Managing demand in the North East.

HOOD, C. and LAING, R.

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Contents

Authors:
Caroline Hood, Lecturer, School of Applied Social Studies, Robert Gordon University
Professor Richard Laing Bsc PgCert PhD MRICS, Professor of Built Environment Visualisation, The Scott Sutherland School of Architecture & Built Environment, Robert Gordon University
, Robert Gordon University

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1. Introduction

1.1. Background

The policy context

Local authorities and Regional Transport Partnerships may need to be seen to be reacting to the Scottish Government's inclusion of Workplace Parking Charges in the recent Transport Scotland Bill, with provisions soon to be enshrined in legislation. The Nestrans Board has expressed a desire to explore this issue in the context of wider demand management measures. As organisations, there is a need to have evidence to express meaningful views when faced with questions regarding demand management. Furthermore, the wider policy context operating in the North East of Scotland must also be reflected upon and due regard given to the existing local, regional and national transport policy objectives and how the forthcoming regional transport strategy will set the future agenda for how businesses and citizens travel in and around the region in a sustainable way.

Furthermore, the population increase associated with economic migration to the North East has also seen a concurrent increased need for transport. This is of particular relevance when considering the high paid nature of employment in the region, coupled with aspirations connected to quality of life, that has resulted in population increases not only in Aberdeen but throughout the towns and villages in the region (Nestrans 2019a para 1.1.3). As a result, "the past few years of delivery of transport improvements has been a catch up on that required to match jobs and population growth" (Nestrans 2019a para 2.1).

As previously observed in 2012, individual travel choices remain habitual, despite transport improvements and alternatives becoming more widely available and that if significant modal change is to be delivered, there needs to be a transformation in the way goods are moved, services are delivered and personal journeys are undertaken (Aberdeenshire Council 2012 para 2.3). In 2019, the North East continues to see high levels of private vehicle use and demand management strategies are part of a suite of measures which can assist in helping the region meet both its climate change obligations and public health targets, while still maintaining the economic vitality of the region. From an economic perspective, there are a number of opportunities presented through the revenues generated via various demand management mechanisms to invest in public transport to improve both journey times and the overall user experience.

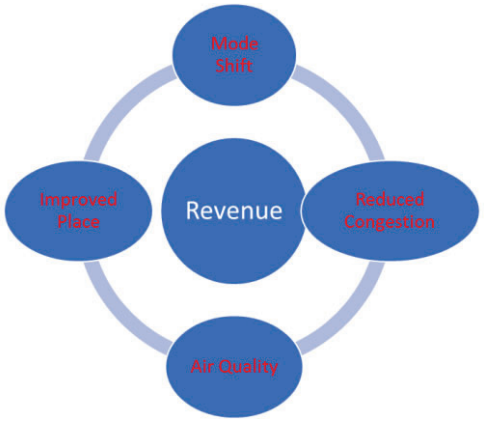

Figure 1: Nestrans 2019

On a national scale, the recent First Report of the Commission on Travel Demand noted that, "it is not just how much we travel but where, when and how we travel that affects society" (Commission on Travel Demand 2018 p. 12). This also feeds into the wider question of social justice and the role that transport plays in access to employment, training and education alongside issues of access to services and how age and socio-economic background will shape an individual's travel choices. Therefore, all users need to be considered, with recognition given to disadvantaged and vulnerable users to both improve access to potential employment and key services (see further Nestrans 2019a para 4.3.3).

Air quality

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In Europe, transport is responsible for more than half of all NOx emissions and contributes significantly to the total emissions of other pollutants such as particulate matter (EEA 2018). While air quality in the UK is reported as having improved since 2010, road transport constitutes 80% of NOx concentrations at the roadside (Department for Transport 2019, 2.7). In common with many urban areas, the main pollutants of concern in Aberdeen City are nitrogen dioxide and particulate matter (PM10), related to road traffic emissions (Aberdeen City Council 2019a). By 2026, Aberdeen City Council has set the ambitious target of reducing Aberdeen's total carbon emissions (including those attributed to transport) by 42.5% (Community Planning Aberdeen, 2019) and Aberdeenshire Council's Sustainability Charter Action program contains a commitment for a long-term goal of significantly reducing the production of greenhouse gases by 2050 (Aberdeenshire Council 2019). Therefore, addressing how demand is managed in the City and the wider region will be critical in moving towards such a reduction and in assisting the Scottish Government in meeting its commitment to net zero emissions by 2045[1].

There is also a need to consider the economic competitiveness of the region and the role transport can play in fulfilling the objectives of the Regional Economic Strategy. It has already been noted that the overarching objective should be one that promotes the UK and Scottish economy by improving connectivity of the transport network and addressing key problems such as transport related costs, long journey times and journey time reliability (Nestrans 2019a para 4.3.3) all of which have significance to the region's economy.

Active travel has a significant role to play in achieving many of these emissions targets and also has the important associated benefit of improving the health of the population through decreased exposure to poor air quality and increased levels of physical activity. Research conducted in Stockholm in 2017 demonstrated that there is a "very large" potential for reducing emissions and exposure to such emissions if all drivers living within a distance that equated to a maximum 30-minute bicycle ride to work would change from commuting by motorised vehicle to commuting by bicycle (see Johansson et al 2017). Such activity levels would contribute to ensuring adults meet their recommend levels of physical activity per week, in addition to the carbon savings of reduced vehicle usage. Therefore, there are multiple benefit to effective demand management policies, with a complement of enhanced economic, environmental and public health outcomes possible.

Dominance of the private car

The relationship of citizens to the private car is one that extends beyond utility and encompasses outward displays of status and success (Gatersleben 2012 p. 679). In contrast to modes of active or collective travel, the private car creates a feeling of safety and security that is not found in these alternative transportation methods (Gatersleben 2012 p. 679). This is a consistent theme for the North East of Scotland with the heavy reliance on the private car having a detrimental impact on journey time reliability, emission levels and safety concerns with other road users and active travel conflict during Aberdeen at peak periods (Jacobs 2018 para. 1.6.3). At 58%, Aberdeen City has a significantly higher car mode share than Edinburgh (32%), Glasgow (36%) and Dundee (45%) (Nestrans 2019a para 4.2.3).

Although affected by a lesser extent, key commuter locations in Aberdeenshire (e.g. Westhill and Inverurie) also experience congestion during peak travelling hours due to the dominance of private vehicles. At 70%, Aberdeenshire car mode share is higher than

[1] Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 asp 15

all cities and both the Scottish national average (62%) and Scottish rural average (63%) (Nestrans 2019a para 4.2.3).

