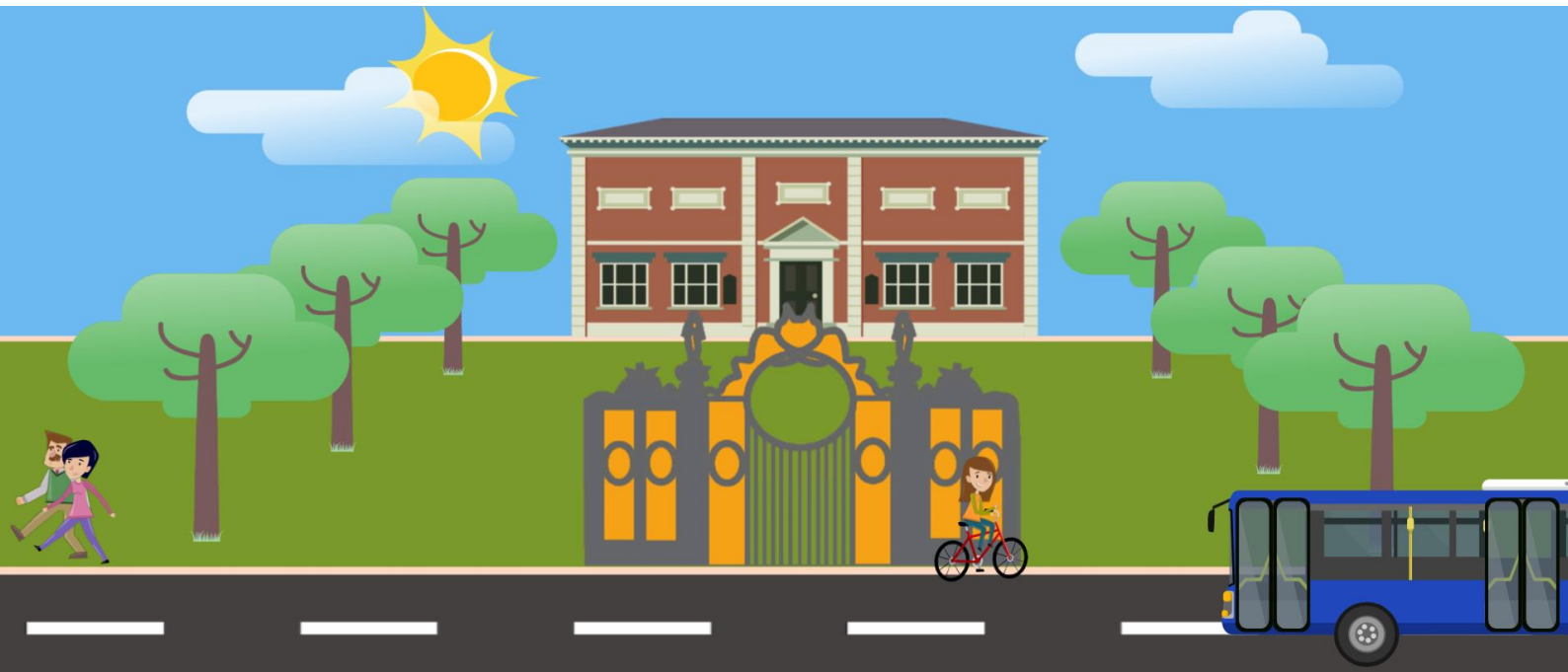
WARRINGTON
Borough Council

WARRINGTON FOURTH LOCAL TRANSPORT PLAN

EVIDENCE BASE REVIEW



1 Introduction

This document provides the evidence base for Warrington's Local Transport Plan Four (LTP4). The evidence base was reviewed prior to the development of LTP4, providing an overview of the transport networks in Warrington and how we use them. This has supported the production of the Draft LTP4.

The Local Transport Plan helps address local transport issues by providing a framework for decisions on future investment, the strategy will:

- set objectives for transport to support our wider goals and ambitions;
- establish policies to help us achieve these objectives; and
- Contain plans for implementing these policies.

1.1 Purpose of this document

The evidence review is an important part of the LTP4 development process. It provides an opportunity to understand existing travel patterns and the reasons why people travel within Warrington. A structured and thorough evidence review ultimately enables identification of existing and future problems with Warrington's transport system.

The findings of the evidence base have helped to inform the development of LTP4 policies. Therefore, the review enabled evidenced based objective setting; a process which enables the production of applicable transport policy that more effectively addresses residents, workers, businesses and visitors travel needs.

1.2 Document structure

The document reviews a variety of statistics and studies from local, regional and national sources. To enable a structured and comprehensive review of the available datasets, the document is structured in the following way:

Section number	Section	Description
2	Key findings	A summary of the key findings of the individual evidence chapters.
3	Socio-economic review	A review of socio-economic trends and activity, such as population, the economy, health and leisure.
4	Transport and travel	A review of travel patterns, behaviour and use within Warrington.
5	The future	A review of future growth forecasts, regeneration and development proposals.
6.2	Environment and well-being	A review of environmental issues, considerations and the natural environment.

2 Key findings

2.1 Socio Economic

2.1.1 Population

- Warrington is growing at a substantial rate - the town has grown at an average annual growth rate of 0.58% during the last 15 years and has exceeded the North West's average growth rate 0.39%.
- According to ONS 2014 population growth projections, Warrington's population is projected to grow at an average annual growth rate of 0.51%, this is greater than the North West average of 0.32%.

2.1.2 Employment activity

- Employment levels in the town have grown faster than the national average. Between 1998-2014, Warrington's workforce grew 21% whereas the England and North West average were 14% and 10%.
- Warrington has a very strong labour market with 105,000 economically active residents (2015). This represents 81.5% of the workforce, this is higher than the LEP and national average (78.0%).
- The average Warrington resident earns more at £28,241 than the average Warrington worker who earns £25,911. One apparent trend driving this being the commuting of the most senior people in Warrington into highly paid jobs in Manchester.

2.1.3 Labour market participation

- There are comparatively low levels of home working in Warrington (9.3%). This is lower than the LEP (11.4%) and national average (10.4%). This indicates that a large proportion of Warrington's population will likely travel to access employment.
- There are above average concentrations of mangers, directors and senior officials to the south of the Ship Canal.

2.1.4 Employment distribution

- A 'T' shaped distribution of employment is observed in Warrington; employment is concentrated in the town centre, and along the M62 corridor to the north of the town centre at Omega, Gemini and Birchwood.
- The majority of the town's population are located to the west, east and south of the town centre, with fewer residents located north. This sparse development pattern vastly influences the way Warrington residents and workers travel, with most favouring the car.

2.1.5 Sectoral composition change

- The industries which are represented in Warrington to a greater extent than England, and have also generated growth, are business services, utilities, professional scientific and technical as well as transport. These industries are mostly located outside the town

centre and demonstrate the significance of Warrington's out of town employment locations.

- For Business Administration and Support Services (the largest sector with 16% of jobs in the Borough), a high concentration of these jobs (28%) were concentrated in the town centre.
- Transport is a sector that has demonstrated consistent growth over the period 1998-2014. Transport employment has risen by over 2,000 jobs. The productivity of this industry heavily relies on a functioning and efficient highways network.

2.1.6 Productivity

- Warrington's economy has performed strongly over the last 15 years. GVA performance has outstripped the national average.
- The Warrington economy also generates more GVA per head than the average for England.
- Warrington has £49,695 of GVA per filled job. This is higher than the North West average of £45,519, but lower than the England figure of £51,803. This suggests the need for Warrington to grow its GVA per filled job by encouraging the growth of higher value businesses.
- Warrington records lower levels total stock of businesses per 1,000 working age people than across England as a whole – but in the last five years the number of new businesses in Warrington has grown faster than the national average.

2.1.7 Deprivation

- Parts of the Borough are within the 10% most deprived nationally, particularly the town centre, Orford and Padgate.
- The proportion of claimant counts (aged 16-64) has fallen in Warrington between 2013 and 2017.

2.1.8 Health

- Areas with the greatest health deprivation are located in central and northern Warrington, such as the town centre, Orford and Padgate.
- In Warrington, admissions where obesity was a factor is increasing at health clinics.
- In Warrington in 2016/17, the prevalence of children overweight and obese in reception and Year 6 were 21.9% and 30.8% respectively.

2.2 Transport and travel

2.2.1 Travel patterns and trip behaviour

- In Warrington, car travel accounted for three quarters (75.1%) of vehicle miles in 2015.
- There are higher traffic flows to the north-west of the town centre around Westbrook, and north-east along Birchwood Way compared with A roads in the south of the Borough.
- Shopping is the most popular type of journey undertaken in Warrington (24%) followed by commuting (18%) and visiting friends at private home (11%). These trips are

dominated by use of the car, either as a driver or passenger, and account for 80% of journeys.

2.2.2 Journey times and congestion

Serious congestion problems are observed in Warrington during peak time periods. Slow journey times exist in the following locations:

- *The town centre* - A57/A5061 roundabout; A49 Cockhedge Green Roundabout; and Sankey Way/Liverpool Road roundabout.
- *Waterway crossings* - A49 Wilderspool Causeway Canal crossing; Bridgefoot Gyratory; Brian Bevan Island; and the A50/A5031 gyratory.
- *Approach to the town centre* - the A5060, Midland Way, A49 and Knutsford Road.
- *Motorways access* - along Birchwood Way accessing the M6; along the A50 accessing the M6; and where the A49 joins the M62.

2.2.3 Travel to work

- Warrington sees greater inflows of workers than outflows.
- Greater worker inflows are concentrated in selected MSOA: Warrington Town centre; Birchwood; Westbrook; and Woolston.
- Most use the car for commuting and this has increased from 72.1% in 2001 to 73.9% in 2011
- Car commuting is higher than the North West, National averages and other UK New Town's.
- 10.5% of Warrington's residents use active travel to get to work. This is lower than the national average and other New Town developments, Peterborough (15%) and Northampton (14%).
- Commuting to the town centre is dominated by car travel (73%) despite being served by a variety of public transport modes.
- Above average proportions cycled to work from Orford, Hulme and to the east of Victoria Park, near Latchford

2.2.4 Car ownership

- 81% of Warrington residents own a car. This is above the 74% national average.
- Areas of central Warrington had the highest proportion of households without access to a car/van; perhaps owing to the proximity and availability of public transport.

2.2.5 Rail travel

- The number of rail users in Warrington is growing, with a 37% increase observed between 2010-11 and 2016-17.
- Warrington Central is the busiest station with 1,729,877 entries and exits in 2016/17.
- The greatest increases in rail passengers occurred on the CLC line at Padgate and Sankey for Penketh (88% and 73% respectively).
- Warrington is a key trip origin and there is evidence of greater rail outflow compared with inflow on the line.

2.2.6 Bus travel

- Bus services in Warrington are centred on Warrington Bus Interchange. This often requires passengers to change services in the centre for cross town journeys.
- Between 2010/11 to 2015/16, there has been a decline in bus patronage from 11.5million to 6.6 million per year. This has declined at a greater rate than the North West average.
- The majority of bus services finish at 23.00 and have limited services on most routes on Sundays.
- Bus fares have also increased in recent years. As a result, taxis are becoming increasing more competitive to local bus services
- There has been a significant reduction in local bus spend in Warrington, with a reduction of -48% between 2009/10 and 2014/15.

2.2.7 Public transport satisfaction

- Bus passenger satisfaction levels in Warrington are below the national average. The routing of services and congestion in the town was identified to reduce the quality of bus services.
- Stakeholders at the local transport summit suggested that implementing bus priority measures, better routing and improved journey reliability could raise quality of service.
- Price was identified as a key issue on both local bus and rail services and was a key factor in low public transport patronage and high car use. Stakeholders also voiced preference for implementing smart ticketing to help improve the attractiveness of services.
- There was broad agreement between transport summit delegates that a project to transform and improve the passenger transport offer in Warrington is necessary in order to reduce congestion, improve health, and accommodate housing and jobs growth.
- Stakeholders expressed mixed views about the type of mode that any transformative mass transit scheme should use. Trams, Guided Bus, and Bus Rapid Transit were amongst the options discussed.

2.2.8 Active travel

- Compared with national figures, the proportion cycling in Warrington was below the national average. However, Cycle count data shows cycling to be increasing in Warrington; a 21% increase in the level of cycling was observed within Warrington between 2006 and 2015.
- The town centre can be considered less permeable for cyclists. It requires good cycling experience to cycle on routes to the town centre.
- The proportion of Warrington residents doing any walking in 2014/15 was consistent with the national average. However, the proportion of walking 3 or more times a week was notably lower in Warrington compared with the national average.

2.2.9 Active travel user satisfaction

- Satisfaction with walking and cycling infrastructure in Warrington has increased between 2014 -2017. However, inconsistent infrastructure across the town, particularly penetration into the town centre and at the end of the journey, were identified as key barriers.

- At the Warrington transport summit, the dominance of the car and hostility of Warrington's roads were identified to make active travel uncomfortable in areas of the town, with this it brought concerns over safety and reduced the appeal to travel cycling and walking.

2.2.10 On demand travel

- Patronage on community dial-a-ride services remained steady around 1,700 journeys per month between 2016 and 2018.
- From 2011 to 2016, the number of licensed private hire vehicles has increased 13% to a total 421 vehicles. Whereas due to WBC control of numbers of Hackney carriage, the number of taxis has remained stagnant around 150.

2.2.11 Highways accessibility

- Warrington's employment destinations positioned further outside the town centre (Gemini, Omega, Sci tech Daresbury, Lingley Mere and Birchwood Park) have poorer public transport accessibility. Less than 25% of residents were able to access these employment locations within 30 minutes using public transport.
- Woolston Grange has limited public transport accessibility with only 5% of residents within 25-30 minute public transport accessibility.

2.2.12 Freight

- The number of LGV's on Warrington's highways network is increasing; 10.3% of vehicle miles were completed by LGV in 2000 and this has risen to 14.0% in 2015.
- The number of HGV's on Warrington's highway network has slightly decreased, with 11.7% of vehicle miles completed by HGV in 2000 and this has fallen to 9.9% in 2005.
- Excluding the SRN, higher freight flows were observed to the north-west of the town centre around Westbrook and along Birchwood Way between the town centre and Birchwood Business Park;
- Between 2013-2017, there has been a decrease in the number of total swing bridge movements on the Manchester Ship Canal.

2.2.13 Highways safety

- Warrington's roads can be viewed as being increasingly safer for highways users. KSIs in Warrington fell between 2011 and 2015.
- The casualty rate per billion vehicle miles was also lower in Warrington compared with the whole of the North West.
- Warrington town centre is identified as an accident hotspot.
- Active travel users are more at risk from highways accidents. 42.6% of KSIs that occurred in Warrington 2015 were active travel users.

2.2.14 Car parking

- There is significant demand to access parking for Warrington's rail stations, indicating multi-modal trips to be taking place for longer distanced journeys.
- There is significant demand to use the town's car parking facilities; Cobden, Town Hall and Cockhedge car parks are seen to be at or nearing full capacity.

2.2.15 Asset condition

- Warrington has in excess of 1200km of publicly maintained highways, 221 highway bridges and approximately 13,000 street lights.

2.3 The Future

2.3.1 Future growth

- Identified within the Preferred Development Option, Warrington will be home to vast numbers of new residents and workers with the plans for 24,200 houses and 381ha of employment land over the next 20 years.
- Within the existing Urban Area and Warrington Waterfront there will be approximately 15,000 new homes and 129 hectares employment land
- Within the green belt there will be approximately 9,000 new homes and 220 hectares of employment land, including:
  - Garden City Suburb: 6,300 new homes and 117 hectares employment land
  - South West Extension: 1,800 new homes
  - Outlying settlements: 1,190 new homes across the 7 green belt areas of the Borough

2.3.2 Locations of growth within Warrington

- Various transport packages were identified to be needed to help support Warrington's new residents and workforce:
  - Public realm and accessibility improvements in the centre.
  - Highways packages at Cockhedge and Dial Street roundabouts on the A49 to support development in the centre.
  - A transport package to improve east-west connections between Birchwood, the A49 and through to Omega.
  - A transport package of new distributer roads, walking and cycling network and public transport linkages will be required to support the mass movement of people from the Garden City Suburb.

2.3.3 Cheshire and Warrington

- There may be increased demand to reach important employment destinations identified within the Atlantic Gateway and Cheshire Science Corridor, this includes: Birchwood Park; Warrington Waterfront; Omega; Lingley Mere; and Sci-Tech Daresbury.
- Port Warrington has the potential to become an intra modal freight facility with connections on sea, rail and road integrated at one site.

2.3.4 Future transport within The North

- NPR would see the development of a new line between Liverpool and the HS2 Manchester Spur via Warrington. The services which use the line from Liverpool to Manchester Piccadilly, via Warrington and Manchester Airport, could take around 28 minutes.
- Warrington could capitalise on high speed rail and NPR with the rail services meeting at an integrated Warrington Bank Quay rail hub.

- TfN strategic Road study seeks to provide substantial upgrades to improve journey times, east-west connectivity, safety, and user experience on Warrington's surrounding motorways (M6, M62 and M56).
- TfN integrate smart travel programme is developing smart ticketing, payment and information technologies to transform passenger transport across the North.

2.3.5 Future transport

- Autonomous vehicles could be on UK roads as early as 2021 and form an essential part of the future UK economy, with market worth £28 billion to the UK by 2035. The vehicles have the potential to reduce accidents, improve network resilience and cut congestion.
- Mobility as a Service is a new technological innovation disrupting the transport industry. The widespread use of smartphones have generated new opportunities to engage with travellers and the way they influence the demand on the network.
- A total of 1121 ULEVs were licensed within Warrington in 2017. This encompasses 1.04% of all cars licensed within Warrington.
- The number ULEVs licensed has also grown at a faster rate within Warrington compared with the North West.
- Lithium ion battery densities are increasing and prices are falling, thus raising the attraction to purchase ULEVs. It will be important for Warrington to investigate current use of ULEVs and consider changing the policy environment to help support the growing use of the vehicles.

2.4 Environment and well-being

2.4.1 Carbon dioxide

- In 2006, road transport contributed to 37% of Warrington's CO2 emissions, Industry and commerce accounted for 40% and Domestic activity accounted for 23% of emissions.

2.4.2 Climate change

- In Warrington, daily mean, maximum and minimum temperatures and total precipitation have all increased since 1961 to 2006.
- The history of extreme weather events has shown Warrington is most vulnerable to high winds and heavy rain/surface water flooding.
- Past extreme weather events have disrupted public transport services and the highways network.
- Scientific research indicates that extreme precipitation and high wind events with a 1 in 100 year will see an increase in the likelihood of 40% if climate change continues to occur at its current rate.

2.4.3 Air quality

- National standards for NOx are being exceeded on the motorway surrounding Warrington, the town centre and roads the lead into the centre. The Air Quality Action Plan highlights that a 43% and 41% reduction is required in the motorway and town AQMA.

- Within the AQMA, petrol cars contribute approximately 11% and diesel cars 50% of NOx.
- HGVs and LGV contribute 20% of NOx, yet account for only 9% of distance travelled.
- Buses contribute approximately 11% of NOx yet account for only 1% of distance travelled

2.4.4 Flood risk

- Up to 1032 properties (890 residents, 117 business and 25 critical services) could be at risk from surface water flooding in a 1% (1 in a 100) annual probability rainfall event.
- Warrington is at greatest risk from flooding in the south in Stockton Heath, Grappenhall and parts of Walton around the River Mersey and Manchester Ship Canal.

2.4.5 Noise

- First priority locations for noise action planning are found:
  - Junction 9 and 11 of the M62
  - Winwick Lane Road north of Junction 9 M62
  - A49 on the approach to the Junction 9 M62
  - A56 Chester Road near Higher Walton Knutsford Road near Latchford East
- Noise action planning areas that are considered 'important areas' are also found on:
  - A57 Sankey Way
  - Within the town centre at Wilson Pattern Street and Mersey Street
  - Knutsford Road
  - A50 Kingsway street
  - M62 Junction 10 /Junction 21A

3 Socio-Economic Review

3.1 Socio-economic Key Findings

Continued population growth

- Warrington is growing at a substantial rate and is projected to continue growing. The transport system will have to cater for many more movements in and around the town.
- Warrington's highways network already suffers from chronic congestion. Without critical transport intervention, an increase in transport movements could cause severe network degradation and peak hours to substantially increase. This could further reduce the attraction of living and working in Warrington and choke development plans.

Warrington's strong and positive economic performance

- Warrington's economy has performed strongly and the town is a desirable place to work and do business. The Borough sees large volumes of people travel to employment during concentrated AM and PM periods. This results in congestion, poor journey times and commuting which vastly affects productivity levels.
- Parts of the Borough are within the 10% most deprived nationally

Development pattern

- When comparing population density and employment density, there is an inverse relationship between residential and employee densities.
- The town's sprawl of employment destinations and residential areas, has added to the difficulty of providing good public transport accessibility and led to favouring car travel.

Warrington's labour market

- Residents in Warrington are comparatively highly qualified and the average Warrington resident earns more than the average Warrington worker.
- Those employed in higher paid jobs and skilled activities, commonly leads to increased commuting distances and complex trip patterns. Warrington needs a more diverse transport offer to attract those who travel cross town and longer distances to consider multi-modal transport and modes other than the car.

Sectoral composition

- Industries which are represented in Warrington to a greater extent than England, and are growing, are business services, utilities, professional scientific and transport.
- The productivity of Warrington's growing transport industry will be dependent on a functioning highways network –this is under threat from congestion
- Providing good accessibility to the town centre is important to support the Boroughs largest sector (Business Administration and Support Services).

Health and well-being

- Similar to the rest of the UK, obesity is becoming an increasing health problem for Warrington residents. Raising levels of active travel presents an opportunity to make exercise a regular part of the daily routine.

3.2 Socio-economic review

The purpose of this section is to assess socio-economic trends in Warrington. This concerns the investigation of population trends, employment, productivity and health statistics within the Borough. The section identifies societal and economic implications that may affect the way Warrington residents and workforce travel. The section examines data sources from the Office of National Statistics (ONS), NOMIS, health statistics and indices of deprivation.

3.3 Warrington's population

Warrington was given New Town status in 1968 and has since grown in size. The latest count in 2015 found Warrington's population to stand at 207,700. The town continues to grow at a substantial rate, experiencing an average annual growth of 0.58% which exceeds the North West average by 0.19% (Table 1).

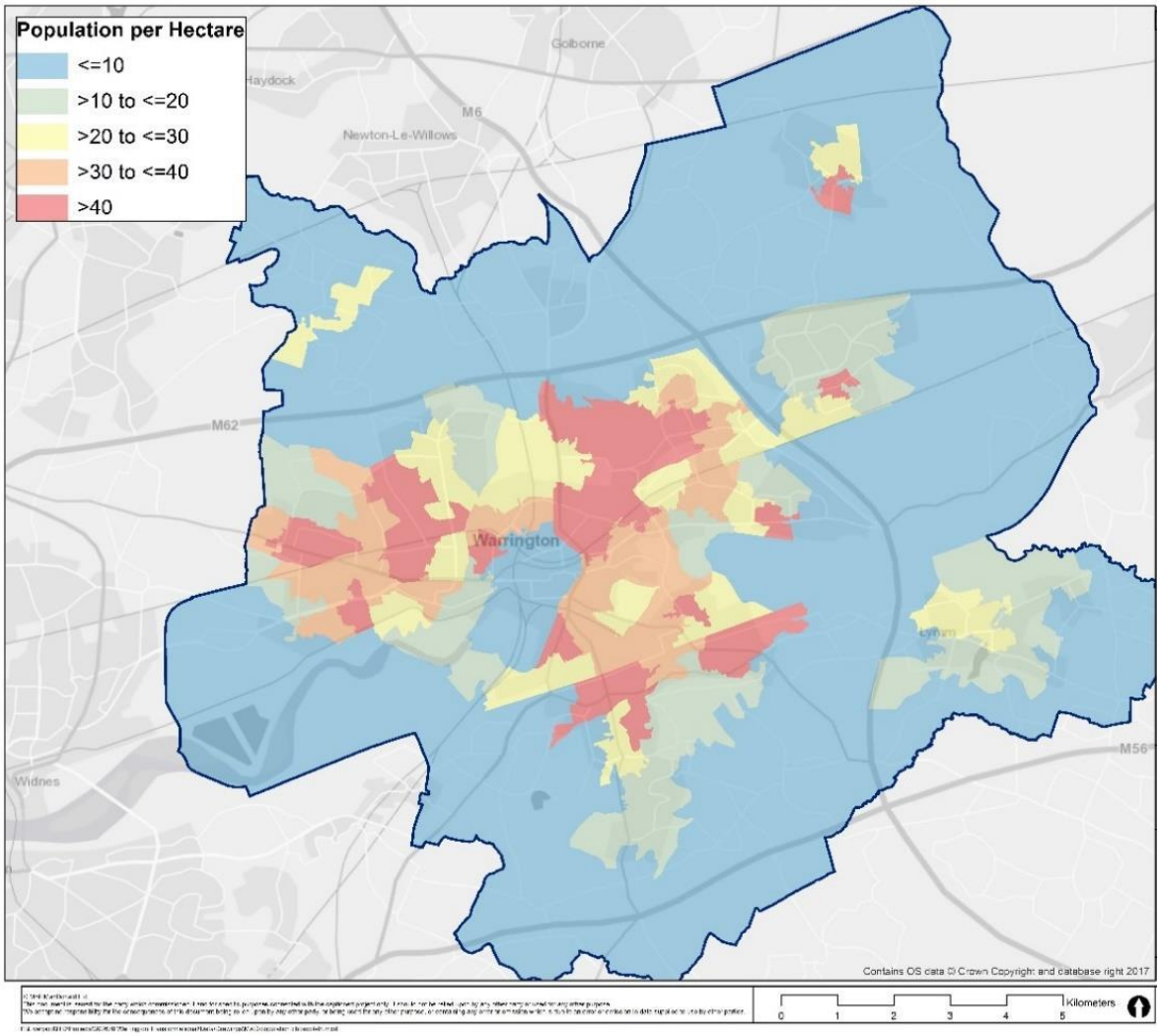
Table 1: Mid-year population estimates

Area	Population				Population growth	
	2001	2006	2010	2015	Absolute Growth	Average Annual Growth
Warrington	191,200	194,600	202,700	207,700	8.63%	0.58%
North West	6,773,000	6,901,600	7,056,000	7,173,800	5.92%	0.39%
Great Britain	57,424,200	59,084,000	61,470,800	63,258,400	10.16%	0.68%

Source: ONS Mid-year population estimates

The population has been mapped, Figure 1 shows the current population per hectare for each LSOA in the Borough. Warrington is a multi-centric Borough in terms of population; the urban area of Warrington covers a large expanse, with the majority of the Borough's population located to the west, east and south of the town centre, with fewer residents to the north of the town. There is also a sizeable number of outlying settlements in the Borough, such as at Lymn, Cachet and Birchwood.

Figure 1: Population density in Warrington

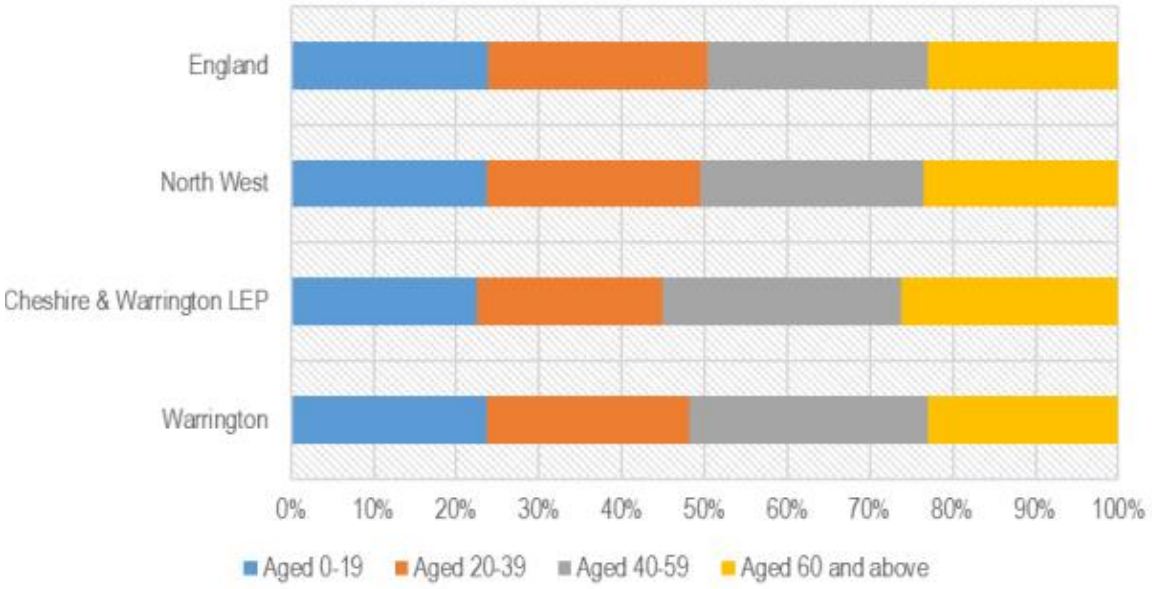


Source: Mott MacDonald

3.3.1 Age profile

The age profile of Warrington residents is shown in Figure 2. The Borough's profile broadly reflects wider trends, but is also consistent with Warrington town gaining New Town status in the late 1960s. The greatest proportion of the local population is now aged 40-59, reflecting population influx into the New Town in the 1970s and 1980s of young families. The proportion of the population in this category in Warrington is slightly higher than the regional or national average.

Figure 2: Age profile



Source: ONS Population estimates, 2014

It was estimated in 2013 that 6% of the Borough's population were born outside the UK which equated to 12,000 residents. In the North West 8%, and across England 14%, of the population as a whole was estimated to have been born outside the UK in that year. In recent years Warrington has also been the net recipient of internal UK migration, as shown in Table 2.

Table 2: Internal UK migration, to/from Warrington

	Inflow	Outflow	Net
2012	6,935	6,800	+135
2013	6,962	6,301	+661
2014	7,195	6,699	+496

Source: ONS migration statistics, 2014

3.3.2 Future population

ONS provide 2014 based population projections. In Table 3, the town's population growth has been projected for 2020, 2025, 2030, 2035 and 2040 horizons. Warrington's population is estimated to grow to 213,000 by 2020 and continue to grow through to 2040. The town is seen to grow at a considerable rate, with its growth rate larger than the North West average and nearing the Great Britain average (Figure 3).

Table 3: 2014 based population projection (% change)

	2020	2025	2030	2035	2040	Average annual growth
Warrington	3.29%	6.49%	9.16%	11.39%	13.37%	0.51%
North West	2.00%	3.87%	5.55%	6.97%	8.23%	0.32%
Great Britain	3.49%	6.72%	9.69%	12.32%	14.73%	0.57%

Source: ONS Mid-year population estimates

Figure 3: 2014 Based population projection (% change)

Source: ONS 2014 based population projection

3.3.3 Population key findings

The key findings of Warrington's current population base and future population predictions are:

- Warrington has grown at a substantial rate through New Town development. The town has grown at an average annual growth rate of 0.58% during the last 15 years and has exceeded the North West's average growth rate 0.39%.
- The town is also projected to continue growing. According to ONS 2014 population growth projections, Warrington's population is projected to grow at an average annual growth rate of 0.51%, this is greater than the North West average of 0.32%.
- The town has a smaller proportion of people aged over 60 than the national average but it does demonstrate a 'New Town demographic' where many of the original residents attracted to Warrington in the 1970s are now approaching retirement age.
- Warrington has a sparse development pattern with the majority of the Borough's population located to the west, east and south of the town centre, with fewer residents to the north of the town. There is also a sizeable number of outlying settlements in the Borough, such as at Lymm, Cachet and Birchwood.

What does this mean for LTP4?

Warrington will be home to a larger number of residents and this will increase the demand to travel. The town's previous travel patterns show a history of extreme car travel and congestion issues. A rising population, and a continuation of previous travel patterns, pose severe risk to the operation of the highways network and people's mobility.

3.4 Employment

Warrington has a strong labour market with 105,000 economically active residents. This represents 81.5 % of the workforce and as such economic activity rates in Warrington are higher than LEP area, regional or national averages (see Table 4).

Table 4: Economic activity 2015

	Warrington		LEP	NW	England
	No.	Percent	Percent	Percent	Percent
Economically Active	105,000	81.5	78.2	75.3	78.0
Employment	100,400	78.0	75.2	71.2	73.9
Self-employment	11,200	8.7	9.5	8.8	10.4
Unemployment	4500	4.3	3.9	5.4	5.3
Inactive	23,800	18.5	21.8	24.7	22.0

Source: ONS Annual population survey 2015

The unemployment rate for Warrington exceeds that of the LEP area, although this is lower than the regional or national average. At December 2015 there were 4500 people registered as unemployed and this represented 4.3% of the economically active labour force.

3.4.1 Annual pay

Resident based earnings are significantly higher than workplace earnings in Warrington, with an average resident wage which is £2,300 above the average workplace wage (Table 5). While wages for Warrington residents and workers are below the average for the LEP, Warrington residents do earn more than the average for England.

Table 5: Annual pay (£)

	Resident	Workers
Warrington	28,241	25,911
LEP	28,281	26,355
North West	25,721	25,681
England	27,869	27,872

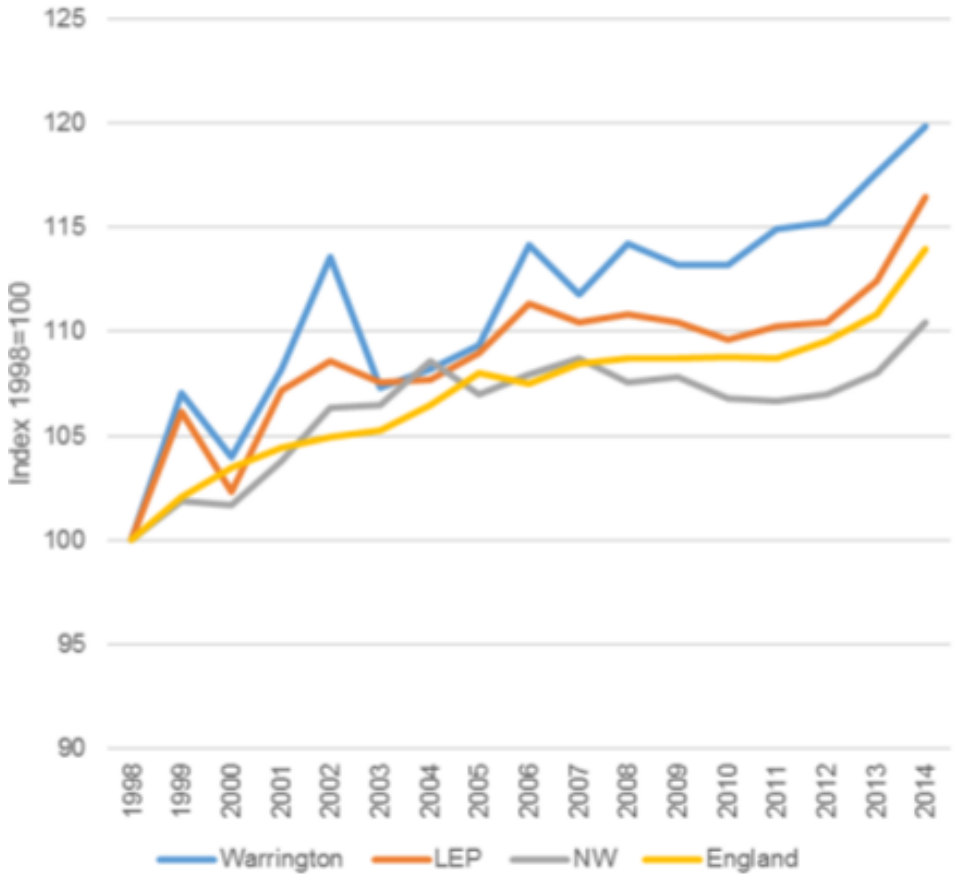
Source: Annual survey of hours and earnings, 2015

3.4.2 Employment change

Warrington has generated significant employment growth in the period 1998-2014 (the period over which employment data is readily available). During this period its employment generation rate has outstripped that of the LEP area, the region or the national average (England).

The workforce in Warrington grew from 101,000 to 122,000, a rise of 21% (see Figure 4). In the same period Employment growth in England was 14% and the North West grew by 10%.

Figure 4: Employment change 1998-2004



Source: ONS Annual population survey 2015

The graph shows that employment levels were volatile in the period pre 2008 recession. Such volatility is also likely to reflect survey/data issues over the smaller geographic area. Despite the variability, the growth since 2010 has been steady.

3.4.3 Employment key findings

The key trends of employment in Warrington are:

- Employment levels in the town have also grown faster than the national average.
- Warrington has a very strong labour market with 105,000 economically active residents (2015). This represents 81.5% of the workforce and as such economic activity rates in Warrington are higher than LEP area, regional or national averages (78.0%).
- The average Warrington resident earns more at £28,241 than the average Warrington worker who earns £25,911. One apparent trend driving this being the commuting of the most senior people in Warrington into highly paid jobs in Manchester.

What does this mean for LTP4?

Improving access to employment and commuting journey times could help raise productivity. LTP4 should look to enhance journey time reliability and relieve existing pinch-points along the highways network to boost the economic performance of the town.

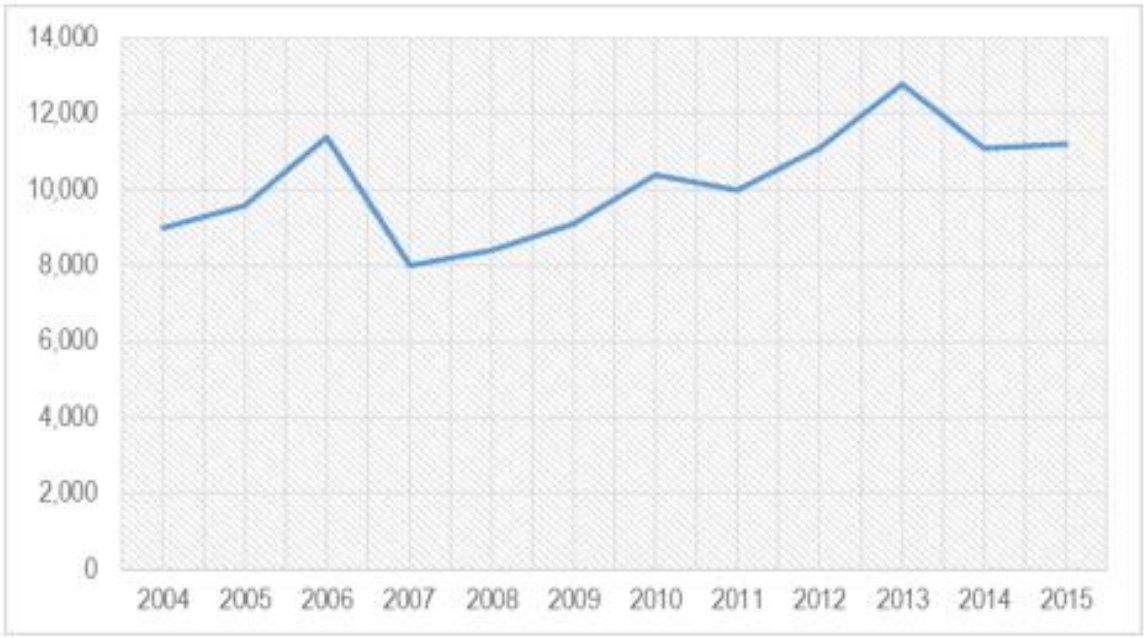
LTP4 should implement schemes that can provide quick and affordable transportation to the most economically deprived areas of Warrington to help reduce the unemployment rate. The strategy should also look at schemes that can develop new strategic connections which can unlock new land for employment opportunities, particularly for high value business premises.

3.5 Labour market participation

Warrington has a lower proportion of self-employment than the LEP area, the North West Region or national averages. However, locally, self-employment does appear to be on an upward trend and grew rapidly between 2011-2013 before reducing slightly (see Figure 5).

The number of people working for themselves in Warrington was 11,200 in 2015 and this represented 8.7% of the working age population. 9.3 % of Warrington residents work from home which is less than for the LEP as a whole (11.4%) or compared to the national average (10.4%). The figure is likely to under-represent the full scale of homeworking as further people will work from home some days in a week.

Figure 5: Self-employment in Warrington 2004-2015



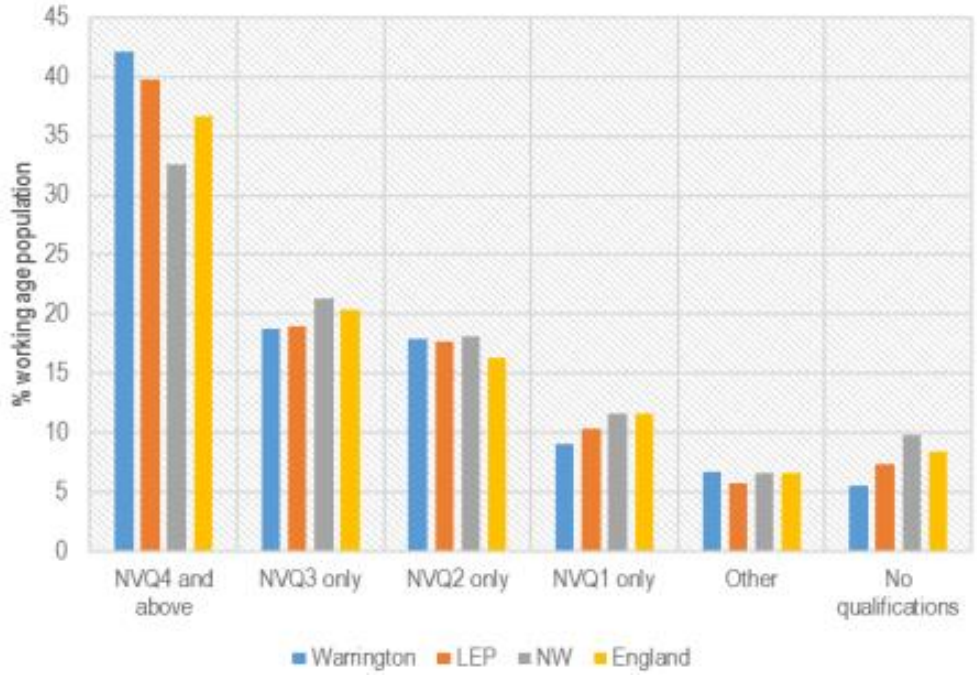
Source: ONS Annual population survey 2015

Warrington appears to be unusual insofar as homeworking dropped considerably between the 2001 census, when home working was recorded as 7,541, and the 2011 census when the figure had dropped to 4,648 – a decrease of 38%.

3.5.1 Skills and qualifications

The residents of Warrington are highly qualified in comparison to that of the wider LEP area, the North West and England as a whole (see Figure 6).
In Warrington 42% of residents are qualified to NVQ level 4 or above (equivalent to degree level) and the equivalent figure is 40% for the LEP and 37% for England as a whole.
Warrington also has a lower proportion of the working age population with no qualifications than the comparator areas. Just 6% of the working age population have no qualifications in the Borough, whereas 8% have no qualifications across England.

Figure 6: Level of qualifications of residents, 2015



Source: ONS Annual population survey 2015

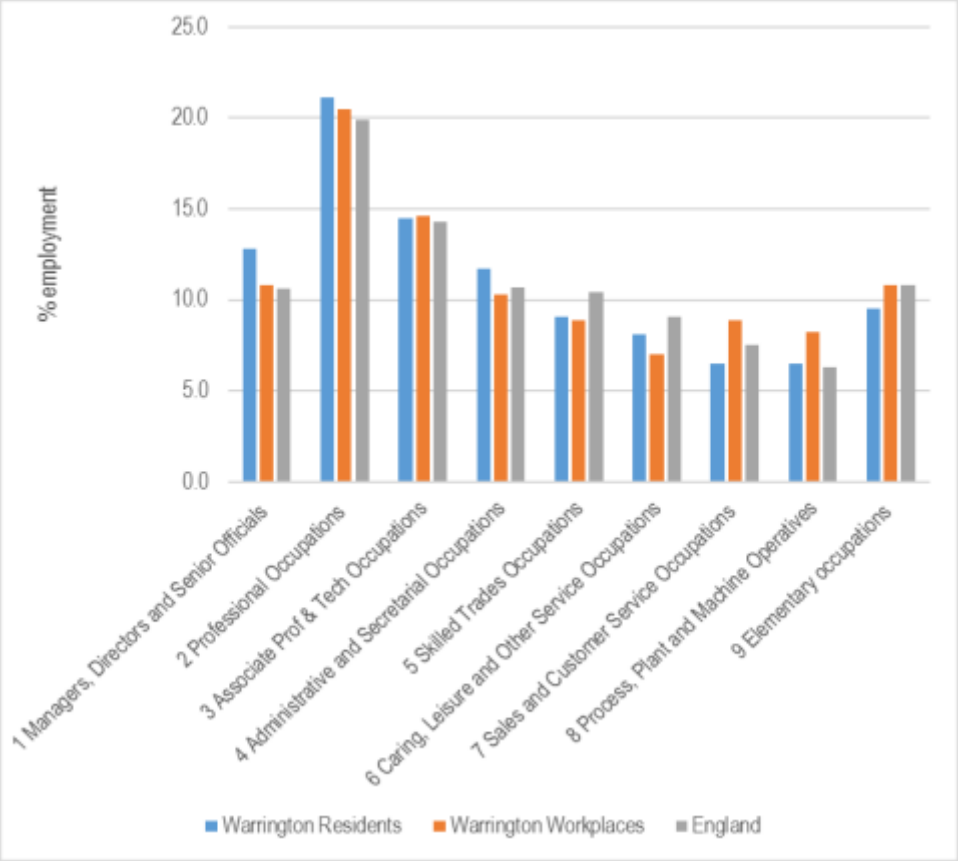
3.5.2 Occupation

The occupational profiles of the Warrington employment base (based on those who work in the area) and resident base (based on those who live in the area) have some significant differences (see Figure 7):

- There is a higher proportion of managers, directors and senior officials in Warrington residents than in Warrington workplaces and this is also (marginally) the case for professional occupations;
- There is a higher proportion of Warrington residents involved in administrative activities than in Warrington workplaces and this is also the case for caring professions; and

- Conversely the Warrington workforce contains a higher proportion of sales / customer service occupations; machine operatives; and those involved in elementary occupations than is the case amongst Warrington residents.

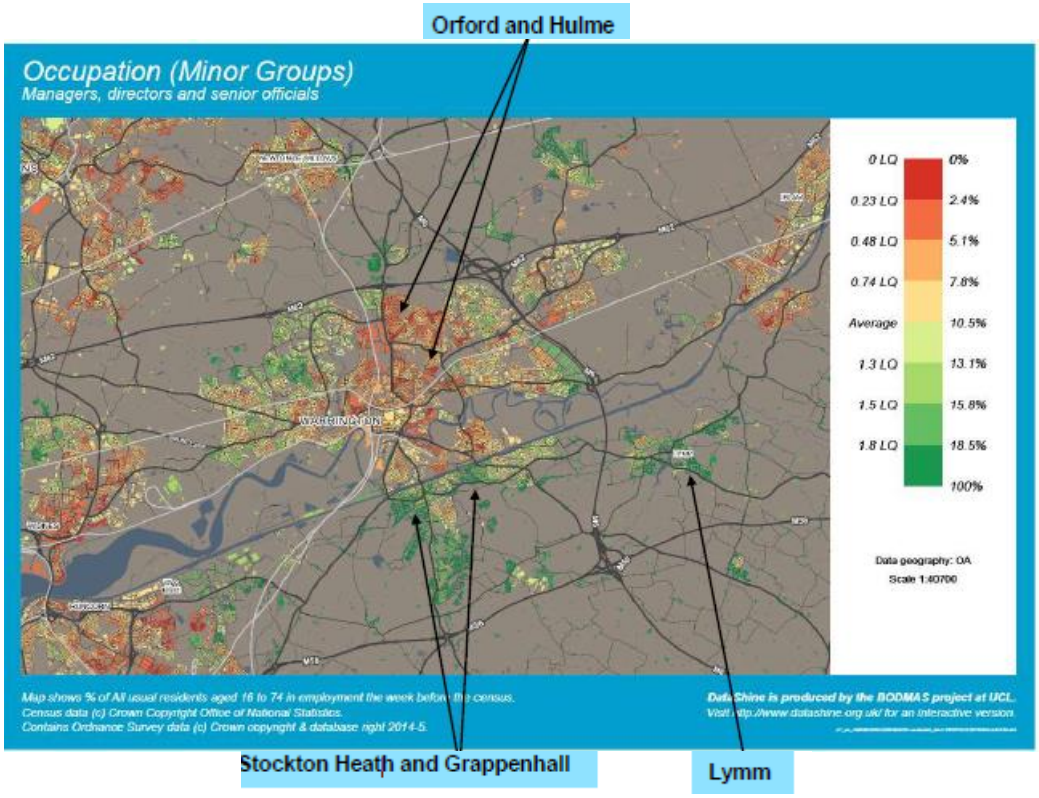
Figure 7: Occupations for Warrington Employees/ residents, 2015



Source: ONS Annual population survey 2015

Figure 8 presents the proportion of residents employed as a manager, director or senior official. The results show above average concentrations to the south of the Ship Canal, around Grappenhall and Stockton Heath, whilst much of the town centre has below average concentrations.

Figure 8: Warrington residents employed as a manager, director or senior official



Source: Datashine

3.5.3 Labour market participation key findings

A summary of the key trends for labour market participation is given below:

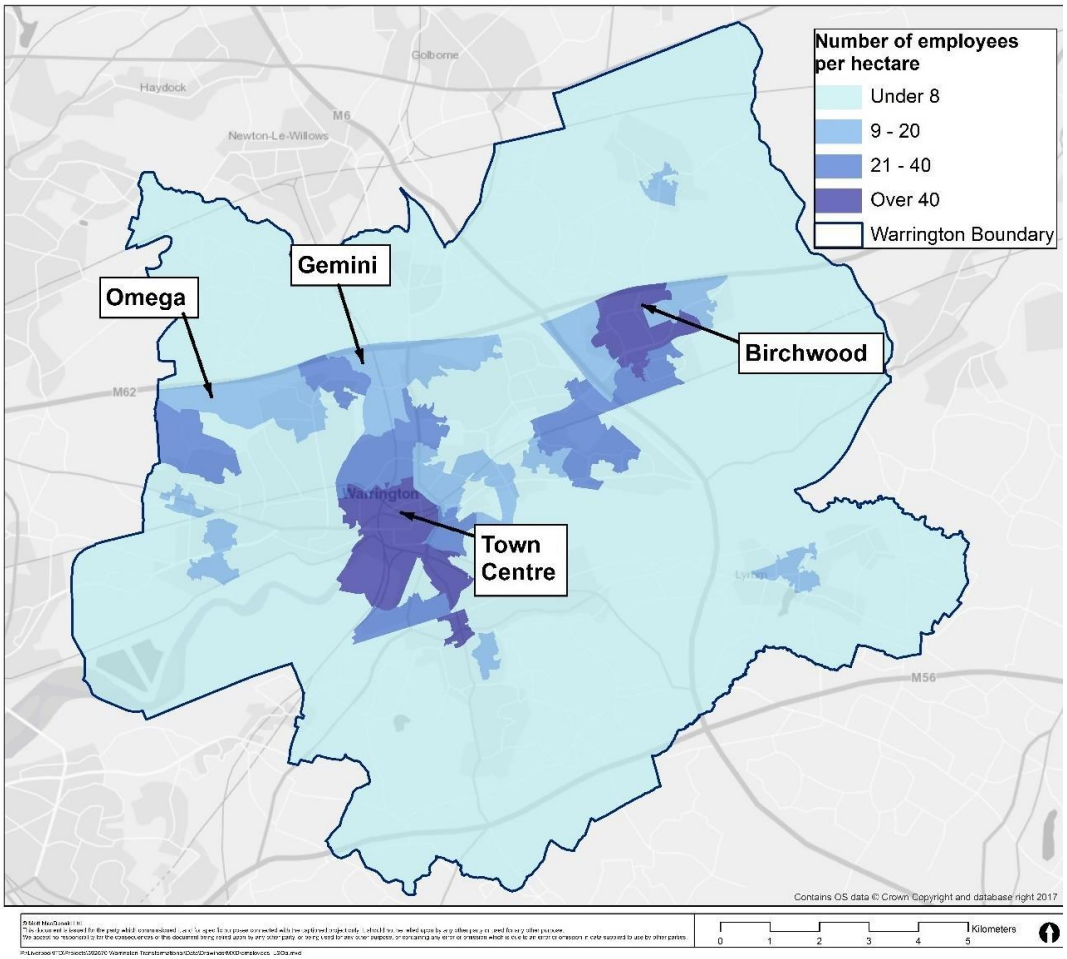
- There are comparatively low levels of home working in Warrington; 9.3% of Warrington residents work from home which is less than for the LEP as a whole (11.4%) or compared to the national average (10.4%). This indicates that a large proportion of Warrington's population will likely travel to access employment.
- In Warrington, 42% of residents are qualified to NVQ level 4 or above (equivalent to degree level) and this is higher than the LEP (40%) and England average (37%). Therefore, Warrington residents are more likely to have a degree than across England and perhaps as a consequence are also more likely to be employed in the higher Standard Occupational Classifications.
- There are above average concentrations of mangers, directors and senior officials to the south of the Ship Canal, around Grappenhall and Stockton Heath.

