Bumper-to-Bumper in Bristol: A congestion charge for climate change

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This policy brief is aimed at **Marvin Rees, Mayor of Bristol:**
The Mayor is the head of Bristol City Council, and is responsible for the strategic government for the city of Bristol. One of Rees's priorities is improving transport and people flow within the city and this policy brief is concerned with this issue, suggestion a city centre congestion charge in Bristol.

Executive Summary

Transport plays a major role in air pollution and contributes highly to domestic greenhouse gas emissions within the United Kingdom, impacting negatively on climate change. Statistics derived from the Transports Statistics Great Britain report show that in 2008, transport pollution equated to 26 percent of all greenhouse gas emissions[1]. These greenhouse gas emissions contribute hugely to climate change and are detrimental to the environment; therefore, it seems logical to attempt to ameliorate these figures. London is a city that has taken this into consideration, implementing a congestion charge in the city centre in order to reduce air pollution emitted by road traffic. The results of the charge have been positive in several different areas including a reduction in air pollution caused by the transport sector and reduced traffic flow, suggesting that this solution can work in other urban areas. Another city with high levels of traffic and air pollution is Bristol and I believe that this city benefit from a congestion charge similar to that in London. With aims to become a more sustainable and transport friendly urban area, a congestion charge can offer Bristol an opportunity to ameliorate said environmental concerns whilst improving the air conditions and emission rates, among other things, for both its inhabitants and the environment. Using the London congestion charge as a case study, this policy brief considers the pros and cons of implementing such a charge, this policy brief includes positive impacts as well as logistical challenges you can expect this from this policy.

Empirical Analysis

There are many intricacies of transportational air pollution, but it is essential to know that pollution from cars can be split into primary pollution – emitted directly into the atmosphere – and secondary pollution – chemical reactions between pollutants in the atmosphere. Firstly, the particle matter (PM10) released results in smog and is damaging to human respiratory health whilst acting as a greenhouse gas, cooling and warming the earth's climate[2]. Hydrocarbons, Nitrogen Oxides (NOx), Carbon Monoxide, Sulphur Dioxide and other hazardous air pollutants (toxins) all have negative effects for people, causing varying health concerns such as reduced lung capacity, with links to birth defects and even cancer[3]. NOx - comprised of Nitrogen Monoxide (NO) and Nitrogen Dioxide (NO2) - is important in air pollution as it is emitted during fuel combustion and contributes to the Greenhouse Gas effect[4], whereby some of the sun's energy is either reflected away from or absorbed into the earth and is either trapped by greenhouse gasses (thus warming the earth) or released into space[5].

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[1] Department for Transport (2010). *Transport Statistics Great Britain: 2010*. [online] Available at:
[2] European Environment Agency, Air Pollution Fact Sheet 2014 - United Kingdom. (2014). p.3.

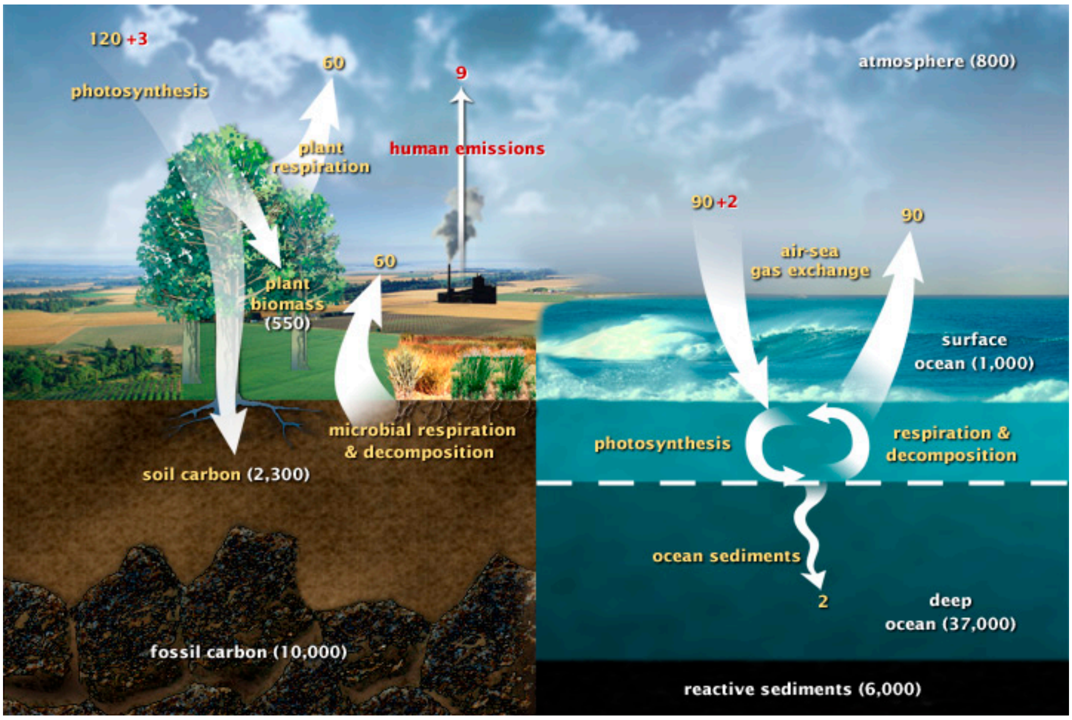
[3] Rossman, R. (2017). *The Effect of Vehicular Emissions on Human Health*. [online] Teachers.yale.edu. Available at: http://teachers.yale.edu/curriculum/viewer/initiative_08.07.09_u [Accessed 28 Apr. 2017].