Recent work undertaken by Jacobs notes that public transport in the region suffers from a lack of competitiveness compared with the private car, citing long journey times throughout the region and lack of direct services on radial routes (Jacobs 2018 para 1.6.4]. As noted above, there are a number of opportunities presented through the revenues generated via various demand management mechanisms to invest in public transport to improve both journey times and the overall user experience.

CIVITAS PORTIS

The Horizon 2020 CIVITAS PORTIS project has allowed the Aberdeen partners to set ambitious targets with the aim of maximising uptake of active travel for short journeys with the intention of meeting the project's ambitions of creating more sustainable and healthier city-port environments. From 2016 to 2020, Aberdeen has been one of five "living laboratories" seeking to develop and implement policies that will: (i) improve governance for enhanced co-operation between cities and ports; (ii) create more sustainable and healthier city-port environments; (iii) shape more integrated transport infrastructure and mobility systems; and (iv) improve the efficiency of urban freight transport (Civitas Initiative 2016). Included within Aberdeen's plans for the project are a range of measures that seek to encourage and develop active travel as a credible mode of transportation for citizens and a number of demand management options have also been explored within this context.

As part of the CIVITAS PORTIS project, the city's Sustainable Urban Mobility plan (SUMP) has been re-developed and it is envisaged that this will act as a framework for future city transport projects, complement and expand the City Centre Masterplan and Roads Hierarchy and more generally support the aspirations of regional policy in relation to transport, active travel and demand management options.

What is demand management?

Demand management can include Low Emission Zones, parking controls and charging regimes as well as traffic management and traditional means. The Regional Transport Strategy will also need to provide clear guidance to local authorities in the role of these in their own Local Transport Strategies. It is also intended that this work will support the current work being undertaken to develop the next Regional Transport Strategy to 2040. Appendix II provides a visual summary of the cause and effect of parking related issues, demonstrating that demand management has a significant role to play in addressing a variety of challenges the region faces.

It is acknowledged that local authorities are currently faced with extremely challenging budget limitations. It is the intention of this research to inform North East authorities whether reviewing demand management policies and decisions, including car parking and the prospect of other charges could help to deliver committed projects and achieve desired outcomes including the City Centre Masterplan, Roads Hierarchy, Regional Economic Strategy and identified Local Development Plan (LDP), Local Outcome Improvement Plan (LOIP) and other objectives. However, the benefits of successful demand management interventions hold potential to have both commercial benefits (through reduced and more predictable journey times) and tangible benefits for the lives of those who live and work in the North East of Scotland, as more walkable and cyclable environments are created.

1.2. Aim and Objectives

The aim of this paper is to identify and explore the options and implications for managing demand in the North East of Scotland.

Pursuant to this aim, this discussion paper has two defined objectives:

1. To conduct desk-based analysis of existing literature and materials to identify best practice and places where such schemes have been successfully implemented and/or are being considered; and
2. To conduct a SWOT analysis of the various demand management measures within the context of the North East of Scotland.

This paper considers the full range of demand management measures, including:

- Low Emission Zones
- Road User Charging options
- Congestion Charges
- Workplace Parking Charges
- More general parking controls
- Traffic management measures

In fulfilling the stated objectives, this paper will provide an overview of demand management in the North East and use knowledge and understanding around best practice, academic literature and current policy to guide the reader in assessing: (i) whether such a scheme could work in the North East; (ii) the need for such a scheme and the potential benefits that could assist in meeting policy objectives (particularly those relating to mode shift and air quality improvements); (iii) key considerations required to ensure success; (iv) revenue raising implications; (v) potential improvements possible through hypothecation of revenue gathered; (vi) public and political acceptance; and (vii) whether such measures provide additional benefits beyond existing demand management regimes already in operation in the North East.

The paper concludes by offering a SWOT analysis of each of the considered demand management measures to provide a user-friendly overview of each policy to enable further discussion and structured debate.

2. Demand Management Best Practice & the North East Context

2.1. Low Emission Zones

2.1.1. The North East Context

Policy context

The Scottish Government's commitment to introduce low emission zones (LEZ) into Scotland's four biggest cities has resulted in the commissioning of work by Aberdeen City Council into a Detailed Assessment following on from an earlier Scoping Assessment into the potential for a LEZ in the city. The potential for a LEZ covering the city Centre Air Quality Management Area for all routes within the city centre is currently being investigated by Aberdeen City Council.

The current Local Transport Strategy (LTS) developed in 2016 by Aberdeen City Council has the overarching objective of developing "a sustainable transport system that is fit for the 21st century, accessible to all, supports a vibrant economy, facilitates healthy living and minimises the impact on our environment". As such, the LTS's high level objectives are capable of accommodating the inclusion of a LEZ, particularly considering the high-level aims of "a cleaner, greener transport system" and "a transport system that facilitates healthy and sustainable living".

Furthermore, the Roads Hierarchy work undertaken in the City was developed on agreed principles that included:

- Improved air quality, particularly in the city centre AQMA
- Reduced carbon dioxide emissions throughout the city
- An increase in the proportion of vehicular journeys undertaken by low-emission or emission-free vehicles (Aberdeen City Council 2019c para 3.21)

The establishment of a LEZ within the City would conform not only to those principles identified within the Roads Hierarchy but also of those established in the Local Transport Strategy and City Centre Masterplan. Furthermore, as a by-product of the introduction of a LEZ, it is suggested that the additional principles of: (i) an economically buoyant and people-focussed city centre; (ii) an accessible city centre that functions as a popular and attractive destination for shopping, leisure and tourism; (iii) A more pedestrian and cycle friendly city that prioritises the movement of people over the movement of vehicles; and (iv) increased mode share for active travel and public transport could be realised with the introduction of a LEZ as vehicles are removed from the City's core and air quality is improved thereby enhancing the public realm.

However, it should be noted that the substitution of low-emission or emission-free vehicles in place of traditional hydrocarbon fuelled vehicles does not contribute to a modal shift nor increase safety for active modes of transport. Therefore, any incentivisation of vehicular access to the city centre by such vehicles should be balanced against the need to place pedestrians and cyclists above motorised vehicles in the hierarchy of need within the city centre. Policymakers should therefore be mindful of wider commitments to active travel when considering any incentives directly aimed at such vehicles.

Improvements to both air quality and perceived safety of pedestrians and cyclists also contribute to a wider sustainability and active travel agenda. However, a LEZ remains only one aspect of demand management that is required to support the improvement of air quality in the city and the recent reassessment of the Roads Hierarchy also has the potential to positively impact on air quality.