What does this mean for LTP4?
A large proportion of Warrington's population will likely travel to access employment. LTP4 may need to explore travel demand management measures to help manage the high volumes of workers accessing employment. This could explore ways to: reduce the number of people who travel; re time and re-route movements; and re-mode trips to help manage flows on the network.

3.6 Employment distribution

Employment density in Warrington was plotted for each LSOA within Warrington using 2014 Business Register and Employment Survey (BRES) data (Figure 9).Employment density is shown to be quite spread out. As in the case of the distribution of the Borough's population, a 'T' shaped distribution can be seen, with employees concentrated in the town centre, and along the M62 corridor to the north of the town centre.

Figure 9: Employees per hectare



Source: BRES 2016

When comparing population density in Figure 1 and employment density, there is an inverse relationship between residential and employee densities. The urban area of Warrington covers a large expanse, with the majority of the population located to the west, east and south of the town centre, with fewer residents located north of the town. There is also a sizeable number of outlying settlements in the Borough, such as at Lymm, Cachet and Birchwood. In tandem, many of Warrington's employer areas are concentrated in the town centre and along the M62 Corridor to the north of the town centre.

This sparse development pattern vastly influences the way Warrington residents and workers travel. With residents and workers favouring the private car to access these sparsely located employment sites.

3.6.1 Employment distribution key findings

The key findings of the employment distribution in Warrington are:

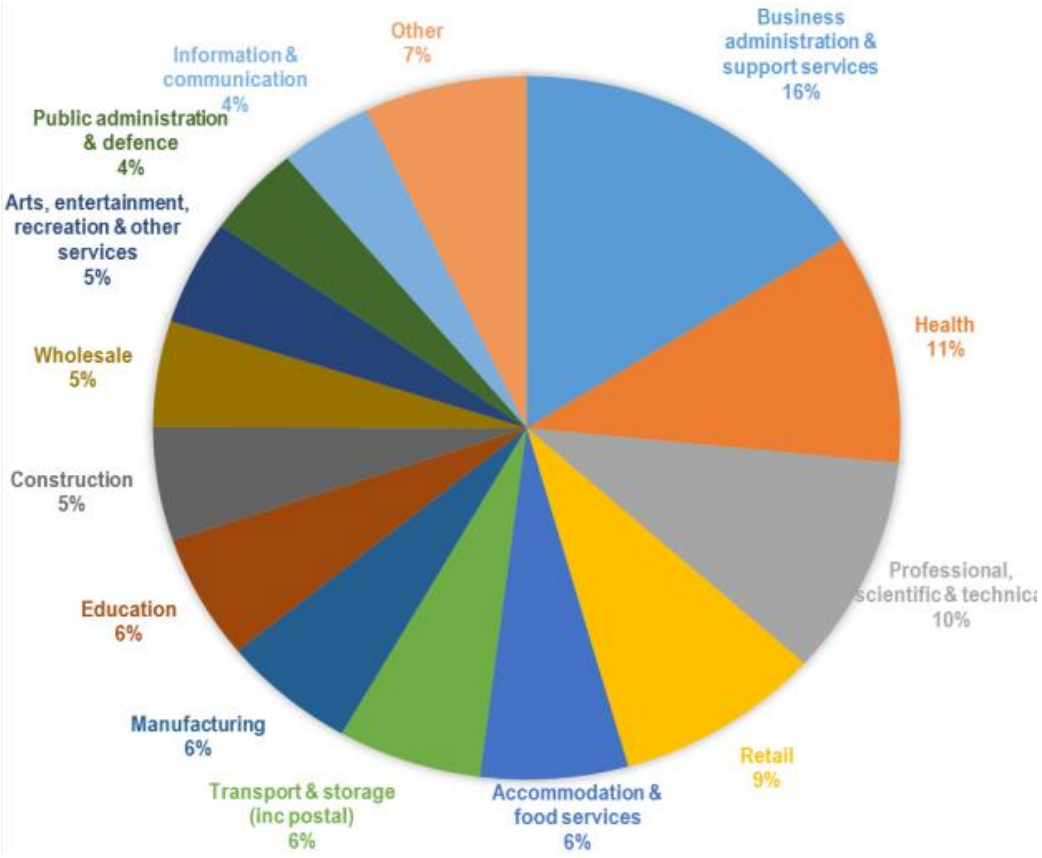
- A 'T' shaped distribution of employment can be seen in Warrington, with employees concentrated in the town centre, and along the M62 corridor to the north of the town centre at Omega, Gemini and Birchwood.
- When comparing population density and employment density, there is an inverse relationship between residential and employee densities. The majority of the population are located to the west, east and south of the town centre, with fewer residents located north of the town.
- This sparse development pattern vastly influences the way Warrington residents and workers travel, with most favouring the private car to access the sparse located employment sites.

What does this mean for LTP4?
LTP4 should target improving journey reliability to the town's key employment areas (the town centre, Birchwood, Omega, Lingley Mere and Woolston). The strategy should also seek to provide a more sustainable workplace and commuter transport strategy. It should look at schemes that can improve the public transport and active travel offer when travelling to the towns out of town employment areas. To do so, a step change in the quality of public transport and active travel may be needed. LTP4 will need to increase the quality of cross town services, introduce more competitive journey times, increase accessibility and the reliability of these transport modes.

3.7 Sectoral composition change

In 2014, BRES data indicated that there were 122,400 in employment in Warrington (see Figure 10). Unlike many other local authority areas in England, the largest employment sector is not health, education or retail but business administration with 16% of the total.

Figure 10: Growth in business stock (index)

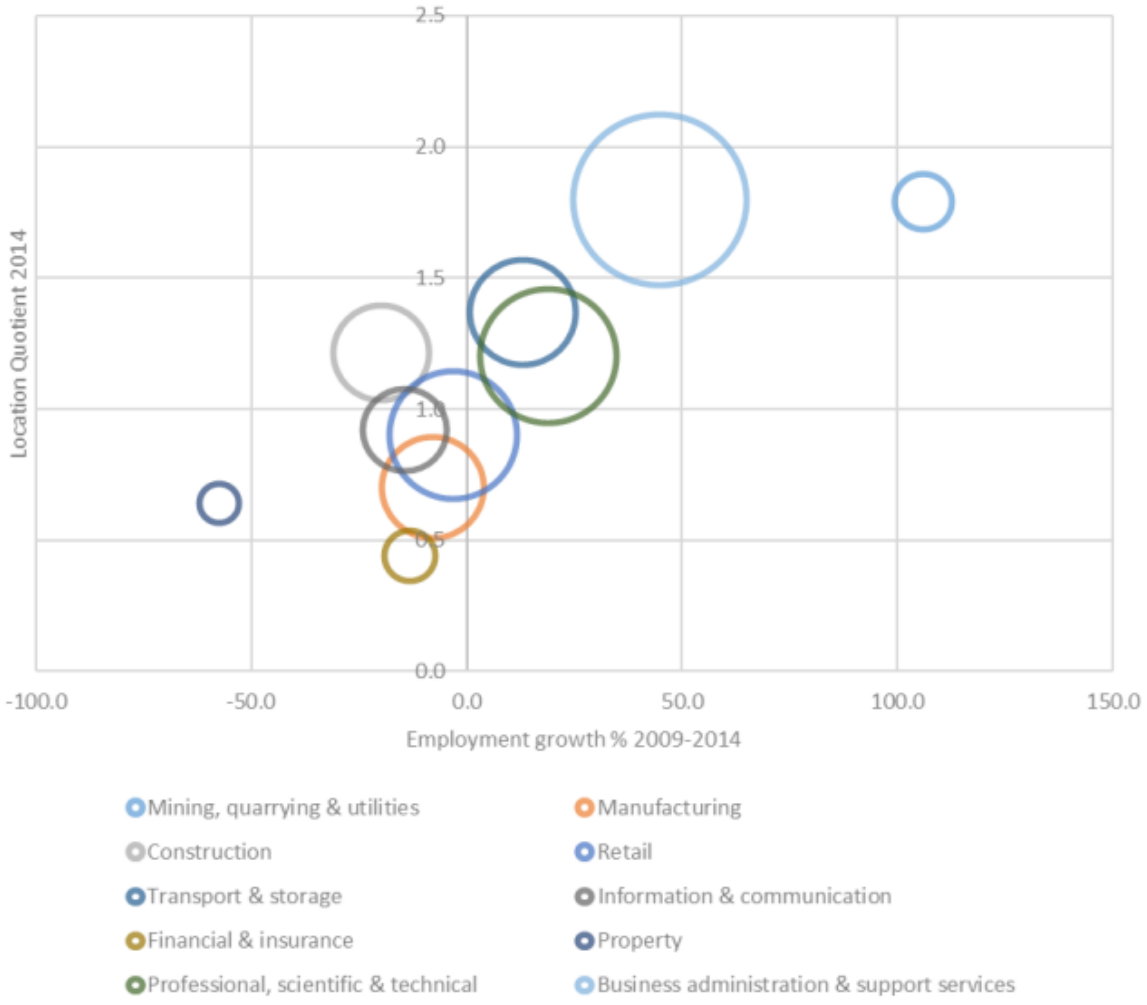


Source: UK business count, 2013

Figure 11 and Figure 12 use Location Quotients (LQs) to consider how sectoral employment in Warrington differs from the English average. A LQ of one indicates that the proportion of employment is the same as the English average and a LQ of two shows a proportion double the national average.

The graph maps the LQ against the growth of employment in the sector whilst the size of the circle indicates the total size of employment. The two Figures are the same graph, but shown as two figures to prevent the number of sectors cluttering the chart.

Figure 11: Location Quotients vs Growth One

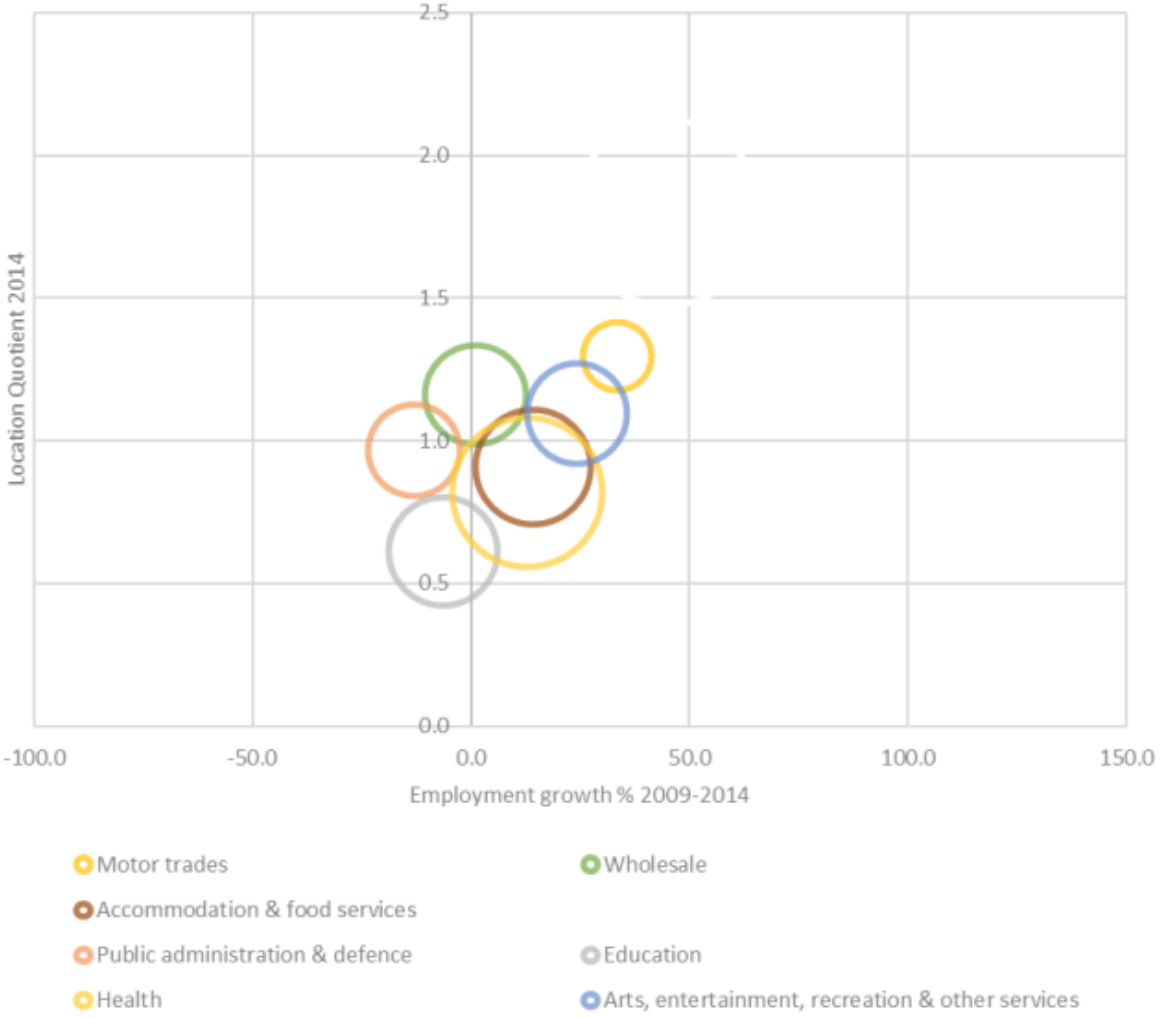


Source: BRES, 2014

The graph clearly shows the importance of utilities, business services, professional and technical and transport. Each have grown in the last five years and each are 'over-represented' in Warrington. Business administration and support services is also the largest absolute employer. Warrington has also a strong motor trade sector.

The declining sectors are also picked up by the data. Construction has a LQ above one, is a reasonably large employer but is in decline, manufacturing has a LQ below one and is declining and property has declined the most rapidly but is a relatively small employer.

Figure 12: Location Quotients vs Growth Two



Source: BRES, 2014

3.7.1 Spatial employment characteristics

3.7.2

Table 6 presents the number and proportion of jobs within each industry sector across the Borough and within the town centre. Business Administration and Support Services was the largest sector with 16% of jobs in the Borough and 28% of jobs within the town centre.

Across the Borough, almost half (47%) of the jobs were within the Business Administration and Support Service (16%), Health (11%), Professional, Scientific and Technical (10%) and Retail (9%) sectors. In comparison, within the town centre, just 6% were employed in the Health sector (compared with 11% in the Borough), whilst 11% worked in Public Administration and Defence (compared with 4% across the Borough).

Table 6: Employment by sector – Warrington Borough Council area and Warrington town centre

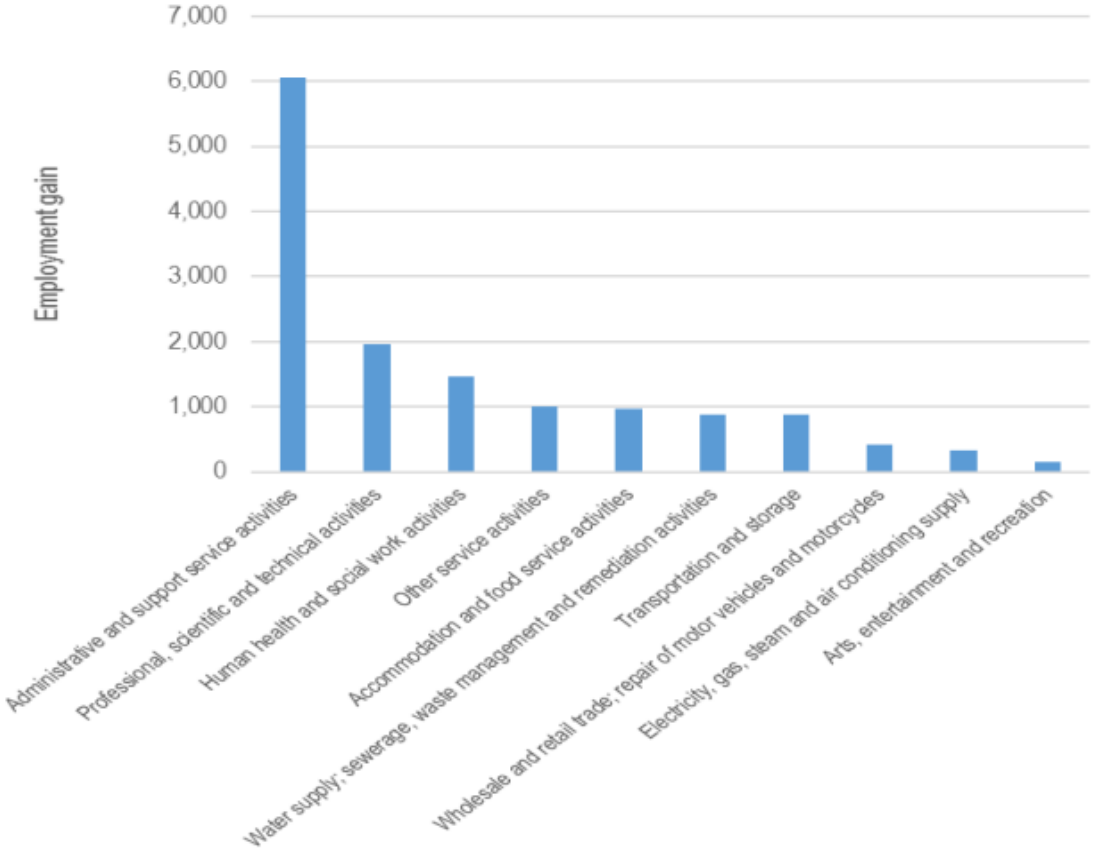
Industry Sector	Warrington Borough Council		Warrington Town Centre		% Difference
	N	%	N	%	
Business administration and support services	19,519	16	8,097	28	12
Health	12,921	11	1,872	6	-4
Professional, scientific and technical	12,337	10	3,176	11	1
Retail	10,939	9	3,428	12	3
Accommodation and food services	7,810	6	1,242	4	-2
Transport and storage (including postal)	7,623	6	1,016	3	-3
Manufacturing	7,119	6	1,326	5	-1
Education	6,950	6	356	1	-4
Construction	6,420	5	463	2	-4
Wholesale	5,949	5	458	2	-3
Arts, entertainment, recreation and other services	5,941	5	1,365	5	*
Public administration and defence	5,109	4	3,336	11	7
Other	13,442	11	3,220	11	*
Total	**122,079**	**100**	**29,355**	**100**	-

Source: BRES, 2014

3.7.3 Detailed sector analysis

When measured at a more detailed level, consideration of BRES data shows that by far the largest growth was in administrative and support services (see Figure 13). This data captures those firms who provide agency staff across a variety of sectors and does not tell us which sectors are actually seeking local labour through agencies. However, it does demonstrate the changing nature of the local workplace with more companies out-sourcing recruitment and using agencies to manage the terms and conditions of staff.

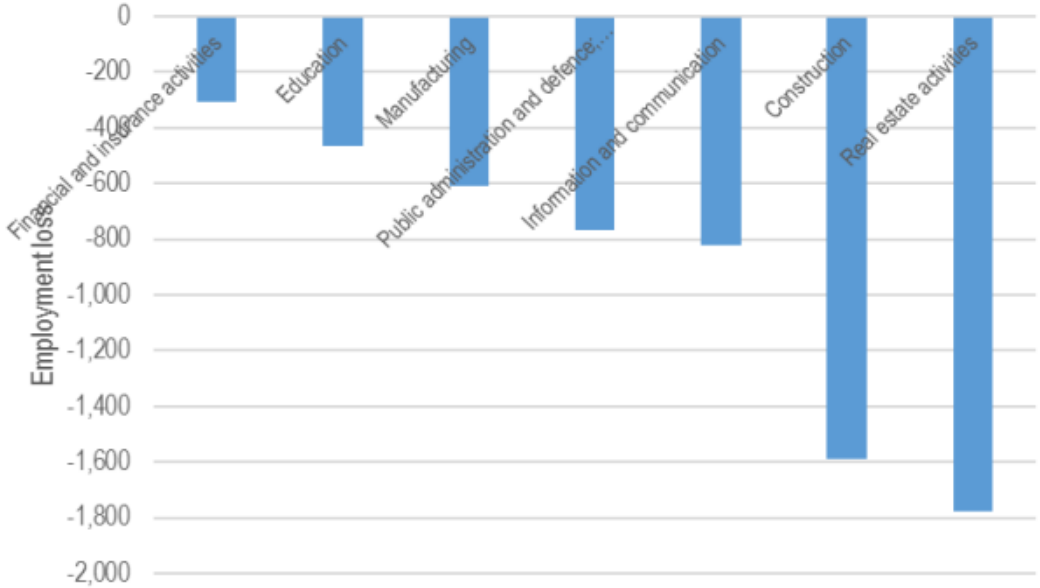
Figure 13: Detailed Sector Change 2009-2014 – Sectors which saw Employment Increase



Source: BRES, 2014

Figure 14 sets out those sectors which have declined using the more detailed definitions. This shows a strong decline in real estate but also a decline in information and communication, specialist construction as well as the public sector, excluding health.

Figure 14: Detailed Sector Change 2009-2014



Source: BRES, 2014

Data on the ten largest and ten highest represented sub-sectors reinforces the points made above (Table 10).

Table 7: Sub-Sector Analysis

10 Largest Sub Sectors			10 Highest Represented Sectors		
	No.	LQ		No.	LQ
Retail	11,000	0.9	Computer repair	900	4.1
Employment and Agency	8,600	2.1	Postal and courier	2,700	2.7
Health	7,100	0.8	Waste collection	1,300	2.6
Food and drink service	7,000	1.0	Gambling and betting	1,000	2.5
Education	7,000	0.6	Architecture and Engineering	4,500	2.2
Wholesale	5,900	1.2	Electricity and gas supply	900	2.1
Building services	5,700	2.0	Employment and Agency	8,600	2.1
Public admin	5,100	1.0	Installation and repair of machinery	900	2.0
Architecture and Engineering	4,500	2.2	Building services	5,700	2.0
Specialist construction	3,800	1.4	Manufacture of chemicals	800	1.8

Source: BRES, 2014

3.7.4 Key findings of sectoral compositional change

The key findings of Warrington's sectoral composition are noted below:

- The industries which are represented in Warrington to a greater extent than England, and have also generated growth, are business services, utilities, professional scientific and technical as well as transport. These industries are mostly located outside the town centre and demonstrate the significance of Warrington's out of town employment locations.
- However, for Business Administration and Support Services (the largest sector with 16% of jobs in the Borough), a high concentration of these jobs (28%) were concentrated in the town centre.
- Transport is a sector that has demonstrated consistent growth and over 1998-2014 transport employment has risen by over 2,000 jobs. This shows that Warrington has a strong dependency on transport and logistics industries. The productivity of these industries heavily relies on a functioning and efficient highways network
- Manufacturing has been consistent in its declining levels of employment and has lost more than 4,000 jobs during 1998-2004.
- The largest decline in employment according to quotient were in real estate, information and communication, specialist construction as well as the public sector, excluding health.

What does this mean for LTP4?
LTP4 should seek to implement schemes that can help improve network resilience and journey time reliability to support the growth and performance of the transport and logistics industry. The strategy should also develop a freight strategy to coordinate and mange logistics movements.

The town centre is congested and suffers from poor air quality. These transport issues need to be addressed to help make the centre a more attractive place to work and support the growth of the town's key employment sector.

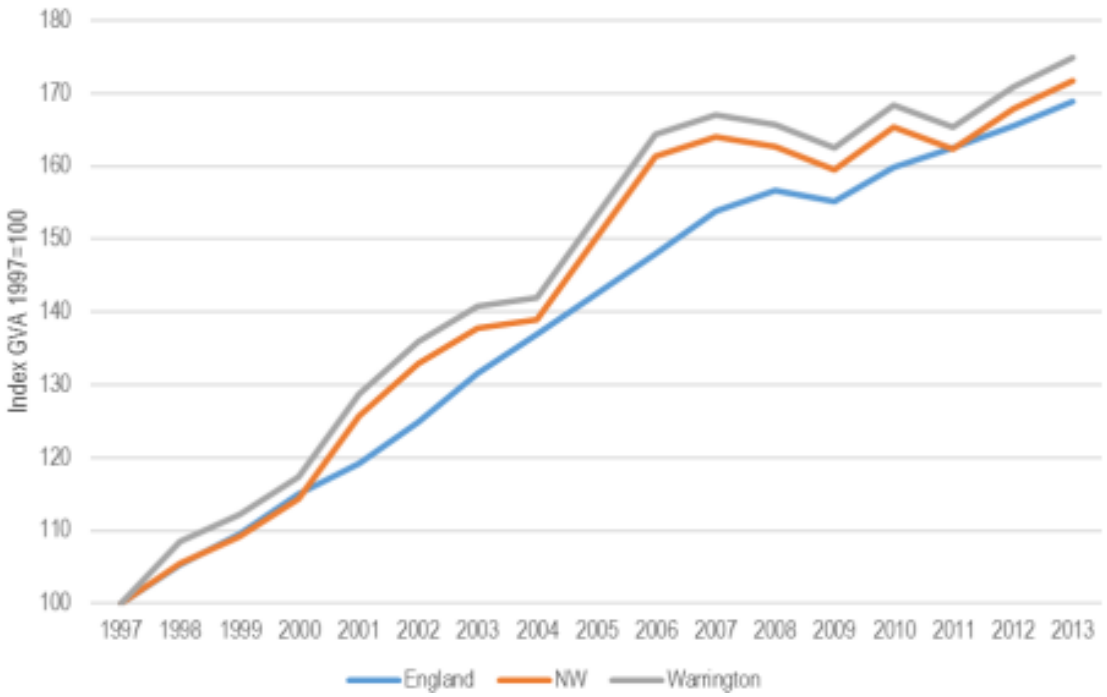
3.8 Productivity implications

The headline statistics on Warrington's economy are set out in the previous section and show a relatively positive profile in terms of employment and economic activity levels. This section investigates productivity within Warrington and highlights the performance of businesses and the economy of Warrington relative to both the North West and Great Britain.

3.8.1 GVA

In 2013, Warrington generated £5.9 billion of GVA and the performance of the area since 1997 is set out in Figure 14. During this period both the North West and Warrington have outperformed England in terms of GVA growth. The Warrington economy was three quarters larger, in terms of GVA, in 2013 than it was in 1997. By GVA, Warrington makes up a quarter of the LEP economy. GVA per filled job GVA per head Business start-ups Gross weekly pay.

Figure 15: GVA growth indicies (1997 = 100)

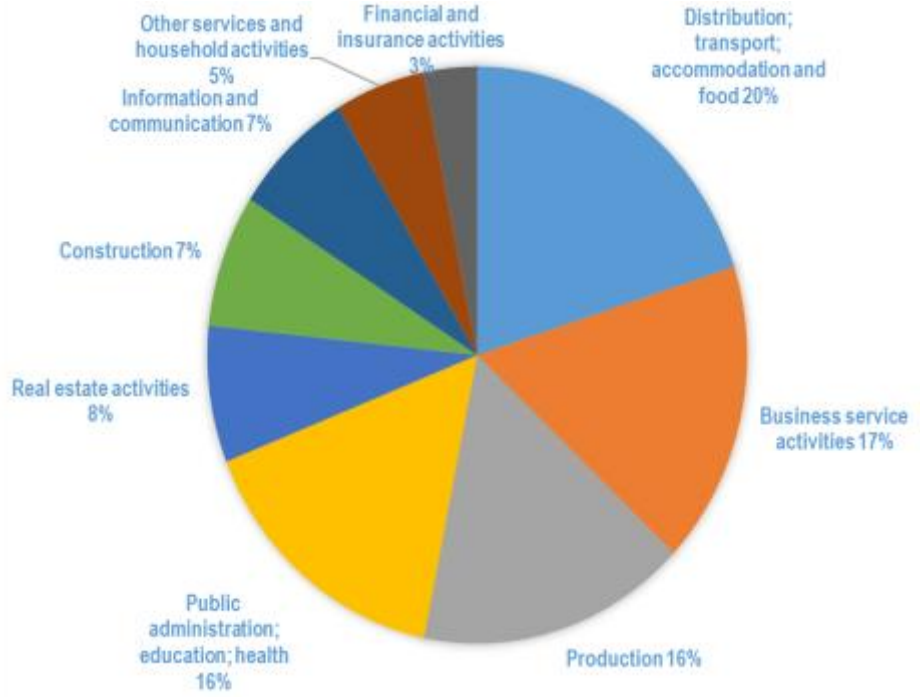


Source: ONS Annual Regional Accounts, 2013

The breakdown of the sectors which make up the total GVA for Warrington is shown in Figure 16. Key points to note are that:

- Warrington generated the largest proportion of its economy from distribution, transport, accommodation and food (20 %). This is the second largest sector for England as a whole in terms of GVA, marginally behind public administration education and health, at 18 %.
- Public administration education and health in Warrington accounted for 16 % of the economy compared to nearly 19 % in England.
- The Warrington economy is slightly more polarised in its activities than England – the largest four sectors in Warrington accounted for 69 % of GVA whilst across England the figure is 62 %.
- It follows that the remaining 5 sectors generate a relatively low level of GVA. Warrington has a notably small financial and insurance sector. This generated just 3% of the local economy compared to 8 % across England.
-

Figure 16: Breakdown of Warrington GVA by broad sector 2013

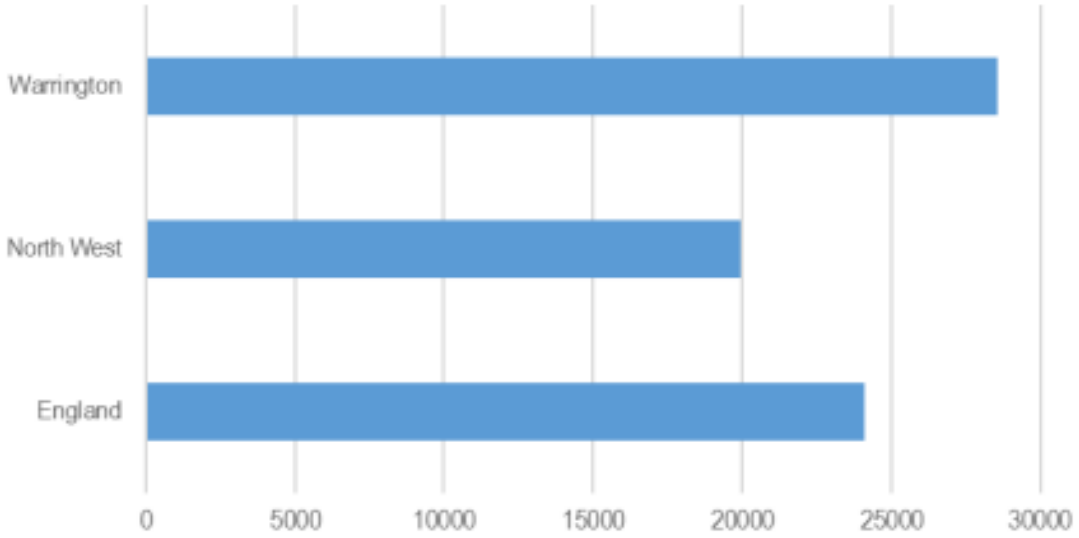


Source: ONS Annual Regional Accounts, 2013

3.8.2 GVA per head

When GVA generated is examined on a per worker basis, some measure of productivity can be estimated. In Figure 17, the figures are compared for 2013 and demonstrate that Warrington generates more economic output per worker than the regional or the national averages. Therefore, it provides some indication that productivity levels are considerably high in Warrington.

Figure 17: GVA per head 2013



Source: ONS Annual Regional Accounts, 2013

3.8.3 GVA per filled job

GVA per filled job data sets out the total GVA of Warrington and its comparator areas, divided by the number of jobs that are currently taken in the area. This data shows:

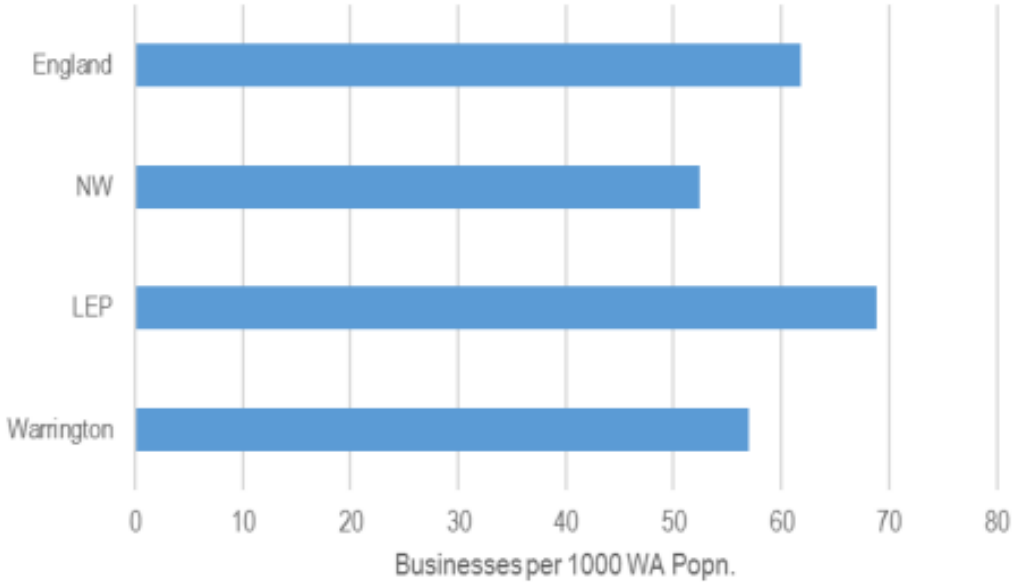
- Warrington has £49,695 of GVA per filled job;
- This is higher than the North West average of £45,519; but lower than the England figure of £51,803; and
- Within the Cheshire and Warrington LEP area, Warrington has the lowest GVA per filled job of all three unitary authorities:
  - Cheshire East: £59,471
  - Cheshire West and Chester: £51,127
  - Cheshire and Warrington: £54,093.

This suggests the need for Warrington to grow its GVA per filled job by further encouraging the growth of higher value businesses in the town.

3.8.4 Business Base

In 2015 there were approximately 7,340 businesses operating in Warrington equating to a business density of 57 per 1,000 working age residents. Whilst out-performing the North West average, this lags the national average of 62 businesses per 1,000 working age residents and the LEP average of 69 (see Figure 18).

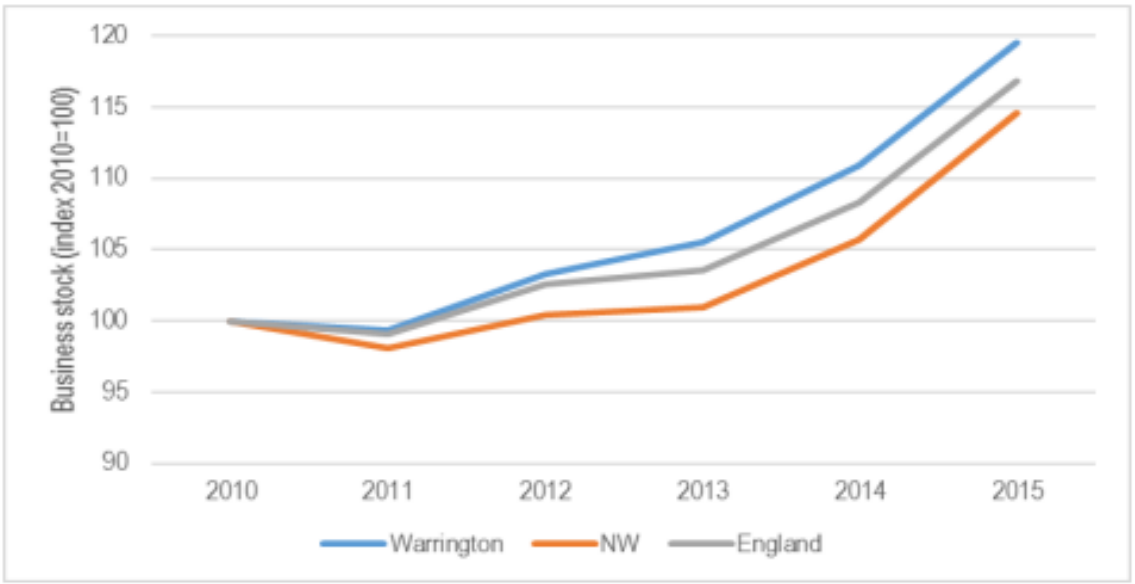
Figure 18: Businesses per 1,000 people – working age population 2015



Source: ONS Annual Regional Accounts, 2013

The overall local stock of businesses has been increasing over time and in Warrington the recorded growth was 20 % over the last five years **(**Figure 19). This growth in the number of businesses has outperformed the England rate of 17 % growth over the same period.

Figure 19: Growth in business stock (index)



Source: UK business count, 2013

88.8 % of businesses in England employ less than ten people (micro businesses), and overall 98.0 % of all businesses are classified as small (up to 49 employees). Warrington, generally follows this broader trend. As Table 8 shows, 97.6 % of businesses in Warrington employ less than 50 employees, while the proportion employing less than ten is 87.7 %. 40 local businesses are identified as having more than 100 employees.

Table 8: Business by size band 2015

Employees	Warrington		North West	England
	Count	Percent	Percent	Percent
Micro (1-10)	6,440	87.7	87.8	88.8
Small (11-49)	725	9.9	10.1	9.2
Medium (50-99)	135	1.8	1.7	1.6
Large (100+)	40	0.5	0.4	0.4
Total	**7,340**			

Source: UK business count, 2015

3.8.5 Key findings of productivity implications

A summary of the key findings for productivity implications for Warrington are:

- Productivity can be viewed positively within Warrington and the economy has performed strongly when a 15-year perspective is taken and GVA performance have outstripped the national average.
- The Warrington economy also generates more GVA per head than the average for England
- Warrington generates more economic output per worker than the regional or the national averages.
- Warrington generated the largest proportion of its economy from distribution, transport, accommodation and food (20%).
- Warrington has £49,695 of GVA per filled job. This is higher than the North West average of £45,519, but lower than the England figure of £51,803. This suggests the need for Warrington to grow its GVA per filled job by further encouraging the growth of higher value businesses in the town.
- Warrington records lower levels total stock of businesses per 1,000 working age people than across England as a whole – but in the last five years the number of new businesses in Warrington has grown faster than the national average.

What does this mean for LTP4?

Warrington has displayed a strong economic performance in recent years and is recognised as a great place to work. However, increasing strain on the highways network could cause productivity levels to decrease.

Productivity levels are highly influenced by the quality of the commute and how easily workforce can access employment. LTP4 should consider schemes that can help improve journey time reliability, relieve existing pinch points and reduce congestion. It may also be important for the strategy to develop new strategic connections which can unlock new land for employment opportunities, particularly for high value business premises.

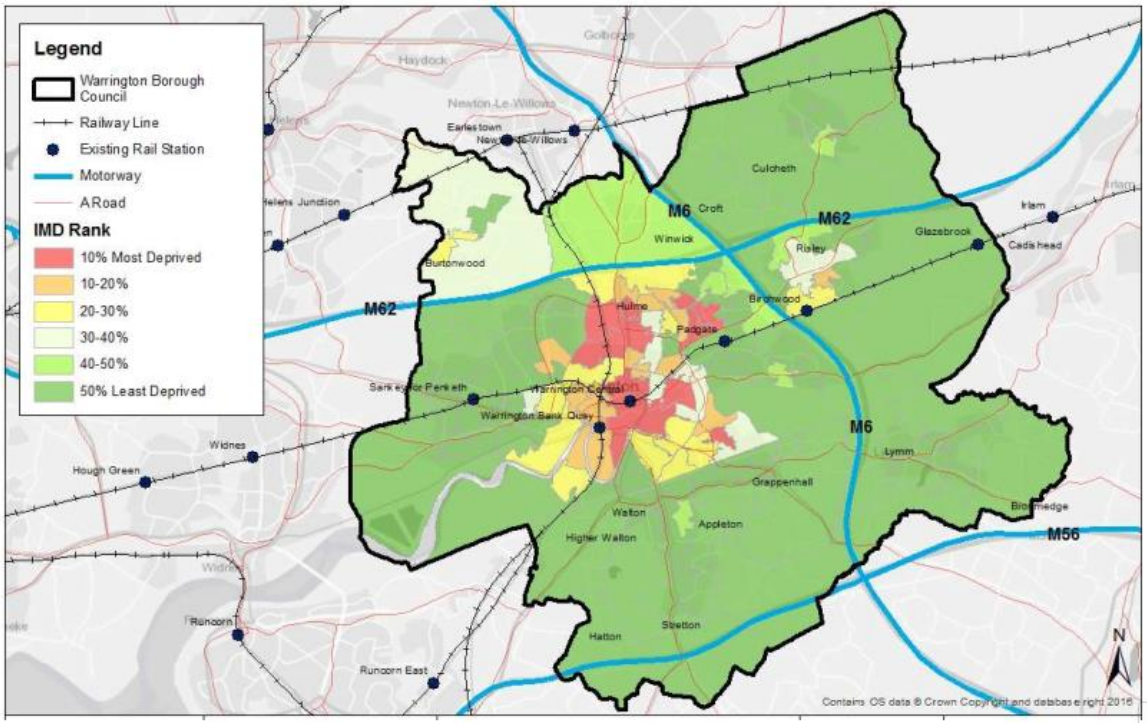
3.9 Level of deprivation

The Index of Multiple Deprivation (IMD) considers several domains of deprivation to determine a level of deprivation for Lower-layer Super Outputs Areas (LSOAs) across England.

At local authority level, Warrington is ranked 147th out of 326 local authorities using an average LSOA score.

Figure 20 highlights parts of Warrington are amongst some of the most deprived nationally with parts of the town centre, Orford and Padgate within the most deprived 10%. These areas correlate with those areas identified later in Section 4.7 with high proportions of households without access to a car / van. A pocket of deprivation is also evident at Birchwood though this is not to the extent of the other areas identified.

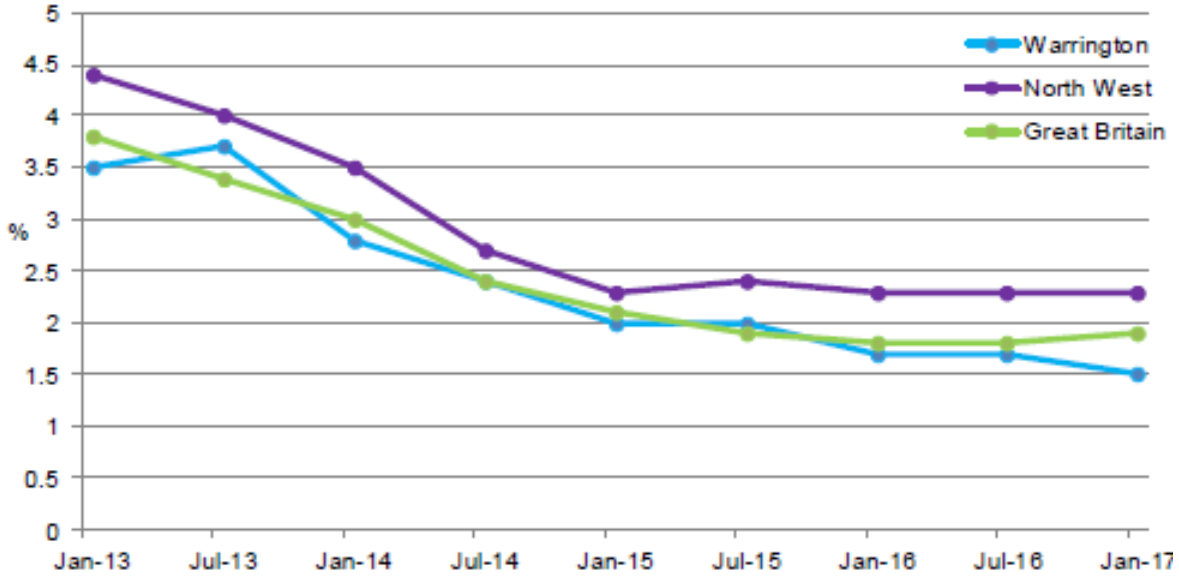
Figure 20: Index of Multiple Deprivation



Source: Department Communities and Local Government (2015)

The percentage of claimants as a proportion of residents aged 16-64 is shown in Figure 2.8. In January 2017, this figure was 1.5% for Warrington which was lower than the North West and Great Britain figures (2.3% and 1.9% respectively). The results show a falling trend between January 2013 and January 2015. Since then, the national proportion has been reasonably consistent whereas in Warrington, the proportion continued to decrease, though less steeply compared with the period between January 2013 and January 2015.

Figure 21: Claimant count (aged 16-64)



Source: NOMIS

3.9.1 Key findings of deprivation levels

The key findings of deprivation levels in Warrington are:

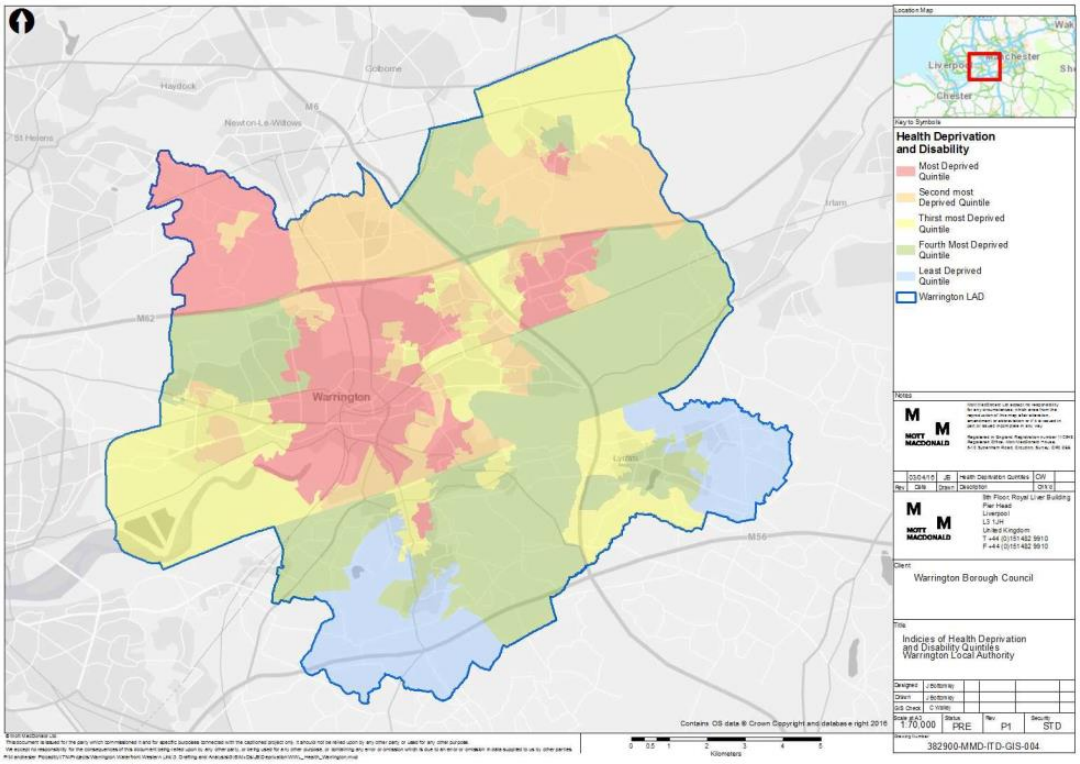
- Warrington ranked 147th out of 326 local authorities with regards to the IMD.
- Parts of the Borough are within the 10% most deprived nationally, particularly the town centre, Orford and Padgate.
- Proportion of claimant counts (aged 16-64) has fallen in Warrington between 2013 and 2017.

What does this mean for LTP4?
LTP4 should implement schemes that can provide quick, accessible and affordable transportation from the most deprived areas of Warrington to the Borough's key employment and service destinations.

3.10 Health

Health deprivation and disability indices were mapped for Warrington (Figure 22). Comparable to other deprivation assessments, the areas with most poor health are located in central Warrington, north Warrington and residential areas near to the A49, and the A57 as well as south-west Warrington near the A56, north-west near Burtonwood, and the north-east near Birchwood and Culcheth.

Figure 22: Index of Multiple Deprivation

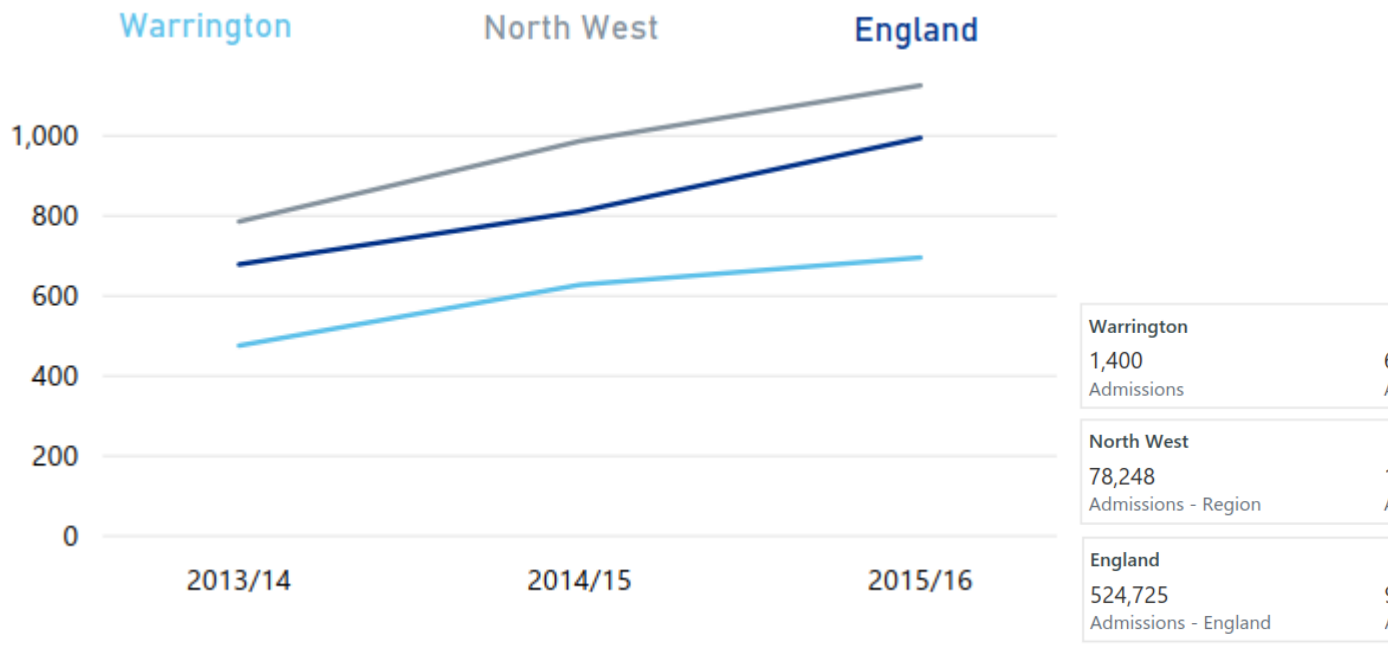


Source: Department Communities and Local Government (2015)

The health of Warrington's population was further explored by looking at admissions where obesity was a factor in Warrington using hospital episode statistics from the NHS. The results are set out below in Figure 23.

The analysis shows that Warrington has 696 admissions per 100,000 and this is less than the North West (1,126) and England average (995). Warrington has seen a lower admissions between 2013 -2016; however, similar to the rest of the country, the number of admissions are increasing.

