

Encouraging sustainable modal shift – an evaluation of the Portsmouth Big Green Commuter Challenge

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Abstract

This paper describes the impact of the Portsmouth "Big Green Commuter Challenge" (BGCC) event, organized by Portsmouth City Council (PCC) in order to reduce carbon and nitrogen oxide emissions from transport within the city. In total, over 1000 people and 36 organizations took part in the 2011 event. This is an example of a "Smarter Choice" measure designed to encourage travel behavioral change to more sustainable modes of transport. A literature review and evaluation of previous "Smarter Choices" measures has been carried out to give some context to the BGCC. An introduction to the city of Portsmouth is presented, in particular its efforts to reduce road traffic and emissions from the city centre area. The event encouraged a modal shift to more sustainable modes of travel, resulting in estimated reductions in CO₂ and NO_x emissions per mile. However, a number of further recommendations have been made to enable future similar events to have a greater impact on road traffic and emissions.

Keywords: Smarter choices, Portsmouth, behavioral change, soft and hard measures, vehicle emissions, AQMA, AQAP, awareness, sustainable, modal shift.

1. Introduction

Sustainable transport policies and initiatives have attracted a lot of interest across the UK, particularly over the last decade. These initiatives all focus on creating greater awareness of travel behavioural decisions through more reliable information, encouraging better informed commuters' attitudes, and promoting active travel in relation to a healthy lifestyle. In the transport sector, these initiatives are widely referred to as 'Smarter Choice' measures. This paper presents an evaluation of one such measure; the Portsmouth "Big Green Commuter Challenge" (BGCC). This evaluation was carried out as part of the EU INTERREG TraCit (Transport Carbon IntenCities) project (TraCit, 2011).

The Portsmouth BGCC was organised by Portsmouth City Council (PCC) during 17-23 May 2011. In total, over 900 people and 33 organizations took part in the 2011 event. It has been run as an employer-led initiative for the last nine years. PCC set up 13 Air Quality Management Area's (AQMA) in 2005 under the 1995 Environment Act. An AQMA is an area labelled by a local authority as having unacceptably high levels of air pollution that requires a plan of action to reduce the levels. The AQMA acted as a key driver for the BGCC and other policies and measures aimed at reducing road traffic in the city centre area (Portsmouth City Council, 2010a and 2010b). The specific objectives of the BGCC were to increase the number of journeys using sustainable modes, decrease single occupant vehicle journeys, encourage individuals to explore healthier options and to recognize and reward these individuals and groups, as well as contributing to improve air quality in the area.

A review of the literature on ‘Smarter Choice’ measures is presented in section 2, to give some context for the Portsmouth BGCC. Section 3 contains an introduction to the city of Portsmouth, providing details of its size, demography, location and transportation infrastructure. Following a description of the data collection process in section 4, a summary of the key results from the BGCC is presented in section 5 which includes the estimated emissions savings, modal split, bus patronage and the various awareness raising methods used to encourage more sustainable travel. A number of conclusions and recommendations have been drawn from both the literature and the evaluation of the 2011 BGCC which are presented in section 6. The acknowledgements and references are at the end of the paper.

2. Review of Smarter Choices

Increased car use is often associated with higher levels of pollution and congestion in urban areas. These problems cannot be mitigated completely through the use of cleaner fuels or cleaner engine technology. Local authorities have implemented a number of measures to reduce the level of car use. These can be divided into two areas; hard measures and soft measures. Hard or structural measures such as improvements to the transport infrastructure and traffic engineering solutions have not always been as successful as hoped in reducing car use (Stopher, 2004; Moser and Bamberg, 2007). The UK fuel duty escalator policy introduced in 1993 did not have the desired effect on reducing car use. Traffic grew by 18% in the 6 years before its introduction and by 13% in the subsequent 6 years after its introduction (Ison and Rye, 2010). Other hard measures such as road pricing have not been widely implemented in the UK due to political concerns over public acceptability. As a result, a number of soft measures have been implemented. These measures aim to change people's travel behaviour through persuasion rather than cost.