Finally, it is noted that within the context of Aberdeenshire, given that air quality is generally reported as being very good and

there are currently no active AQMAs, it is suggested that there may be alternative methods of demand management more appropriate for towns in Aberdeenshire. As such, no further consideration will be given to the applicability of LEZs within Aberdeenshire within this paper.

Freight and air quality

In common with many urban areas, the main pollutants of concern in Aberdeen City are nitrogen dioxide and particulate matter (PM10), related to road traffic emissions (Aberdeen City Council 2018) and freight movements in the city contribute to these emissions. It has been identified that freight and buses cause 80% of the air quality issues within the city but represent some 20% of total traffic within the city centre (Aberdeen City Council 2019b).

The density of road freight is notable in the city, with some routes comprising 15% HGVs and the city's Wellington Road (A956) recording levels of HGVs accounting for over 20% of all vehicles on the route (Nestrans 2018). The existence of an Air Quality Management Area covering Wellington Road (A956) means that careful consideration is required as to the number of these freight movements which are necessary to access the city centre and port areas, and which could potentially be diverted away from the city, particularly given the existence of the new Aberdeen Western Peripheral Route (Nestrans 2018).

Freight routeing decisions

To facilitate improvements in air quality within the region, it is proposed that a routeing strategy that ensures freight vehicles are not unnecessarily travelling through Aberdeen or towns in the region is required (Nestrans 2018). Three infrastructure aspects have been identified as being key to the implementation of a successful routeing strategy that will reduce HGV presence: (i) Roads Hierarchy; (ii) HGV usage of the AWPR; and (iii) proposals to dual the A96 currently being developed by Transport Scotland and partners (see further Nestrans 2018). However, the efficiency of such routes and associated economic considerations calculated into route selection by hauliers, are both critical components that need to be considered and will require to remain a core aspect of any work undertaken in both freight routeing and the implementation of a LEZ.

2.1.2. Guidance for Implementation

The first LEZs in Europe were established in Sweden in 1996 (Stockholm, Goteborg, Malmo). Since then, around 260 LEZs have been established across 12 European countries and restrict the entry of vehicles based on the emission standard the vehicles were originally constructed to meet. It should be noted that research into the effectiveness of LEZs shows that although they are capable of delivering a reduction in emissions, the impact can be described as "modest" (Rehfisch 2018) and therefore it is suggested they remain only one of the tools available to policy makers.

European Commission Guidance on LEZs

Research conducted for the European Commission in 2016 makes 12 recommendations for cities contemplating the implementation of a LEZ:

1. **National LEZ frameworks** – these are recommended as they reduce cost, time and effort in setting up LEZs and make the communication of entry criteria easier and increases industry and public acceptance;
2. **Aim of LEZ** – the aim of the LEZ should be clear e.g. to achieve EU limit values; improve the health of citizens;
3. **Understand local air quality** – the proportion of PM10 and NOx from vehicle exhausts should be understood before developing a LEZ. It is also important to understand the composition of the local vehicle fleet (e.g. vehicle types & Euro classes);

4. **LEZ area** – determine the area the potential LEZ should cover;
5. **Vehicles** – determine which vehicles will be targeted. Consider the dominant vehicles in city hot-spots. Decide whether passenger cars should be included. In most cities these are the dominant vehicles by number but not necessarily the greatest source of traffic emissions. There are social justice issues of penalising older cars which tend to be owned by poorer members of the community;
6. **Appropriate assessment** – an assessment of the potential impact of the proposed LEZ should be undertaken to determine if there is likely to be an improvement in air quality. The financial, socio-economic and political impacts of the LEZ also need to be considered at the planning stage. When estimating the cost of the scheme consider separately the costs to the authority of implementation, operation, enforcement and monitoring, the vehicle operator/owner of upgrading vehicles(s), and the societal benefits
7. **Retrofitting** – determine how equipment will be certified, its minimum efficiency and how often recertification will be required
8. **Enforcement** – determine how the LEZ would be enforced, e.g. Automatic Number Plate Recognition (ANPR). An added incentive to comply would be for the vehicle driver to be given penalty points on their licence, as happens in Germany.
9. **Industrial and public acceptance** – getting the freight industry, bus and coach operators and, if applicable motorists, to accept a LEZ requires a well thought out and consistent communication campaign. A simple LEZ is easier to understand and will gain more public acceptance than a highly complex scheme. Publicise the LEZ restrictions widely to make it easier for vehicle operators/drivers to comply. Use simple and clear signage at the LEZ boundary. Communicate with a wide range of stakeholders before implementation
10. **Exemptions** – in general, the fewer exemptions the more impact and credibility the LEZ would have, however, there are some exemptions that can increase the credibility of the scheme. For example, some countries have 'hardship exemptions' for companies that are having financial difficulties
11. **Phased implementation** – phased implementation with emission criteria tightened over time allows the worst polluting vehicles to be removed in the first phase and the affected communities to get accustomed to the LEZ concept. The later phases of the LEZ should have tighter emissions standards to ensure that the emission criteria are ahead of the natural fleet characteristics.
12. **EU Requirements** – finally, ensure compliance with the EU freedom of movement principle. The LEZ criteria should not be harder for a foreign vehicle to comply with than a local one, and publicity needs to be EU-wide. The emission standard must be in line with the EU Euro standards (European Commission 2016).

Estimated Costs

In 2017, Transport Scotland commissioned consultants Jacobs to produce cost estimates for low emission zones in Scotland, including estimated public sector costs for creating and operating a hypothetical small (0.5 sq. km), medium (1.5 sq. km) and large (3 sq. km) LEZ. The information is not publicly available but the costings table was reproduced as part of the recent SPICe Briefing on LEZs in the Transport (Scotland) Bill. The table outlines three estimates for each of the LEZ scenarios, based on low, medium and high grant awards to vehicle owners for the retrofitting of

emissions reduction equipment or the scrappage of polluting older vehicles (Rehfisch 2018).

Utilising 2017 figures, it is summarised that public sector costs over 10 years for small LEZs are between £4.228m and £5.644m, medium LEZs between £9.879m and £14.129m and large LEZs between £17.549m and £26.048m (Rehfisch 2018).

For reference, the table is reproduced in Appendix I below.

Glasgow

Scotland's first LEZ came into effect in Glasgow city centre on 31 December 2018 (Phase 1). Adopting a phased approach to implementation, the measure is currently only applicable to local service buses with a view to full implementation by 31 December 2022 (Phase 2). It should be noted that a decision was made to exclude Buchanan Bus Station and specific access roads to allow low frequency services operated by non-compliant vehicles to continue to service the city.