Figure 23: Admissions where obesity was a factor



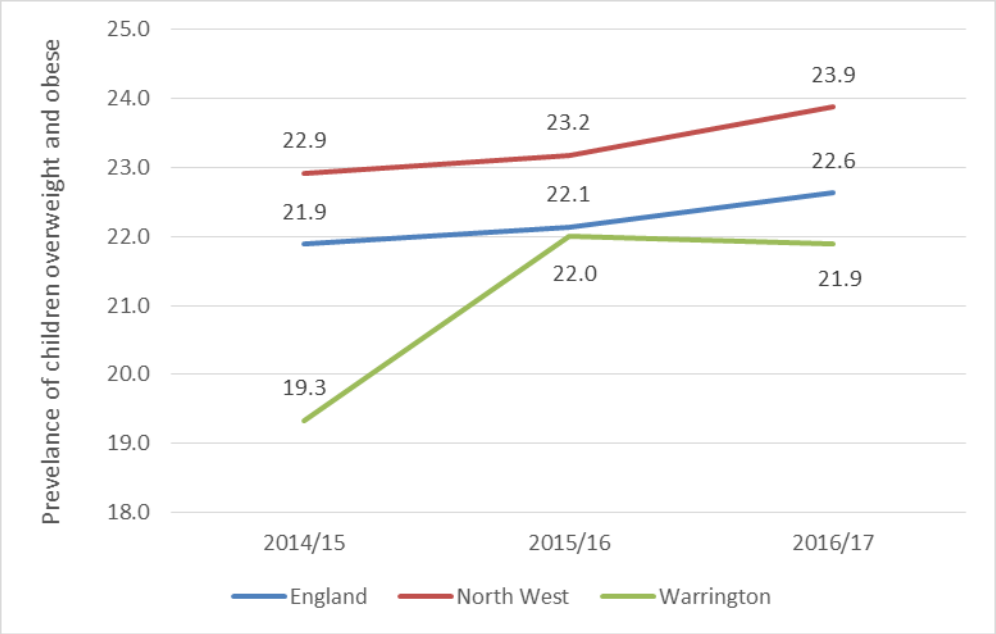
Source: Hospital Episode Statistics (HES), NHS Digital.

Data was obtained from the national child measurement programme; it measures the height and weight of children in reception class (aged 4 to 5) and year 6 (aged 10 to 11), to assess overweight and obesity levels in children within primary schools.

The prevalence of children who were overweight and obese in Warrington, North West and England average are shown for reception in Figure 23 and in Year 6 in Figure 24 .

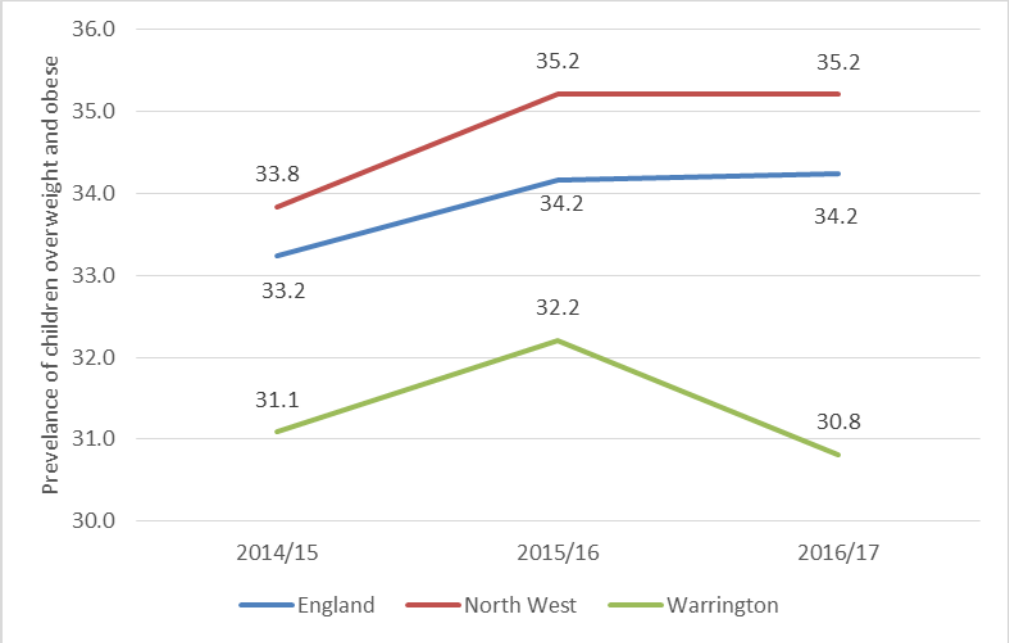
The prevalence of obese and overweight children in reception and year 6 is growing across the country. Warrington is observed to have a lower prevalence of children obese and overweight than the North West and England average. There has been a very small decrease in recent years. Furthermore, there is greater prevalence of overweight and obese children in Year 6 than reception, suggesting the risk of obesity and overweight to increase with age for children.

Figure 24: Prevalence of children overweight and obese in reception children



Source: NHS National child measurement programme

Figure 25: Prevalence of children overweight and obese in Year 6 children



Source: NHS National child measurement programme

3.10.1 Key findings of health

The key findings of the health analysis in Warrington are:

- The areas with the greatest health deprivation are located in central and northern Warrington, such as near the town centre, Orford and Padgate.

- In Warrington, admissions at health clinics where obesity was a factor is increasing. This is a trend being experienced in the North West and England at a larger rate than in Warrington.
- In Warrington in 2016/17, the prevalence of children overweight and obese in reception was 21.9% and Year 6 30.8%). This is below the North West and national average.
- The prevalence of obese and overweight children in reception and year 6 is growing in Warrington and across the country.
- There is greater prevalence of overweight and obese children in Year 6 compared with reception, suggesting the risk of obesity and overweight to increase with age.

What does this mean for LTP4?
LTP4 should seek to increase levels of active travel in Warrington to help encourage healthier lifestyles across the Borough. There may be merit in targeting active travel at an early age to help embed walking and cycling as part of the daily routine.

3.11 Leisure

Warrington has a strong cultural and leisure offer. The key leisure activities and tourist attractions in Warrington are found below:

- LA Bowl – bowling situated on Winwick Quay
- Odeon cinema complex located at the Westbrook centre
- Gulliver's World theme park
- Pyramid & ParrHall theatre arts centre
- Speedkarting Warrington is the largest indoor go karting circuit in the UK
- Warrington Museum and Art Gallery
- Walton Hall and Gardens
- Jellybeans Play Centre
- Grappenhall Heys Walled Garden
- The Museum of Policing in Cheshire
- Warrington Wolves Halliwell Jones Stadium
- Bluebell Cottage Gardens
- Sankey Valley Park
- Woolston Park

4 Transport and Travel

4.1 Transport and travel key findings and implications

Car dominance

- Warrington has above average car ownership. The car is the travel mode of choice and dominates highways transportation.
- The volume of cars attempting to use the supply of network is too great during peak periods and often results in severe congestion problems.

Poor journey times and congestion

- Warrington suffers from serious congestion. Slow journey times exist on the approach and within the town centre and within proximity to motorway access points.
- Travel during peak periods has become a burden for Warrington residents and workers.
- Continuing congestion could reduce productivity and stifle Warrington's growth plans
- Although Warrington holds good transport connectivity with the wider region through its links with the SRN and the rail network, the poor performance of the Borough's local highways network is impeding accessibility to these gateways.

Travel to work patterns

- There is high dependency on the car for commuting and this proportion has increased.
- Despite being served by public transport modes, the commute to the town centre is dominated by the private car. This suggests the offer and quality of public transport services and active travel modes are less convenient.
- Rail use is increasing - maintaining good rail accessibility is important for existing travel to work patterns and helping to grow rail commuting within Warrington.
- Cycling as a commuter mode is more popular in the town's inner areas.

Public transport use

- The number of rail users is growing, with a 37% increase observed in the last 7 years.
- Bus patronage has declined and satisfaction levels are below the national standard. Town centre congestion and lack of cross town routes reduce the quality of the service.
- Warrington requires a step change in the quality of its public transport services, and possibly the introduction of a mass transit system to help encourage a modal shift away from the car, reduce congestion and accommodate housing and job growth.

Active travel

- Cycle count data shows cycling to be increasing in Warrington.
- The dominance of the car and hostility of roads hinder levels of active travel. Improving the pedestrian environment across the Borough could help raise levels of walking

Freight

- The number of freight vehicles on Warrington's roads is increasing and adds to the town's congestion and air quality issues. A freight strategy is required to coordinate freight movements and to help the important industry grow in a sustainable way.

4.2 Transport and travel

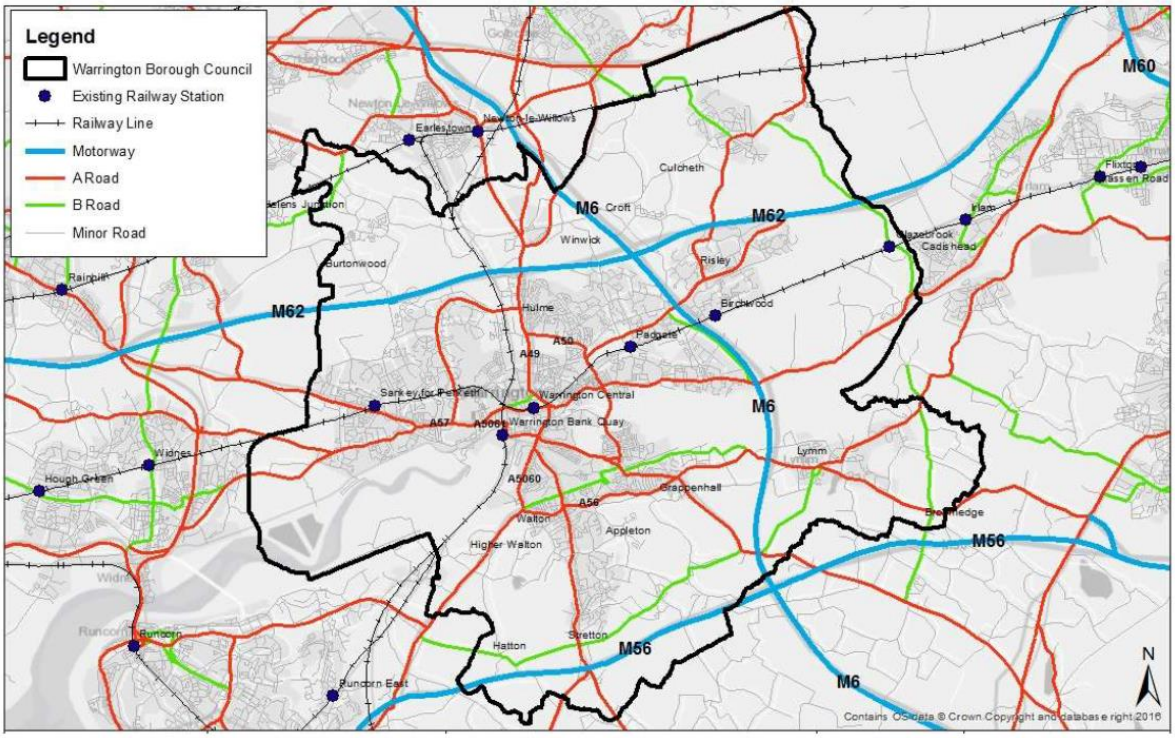
The purpose of this section is to review the past and existing transport and travel patterns within Warrington Borough. The section examines data sources from Office for National Statistics, NOMIS, DfT travel statistics and local travel surveys.

4.3 Warrington transport network

Warrington's existing transport network is shown in Figure 26. This shows motorways, A roads and B roads in Warrington, as well as rail lines and stations. Three motorways run through the Borough.

The M6 provides a connection from Birmingham in the south to Carlisle in the north, whilst the M62 is an east-west link between Manchester and Liverpool. The M56 also runs east-west, but is through the south of the Borough and provides a connection between South Manchester and Chester.

Figure 26: Warrington transport network



Source: Warrington transport summary: Part II

The A roads that run through the Borough are:

- The A49 which runs north-south from the M62 to M56;
- The A57 which provides a connection to the west of Warrington Town Centre through Great Sankey and joins the M62 at Junction 7;
- The A5061 connects with the A49 at the River Mersey and joins the A50 after travelling through Latchford;
- The A50 which links the A49 in Orford with the M6 at Junction 20;

- The A5060 is between Lower Walton and Brian Bevan Roundabout, providing a connection to Warrington Town Centre from the A56; and
- The A56 which runs east-west through the south of the Borough, parallel to the Manchester Ship Canal.

Warrington has an extensive highways network. However, there is a gap in the town's inner arterial network, west of the town centre. There is limited highways infrastructure that facilitates crossing between south-west and north-west Warrington over the Manchester Ship Canal and the River Mersey. As a result, this causes substantial amounts of traffic to pass through the town centre when travelling north-south across west Warrington.

4.3.1 Key findings of Warrington's transport network

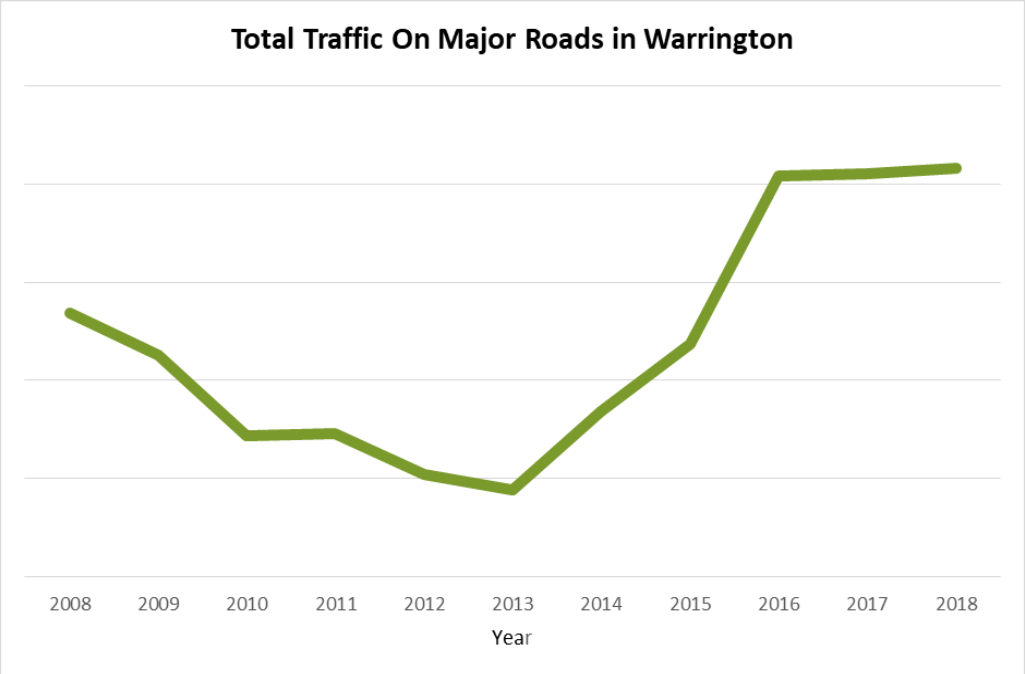
The key findings of Warrington's transport network are:

- Warrington is strategically located and has convenient access to the motorway network.
- Warrington has good access to rail services; the CLC line provides good east-west connections to Manchester and Liverpool. The West Coast Mainline provides extensive north-south connections to key English and Scottish cities.
- There is a gap in the town's inner arterial highways network in west Warrington.

4.4 Travel patterns and trip behaviour

The total traffic on major roads, in thousand vehicle miles, is presented in Figure 27 for Warrington. The 'major roads' includes motorways and all class 'A' roads and there are 72 markers around the Borough.

Figure 27: Total traffic on major roads, in thousand vehicle miles (2000-2016)



Source: DfT (https://roadtraffic.dft.gov.uk/local-authorities/74)

The car dominates traffic on major roads. Between 2000 and 2016, car traffic has fluctuated over time but overall it has increased by approximately 15%. Moreover, the total car traffic on major roads reached its greatest levels in 2016 at 1,020,208 thousand vehicle miles.

For goods vehicles, Figure 27 shows a 62% increase from 2000 to 2016 for LGVs, whilst the number of HGVs has remained reasonably consistent over the time period.

The information presented in Figure 27 was expressed as a proportion of different travel modes and can be found in Table 9. The results show:

- Three quarters (75.4%) of vehicle miles were made by car in 2016 and this proportion has fallen slightly from 77.1% in 2009.
- 10.3% of vehicle miles were by LGV in 2000 and this has risen to 14.1% in 2016.
- The proportion of pedal cycles and motorcycles has been consistent over the time period.

Table 9: Total traffic on major roads, in thousand vehicle miles (2000-2015) – modal split proportions

Mode	Year																
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Pedal Cycles	0.1%	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%
Motorcycles	0.5%	0.5%	0.5%	0.6%	0.5%	0.4%	0.4%	0.4%	0.5%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%
Cars	76.8%	77.0%	77.4%	77.1%	77.4%	76.7%	76.4%	75.7%	76.1%	77.2%	77.0%	76.6%	76.1%	76.1%	75.8%	75.2%	75.4%
Buses & Coaches	0.7%	0.6%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.4%	0.4%	0.4%	0.4%	0.4%	0.3%
LGVs	10.3%	10.5%	10.2%	10.6%	10.5%	11.1%	11.7%	11.8%	11.5%	11.1%	11.0%	12.6%	13.2%	13.5%	13.7%	14.1%	14.1%
HGVs	11.7%	11.4%	11.4%	11.2%	11.2%	11.3%	11.0%	11.6%	11.4%	10.8%	11.1%	10.0%	9.9%	9.7%	9.7%	9.9%	9.8%

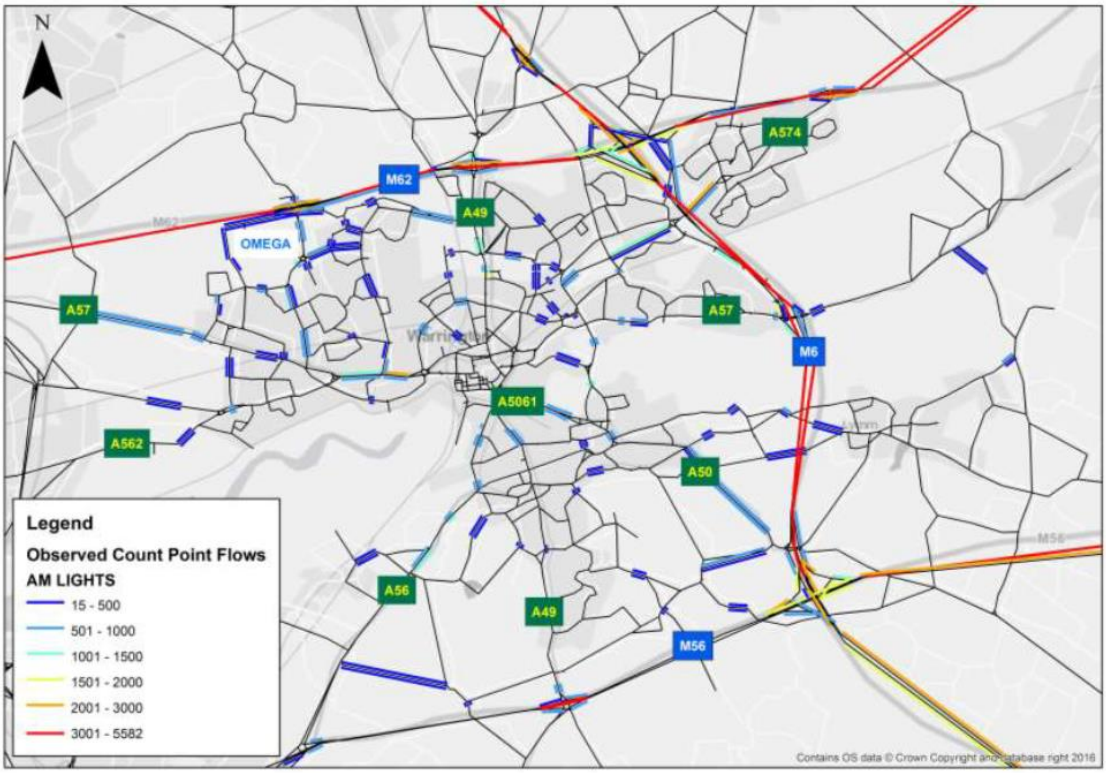
Source: DfT (www.dft.gov.uk/traffic-counts/area.php?region=North+West&la=Warrington)

4.4.1 Traffic flow

Data collection in 2016 for the upgrade of the Warrington Multi-Modal Model was analysed to understand flows on the highway network. Figure 28 to Figure 30 present these results and the key findings were:

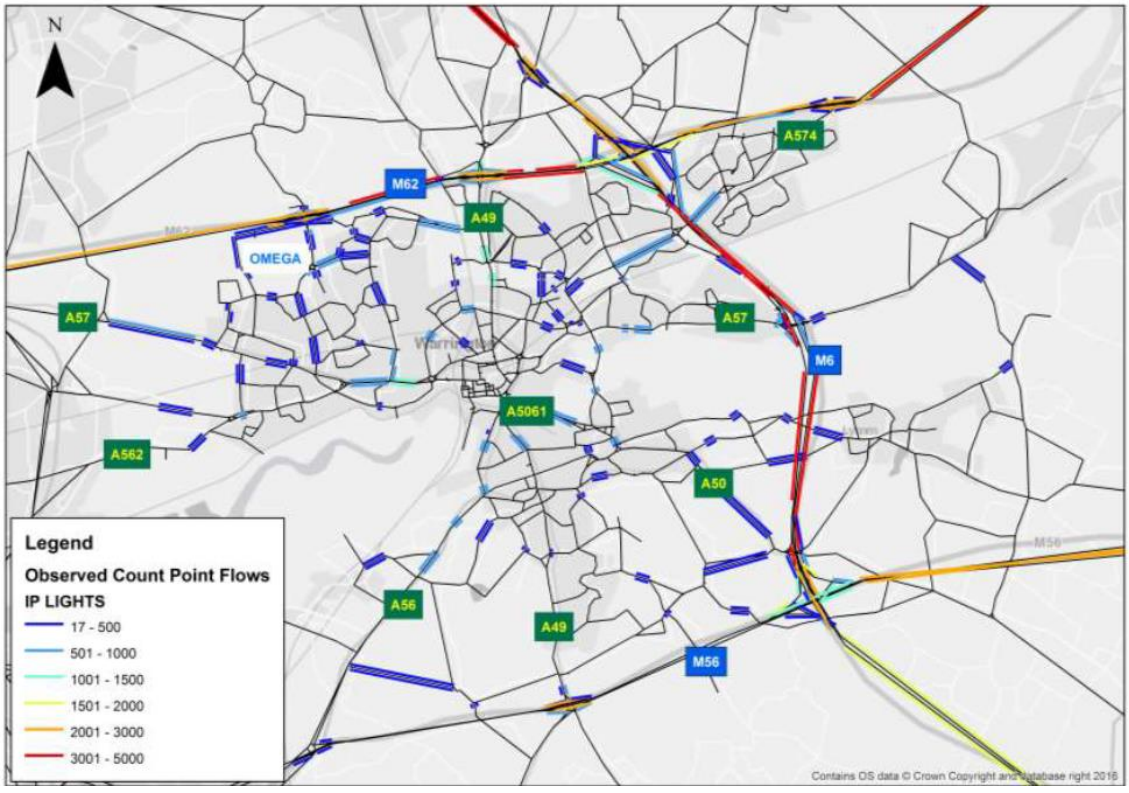
- Flows was generally greater along the M6 with consistently high flows during the AM peak, inter-peak and PM peak compared with all other roads in the study area.
- There were also high flows along the M62, but these were less prominent during the inter-peak compared with those flows along the M6.
- Although the M6 experienced high flows during the AM peak, inter-peak and PM peak; the exception to this is south of Junction 20 on the M6 where flows were lower compared with north of this junction.
- South of Warrington Town Centre, flows were generally consistent across the AM peak, inter-peak and PM peak; except for the approach to / from the M6 Junction 20 where flows were slightly higher.
- Higher flows are observed to the north west of Warrington Town Centre around Westbrook and along Birchwood Way to the north east compared with A roads in the south of the Borough.

Figure 28: Flows AM Peak (07:45-09:15)



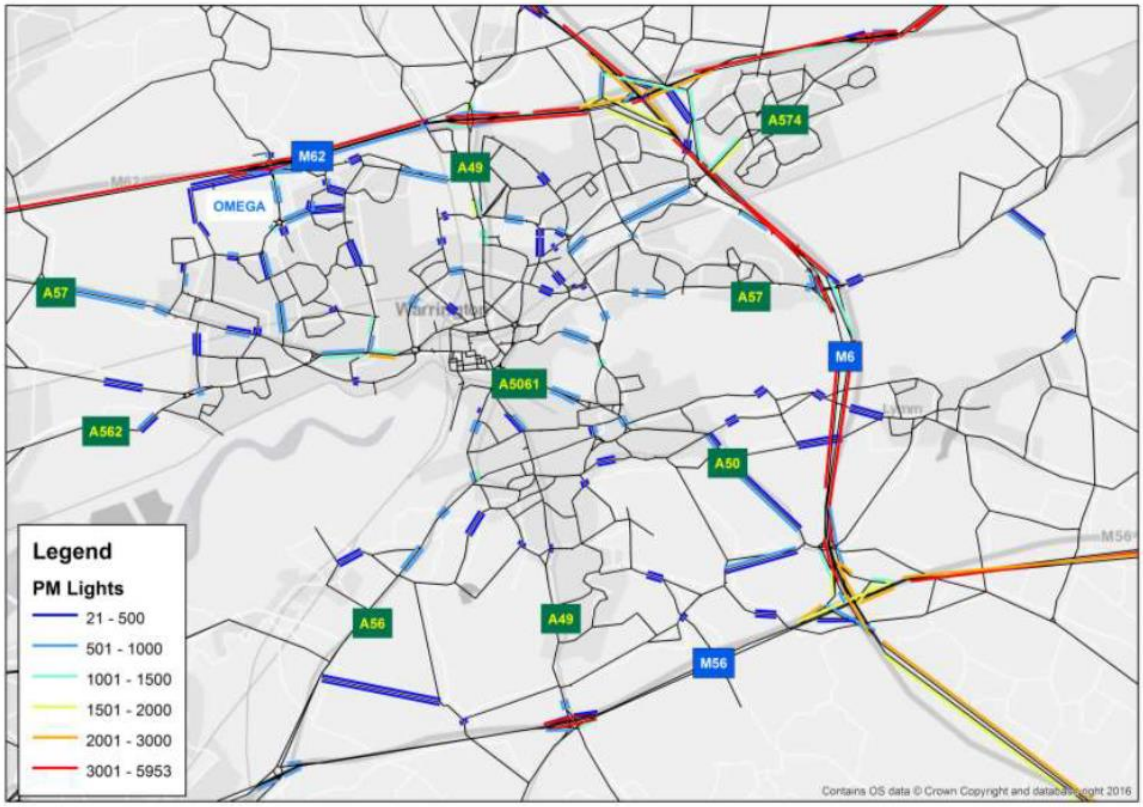
Source: 2016 data collection for Warrington Multi-Modal Model

Figure 29: Flows Inter-Peak (10:00-16:00)



Source: 2016 data collection for Warrington Multi-Modal Model

Figure 30: Flows PM Peak (16:30-18:00)



Source: 2016 data collection for Warrington Multi-Modal Model

4.4.2 Key findings of travel patterns and trip behaviour

The key findings of travel patterns in Warrington are summarised below:

- Car travel dominates the highways work and accounted for three quarters (75.1%) of vehicle miles in 2015.
- LGV traffic is increasing; 10.3% of vehicle miles were made by LGVs in 2000 and this has risen to 14.0% in 2015
- Traffic flow is greatest along the M6, with consistently higher flows during the AM peak, inter-peak and PM peak compared with all other roads in the study area.
- South of Warrington Town Centre, flows are generally consistent across the AM peak, inter-peak and PM peak; except for the approach to / from the M6 Junction 20 where flows were slightly higher.
- There are higher traffic flows to the north west of Warrington Town Centre around Westbrook, and north-east along Birchwood Way compared with A roads in the south of the Borough.
- Some of the highest high traffic flows occur in the location of some of Warrington's most deprived areas.

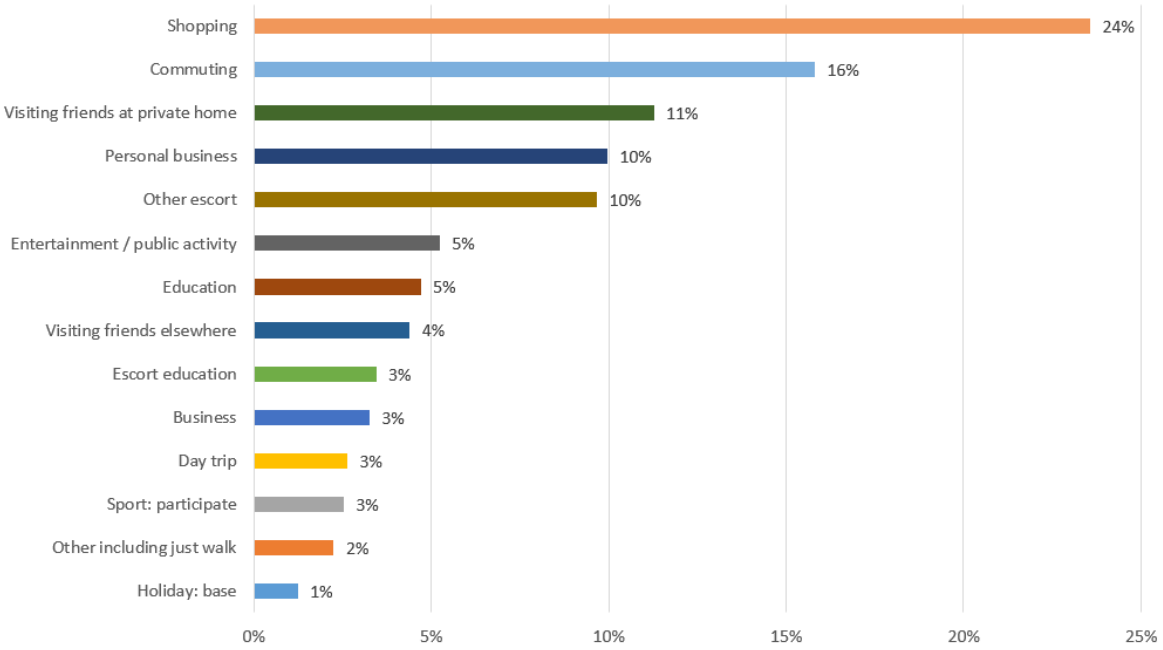
What does this mean for LTP4?
Warrington is strategically located to the motorway network. The SRN acts as a key gateway to the rest of the UK. LTP4 should ensure this gateway can continued to be accessed by residents, workers and business movements.
The private car is the favoured travel mode within Warrington. At times, the demand of cars attempting to use the existing supply of network is too great. This results in periodic and severe congestion problems in the town. Continued use and growth of the car runs the risk of choking economic growth in the town and making Warrington an unpleasant place to live, work and visit.

LTP4 should look to implement schemes that can help manage private car travel movements and reduce congestion at peak times. The strategy needs to effectively discourage car travel, without severely limiting access to services and employment.

4.5 Journey purpose

Journey purpose for trips within Warrington were obtained from the National Travel Survey for years 2007 to 2012. The types of journey undertaken by residents who took part in the survey has been expressed as a percentage of the overall trips (Figure 31). It can be seen that shopping is the most popular type of journey undertaken in Warrington (24%) followed by commuting (18%) and visiting friends at private home (11%).

Figure 31 Journey purpose of trips made by Warrington residents 2007-2012

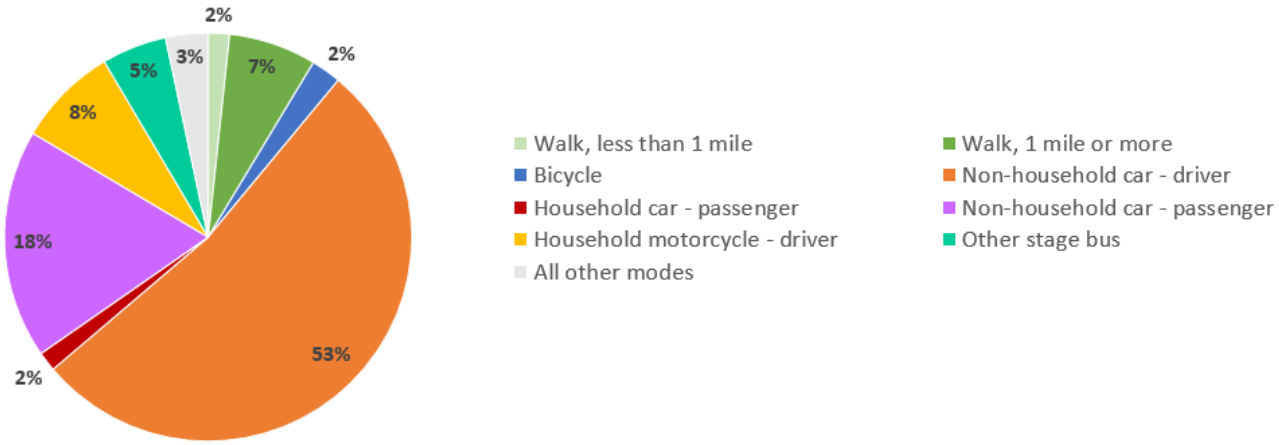


Source: National travel survey for Warrington journeys 2007-2012

The type of mode used to undertake all these journeys can also be seen in Figure 32. It shows that trips are dominated by use of the car, either as a driver or passenger, and account for 80% of journeys.

Active travel used to undertake journeys was fairly low with walking accounting for a total of 9% of journeys and use of a bicycle accounting for 2% of journeys.

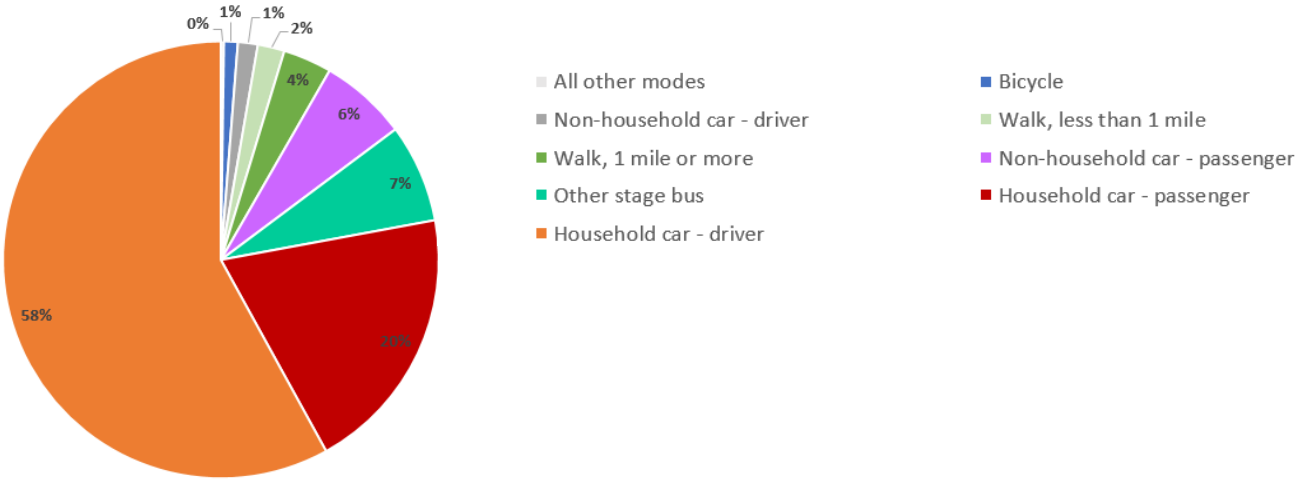
Figure 32 Type of mode used for all trips made by Warrington residents 2007-2012



Source: National travel survey for Warrington journeys 2007-2012

Trip behaviour was also explored for the most popular type of journey – Shopping trips (Figure 33). Again use of the car dominates trips and accounts for 85% of journeys. Subsequently, use of public transport and active travel modes remains low with bus accounting for 7% and walking accounting for 6% and use of a bicycle 1% respectively.

Figure 33 Type of mode used for shopping trips made by Warrington residents 2007-2012



Source: National travel survey for Warrington journeys 2007-2012

4.5.1 Key findings of journey purpose

The key findings of journey purpose of trips made by Warrington residents are:

- Shopping is the most popular type of journey undertaken in Warrington (24%) followed by commuting (18%) and visiting friends at private home (11%).
- Trips are dominated by use of the car, either as a driver or passenger, and account for 80% of journeys.
- Active travel used to undertake all types of journeys was fairly low with walking accounting for a total of 9% of journeys and use of a bicycle accounting for 2% of journeys.
- Use of the car dominates shopping trips and accounts for 85% of journeys. Subsequently, use of public transport and active travel modes remains low with bus accounting for 7% and walking accounting for 6% and use of a bicycle 1% respectively.

What does this mean for LTP4?
A large number of trips are undertaken using the highways network. LTP4 should continue to raise network performance by relieving existing network pinch points and introducing highways schemes that can help improve journey reliability.

A large number of shopping trips are undertaken in Warrington. LTP4 should help improve journey times to key shopping areas across the Borough such as Golden Square Birchwood Shopping Centre, with particular emphasis on improving accessibility to the centre to help encourage the use of the town's main shopping facilities.

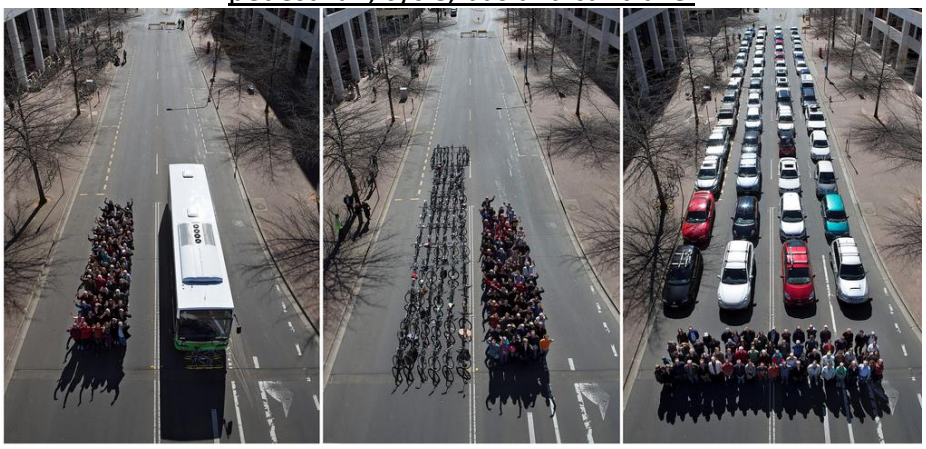
4.6 Transport efficiency

It is useful to consider the efficiency of different transport modes.
Figure *34* shows the road space that 60 people require when traveling by bus, bicycle and car. The findings show that substantial amount of highway is required to accommodate the car. Conversely, bus and cycles use significantly less road space to accommodate 60 people.

It can be inferred from cars demanding use of highways space that the more cars that use the network, the quicker the capacity of the highways is filled up. Therefore, increasing car travel will more likely result in congestion as more drivers have to compete for limited road space.

Whereas the use of buses, cycles and walking offer a more efficient use of road space. Therefore, greater increases in the proportion of people travelling by these modes pose less risk of congestion when compared with the car.

Figure 34 Use of available highways capacity for the transportation of 60 people for pedestrian, cycle, bus and car travel

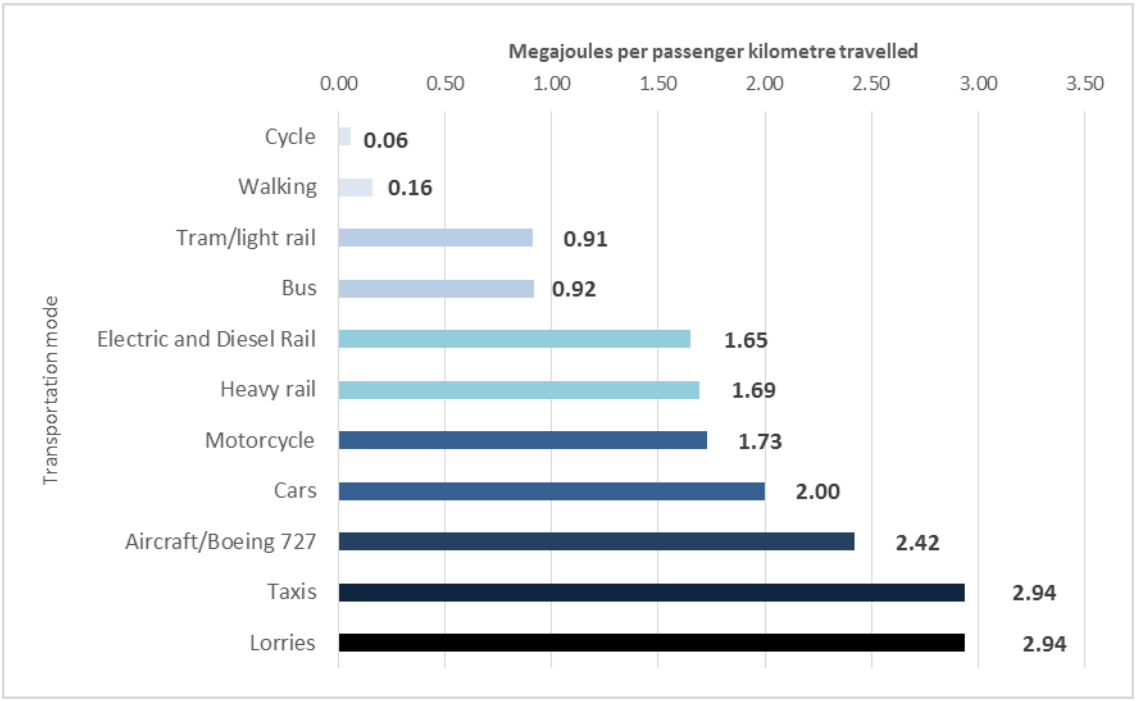


Source: Warrignton Borough Council

The University College London also produced a hierarchy of sustainable modes (Figure 35). This research saw different transport modes ranked according to their energy consumption, maintenance per transport kilometre and per passenger loading.

The analysis demonstrates that active travel modes and public transportation require less energy to transport a greater number of people than the private car. Therefore, these modes offer far greater transport energy efficiency and offer a much more sustainable and environmentally friendly way of travelling compared with the car.

Figure 35 Transport energy efficiency for 11 different modes of transport



Source: Adapted from Banister, D (2009) Sustainable Transport and Public Policy.

4.7 Car Ownership

2011 census data was obtained to acquire an understanding of car ownership in Warrington. For Warrington Borough, household car ownership is displayed in Table 10 81% of Warrington households had access to at least one car / van with 39% having access to two or more cars/ vans.

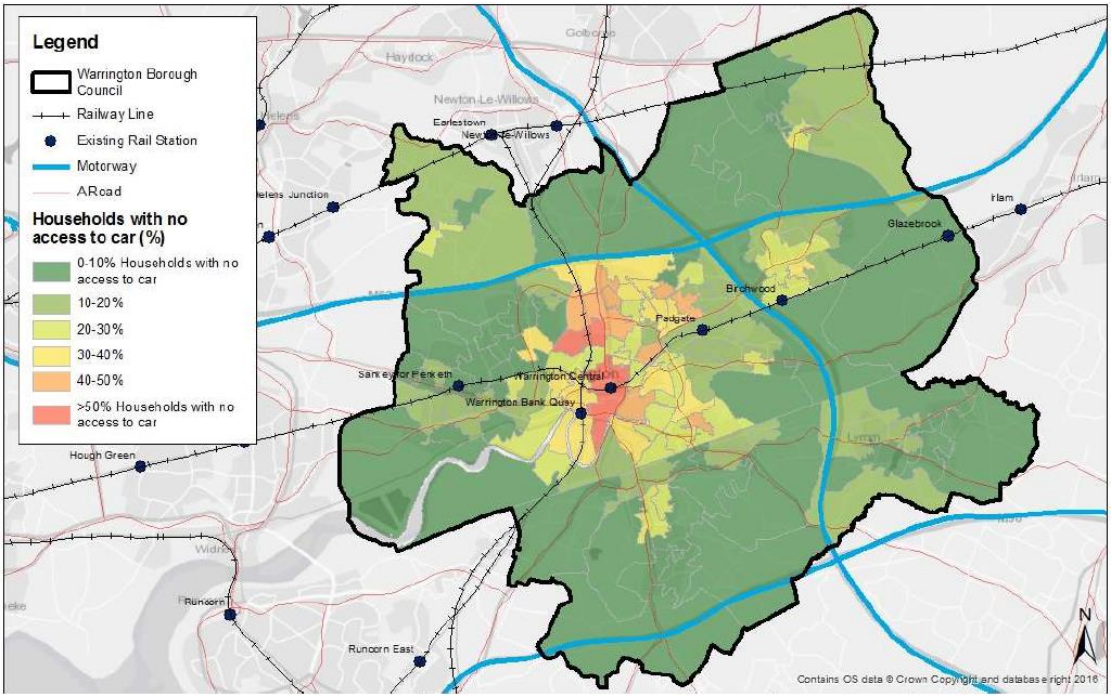
Table 10: Household car ownership in Warrington (2011)

No. of cars or vans in household	Warrington (%)	Cheshire and Warrington LEP (%)	England (%)
None	19	18	26
One	42	41	42
Two	31	32	25
Three	6	7	5
Four or more	2	2	2

Source: Census 2011

Nationally, just over a quarter (26%) of households had no access to a car / van. Warrington sees fewer residents with no access to a car than the national average. Figure 36 maps the proportion of households without access to car and demonstrates high proportions with access to a car / van across the Borough.

Figure 36: Access to a car in Warrington (2011)



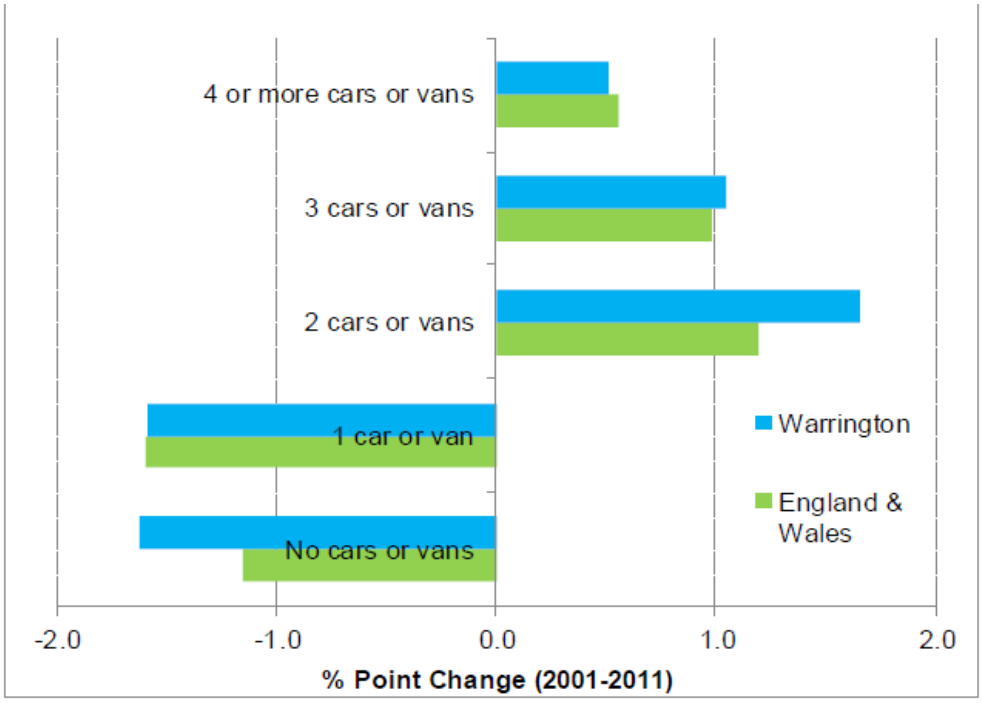
Source: Census 2011

It can be seen from Figure 36 that the highest proportion of households without a car was in central parts of Warrington. To some extent, this reflects the socioeconomic profile of these residents; for example, Figure 8 indicated lower proportions of residents employed as managers, directors or senior officials. It may also reflect the proximity to the town centre and the public / active transport network available.

A comparison of percentage change in car ownership between 2001 and 2011 for Warrington and nationally across England and Wales was undertaken and is show in Figure 37. A summary of the findings can be found below:

- There are decreases in the proportion noting they have no or one car / van in their household nationally and also within Warrington. However, there has been a greater decrease in the proportion without a car / van in Warrington compared with the national change.
- Across Warrington and nationally, there has been an increase in the proportion of households with two or more cars.
- The proportions with three or more cars / vans were consistent between Warrington and the national figure.

Figure 37: Modal share comparison for Warrington, neighbouring cities and New Towns



Census 2011 – travel to work

4.7.1 Key findings of car ownership

A summary of the key findings of car ownership in Warrington is given below:

- Above average levels of car ownership are displayed in Warrington compared with the national average.
- Areas of central Warrington had the highest proportion of households without access to a car / van; perhaps owing to the proximity to Warrington Interchange and the availability of public transport.

What does this mean for LTP4?

For many Warrington residents, car travel is likely to be the norm for travelling in and out of the Borough. The large dependency on the car drives the towns travel problems with many residents and workers competing for road space during peak periods across the borough. This was highlighted in the previous sub-section 4.6, where congestion and journey reliability were identified as a serious travel problem within Warrington.

LTP4 should look to implement schemes that encourage a modal shift away from the private car towards more sustainable travel modes. This would help enable more efficient travel around the Borough and offer cleaner and less polluting ways of travelling. The transport strategy will need to improve the competitiveness and quality of public transport and active travel modes to help encourage this modal shift.

4.8 Journey times and congestion

Figure 38 to Figure 40 present the average speeds during the AM peak, inter-peak and PM peak using Trafficmaster data for June 2015. The results present the weekday average speeds for all vehicles and all road types in the Borough.

To mitigate against any potential biases in the calculations, data was extracted for roads with a minimum of ten observations recorded and 'extreme' fast and slow journey time outliers observed on the network were removed.

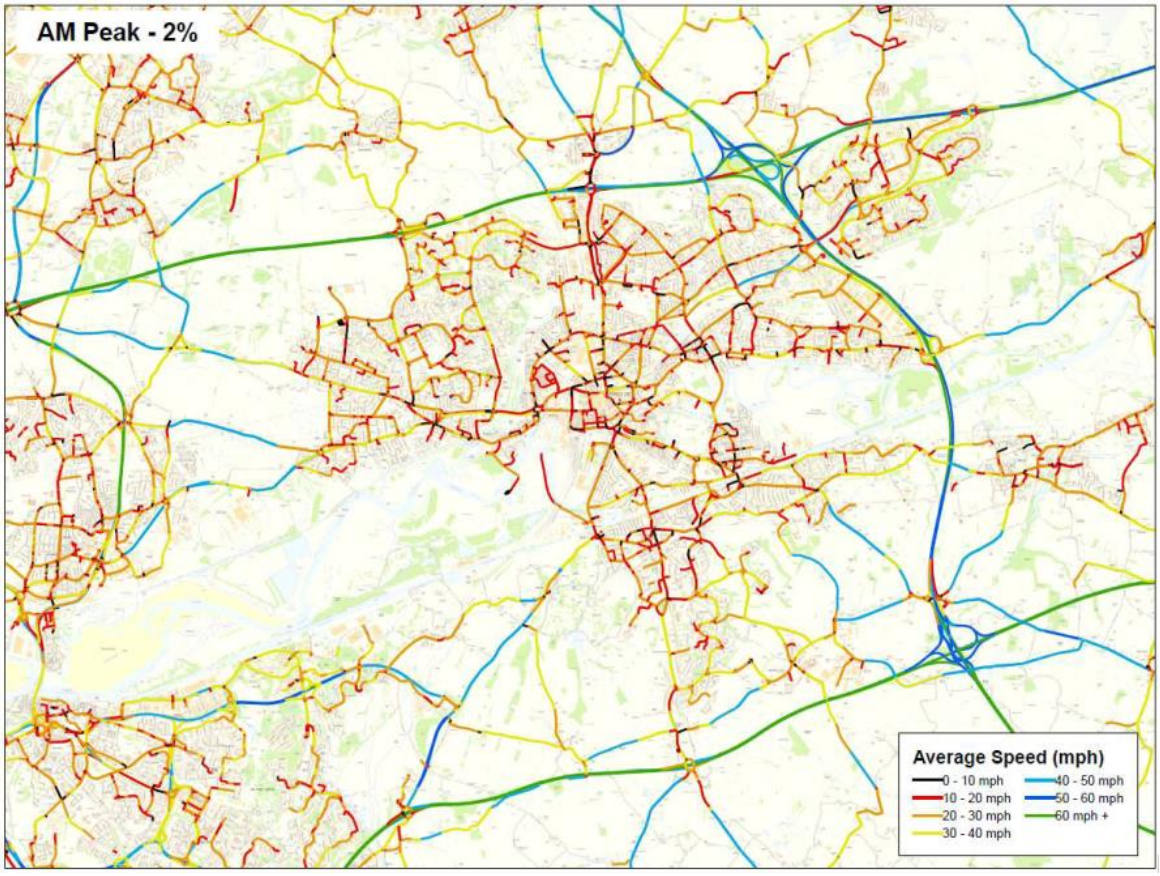
The key findings of the speed data are given below:

- Results showed traffic travelled at higher speeds along motorways with higher speeds along the M56 and M62 compared with M6 during the AM peak.
- There were congestion hotspots on the network where the A50 joins the M6 and where the A49 joins the M62.
- During the PM peak, speeds were slower on the motorway network, particularly between Junctions 9 and 10 on the M56 and along the M6 between Junctions 20 and 21.
- During the inter-peak, traffic along the majority of the motorway network had an average speed of +60mph highlighting clear traffic flows.