Harder measures seek to change travel behaviour by altering the travel costs. Under a utility maximising behavioural model (e.g. Eluru et al, 2013), changing costs would be expected to lead to changes in the number of trips, distribution of the trips, modes of transport used and routes selected. Softer measures seek to change travel behaviour not through changing the relative costs of transport but through changing attitudes and preferences of the individuals. This approach is in keeping with an attitudinal model utilising the theory of planned travel behaviour (e.g. Anable, 2005) as opposed to a utility maximising model that is appropriate for harder measures (Banister, 2002).

Another categorisation is that of pull and push measures; push measures are aimed at deterring car use whereas pull measures are used to improve people's travel options by the provision of good quality alternatives (Steg and Vlek, 1997). Eriksson et al (2008) studied the acceptability of different pull and push measures in a questionnaire survey of car drivers in Sweden and found that while respondents found the pull measures to be effective, fair and acceptable, the reverse was found for the push measures.

'Smarter choices' are an example of a pull technique. They were introduced to local authorities in the UK by the Department for Transport (DfT) to influence the travel decisions people make and to cut congestion on roads (DfT, 2005). Smarter choices include local programmes to encourage schools, workplace and personalised travel planning; improving public transport information and marketing services, setting up web sites for car share schemes and supporting car clubs; encouraging teleworking and teleconferencing, travel awareness campaigns and home shopping (DfT, 2005). They act as a tool to initiate the desired change in the growing level of road traffic, particularly when it is deemed that

the existing 'hard' measures such as physical improvements to transport infrastructure, traffic engineering and control of road space will not alter the problem of congestion, pollution and emissions experienced on a day to day basis (Stopher, 2004). This brought about the need to adopt measures that affect the nature of traveller response, with initiatives often addressing psychological motivations for travel choice as well as economic ones. The objectives of smarter choices are to reduce congestion, improve health by encouraging physical activity, improve social inclusion, reduce environmental damage and reduce cost for employers (Cairns, et al., 2004; Anable et al, 2008). 'The most specific feature linking these different policies has been the potential to impact on the level of car use' (Cairns, et al., 2004).

There has been extensive research/recommendations in the UK on reviewing the national and international evidence of the effectiveness of soft transport policy measures on traffic levels in British conditions (e.g. Avineri and Goodwin, 2010; Cairns et al, 2004). Overall, Cairns et al. (2004), in their review of policy evidence of smarter choices, suggest that reductions in car use have frequently been observed, of the order of 5%-10% overall or 10%-20% for specific types of journeys. They suggested that an intensive and prolonged application of these measures over wide geographical areas and over time could reduce traffic levels by 11% on average and as much as 20% in congested urban conditions. However, the campaign or intervention must be of good quality and be sustained over a long period of time (possibly between 10 and 20 years). The evidence suggests that simple information provision about a journey does not have much effect on travel behaviour and this is because most journeys are routine and habitual and therefore do not require people to seek information for them (Chorus et al., 2006).

Larger scale advertising campaigns generally have small scale effects, which is much stronger on attitudes than it is on behaviour; targeted campaigns can be more successful on changing behaviour (Cairns et al., 2004). Indeed, personalised travel planning can yield success, though mostly amongst those who are already willing to change. There is, however, debate about how long afterwards this effect lasts (Avineri and Goodwin, 2010). Social facilitation can enact a change through challenging social norms by observing what others do in relation to one's own behaviour (see Avineri and Goodwin, 2010 for a review). Overall, the intervention should be something that breaks the habitual routine and provides alternative information that is personalised and localized with a meaningful social element (Avineri and Goodwin, 2010). The BGCC fulfils these behavioural change mechanisms by trying to change habitual behaviour by marketing this event, providing information about alternatives to using the car and challenging social norms (by trying to enact together a sense of social facilitation around the event).

3. Portsmouth and the BGCC

3.1 Introduction to Portsmouth

Portsmouth is the second largest city in Hampshire and is the UK's only island city (see Figure 1). It has a population of 205,056 and is the most densely populated city in the UK with 46.4 persons per hectare compared to 45.6 in London (ONS, 2011). Around 100,900 are estimated to be working, of which 66% travel to work within its own boundaries (ONS, 2011). Tourism accounts for 7.6 million visitors per year (Hampshire, County Council, 2010). The geographical area covers 23.2 m² of land and sea (15.5 m² of land). It has a higher proportion of households owning no vehicle compared to the average for Hampshire and England as a whole (33.4% compared to 14.7% and 25.8% respectively) (ONS, 2011). It is home to 3,400 businesses although employment in the city has been in decline and

