



**Friends of  
the Earth**



Manchester Urban Institute

Governing Urban Transformation

# **A Comparative On-Street Parking Study of Manchester City Centre**

12<sup>th</sup> May 2017

9499903 / 9379092

I, 9379092 confirm that this report is based on my own work and that I am happy with both by own and my partner's, 9499903, contribution to the final submitted version.

# Contents

---

- Executive summary.....1
- 1.0 Introduction .....2
  - 1.1 Introducing the report .....2
  - 1.2 Introducing Manchester..... 3
- 2.0 Methodology.....4
  - 2.1 Methods Chosen..... 4
- 3.0 Manchester as a Case Study..... 5
  - 3.1 Existing Transport Infrastructure and Issues .....5
- 4.0 Comparative Policy and Governance .....8
  - 4.1 Bristol City Councils successful policy integration .....8
  - 4.2 The city of Malmö and Smart Technologies..... 9
  - 4.3 Copenhagen..... 10
  - 4.4 Summary of Parking .....11
- 5.0 Conclusions .....13
- Referencing .....14

This report will consider the complexities of on-street parking and how they relate to the broader transport policies of Manchester City Council. The future plans and hopes for the city will be considered in order to fully comprehend how on-street parking fits in with the city's goals. In order to ensure the successful delivery of these goals, this report examines transport policies of other European cities with particular interest in on-street parking changes that have been successfully implemented and received in order to enhance Manchester City Councils approach.

# 1.0 Introduction

---

## *1.1 Introducing the Report*

Recently there has been widespread support expressed by multiple international organisations who promote cycling and walking as a strategy to improve wellbeing whilst contributing towards sustainable development (European Commission, 1999; WHO Europe, 2005; WHO-UNECE, 2003;). Michael Kodransky, the global research manager for the Institute of Transportation and Development Policy agrees, arguing that “increasingly, cities are waking up to the fact... these land uses are not being used in the most optimal way” and that “parking needs to be tackled as part of a package of issues” (Berg, 2016) as it is by Manchester City Council who are considering the wider implications of car use and the prime real estate on-street parking consumes. Friends of the Earth Manchester (FoE) is a campaign group that advocates maximising green space to improve air quality and to reduce the environmental costs of 21<sup>st</sup> century urbanism. The ultimate focus of this report is the removal of cars out of inner-city spaces and instead prioritising walking and cycling as sustainable modes of transport. It is hoped that a successful integration of policy will transform behavioural and land use patterns, leading to cleaner air and more efficient land-use within central Manchester.

### *1.1.1 Structure of the Report*

A detailed summary of Manchester’s current strategy is offered below providing a thorough understanding of their aims and objectives, before the reports methodology and existing issues surrounding Manchester’s infrastructure are considered. The report then examines policies that have been successfully implemented by Bristol City Council, Malmo and Copenhagen. Each city has taken on a completely different approach in steering its population towards more sustainable methods of transportation and it is hoped that by outlining these, Manchester city council could consider these methods to further the success of their own transformation as suggested in the solutions discussed in the conclusions chapter.

## ***1.2 Introducing Manchester***

Manchester's recent economic success has generated a rise in travel into and around the city centre. An expected rise of 50,000 new jobs by 2020 is estimated to stimulate an extra 30,000 trips into the centre during peak-times. Around 10,000 of these trips will be completed by car and the availability of parking to accommodate this surge in peak time traffic poses a serious concern to the council. To tackle this issue, Manchester City Council developed a 'Transport Strategy' in 2010 which aims to encourage the use of public transport, walking and cycling over the use of individual cars. The Transport Strategy uses the Stern Review of the economics of climate change (2006) as a theoretical base, which emphasises the need for efficient management and improvement of existing transportation systems, specifically focusing on the importance of planning decisions concerning sustainable transport and land-use. The strategy recognises the limited amount of road space within central Manchester and believes that a continuous growth of road traffic is unsustainable. The council has therefore turned to alternative measures to reduce the levels of traffic in the city centre. Building upon the Stern Review (2006) and Manchester's Transport Strategy (2010), the report considers a more efficient management of land, specifically exploring how measures to reduce the amount of on-street parking spaces around central Manchester will further the growth of the local economy, improve congestion, increase air quality and physical wellbeing.