For the rest of the highways network local road network, average speeds were broadly similar across the AM, inter-peak and PM peak. The additional following conclusions can be drawn:

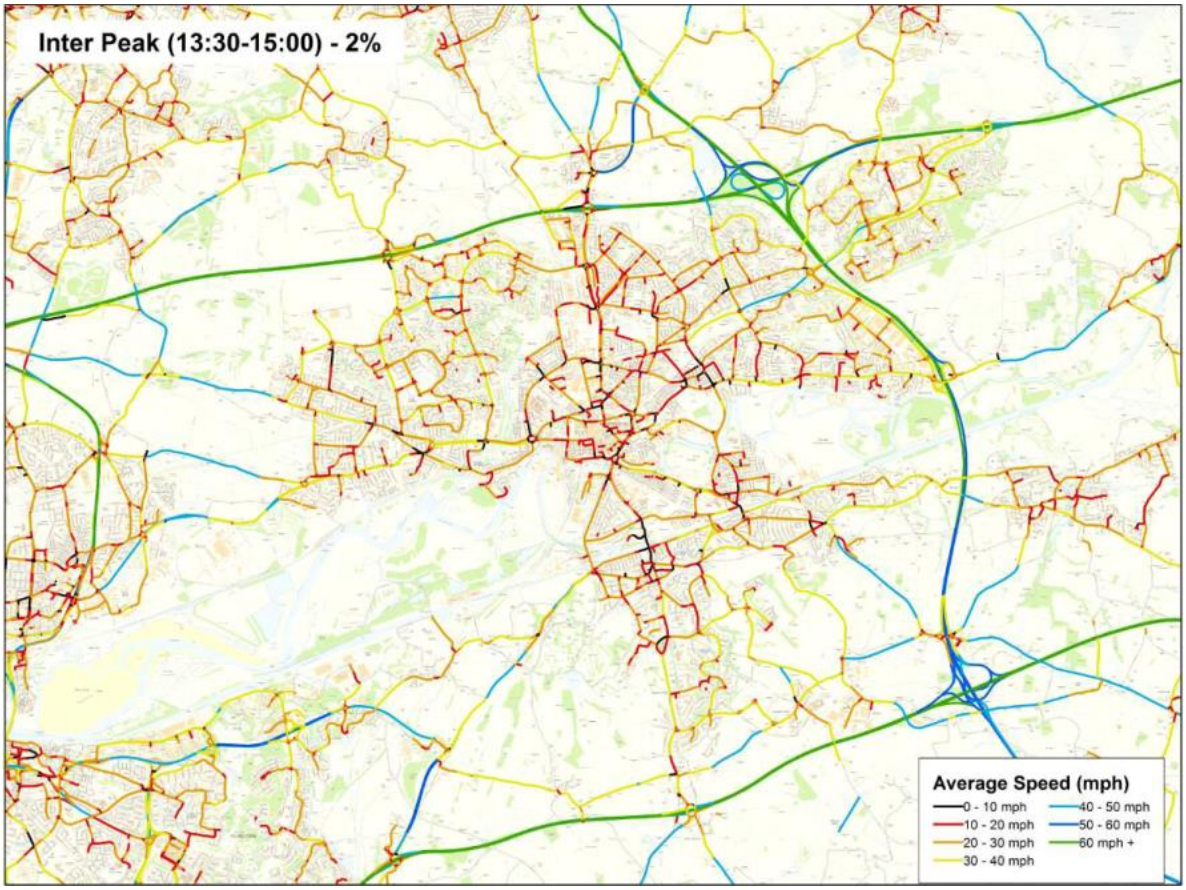
- Slower speeds in Warrington Town Centre and Stockton
- Wilson Patten Street (A5061) had an average speed of less than 10mph during the PM peak.
- To the north of the M62 and east of the M6, average traffic speeds highlighted limited evidence of congestion within the Borough boundary
- Slow traffic speeds from the M6 towards Birchwood during the AM peak with an average speed of 10-20mph compared with 40mph during the inter-peak and PM peak.
- During the inter-peak, traffic speeds on routes into Warrington were generally free-flowing; however, the A49 north of Warrington Town Centre appears to be more prone to slower speeds.

Figure 38: 2015 June Trafficmaster average speeds – AM-peak (07:45-09:15)



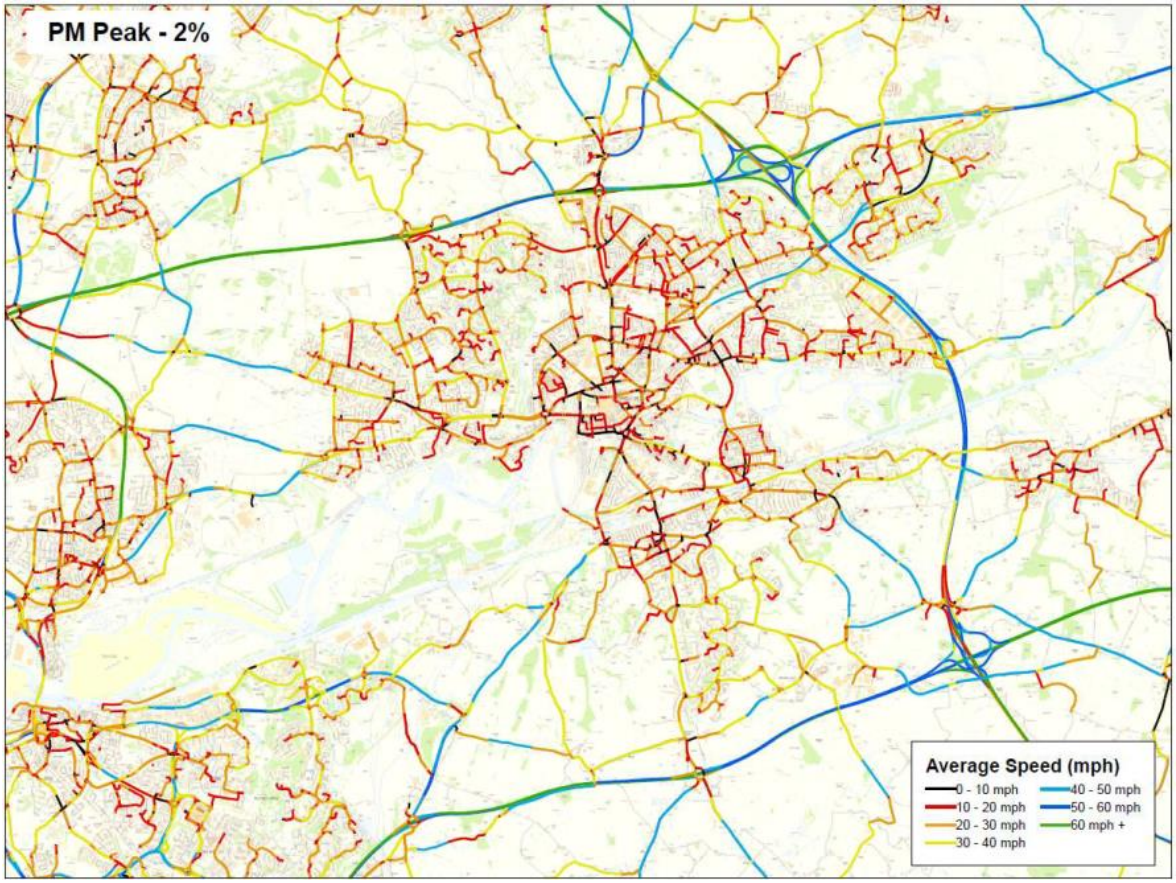
Source: Trafficmaster 2015 - Mon-Fri, second percentile

Figure 39: 2015 June Trafficmaster average speeds – inter-peak (13:30-15:00)



Source: Trafficmaster 2015 - Mon-Fri, second percentile

Figure 40: 2015 June Trafficmaster average speeds – PM Peak (16:30-18:00)



Source: Trafficmaster 2015 - Mon-Fri, second percentile

4.8.1 Congestion hot spots

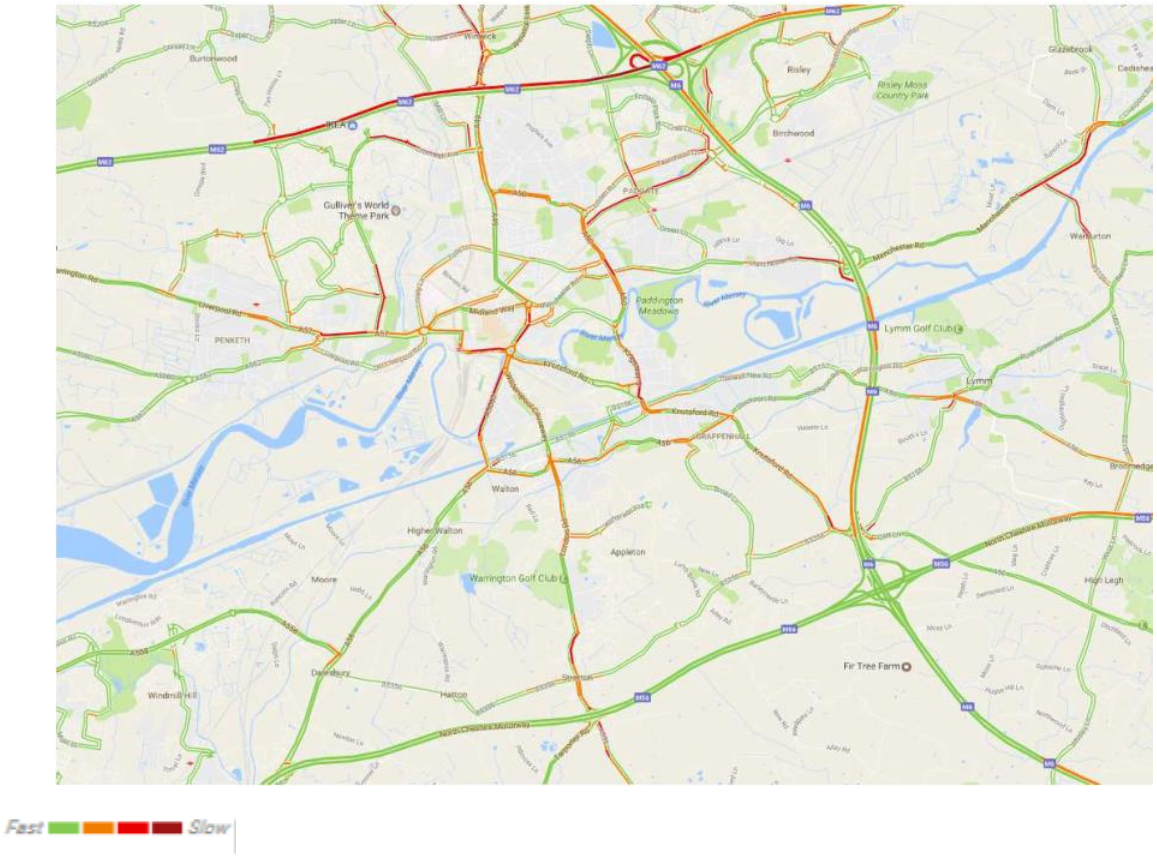
Trafficmaster data helps identify congestion hotspots and stress points on the highway network by highlighting areas on the network where average speeds are slower. To support this, Googlemaps was utilised to take snapshots of live traffic throughout a typical weekday (Figure 41 – Figure 43). This provided another data source to help identify roads where traffic is flowing slowly. The results are summarised in the table below:

Table 11 Summary of typical Tuesday traffic on google maps

Period	Findings
AM peak 08:00	• Slow speeds along the M62 towards Manchester, particularly on the approach to the M6. • Slower speeds were also identified on the A5060 towards Warrington Town Centre from Walton. • Several other approaches to Warrington town centre also had slow speeds.
Inter-peak 12:00	• Speeds were considerably faster compared with the AM peak across the network. • There were slower speeds in Warrington Town Centre, particularly along Midland Way and the A49, north of the town centre. • Wilderspool Causeway and Knutsford Road cross the Manchester Ship Canal and traffic on both routes had slower speeds over the canal.
PM peak 17:30	• Congestion had returned by 17:30 • Congestion in the town centre was more severe than it had been at 08:00 • During the AM peak, speeds along the M62 were notably lower west of the M6 but during the PM peak, slower speeds were evident to the east of the M6. • Towards the south of the Borough, the M6 experienced particularly slow speeds either side of the M56.
All peak periods	• Slower speeds along the M62 and M6 during peak periods compared with the inter-peak. • Warrington Town Centre experiences congestion throughout the day

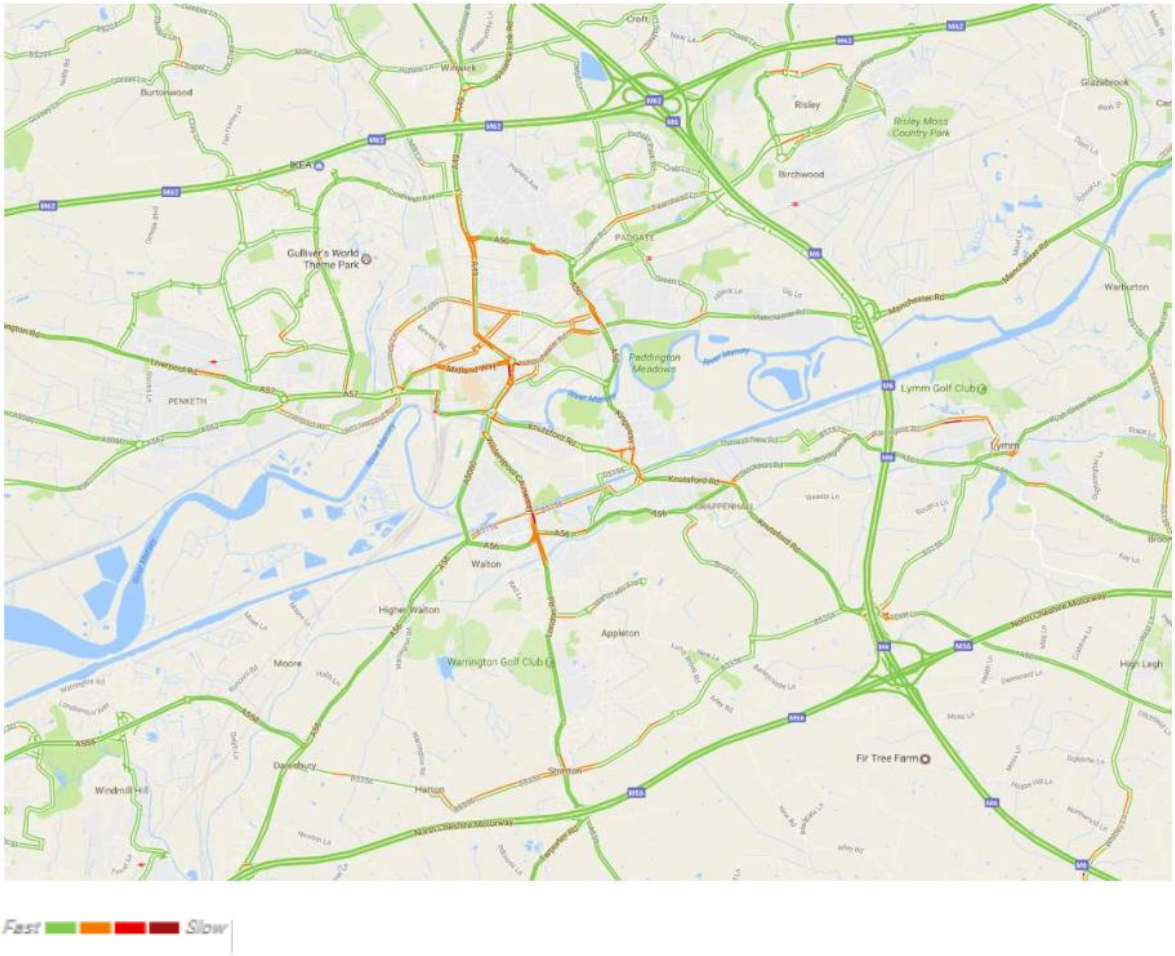
Source: Google maps, typical Tuesday traffic

Figure 41: Warrington highway network at 08:00



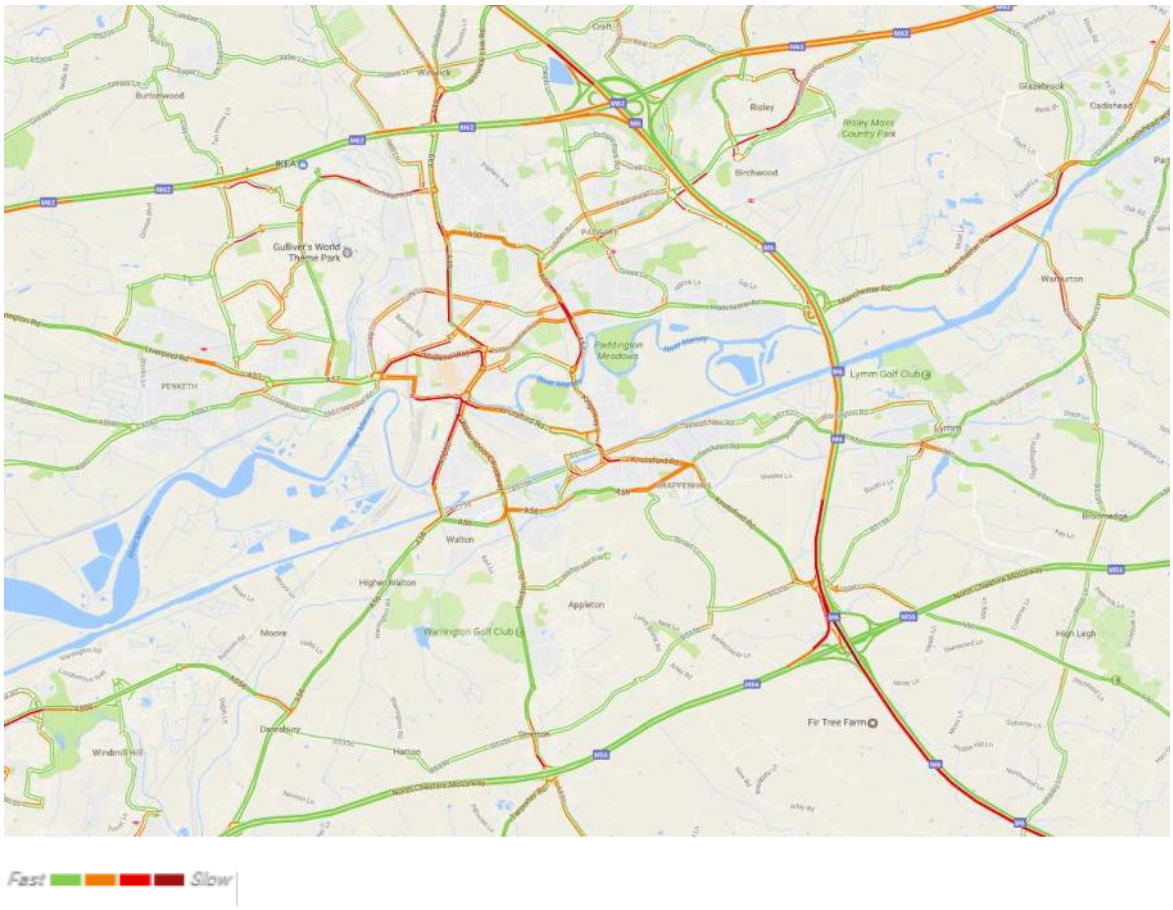
Source: Google Maps, typical Tuesday traffic (2015)

Figure 42: Warrington highway network at 12:00



Source: Google Maps, typical Tuesday traffic (2015)

Figure 43: Warrington highway network at 17:30



Source: Google Maps, typical Tuesday traffic (2015)

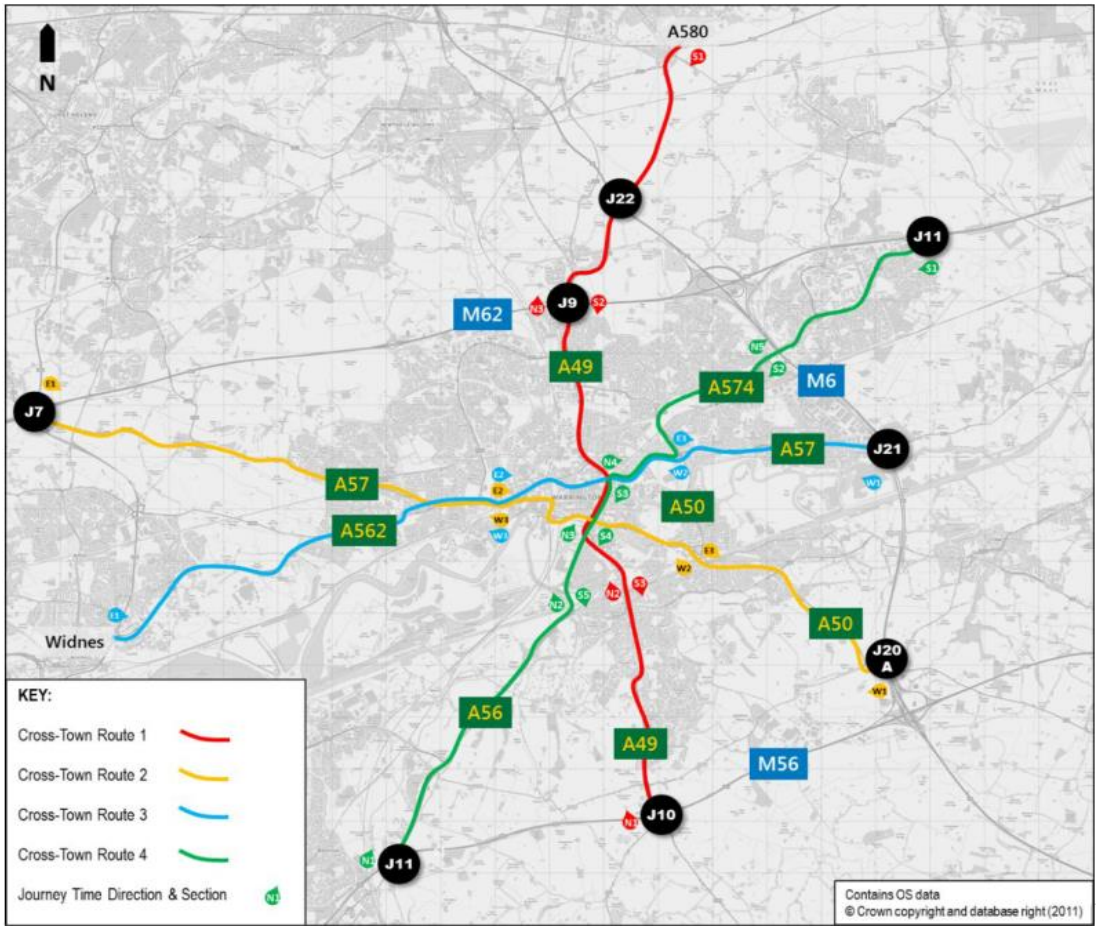
4.8.2 Network journey times

As part of the AECOM data collection study undertaken to inform the Warrington Multi-Modal Transport Model, a number of travel time surveys were undertaken around Warrington to gage traffic conditions around the study area. These included four cross-town surveys:

- **Cross-Town Route 1:** A49/A579/A572 between Lowton (A580 East Lancashire Road) and M56 Junction 10
- **Cross-Town Route 2:** A57/A5060/A5061/A50 between M62 Junction 7 and M6 Junction 20A
- **Cross-Town Route 3:** A562/A57 between Widnes (A557 Watkinson Way) and M6 Junction 21
- **Cross-Town Route 4:** A56/A5060/A49/A57/A50/A574 between M56 Junction 11 and M52 Junction 11

Each of these routes were timed in both directions during peak hour and interpeak conditions, and divided into sections to illustrate where changes in traffic conditions may take place. The path of each route and locations of sections are shown in Figure 44.

Figure 44: Warrington highway network at 17:30

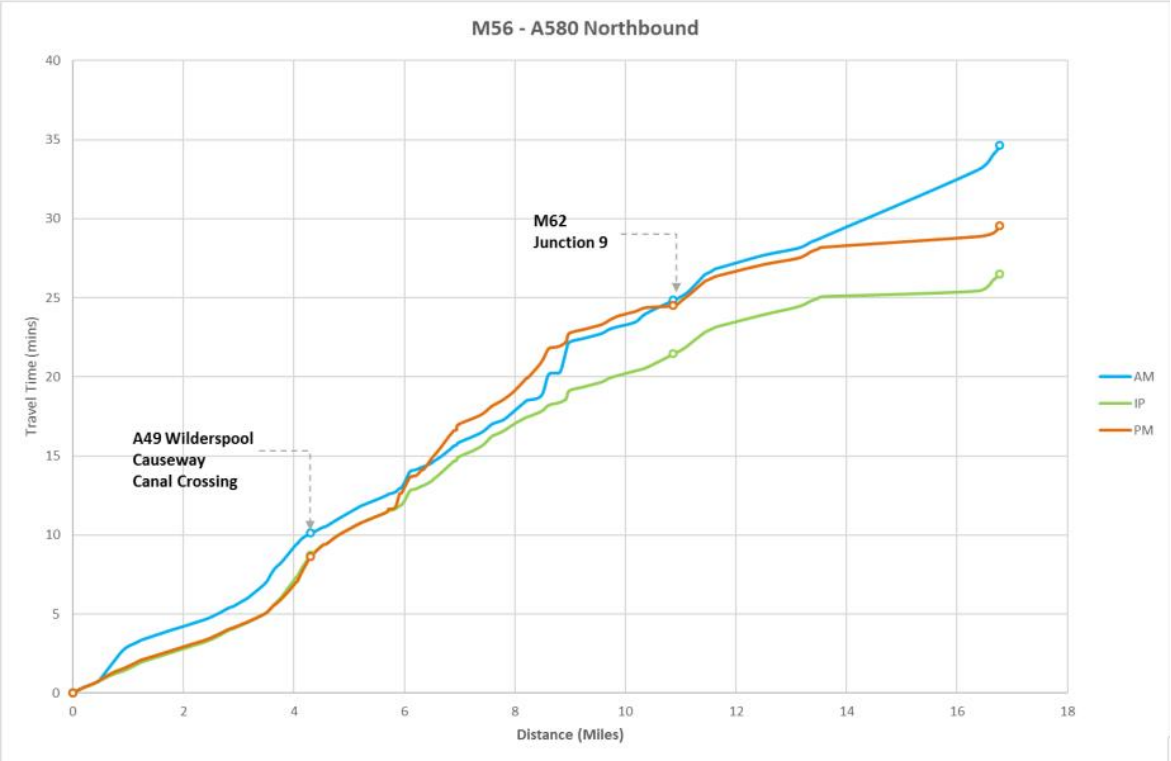


Source: Mott MacDonald, AECOM Warrington Transport Model – Data collection report

A summary of the key findings of the journey time routes is provided below in Figure 45 to Figure 52. The journey time routes highlight network pinch points to exist in the following locations:

- Motorway access points: Congestion is observed in north-east Warrington; slow traffic speeds were observed from the M6 towards Birchwood during the AM peak with an average speed of 10-20mph compared with 40mph during the inter-peak and PM peak.
- On approach to the town centre: Slower speeds were identified on the A5060, Midland Way, A49 and Knutsford Road.
- The town centre: pinch points exist at the A57/A5061 roundabout, A49 Cockhedge Green Roundabout and Sankey Way/Liverpool Road roundabout.

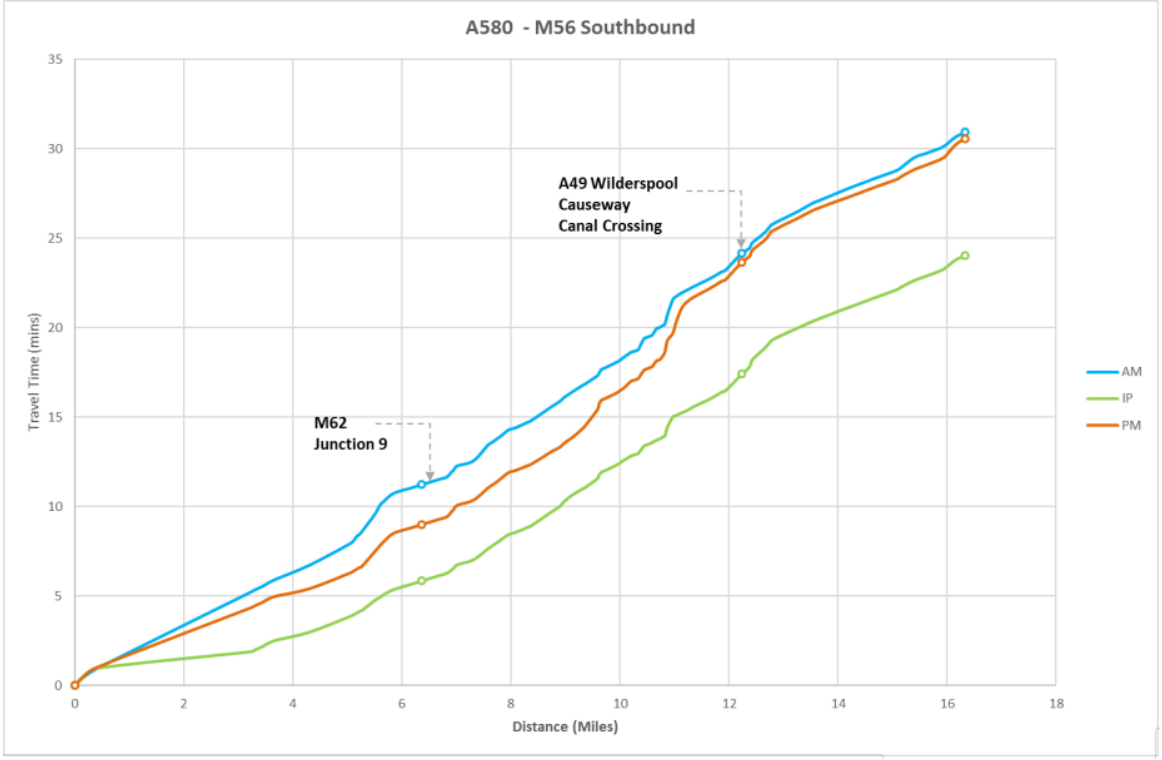
Figure 45: Cross-Town Route 1: Northbound



Source: Mott MacDonald, AECOM Warrington Transport Model – Data collection report

- From the M56 northbound, the journey time profiles are relatively stable, with both IP and PM traffic experiencing similar travel times towards the canal crossing.
- AM traffic appears to experience some congestion as soon as it leaves the motorway, indicating some delays caused by inbound traffic towards the town centre.
- Beyond the canal crossing, travel times become more variable, with steeper profiles taking place in all time periods approximately 2 miles north of the canal crossing.
- Traffic in the morning peak then experiences a large delay approximately 2 miles south of the M62 motorway junction, which corresponds to the A49 as it travels along Lythgoes Lane and the southern section on Winwick Road.
- Beyond the M62 Junction 9, northbound profiles become more uniform, although morning peak traffic continues to experience slower travel times.

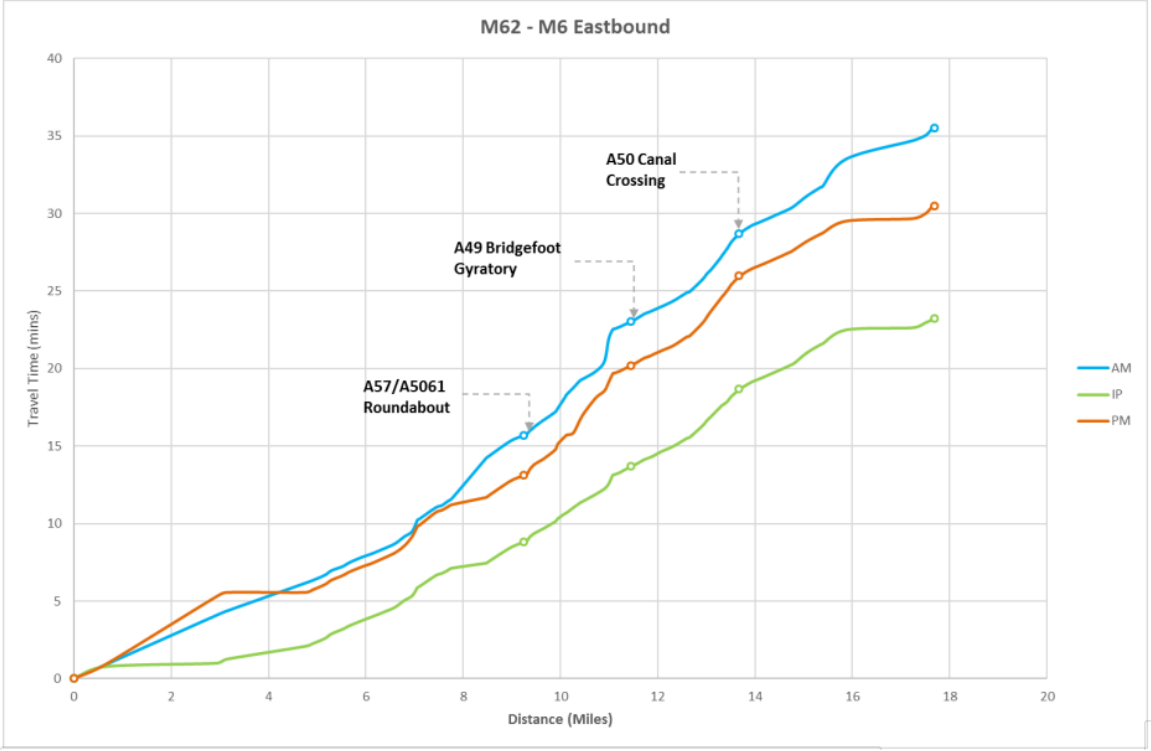
Figure 46: Cross-Town Route 1: Southbound Travel Time Profile



Source: Mott MacDonald, AECOM Warrington Transport Model – Data collection report

- Early travel time profiles remain relatively flat until the approach to the M62.
- All time periods experience a level of delay as they enter the M62 junction.
- Beyond the M62, there is another notable delay affecting all time periods approximately 1 mile north of the A49 canal crossing. This corresponds to the Bridgefoot Gyratory and Brian Bevan Island.
- South of the canal crossing, all travel times retain a similar profile, although both the AM and
- PM peaks have taken longer than the Interpeak

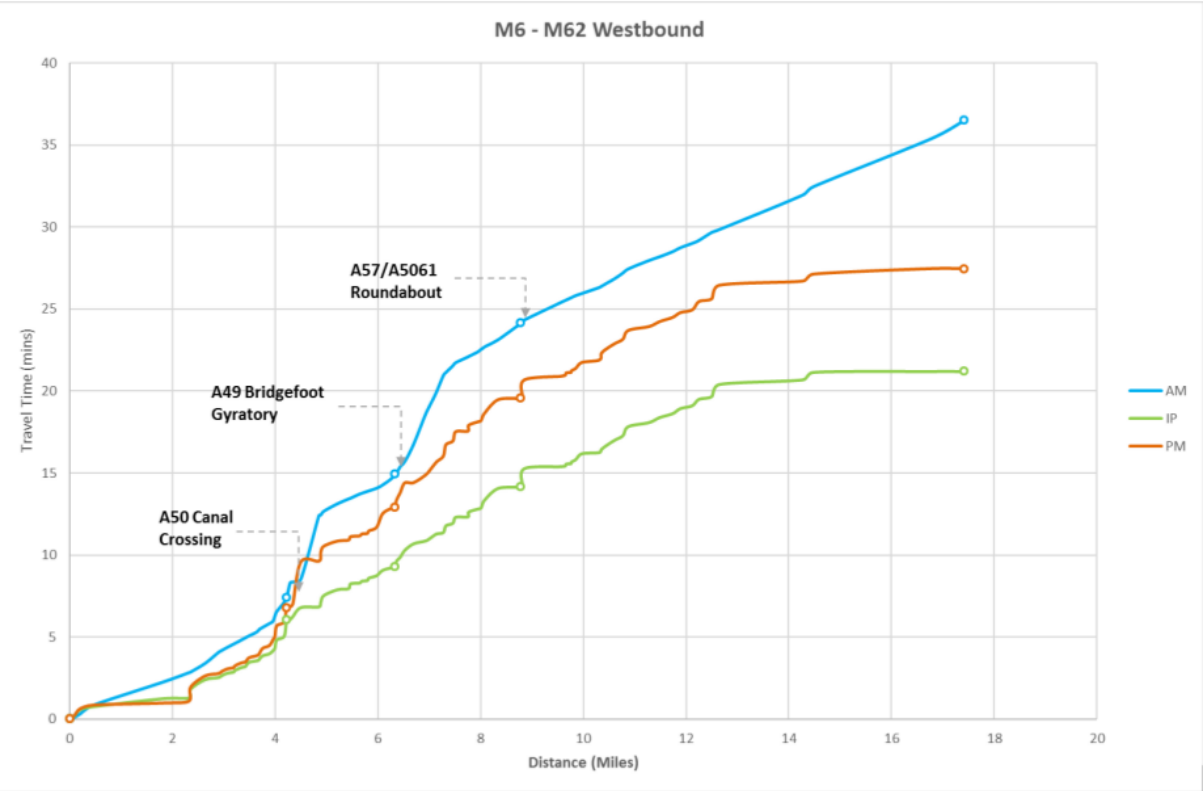
Figure 47: Cross-town Route 2: Eastbound travel time profile



Source: Mott MacDonald, AECOM Warrington Transport Model – Data collection report

- On the eastbound approach to Warrington, delays are infrequent. Although in the PM peak there is a build-up in delay followed by a period of relatively free-flowing traffic.
- As traffic approaches the A57/A5061 roundabout, there is a slight increase in delay, which is more pronounced in the AM peak.
- A further noticeable increase in delay takes place on the eastbound approach to the Bridgefoot Gyratory, which affects both the AM and PM peak.
- Beyond the town centre, there are small increases in delay on the approach to the canal crossing and approximately 2 miles west of the motorway junction, which could relate to delays at the A50/A56 junction in Grappenhall.

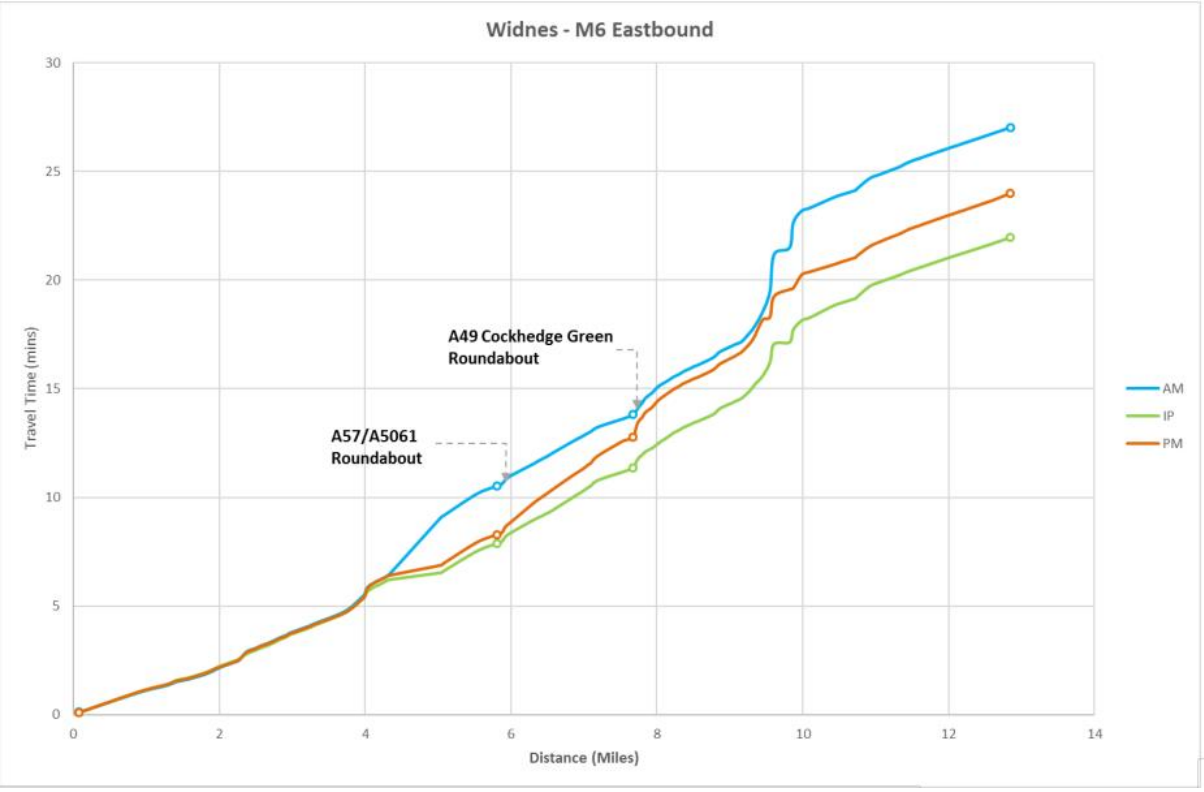
Figure 48: Cross-Town Route 2: Westbound Travel Time Profile



Source: Mott MacDonald, AECOM Warrington Transport Model – Data collection report

- Travelling westbound, there is a sharp increase in delay immediately after the A50 canal crossing in the AM peak, indicating potential delays around the A50/A5031 gyratory.
- Delays into the Bridgefoot gyratory appear to affect PM peak traffic the most.
- The AM peak is more affected by delays experienced after Bridgefoot Gyratory, along Wilson Patten Street and Parker Street.
- Beyond the A57/A5061 roundabout, journey times stabilise across all peak periods.

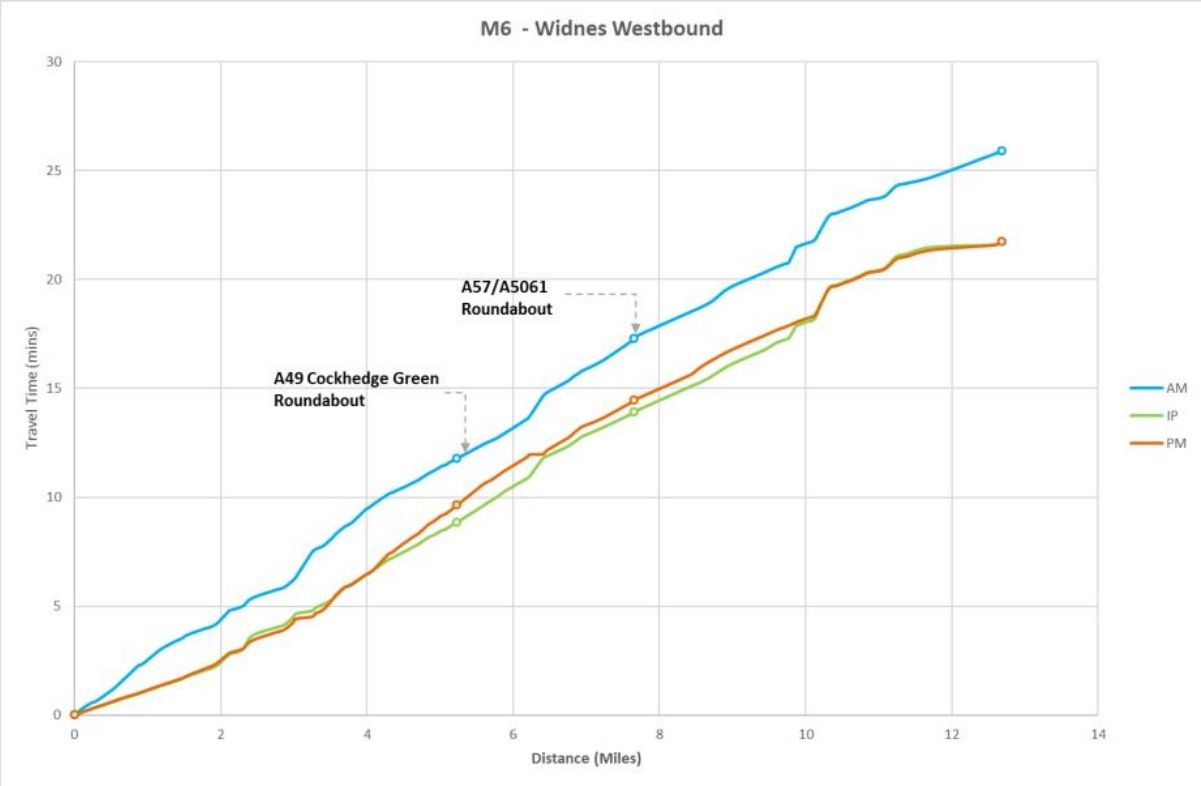
Figure 49: Cross-Town Route 3: Eastbound Travel Time Profile



Source: Mott MacDonald, AECOM Warrington Transport Model – Data collection report

- Heading eastbound into Warrington from Widnes, there is little to differentiate the travel times of all three peak periods until the approach to the A57/A5061 roundabout, where delays slowly start to increase in the AM peak.
- Following the A57 north of the town centre, no noticeable increases in delay take place until approximately 2 miles from the Cockhedge Green roundabout, which could relate to delays along the A57 in the western suburbs.

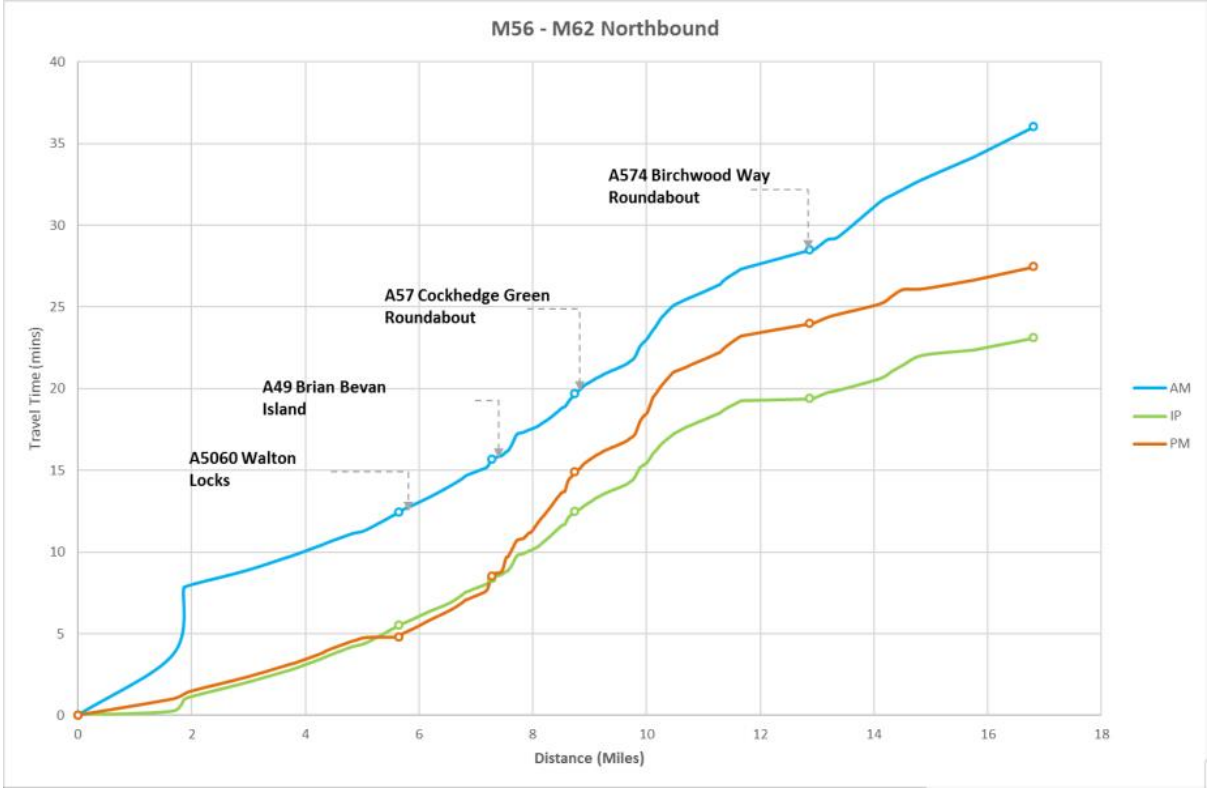
Figure 50: Cross-Town Route 3: Westbound Travel Time Profile



Source: Mott MacDonald, AECOM Warrington Transport Model – Data collection report

- Travelling from the M6 towards Widnes, travel times are relatively stable across all peaks. Incremental delays along the route cause AM travel times to be higher overall whilst IP and PM travel times remain comparable to one another.

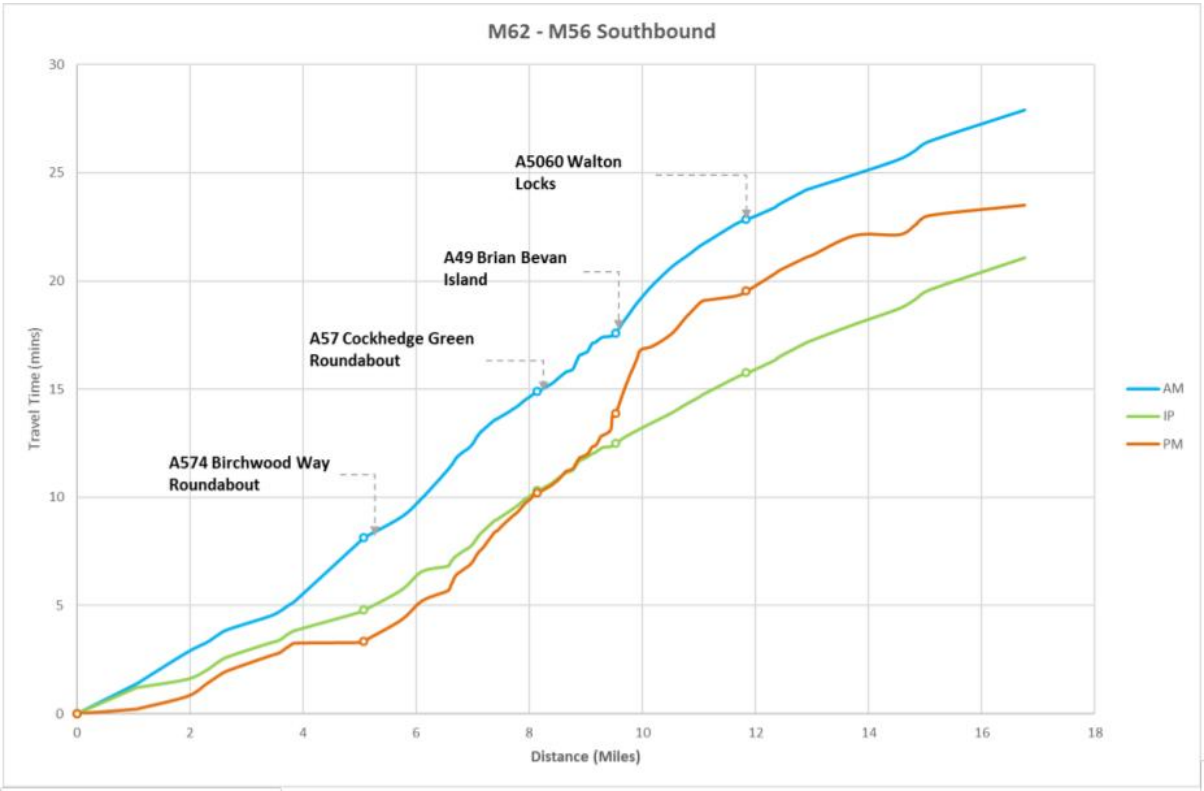
Figure 51: Cross-Town Route 4: Northbound Travel Time Profile



Source: Mott MacDonald, AECOM Warrington Transport Model – Data collection report

- The northbound profiles illustrate a sudden increase in delays for traffic in the AM peak, approximately 2 miles from the M56, which could indicate congestion on the A56 heading into Warrington
- Delays begin to affect northbound traffic in the PM peak between Brian Bevan Island and Cockhedge Green, indicating that the Bridgefoot Gyratory and A49 are congested to the south and east of Warrington Town centre.
- There is another increase in delay approximately 1 mile from Cockhedge Green which could correspond to queues on the A574/A50 junction.
- Travel through Birchwood towards the M62 is relatively unaffected by delay.

Figure 52: Cross-Town Route 4: Southbound Travel Time Profile



Source: Mott MacDonald, AECOM Warrington Transport Model – Data collection report

- Southbound traffic also travels slower in the AM peak compared to other peak periods. Again, delays tend to take place on the A49 southbound between Cockhedge Green and Brian Bevan Island.
- There is a steep increase in delay around Brian Bevan Island in the PM peak for traffic travelling southwards out of Warrington, although these tend to stabilise across all peaks as traffic reaches the M56.