there has been a recent trend for large companies to re-locate around the M27 corridor or elsewhere in the sub-region in order to be more accessible by car and less likely to be affected by congestion (PCC, 2012). Portsmouth has a good public transport infrastructure (bus and rail) in place to serve the city and has numerous flat cycle routes. The proportion of people cycling to work in the City of Portsmouth is higher than the national average of 3.1%, with 7.6% of all commuters from outside the administrative area of Portsmouth (ONS, 2001). A recent travel survey showed that 62% of visitors in 2010 travelled to the city by car providing significant opportunities for modal shift to more sustainable modes of travel (PCC, 2012).

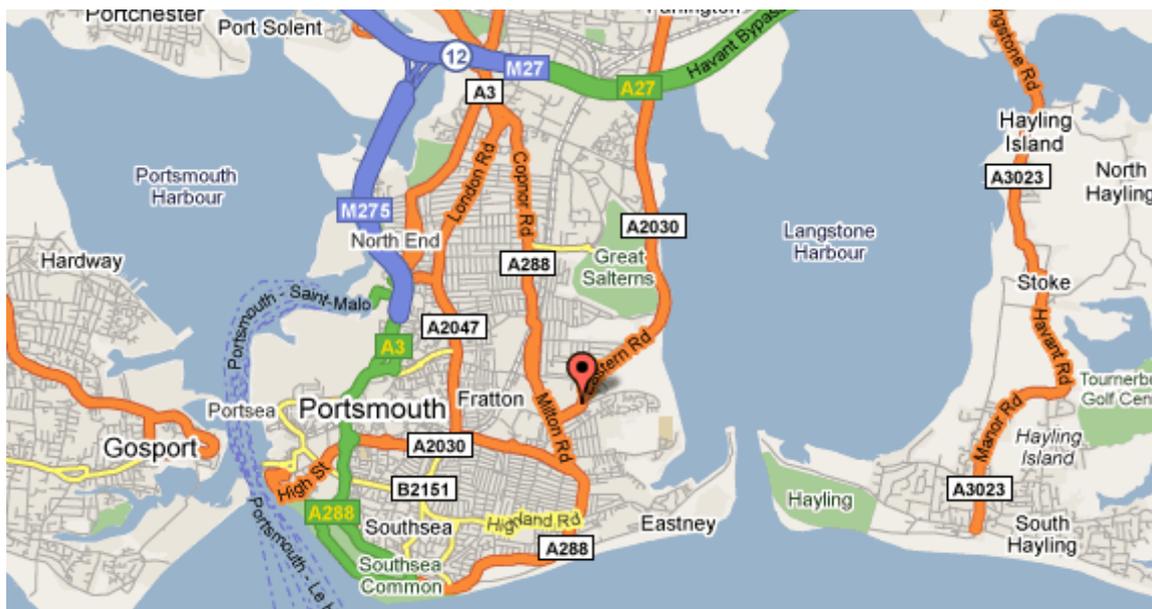


Figure 1 : Map of Portsmouth (from www.destination360.com)

3.2 The Portsmouth Big Green Commuter Challenge (BGCC)

The BGCC in Portsmouth has been run for the previous 9 years (Portsmouth City Council, 2008 and 2010c). It endeavored to raise awareness by making ‘Smarter Choices’ in travel

amongst organisations and local businesses in Portsmouth. PCC stated that the main objectives of the BGCC were to increase the number of commuters that use active and sustainable modes of transport, to decrease the number of single occupant vehicles as a means to reduce emissions and air pollution, to encourage individuals to explore healthier options and to publicise the social, personal and environmental benefits of sustainable commuting and encourage other commuters to make healthy choices (PCC, 2010b). Incentives were also introduced in order to make it more competitive and motivating for individuals and organisations to participate.

