedes as members. Biking is a popular topic.

In the spring of 2012 the regional branch of the Transport Administration, STA Skåne, asked the municipalities for a list of new cycle tracks they would prioritise. A second request asked for cycle tracks important for recreational cycling. Since the STA is responsible for the state roads, these questions mostly refer to rural roads. However, while bicycle tracks within the built-up areas of the municipalities are generally extensive, there is a great need for new cycle tracks along the roads leading into these built-up areas.

This is not the first attempt to make a regional bicycle plan. The first plan was made in 2001 and a follow-up in 2006. STA Skåne has consulted the municipalities and made a plan, though this plan tends to downplay the need for cycle tracks connecting municipalities.

The regional branch of SSNC has made its own analysis of cycle tracks needed to give the entire region a decent cycling network, making commuting easy, for children going to school in minor built-up areas, and to fill in missing links in the regional network of cycling routes[12].

Everyday cycling

According to the national travel survey, commuting time to work averages around 70 minutes per day[13]. In Sweden, 9.3 per cent of all journeys are made by bicycle every day. The average distance travelled by bicycle on a single journey is 3 to 4 km.

The allocation of journeys by purpose according to the survey is (p 25):

- 46 % Business, work or school-related
- 18 % Service (personal business) and shopping
- 30 % Leisure

It is reasonable to assume that the speed for a cyclist is around 16 km/h averaged over time and under different weather conditions. Hence commuting by bike appears a good alternative for distances up to 9 km, and in cities like Stockholm, neither car nor public transport are faster modes. In smaller built-up areas with surrounding countryside, it is faster to take the car, but the national travel survey shows that people are prepared to commute 4 km by bicycle, that is fifteen minutes to get to work, school or other everyday activities. From this discussion, it seems reasonable to conclude that bicycle lanes and tracks should be built along roads and extend at least four km from the built-up area. A commuting cyclist needs a direct route alongside roads, rather than through more circuitous countryside paths.

Recreation

The STA Skåne also has a project to define classification criteria for longer cycle routes and has asked the municipalities to provide cycle tracks that may be important for recreational cycling.

The conditions for cycle tourism have been covered in a report from Nutek[14] stating that parts of Skåne are among the most important destinations in the country.

In terms of reduced emissions, recreational cycling does not just substitute a car trip for the distance travelled. The alternative for a day on a bike is not taking the car to drive the same route. If the car is used, the distance travelled is likely to be much further. The national travel survey covers long distance journeys (p 33): "The median distance for long-distance travel by car was 155 km. Half of all long-distance journeys taken within Sweden were for leisure purposes, often to visit friends or relatives."

In light of this, the emission reductions from recreational cycling are probably not negligible.

Traffic

The amount of traffic on a road is normally measured as the number of vehicles per day as an average over the year.

If people want to be able to bike along with their children without being disturbed by traffic, the SSNC argue that it is necessary to use cycle-only tracks or roads with very low traffic. Experience says that people will tolerate 100 to 150 vehicles per day in this case. That corresponds to roughly one vehicle every five minutes, but traffic on such a road is often concentrated to commuter hours and these roads are very calm in the middle of the day. Needless to say, the speed limit must not be too high in order to make cyclists feel comfortable using the road. Most of the roads discussed in the cycle plan have a 70 km/h speed limit.

The report on recreational cycling mentioned above agues in the same direction and that an essentially car-free cycle route network should be built.

The Swedish Transport Administration has suggested a limit of 500 vehicles per day to classify a road as having low traffic and as such suitable for cyclists. That corresponds to approximately one vehicle per minute, a level which prohibits an undisturbed cycling trip. Particularly, this amount of traffic will be too much for a person commuting during parts of the year when mornings and evenings are dark. Also it is definitely too much to let children cycle to school.

A sole cyclist going fast will probably consider a road with up to 1500 vehicles per day as acceptable. In the middle of the day in summer there will not be intense traffic on such a road, and in some cases it can be signposted as part of a route where alternatives are not available.

There is strong case for a general decrease in vehicle kilometers of car travel at the same time as accessibility to commonly used destinations increases and there is a modal shift towards walking, cycling and public transport. The drivers for change are many and include the need to reduce greenhouse gas emissions and air pollution and to provide a degree of protection from future increases in the price of fossil fuels. This reduction in vehicle kms of car travel might remove the need for some new bicycle tracks as traffic levels and speeds are more supportive of bike use than is currently the case. Currently political and business priorities do not support significant reductions in traffic levels and official government forecasts (as reported by OECD Transport Outlook) predict large increases over the next two decades and reject evidence that car use is declining.

Methodology

Making a plan for new bicycle tracks requires not only intense study of maps, satellite pictures and older municipal plans, but needs to take into account a thorough knowledge of the real world. In other words, it is essential to go out on a bike and travel along most of the roads to be discussed. Maps do not indicate clearly whether a road has sharp bends where cars are hidden to the cyclist or if the road has many ups and downs.

A draft of the SSNC plan was sent to the local branch of the society in each municipality. They have taken the task very seriously and made corrections and additions to the projects suggested. After this first round, a second or even a third draft was presented to them for approval.