[4] Schumann, U. (1997). The impact of nitrogen oxides emissions from aircraft upon the atmosphere at flight altitudes—results from the aeronox project. *Atmospheric Environment*, 31(12), pp.1723-1733.

[5] Environment.gov.au. (2017). *Greenhouse effect | Department of the Environment and Energy*. [online] Available at: http://environment.gov.au/climate-change/climate-science/greenhouse-effect [Accessed 27 Apr. 2017].

Moreover, greenhouse gases, such as Carbon Dioxide (CO2) are emitted by motor transport, contributing heavily to global climate change.[6] CO2 is naturally present in the atmosphere and is a greenhouse gas heavily emitted by human activities, which has affected the natural balance of CO2 within the atmosphere, as levels of CO2 have increased by 40 percent since the Industrial Revolution[7], affecting the earth's carbon cycle (demonstrated in figure 1). The carbon cycle involves absorption of CO2 by plants via photosynthesis and returning of carbon by the terrestrial system to the atmosphere via plant respiration, fires and also human activities. Simultaneously, gases are exchanged on the ocean's surface and the deep ocean is transferred carbon by circulation and biological production[8]. The addition of CO2 released by burning fossil fuels effects this cycle, swaying the natural balance, and alongside other greenhouse gasses traps more heat within the atmosphere, causing global warming and climate change.

Figure 1: ***Simplified schematic of the global carbon cycle*** – yellow numbers are natural fluxes, red are human contributions, white are stored carbon, all in gigatons per year.[9]



[6] Union of Concerned Scientists, *Cars, Trucks, and Air Pollution*. (2014). *Union of Concerned Scientists*. Retrieved 23 February 2017, from http://www.ucsusa.org/clean-vehicles/vehicles-air-pollution-and-human-health/cars-trucks-air-pollution#.WK8afLaLSHp

[7] World Health Organization, United Nations Environment Program, *Climate change 2013: The Physical Science Basis*. (2013). 1st ed. Geneva: IPCC Secretariat, p.11.