### ***1.2.1 Vision 2040***

The 2010 Transport Strategy was aligned with Manchester's 2040 Vision which aims to improve Manchester's air quality and physical wellbeing while stimulating socio-economic growth. The 2040 vision recognises the need to connect people with employment and social opportunities as vital, regarding transport as a 'catalyst' for urban development and revitalisation. A successful 2040 Vision will see the development of an integrated and sustainable public transport system, one which allows fluidity between trams, trains, bicycles and buses through an integrated ticketing system for these services.

## 2.0 Methodology

---

### **2.1 Methods Chosen**

#### *2.1.1 Policy Document Analysis*

To assess the current position and impacts of street parking in central Manchester, a variety of published policy documents from the Greater Manchester Combined Authority were analysed. Each policy was evaluated on how it intended on bringing about real changes in Manchester city centre and the political reasoning behind these actions. Policy stimulates change through influencing the behaviours of the residents (Dolan et al., 2010), with the intention on an increase in uptake and investment in a sustainable and integrated transport system.

#### *2.1.2 Media Discourse Analysis*

Various media sources were evaluated to provide an in-depth analysis of the levels of street parking in Manchester. Media texts are “literally forensic evidence” (Hartley, 1992: 29) which can be deconstructed to understand the message contained within them. These discourses provide information on “how other human beings make sense of the world” (McKee, 2003: 1) and offer a valuable insight into how the local population views the issues surrounding on-street parking in Manchester.

## 3.0 Manchester as a case study

### 3.2 Existing Transport Infrastructure and Issues

#### 3.2.1 Land use and on-street parking

- There are 2500 on-street parking spaces covering 2.95km<sup>2</sup> of Manchester city centre<sup>1</sup>, spread across four zones (figure 1).
- This space is often vacant.

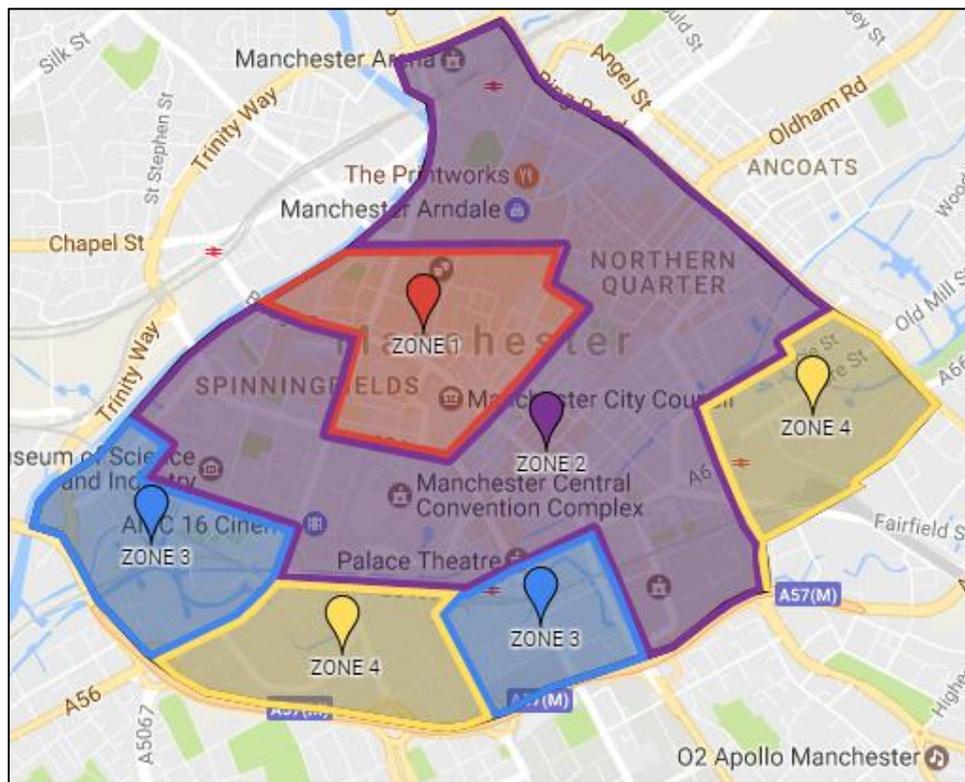


Figure 1 Map of Manchester City Centre's Parking Zones.