It was noted that due to the initial focus on the bus fleet, a detailed transport model was not required at that stage. However, the exact area of the Phase 2 of the LEZ will be determined via detailed transport modelling to permit re-routeing of vehicles who wish to avoid entering the zone. ANPR will be utilised to enforce the LEZ and penalty notices will be issued to vehicles in breach of the zone's requirements at a rate yet to be determined by the Scottish Ministers.

2.2. *Road User & Congestion Charging*

2.2.1. The North East Context

As a demand management tool, congestion charging could potentially fulfil current LTS aspirations in Aberdeenshire that: (i) existing infrastructure ought to be maximised; and (ii) that individuals should question their journeys with a view to considering ways to travel less, travel more actively and how journeys can be made more effectively (Aberdeenshire Council 2012 para 1.2). Similarly, in Aberdeen, such a tool aligns with the broad assertion that the LTS should develop "a sustainable transport system that is fit for the 21st Century, accessible to all, supports a vibrant economy, facilitates healthy living and minimises the impact on our environment" (Aberdeen City Council 2016 p. 3).

However, there are a number of critical factors that ought to be considered within the North East context as to the suitability of a congestion charging scheme and whether it presents itself as an appropriate demand management tool for the region. In general, the implementation of congestion charging is limited mainly due to low levels of public acceptance of such schemes (Gu et al 2018) and it is suggested that this should be of primary consideration should implementation wish to be pursued within a North East context. This is particularly pertinent given that research conducted on the Stockholm congestion charge indicates that low car dependence and good public transit supply are associated with high levels of acceptability (see Eliasson and Jonsson 2011). This should be contrasted with the current status of both car ownership and accessibility of public transport across the North East of Scotland.

It is suggested that for larger cities, taxing congestion raises revenue while changing behaviour, thus making it an efficient form of taxation (Clayton, Jeffrey and Breach 2017). However, this change in behaviour needs to be supported by the existence of credible alternatives to the car for journeys and investment in public transport networks. For example, in London, 43% of revenue from the congestion charge is spent on Transport for London's bus network (Clayton, Jeffrey and Breach 2017 p. 16). In addition to provisions for alternative methods of transportation, any congestion charging scheme must also

confront issues surrounding equity within the context of social justice and access to transport. For example, in terms of the impact of congestion charging, for London, it is argued that as the charge raises most of its revenue from individuals in the richest quintile who are more likely to commute by car, the overall impact is disproportionately progressive as it expanded and subsidises public transport that is mostly used by lower income residents (Clayton, Jeffrey and Breach 2017 p. 17). Given the high level of car ownership, relatively low levels of public transport usage and accessibility of public transportation options to citizens in the region, it is suggested that the context within the North East will be markedly different and careful consideration to the social justice and public acceptability perceptions of any form of congestion charging would be required. For example, any negative distribution effects could be offset by other progressive policies, so the net effect becomes more acceptable from an equity perspective (Kristofferson, Engelson and Boerjesson 2017).

Edinburgh as a comparator for the North East

In 2005, residents of Edinburgh were given the opportunity to vote in a referendum on the introduction of a road user charging scheme for the city. The public voted against the scheme by a ratio of 3:1 and it was subsequently abandoned as a policy. Research conducted by Gaunt, Rye and Allen in 2007 found that car use was shown to be a principal determinant of voting behaviour, with car users strongly opposing the scheme and non-car owners only weakly supporting it (see Gaunt, Rye and Allen 2007). Although there were a number of causative factors identified as contributing to the failure of the scheme proposals, the high level of car ownership in North East Scotland ought to be considered within the context of public acceptability of road user and/or congestion charging and due consideration given to how these barriers may be successfully overcome.

Despite the prior rejection of such a strategy for the city in 2005, it should also be noted that Edinburgh City Council has recently indicated that congestion charging proposals have been included within the city mobility plan framework as part of a number of demand management strategies currently being considered for the city (BBC News 2019a), indicating that conditions are now perhaps more conductive to accommodating such a scheme.

2.2.2. Congestion Charging in the United Kingdom

Durham City Congestion Charge[2]

The Durham City congestion charge (Durham Road User Charge Zone) was the first to be introduced to the UK in October 2002. The toll was introduced with the aim of reducing traffic congestion and pollution and improving air quality. A daily charge of £2.00 is payable between 10am and 4pm, Monday to Saturday with an ANPR system deployed to enable enforcement. There are a number of exemptions from the scheme, with automatic exemptions applied to:

- Two wheeled motorbikes, mopeds and bicycles
- Vehicles being used for the purpose of delivering or collecting postal packets in the service of a universal service provider
- Liveried police, fire brigade or ambulance vehicles
- Powered wheelchairs or scooters used by disabled persons
- Liveried Durham County Council vehicles

There are also a number of additional exemptions required that require individuals to register their vehicle and include hackney

[2] See further - https://www.durham.gov.uk/article/3437/Durham-Road-User-Charge-Zone-congestion-charge

carriages and private hire vehicles, vehicles associated with permanent residents located within the charging area and vehicles associated with organisations and businesses located within the charging area with off-street parking.

A case study of the charge undertaken in 2014, reported that vehicle flow through the area had reduced by 90% (Eltis 2014). It is noted that around £120,000 revenue per annum is required to support the administration costs of the scheme, along with subsidising the "Cathedral" bus service and supporting the Shopmobility scheme and is funded largely from income generated by the access charge and bus fares. (Eltis 2014).

London

The London Congestion Charge is an £11.50 daily charge for driving a vehicle within the charging zone between 0700 and 1800, Monday to Friday (Transport for London 2019a). A number of discounts and exemptions to the charge are available, notably for taxis actively licensed with London Taxi and Private Hire. It is observed that "competition for London's streets remains high" (Badstuber 2018). Indeed, it's reported that data demonstrates that people make fewer personal trips but that there are more deliveries and taxi rides (Badstuber 2018). This demonstrates that the nature of any exemptions given within a congestion charging need to be carefully considered to ensure that the overarching objectives of the scheme are achieved. However, it should also be noted that from an active travel perspective, between 2005 and 2016, there was an overall 75% increase in cycle journeys in London (Transport for London 2017 p. 56).

Public support for the congestion charge in London was initially low and declined prior to its introduction, which is noted as pattern also seen elsewhere (Clayton, Jeffrey and Breach 2017 p. 17). However, the percentage of Londoners opposed to it fell from 72% to 36% five years after the charge was introduced (Clayton, Jeffrey and Breach 2017 p. 17).