4.8.3 Warrington intelligent transport system

WBC Urban Traffic Management and Control system (UTMC) combines the urban traffic control (UTC), remote monitoring system (RMS), fault monitoring, variable message signs (VMS) and car park systems all in one place to ensure the efficient operation of the highways network.

To enhance this system further, WBC look to develop journey time monitoring devices and software to distribute the information in a user friendly format. This led to the Warrington Intelligent Transport Systems (WITS) project.

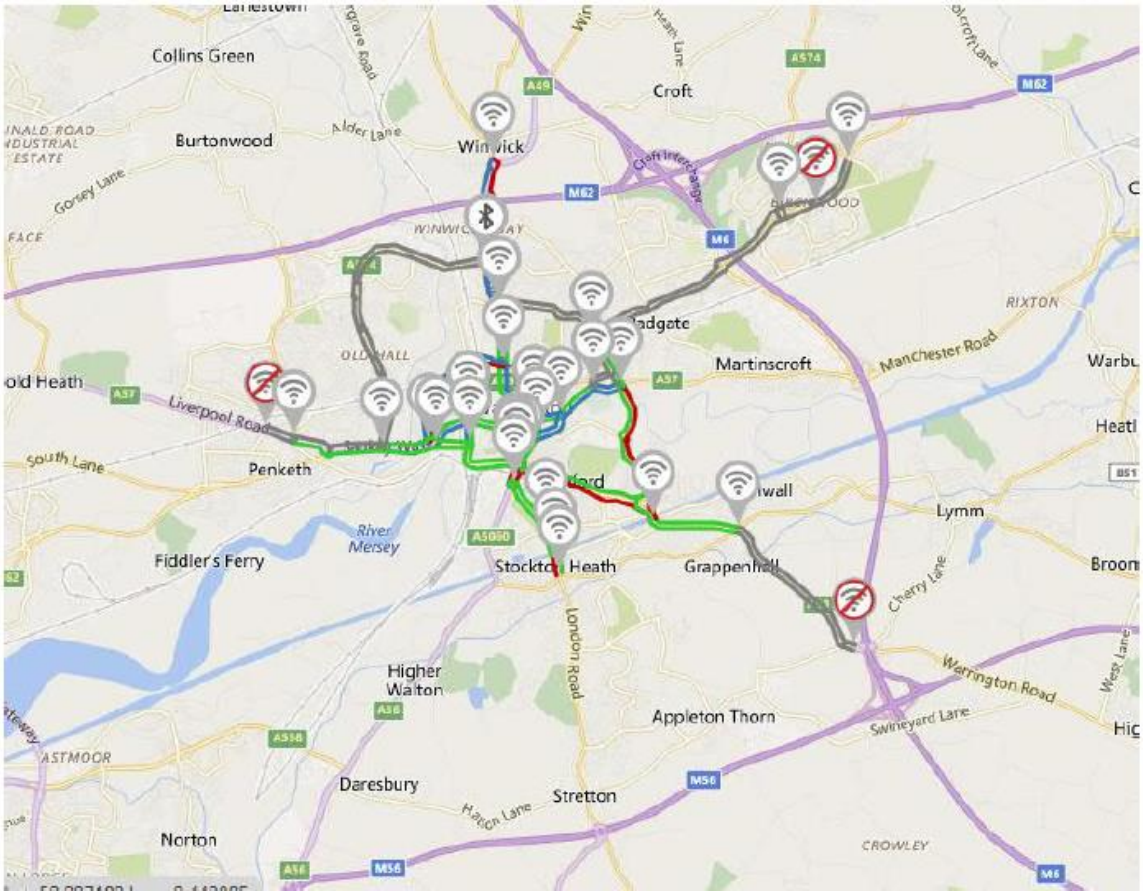
The WITS project combined real-time journey information with the latest Wi-Fi and 'smart devices' – such as mobile phones and modern vehicles with integrated wireless communications - to develop network strategies to allow them to manage traffic flows using the UTMC.

The WITS project took place from April 2017 until March 2018 and was delivered by WBC UTMC team with support from WSP and suppliers, including Siemens and IDT. The project covered the key highways corridors within the Borough of Warrington namely the A49, A57, A574 (Birchwood Way) and A50.

The system

In order to collect and monitor journey time information, Wifi journey time monitoring units were installed to allow Warrington to utilise existing equipment, expand their current network coverage and reduce on-street equipment to maintain.
A map of the existing and new sensors are found below:

Figure 53: Location of WIFI and Bluetooth monitoring sensors



Source: Warrington Intelligent Transport System (WITS) 2018

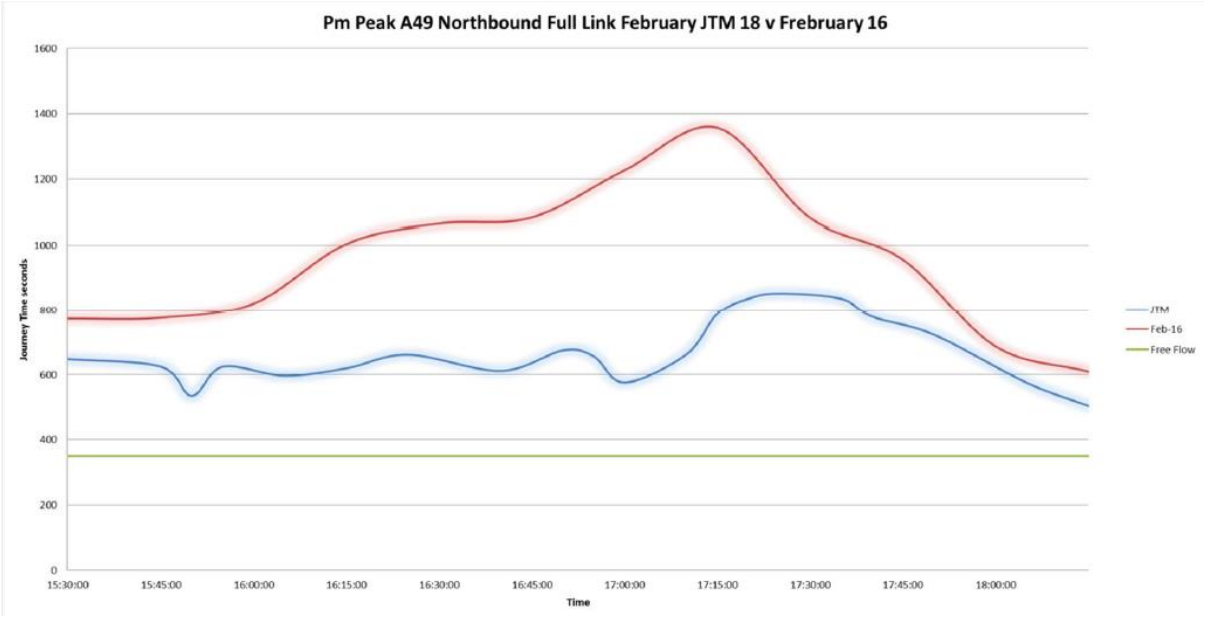
The fully developed system intends to provide real-time information to the general public and businesses via on-street information displays, interactive web pages, social media and an innovative local mobile phone app for the general public available to access free on the internet or via iOS or Android mobile friendly operating systems.

Results

A comparison of journey Comparing journey information from Basemap and current Wifi JTM data used for the WITS on the A49, the results suggest there has been an average

journey saving of 30% during the evening peak on the A49 northbound route out of Warrington (Figure 54).

Figure 54: PM Peak A49 Northbound Journey time comparison between JTM data used form the WITS system 2018 and information form Basemap 2016



Source: Warrington Intelligent Transport System (WITS) 2018

The system was also capable of identifying critical pinch points on each of the key corridors using the journey time data collected from JTM data. This has enabled WBC to target critical junctions for improvement, to increase reliability and reduce journey time across the corridors.

The Journey Time Monitoring (JTM) capabilities now allow WBC to quantify these improvements via the various detectors installed around the borough.

Future system

Warrington intends to continue to develop WITS to ensure their system is constantly update with new technology and functioning as efficiently as possible. WBC hope to expand on the current system through the following developments:

- Expand the Imesh network including Wifi JTM units across the Borough to ensure full coverage.
- Introduce more units on current corridors specifically between junctions in order to highlight problems on the network in more detail.
- Transfer all RMS sites on UTC
- Purchase Bluetooth JTM units for rural areas with no ADSL and run off 4G
- Purchase the disruption module within Stratos (common database) to allow a direct feed from Highways England and push out additional information.
- Roll out air quality detectors and use the information to aid traffic flow and in return reduce NOx gas.

- Combine the Road work system into the common database to automatically in form Stratos of journey time disruptions.
- Look at network optimisation and strategies on all corridors and route across Warrington. This will require a full audit of the UTC system, each junction and stored documentation.
- Combine different modes of control, utilising MOVA during off peak situation and only allow SCOOT to take over when large platoons are on the network.
- Develop strategies for motorway closures and major diversions

4.8.4 Key findings of journey times and congestion

The key findings of journey time and congestion analysis are:

- Substantial congestion occurs on the network where the A50 joins the M6 and where the A49 joins the M62.
- Congestion is frequently observed in the town centre during peak periods. Wilson Patten Street (A5061) had an average speed of less than 10mph during the PM peak and Parker Street also suffers from slow speeds.
- There are a number of town centre pinch points were traffic is considerably slower: A57/A5061 roundabout, A49 Cockhedge Green Roundabout and Sankey Way/Liverpool Road roundabout.
- There are congestion hotspots at or near waterway crossings: A49 Wilderspool Causeway Canal crossing, Bridgefoot Gyratory, Brian Bevan Island and the A50/A5031 gyratory.
- There are substantial congestion problems on the approach to Warrington town centre. Slower speeds were identified on the A5060, Midland Way, A49 and Knutsford Road.
- Congestion is observed in north-east Warrington; slow traffic speeds were observed from the M6 towards Birchwood during the AM peak with an average speed of 10-20mph compared with 40mph during the inter-peak and PM peak.
- During the inter-peak, traffic speeds on routes into Warrington were generally free-flowing; however, the A49 north of Warrington Town Centre appears to be more prone to slower speeds.

What does this mean for LTP4?

The town centre can be categorised as a place of severe congestion and poor journey quality. Delays are frequently observed at waterway crossing points, motorway access points, on the approach to the town centre and in the centre.

LTP4 should seek to raise journey time reliability, network performance and reduce congestion by implementing policies that can:

- Reduce the dependency on the private car and encourage a modal shift towards more efficient transportation modes such as public transport and active travel;
- Support Western Link and the introduction of an extra crossing point over Warrington's key watercourse to help relieve pressure on the existing congested crossing points;
- Tackle network pinch points and mitigate congestion hotspots along the highways network;
- Introduce schemes that can help relieve the pressure of existing water crossing points; and
- Explore demand management strategies that can remove, reduce, route and retime private car movements.

4.9 Travel to work

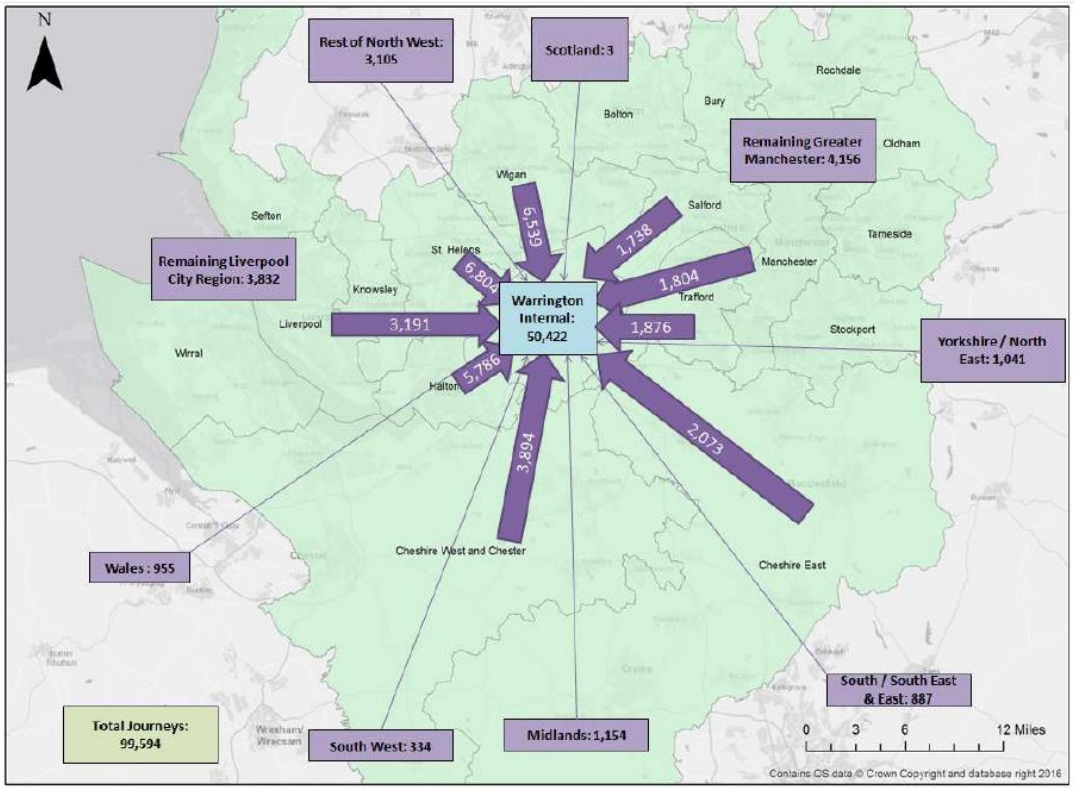
A productive economy relies requires a functioning transport system; one that enables quick and easy connections for its population with its places of work. Therefore, it is crucial to assess work travel patterns.

4.9.1 Travel to work flows

Analysis of 2011 Census travel to work movements was completed. Travel to work flows to, from and within Warrington are presented in Figure 55 to Figure 57. Figure 55 shows flows into Warrington, Figure 56 illustrates outflows from Warrington, whilst Figure 57 summarises the largest overall flows.

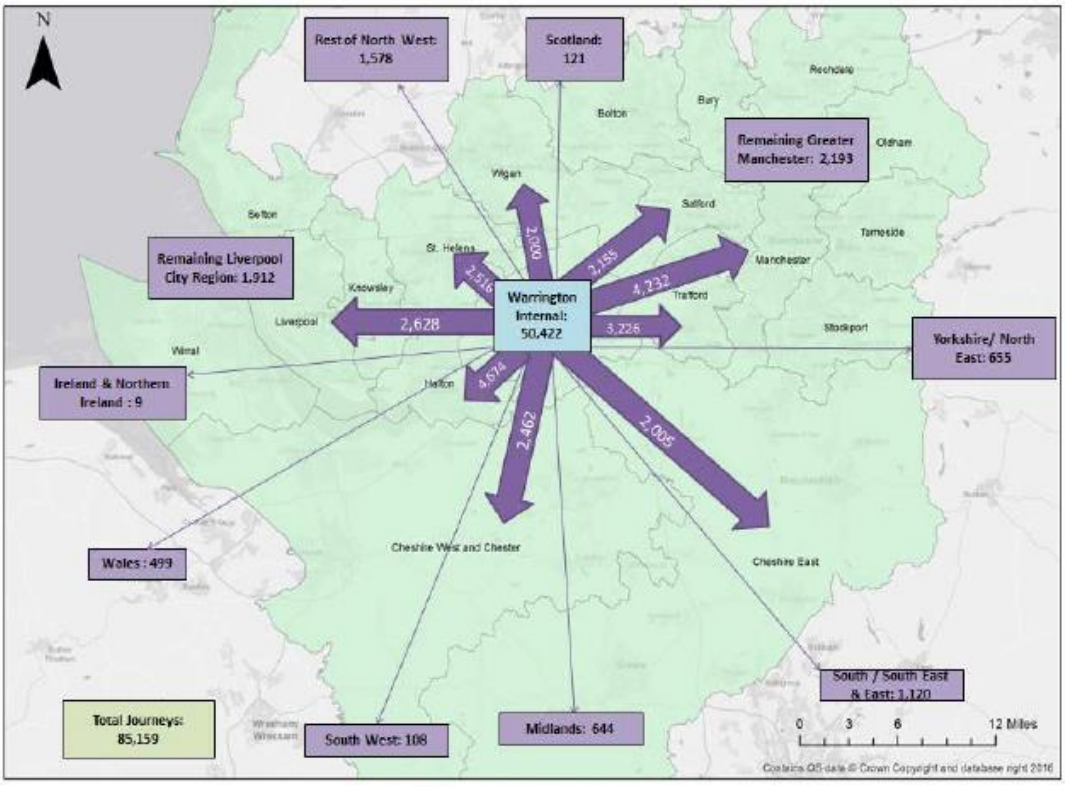
The results highlight greater numbers of people travelled into Warrington to work compared with the number of residents that left Warrington, whilst a significant proportion travelled within Warrington for work.

Figure 55: Travel to work inflows to Warrington



Source: 2011 Census

Figure 56: Travel to work outflows from Warrington



Source: 2011 Census

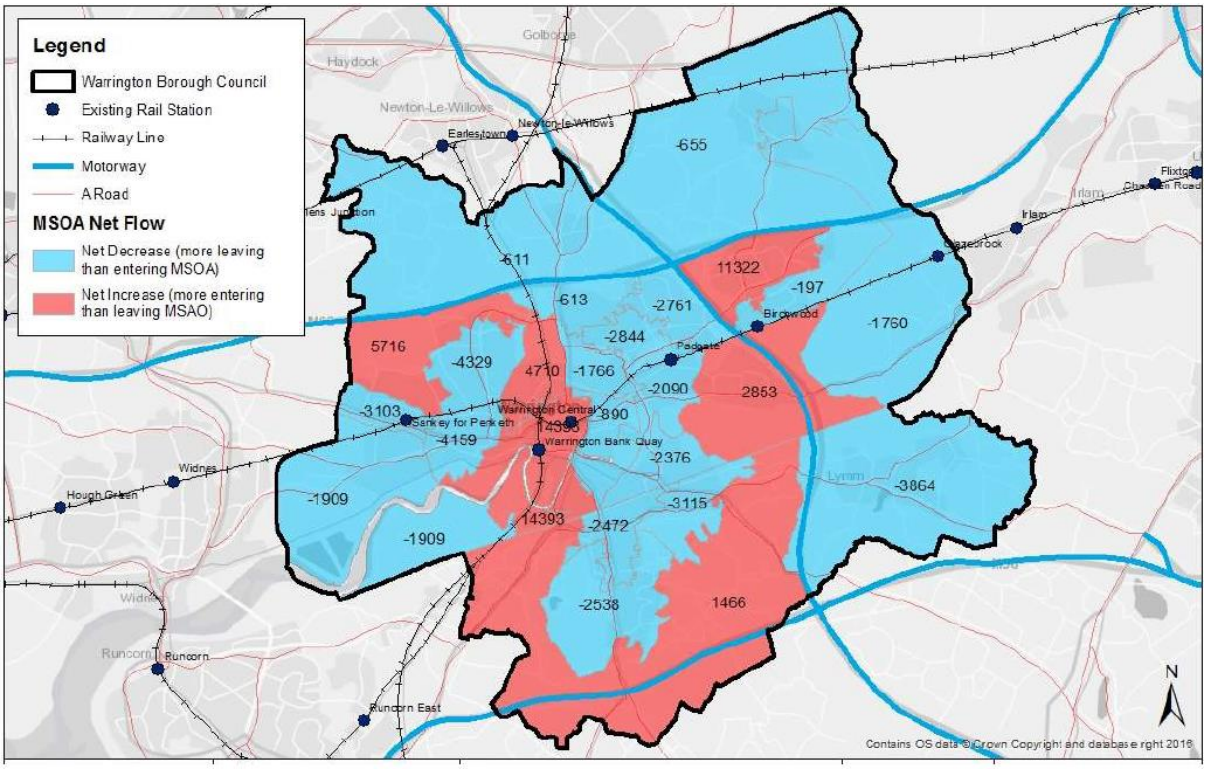
Figure 57: Largest inflow and outflow travel to work movements

Source: 2011 Census

It was possible to assess travel to work flows at a more detailed level by assessing net flows between MSOAs in Warrington (Figure 58). The results show six MSOAs had a net increase; these were located in Warrington Town Centre, Birchwood, Westbrook and Woolston.

These areas are the key employment locations in Warrington. The rest of the MSOAs in the Borough experienced a net decrease, reflecting their predominately residential characteristics. Due to the dispersal of these inflows and outflows, the town is prone to a range of cross-town movements.

Figure 58: Warrington MSOA Net Flows (2011)



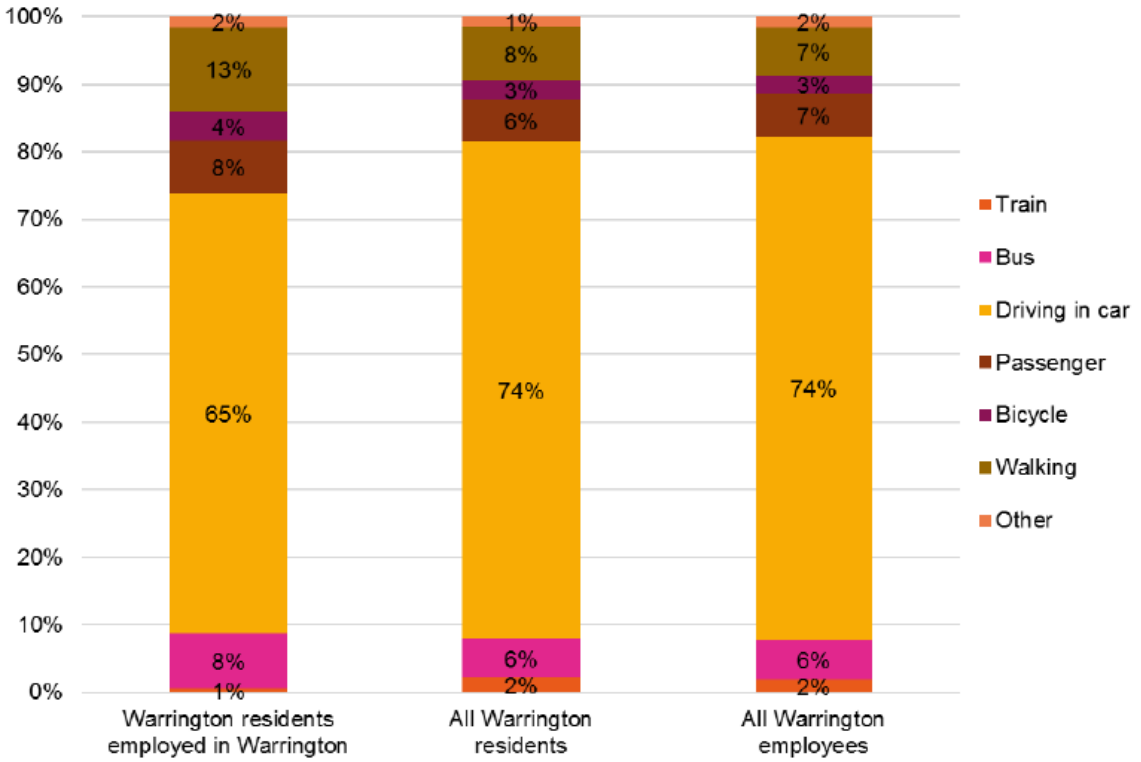
Source: Census 2011

4.9.2 Method of travel to work

Analysis of the modal share in 2011 Census travel to work data provides an understanding of how Warrington residents and workforce travels to work. Usual method of travel to work by Warrington residents and employees is summarised in Figure 59, the key findings are:

- Travel within and into Warrington Borough is dominated by the use of the private car;
- Census data indicates that the private car or van is used by 80% of Warrington residents to get to work (anywhere); and
- 73% of Warrington residents who also work within the Borough travel by car to work – 65% as a driver, 8% as a passenger.

Figure 59: Usual method of travel to work by Warrington residents and employees

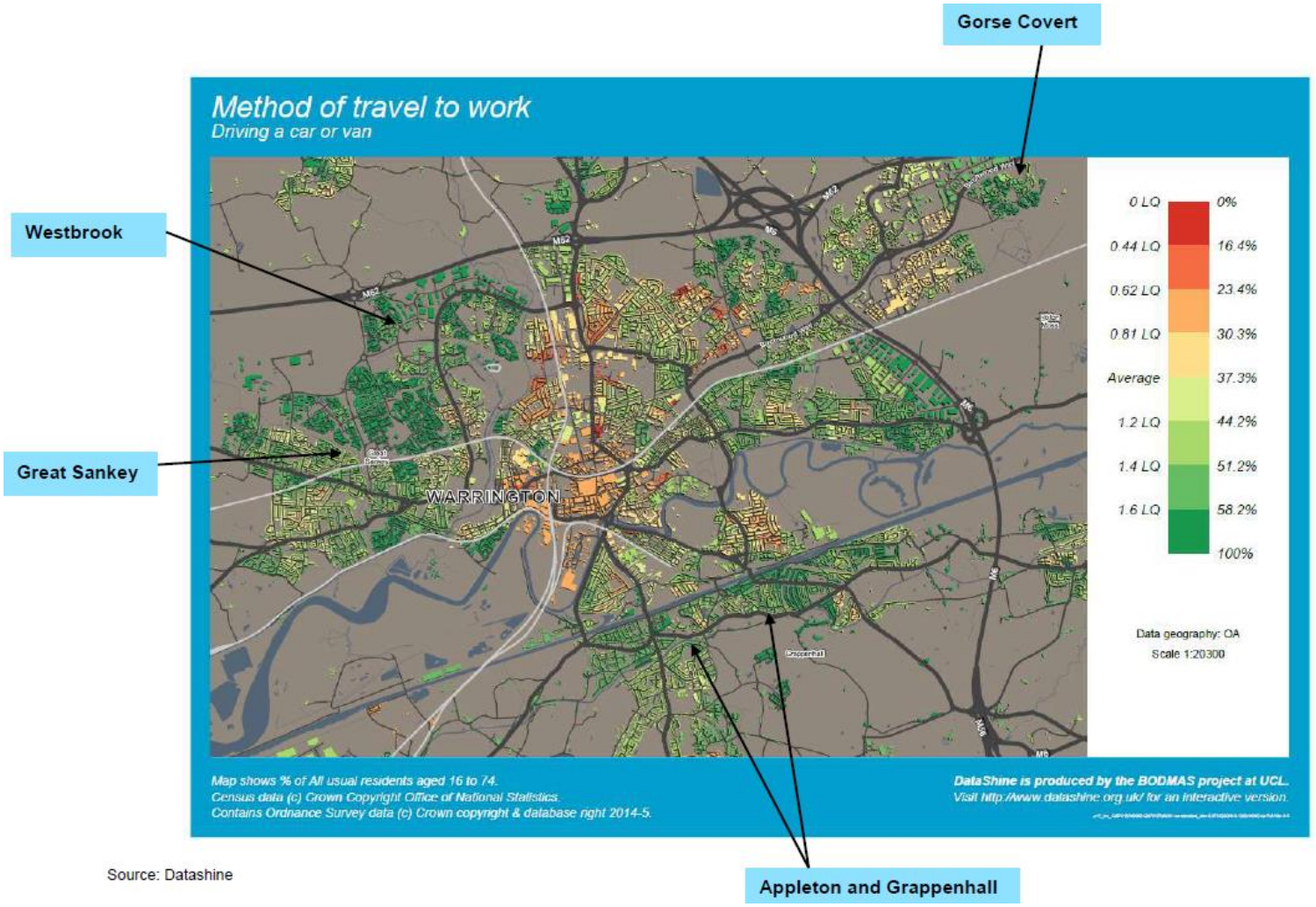


Source: Census 2011 Travel to work

Usual method of travel to work for Warrington residents was mapped using Datashine which uses 2011 Census, this is mapped in Figure 60 – Figure 65. This provides a spatial interpretation of how Warrington residents are travelling to work. The key findings are:

- Higher proportions travel to work as a car / van driver on the outskirts of the Borough, particularly around Great Sankey and Westbrook, as well as along the A56 and west of the M6.
- Higher proportions of residents travel as a car passenger, bus and active travel modes from the town centre.
- Lower proportions commute as a car / van driver around Birchwood, particularly the area between Birchwood Way and the CLC Line.
- Slightly higher proportions commuting by train in the town centre compared with the rest of the Borough.
- Within Warrington, use of the bus for travel to work was highest in the town centre and around Orford and Hulme to the north of the town centre.
- In general, as could be expected, active travel use was lowest at the extremities of the Borough particularly to the west of Sankey Brook.
- Above average proportions cycled to work from Orford, Hulme and to the east of Victoria Park, near Latchford.
- Greater proportions walked to work from Warrington Town Centre, whilst above average proportions were also recorded in Birchwood.

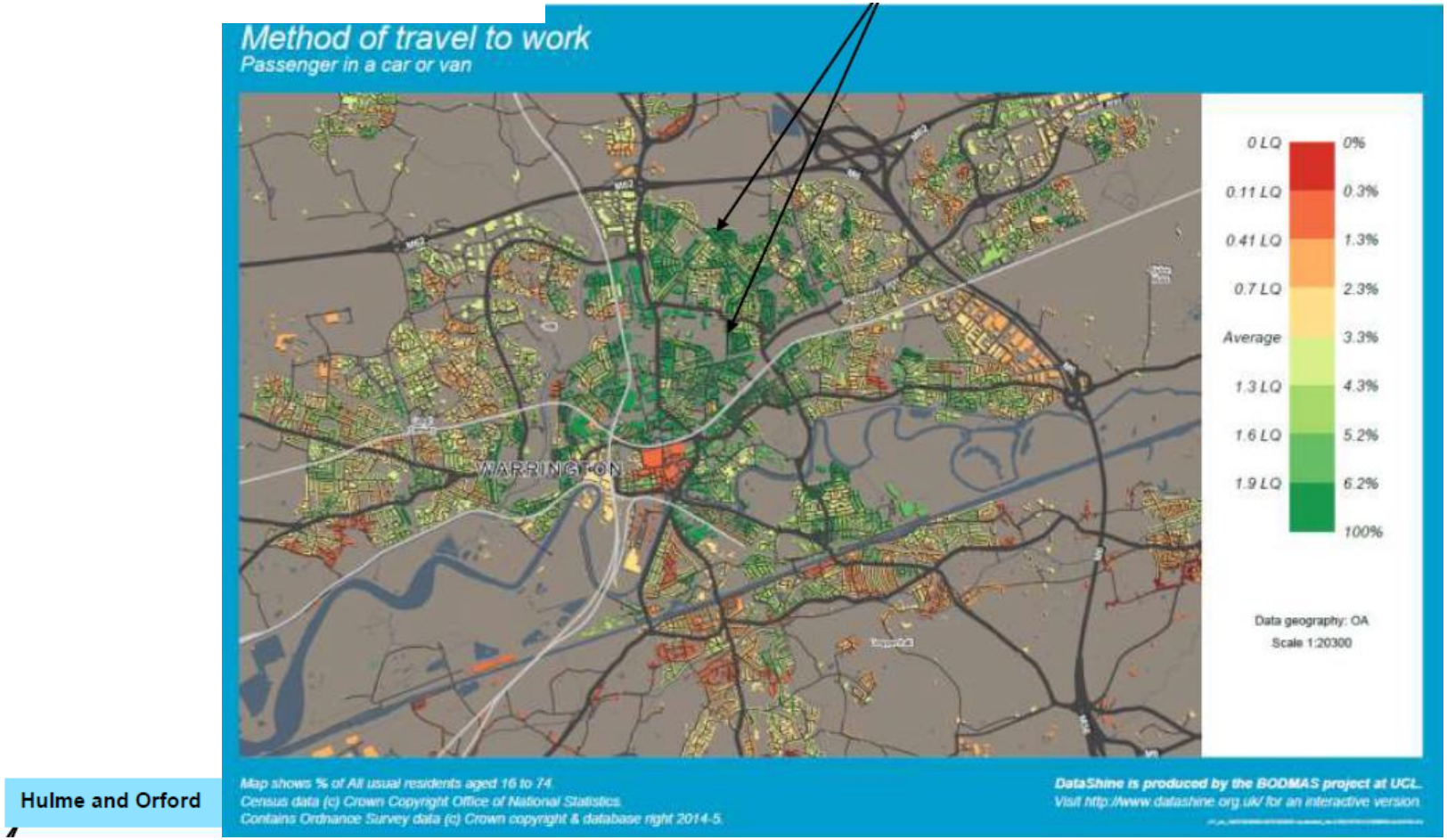
Figure 60: Method of travel to work for Warrington



Source: Datashine

Source: Datashine

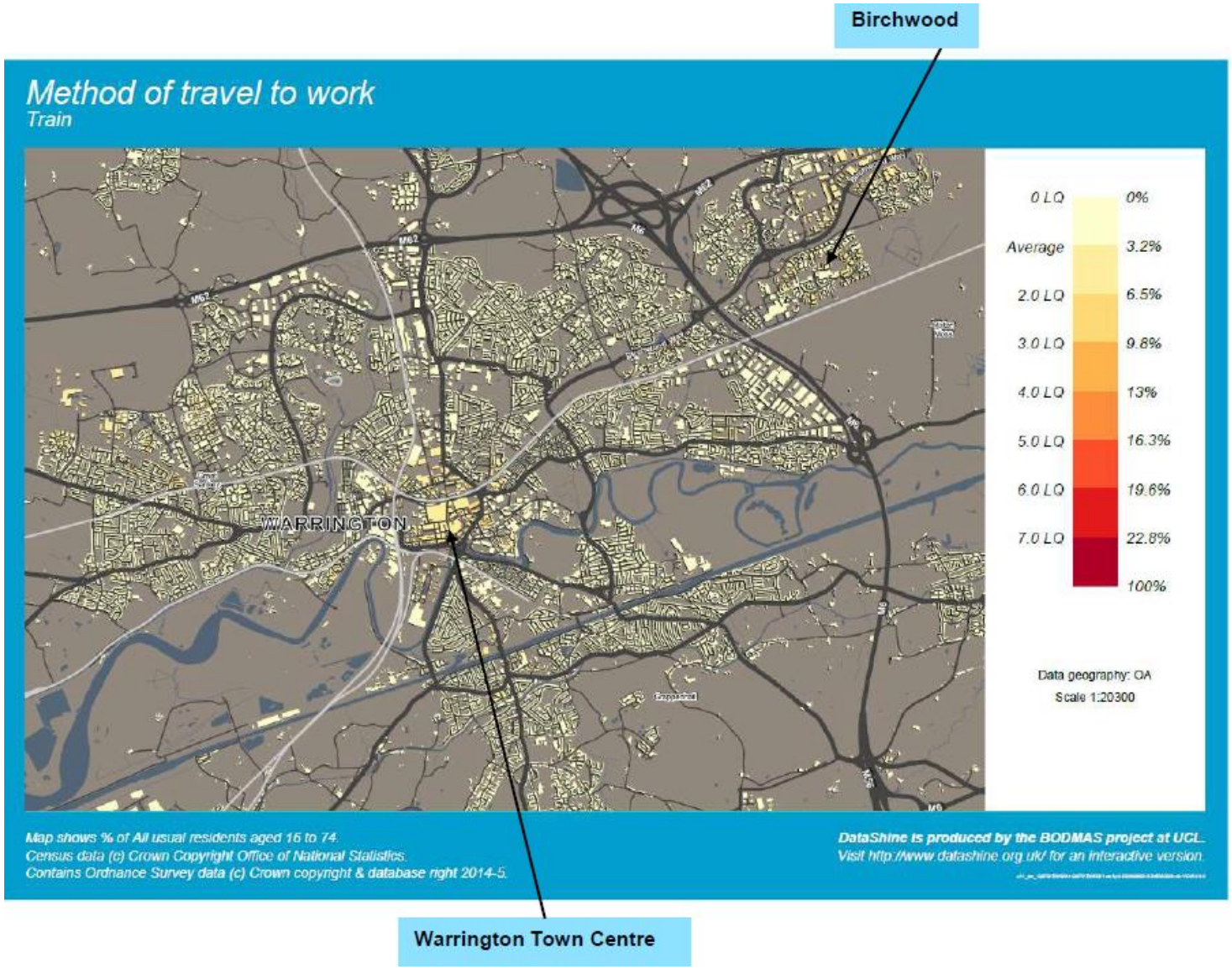
Figure 61: Method of travel to work – Passenger in a car or van



Hulme and Orford

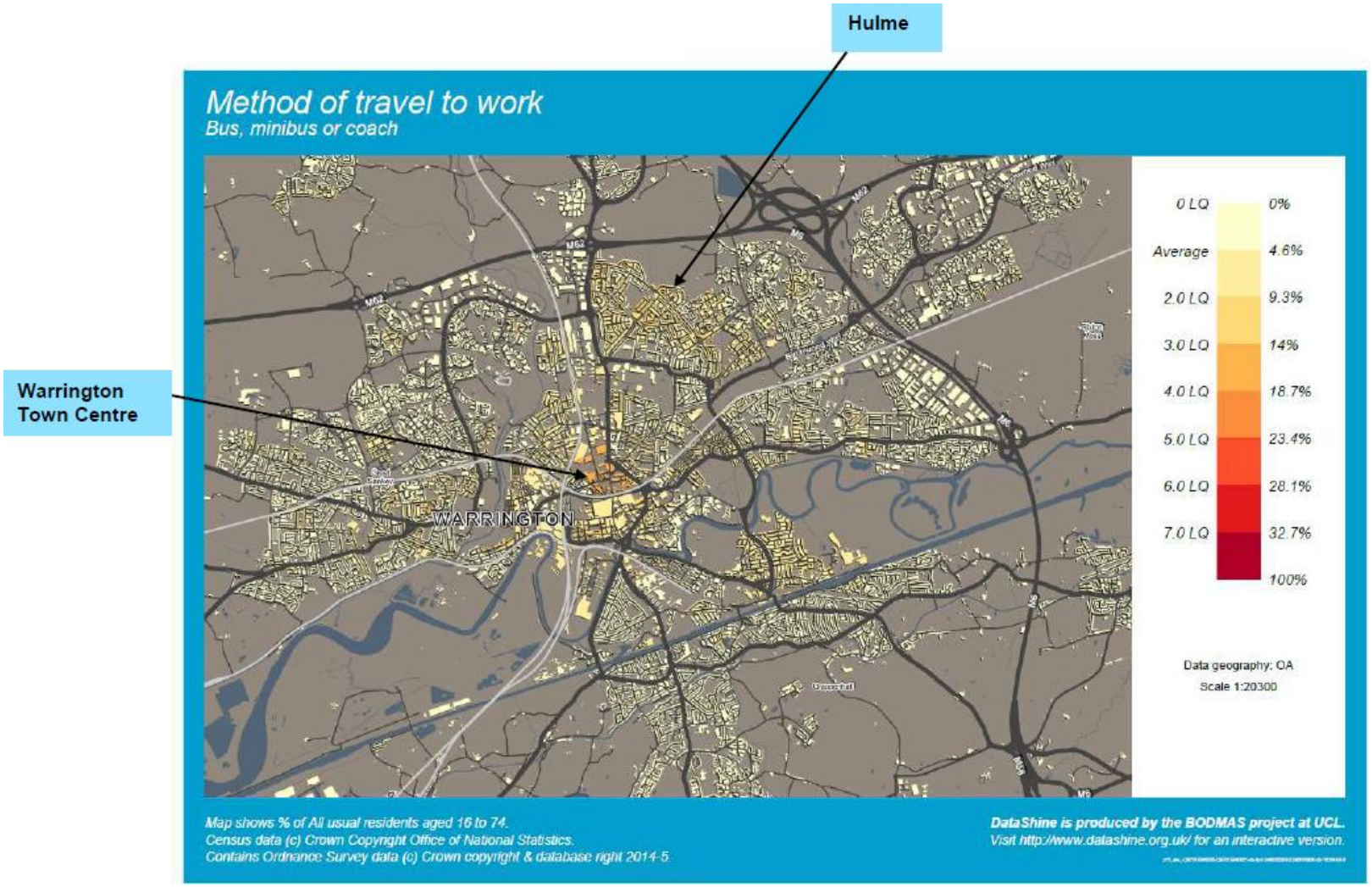
Source: Datashine

Figure 62: Method of travel to work - Train



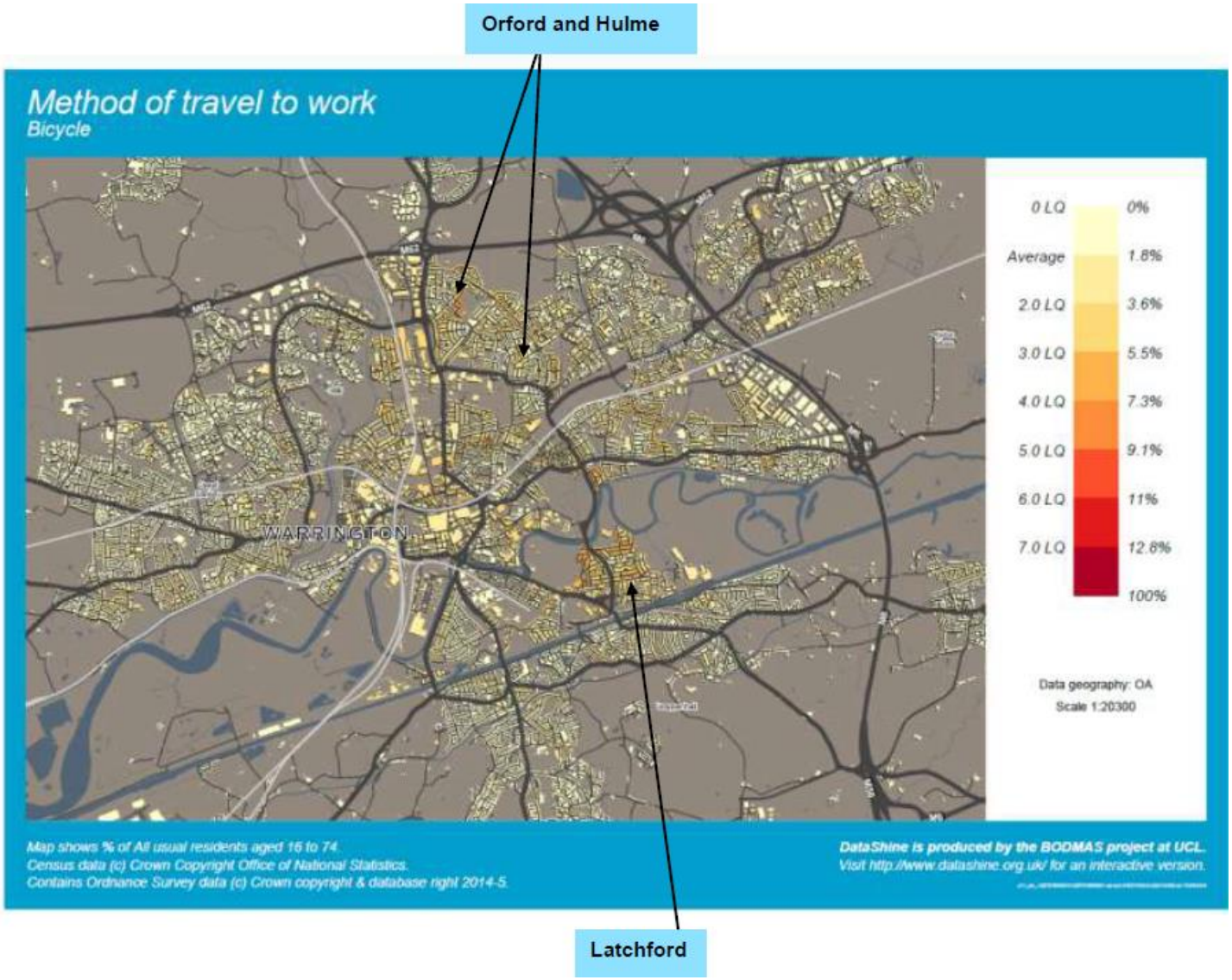
Source: Datashine

Figure 63: Method of travel to work – bus, minibus or coach



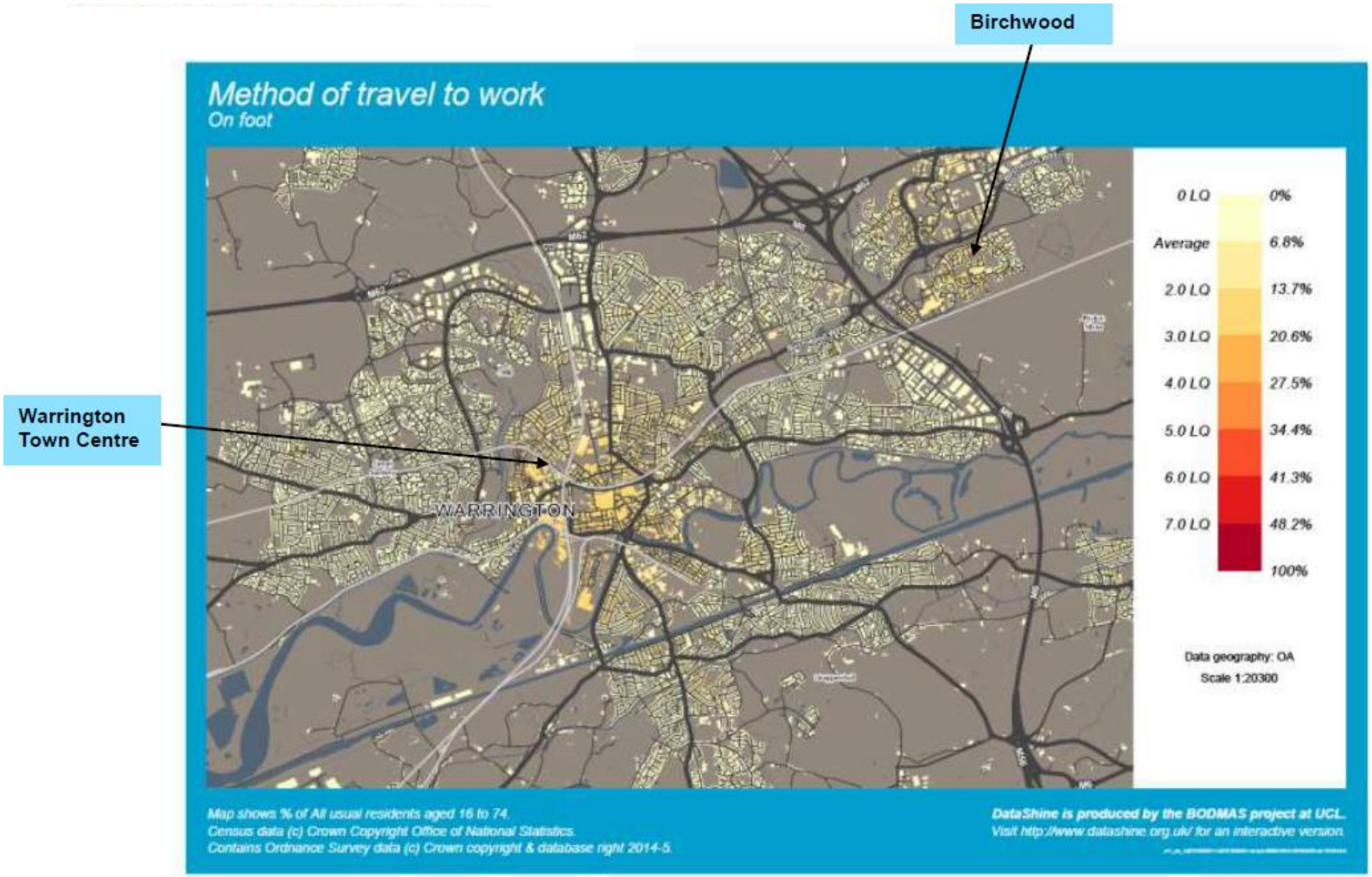
Source: Datashine

Figure 64: Method of travel to work – bicycle



Source: Datashine

Figure 65: Flows PM Peak (16:30-18:00)



Source: Datashine

The town centre is a key destination for employment (Section 3.6). Therefore, it is useful to understand usual method of travel to work for this area. Table 12 highlights of all those commuting to Warrington Town Centre, almost three-quarters (73%) travelled by car (as a driver or passenger). A higher proportion travelled by bus / coach (11%) compared with train (4%), whilst 11% used active travel modes. Again, travel patterns in Warrington indicate the dependency on the private car.

Table 12: Journey to work mode share to Warrington town centre

All Trips to Warrington Town Centre (E02002607)	Journey to Work Mode Share (%)
Car (Driver / Passenger)	73
Bus / Coach	11
Walk / Cycle	11
Train	4
Other	1

Source: Census 2011 travel to work

4.9.3 Modal share comparison

Table 13 compares the modal share for the journey to work in 2001 and 2011, excluding those who work mainly at or from home and not in employment. The results show an increase in the proportion stating they drive to work and travel by train.

The number of residents aged 16-74 travelling to work increased by 9.3% between 2001 and 2011 and it is also useful to consider the proportional increase of trips made by each mode. For example, the number of rail trips increased by 83.3% over this period from 1,128 trips in 2001 to 2,068 in 2011.

Although the modal shift proportion showed a greater increase in the proportion driving by car / van to work, the proportional increase in car trips was smaller than rail at 12.0%. Whilst the results showed a decrease in the proportion travelling by bus, there was a 3.6% increase in the absolute number of bus (minibus, coach) trips over the period.

Table 13: Warrington travel to work modal share (2001-2011)

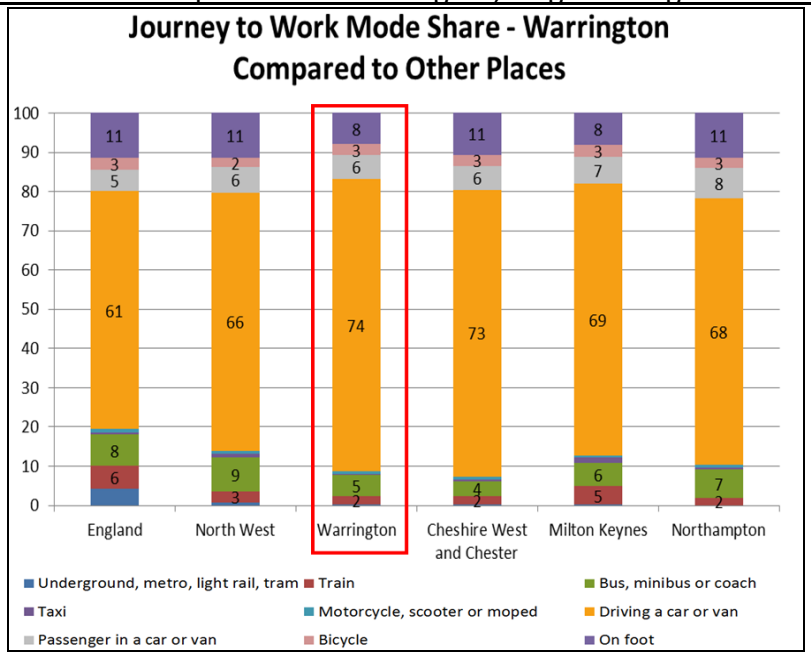
	2001		2011		Mode Share Change	Change in Absolute No. of Trips
	N	%	N	%	%	%
Underground, metro, light rail, tram	157	0.2	142	0.2	*	-9.6
Train	1,128	1.3	2,068	2.3	1.0	83.3
Bus, minibus, coach	4,775	5.7	4,946	5.4	-0.3	3.6
Taxi	414	0.5	368	0.4	-0.1	-11.1
Motorcycle, scooter or moped	1,028	1.2	677	0.7	-0.5	-34.1
Driving a car or van	60,413	72.1	67,670	73.9	1.8	12.0
Passenger in a car or van	5,972	7.1	5,650	6.2	-0.9	-5.4
Bicycle	2,936	3.5	2,577	2.8	-0.7	-12.2
On foot	6,599	7.9	7,038	7.7	-0.2	6.7
Other	323	0.4	384	0.4	*	18.9
All Residents (aged 16-74)	**83,745**	**100**	**91,520**	**100**		

Source: Census 2001 and 2001 Travel to work

A comparison of the modal split for Warrington with neighbouring cities and districts and other designated New Towns was undertaken. Figure 66 presents the modal split results for all residents in employment who travel to work.

The results show almost three quarters (74%) of Warrington residents commute by car (alone) to work compared with 65% of North West residents and 60% nationally. Overall, it shows that there is a greater reliance on the car for commuting in Warrington than compared with other cities identified and the national average.

Figure 66 Modal share comparison for Warrington, neighbouring cities and New Towns



Source: Census 2011 – travel to work

Warrington is situated within close proximity of to three large regions Greater Manchester Merseyside and Cheshire West and Chester. Figure 66 shows Warrington has a very similar modal share compared with Cheshire West and Chester. Meanwhile, solo car driving was notably lower in Greater Manchester (63%) and Merseyside (60%). Bus use was much greater in these areas (12% Merseyside, 11% Greater Manchester) and the proportion walking was also higher compared with Warrington.