- In 2012, a 'PayByPhone' system was introduced allowing parking to be monitored effectively through technology. This system is popular with drivers as it allows cashless parking and the ability to top-up remotely.

<sup>1</sup> <https://www.daftlogic.com/projects-google-maps-area-calculator-tool.htm>

- Manchester’s Velocity program aims to develop cycling into “a signature of our future city brand” (2013: 4) and aims to capitalise on the recent European cycling renaissance (Jensen et al., 2007) by promoting cycling as an attractive, alternative commuting method.
- New Dutch-inspired cycle paths (Glendinning, 2015) are being built throughout Manchester’s key roads with the hope of encouraging an uptake of cycling (Figure 2).



Figure 2 Cycle Paths located on Manchester’s Oxford Road (Ratcliffe, 2015)

### 3.2.2 Emissions and Traffic

- Manchester is the second most congested city in the UK (Crook, 2017) and the direct and indirect charges of traffic costs drivers an average of £968<sup>2</sup> per year.
- The average motorist wastes a total of 2,549 hours (106 days) searching for a parking space during their lifetime<sup>3</sup> and therefore traffic is often caused “by people who have gotten where they want to be but are cruising around looking for a place to park” according to Shoup (2007: 16).

<sup>2</sup> <http://www.itv.com/news/granada/2017-02-20/manchester-is-second-most-congested-city-in-uk/>

<sup>3</sup> <http://www.telegraph.co.uk/motoring/news/10082461/Motorists-spend-106-days-looking-for-parking-spots.html>

- This is confirmed by Zhang and Batterman as “congestion lowers the average speed, which increases travel time” (2013: 8).
- “Slower moving traffic emits more pollution” as the “constant acceleration and braking of stop-and-go traffic burns more gas” (Hermes, 2012: 3) therefore lowering the overall air quality.
- This degradation of air leads to “excess morbidity and mortality for divers, commuters and individuals living near major roadways” (Zhang & Batterman, 2013: 9).
- Cutting emissions was prioritised in the existing Greater Manchester Air Quality Strategy and Action Plan (2006) and is an overarching aspect of the 2040 Vision. Travel for Greater Manchester (Tfgm) (2017: 21) states “damaging emissions from transport affect the whole of Greater Manchester, in terms of both air quality and carbon”.
- Tfgm plan to introduce low emission buses, promote the uptake and use of electric vehicles, while encouraging more people to travel by public transport, bike or on foot to improve the ambient air quality.

### *3.2.3 Integrating New Transport Policy*

- “The car is a status symbol of freedom and independence” and therefore represents cultural and psychological values which people are reluctant to relinquish “because in their view, public transport cannot compete with their private car” (Steg, 2003: 14).
- Therefore, “policies should be aimed at reducing the functional, psychological and cultural values of private cars, as well as increasing the performance of public transport and other (more) environmentally sound modes of transport on these aspects” (Steg, 2003: 13) as advocated by Tfgm and the 2040 Vision.

## **4.0 Comparative Policy and Governance**

---

Table 1 compares statistics between Manchester and other European cities whose transport policies are of value, considering Manchester City Council’s own vision.