2.3. *Workplace Parking Levy*

2.3.1. The North East Context

In October 2019, the Scottish Parliament approved powers for local authorities in Scotland to charge a levy on workplace parking spaces in Scotland. NHS sites are to be exempt from the scheme, with local authorities having the autonomy to demarcate further exemptions as appropriate. Locating the scheme within a North East context, in 2018, Edinburgh City Council produced a scoping report into the issue of workplace parking and the potential to introduced a levy (Edinburgh City Council 2018) and has instructed further work to take place on investigating scope for its introduction. Therefore, the inclusion of the option to implement such a scheme is being considered as a credible option by at least one of Scotland's local authorities.

From a local perspective, it will be up to the respective local authorities in the North East to determine whether it represents an appropriate solution to encourage modal shift and foster a higher uptake of public transport and active travel options for commuting. It is suggested that consideration will be required to be given into the feasibility of such alternative transportation means, with due consideration given to the social justice implications of implementing a levy in absence of offering individuals real alternatives to travel by private car.

Public transport

Within this context it is important to note that, at present, on average around 50% of postcodes in the North East cannot reach any of the top 13 employment attractors within a 90-minute period by public transport and a year's bus season pass for Aberdeen City is £160 more expensive that a season pass for Dundee City, and £130 more expensive than a season pass in Glasgow (Nestrans 2019a para

4.2.3). It is suggested that this represents a significant barrier to achieving modal shift of journeys made for the purposes of commuting in the North East.

However, rail patronage in the region has been reported as showing significant growth levels between 2010 and 2016 (Nestrans 2019a para 4.2.3). Consequently, this has led to overcapacity issues at rail park and ride sites in the region, which is not reflected for the bus-based facilities (AECOM 2017 para 14.5). It is suggested that such increases may be further enhanced following the implementation of revised rail timetables in December 2019 that will take cognisance of the Aberdeen to Inverness rail improvements along the A96 corridor and also when the new station at Kintore is operational in 2020.

Infrastructure investment

Nestrans reports that (based on 2017 data), 2% travel to work by bike in the North East and 20% travel to work on foot in Aberdeen City, with this falling to 13% in Aberdeenshire (see Nestrans 2019b).

It has been demonstrated that an individual's active exposure to infrastructure has a positive association with a modal shift towards active travel, even when data is adjusted for personal and household characteristics (Song, Preston and Ogilvie 2017 p. 330). This contrasts with passive exposure which is not directly associated with modal shift (Song, Preston and Ogilvie 2017 p. 330). Further research also suggests that use of new infrastructure was "strongly predicted" in individuals who had higher existing levels of walking and cycling but that the impact of the new infrastructure on the least active was "not trivial" and therefore there is potential for such infrastructure to impact positively upon individual activity levels (Goodman, Sahlqvist and Ogilvie 2013 p. 522). Similar results were found in an analysis of the impact of new infrastructure on activity levels in Cambridge in a group of 469 commuters, where data indicated that infrastructure improvements to the environment had the potential to influence levels of activity within a cycling context (Panter et al 2016). However, it should be noted that infrastructure improvements alone may not be sufficient to achieve modal shift and that these also need to be supported with cultural interventions that support and "normalise" active travel. Due consideration should be given to these research findings when considering the North East context.

2.3.2. Examples of Best Practice

Nottingham

The Nottingham Workplace Parking Levy (WPL) scheme uses the provisions contained within the UK Transport Act 2000 and Workplace Parking Levy (England) Regulations 2009 to levy a charge on occupied private non-domestic off-street parking spaces – Workplace Parking Place (WPP) – occupied by employees, regular business visitors or students. It was introduced in October 2011 and charging commenced in April 2012. In 2017, it was estimated that since charging began in 2012, over £44 million of revenue has been generated with 100% compliance of liable employers and the WPL themselves operating at less than 5% of revenue (approximately £500k per year) (Hallam and Gibbons 2017).

The revenue raised is ring-fenced by law and is destined to be spent on transport initiatives in the city. It has contributed to costs of doubling the city's tram network, redevelopment of the railway station and supporting the fully electric Link bus network, along with contributing towards the development of Nottingham's integrated all-operator pay-as-you-go smartcard (Hallam and Gibbons 2017). The WPL revenue is also used as local match funding to bid for external funding (see further Hallam and Gibbons 2017).

The nature of these investments indicates that in addition to the implementation of the levy, there has also been a commitment to the type of improvements required to ensure that the public has access to upgraded public transport

to provide real and effective alternatives to private vehicles. Furthermore, a levy monitoring framework was adopted by Nottingham City Council to ensure that performance indicators were identified and measured to enable the overall success of the scheme to be evaluated (see further Dale et al 2014). The performance indicators are aligned with the following six policy objectives:

- Objective 1: constrain congestion in the AM and PM peak periods;
- Objective 2: increase uptake of workplace travel plans and responsible parking management strategies
- Objective 3: contribute to the implementation of major transport schemes and the Local Transport Plan
- Objective 4: encourage sustainable travel and mode choice
- Objective 5: enhance the attractiveness of Nottingham as a location for business investment
- Objective 6: no significant displaced parking problems

Finally, in it should be noted that there are a number of exemptions in place and there a are a number of classes of individuals for whom the charge does not apply, specifically:

- Premises from which frontline health services are provided by or on behalf of the NHS
- Premises occupied by the emergency services
- Places occupied by customers, disabled blue badge holders and delivery vehicles
- Employers with 10 or fewer WPP (Nottingham City Council 2013 p.5)

The Nottingham WPL charge currently stands at £415 per space, per year (approx. £2 per day) and employers can choose whether they pass this on to their employees or not. Increases in the cost of the levy are based on the Retail Prices Index. Recent research into the scheme suggests that that a "significant number" of larger employers have passed this cost on to their employees, with medium sized organisations tending to have absorbed the cost (Dale et al 2017 p. 150). It should be noted that while reducing congestion may be a primary objective for the charge, unless the price point is correct, it may not have the desired outcome (see Rye and Ison 2005).

As with other demand management mechanisms, the major barrier to implementation is public acceptability. Evidence from Nottingham City Council's consultation process and subsequent press coverage has been analysed to identify three main groups of criticism:

- Additional burden on business and therefore damaging to the city's economy
- Ineffective as a tool to combat congestion
- Unfair on the motorists who already carry a high tax burden (Dale et al 2014 p. 416).

A review of the policy conducted in 2017 concluded that "the number of jobs based in Nottingham has seen strong and sustained growth and suggests that Nottingham has fared better than average when compared to other comparator cities (Dale et al 2017 p. 161). This is despite early warnings from the local Chamber of Commerce that Nottingham was losing businesses to other cities as a direct result of the WPL (BBC News 2012).