Warrington was designated a New Town in 1968 and other New Towns in this wave were Milton Keynes (1967), Peterborough (1967) and Northampton (1968). Figure 66 also presents the modal share for Milton Keynes, Peterborough and Northampton. Of these three towns, the modal share in Milton Keynes was most similar to Warrington though the proportion of solo car drivers was still greater in Warrington.

Active travel use was higher in Peterborough (15%) and Northampton (14%) compared with 11% in Warrington and Milton Keynes.

4.9.4 Distance travelled to work

Table 14 presents the distance travelled to work in 2001 and 2011 for Warrington. 16% of journeys were less than 2km whilst 25% travelled 2-5km. Almost a third (31%) were of 5-20km, whilst 11% were 20-30km. The remaining 7% of journeys were over 30km.

A comparison to the 2001 Census highlights there has been very little change in the distances travelled; there has been a small decrease in those travelling 30-60km (7% 2001, 4% 2011) and an increase in the proportion travelling 20-30km (8% 2001, 11% 2011).

Table 14: Warrington distance travelled to work (2001-2011)

	2001		2011		Change in %
	N	%	N	%	
Works mainly at or from home	10,262	10	9,336	10	*
Less than 2km	16,217	16	15,292	16	*
2km to less than 5km	24,527	24	24,014	25	1
5km to less than 10km	17,993	18	16,340	17	-1
10km to less than 20km	15,658	15	12,844	14	-1
20km to less than 30km	8,237	8	9,933	11	3
30km to less than 40km	4,845	5	2,767	3	-2
40km to less than 60km	2,093	2	998	1	-1
60km and over	2,677	3	2,737	3	*
All	**102,509**	**100**	**94,261**	**100**	

Source: Census 2001 & 2011

4.9.5 Key findings of travel to work movements

The key findings of travel to work movements are summarised below:

- Inflows compared with outflows were concentrated in selected MSOAs - Warrington Town Centre, Birchwood, Westbrook and Woolston. This provides of the town's most important employment destinations.
- There is a high dependency on the car for commuting and this proportion has increased between the 2001 (72.1%) and 2011 Census (73.9%). The high proportion of commuters that use the car to travel to work drives the congestion problem during peak periods.
- Use of the private car to travel to work is higher than the North West (65%) and national average (60%). The use of the private car in Warrington is also higher than other UK New Town Developments.
- The number of rail trips increased by 83.3% from 1,128 trips in 2001 to 2,068 in 2011;
- Active travel as a commuter mode in Warrington stood at (10.5%). This is lower than the national average and other New Town developments, Peterborough (15%) and Northampton (14%).
- For employment in the town centre, where a variety of public transport connections connect to, car travel still dominates the commute (73%);
- Within Warrington, use of the bus for travel to work was highest in the town centre and around Orford and Hulme to the north of the town centre;
- Higher proportions travel to work as a car / van driver on the outskirts of the Borough, particularly around Great Sankey and Westbrook, as well as along the A56 and west of the M6.

- Above average proportions cycled to work from Orford, Hulme and to the east of Victoria Park, near Latchford
- East-west connectivity from Warrington is particularly important given the demand for travel to Greater Manchester and Liverpool City Region.

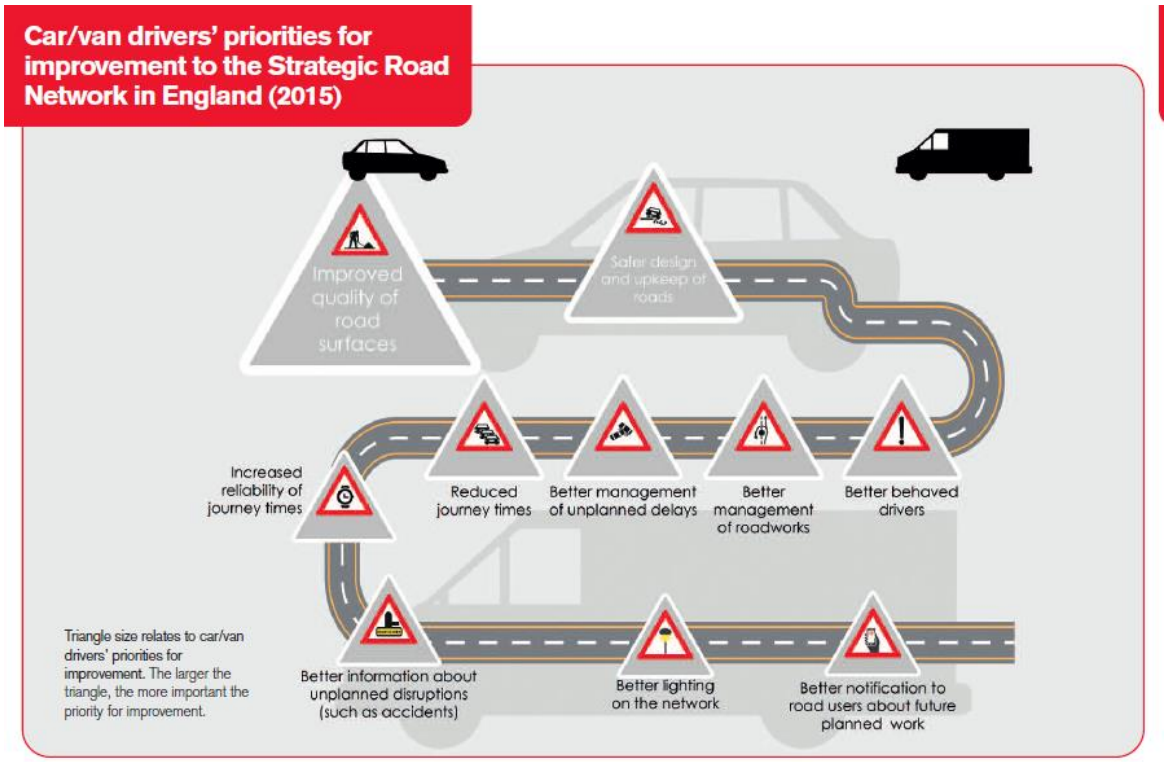
What does this mean for LTP4?
Large amounts of car based commuting contributes to the borough's traffic problems. LTP4 should look to improve the quality and attraction of using other travel modes for the daily commute. It may also be important to consider the use of travel demand management strategies to help support a modal shift away from the car.

4.10 What do highways users want

Warrington is captured by a 'motorway box' with many residents and workforce using the SRN to commute to and from Warrington. Therefore, it is useful to consider road use priorities of highways users to inform future transport policy.

Transport focus, the independent transport watchdog, published research looking at national road users' needs and experience using the Strategic Road Network (SRN). The research also explored users' views on safety, journey planning, congestion and disruption. It showed that road users tend to focus on the negative experiences and overlook typical journeys.
The research provides a useful indication of what car users priorities are for improvement of the SRN in England. This is summarised in the figure below:

Figure 67: Modal share comparison for Warrington



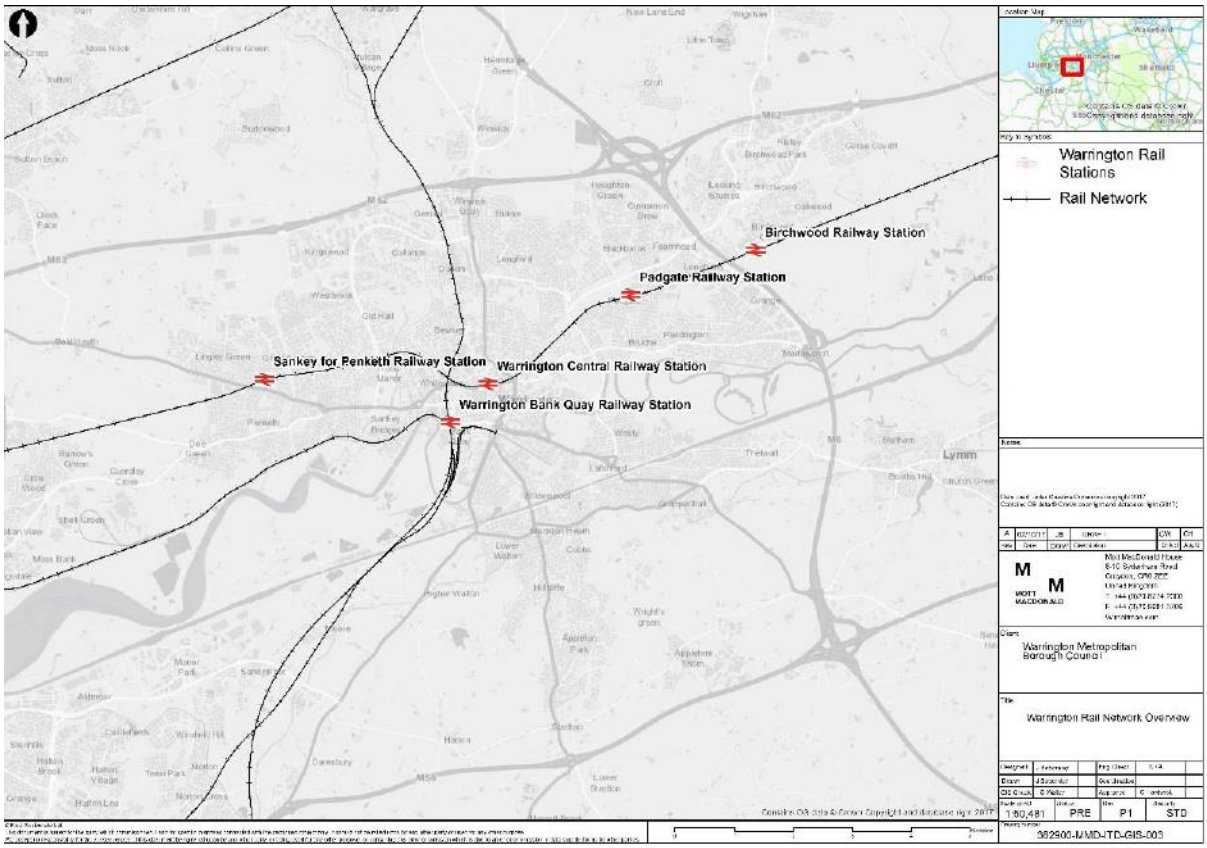
Source: Transport focus - Road users priorities for imporvement: Car, van and motorcycles

What does this mean for LTP4?
The responsibility to maintain and improve the SRN rests with Highways England. However, within Warrington, drivers use the town's local highways network to connect to the SRN. LTP4 should therefore look to improve journey time reliability and journey times when connecting to the SRN to help enhance the overall experience of travelling from home to using the SRN.

4.11 Rail travel

There are six rail stations in Warrington. A map of Warrington's rail network is shown in Figure 3.12. The Cheshire Lines Committee (CLC) Line runs east to west through Warrington, the West Coast Main Line (WCML) runs north to south through the Borough, and the Ellesmere Port – Warrington Line provides a service from Warrington Bank Quay to Ellesmere Port.

Figure 68: Rail network



Source: Mott MacDonald

Five of the six stations in Warrington are along the CLC Line and the services on this line are summarised in Table 15 with stations in Warrington highlighted. The table shows varying levels of rail provision at Warrington stations on the CLC Line from Glazebrook with a Northern service every two hours to Warrington Central which is served by all four services.

Table 15: Warrington rail services (CLC line)

Operator	Manchester Piccadilly	Manchester Oxford Road	Deansgate	Trafford Park	Humphrey Park	Urmston	Chassen Road	Flixton	Irlam	Glazebrook	Birchwood	Padgate	Warrington Central	Sankey for Penketh	Widnes	Hough Green	Halewood	Hunts Cross	Liverpool South Parkway	West Allerton	Mossley Hill	Edge Hill	Liverpool Lime Street
Transpennine Express	●	●									●		●						●				●
Northern		●	●			●		●	●		●		●		●	●			●	●	●	●	●
East Midlands Trains	●	●											●		●				●				●
Northern		●	●	□	□	●	□		●	□	●	●	●	●	●	●	●	●	●	●	●	●	●

Source: CLC Part 1 Market Analysis Report, AECOM (2017). The table resperesnets Mon-Fri passenger services. Black circles represent the service stops at this staton. The square outlines symbolise the service stops every two hours. Warrington stations highlighted in blue.

The WCML provides connectivity to stations between London Euston and Glasgow Central, whilst the Ellesmere Port to Warrington Line operates just four services per day

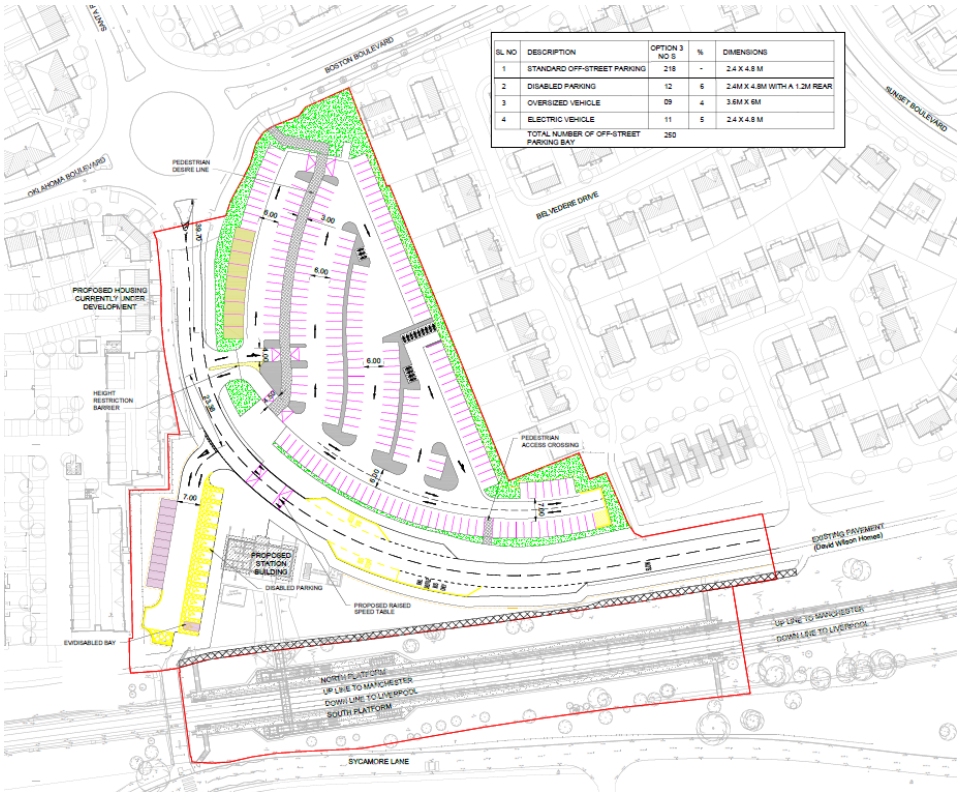
4.11.1 Warrington West Station

The new Warrington West rail station was approved in late 2017 where it received full funding, and opening is expected in 2019/20. The station will be positioned on the CLC line between Central station and Sankey for Penketh.

Warrington West station, adjacent to Sycamore Lane, would provide enhanced accessibility for the southern end of the Chapelford Urban Village residential development. The intention is that this will act as a key interchange node, improving accessibility throughout Warrington's northern sector and servicing the Chapelford, Lingley Mere and Omega development zones.

The concept design of the station is shown in Figure 69. The new station will provide three services per hour (as per the franchise agreement), enhancing the opportunity to serve the local area, and regional centres of Liverpool and Manchester with an improved service frequency. The station will also provide 268 car parking spaces, secure parking for 50 bicycles, bus stops and layover facilities and a taxi rank / drop-off area. The station is due to be completed in Spring 2019.

Figure 69: Concept design of Warrington



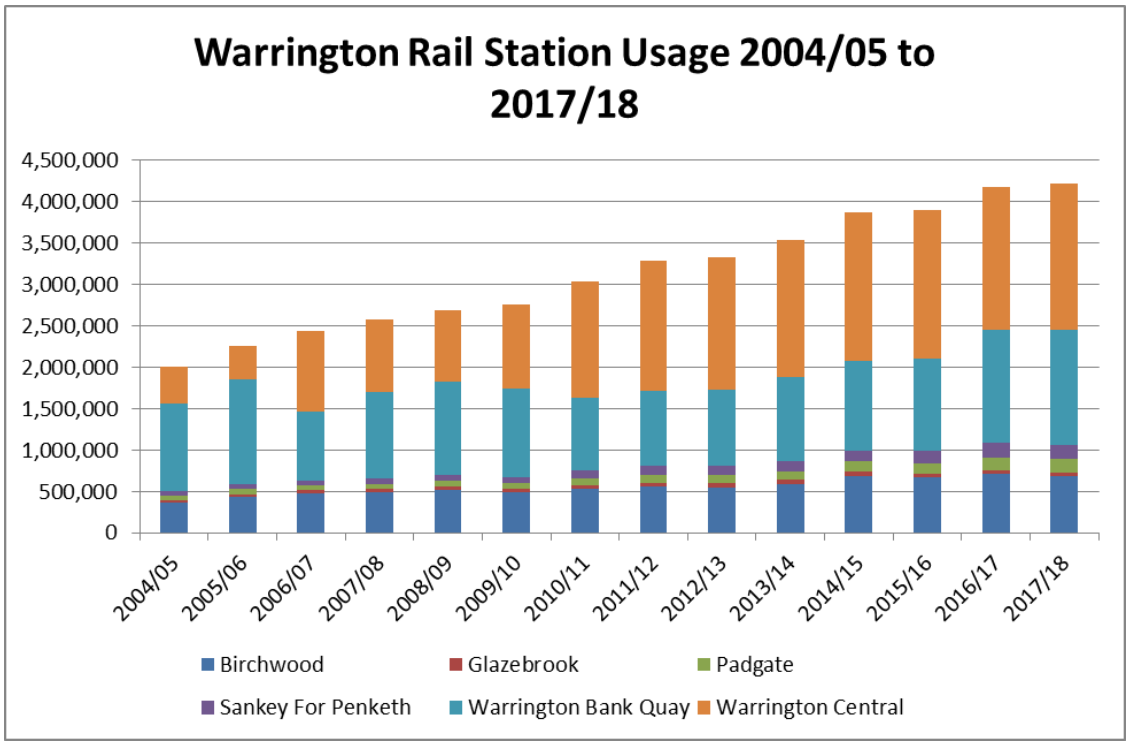
Source: Warrington Borough Council

4.11.2 Rail patronage

Nationally, rail use is growing[1]. This trend is evident in Warrington (Figure 70). Between 2004/05 and 2017/18, patronage across the six rail stations more than doubled. Table 16 presents the number of entries / exits at each station.

[1] DfT Rail Factsheet November 2017

Figure 70: All Warrington stations – rail entries and exits (2004/05 to 2016-17)



Source: Office of Rail Regulation

Table 16: Warrington rail station entries and exists rail

Station Name	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
Birchwood	366,301	434,306	481,594	493,027	512,042	489,242	526,880	555,138	549,578	583,454	686,668	670,450	712,562	687,758
Glazebrook	28,462	30,750	33,378	34,593	42,598	41,226	47,360	47,592	49,524	54,548	49,442	48,380	47,032	45,432
Padgate	54,685	62,768	59,992	61,288	68,656	67,868	80,224	91,668	94,002	107,166	127,552	124,232	150,728	155,582
Sankey For Penketh	56,905	62,980	59,780	69,285	78,730	75,468	99,652	120,118	111,822	118,460	134,156	144,868	172,346	171,648
Warrington Bank Quay	1,054,508	1,261,505	830,481	1,042,754	1,120,926	1,073,842	879,322	894,710	923,214	1,011,584	1,081,176	1,110,400	1,363,569	1,390,484
Warrington Central	443,650	398,620	968,743	869,321	868,835	1,007,372	1,406,445	1,568,006	1,592,958	1,661,954	1,785,378	1,801,788	1,729,877	1,764,022

Source: Office of Rail Regulation

The key findings of entries and exist at Warrington stations are summarised below:

- Between 2010-11 and 2016-17, Rail trips have increased across the Borough by 37%;
- Warrington Central is the busiest station in the Borough with 1,729,877 entries and exits in 2016/17 and accounts for 41% of the total rail trips for the Borough;
- Warrington Bank Quay and Birchwood are the next busiest stations with 33% and 17% respectively for the Borough;
- The greatest increases in passengers occurred on the CLC line east and west of the town centre; at Padgate and Sankey for Penketh (88% and 73% respectively); and
- Glazebrook has witnessed a small decline of -1%.

Data along the CLC Line was analysed to understand current operations and usage during the preparation of a Market Analysis Report for the CLC Line. Table 17 presents the station origin and destinations along the CLC Line for 2015/16.

Table 17: Origin-destination CLC annual demand (2015/16, '000s)

		Destination								
		Liverpool Lime Street / Edge Hill	Mossley Hill to Sankey	Warrington	Padgate to Trafford Park	Manchester stations	East External	West External	North / South External	Total
Origin	Liverpool Lime Street / Edge Hill	-	101.6	**122.9**	54.5	261.4	228.0	-	-	**768.4**
	Mossley Hill to Sankey	497.4	72.0	**117.7**	48.9	347.2	78.6	51.6	22.2	**1,235.6**
	Warrington	**276.5**	**44.9**	**-**	**111.3**	**513.6**	**101.2**	**18.9**	**7.3**	**1,073.7**
	Padgate to Trafford Park	69.6	13.4	**104.2**	65.7	778.6	36.4	9.1	9.8	**1,086.8**
	Manchester stations	216.7	54.0	**148.8**	217.2	-	-	34.5	-	**671.2**
	East External	318.3	51.5	**88.3**	36.3	-	-	46.0	-	**540.4**
	West External	-	21.4	**30.1**	19.7	137.2	56.3	-	-	**264.7**
	North / South External	-	11.7	**9.2**	20.2	-	-	-	-	**41.1**
	Total	**1,378.5**	**370.5**	**621.3**	**573.8**	**2,037.9**	**500.4**	**160.1**	**39.3**	**5,681.3**

Source: CLC Part 1 Market Analysis Report, AECOM (2017)

A summary of the origin and destination trips along the CLC is given below:

- Warrington stands out as a key origin of trips along the line with Manchester and Liverpool the most frequent destinations;
- Of all origins along the line, 19% originated at Warrington with the only greater origins being Mossley Hill to Sankey and Padgate to Trafford Park (22% and 19% respectively);
- Of the journeys originating at Warrington, almost half (48%) were alighting at Manchester stations, over a quarter at Liverpool/Edge Hill (26%), 10% at a station between Padgate and Trafford park, and 9% travelling at a station east of Manchester;
- The most common destinations to the east of Manchester, from Warrington, are Leeds, Sheffield, Stockport and York; and
- 19% of return journeys originated at Warrington, whereas 11% just alighted at Warrington. Therefore, indicating greater out-flow by rail compared with in-flow.

Station ambience was also rated as part of the Market Analysis Report and this was on a four point scale (Very Good, Good, Poor, Very Poor). Stations ratings are shown below:

- Warrington Central - 'Very Good'
- Birchwood - 'Good'
- Sankey for Penketh – 'Poor'
- Padgate – 'Poor'
- Glazebrook - 'Poor'.

4.11.3 Rail journey times

A summary of rail journeys time to and from Warrington Central and Warrington Bank Quay are shown in Table 18.

Table 18: Fastest rail journey times to / from Warrington (minutes)

	From Warrington Central	From Warrington Bank Quay	To Warrington Central	To Warrington Bank Quay
Manchester Piccadilly	28	45	20	35
Liverpool Lime Street	29	-	22	-
Birchwood	5	-	5	-
Newton-le-Willows	-	13	-	13

Source: CLC Part 1 Market Analysis Report, AECOM (2017). Rail journey times departing between 08:00 and 09:00, direct services only.

The CLC Market analysis report also undertook a journey time comparison between bus/coach, private car and the fastest rail journey for travel between Warrington and Manchester/Liverpool (Table 19). The results highlight the fastest rail journey is the quickest mode of travel, compared with car and bus / coach, during the AM peak and interpeak.

Table 19: Journey time comparison for bus/coach, private car and the fastest rail journey for travel between Warrington and Manchester/Liverpool (minutes)

	Bus / Coach (AM Peak)	Bus / Coach (inter-peak)	Car (AM Peak)	Car (inter-peak)	Rail (fastest)
Warrington to Manchester	131	100	47	40	20
Manchester to Warrington	113	113	45	43	16
Warrington to Liverpool	93	45	47	41	29
Liverpool to Warrington	92	89	41	40	22

Source: CLC Part 1 Market Analysis Report, AECOM (2017). N.B. table presents Mon-Fri passenger service.

4.11.4 Key findings of rail travel

The key findings of the rail network within Warrington are summarised below:

- The number of rail users in Warrington is growing, with a 37% increase observed between 2010-11 and 2016-17.
- Warrington Central is the busiest station in the Borough with 1,729,877 entries and exits in 2016/17 and accounts for 41% of the total for the Borough.
- The greatest increases in rail passengers occurred on the CLC line east and west of the town centre; at Padgate and Sankey for Penketh (88% and 73% respectively).
- Along the CLC Line, Warrington is a key trip origin and there is evidence of greater rail outflow compared with inflow on the line.

- Of the journeys originating at Warrington, almost half (48%) were alighting at Manchester stations, over a quarter at Liverpool/Edge Hill (26%), 10% at a station between Padgate and Trafford park, and 9% travelling at a station east of Manchester.
- Anticipated service changes and a new station at Warrington West would have a positive impact on the rail network.

What does this mean for LTP4?
The rail network provides fast connection within and out of Warrington. Rail patronage is shown to be increasing within the Borough. LTP4 should consider how more residents and workers can benefit from Warrington's rail network. Future policy should consider the following:

- Encourage more residents and workers to undertake a modal shift away from the car and use rail services for short and long-distance commuting;
- Deliver rail services that can help provide an increasing 'metro' function within the town, where residents and workers use rail services to access the different parts of the Borough;
- Continue to speak with Rail stakeholders and operators over improving the reliability and quality of services on Warrington's rail lines;
- Promote the use of park and ride facilities at stations to reduce the number of vehicles entering the town centre; and
- Ensure there are adequate active travel connections between existing and new stations to promote sustainable multi-modal travel.

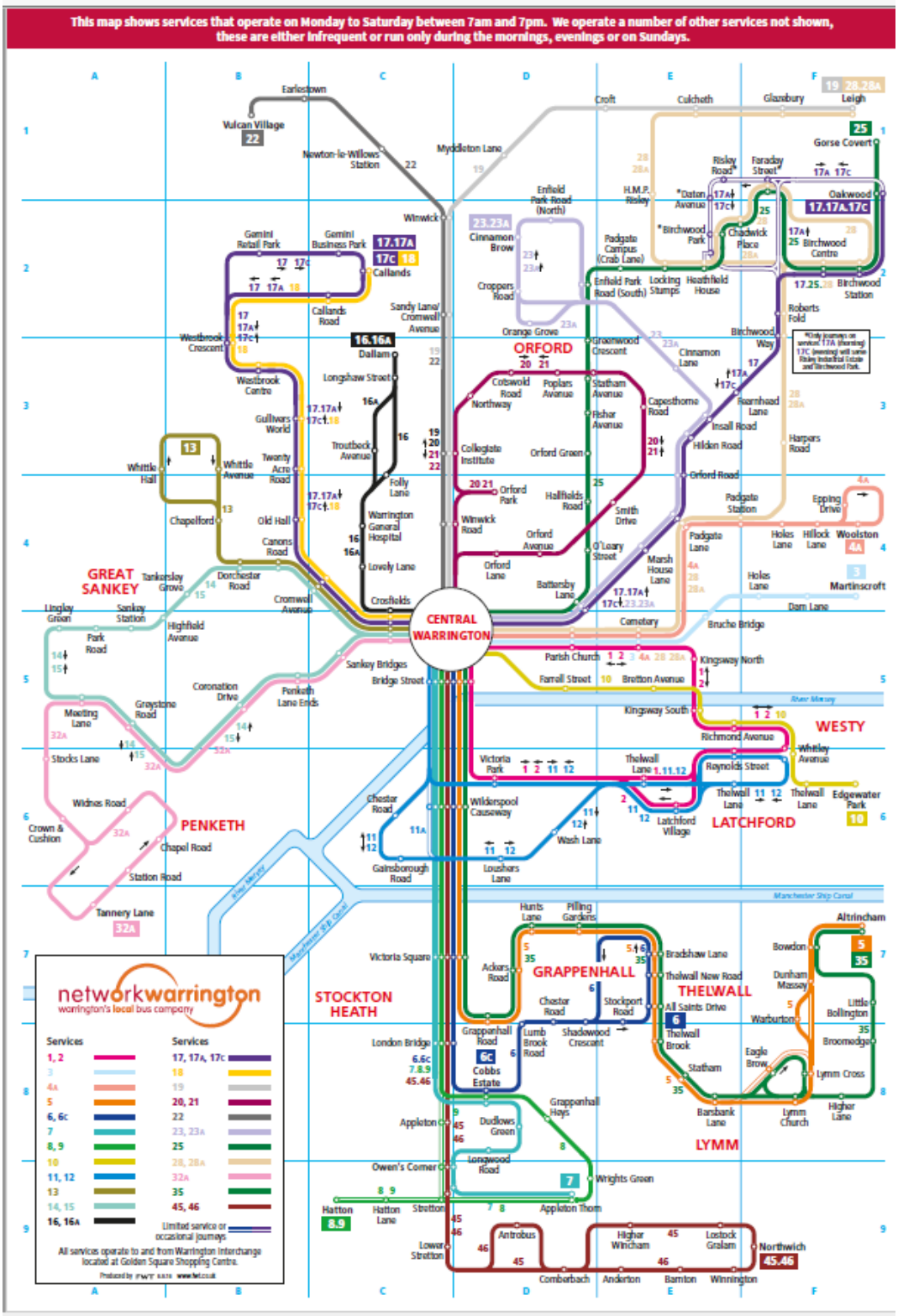
4.12 Bus travel

Network Warrington is the main bus provider within Warrington and Figure 71 illustrates this network. The bus network shows services are centred on Warrington Interchange with most services providing a circular route from the town centre. This provides effective access to the town centre.

There are very few cross-city routes or routes between outlying parts of the Borough, leading to passengers often requiring two services to get to destinations beside the town centre.

A new regular bus service calling at Bank Quay rail station was introduced in 2018. Subsequently, there is now a bus every ten minutes into the town centre and to Stockton Heath and beyond.

Figure 71: Network Warrington bus network



Source: https://www.warringtonsownbuses.co.uk/assets/images/content/Network-Map-Final.pdf

Arriva also operate several bus services within Warrington and Table 20 identifies these services and the locations served. Arriva services extend the available bus network,

particularly to the south west and west of Warrington with services to Runcorn, Chester and Liverpool. In addition, there are several bus services operated by smaller companies, as well as private sector funded commuter services within the Borough.

Whilst route coverage and frequencies of the bus network have fallen in Warrington in recent years, no more than 10% of services are publicly subsidised and WBC have also stopped funding evening services. Furthermore, there has been some increase in evening bus services across the Borough in recent years, implying that some of these routes are now considered commercially viable by operators.

Table 20: Arriva bus services operating within Warrington

Arriva Bus Service	Locations Served
21 / X30	Chester to Runcorn and Warrington via Frodsham and Daresbury
110	Murdishaw to Warrington via Runcorn, Widnes and Penketh
329	St Helens to Warrington via Winwick
7 / 7A	Warrington / Huyton to Liverpool
360	Warrington to Wigan via Winwick, Newton, Golborne and Platt Bridge

Source: Arriva website

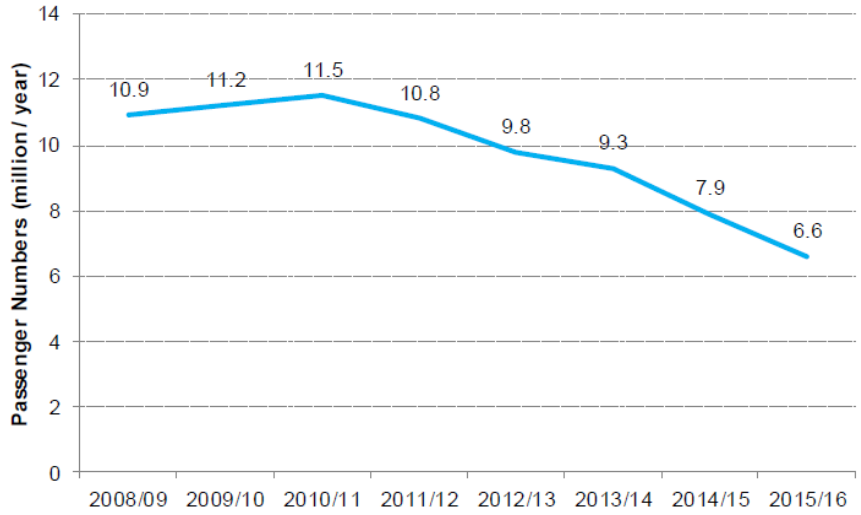
The majority of bus services finish at 23.00 and have limited services on most routes on Sundays.

4.12.1 Bus patronage

Bus patronage in Warrington between 2008/09 and 2015/16 is presented in Figure 72. The chart shows bus patronage was relatively stable between 2008/09 and 2011/12, fluctuating between 10.8 and 11.5 million passengers / year. However, since 2010/11, bus patronage has fallen from 11.5 to 6.6 million passengers / year. This is nearly a 43% drop in patronage and vastly exceeds the 10% decrease in patronage observed across the North West region over the same time period [2].

[2] Department for Transport Passenger journeys

Figure 72: Bus patronage (boarders in Warrington Borough Council area)



Source: Introduction to Public Transport Presentation WBC June 2016

Figure 72 shows bus patronage fell by 39% in Warrington between 2008/09 and 2015/16. Similarly, national trends have also shown declining bus patronage with the 2015 National Travel Survey demonstrating a 19% decrease since 1995/97.

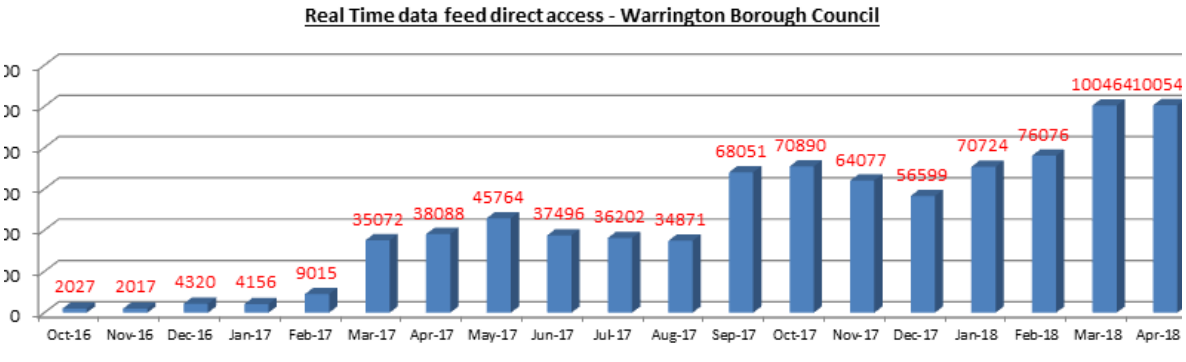
4.12.2 Bus Real time passenger information

In October 2016, Warrington launched real time bus passenger information system (RTPI). The system monitors the real time position of the majority of buses operating scheduled bus services across the borough and sends countdown information of bus arrivals to 55 digital displays located at many of the most popular bus stops.

Passengers with internet enabled devices get reliable, live information for any of the 1,300+ bus stops across the borough. The service is helping to improve the quality of bus travel and make journeys easier.

Warrington Borough Council monitors how many hits the RTPI website receives. Figure 73 shows the number of monthly downloads for the website between October 2016 and April 2018. The graph shows that the use of RTPI is growing and there is continuing use of the service.

Figure 73: Real time bus passenger information monthly downloads



Source: Warrington Borough Council

4.12.3 Fare price

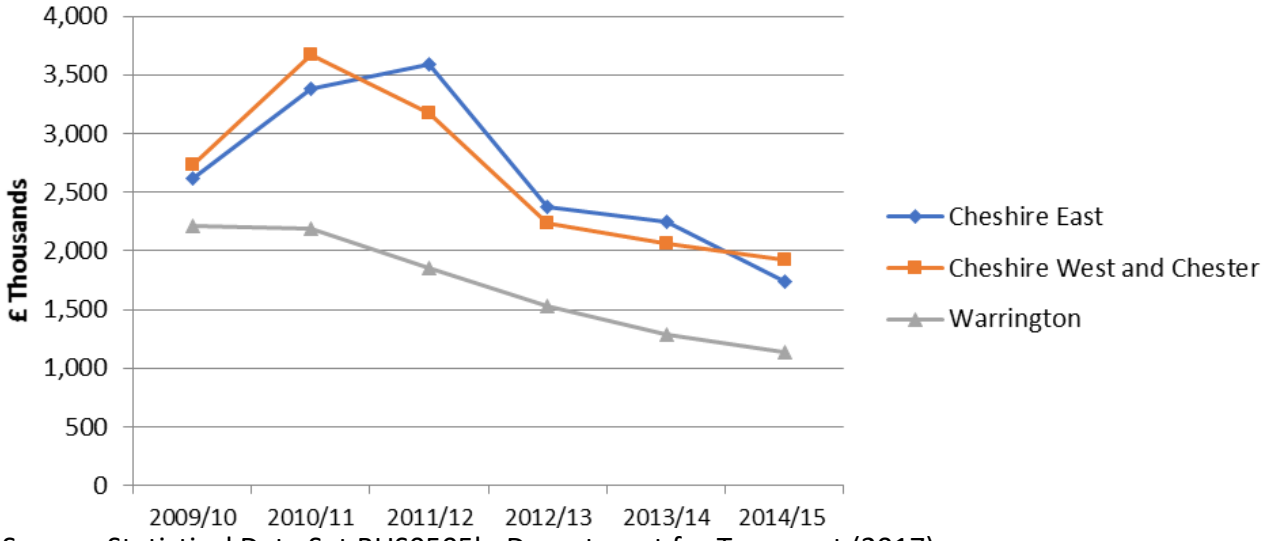
One of the influencing factors behind declines in bus patronage is an overall trend for increases in bus fares. Between 1995 and 2016 the average bus fare in England (in real terms) rose by 45.3%. There are significant regional differences within this figure with fares in London rising by 36% against a 60% increase in other Metropolitan areas outside of London. In English non-metropolitan areas the increase in fares was 34%. If passengers do not feel that fares provide value for money they are likely to look at alternatives.

This has become a problem in Warrington; feedback from the Warrington Transport Summit indicated that the high cost of public transport was a key factor in why residents choose the car to travel. Furthermore, the price of a bus fare for two adults to take a taxi for a return journey across many areas of Warrington is cheaper than it is to use the bus for two persons. Subsequently, taxis have been noted to provide an increasingly competitive offer to the bus.

4.12.4 Funding

In a climate of public spending restraint and devolved responsibility transport funding, there has been a significant reduction in expenditure in subsidised bus services. Figure 3.3 and Table 3.2 highlight the reduction in local bus spend in the Sub Region and identify the overall decline in spend between 2009/10 and 2014/15. The most significant reduction was in Warrington (-48%).

Figure 74: Estimated net support paid by central and local government for Local Bus Services



Source: Statistical Data Set BUS0505b, Department for Transport (2017)

[3] DfT, Costs, fares and revenue (BUS0405B), 14 June 2016

Table 21 Spend on Local Bus Services between 2009/10 and 2014/15

	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	% change 09/10-14/15
CEC	2,618	3,380	3,593	2,379	2,246	1,742	-33%
CWaC	2,734	3,667	3,172	2,231	2,056	1,925	-30%
Warrington	2,215	2,192	1,849	1,527	1,282	1,141	**-48%**
TfGM	36,487	37,855	41,564	37,631	37,742	35,523	-3%
Merseytravel	18,277	17,438	17,599	19,023	18,536	16,596	-9%

Source: Statistical Data Set BUS0505b, Department for Transport (2017)

4.12.5 Congestion

Congestion and poor journey time reliability has been noted to be a serious problem along Warrington's highways network. The impact of congestion can result in a downward trajectory in service quality and passenger numbers.

In Professor David Begg's report on the impact of congestion on bus passengers, highlighted the following patterns associated with increased congestion on bus routes [4]

1. Slower speeds leading to higher costs, higher fares, fewer passengers, service decline, fewer passengers;
2. Slower speeds leading to increased journey time, fewer passengers, service decline, fewer passengers; and
3. Slower speeds, punctuality and reliability decline, fewer passengers, service decline, fewer passengers.

For operators, the response to congestion is either to increase frequency (with increased costs and therefore fares) or decrease frequency. Either option is likely to result in reduced patronage.

This correlation between journey times and patronage outlines the importance of addressing congestion for the future vitality of the bus network. Not only is this important from an accessibility perspective but it is also important for the health of the local economy and from an environmental perspective with fuel efficiency declining when driving in congested areas.

4.12.6 Key findings of bus travel

The key findings of bus travel within Warrington are presented below:

- Bus services in Warrington are centred on Warrington Bus Interchange with the majority of services providing a circular route from the interchange. This often requires passengers to change services in the centre for cross town journeys.
- Between 2010/11 to 2015/16, there has been a decline in bus patronage from 11.5million to 6.6 million per year.

[4] The impact of Congestion on Bus Passengers, (2016), Professor David Begg

- Bus patronage in Warrington has declined at a greater rate than the North West average.
- Use of Warrington's Real Time Bus passenger information is increasing
- The majority of bus services finish at 23.00 and have limited services on most routes on Sundays.
- Bus fares have also increased in recent years. As a result, taxis are becoming an increasing competitor to local bus services
- There has been a significant reduction in local bus spend in Warrington, with a reduction of -48% between 2009/10 and 2014/15.

What does this mean for LTP4?
Buses provide a crucial transport mode; they present an efficient means of travelling short to medium distances, and present good connections to the town centre and across the Borough. Bus travel also presents an affordable means of travel and the services are important in providing for residents with low incomes and those who do not have access to a car.

LTP4 provides the opportunity to consider the development of a more comprehensive bus strategy and to consider bus priority measures, bus rapid transport, and provide better access to the town's key employment destinations.
The introduction of the Buses Bill and devolved powers to combined authorities could also have the opportunity to increase the governance of bus service provision within Warrington.

4.13 Passenger transport satisfaction

This section reviews public transport satisfaction with services that operate within Warrington. The analysis draws upon passenger surveys within Warrington and across the UK.

4.14 Rail passenger satisfaction

Transport Focus are an independent transport user watchdog. They undertake annual surveys into rail passenger satisfaction. The 2017 National Rail Passenger Survey provides the overall satisfaction of rail services that operate within Warrington. The operators and routes of interest are:

- Northern: West
- East Midlands Trains: Liverpool – Norwich
- TransPennine Express: North West
- Virgin Trains London – Scotland

Figure 75 shows no significant change in passenger satisfaction on the above named routes. There were variations in satisfaction between services, but generally reasonably high levels

were exhibited: Northern (82%); East Midlands (77%); TransPennine Express (77%); and Virgin (90%).

Figure 75: Overall satisfaction for operators for routes

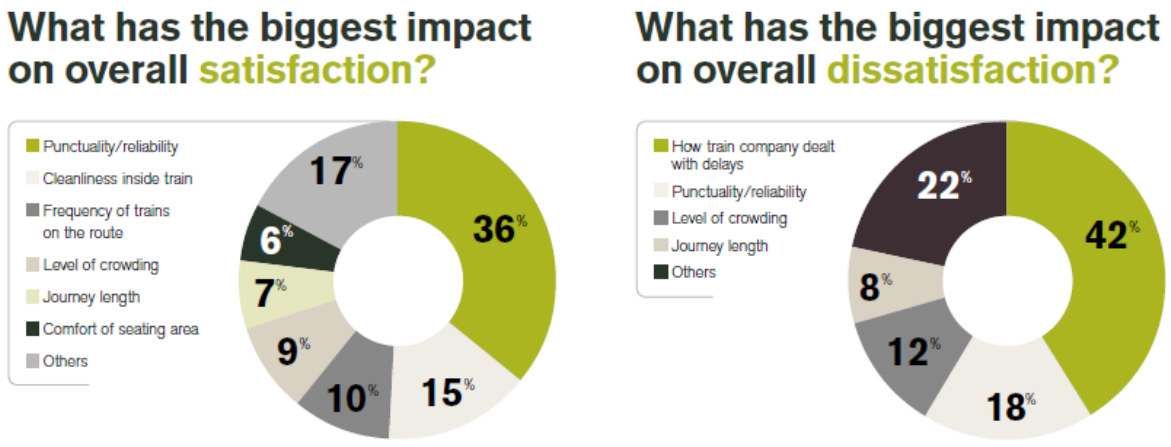
Route	sample size	% satisfied or good	significant change
Arriva Trains Wales: Cardiff and Valleys	231	79	=
Arriva Trains Wales: interurban	249	86	=
Arriva Trains Wales: Mid Wales and Borders	320	88	=
Arriva Trains Wales: North Wales and Borders	101	87	=
Arriva Trains Wales: South Wales and Borders/West Wales	76	61	↓
c2c: Southend Line	615	91	=
c2c: Tilbury Line	359	87	=
Chiltern Railways: commuter	258	88	=
Chiltern Railways: Metro	249	85	=
Chiltern Railways: Oxford	174	82	=
Chiltern Railways: West Midlands	284	94	=
CrossCountry: East - West	349	83	=
CrossCountry: North - South Manchester	295	79	=
CrossCountry: North - South Scotland and North East	579	86	=
East Midlands Trains: Liverpool - Norwich	223	77	=
East Midlands Trains: local	209	90	↑
East Midlands Trains: London	558	86	=
Gatwick Express*	451	81	=
Grand Central: London - Bradford	72	95	=
Grand Central: London - Sunderland	585	96	↑
Great Northern*	592	77	=
Great Western Railway: Long-distance	769	82	=
Great Western Railway: London Thames Valley	418	78	=
Great Western Railway: West	400	78	=
Greater Anglia: Intercity	257	91	↑
Greater Anglia: Mainline	487	80	=
Greater Anglia: rural	128	81	=
Greater Anglia: Stansted Express	110	93	=
Greater Anglia: West Anglia	313	76	↓
Heathrow Connect	474	83	=
Heathrow Express	442	91	↓
Hull Trains	568	95	=
London Midland: London commuter	252	84	=
London Midland: West Coast	190	88	=
London Midland: West Midlands	611	83	=
London Overground: Gospel Oak - Barking	84	84	-
London Overground: Highbury and Islington - Croydon/Clapham	470	90	=
London Overground: Richmond/ Clapham - Stratford	469	84	↓
London Overground: Watford - Euston	159	90	=
London Overground: West Anglia	387	86	=
Merseyrail: Northern	530	87	↓
Merseyrail: Wirral	241	92	=
Northern: Central	410	79	=
Northern: East	648	81	=
Northern: North East	306	90	=
Northern: West	293	82	=
ScotRail: Interurban	499	84	=
ScotRail: rural	93	86	=
ScotRail: Strathclyde	477	84	=
ScotRail: urban	297	87	=
South Western Railway: Island Line**	123	88	=
South Western Railway: Longer-distance**	728	74	↓
South Western Railway: Metro**	728	74	=
South Western Railway: outer suburban and local**	542	77	=
Southeastern: High Speed	271	91	=
Southeastern: Mainline	492	79	=
Southeastern: Metro	748	79	=
Southern: Metro*	555	71	=
Southern: Sussex Coast*	733	74	↑
TfL Rail	215	75	=
Thameslink: Loop*	306	84	=
Thameslink: Kent*	211	81	↑
Thameslink: North/South*	567	84	↑
TransPennine Express: North	719	84	=
TransPennine Express: North West	170	77	=
TransPennine Express: South	110	68	=
Virgin: London/Birmingham - Scotland	246	87	=
Virgin: London - Liverpool	121	93	=
Virgin: London - Manchester	294	92	=
Virgin: London - North Wales	74	91	=
Virgin: London - Scotland	173	90	=
Virgin: London - Wolverhampton	273	94	=
Virgin Trains East Coast: London - Leeds and West Yorkshire	342	93	=
Virgin Trains East Coast: London - Newcastle/Sunderland and East Yorkshire	189	92	=
Virgin Trains East Coast: London - Scotland	524	91	=

Source: Introduction to Public Transport Presentation WBC June 2016

The report also summaries the biggest drivers for customer satisfaction and these are summarised in Figure 76 . Punctuality and reliability is the biggest factor in providing affecting satisfaction levels for train services followed by other factors and cleanliness of the train inside.

The largest factors affecting overall dissatisfaction with rail services are how the operator deals with delays, other factors and the punctuality and reliability of services.

Figure 76: Key drivers for customer satisfaction and



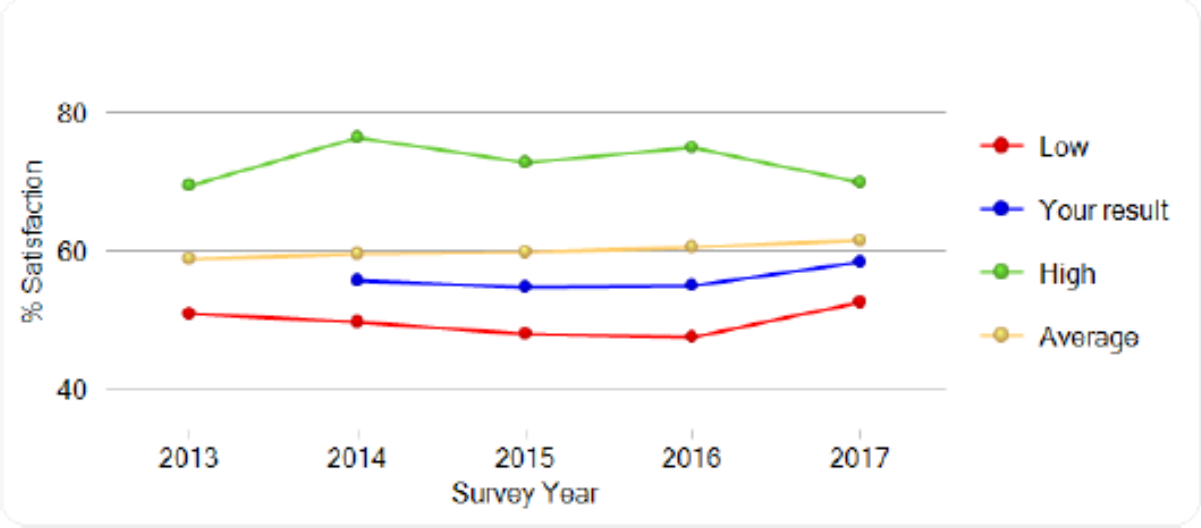
Source: Introduction to Public Transport Presentation WBC June 2016

4.14.1 Bus passenger satisfaction

The national Highways and Transport network (NHT) undertake surveys of public transport satisfaction for bus services at a local authority level. Therefore, an interpretation of satisfaction with bus services in Warrington can be obtained.

Figure 77 shows that passenger satisfaction in 2017 with local bus services within Warrington (57%), fall below the national average (60%) and rank 83rd out of all the 112 authorities who responded to the survey.

Figure 77: Satisfaction with local bus services in Warrington compared with the national average



Source: NHT Survey Report 2017: Warrington BC Public Transport Theme Report

Figure 78 shows how passenger satisfaction with bus services in Warrington has changed over time between 2014 and 2017. The analysis shows satisfaction with local services to improve. Whereas the information available on public transport, the satisfaction with taxi/mini cab services and community transport to decline.

Figure 78: Satisfaction results with local bus services in Warrington (2014-2017)

Question	2014	2015	2016	2017
KBI 06 - Local bus services	55	54	56	57
KBI 07 - Local bus services (BVPI 104)	54	57	60	
KBI 08 - Public transport info (BVPI 103)	47	45	43	
KBI 09 - Taxi/mini cab services	64	61	60	61
KBI 10 - Community Transport	59	55	56	57

Source: NHT Survey Report 2017: Warrington BC Public Transport Theme Report

4.14.2 Warrington transport summit – public transport

Warrington Borough Council has hosted a series of Transport Stakeholder Summits that were intended to obtain view from stakeholders over Warrington's transport system. The third transport summit focused on passenger transport.

The event took place 15th November 2017 and was well-attended, with 36 delegates present. The findings of the summit are split into two parts:

- Current passenger transport in Warrington
- Methods for transforming passenger transport in Warrington

Current passenger transport

Delegates were first asked about what they consider to be the most important issues regarding bus and rail services in Warrington. These are summarised below in Table 22. Responses were wide ranging and took in the cost of travel, the times and routes of services that are available, the impact of congestion, accessibility issues, mode integration, and communication with passengers.