City	Size (based area on on-parking zones)	Population of city	Targeted End of Strategies
Manchester	3km <sup>2</sup>	449,300	2040
Bristol	10.5 km <sup>2</sup>	514,414	2026
Malmö	1.97km <sup>2</sup>	342,457	On Going
Copenhagen	14.2km <sup>2</sup>	763,908	2025

Table 1 Basic Comparative statistics

## 4.1 Bristol City Council's successful policy integration

### 4.1.1 Relevance to Manchester

Like Manchester, Bristol has been working towards a sustainable transport system since 2001 and has a comparable set of aims and objectives which strongly overlap with Manchester's 2040 vision:

Main Aims	Detailed Objectives
<ul style="list-style-type: none"> <li>To offer a seamless transition between different modes of transport</li> <li>To be efficient and affordable</li> <li>To be environmentally sustainable</li> </ul>	<ul style="list-style-type: none"> <li>Ensure all new development facilitates journeys to work, shopping, education and leisure by walking, cycling and public transport;</li> <li>To reduce unnecessary use of private cars, especially in the city centre</li> <li>Parking policies to discourage the use of private cars for journeys to work.</li> </ul>

Table 2 Aims and Objectives of Bristol's parking policy<sup>4</sup>

### 4.1.2 Successful Elements of Bristol's Strategy

#### 4.1.2.1 Integrating policy successfully

Bristol city council have prioritised community involvement and participation as they realised "everyone who lives in, works in or visits the city has a stake in the way transport works" (BCC, 2000; 3). Table 3 illustrates several of the methods of involvement implemented by Bristol council.

Principles	Methods
Early Involvement	Publication of 'Towards a Transport Plan' for discussions and questions; detailed public meetings; citizens panel involvement
Interactive	Interactive IT material prepared for consultation on Air Quality strategy

<sup>4</sup> <https://www.bristol.gov.uk/documents/20182/34088/Main%20LTP%20document.pdf/6911cf74-48ef-4807-aeb6-2d26570fe208>

	Sub-strategies such as parking changes and park and ride schemes developed through interest groups and meetings
<b>Inclusivity</b>	30,000 houses directly leafleted about propositions
<b>Continuous</b>	Public meetings to ensure community agreement Bus and walking strategies Air Quality management
<b>Open</b>	Openness is a key characteristic of many elements discussed above, particularly allowing individuals to talk directly to the organisers and contribute to open public meetings.

Table 3 Methods for similar policy and public involvement

## 4.2 The City of Malmö and Smart Technologies

### 4.2.1 Relevance to Manchester

Manchester is undergoing a “digital revolution”<sup>5</sup> supported by council funding and institutions such as the ‘Manchester Institute of Innovation and Research’ that are positioning the city as the “powerhouse” (Chester, 2016) of the North. The council is promoting Manchester as a “Smarter City”<sup>6</sup> through integrating technology with the urban environment. Considering governance methods that harness technology and innovation at the roots is therefore relevant to Manchester in terms of enhancing the cities broader goals, sustainability and, ultimately, the 2040 Vision.

### 4.2.2 Transport Technologies

Type of Transport	Technologies
<b>Public Transport</b>	<ul style="list-style-type: none"> <li>• Public Transport has priority on the road</li> <li>• Buses communicate electronically with traffic lights speeding up journeys</li> <li>• Digital real-time signs at &lt;100 bus stops</li> <li>• Bus passengers take priority</li> </ul>
<b>Innovative Cycling Design</b>	<ul style="list-style-type: none"> <li>• Rails at traffic lights which cyclists can rest without putting feet down</li> <li>• Large mirrors installed on street corners where visibility would otherwise be poor</li> <li>• Mini-service stations can be found throughout the city allowing cyclists to carry out simple repairs</li> <li>• Radar sensors are fitted at crossings to detect approaching cyclists and automatically give</li> </ul>

<sup>5</sup>[http://www.manchester.gov.uk/news/article/7577/tech\\_hubs\\_will\\_help\\_drive\\_manchesters\\_digital\\_revolution\\_forward](http://www.manchester.gov.uk/news/article/7577/tech_hubs_will_help_drive_manchesters_digital_revolution_forward)