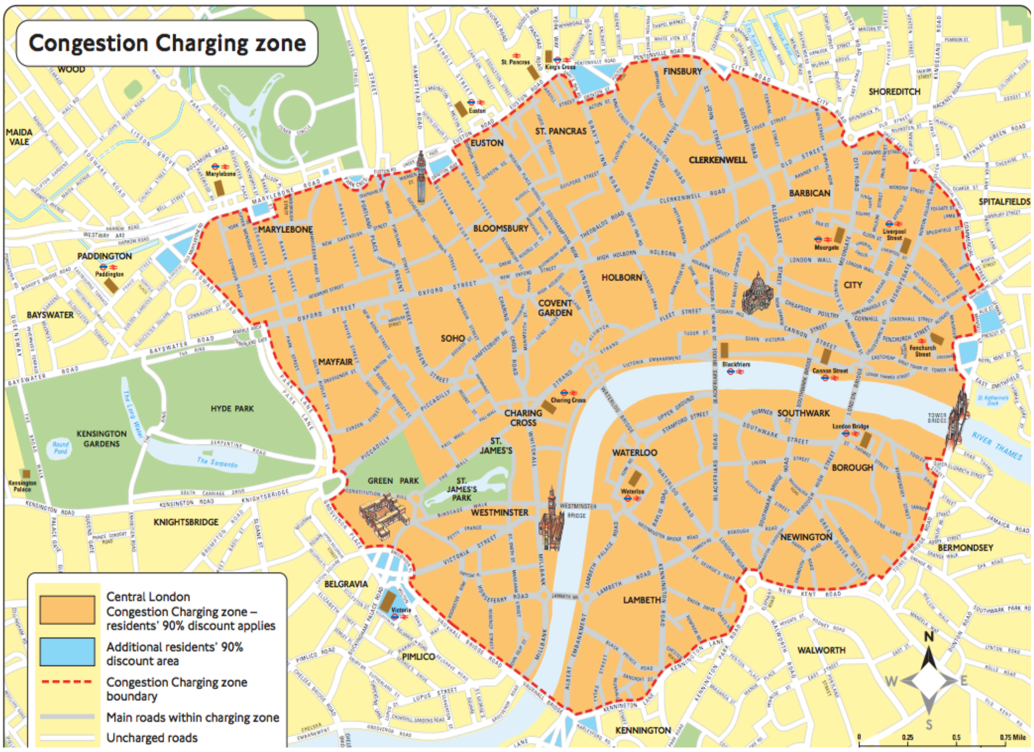
[8] Post, W., Peng, T., Emanuel, W., King, A., Dale, V. and DeAngelis, D. (1990). 1st ed. American Scientist, Volume 78, p.314.

[9] Riebeek, H. (2011). *The Carbon Cycle : Feature Articles*. [online] Earthobservatory.nasa.gov. Available at: https://earthobservatory.nasa.gov/Features/CarbonCycle/ [Accessed 27 Apr. 2017].

Assessment/analysis of evidence

Transport's contribution to climate change is large and the emissions of transport within the United Kingdom demonstrate this: 31 percent of Nitrogen Oxide[10] (in 2012) and 27 percent of Carbon Dioxide emissions were from transport, illustrating the large proportion of greenhouse gas contribution transport has. Considering the aforementioned concerns regarding high levels of pollution, the transport sector requires attention regarding methods of ameliorating its negative effects on climate change. Many cities have implemented strategies in order to combat excessive vehicular use, in attempt to reduce pollutant levels. Introduced February 13th, 2003, the London Congestion Charge (LCC) is a daily fee of £11.50 for driving a vehicle within the charging zone (see figure 2) between the hours of 07:00 and 18:00, Monday to Friday.[11]

Figure 2: ***Congestion Charging Zone in London***[12]



This has been a successful attempt in reducing traffic flow, with significant reductions of both PM10 and NOx within the congestions charge area. Within the first year, total NOx emissions in the charging zone have reduced by −12.0% ±12% and PM10 emissions have reduced by –11.9%[13], highlighting a positive impact on air quality. Furthermore, there

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10 European Environment Agency, Air Pollution Fact Sheet 2014 - United Kingdom. (2014). p.6.

11 Matters, T. (2017). *Congestion Charge (Official)*. [online] Transport for London. Available at: https://tfl.gov.uk/modes/driving/congestion-charge [Accessed 28 Apr. 2017].

12 *Congestion Charge zone*. (2017). *Transport for London*. Retrieved 23 February 2017, from https://tfl.gov.uk/modes/driving/congestion-charge/congestion-charge-zone?intcmp=2055

13 Beevers, S.. & Carslaw, D. (2005). The impact of congestion charging on vehicle emissions in London. *Atmospheric Environment*, *39*(1), 1-5. http://dx.doi.org/10.1016/j.atmosenv.2004.10.001

have been far less road casualties within charging hours than outside charging hours[14], a positive local impact of the congestion charge. Moreover, the fourth annual report conducted by Transport for London recorded a 12 percent savings of both NOx and PM10 within the charging zone, and savings of 20 percent of CO2 within the zone[15]. The costs associated with implementing the London congestion charge were higher than expected, however, net revenue has been positive and 80 percent [16]of scheme revenues have been spent on bus service improvements within the city. Furthermore, with reductions in traffic and journey time, political support for charge has been high and public support common.