Table 22: What are the key issues for current passenger services in Warrington

Issue Type	Comments Summary
Bus	• Radial bus routes often mean needing more than one bus for journeys, changing in the town centre • Congestion leads to buses being late or unreliable • Improving facilities on buses (e.g. Wi-Fi) would make bus travel more attractive • Bus services should operate later into the evening
Rail	• There is insufficient capacity on Liverpool - Manchester services • More space is needed for pushchairs and bikes • The direct connection to Manchester (and beyond) is important
Integration of Bus and Rail	• There should be better communication to bus passengers about rail services and vice versa • Bus access to Warrington Bank Quay is poor • Buses to stations should be timed to meet rail services
Price	• Both bus and rail fares are too expensive • Price of travel prohibits people (particularly young people) accessing key services • Price of travel encourages people to drive
Groups with Protected Characteristics	• Disabled facilities at Birchwood, Padgate and Sankey for Penketh stations should be improved • More buses and bus stops should be equipped for step- free access • Cost and service levels risk isolation for elderly and young people
Large Employment Sites	• The shuttle bus to Lingley Mere has been very successful but improvements are needed on services to Birchwood Park • Buses should better serve shift workers

Source: Warrington Borough Council Passenger Transport Stakeholder summit

Delegates were asked what Warrington Borough Council should be doing to improve passenger transport in the next five years. Responses were wide-ranging and included consideration of bus, rail, ticketing, and accessibility, integration of different modes, improved partnership working, and communication with passengers. The responses are summarised in the table below.

Table 23: What should we be doing to improve passenger transport in the next five years

Issue Type	Comments Summary
Bus	• Reduce prices • Improve journey times • Seek more influence over bus service routeing • Improved fleet - better facilities and emissions standards • More bus priority measures
Rail	• Seek reduced cost of travel • Protect Liverpool/Manchester services to/from smaller stations
Integration of Transport Modes	• Improve Active Travel links to and facilities at stations • Better integration of bus/rail timetables • 'Travel hubs' outside of town centre • Allow large mobility scooters to use cycle lanes
Communication with Passengers	• Improved marketing to change perceptions of bus travel • Further improvement and promotion of RTPI • Improved timetable information at stops, and bus stop directional signage to key destinations
Groups with Protected Characteristics	• Improve services to key youth facilities such as the Peace Centre • Improve booking system for rail passengers in wheelchairs
Policy Changes	• Plan new developments to encourage sustainable travel • Increase Council influence over passenger transport services • Seek new funding sources • Roll out smart ticketing across all modes • Improved partnership working between Council and key stakeholders

Source: Warrington Borough Council Passenger Transport Stakeholder summit

Transforming passenger transport in Warrington

The second part of the summit focussed on methods of transforming the passenger transport offer in Warrington in the long term. The majority of responses expressed support for new transport modes such as trams and Bus Rapid Transit, but there was less agreement on the specific mode that should be introduced.

Other responses considered methods of influencing behaviour change, park and ride, and changes to land use planning. The responses are summarised in Table 24.

Table 24: How should we transform passenger transport in Warrington?

Issue Type	Comments Summary
New Passenger Transport Modes	• Need for new passenger transport modes was identified but views on what that mode should be varied between Guided Buses, Bus Rapid Transit, and trams • Lack of flexibility of a tram network was identified as an issue should this mode be introduced • Demand Responsive transport options should be considered • Active travel routes should run alongside new passenger transport corridors
Behaviour Change	• Use technology to target younger people when influencing travel choices • The way people work will change in the future, possibly reducing the demand for travel • Offer incentives to businesses that encourage use of sustainable modes for commuting
Park and Ride	• The location of parking sites is vital to the success of any park and ride facility • Park and stride should be considered
Land Use Planning	• The location of employment sites, and the nature of the employment they offer will affect how people travel to work • Plan spaces to accommodate mobility scooters

Source: Warrington Borough Council Passenger Transport Stakeholder summit

The second question in this section of the summit asked delegates to consider what the Council and other stakeholders should be doing now as we work towards transforming passenger transport. The responses, summarised in Table 25, considered researching and identifying a preferred option for a transformative passenger transport system, changes to council policy, influencing use of the highway, and improving the current passenger transport offer.

Table 25: How should WBC transform passenger transport in Warrington?

Issue Type	Comments Summary
Policy Changes	• Town centre regeneration should create a space that is attractive and accessible for all users and accommodates various transport modes • Future planning should be flexible and able to react to market/technology changes • Planning policy should encourage employers to consider sustainable commuting
Research and Evidence Base	• Look at best practice from other locations to identify the preferred mode and routes • Identify design and costs of preferred scheme
Highway Infrastructure	• Seek ways of discouraging rat-running and preventing motorway traffic using the town centre • Acceptance that road building is not a long term solution to town centre congestion
Improving Current Offer	• Improve bus fleet to increase the number of lower emission vehicles • Improve facilities and reduce costs for public transport users

Source: Warrington Borough Council Passenger Transport Stakeholder summit

For the next question delegates were asked to think about how transformational passenger transport changes could be funded. Suggestions included a Workplace Parking Levy, increasing Council Tax and Business Rates, and exploring wider funding sources. These are summarised in Table 25.

Table 26: How should WBC transform passenger transport in Warrington?

Issue Type	Comments Summary
Workplace Parking Levy	• A Workplace Parking Levy was identified as a potential funding mechanism which has been successful in other locations
Council Tax and Business Rates	• Local retention of business rates • A Council Tax precept that is ring fenced for transport improvements. The benefits of this would need to be clearly outlined to residents
Wider Funding Sources	• Seek funding from Public Health to deliver these benefits to air quality and increasing physical activity • Seek funding from central Government • Tolling could be considered if this does not deter visitors • Use parking revenue and fines from traffic infringements • Partnership working with the transport operators, particularly those that would benefit from increased use of public transport

Source: Warrington Borough Council Passenger Transport Stakeholder summit

4.14.3 Key findings of public transport satisfaction

The key findings of public transport satisfaction are summarised below, this is categorised according to rail and bus travel:

- Bus passenger satisfaction levels in Warrington are below the national average. However, satisfaction levels have increased over the last 2 years.
- The routing of services and congestion in the town was identified to reduce the quality of bus services.
- Stakeholders suggested implementing bus priority measures, modern technology, services to operate later in the evening, better routing and improving journey reliability to help improve the quality of service.
- A key theme of the feedback from the transport summit was a requirement for improved communication. This includes communication amongst the key stakeholders to improve integration of services at transport hubs and create a more consistent service for multi-mode journeys.
- Passenger satisfaction with rail operators for Warrington stations has remained quite stagnant. Satisfaction is reasonably high with the following satisfaction levels exhibited: Northern (82%); East Midlands (77%); TransPennine Express (77%); and Virgin (90%).
- There was a preference for increasing the capacity of the Manchester-Liverpool rail service and safeguarding it from delays and the addition of extra stops.
- Reliability of rail services were the biggest factor in providing good satisfaction levels.
- Price was identified as a key issue on both local bus and rail services and was a key factor in low public transport patronage and high car use.
- Accessibility and the facilities for disabled users and those who use pushchairs needs to be improved for public transport services.

- There was broad agreement between transport summit delegates that a project to transform and improve the passenger transport offer in Warrington is necessary in order to reduce congestion, improve health, and accommodate housing and jobs growth.
- Views were mixed about the mode that any transformative mass transit scheme should use. Trams, Guided Bus, and Bus Rapid Transit were amongst the options discussed. It was considered important that any mode introduced should offer sufficient flexibility to accommodate future land use changes.
- The steer provided by stakeholders regarding funding for a transformative change was less clear. A Workplace Parking Levy and Council Tax precept were amongst the options considered for locally funding mass transit improvements.

What does this mean for LTP4?
Feedback from the national rail passenger survey, NHT and Warrington Transport Summit, suggests the following policy actions could be useful in addressing public transport and stakeholder concerns:

- A bus strategy which improves the routing of services, timing and integration with rail services and bus priority measures that can reduce journey times;
- Enhance the quality of public transport hubs by improving routing to them from sustainable modes;
- Improve the quality and reliability of rail services on the CLC line;
- Actions that can help take advantage of TfN's smart ticketing programme;
- Introduce a transformational public transport system that can best serve Warrington residents and businesses. This could consider a tram, guided bus or bus rapid transit system; and
- Investigate a funding mechanisms which could support a new transformational public transit system.

4.15 Cycling

Warrington's cycle network is shown in Figure 79. The road network has been assessed on a five point scale to show the 'cycleability' as well as identifying cycle paths, shared-use cycle paths and pedestrian links. National Cycle Network (NCN) routes are labelled as well as cycle parking, crossings and key destinations.

Figure 79: Warrington cycle network

Source: NHT Survey Report 2017: Warrington BC Public Transport Theme Report

National Cycle Route 62 runs through the south of the Borough and forms the west and central sections of The Transpennine Trail which is a long-distance path running from coast to coast across northern England. From Warrington, the route provides a connection to Widnes in the west and through Lymm and onwards towards Altrincham in the east.

The cycle map displays the designated cycle routes within the town. Tarmac surfaced cycle paths are represented by a green line and unsurfaced cycle paths by a brown line. The map also indicates which roads are suitable for cyclists according to cycle skill level. Paths in yellow are most suitable for beginners, roads are then graded with increasing difficulty (2 Green, 3 Blue, 4 Pink, and 5 Red). Pedestrian links are coloured purple.

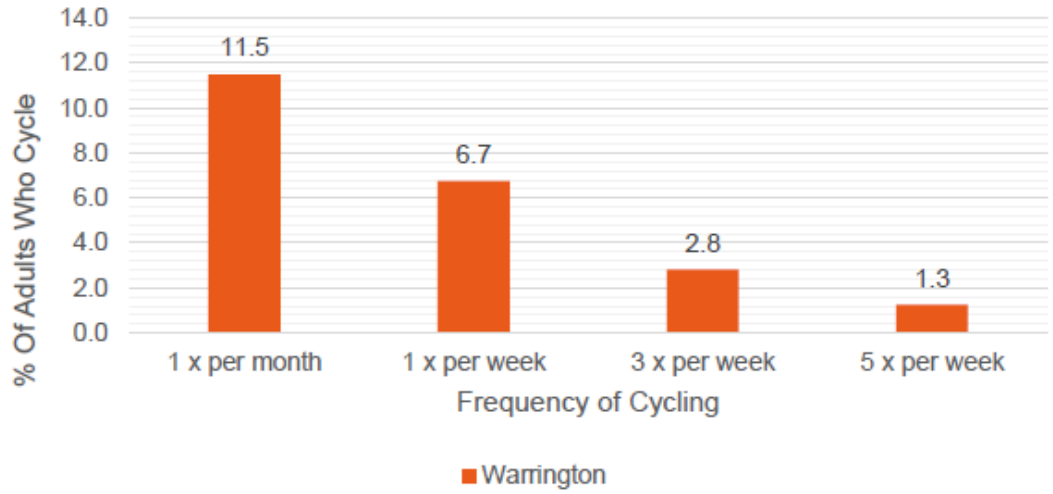
Surfaced cycle paths are generally found outside of the town centre between connecting residential areas. Nearer the town centre it appears cyclists would have to ride on the road in a shared environment, mostly on blue assigned roads (medium level difficulty) in order to reach Warrington town centre.

4.15.1 Cycling levels

DfT prepare walking and cycling statistics based on results from the Active People Survey which is an annual household survey administered by Sport England. Figure 80 shows that in

2015, 11.5% of the adults in Warrington cycled once a month and 6.7% cycled once a week. Even fewer adults cycle more than once a week.

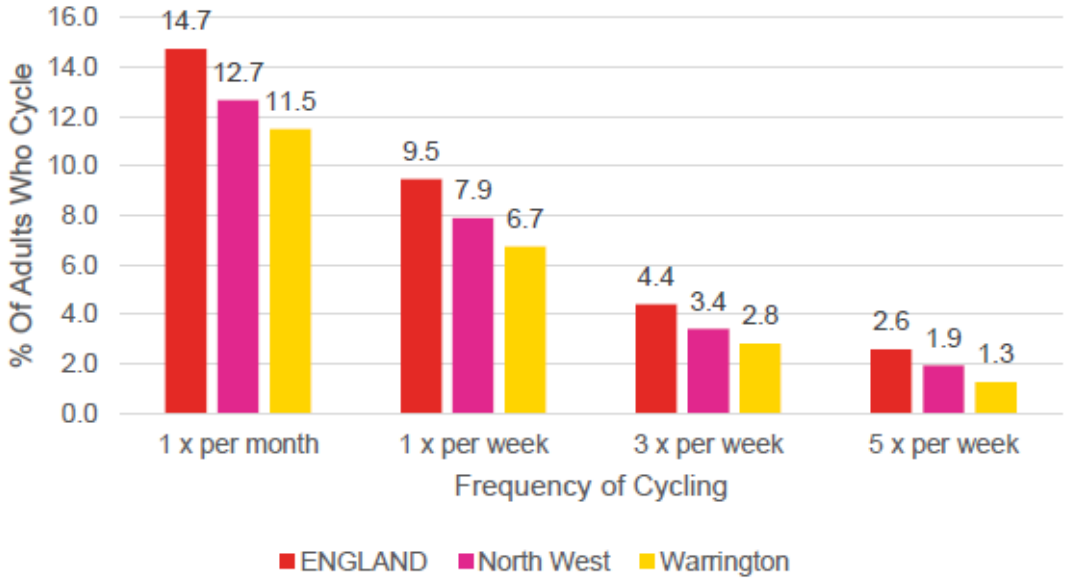
Figure 80: 2015 Cycling levels within Warrington



Source: Department for Transport Cycling and Walking Statistics

The percentage of adults who cycle in Warrington was compared with the North West and England average in 2014/2015 (Figure 81). For all cycling frequencies, the average percentage of Adults who cycle for England and the North West is greater than the Warrington average. On this basis, Warrington sees a lower percentage of adults who cycle compared with the regional and national averages.

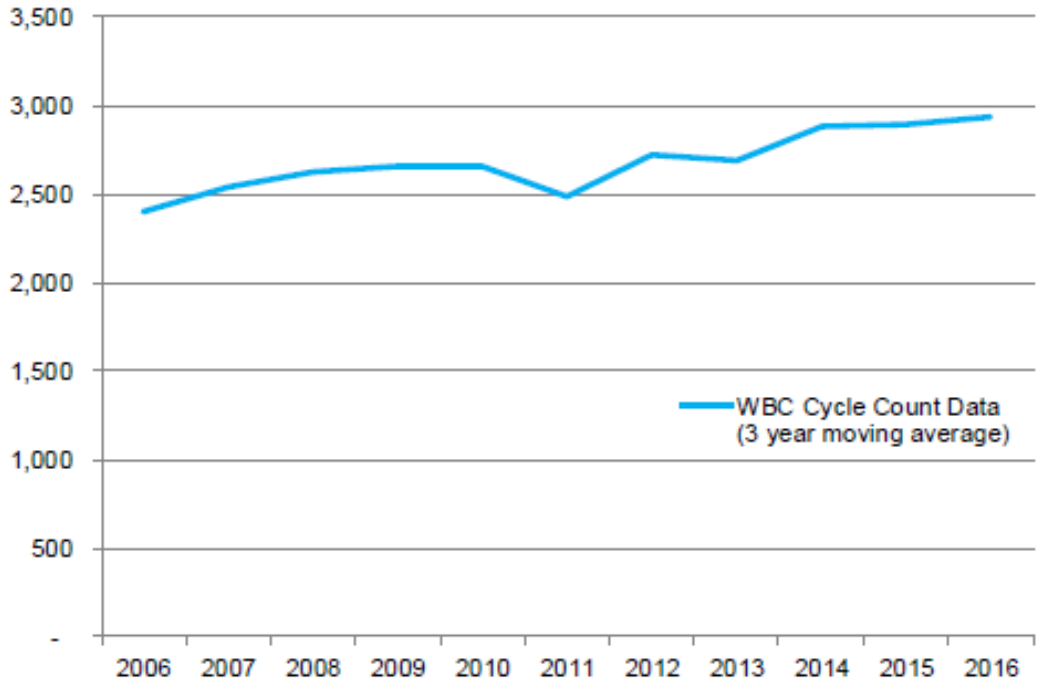
Figure 81: percentage of adults who cycle according to area 2014/15



Source: Department for Transport Cycling and Walking Statistics 2015

WBC has collected pedestrian and cycle count data at various sites. Between 2006 and 2015, Figure 82 shows there has been a 21% increase in the number of cyclists on the Warrington network, according to WBC cycle count data.

Figure 82: Cycling counts in Warrington (2006-2016)



Source: Walking and cycling count data provided by Warrington Borough Council

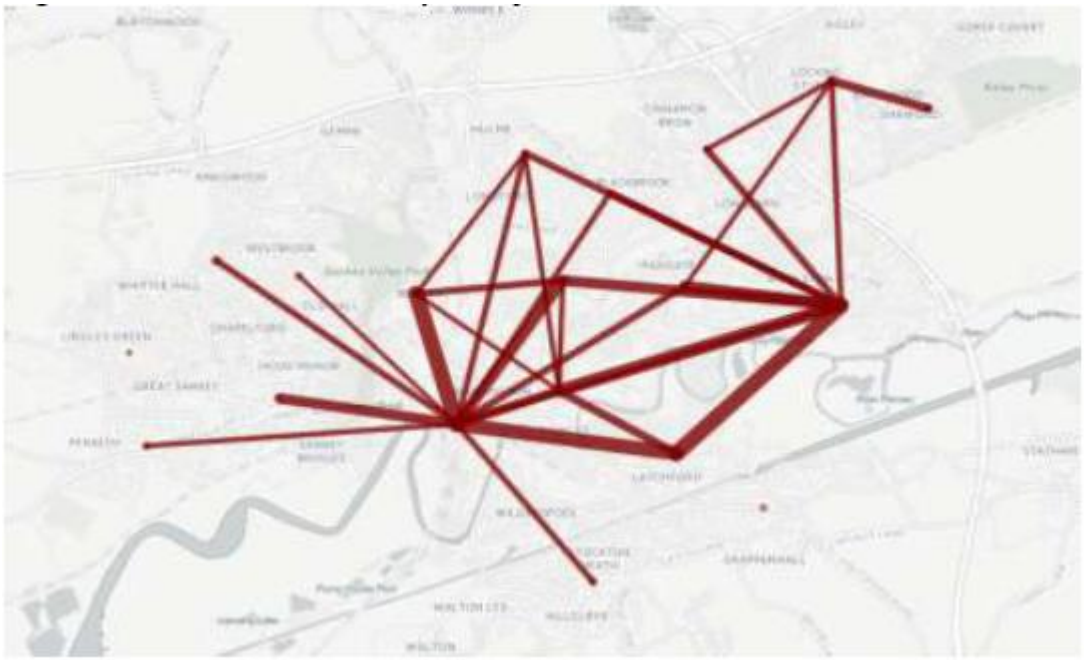
4.15.2 Future cycling levels

The Propensity to Cycle Tool (PCT) is a useful tool to estimate future mode share for cycling along particular corridors if differing barriers are removed (for example infrastructure and culture). This can be used to identify opportunities for cycle investments and interventions to encourage uptake of cycling. The tool allows various scenarios to be presented; the top 30 flows are shown for the following:

- Census 2011: Main mode of travel to work;
- Government Target: Doubling of cycling nationally (between 2013 and 2025) as per DfT draft Cycling Delivery Plan;
- Go Dutch: The level of cycling if English people were as likely as Dutch people to cycle a trip of a given distance and level of hilliness.

Figure 83 shows the predominant flows within the 2011 Census were between central Warrington and Woolston, Bewsey, Latchford and Orford. The results show greater flows to the northeast of Warrington Town Centre compared with other directions.

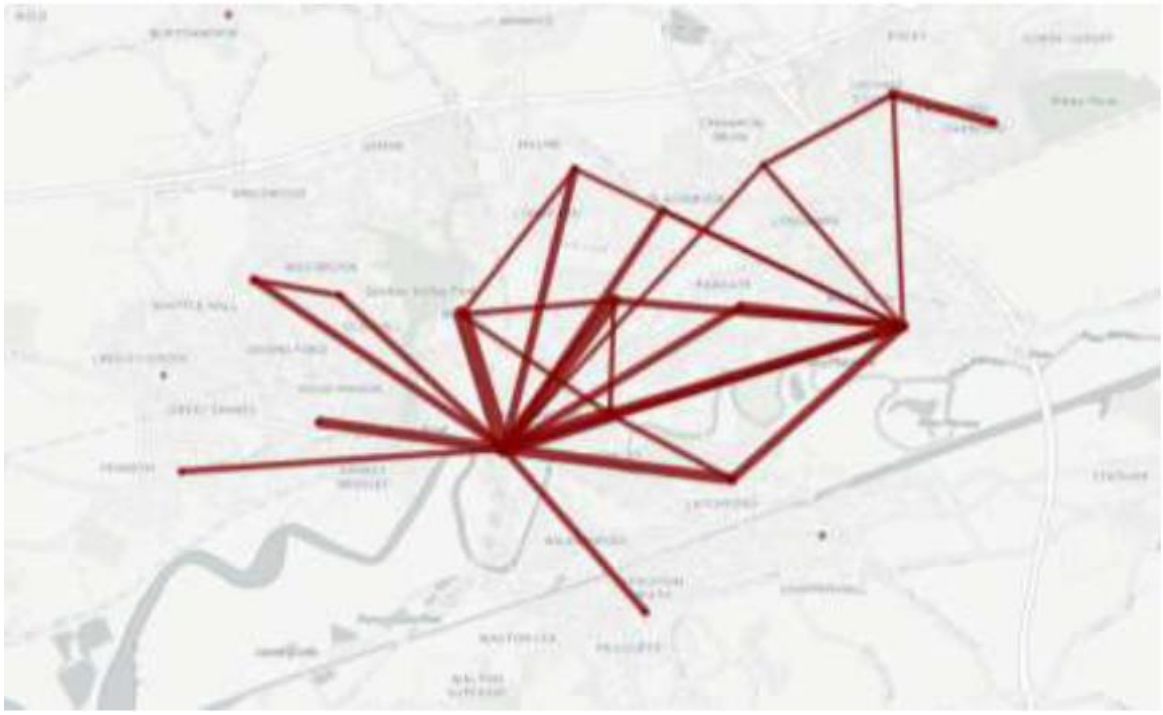
Figure 83: Census 2011 top



Source: DfT Propensity to Cycle Tool

When the Government target is considered (Figure 84) the results show a similar pattern to Figure 83. However, the cycle flow from Bewsey and Orford is stronger than the flow from Woolston and Latchford with the government target.

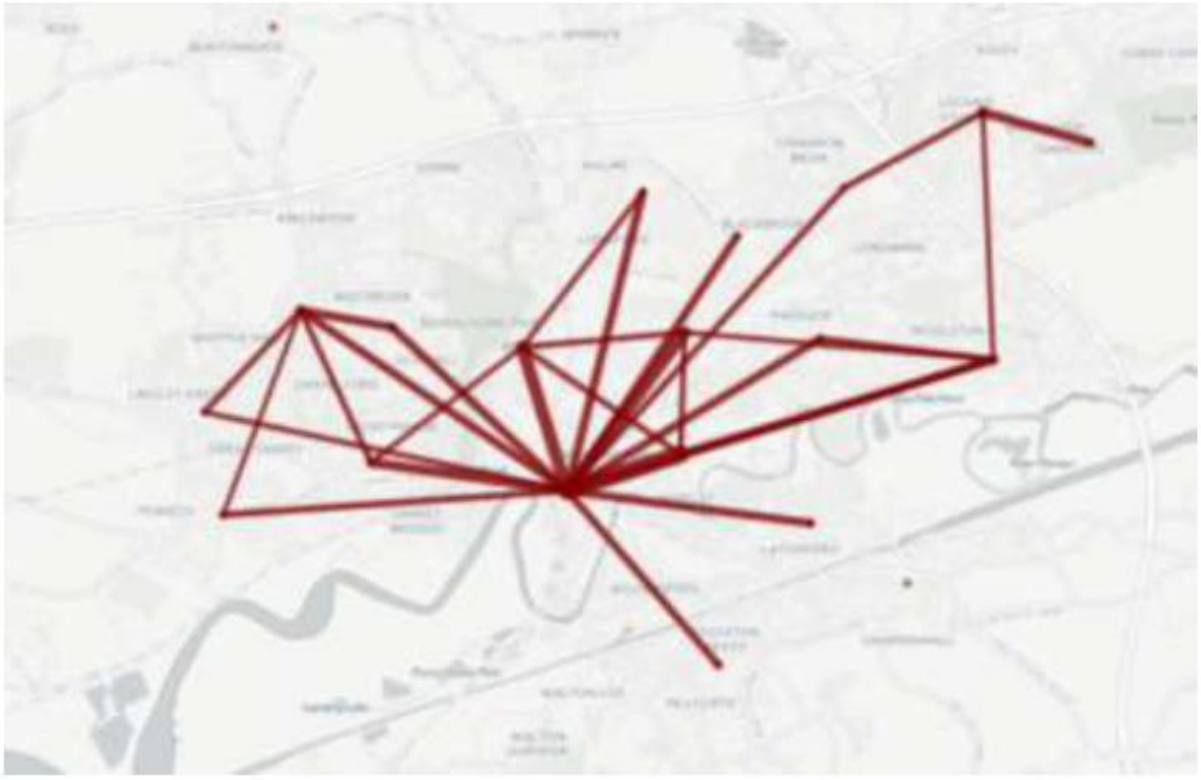
Figure 84: Government cycling target scenario, top 30 cycle flows



Source: DfT Propensity to Cycle Tool

Figure 85 presents the Go Dutch cycle flows; the results show greater cycle flows around Westbrook and Great Sankey compared with Figure 83 and Figure 84. Whereas the 2011 Census showed strong flows between Latchford and Woolston, this did not feature within the top 30 flows under the Go Dutch scenario.

Figure 85: 'Go Dutch' cycling scenario, top 30 cycle flows

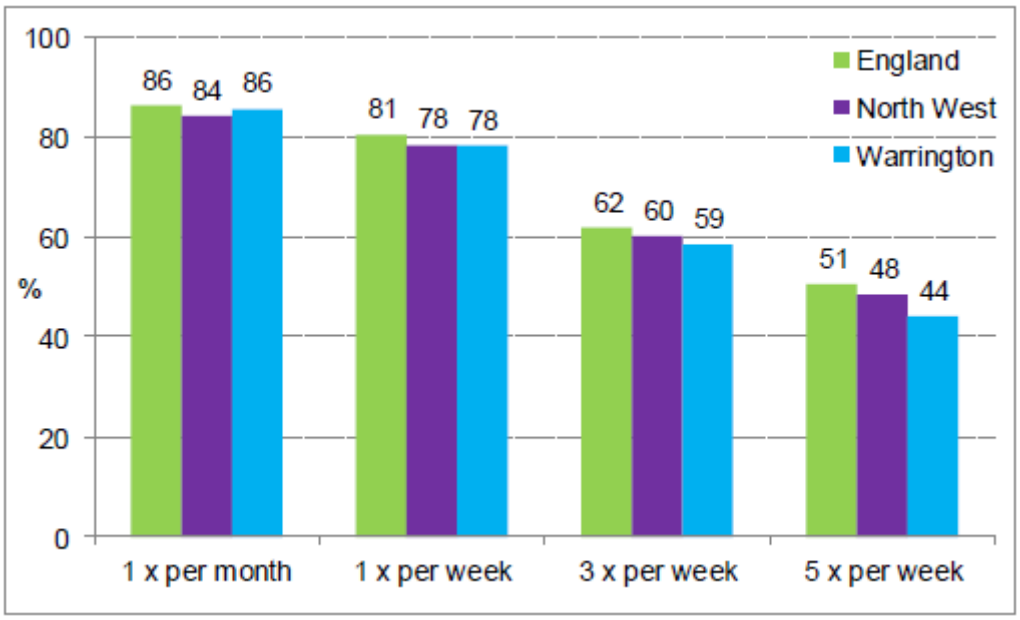


Source: DfT Propensity to Cycle Tool

4.16 Walking

DfT prepare walking statistics based on results from the Active People Survey which is an annual household survey administered by Sport England. The survey samples at least 500 people for each local authority over four weeks in October every year.
Figure 86 presents how frequently adults walk for at least 10 minutes. The proportion walking at least once per month in Warrington is consistent with the national figure. However, nationally 51% of adults walk for at least 10 minutes five times per week, but in Warrington this proportion is notably lower at 44%. Although the proportion across the North West (48%) is lower than the national figure, it is greater than the proportion in Warrington.

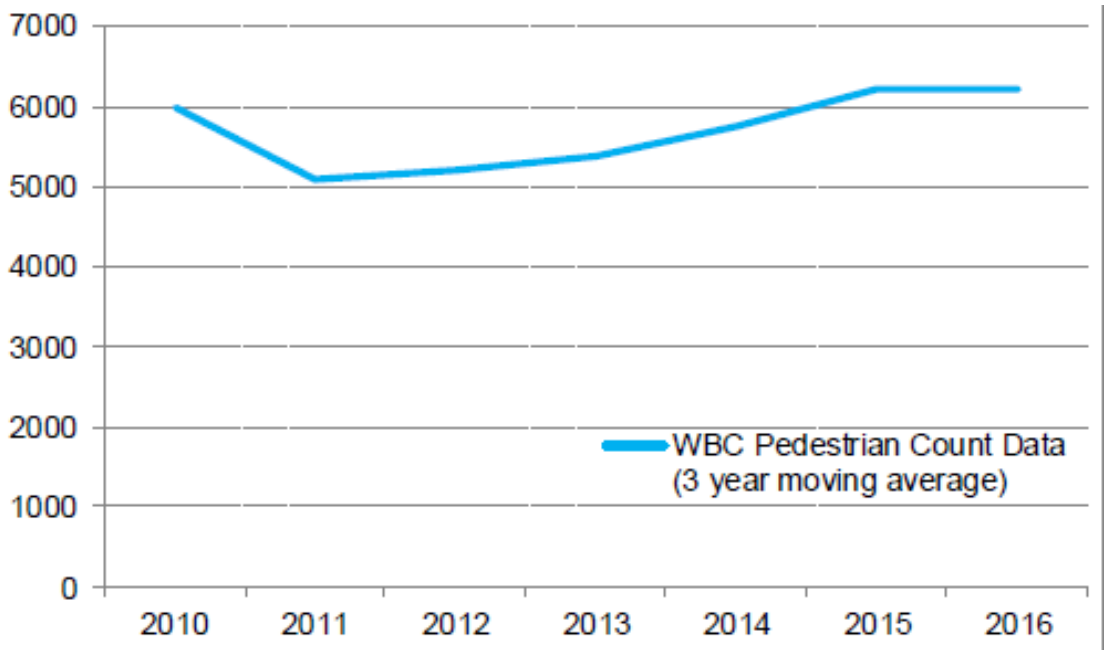
Figure 86: Proportion of adults that walk for at least 10 minutes (2014-2015)



Source: DfT Local area walking and cycling statisitcs

Warrington Borough Council has collected pedestrian and cycle count data at various sites in Warrington. Figure 87 shows a decrease in pedestrians between 2010 and 2011, but a steady increase between 2011 and 2015 to surpass the 2010 value.

Figure 87: 2015 Cycling levels within Warrington



Source: DfT Propensity to Cycle Tool

4.16.1 Key findings of cycling and walking

The key findings of active travel within Warrington are presented below:

- Compared with national figures, the proportion cycling in Warrington was below the national average. However, local cycle count data shows cycling to be increasing in Warrington; a 21% increase in the level of cycling was observed within Warrington between 2006 and 2015.
- The town centre can be considered less permeable for all cyclists. It requires good cycling experience to cycle on the routes that penetrate the town centre.
- The greatest cycling flows occur between central Warrington and Woolston, Bewsey, Latchford and Orford. The results show greater flows to the northeast of Warrington Town Centre compared with other directions.
- For the government growth cycle target, the flows show a similar pattern to existing cycling patterns. However, there are greater flows occurring in Bewsey and Ordford, when compared with Woolston and Latchford.
- The proportion of Warrington residents doing any walking in 2014/15 was consistent with the national average. However, the proportion walking 3 or more times a week was notably lower in Warrington compared with the national average.

What does this mean for LTP4?
LTP4 should seek to improve cycling and walking in Warrington with the development of a comprehensive active travel strategy. In light of the findings above, the strategy could look to address the following:

- Increase cycling penetration into Warrington town centre;
- Increase the attraction of walking and cycling for short distanced journeys and commuter trips; and
- Enhance the quality of cycle infrastructure across the town; and
- Promote cycling on corridors which see larger cycling flows and those that have been identified for future growth.

4.17 Active travel user satisfaction

This section concerns the satisfaction of active travel within Warrington and looks at the issues and opportunities for active travel use according to residents and businesses feedback. The section utilises research undertaken by national surveys and stakeholder summits in Warrington.

4.17.1 Active travel survey

National highways & Transport network undertake an annual survey of satisfaction for walking and cycling. The NHT Survey report 2017 was used to identify Warrington resident's

opinions of active travel infrastructure. Residents were asked how satisfied or dissatisfied they were with the following:

- Pavements of footpaths
- Cycle routes/lanes & facilities
- Rights of way

The results are shown in Table 27. The survey results indicate satisfaction with pavements and footpaths, cycle routes/lanes and facilities and rights of way to have increased between 2014 and 2017.

Table 27: 2015 Cycling levels within Warrington

Question	2014	2015	2016	2017
KBI 11 - Pavements & Footpaths	50	56	51	55
KBI 12 - Pavements & Footpaths (aspects)	52	59	57	59
KBI 13 - Cycle routes and facilities	52	51	52	55
KBI 14 - Cycle routes and facilities (aspects)	51	55	56	54
KBI 15 - Rights of Way	58	59	57	58
KBI 16 - Rights of Way (aspects)	52	54	54	

Source: DfT Propensity to Cycle Tool

4.17.2 Active travel summit feedback

Warrington Borough Council has hosted a series of Transport Stakeholder Summits that were intended to obtain view from stakeholders over Warrington's transport system. The first transport summit focused on active travel.

Stakeholders were first asked a series of questions relating to the barriers behind active travel in Warrington. A summary of the responses can be found in Table 28.

The dominance of the car was identified to make active travel uncomfortable in areas of the town, with this it brought concerns over safety and reduced the appeal to travel cycling and walking. Inconsistent infrastructure across the town, particularly penetration into the town centre and at the end of the journey were also identified as key barriers to active travel.

Table 28: What are the barriers to active travel in Warrington

Theme	What are the barriers
Commuting	• Perception of lots of bad weather and unsafe environment for cycling • People don't know alternative cycle routes • Commuting is difficult if you need to carry equipment and your workplace has no facilities
Infrastructure	• Infrastructure peters out in the town centre for cyclists making it unsafe in some areas • There is inconsistent infrastructure for active travel – although stakeholders were pleased that this is improving • Lack of facilities at end of journey – suggestion central cycle hub in town centre
Location and planning	• Not everyone received a cycle map through the post
Travel behaviours	• Concerns over safety when cycling or walking • Dominance of the car makes cycling and walking uncomfortable in some areas. • Warrington has been built around access by car and free and plentiful parking.

Source: DfT Propensity to Cycle Tool

Stakeholders were then asked how Warrington Borough Council and stakeholders can help address the barriers to active travel and increase levels of cycling and walking.

Enhancing the quality of active travel journeys through infrastructure improvements was expressed frequently at the summit; there should be more designated cycle lanes and the roads should be made more cycleable. In tandem, the council should work to reduce highways demand and help make more hospitable cycling and walking environments.

Improvements to interchange and end user facilities were also a common response; it was suggested that enhancements to cycle parking, security and changing facilities both at transport interchanges and end destinations could help increase the quality of active travel in Warrington.

Another key area of focus was providing adequate provision of active travel infrastructure in future housing and employment developments to help support active travel as a common and frequent travel mode.

Table 29: How can Warrington Borough council and stakeholders help improve active travel in Warrington?

Theme	What are the barriers
Commuting	• Integrate buses with cyclists by building secure cycle parking near key bus stops and interchanges, or by adding bike carriers on buses • Ensure destination facilities are high quality • Ensure secure town centre cycle parking
Infrastructure	• Provide and promote a map with bike parking on the council's website • Make space for bikes on buses and have cycle lockers at certain bus stops • Provide more cycle lockers and showers • Encouraging people to cycle by making more designated cycle lanes • Finding more space for cyclists – would enable trikes, people with carers, wheelchair and mobility scooter users, etc., to be more active
Location and planning	• Building wider pavements with dedicated cycle lanes. • Making the roads more cycleable, not segregating cyclists to parks etc. • Ensuring permeability by sustainable travel in new developments, with cut-through for pedestrians and cyclists, and less car favoured development. This was identified as being very important to stakeholders. • Incorporate active travel provision around new housing and employment developments
Journey to school	• Ensure access for all to cycling. Provide better access to adapted bikes e.g. hand bikes to ensure all children have opportunity/access to cycling
Travel behaviours	• Reduce the demand of highways traffic to help promote active travel. • Address confusion over the rights of pedestrians and cyclists on pavements and in town centre – address bylaw issue

Source: DfT Propensity to Cycle Tool

4.17.3 Key findings of active travel user satisfaction

Key findings of satisfaction of active travel within Warrington are set out below:

- The dominance of the car was identified to make active travel uncomfortable in areas of the town, with this it brought concerns over safety and reduced the appeal to travel cycling and walking.

- Satisfaction with walking and cycling infrastructure in Warrington has increased between 2014-2017. However, inconsistent infrastructure across the town, particularly penetration into the town centre and at the end of the journey were identified as key barriers to active travel.
- Enhancing the quality of active travel infrastructure in the form of new segregated cycle lanes, making the road more cycle able, interchange and end user facilities was suggested as a good way to help improve the quality of active travel.
- Incorporating active travel into new developments was also seen as a priority.
- Ensuring access for all to cycling, and providing better access to adapted bikes e.g. hand bikes to ensure all children have opportunity/access to cycling

What does this mean for LTP4?
The feedback from national surveys and the local transport summit has identified a key number of measures that could help increase active travel in Warrington .The findings suggest LTP4 should look to do the following:

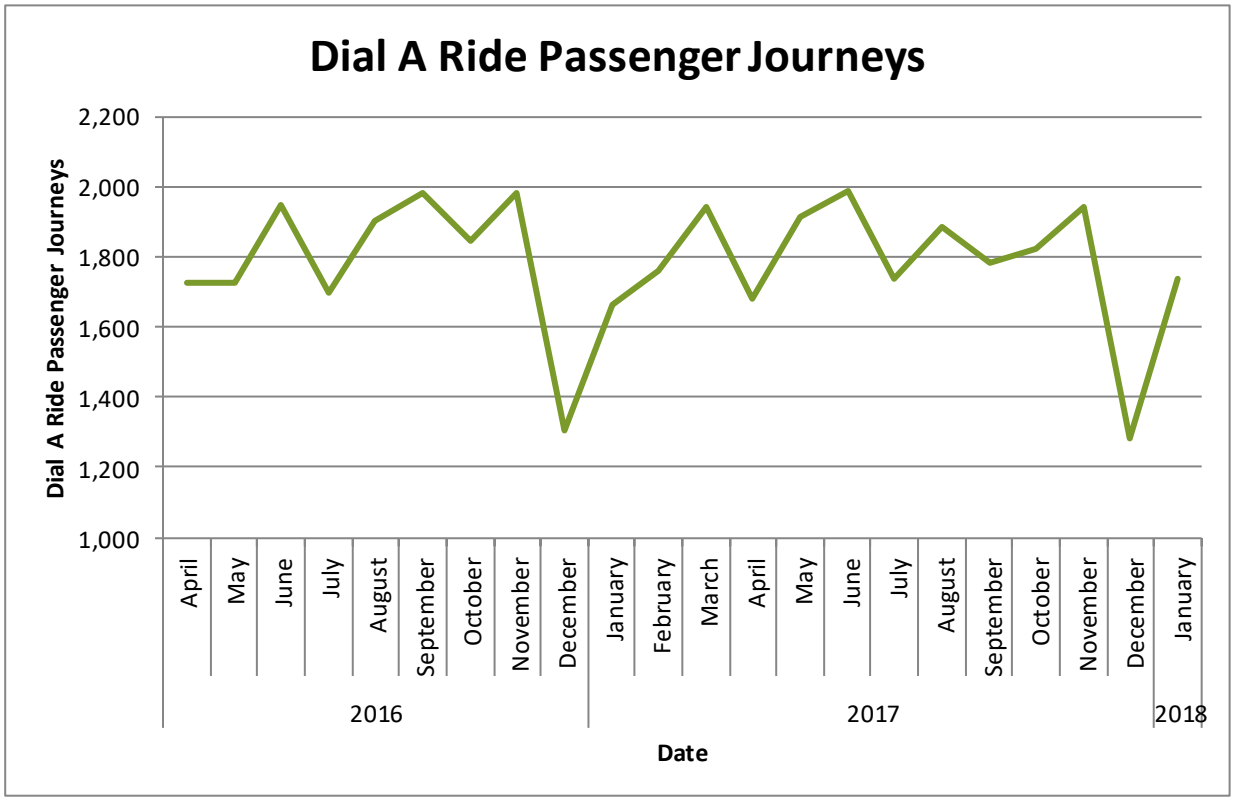
- Deliver more consistent and enhanced cycle infrastructure across the town;
- Improved and more widespread cycleable routes and better interchange and end user facilities;
- Help reduce the dominance of the private car and make more hospitable active travel environments;
- Ensure new housing and employment developments are provided with adequate and high quality active travel infrastructure and that supports a transition away from development prioritise the private car; and
- Provision of cycles and infrastructure that supports adapted cycles.

4.18 On demand travel

Warrington Dial-a-ride service provides a door-to-door accessible minibus transport service in Warrington for people aged 5+ with registered disabilities/mobility difficulties. Journeys catered for include shopping trips, healthcare appointments, social, community and leisure activities, church services and functions, education, employment, and direct access to Shopmobility.

Passenger journeys completed on the Dial-a-ride service between April 2016 – January 2018 were obtained from Warrington Borough Council and are shown below in Figure 88. Patronage is shown to fluctuate around 1,700 journeys per month. Both in 2016 and 2017 a fall in patronage is observed in winter months and subsequent increase into spring.

Figure 88: Passenger journeys completed on Dial-a-ride community bus services April 2016 – January 2018



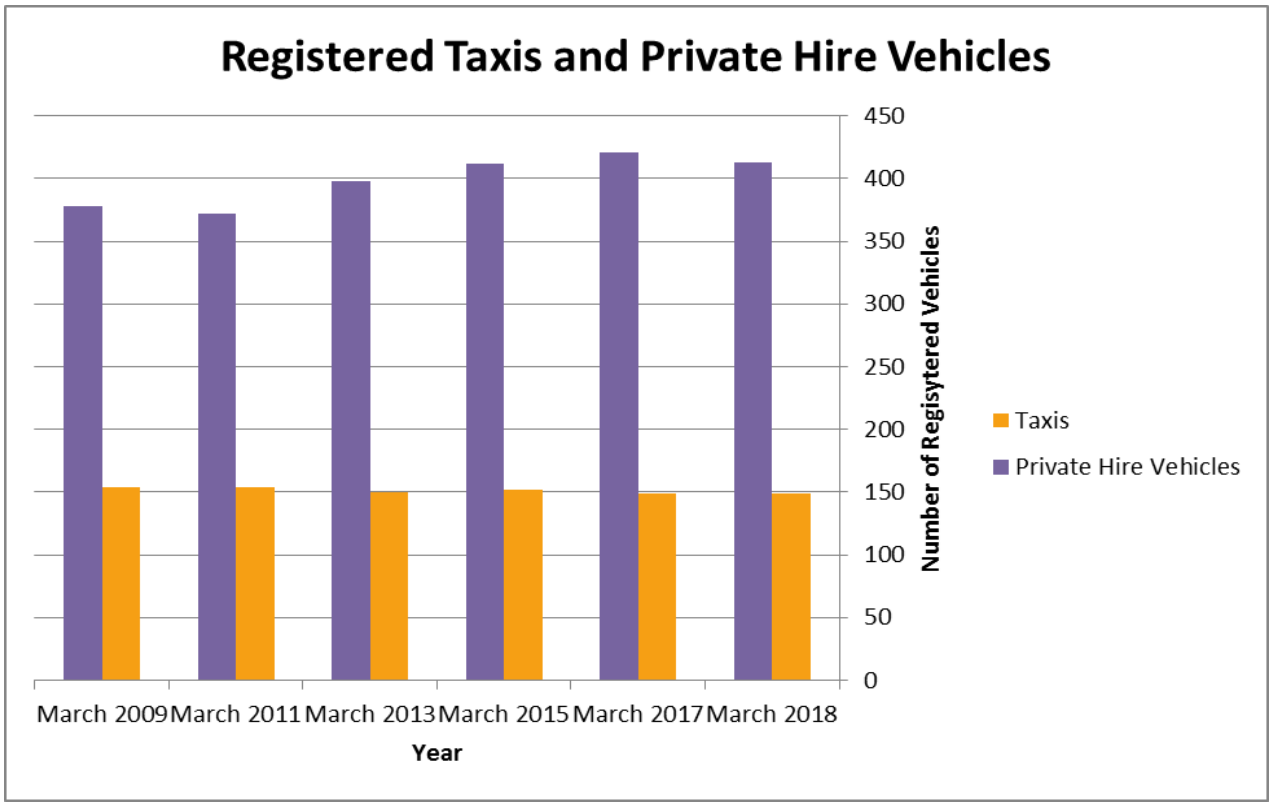
Source: NHT Survey Report 2017: Warrington BC Public Transport Theme Report

4.18.1 Taxi and private vehicle

Taxis and private hire vehicle registrations are recorded by the DfT every two years. Warrington Borough Council presently restricts the number of Hackney Carriage vehicles to 150. Therefore, the number of taxis has remained relatively constant over the 6 year period. Included in the 150 taxis, are wheelchair accessible taxis. From 2011, there has been a slight decline of these vehicles from 57 registered in 2011 to a total of 48 I registered in 2017.

There is no restriction on private hire vehicles or (joint) drivers licences' issued. The number of licensed private hire vehicles has increased 13% over the six year period to a total of 421 in 2017 (Figure 89).

Figure 89: Total number of registered Private hire vehicles in Warrington 2007-2018 (PHVs)



Source: DfT Taxis, Private Hire Vehicles (PHVs) and their drivers

There are taxi ranks at key points within the town centre and Warrington's central train stations. New local development, such as Times Square, requires some temporary operational adjustment to ranks.

All taxis are able to use most bus priority measures, except bus gates at Faraday Street and Winwick Street / Winwick Road. There was some indication that taxi drivers were apprehensive about taking passengers to Central station as there were long waits on the ranks for quite often minimum fairs.

4.18.2 Key findings of on demand travel

Key findings of on demand travel in Warrington:

- Patronage on dial-a-ride services has fluctuated around 1,700 journeys per month. Both in 2016 and 2017 a fall in patronage is observed in December and increases in January
- From 2011 to 2016, the number of licensed private hire vehicles has increased 13% to a total 421 vehicles. Whereas due to WBC control of numbers of Hackney carriage, the number of taxis has remained around 150.
- From 2011, there has been a slight decline in wheelchair accessible taxis from 57 registered in 2011 to a total of 48 registered in 2017.
- New local development, such as Times Square, requires some temporary operational adjustment to ranks.

What does this mean for LTP4?
LTP4 should continue the use of the dial-a-ride bus service as it provides crucial community transport. The strategy should also ensure taxis' are available at key interchange points and points of interest. A taxi strategy should be put in place to promote low emission vehicles and review of anti-idling enforcement at taxi ranks.

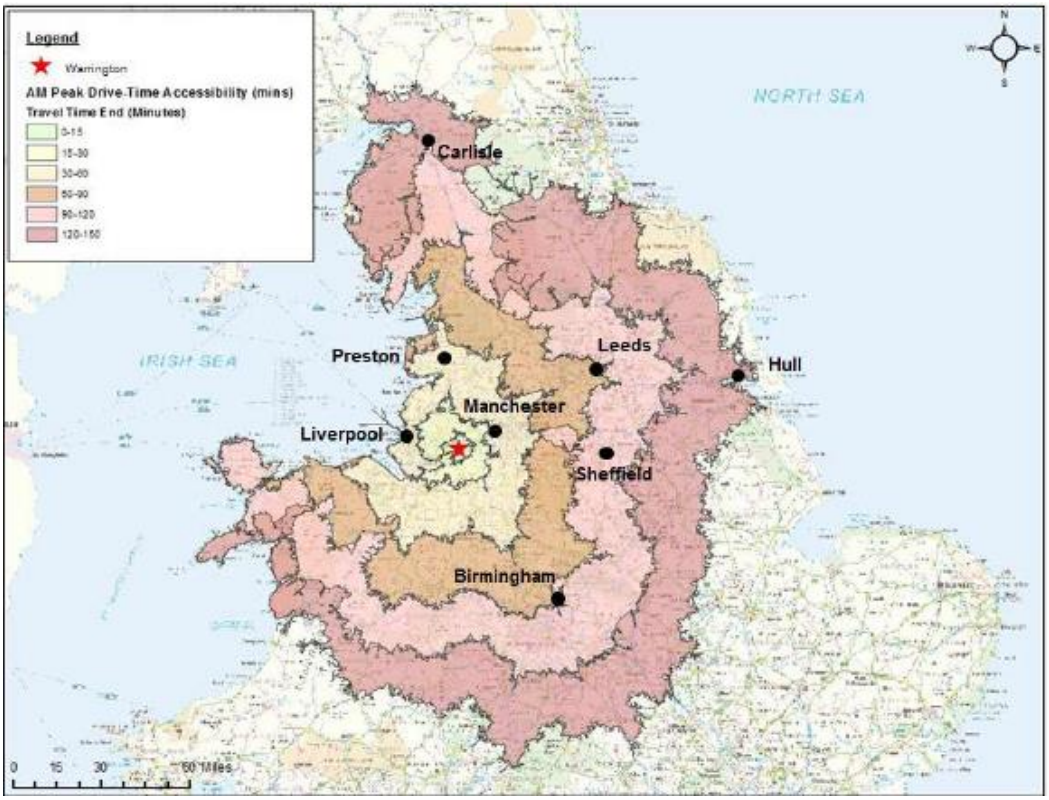
4.19 Highways accessibility

Drive time highway accessibility analysis has been undertaken for Warrington Town Centre using ArcOnline, a web GIS utilising Esri's transport network data source.

Figures 4.12 and 4.13 illustrate the drive time journey time in isochrones up to 2.5 hours. The analysis has been conducted for the AM peak [08:15-09:15] and off peak [10:15-11:15]. Key findings from the analysis are:

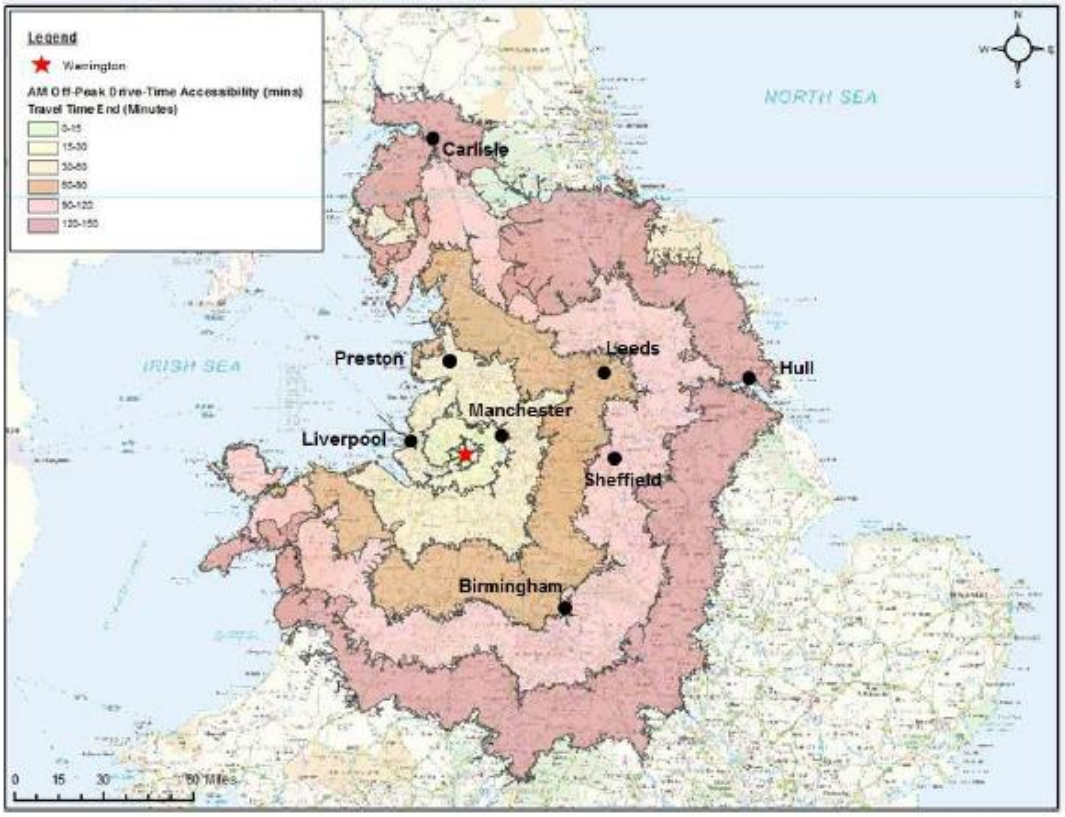
- The catchment within 30 minutes of Warrington town centre highlighted greater accessibility to the north west of Warrington compared with the east towards Manchester.
- A comparison between the AM peak and AM off peak 30 minute catchment showed this area extended over a greater area to the east towards Manchester though was reasonably similar in size in all other directions.
- The drive time catchment within 60 minutes included much of Merseyside and west and central Greater Manchester, as well as Chester, Preston and Stoke-on-Trent. The 60-minute drive time catchment was consistent between the AM peak and AM off peak.