<sup>6</sup><http://www.manchester.gov.uk/smartercity>

	<p>them a green light, enabling cyclists to move fluidly in traffic</p> <ul style="list-style-type: none"> <li>• Cycling barometers count passing cyclists and provides visual indications of cycling levels creating a sense of community among cyclists.</li> </ul>
<b>Car Parking</b>	<ul style="list-style-type: none"> <li>• Sensors are located at all on-street parking locations allowing spaces to be seen online – no need to “cruise” around looking for a space</li> <li>• Parking spaces can be purchased in advanced to improve the fluidity of traffic.</li> </ul>

Table 4 Transport Technologies used in Malmö<sup>7</sup>

## 4.3 Copenhagen

### 4.3.1 P-Strategy 2005 and 2009

P-strategy 2005<sup>8</sup> was the first parking strategy implemented by Copenhagen City Council to reduce commuter traffic, improving parking facilities for citizens and creating more recreational urban space. The 2009 P-strategy<sup>6</sup> built on the 2005 strategy and table 5 contains the aims and strategies.

<b>Aims</b>	<b>Achieved by;</b>
<b>Increased pay parking to reduce commuter traffic by car</b>	<ul style="list-style-type: none"> <li>• Increasing paid parking by 50% causing a direct fall in car traffic in the inner city by 18000 a day (6%)</li> </ul>
<b>4000 parking spaces for residents</b>	<ul style="list-style-type: none"> <li>• 640 new on-street parking spaces built through angle parking and rebuilding street corners</li> <li>• 3 fully automated underground car parks built in 2008</li> <li>• Streamlining of existing parking facilities</li> </ul>
<b>Improvements to urban spaces and traffic environment</b>	<ul style="list-style-type: none"> <li>• Closing 1000 on-street parking spaces in the inner metropolitan districts</li> <li>• Solar powered parking machines since 2007</li> <li>• From 2011 all cars bought in the city will be either electric or hydrogen powered.</li> </ul>

Table 5 Aims and successful strategies used in Copenhagen

<sup>7</sup> <http://malmo.se/download/18.58f28d93121ca033d5e800077>

<sup>8</sup> [file:///C:/Users/Victoria/Downloads/682\\_x8IQDnzcqQ%20\(1\).pdf](file:///C:/Users/Victoria/Downloads/682_x8IQDnzcqQ%20(1).pdf)

### 4.3.2 Reducing appeal of cars

Several measures have been implemented in order to reduce the attractiveness of car use in Copenhagen as Pucher and Buehler (2008) outline. These include reducing lanes of traffic, a toll ring around the inner city and, as discussed above, high parking fees. Furthermore, Copenhagen has transformed its road hierarchy in favour of cyclists and pedestrians even legally as motorists involved in accidents are assumed at fault (Jean, 2013).

## 4.4 Summary of Parking

Copenhagen has stimulated changes in the behaviour of private car users by devaluing the lifestyle these vehicles offered, effectively steering users away from private cars. The reorganization of on-street parking facilities improved congestion by reserving spaces for residences over commuters, while enabling the city to evolve its streetscapes for more recreational land use.

Malmo used a comparative approach, evolving opinions of cycling and public transport by innovating and prioritising both modes, making them more attractive than private car use. This displayed an effective method of governance as it influences behavioural patterns rather than pricing out alternative behaviour, such as in Copenhagen. However, the disparity in size between the two cities indicated that a less dominant strategy may prove ineffective in a city of Copenhagen's scale.

Conversely, the principles of public involvement used in Bristol ensured the strategies implemented were widely accepted and integrated successfully at all levels in the community due to the openness created by the managing bodies. This enabled the city to integrate successful and transformative policies to meet their 2026 deadline. In terms of promoting cycling and walking in Manchester city centre, figure 3 is adapted from Bristol's policy documents summarising the governance needed to invert the road hierarchy of Manchester. The suggested management approaches have been developed from strategies used in Bristol, Malmo and Copenhagen.