Given the experience in Nottingham, it is suggested that due regard ought to be given to two key factors in connection with the potential for a workplace parking levy in the North East: (i) the potential for business migration in the North East, particularly given the relative proximity of industrial parks in Aberdeenshire to the city, in the event that one local authority elected to pursue the policy and another did not; and (ii) investigations would be required into identifying how revenues raised would be invested back into the transport network to ensure a connection

was made between the imposition of the levy and wider societal benefits.

2.4. General Parking Controls

2.4.1. The North East Context

Motorists are attracted into Aberdeen City Centre by relatively inexpensive parking (Nestrans 2019a para 4.2.3). For example, the cost of all-day parking in the city's core is often cheaper than return rail travel, with the average price of a 9-hour stay equating to approximate £11. This compares with an average for Edinburgh of £19 and Glasgow of £21 (Nestrans 2019a para 4.2.3).

In the recently completed *Strategic Car Parking Review* undertaken on behalf of Aberdeen City Council, a number of key contextual observations are made which directly relate to how demand management requires to be approached from a general parking controls perspective:

- High levels of car ownership in Aberdeen City and (even higher) in Aberdeenshire; and,
- Allocations in the respective Local Development Plans for Aberdeen City Council and Aberdeenshire Council to allow the development of a further 23,000 homes prior to 2026.

Both of these factors are key to considering the utility of parking controls as part of a wider demand management strategy. In particular, the issue of long-stay commuter parking will remain prevalent should action not be taken to mitigate commuter car usage and associated parking within Aberdeen City, and to key employment locations in Aberdeenshire.

Economic considerations

It is acknowledged that Aberdeenshire's town centres are vital to the local economy and play important roles for local communities through the provision of social, shopping and recreational spaces (Aberdeenshire Council 2012). However, by creating towns that are attractive to pedestrians and cyclists, the economic vitality of these locations can be enhanced by capitalising on the economic benefits that increased levels of walking and cycling can bring[3]."

In 2019, Transport for London released an information pack that outlines the economic benefits of encouraging more walking and cycling in cities. The headline figures for this document include:

- Walking and cycling improvements can increase retail spend by up to 30%
- Cycle parking delivers 5 x the retail spend per square metre than the same area of car parking
- Over a month, people who walk to the high street spend up to 40% more than people who drive to the high street
- Retail vacancy was 17% lower after high street and town centre improvements and retail rental values rose by 7.5%
- Employees who cycle regularly take 1.3 fewer sick days than those who don't and this is worth £128m every year to the national economy
- 73% of employees who cycle felt it makes them more productive at work
- By 2053, 3 in 4 workers will be millennials. Millennials are more focussed on the environment and use cars less
- One car takes up the same space as 5 people cycle, 20 people walking or 12 cycle parking spaces
- Cycling contributes £5.4bn each year to the UK economy (Transport for London 2019).

It is noted that this report was produced within the context of London/Greater London area but it is suggested that there are demonstrable economic gains to be made by the North East in implementing demand management

[3] For example: Lawlor (2014) and Reid (2018).

policies that prioritise active travel over motorised transportation.

2.4.2. Previous Studies

University of Michigan, Ann Arbor

Research conducted into the parking habits of travellers to the University of Michigan, Ann Arbor campus demonstrated that individuals tended to respond to parking policies by relocating to a different parking lot instead of switching to an alternative travel mode (Yan, Levine and Marans 2019). In the context of this research, these findings were also in spite of the University of Michigan providing free transit passes to staff and students (Yan, Levine and Marans 2019).

The researchers conclude that the reason for the ineffectiveness of parking strategies to promote modal shift is twofold: (i) the relatively low price of fuel and parking in the United States means that driving remains more attractive when compared to public transport (time-savings, convenient, flexibility); and (ii) higher income households tended to live closer to campus, where better transit services are provided, whereas lower-income households tended to live further away where driving is often the only viable travel option (Yan, Levine and Marans 2019 pp. 48-49).

In general terms, the research findings have the following implications for a wide range of parking contexts: (i) pricing remains the single most effective parking policy to alter travel behaviour; (ii) the importance of egress time can be an effective policy tool when political will for increase parking charges is lacking; and (iii) when parking experiences localised overcrowding despite adequate regional supply, parking demand management strategies can be more effective than increasing parking supply (Yan, Levine and Marans 2019 p. 49). Therefore, it is suggested that the findings from this study demonstrate the need to ensure that demand management measures are not implemented in isolation but rather in a wider context where joined-up policy seeks to achieve the region's sustainable and active travel objectives.

Parking availability and car use

Utilising data from the 2013/14 Norwegian Travel Survey, Christiansen et al sought to analyse the impact of parking availability at home and at destination on car use (Christiansen et al 2017). They conclude that parking availability significantly affects the probability of choosing car as an individual's travel mode and offer the following analysis: (i) parking restrictions can be very effective on reducing car-use on work trips and that workplace parking capacity restrictions are considerable more effective than regulation through parking fees in affecting commuting mode choice (Christiansen et al 2017 p. 205); (ii) a city's structure affects the extent of car use in that city and that parking restrictions will have the greatest effect in compact cities (Christiansen et al 2017 p. 205).

As above, this case study also demonstrates the need to have a cohesive approach to demand management and that a package of measures covering multiple aspects of demand management offers the best prospect of success.

2.5. Additional Traffic Management Considerations: Freight

2.5.1. The North East Context

AWPR and re-routing

The recent opening of the AWPR offers an opportunity to rethink and redesign Aberdeen's transportation network. To enable the benefits of the AWPR to be maximised, the new Roads Hierarchy will need to ensure that drivers are directed to the most appropriate route based upon their point of origin and final destination. A clear signage strategy, as has already been proposed and due to be implemented (see BBC News 2019), will require to be deployed to ensure that the potential gains offered by the AWPR (e.g.

reduction in city centre traffic, air quality improvements, improved conditions for vulnerable road users) are not lost.

The risk of induced demand because of improvements to network capacity in North East Scotland also remains a concern. Evidence reviewed in a recent study conducted on behalf of the Department for Transport concludes that induced traffic demand exists, although size and significance will be context dependent and more research is required (Department for Transport 2018). Therefore, to ensure that the benefits of the AWPR are "locked in" (Nestrans 2008), the removal of freight and other unnecessary vehicular traffic from the City Centre where appropriate through adherence to appropriate routeing will remain key to an effective transport strategy for the region. In addition, improvements to public transport and active travel infrastructure will also need to be considered to ensure that concerns around induced demand remain unfounded and additional vehicular traffic does not fill the void created by the AWPR.