The scheme operated mainly through contacts made by the PCC with employers in the city. Many of these employers have an existing contact with the Travel Plan Officer as a result of formulating a travel plan, although many other employers who did not have a travel plan also participated (as well as members of the public). Each employer appointed a co-ordinator to encourage as many of their employees to take part in the BGCC and record their mileage for a typical working week and for the BGCC week, split by mode. The BGCC was also supported by a number of public transport organisations and bicycle shops (including Stagecoach, FirstHampshire, South West Trains, Cycle World and Town Bikes), some of whom meet on a Steering Group on a regular basis to discuss the best ways of implementing the scheme. Incentives for individuals to take part in the BGCC included a 50% reduction on a weekly bus ticket (Stagecoach and FirstHampshire), a 25% reduction on a 7-day train ticket (South West Trains) and between 5%-10% reduction on all bicycles and accessories (from selected bicycle shops in Portsmouth).

Due to cuts in the PCC budget for the 2011/12 financial year, the amount available to spend in promoting the BGCC was just under £3000, which was a 50% reduction from the

previous year. Printing 5000 leaflets cost around £300 and was the second most effective way of making the public aware of the event (after being informed by their employer) (see Figure 2). The publicity budget breakdown for the event is contained in Table 1. By contrast, budgets for the BGCC events in neighbouring towns and Boroughs of Havant, Fareham and Gosport were much lower (£530, £300 and £780 respectively).

Publicity Method	Cost (£)
Prizes	£390
Designing publicity	£290
Printing publicity	£900
Entrance to city' posters	£620
Bus vinyls	£650
Photo	£90
Total	£2940

Table 1: Cost of Publicity for the 2011 BGCC

The use of traditional media such as newspapers, posters and leaflets could have been combined effectively with more use of modern methods such as internet advertising, online social networking and the use of interactive displays within public transport vehicles (TraCit, 2011). The BGCC could also have benefited from having a visual and/or audible presence in the city centre where members of the public could ask questions and engage with those organising the event in order that they are aware of what is happening and what the key message is (MIRACLES, 2006).

Previous research suggests that marketing can result in improvements in the awareness of the public of the problems with the use of private vehicles, increased support for public transport, and increased support of measures put in place to reduce congestion and dangerous driving (see Jones and Sloman, 2003 for an overview). Where actual travel behaviour has been collected, Jones and Sloman (2003) suggests that this type of marketing

approach has typically led to a 7-16% reduction in car use, though previous examples have not necessarily included incentives alongside marketing as this campaign did. No data has previously been collected on changes to pollution levels associated with changes made in travel or mode of travel as a result of such marketing changes.

4. BGCC data collection process:

Data with regards to the participants' travel behaviour 'before' and 'during' the BGCC was collated through an online questionnaire, which had been designed to be user friendly and accessible to all. The co-ordinators of each organization taking part had the opportunity of registering their involvement online before the event.

An alternative option was for participants to fill in a paper version of the questionnaire and then pass it to their company co-ordinator who was then responsible for entering the information online after the event (members of the public could also use the paper version and post it to PCC by a set deadline after the event).

A self-completion questionnaire was developed to assess information from people who had taken part in the BGCC. Travel behavior change was assessed in self-reported miles travelled for a typical week prior to the BGCC by mode and again for the BGCC week by mode. It was asked if they planned to continue with this behaviour in the future (post BGCC). Miles travelled per mode, as opposed to trips or in terms of travel time, for example, was collected as it was seen to be a more accurate reflection of impact on communities, especially in terms of pollution. Finally, awareness of BGCC and motivations for taking part were also collected.

In order to evaluate the emission savings due to the BGCC, emissions savings formulae calculations were made within a bespoke spreadsheet template on the survey data mileage (split by mode) by using figures published by DEFRA (Defra, 2008). These conversion factors, as shown in Table 2 for CO₂ and NO_x, are estimated average values for the UK car fleet in 2007 travelling on average trips in the UK, but do not include cold starts.

Mode	kg CO₂ per unit	kg NO_x per unit
Car	0.33910	0.00154
Motorbike	0.18678	0.00097
	kg CO₂ per passenger	kg NO_x per passenger
Taxi	0.2451	0.00064
Bus/Coach	0.2156	0.00104
Rail	0.1236	0.00305
Ferry	0.0308	0.00015

Table 2: Passenger Road Transport Conversion Factors for CO₂ and NO_x
(from Defra 2008)

5. Results from the 2011 BGCC

5.1 Summary of key results

A total of 928 participants representing 33 organisations took part in the BGCC. Table 3 shows the key results from the BGCC which includes the mileage and estimated emissions before and during the event. The BGCC 2011 mileage for all modes was much lower for the ‘during’ than the ‘before’ week (61,582 compared to 65,574). This 6% reduction was shown to be statistically significant using a paired t-test at the 95% confidence level. Estimated CO₂ emissions per mile for those taking part were reduced by 46%. In addition, NO_x emissions per mile were reduced by 17% which was particularly important as it was an obligation for PCC to improve local air quality under its AQAP, required as part of the Environment Act 1995.