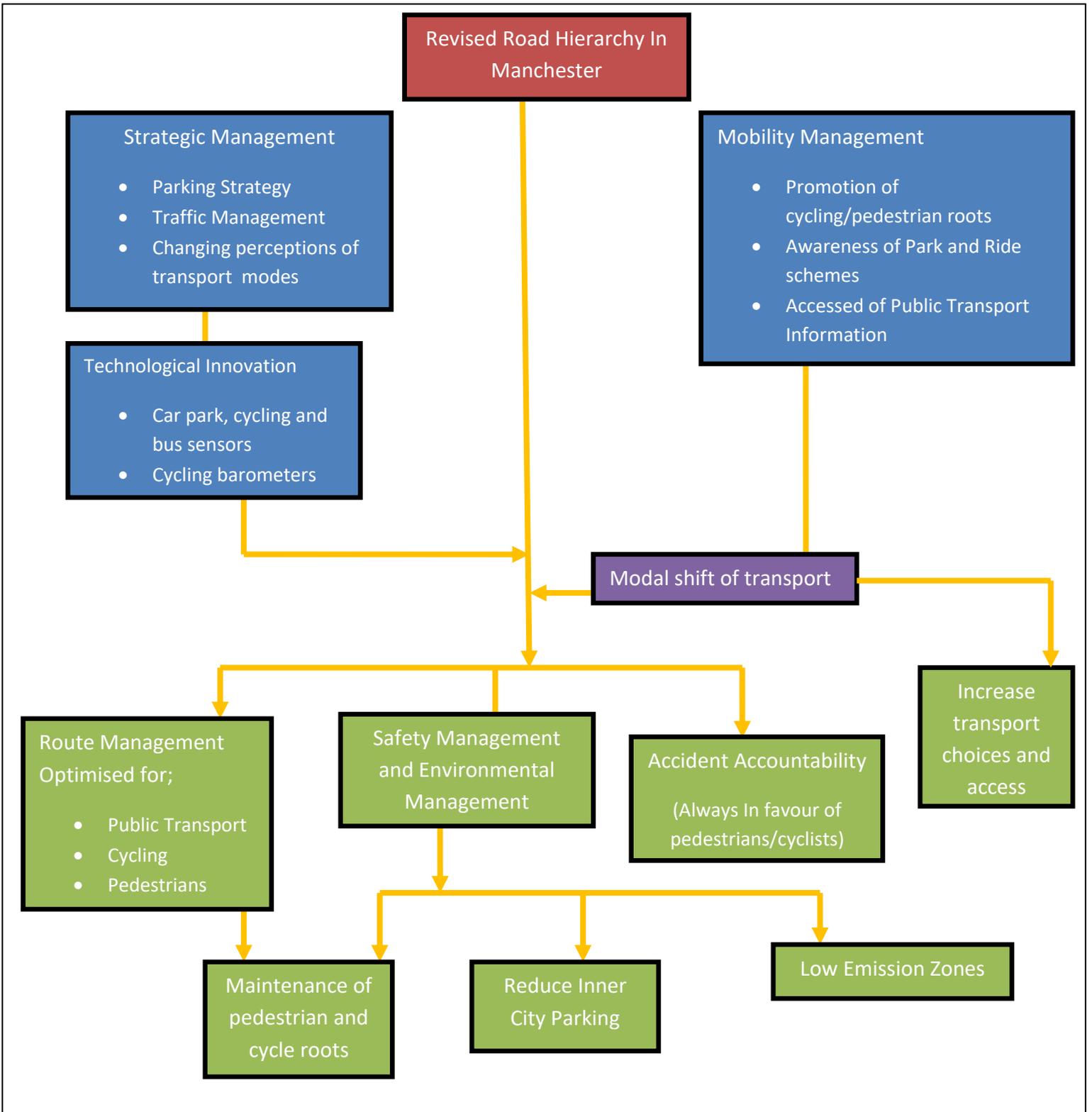


Figure 3 Suggested governance to change enhance behavioural changes (adapted from Bristol's Transport Plan, 2000; 92).