For a large-scale road building programme such as the AWPR's effects to be viewed within the wider context of environmental impact, it will require the implementation of a range of specific demand management measures to encourage vehicular traffic away from city centre routes, thereby allowing road space to be reallocated for safer cycling and walking routes.

Effective freight management

Intelligent transportation systems (ITS) represent a potential tool for realising improvements in air quality, lowered noise levels and reductions in the adverse effects associated with heavy traffic and congestion (Transport Scotland 2017 p. 29). For example, ITS can be used to provide live traffic data to enable both the accurate planning and also the accurate operation of freight routes by local hauliers in the North East of Scotland. However, freight traffic has a different set of operational conditions to general traffic from an ITS perspective, particularly in relation to route restrictions, permissible driving hours, maximum speed, braking distances and taking longer to build up speed from a standing start (Transport Scotland 2017 p. 64). These additional needs require to be factored into the planning and design of any proposed solutions for the effective management of freight in the region as part of wider demand management strategies.

Encouraging the adoption of other innovations in mobility, such as low or zero emission vehicles also has the potential for positively contributing to improvements in air quality in the region. Trials of zero emission light goods vehicles in partnership with the private sector are currently underway within the context of CIVITAS PORTIS and a review of operation of such vehicles in the commercial market will be undertaken to enable better understanding of how such new technologies are successfully incorporated into general commercial activities and the wider freight environment.

3. Demand Management Measures: SWOT Analysis

3.1. Low Emission Zones

Strengths	Weaknesses
• May reduce street and urban background PM2.5 concentrations • Evidence points to potential for reduction in urban PM10 levels • Defined geographical area • Contributes to achievement of objectives defined by Scottish Government's *National Low Emission Framework* (meeting Scottish and EU air quality objectives) • Positive health and wellbeing aspects linked to improved air quality. These would be enhanced by greater uptake of active travel • Contributes to achieving outcomes relating to mitigating impact on climate change and protecting the natural and built environment in the North East • Reduces the impact of transport on public health and the natural and built environment	• Privileges those with access to private vehicles (impact on equality) • Evidence shows that LEZ policies directed at old heavy-duty vehicles do not substantially change concentrations of traffic-related pollutants (e.g. NO2, NOx, Cu, Fe) at street sites more than suburban background sites outside of the LEZ • Does not impose overall traffic throughput reductions within the zone • Defined geographical area
Opportunities	**Threats**
• Defined geographical area • May introduce a step-change in normal fleet turnover • Raising of hypothecated funds via penalties for active travel infrastructure & public transport improvements • Improved perceptions of public transport	• Regulations may need regular review to ensure objectives are being met • Public acceptability • Political acceptability • Social justice/access to transport - affordability of penalty charge and/or replacement vehicle to meet requirements of LEZ • Variability in reported air quality improvements suggest that there may be a risk of lower reductions in air pollution than anticipated • Monetary cost/financial implications of implementation • Poor perception of public transport

3.2. *Road User & Congestion Charges*

Strengths	Weaknesses
• Flexible – defined geographical scope; time of day dependent • Reduction in traffic volumes during peak periods • Air quality enhancements due to reduced car traffic volumes • Price mechanism can make users more aware of costs imposed when using the road at peak times • Positive health and wellbeing aspects linked to improved air quality. These would be enhanced by greater uptake of active travel • Contributes to achieving outcomes relating to mitigating impact on climate change and protecting the natural and built environment in the North East • May contribute to reduced business costs of transport due to reductions in congestion • May contribute to the maintenance and enhancement of a safe, resilient and reliable transport network • Reduces the impact of transport on public health and the natural and built environment	• Most efficient system can be the least equitable (i.e. favours high-income users) due to distribution of residential and workplace areas (impact on equality) • Defined geographical area • Can cause re-routing and associated increased in vehicle miles travelled & displaced congestion • Cost of implementation/System costs
Opportunities	**Threats**
• Negative perception could be mitigated through spending income generated on local public transport • Potential for increased levels of walking and cycling & therefore related health benefits for population • Raising of hypothecated funds for active travel infrastructure & public transport improvements • Improved perceptions of public transport	• Public acceptability • Political acceptability • Privacy concerns • Social justice/access to transport - affordability of charge • Lack of high quality connected active travel provision & associated road safety perceptions • Poor perception of public transport

3.3. *Workplace Parking Levy*

Strengths	Weaknesses
• Reduction in congestion – i.e. reduced delay per vehicle mile and associated economic costs of congestion • Improvements to infrastructure and public transport through investment of hypothecated funds • Reduction in carbon emissions and associated air quality enhancements • Positive health and wellbeing aspects linked to improved air quality. These would be enhanced by greater uptake of active travel • Contributes to achieving outcomes relating to mitigating impact on climate change and protecting the natural and built environment in the North East • Capable of positively promoting integration of transport and land use and the reduction in need to travel by private car • Reduces the impact of transport on public health and the natural and built environment	• Level of charge will be key in influencing travel behaviour • Administration costs of scheme – auditing and managing database of parking spaces • May take time to implement (years) • Cost of implementation/system costs
Opportunities	**Threats**
• Raising of hypothecated funds for active travel infrastructure & public transport improvements • Reduction in overall number of car parking spaces as a result of employers seeking to reduce their liability to the charge (when charged on a per space basis) • Development of a business case for WPL to enable stakeholder engagement • Increased levels of active travel (walking & cycling) and public transport use • Potential for public transport subsidy through funds raised • Improvements to public realm – bias in favour of non-vehicle users	• Public acceptability • Political acceptability – "anti-car" • Acceptability to the business community • Relocation of businesses (particularly in the context of the Aberdeen City/Aberdeenshire boundaries) • Social justice – ability to pay/disposable income should the charge be passed on to employees (impact on equality) • Poor management of stakeholder expectations leading to lower levels of acceptability • Failure to invest in infrastructure creating issues around public acceptability

• Improved perceptions of public transport • Enhanced opportunities for collaboration with employers to facilitate remote working/tele-commuting opportunities for employees • Enhanced opportunities for collaborative travel planning with employers and employees (e.g. GetAbout/Nestrans) • Collaboration with schools to work with children, staff and parents to encourage more walking and cycling to and from school to facilitate less car usage	• Dominance of private car • Lack of viable alternatives to car • Lack of direct public transportation routes to some locations and/or lengthy public transportation journey times • Lack of high quality connected active travel provision & associated road safety perceptions • Limited integration of land use and transport network in the City and Shire region • Poor perception of public transport