Conclusion, recommendations and outlook

Bristol is a city that too suffers from heavy congestion, with twenty-seven hours spent in traffic, with £845 spent per driver per year and a huge sum of £154 million spent by the city[17]. This is time and money that can be saved and spent elsewhere, ideally on current transport systems, such as park and ride schemes, whilst improving sustainability and diminishing air pollution within the city. In November 2012, Bristol City Council published a study entitled 'Connect Bristol Feasibility Study'[18], highlighting the necessity to improve on the city's transport infrastructure. Specifics include improvements to congestion and journey times, as well as promoting sustainable alternatives to private car use. A congestion charge similar to that used in London will promote public transport use whilst improving the current air quality of the city, results that are possible as seen in London. If the congestion fee were wholly used to implement and improve transport strategies within Bristol's city centre, the impacts would be beneficial on a short and long-term basis, improving sustainability and population health simultaneously. Within the City Council's aforementioned study, it is mentioned that local road transport accounted for approximately 20% of Bristol's total CO2 release and that a shift from single person transport could dramatically diminish this total[19]. A congestion charge can combat this issue and positively impact the city and its inhabitants.

However, there are some challenges that arise with implementing a congestion charge, as experienced by London, which shall be used as a case study.

- First we must consider the **amount to charge**: when using economic analysis, Mayor of London Ken Livingstone relied on research regarding

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[14] Tonne, C. (2011). *Air Pollution and Health Impacts of the London Congestion Charge Scheme*. Presentation, London. http://www.tsu.ox.ac.uk/research/uktrcse/UKTRC-w2-ctonne.pdf

[15] *Central London Congestion Charge: Impacts Monitoring*. (2006) (1st ed., p. 114). London. Retrieved from http://content.tfl.gov.uk/fourthannualreportfinal.pdf

16 [16] Leape, J. (2006). The London Congestion Charge. *Journal of Economic Perspectives*, 20(4), p.161.
[17] *INRIX 2016 Traffic Scorecard - U.K.*. (2017). *INRIX - INRIX*. Retrieved 24 February 2017, from http://inrix.com/resources/inrix-2016-traffic-scorecard-uk/

[18] *Connect Bristol Feasibility Study*. (2012) (1st ed., p. 13). Bristol. Retrieved from https://connect.innovateuk.org/documents/3130726/3794125/Feasibility%20Study%20-%20Bristol%20City%20Council.pdf

[19] *Connect Bristol Feasibility Study*. (2012) (1st ed., p. 13). Bristol. Retrieved from https://connect.innovateuk.org/documents/3130726/3794125/Feasibility%20Study%20-%20Bristol%20City%20Council.pdf

'modelling of household behaviour and resulting traffic patterns'[20], illustrating specifics that will need to be research before deciding on the rate of the charge.

- The **location** of the congestion charge is also important. London's covers eight square miles – only one percent of the total area of Greater London – but incorporates some of the principal areas with the highest levels of congestion[21].
- **Payments** can be made in advance (daily, weekly or annually) and via different means, such as by telephone or over the Internet[22], and charges are enforced using video cameras, license plate recognition technology and a database of paid or exempt vehicles[23].

Despite logistical challenges, the benefits of a congestion charge have been displayed in London and can be replicated in Bristol; naturally, this will occur on a smaller scale due to the size difference of both cities, but a positive impact nonetheless. As the inhabitants of the city may not initially be welcome to the idea of a congestion charge, the improvements that can be made to public transport within the city using the revenue from the charge will benefit many people and make Bristol a more logistically traversable city at the forefront of sustainable endeavour within the United Kingdom.

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[20] Leape, J. (2006). The London Congestion Charge. *Journal of Economic Perspectives*, 20(4), p.160 .

[21] Leape, J. (2006). The London Congestion Charge. *Journal of Economic Perspectives*, 20(4), p.161.

[22] Leape, J. (2006). The London Congestion Charge. *Journal of Economic Perspectives*, 20(4), p.162.

[23] Leape, J. (2006). The London Congestion Charge. *Journal of Economic Perspectives*, 20(4), p.163.

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European Environment Agency, Air Pollution Fact Sheet 2014 - United Kingdom. (2014). p.6.

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