	Before BGCC event 2011	During BGCC event 2011
No of Miles	65574	61582 (6% reduction)
No of Participants	928	928
No of Organisations	33	33
CO ₂ emissions (kg)	11800	6023
NO _x emissions (kg)	73	56
CO ₂ emissions (kg) /	12.7	6.5
NO _x emissions (kg) /	0.070	0.060
CO ₂ emissions (kg) /	0.18	0.098
NO _x emissions (kg) /	0.0011	0.00091

Table 3: Summary of key results from the BGCC

The 2011 event took into account the participants usual mileage and mode of travel and used the appropriate conversion factor recommended by Defra in order to generate the actual emission savings. However, these results are based on a self-reported questionnaire survey and are therefore difficult to verify and there can be a possibility of socially desirable responses to particular questions.

The main reason participants took part in the BGCC was in order to help their organization win the BGCC prize (22%), environmental concerns (21%) and health reasons (15%). Only 3% stated that the incentives offered (e.g. discounted bus travel) was their main reason for taking part.

5.2 Modal split of commuters traveling to work

Modal split of commuters travelling to work in Portsmouth for the Census in 2001, before the 2011 event, during the 2011 event and during the 2010 event is shown in Table 4. The census showed that 50% of residents travelled to work by car or van (Hampshire County Council, 2010b); this reduced to 37% before the 2011 event. During the 2011 event, there

was a reported 18% increase in bus travel (although bus passenger numbers showed no change (see Figure 3)), 8% increase in car share and 6% increase in train travel. Participants did not have the option of entering a mileage for their travelling to work by car or van during the 2010 or 2011 events. It is possible that some participants used their car/van at some stage during the event. The vast majority of respondents (96%) stated that they would now continue to commute to work using the mode(s) travelled during the BGCC in the future. Without follow-up travel diaries, it is difficult to verify that stated intentions resulted in actual changes in travel behaviour.

%	City Census 2001	During 2010 event	Before 2011 BGCC event	During 2011 BGCCevent
Walk	15	6	4	5
Cycle	7	16	21	21
Car or Van	50	-	37	-
Car Share	7	17	12	20
Bus	9	29	4	22
Train	2	21	16	22
Ferry	-	2	2	3
Motorbike.....	1	3	2	3
Work from home	7	5	1	3
Others	2	1	1	1

Table 4 : Modal split of commuters traveling to work

5.3 Awareness method

The main method by which participants were made aware of the BGCC was through their employer (52%). This was followed by leaflets, PCC, word of mouth and posters (see Figure 2). As this was an employer led initiative, it is not surprising that most people were made aware of the BGCC through their employer. Other methods of publicity were also used to raise awareness of the event to members of the public such as the BGCC website.