## 5.0 Conclusions

As shown, there is a multitude of strategies and techniques that can be used to implement transformative transport policy within Manchester city centre. While infrastructure is an important element, facilitating and encouraging behavioural changes among the local population is the most important factor as without a desire to use the infrastructure built, it will receive minor uptake. The already inspired Dutch cycle paths that line central and capillary streets of Manchester would receive greater use if similar pricing strategies instigated in Copenhagen were initiated in Manchester making using a private car in the centre less affordable, steering people towards bicycle, pedestrian and public transport. This would allow spaces in the centre to be similarly transformed in favour of re-greening and recreational urban activities that are also promoted by FoE. Furthermore, Manchester is already promoted as a “smarter city” and the integration of digital technology into the transport infrastructure should be facilitated. In Malmo, it was proven that these technologies transform perceptions of public transport and cycling by giving priority to more sustainable road users over private car owners. Not only does this encourage more people to use these modes of transport, it also helps invert the road hierarchy as confirmed by figure 3, significantly altering behavioural patterns as cars are no longer “a status symbol” (Steg, 2003; 14).

No matter the proposed changes though, it should be a priority for Manchester City Council to involve the community at all levels as Bristol’s inclusive strategies ensure. This guarantees that the proposed governance strategies are integrated into the city beyond and infrastructure level and used effectively by all those who “lives in, works in or visits the city” (BCC, 2000; 3).

Further research should consider how the cityscape transformation of on-street parking can enhance a city on a socioeconomic and environmental level, creating the city as a healthier, economical and enjoyable place to inhabit.

## References

---

- Barth, M., & Boriboonsomisin, K. (2009). 'Traffic Congestion and Greenhouse Gases', *Access Magazine*, Fall, [Online], Available at: [http://www.accessmagazine.org/wp-content/uploads/sites/7/2016/01/access35\\_Traffic\\_Congestion\\_and\\_Grenhouse\\_Gases.pdf](http://www.accessmagazine.org/wp-content/uploads/sites/7/2016/01/access35_Traffic_Congestion_and_Grenhouse_Gases.pdf) (Accessed 7th May, 2017)
- Berg, N. (2016). 'ots to lose: how cities around the world are eliminating car parks', *The Guardian*, 27<sup>th</sup> Sep, [Online], Available at: <https://www.theguardian.com/cities/2016/sep/27/cities-eliminating-car-parks-parking> (Accessed 6th of May, 2017)
- Better by Bicycle. (2017). 'Cycling is the most sustainable mode of transport'. [Online]. Available at: <http://www.betterbybicycle.com/2014/02/cycling-is-most-sustainable-transport.html> (Accessed 9th May 2017).
- Chester, S. (2016). 'How Manchester's revival is leading the Northern Powerhouse', *The Telegraph*, 5<sup>th</sup> December, [Online] Available at: <http://www.telegraph.co.uk/property/house-prices/manchesters-revival-leading-northern-powerhouse/> (Accessed 10<sup>th</sup> May 2017).
- Colledge, M., Fender, A. (2013) 'VELOCITY'. [Online] Available at: [http://cycling.tfgm.com/Pages/velocity/Velocit2025\\_Summary.pdf](http://cycling.tfgm.com/Pages/velocity/Velocit2025_Summary.pdf) Accessed (06/08/2017).
- Crook, A. (2017). 'Manchester is second most congested city in country, new study finds', *Manchester Evening News*, 20<sup>th</sup> Feb, [Online], Available at: <http://www.manchestereveningnews.co.uk/news/greater-manchester-news/manchester-second-most-congested-city-12627984> (Accessed 7th of May, 2017).
- Dolan, P., Hallsworth, M., Halpern, D., King, D., & Vlaev, I. (2010). 'MINDSPACE: influencing behaviour for public policy'.
- European Commission. (1999). 'Cycling: The Way Ahead for Town and Cities. Office for Official Publications of the European Communities', Luxembourg.
- Glendinning, A. (2015). 'Manchester's cyclists welcomes new Dutch-Style bike lane – first of 13 for Oxford Road', [Online], Available at: <http://www.manchestereveningnews.co.uk/news/greater-manchester-news/manchesters-cyclists-welcome-new-dutch-10129116> (Accessed 9th May 2017)
- Google.com. (2017). 'Definition of Parking', [Online], Available at: <https://www.google.co.uk/search?q=defintion+of+parking&oq=defintion+of+parking&aqs=chrome..69i57j0l5.4642j0j4&sourceid=chrome&ie=UTF-8#q=definition+of+parking> (Accessed 10<sup>th</sup> May 2017).
- Hartley, J. (1992). 'The politics of pictures: The creation of the public in the age of popular media'. Psychology Press.
- Jean, P. (2013). 'Walker and Cyclists given priority in road hierachy drive', *The Canberra Times*, 9<sup>th</sup> Nov, [Online], Availabe at: <http://www.canberratimes.com.au/act-news/walkers-cyclists-given-priority-in-road-hierarchy-drive-20131108-2x7gk.html> (Accessed 9th May 2017)