3.4. General Parking Controls

Strengths	Weaknesses
• Reduction in congestion • Reduction in carbon emissions and associated air quality enhancements • Aligns with Air Quality Action Plan • Encourages increased use of public transport and/or active travel modes • Increased charges may lead to behaviour change & therefore reduction in overall number of trips made • Positive health and wellbeing aspects linked to improved air quality. These would be enhanced by greater uptake of active travel • Contributes to achieving outcomes relating to mitigating impact on climate change and protecting the natural and built environment in the North East • Reduces the impact of transport on public health and the natural and built environment	• Parking displacement can occur rather than modal shift • Potential for reductions in revenue generated through parking depending on strategy adopted (potential economic impact)
Opportunities	**Threats**
• Growth in Park & Ride usage • Growth in rail user customer base • Increased turnover of spaces • Opportunity to review business permits • Provision of travel planning services to increase acceptability • Improvements to public realm – bias in favour of non-vehicle users • Improved perception of public transport	• Public acceptability • Political acceptability – "anti-car" • Comparative cost of parking charges to public transportation costs • Dominance of private car in North East Scotland • Lack of viable alternatives to car • Lack of high quality connected active travel provision & associated road safety perceptions • Poor perception of public transport

Appendix I – Estimates of costs associated with the establishment and operation of small, medium and large LEZ

Estimates of costs associated with the establishment and operation of a small, medium and large LEZ

LEZ area and grant	Design costs (£)	Imp. costs (£)	Grant costs (£)	Year 1 operate costs (£)	Year 1 risk (£)	Total costs year 1 (£)	Total costs 10 years (£)
Small LEZ - low grant	0.325m	0.522m	1.288m	0.198m	0.233m	2.567m	4.228m
Small LEZ - medium grant	0.325m	0.522m	1.910m	0.198m	0.296m	3.252m	4.912m
Small LEZ - high grant	0.325m	0.522m	2.575m	0.198m	0.362m	3.983m	5.644m
Medium LEZ - low grant	0.424m	0.706m	3.863m	0.463m	0.546m	6.001m	9.879m
Medium LEZ- medium grant	0.424m	0.706m	5.730m	0.463m	0.732m	8.055m	11.993m
Medium LEZ - high grant	0.424m	0.706m	7.726m	0.463m	0.932m	10.250m	14.129m
Large LEZ - low grant	0.424m	0.871m	7.726m	0.805m	0.983m	10.809m	17.549m
Large LEZ - medium grant	0.424m	0.871m	11.460m	0.805m	1.356m	14.971m	21.657m
Large LEZ - high grant	0.424m	0.871m	15.452m	0.805m	1.755m	19.307m	26.048m

Figure 2: Rehfisch 2018

Appendix II – Cause and effect of parking related issues

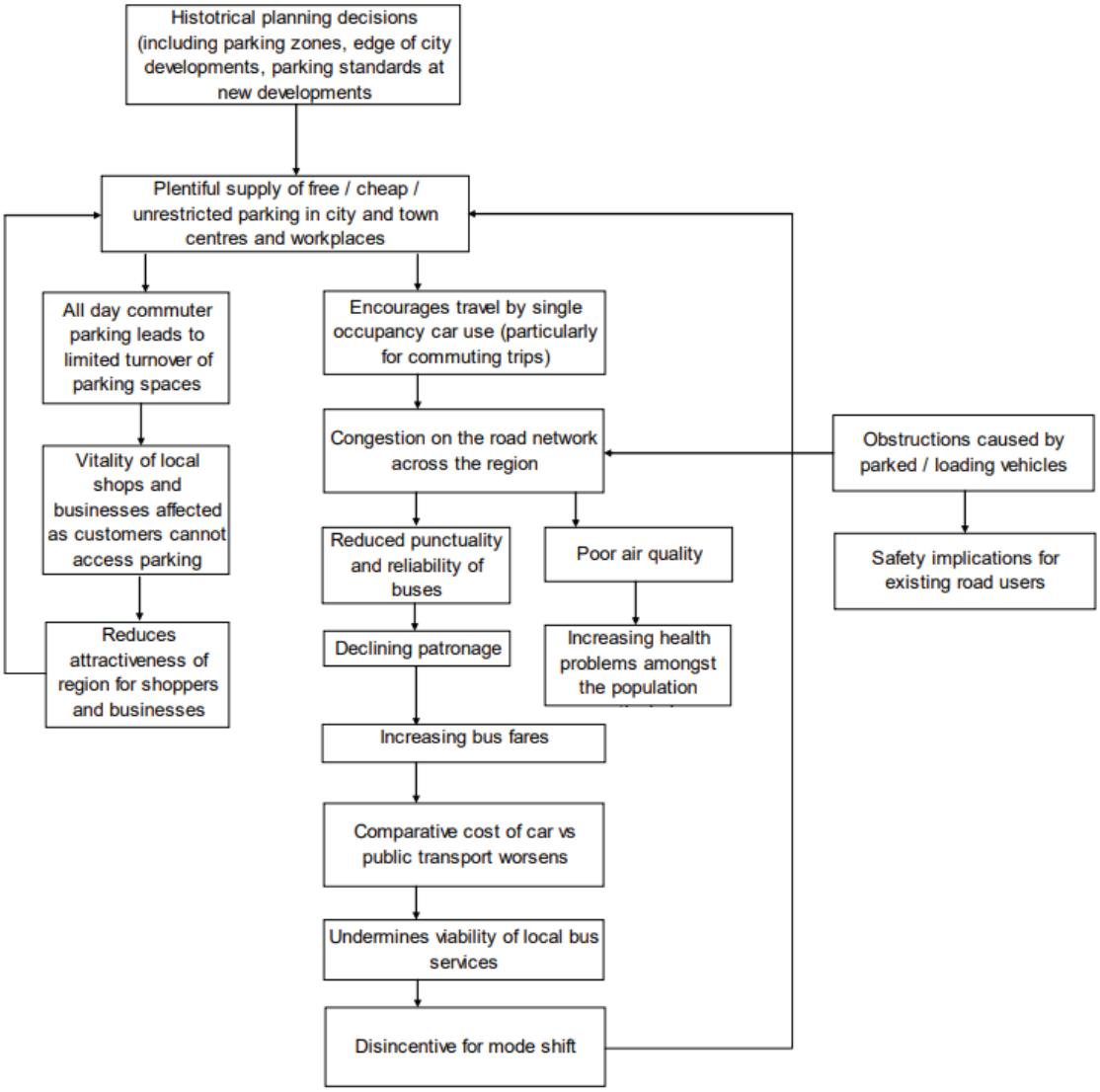

Figure 3: Cause and effect of parking related issues (Nestrans 2012 p. 8)

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