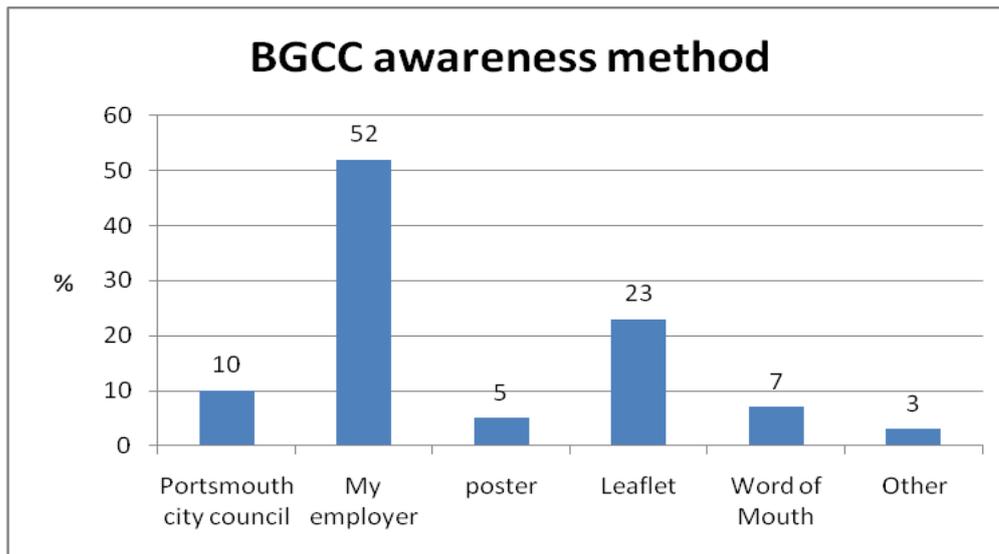


Figure 2 : Awareness publicity statistics for BGCC 2011

5.4 Bus passenger numbers and traffic flows

As previously mentioned, whilst there is robust evidence that those taking part in the BGCC reduced their distance driven, it is not known whether this was offset by those drivers not taking part. It is possible that the data captures random fluctuations in individuals travel behaviour, but excludes this where there was an increase in distance driven. As such it is useful to determine from other data sources whether the reduction in distance driven by participants corresponds to an overall reduction in car traffic and increase in public transport use for the city overall. Figure 3 shows the number of passengers travelling on Stagecoach buses within Portsmouth (along with the total miles travelled by these buses) for April and May 2011. Stagecoach had a fleet of 62 buses. The data shows that passenger numbers dipped during Easter but rose to over 120,000 during the BGCC week. However, passenger numbers and mileage remained similar during the last 3 weeks of May (which included the BGCC week). Passenger numbers for First Bus also showed no noticeable change; 125,880 (9 – 15 May) and 124,550 (16 – 22 May).

During the BGCC, there was a total of 38 promotional season tickets sold (split almost equally between Stagecoach selling 18 and First Bus selling 20).

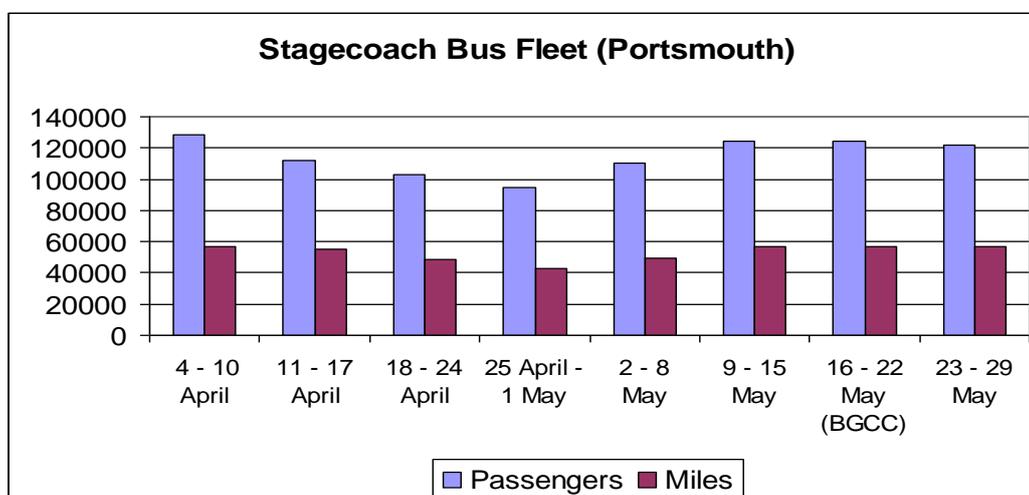


Figure 3 : Bus passenger numbers and mileage for April and May 2011

Similar flows for cars and motor vehicles split by week were not available. However, annual traffic flows (in thousand vehicle miles) have been collected from 53 count points at strategic locations in Portsmouth and are shown in Table 5 (DfT, 2014).