Jensen, S. U., Rosenkilde, C., & Jensen, N. (2007). 'Road safety and perceived risk of cycle facilities in Copenhagen'. *Presentation to AGM of European Cyclists Federation*.

Manchester City Council. (2016). 'Parking Services Parking Policy 2016/17'. Available at: [http://www.manchester.gov.uk/directory/99/policies\\_and\\_strategies/category/1172](http://www.manchester.gov.uk/directory/99/policies_and_strategies/category/1172) Accessed (07/05/2017).

Manchester City Council. (2016). 'Tech hubs will help drive Manchester's digital revolution forward', [Online], Available at: [http://www.manchester.gov.uk/news/article/7577/tech\\_hubs\\_will\\_help\\_drive\\_manchesters\\_digital\\_revolution\\_forward](http://www.manchester.gov.uk/news/article/7577/tech_hubs_will_help_drive_manchesters_digital_revolution_forward) (Accessed 9th May 2017)

McKee, A. (2003). 'Textual Analysis: A Beginner's Guide'. London: Sage.

Pucher, J., & Buehler, R. (2008). 'Making Cycling Irresistible: Lessons from the Neatherlands, Denmark and Germany', *Transort Reviews*.

Rublin, A. (2017). 'Improving Malmö's traffic environment', MILJÖFÖRVALTNINGE, [Online], Available at: <http://malmo.se/download/18.58f28d93121ca033d5e800077> (Accessed 12th May 2017).

Shoup, D. (2007). 'Cruising for Parking', *Access*, pp 16-22

Steg, L. (2003). 'CAN PUBLIC TRANSPORT COMPETE WITH THE PRIVATE CAR?' *IATSS Research*, 27 (2), pp 27-35

The City of Copenhagen. (2009). 'Impact of Copenhagen's Parking Strategy'. [Online], Available at: [file:///C:/Users/Victoria/Downloads/682\\_x8IQDnzcqQ%20\(1\).pdf](file:///C:/Users/Victoria/Downloads/682_x8IQDnzcqQ%20(1).pdf) (Accessed 10<sup>th</sup> May 2017)

Transport for Greater Manchester. (2017). 'Greater Manchester Transport Strategy 2040 Our Vision'. *Greater Manchester Combined Authority*. [Online] Available at: <http://www.tfgm.com/2040/Pages/strategy/assets/2017/supporting/1-GM-Transport-Vision-2040.pdf> (Accessed 09/05/2017).

Trasport for Greater Manchester. (2017). 'Greater Manchester Low-Emission Strategy and Air Quality Action Plan', *Public Consultation*

WHO Regional Office for Europe. (2005). In: 'Fourth Ministerial Conference on Environment and Health'. *Final Conference Report*. [Online] Available at: [/http://www.euro.who.int/document/eehc/ereport](http://www.euro.who.int/document/eehc/ereport) (Accessed 10/05/2017).

WHO-UNECE, (2008). 'Transport Health and Environment Pan-European Programme (THE PEP)'.

Zhang, K., & Batterman, S. (2013). 'Air pollution and health risks due to vehicle traffic,' *Sci Total Environ*, pp 307-31, [Online], Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4243514/> (Accessed 8<sup>th</sup> of May, 2017)