This process has indeed engaged the members of the SSNC. All branches of the organisation, representing all the municipalities in Skåne, have answered the call for an opinion. In many cases they have made important contributions by looking at the questions from a local perspective.

Results

The region of Skåne has around 1.25 million inhabitants in an area of approximately 1.1 million ha. In this region, 13.5 per cent of all trips are made by bicycle. In the city of Malmö, around 17 per cent of all trips are made by bike, and in Lund and Helsingborg, 15 per cent (figures from SIKA RES0506. In the centre of Malmö and Lund, the figures are around 25 per cent). These cities, together with Kristianstad, have around half of the population. In the rest of the region, 11.6 per cent of the trips are made by bike. In 2006 the average daily kilometres cycled per inhabitant in Sweden was 0.5 km.

In its bicycle plan, the SSNC has suggested around 360 new cycle tracks or improvements to existing roads. Figures in parenthesis are measures to which the SSNC gives priority:

- 530 (260) km of new cycle tracks to be built. This means cycle paths separated from motor traffic by a barrier such as a curb as well as stand-alone paths.
- 410 (150) km of smaller roads to have a hard surface or to have a make-over. This category covers abandoned rail corridors and small roads used to connect other parts of the cycle network.
- 20 (17) grade-separated crossings (mostly tunnels)

Rural cycle tracks built during the last year cost SEK (Swedish Crowns) 2000-3000 per meter. The lower figure is for a longer cycle track (6 km), and the higher price is for a shorter one (1 km) including lighting. This and other estimates are confirmed by the STA of the region and from local municipalities.

Assuming a price of SEK 2500 / m for a new cycle track and SEK 400 / m for a make-over and a hard surface and SEK 5 m for a tunnel, the cost per inhabitant could be estimated as (in October 2012, $1 = SEK 6.50):

- SEK 1280 per capita for all suggestions
- SEK 640 per capita for the projects with priority

It is the view of the SSNC that the projects with priority are of such importance, that they should be realized within five years, which means before 2018. All of the sug-

gested projects should be accomplished within a decade that is before 2023.

The resources spent on new and improved state roads in Sweden are around SEK 1210 per capita per year[15]. The cost for implementing the complete cycle plan in ten years would be around SEK 128 per capita per year.

In comparison, the true costs of car use have been estimated in a recent report[16]. It states that the uncovered costs of cars are around SEK 7500 per person per year in Sweden.

Conclusion

Around ten per cent of the resources spent on new and improved roads in the region have to be redirected to complete an extensive cycle track network that would connect all municipalities in the region and give commuters a real alternative of using a bike instead of a car.

Discussion

To what extent the bicycle plan presented can help to increase cycling in the region is difficult to estimate. Neither the municipalities nor the STA seems to make any measurements of the amount of cycling on a road before a separate cycle track is built and after.

Using data from the national travel survey, it would be reasonable to assume that cycling could increase by a few per cent of all the trips made in rural Skåne.

The carbon dioxide saved from building the cycle tracks in this plan is negligible with this assumption as long as the comparison only covers the average distance cycled, around 3 to 4 km. When the bike is used as part of a longer journey in combination with public transport, the savings are greater, but may still not be high enough to motivate the building of new cycle tracks.

To motivate implementation of the cycling plan, other positive factors have to be considered. First of all is health, which has been documented in a number of studies. Cycling leads to increased physical health and has a number of psychosocial health benefits. The chapter Health Benefits of Cycling in City Cycling[17] says:

> *Transportation services and infrastructure often undergo comprehensive economic appraisals as a basis for investment decision making. However, because many of the benefits of cycling are difficult to measure and are distributed across several sectors, cycling projects tend to be undervalued and consequently underfunded.*

Secondly, for children to use a bike to get to school on their own, is very important for their development[18].

As a third argument, the benefits of summer recreational cycling should not be underestimated. As mentioned above, a day's cycling can be viewed as 150 km of car use saved. The author suggests that psychosocial health of this kind of cycling should receive much more consideration.

A fourth argument towards implementation of the entire cycle plan is a comparison with countries and regions where the number of trips made by bike is considerably higher. Both the Netherlands and Denmark have an extensive bicycle track network and this seems to be a requirement to encourage the high level of cycling.

Finally, but perhaps the most important argument for implementing an extensive bicycle plan, is the need for municipalities to be prepared for the transition to a sustainable society.

Building new cycle tracks or even constructing an entirely new network does not guarantee an immediate increase in cycling. Other measures are required as well and these include widespread social marketing, speed limitation, re-design of streets, improvements in the provision of local facilities to reduce distances from origins to destinations and secure bicycle parking. Bike parking is important and more is required at workplaces and shopping centres but overall, system-wide reductions in car dependency and improvements in local facilities are more important and will send strong psychological signals that will increase bike use.

Although a number of measures are needed to promote cycling, the infrastructure of an extensive cycle track network has to

exist before the promotional tools can be effective. It is not possible to sell a concept if it only exists as a plan on a map.

It is the view of the author that the extensive cycle plan suggested is a very low cost infrastructure investment that has great benefits for the future.

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