Year	2006	2007	2008	2009	2010	2011	2012
Cars	403,410	389,053	380,201	386,533	389,651	390,773	396,534
Buses & Coaches	4,073	3,619	3,683	3,393	3,928	3,686	3,759
All Motor Vehicles	484,199	468,312	459,506	465,378	471,700	473,234	482,988
Percentage change in cars	1.62	-3.56	-2.28	1.67	0.81	0.29	1.47

Table 5: Annual traffic flows (in thousand vehicle miles) for Portsmouth

(from DfT, 2014)

The figures show that with the exception of 2007 and 2008 (associated with the economic downturn), annual car flows increased every year between 2006 and 2012. They show that the 6% reduction in car use during the BGCC had very little impact on the overall trend of

annual traffic flows in Portsmouth, perhaps showing little sign of locked-in change after the

6. Conclusions and Recommendations

The BGCC event saw an estimated 46% reduction in CO₂ and 17% reduction in NO_x emissions per mile for participants, which resulted from the modal shift from the car to more sustainable modes of travel. The findings suggest that creating an annual challenge can change modal behaviour, thus further emphasising that travel behaviour is not as unchangeable as might be sometimes perceived, albeit over a short period of time.

It may be people can make sacrifices and suffer perceived inconvenience for a short duration, but the macro level data suggests people are reverting back to their ideal travel mode, despite saying otherwise. This is typically expected given the habitual nature of travel choice decisions, especially regarding work-related travel behaviour and more long-term strategies are needed to lock in such behaviours (e.g. Klöckner, and Matthies, 2004).

The findings suggest that the BGCC fostered a shift towards car sharing. This perhaps was seen as being the option with least amount of change needed at an individual level. This is something that can easily be locked in post event, by companies allowing better parking facilities for those car sharing and by local authorities developing lift-share schemes and infrastructure based changes such as dedicated two-plus lanes, that allow only vehicles with more than one occupant to use. Clearly, the change to car sharing did not increase miles driven as is often mooted to be an issue, meaning people are not travelling far out of their way to share rides in and out of work.

Overall, the BGCC had some success in promoting and encouraging more sustainable travel amongst commuters which was assisted by the involvement of key organizations and public transport companies. However, there is a need for the introduction of other soft and hard measures to build on and lock-in any sustainable modal shift.

It is important that local authorities give attention to the best way of locking in the emission savings after such events or campaigns so that any road space freed up by the BGCC is not taken up by new traffic (although the results of the event show that little road space has been freed up with only 928 out of 41,900 commuters taking part). This may include the use of further publicity and/or follow on travel diaries for participants to fill in to encourage their continued sustainable travel behaviour. It could also include employers encouraging their employees to travel in a more sustainable way with the use of incentives to achieve the targets outlined in the company's travel plan. Avineri and Goodwin (2010) suggest that this is best done with more hard measures as soft measures alone can allow the individual to drift back to the default of using their private vehicle. They suggest, in order for 'soft' measures such as the BGCC to be successful, local authorities may need to implement other 'hard' measures (e.g. Park and Ride, road pricing, stricter parking controls and improved pedestrian and cycling facilities). Carbon pricing could be used to put an economic cost on the emissions generated and so provide an economic incentive for companies to reduce carbon emissions (Wall et al, 2008).

It may also be the case that if the BGCC was very successful, ironically driving becomes more attractive as the roads contain less traffic. In addition, public transport or cycling may become less attractive as facilities become over used. Hence, people may revert or start

driving, filling the void left by others who have changed mode, making the need to lock change in absolutely vital. The bus patronage figures suggest this might well be the case, with people who took part in BGCC reporting they moved to the bus but overall bus patronage staying relatively similar during BGCC as previous and subsequent weeks.

It appears that smarter choice measures are able to change behaviours by changing attitudes and preferences. However, on an aggregate level, it appears that reductions in travel costs caused by these individuals switching to alternative modes can encourage others to drive to work as would be expected in a utility maximisation model. Therefore it is important that the freed up road space does not lead to reductions in costs for other motorists.

The consideration of real-time changes in behaviour and savings in CO₂ as a result of modal shift could have been posted to individuals on their smartphones or computers. This could have fostered a better spirit of social comparison and create new social norms and generate a feeling of competition (essential for behaviour change – see Avineri and Goodwin, 2010), especially between companies, since wanting their company to win the challenge was a popular motivator for entering the challenge. The idea of competing amongst other companies engenders the sporting spirit, with the posting of league tables as the week went on, leading to the announcement of the winner on the final day. After all, the motivation to win the competition was the leading motivation to sign-up to the scheme.

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