Figure 90: Drive time accessibility to Warrington Town Centre AM Peak



Source: ArcOnline

Figure 91: Drive time accessibility to Warrington Town Centre AM Off Peak



Source: ArcOnline

4.19.1 Public transport accessibility

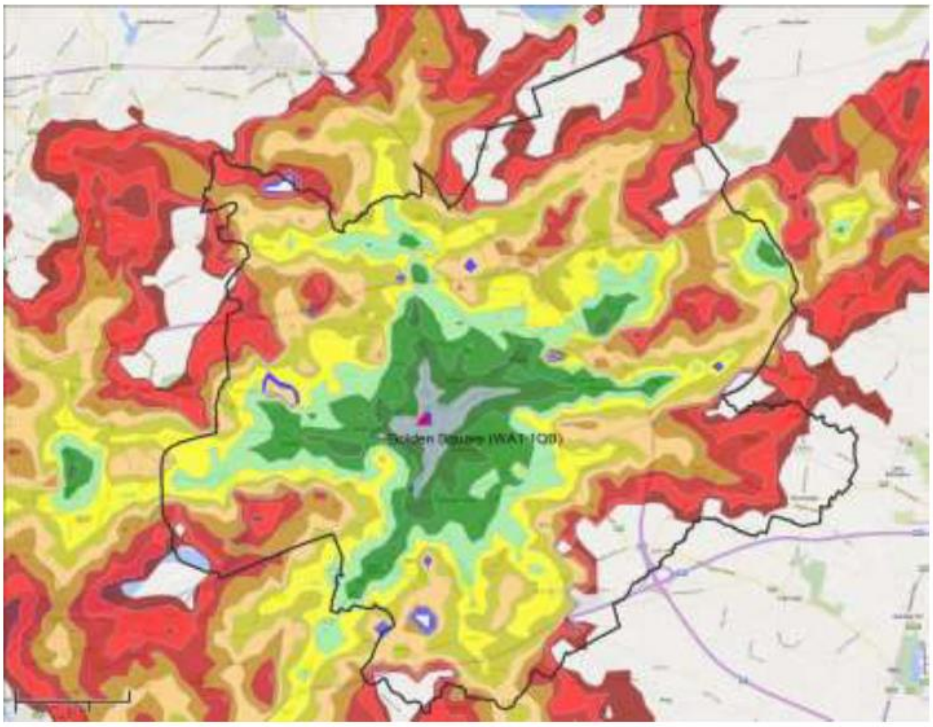
Public transport accessibility analysis has been undertaken for key destinations within Warrington using TRACC. Up-to-date public transport data (October 2016) using Meridian2 road network data was used to complete this analysis. Figure 92 to Figure 100 illustrate the journey time by public transport in five minute isochrones up to one hour. The analysis includes passenger walk time to bus stops, rail stations and also considers restrictions on pedestrian movements, such as along and across motorways and any physical barriers. Analysis has been conducted for Tuesday during the AM peak period (07:00-09:00) for the following locations:

1. Warrington Town Centre
2. Warrington Hospital
3. Centre Park
4. Birchwood Business Park
5. Woolston Grange
6. Daresbury Science Park (Halton)
7. Lingley Mere, Gemini Retail Park and Omega.

Warrington town centre

Figure 92 shows almost the entire Borough was able to access Golden Square, Warrington Town Centre by public transport within one hour. A large area was within 15 minutes reflecting bus and rail services from Warrington Interchange and this area extended reasonably consistently outwards from the town centre. In addition, public transport accessibility extends beyond the Borough in all directions.

Figure 92: AM Peak public transport accessibility to Warrington town centre

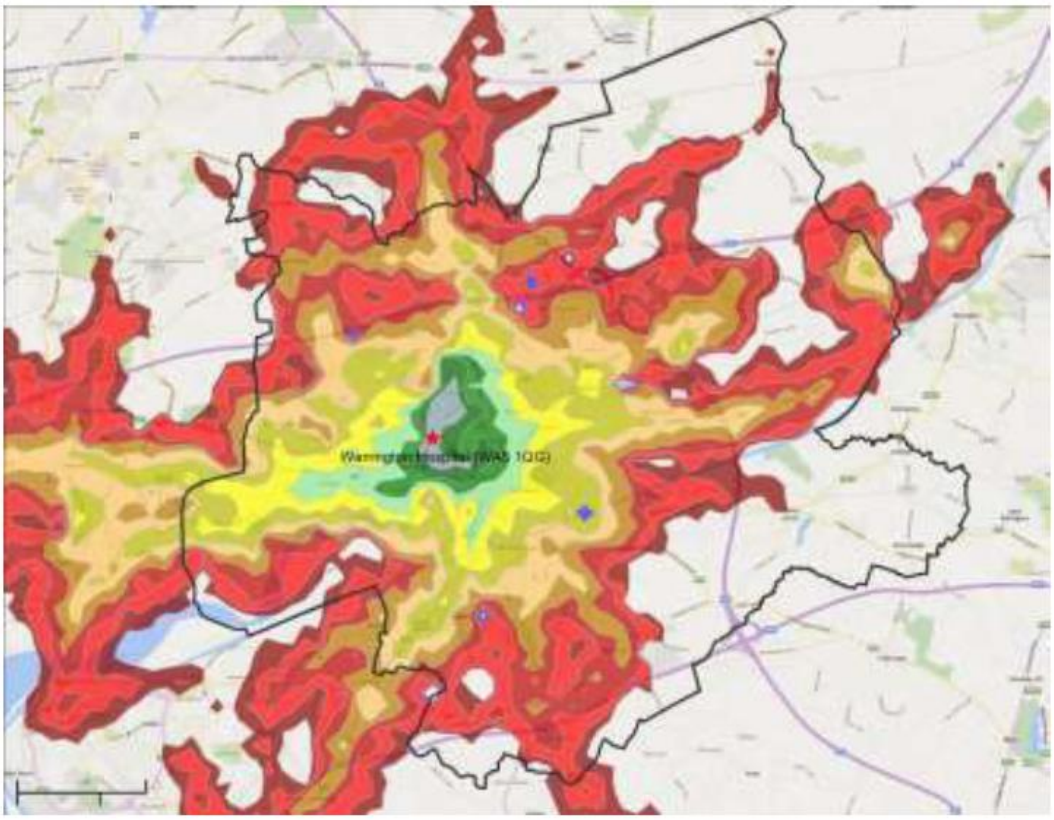


Source: TRACC

Warrington Hospital

Despite the central location for Warrington Hospital (Figure 93), the catchment within 15 minutes public transport journey time was notably smaller compared with Warrington Town Centre. Also, as the hospital is situated towards the west of the town centre, this is reflected in enhanced accessibility towards the west compared with the east of the Borough. Despite this, much of the Borough is accessible within one hour by public transport.

Figure 93: AM Peak public transport accessibility to Warrington Hospital

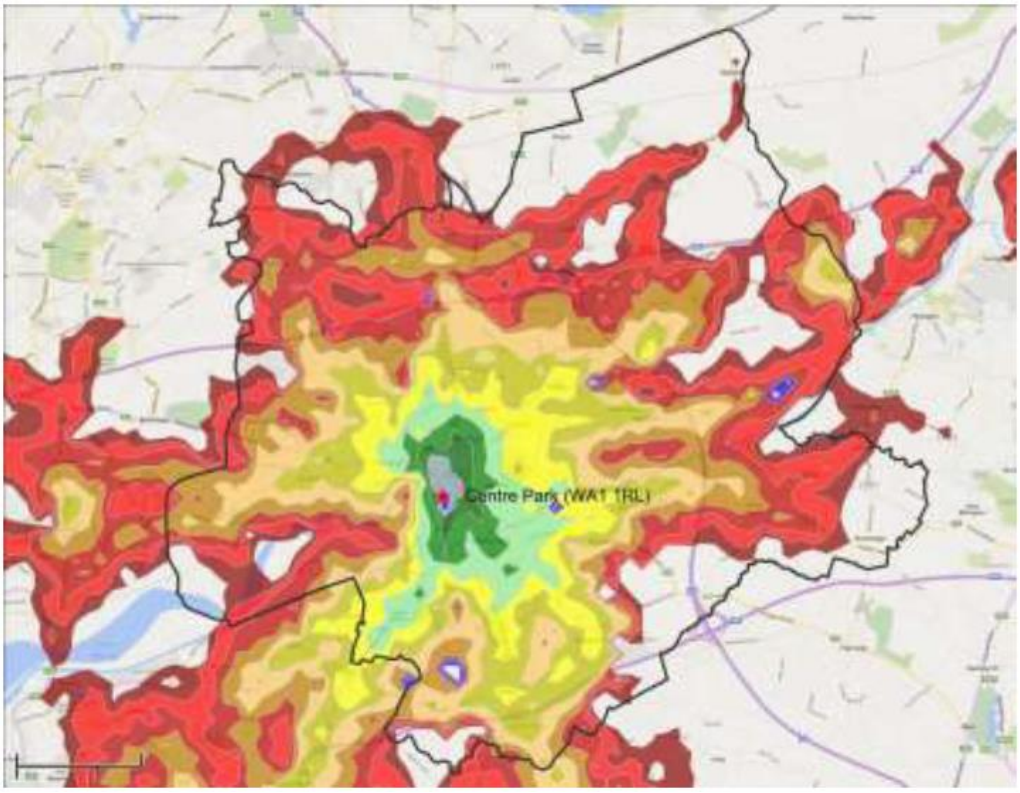


Source: TRACC

Centre Park

Accessibility from Centre Park was similar to Figure 93; much of the Borough was accessible within one hour by public transport reflecting the proximity of the site to Warrington Interchange. The catchment of accessibility within 30 minutes was greater to the east due to the WCML forming a barrier to the west of the site.

Figure 94: AM Peak public transport accessibility to Centre Park

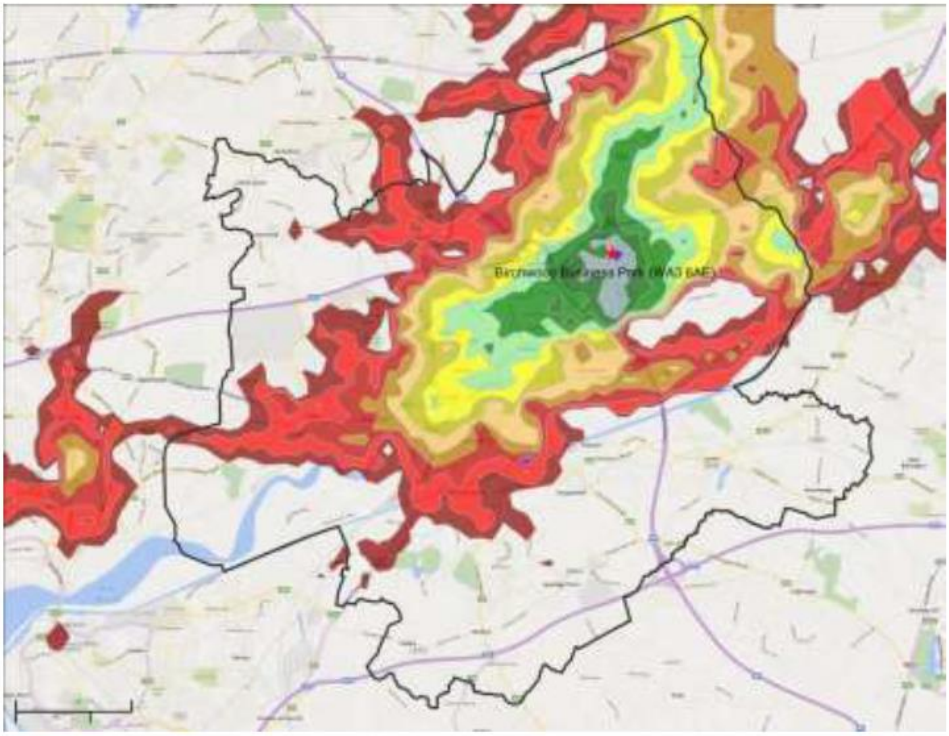


Source: TRACC

Birchwood Business Park

Birchwood Business Park public transport accessibility is shown in Figure 95 and the catchment reflects the CLC Line and bus network from Warrington Interchange. Public transport accessibility within one hour is concentrated to the north-east of the Borough and the town centre. The Manchester Ship Canal forms a barrier with limited public transport accessibility within one hour south of this boundary.

Figure 95: AM Peak public transport accessibility to Birchwood Business Park



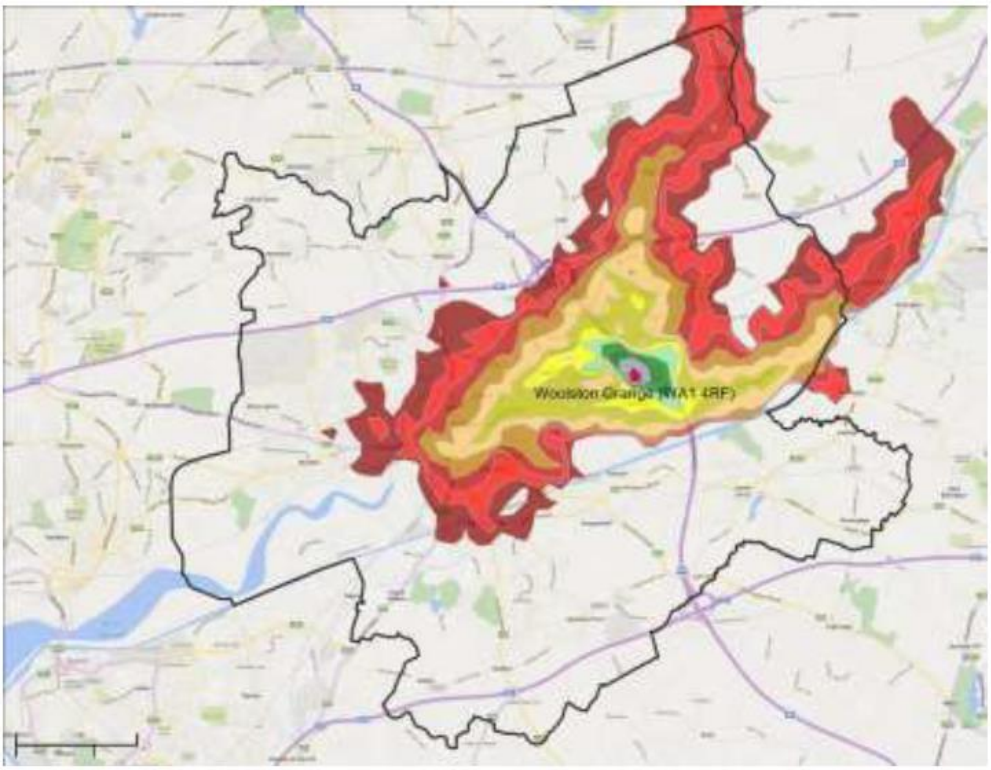
Source: TRACC

Woolston Grange

Woolston Grange is situated adjacent to the M6 and Figure 96 presents the public transport accessibility to the site. In comparison with the other sites identified, public transport accessibility was more limited to this site.

The catchment within 30 minutes was constrained to the immediate vicinity around Woolston and does not reach Warrington Town Centre. The Manchester Ship Canal forms a public transport barrier to the south, whilst the M62 is a barrier to the north; the exception to this is Culcheth.

Figure 96: AM Peak public transport accessibility to Woolston Grange

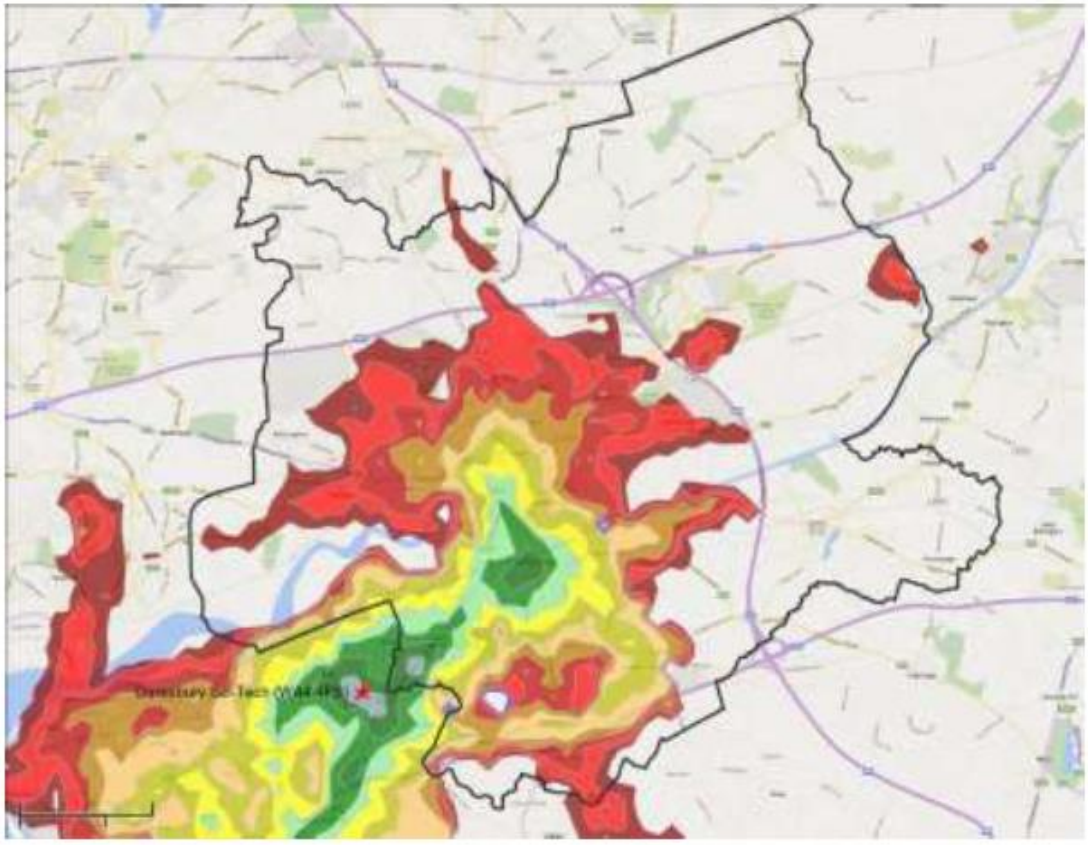


Source: TRACC

Daresbury Science Park

For Daresbury Science Park (Figure 97) public transport accessibility was generally constrained by the M6 and M62 motorways. There was a reasonably sized area within 20 minutes of the site, including Greenbank and Walton, whilst Warrington Town Centre was within 30 minutes. Accessibility extended to the south west of the site towards Halton.

Figure 97: AM Peak public transport accessibility to Daresbury Science Park

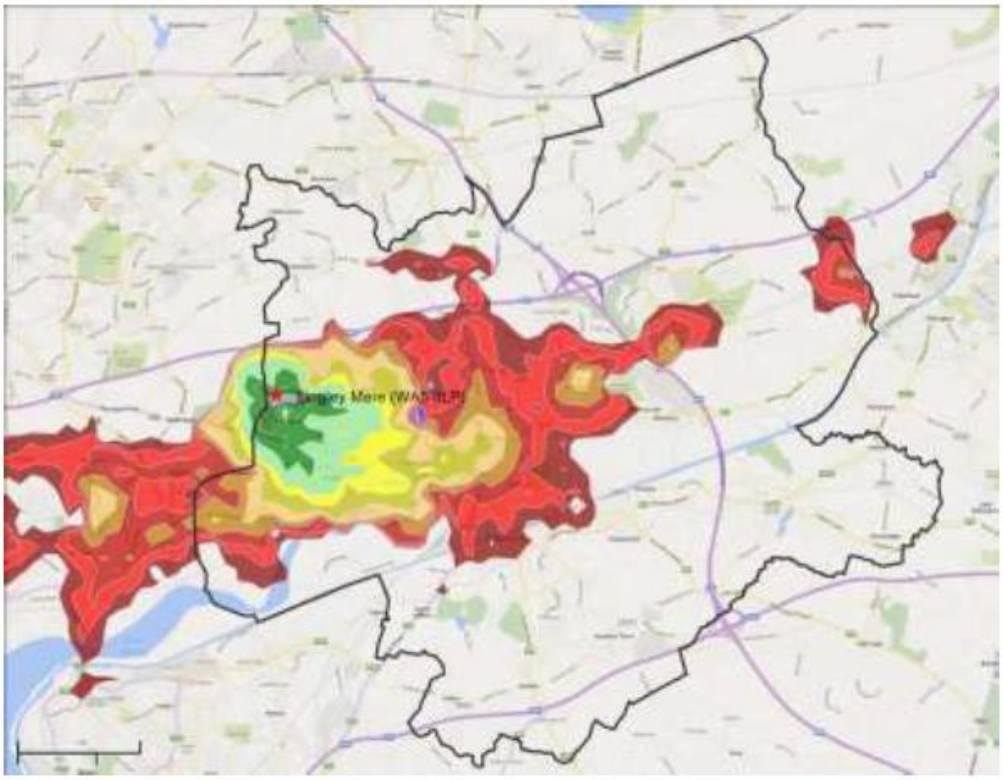


Source: TRACC

Lingley Mere

Accessibility to Lingley Mere (Figure 99) was greater east-west with the M62 and River Mersey forming barriers to the north and south. Public transport journey times were shorter to the east of the site, towards Warrington Town Centre, reflecting the circular bus routes in Figure 71 from Warrington Town Centre to the outskirts of the Borough.

Figure 98: AM Peak public transport accessibility to Lingley Mere

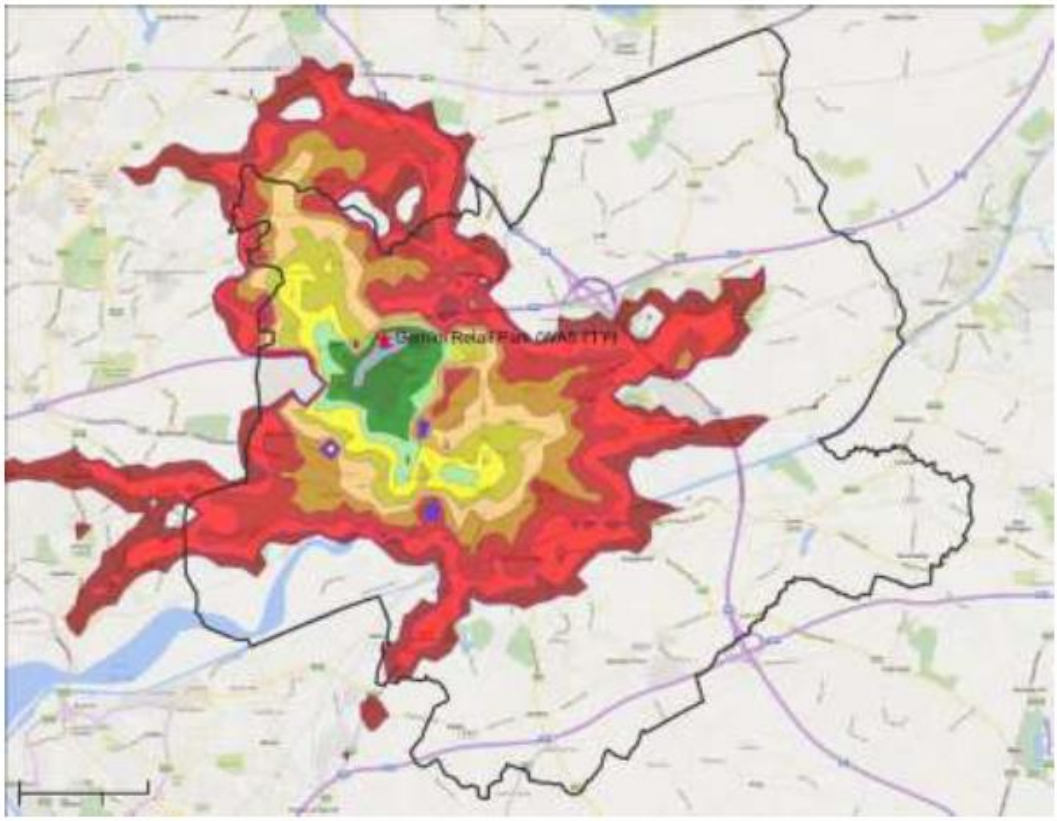


Source: TRACC

Gemini Retail Park

Figure 98 presents accessibility to Gemini Retail Park. The map shows accessibility within 15 minutes was an area south of the M62 and generally followed the bus routes identified earlier. Warrington Town Centre is approximately 30 minutes away by bus and Figure 4.21 highlights the 'hub and spoke' nature of bus travel in Warrington. The M6 and Manchester Ship Canal form barriers to public transport travel within one hour.

Figure 99: AM Peak public transport accessibility to Gemini Retail Park

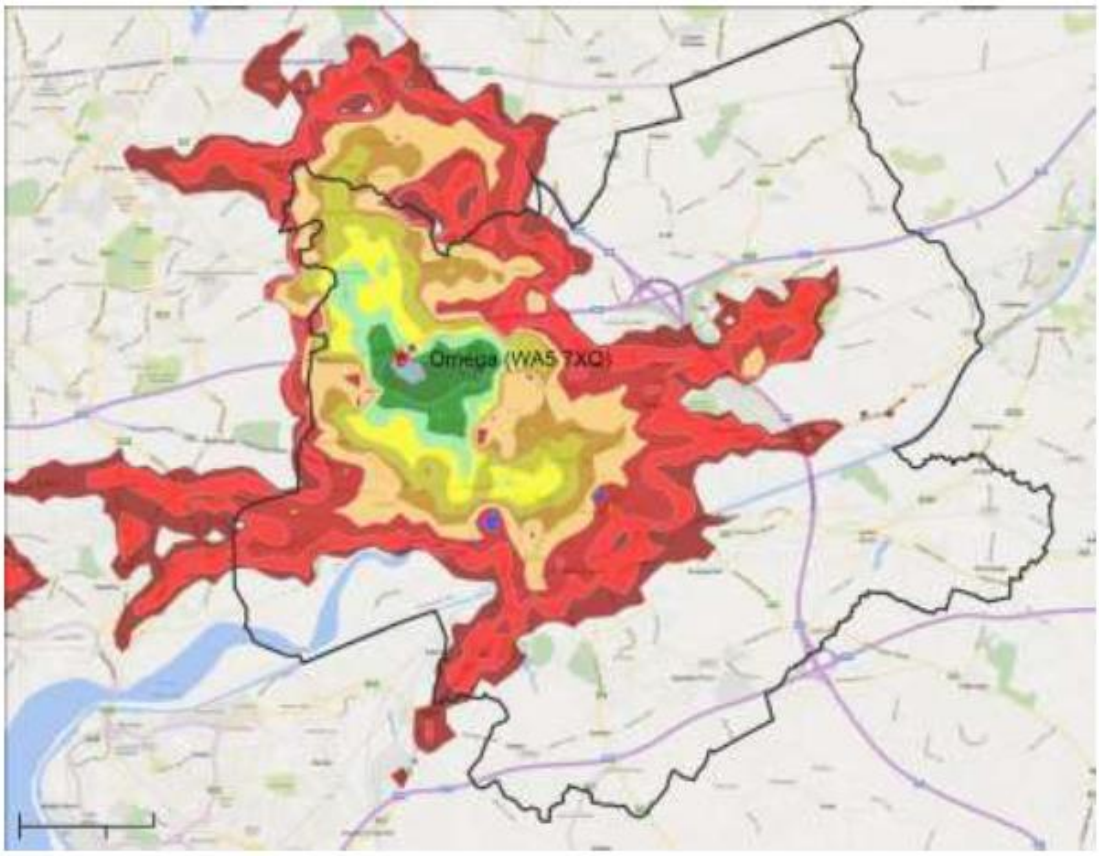


Source: TRACC

Omega

Similarly to Gemini Retail Park, Omega is located adjacent to the M62 motorway and Figure 4.22 presents accessibility to the site by public transport. The results show accessibility within 30 minutes was stronger north-south, which differed from the greater east-west connectivity to many of the other sites identified. Although the M62 did not appear to be a barrier to public transport connectivity, the M62 did form a boundary to the catchment within 15 minutes, with this area extending to the south over a greater area.

Figure 100: AM Peak public transport accessibility to Omega



Source: TRACC

Table 30 presents the number of residents within 60 minutes, by public transport, of each location. The findings are summarised below; The results show a greater catchment to Golden Square compared with the other locations which was expected given the public transport coverage to the town centre and limited cross town services.

A breakdown of the proportion of residents able to access each location for each five minute band is also presented in Table 30. The results show 40% of residents within 60 minutes public transport journey time of Golden Square are able to access the location in 30 minutes or less reflecting public transport availability into the town centre.

Outside the town centre, public transport accessibility comparatively remains poorer. Woolston Grange had the smallest catchment, with just 5% of residents within 60 minutes journey time were able to access this location within 30 minutes. Therefore, reflecting the limited public transport accessibility to the site.

Table 30: Proportion of residents within 60 minutes by public transport, by five minute bands, for each location

Location	Residents within specified public transport minutes of each location (%)												
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	All Residents
Golden Square	*	2	8	19	29	40	48	60	74	87	95	100	471,406
Warrington Hospital	*	2	3	5	11	20	34	48	60	70	84	100	327,733
Centre Park Link	*	*	1	4	11	21	31	44	58	74	88	100	340,979
Birchwood Business Park	*	1	3	8	16	24	30	37	47	62	80	100	255,018
Woolston Grange	*	*	*	*	1	5	17	27	40	54	72	100	130,183
Daresbury Sci-Tech	*	*	2	4	9	16	25	37	50	66	84	100	228,116
Lingley Mere	*	*	1	5	12	18	21	26	37	56	79	100	183,988
Gemini Retail Park	*	*	2	5	7	11	18	27	40	58	79	100	211,510
Omega	*	*	2	4	7	10	17	26	38	58	81	100	229,475

Source: CENSUS 2011 – All usual residents

Public transport accessibility could also be viewed less favourable at Gemini Retail Park and Omega. Approximately 10% residents within 60 minutes public transport journey time were able to access the location within 30 minutes. These sites were two of the furthest from Warrington Town Centre and this may explain the smaller catchment.

A fifth (20%) of those within 60 minutes of Birchwood Business Park needed to travel for 55-60 minutes to access the site. It is likely the proximity to the rail network allows the residential catchment to extend towards Greater Manchester. Consequently, this results in a large residential population being within 55-60 minutes of the site.

It can be seen that the employment destinations which are found further afield from the town centre generally have poorer transport accessibility. This can be attributed to several factors:

Warrington has been subject to a dispersed development pattern with employment being focused in out of town locations and urban sprawl taking place for residential development. This makes it increasingly harder for the servicing of public transport services.

Conversely, public transport services have been focused and route to the town centre. There are also limited cross town services with residents often having to change in the town centre. This has led to longer distances being covered and added interchange time when wanting to travel across town to Warrington's employment and leisure destinations. Consequently, the towns out of town employment destinations, which are major employers in Warrington, have become in adequately serviced by public transport.

4.19.2 Key findings of highways accessibility

The key findings of highways and public transport accessibility are:

- Highways accessibility in Warrington is generally good, with the drive time catchment within 60 minutes included much of Merseyside and west and central Greater Manchester, as well as Chester, Preston and Stoke-on-Trent.
- In general, public transport access to key sites in Warrington is generally quicker according to the proximity of the site to the town centre or CLC Line.

- As the bus network in Warrington is centred on the Bus Interchange in the town centre, has had a notable impact on public transport accessibility. This has led to the centre of Warrington having highest accessibility with 40% of residents within 25-30 minute public transport accessibility.
- Warrington's employment destinations positioned further outside the town centre (Gemini, Omega, Sci tech Daresbury, Lingley Mere and Birchwood Park) have poorer public transport accessibility. They see less than 25% of residents able to access the employment locations within 30 minutes using public transport.
- Woolston Grange in particular has limited public transport accessibility with only 5% of residents within 25-30 minute public transport accessibility.
- The motorway and Manchester Ship Canal provide challenges to resident's accessibility to key destinations within Warrington.
- The town's dispersed development patterns, sprawl of employment destinations and residential areas, has added to the difficulty of providing good public transport accessibility under 30minutes with greater distances having to be covered.

What does this mean for LTP4?

LTP4 should look to increase public transport accessibility to make a more competitive offer against the private car. The strategy should continue to improve journey times and reliability to the town centre to help reinforce the town centre as the hub of activity within Warrington.

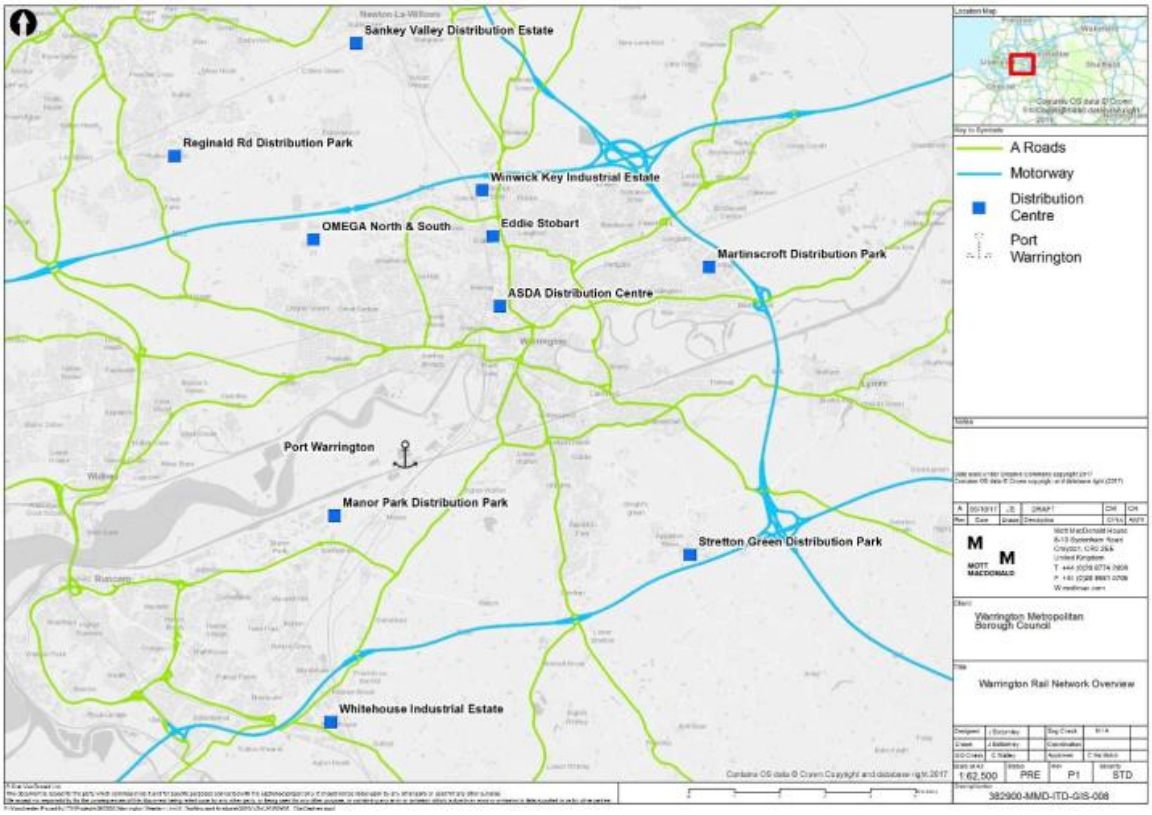
The strategy should also seek to improve public transport accessibility to the town's major employment destinations which lie in the outer reaches of the town. These locations currently suffer from poorer transport accessibility. Therefore, the strategy should seek to improve accessibility by:

- Delivery of a bus strategy that can make better use of the current network and introduce a higher standard of service;
- Consider reallocation of road space and bus priority schemes to improve journey times and reliability;
- Consider mass transit concepts that can produce faster journey times and can connect key residential and employment areas; and
- Better integrate public transport services with seamless travel between rail, bus and park and ride services.

4.20 Freight

The location of key distribution centres that generate local freight movement as opposed to through freight traffic in Warrington have been mapped in Figure 101. These centres are located in close proximity to the Strategic Route Network.

Figure 101 : Location of Warrington distribution centres



Source: Mott MacDonald Western Link Strategic Case

The Atlantic Gateway Business Plan ascribes to the investment and introduction of a new port in Warrington, the Port Warrington development. It will likely be located on the Manchester Ship Canal with transhipment facilities for both rail and highways present. Therefore, its approximate location has been provisionally mapped next to the Manchester Ship Canal at Birchwood Lane.

4.20.1 Highways freight activity

Freight flows have been produced for the AM peak, inter-peak and PM peak for heavy good vehicles (HGVs) based on the 2016 data collection for the Warrington Multi-Modal Model. Figures 3.26 to 3.28 present the flows.
The greatest flows were observed along the M6, followed by the M62 and then the M56. Elsewhere in the Borough, higher flows were observed to the north west of the town centre around Westbrook and along Birchwood Way between the town centre and Birchwood Business Park.

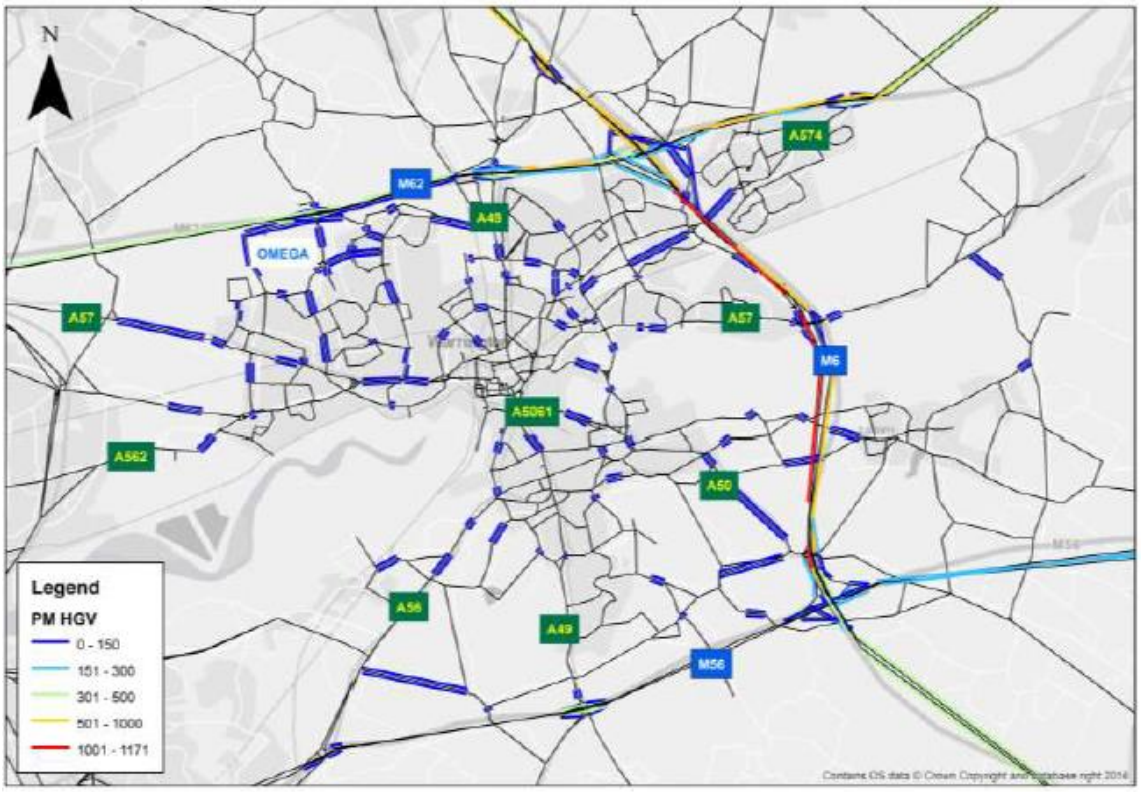
Figure 102 : HGV flows AM Peak (07:45 – 09:15)

Source: 2016 data collection for Warrington Multi-Modal Model

Figure 103 : HGV flows inter-peak (10:00 – 16:00)

Source: 2016 data collection for Warrington Multi-Modal Model

Figure 104 : HGV flows PM peak (16:30-18:00)



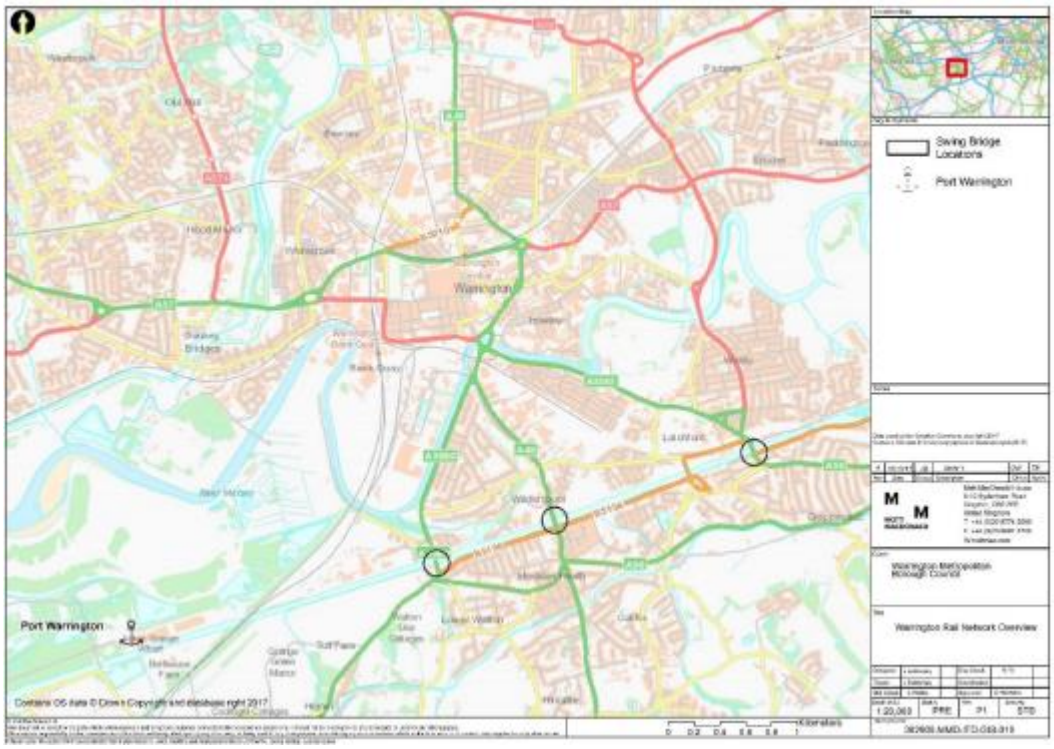
Source: 2016 data collection for Warrington Multi-Modal Model

4.20.2 Waterborne freight activity

Several swing bridges exist in Warrington town centre and provide crossing points over the Manchester Ship Canal. They are owned by Peel Ports and are found in the following locations (Figure 105):

- A5060 Chester Road;
- A49 London Road; and
- A50 Knutsford Road.

Figure 105 : Location of swing bridges along Manchester Ship canal in Warrington town centre



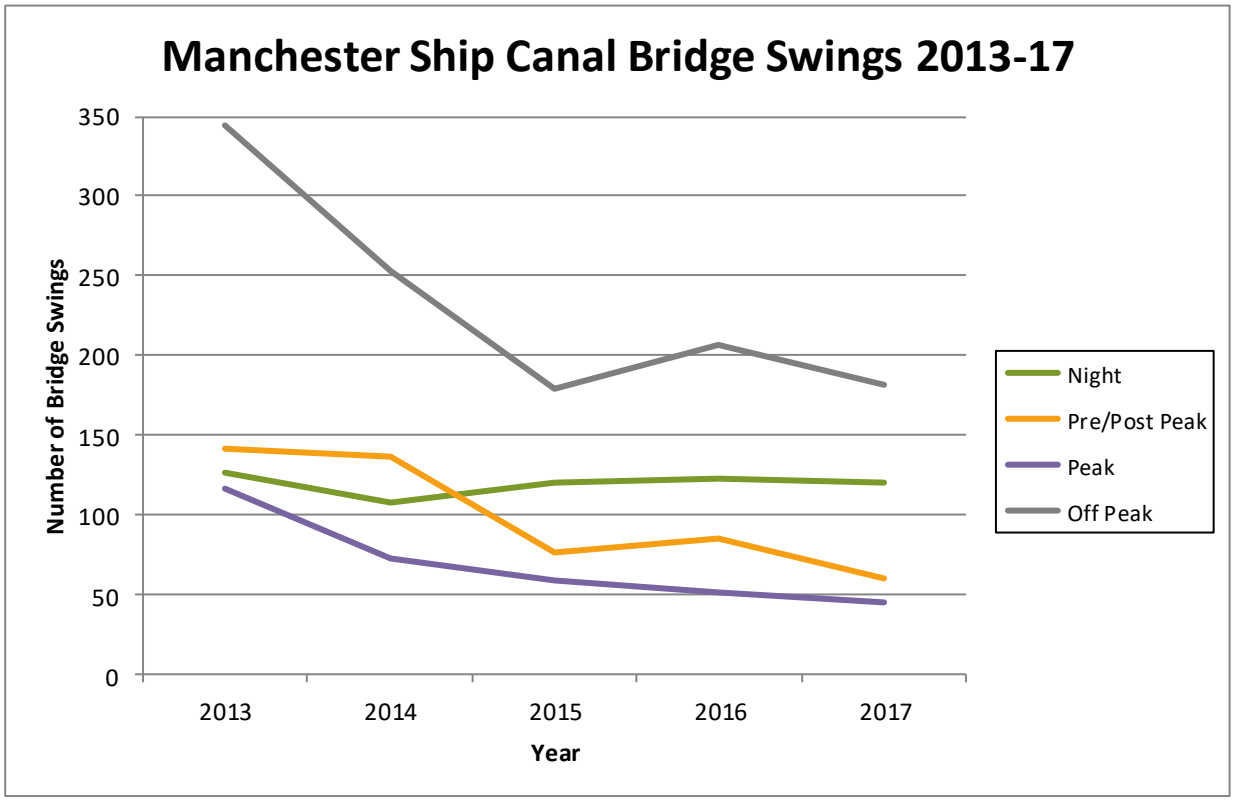
Source: Mott MacDonald

Whilst the swing bridges enable traffic to cross the ship canal, they also rotate to enable ships to pass, temporarily closing key highway routes into the town centre. This can cause substantial queues at the crossing points in both directions as well as causing delays to traffic travelling between the town centre and other parts of Warrington.

Peel's ownership of the bridges limits Warrington Borough Council's control over the swing bridge movements. This, coupled with freight movements being limited to operating during high tide, severely hampers highways network resilience.

Warrington Borough Council has been working with Peel to reduce the number of peak time bridge swings. Figure 106 shows that the number of pre/post peak and peak swings has reduced over the last four years.

Figure 106: Manchester Ship Canal total swing bridge movements 2013-2017



Year Jan - Dec	2013		2014		2015		2016		2017	
Night	126	17.31%	107	18.84%	120	27.65%	122	26.29%	120	29.48%
Pre/Post Peak	142	19.51%	136	23.94%	76	17.51%	85	18.32%	60	14.74%
Peak	116	**15.93%**	72	**12.68%**	59	**13.59%**	51	**10.99%**	45	**11.06%**
Off Peak	344	47.25%	253	44.54%	179	41.24%	206	44.40%	182	44.72%
Total	**728**	**100.00%**	**568**	**100.00%**	**434**	**100.00%**	**464**	100.00%	**407**	100.00%

Source: Warrington Borough Council

4.20.3 Key findings of freight

Key findings of the analysis of freight were:

- The number of LGV's on Warrington's highways network is increasing. With Of 10.3% of vehicle miles were by LGV in 2000 and this has risen to 14.0% in 2015.
- The number of HGV's on Warrington's highway network has slightly decreased. With 11.7% vehicle miles were by HGV in 2000 and this has fallen to 9.9% in 2005.
- The greatest flows were observed along the M6, followed by the M62 and then the M56;
- For the rest of the Borough, Higher flows were observed to the north west of the town centre around Westbrook and along Birchwood Way between the town centre and Birchwood Business Park; and
- There has been a decrease in the number of total swing bridge movements between 2013-2017 on the Manchester Ship Canal. However, they still cause substantial queues at crossing points in both directions and delay.

What does this mean for LTP4?
LTP4 should implement a freight strategy to help manage freight movements and limit the effects of congestion and air quality issues. It should look to more effectively route freight movements and promote the use of alternative fuels.

The strategy should consider the transformation and coordination of freight operations with the introduction of Western Link. This could help bring forward the Port Warrington development and consolidate Warrington's freight operations in one location with water and rail connections to the rest of the country.

4.21 Highways safety

Traffic accidents are generally associated with roads that include higher traffic speeds, heavier traffic flows, roads utilised by more commercial vehicles such as HGVs, and where merging and/or queueing is common.

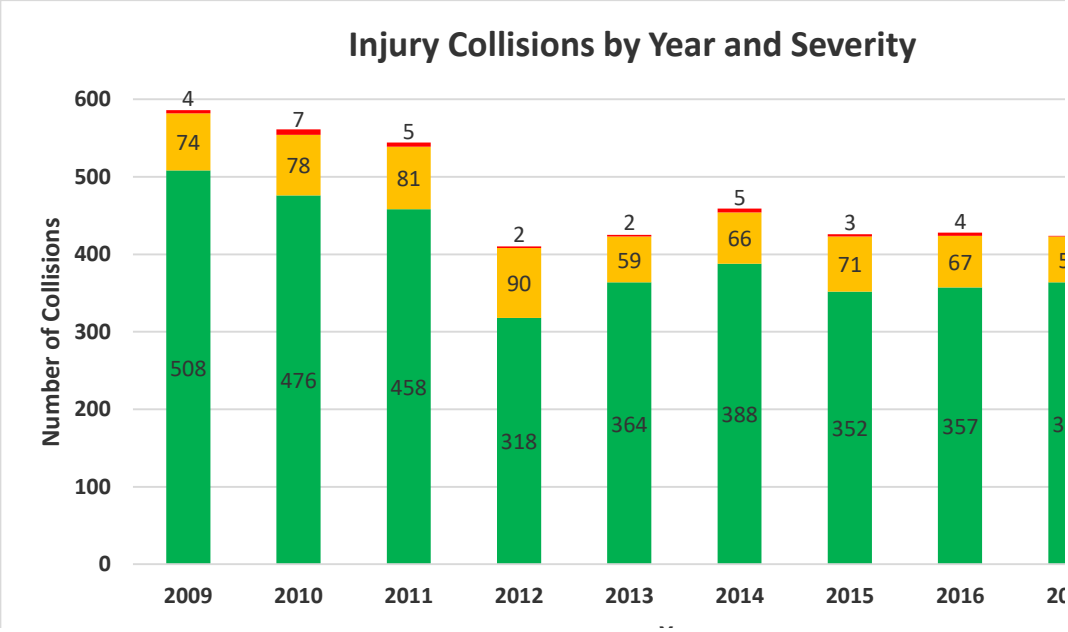
DfT produce an annual Reported Road Casualties Report, the latest report2 was released in September 2016 for 2015 data. The report states there were 505 accidents in Warrington in 2015; 83% (n=420) were categorised as slight, 16% (n=81) were defined as serious and 1% (n=4) were fatal. These severity proportions were consistent with the figures for the whole of the North West; 1% categorised as fatal, 18% classified as serious and 80% classed as slight.

Of the 505 accidents, the road surface condition was dry for 68% (n=345), the surface was wet or flooded for 30% (n=153) and there was snow or ice for 1% (n=7) of accidents.
With regards to casualties, there were 687 in Warrington in 2015. The majority were slightly injured (87%, n=598), whilst 12% (n=85) were seriously injured and four people were killed.
Of the 89 people that were killed or seriously injured (KSI), the road users were:

- Car (n=26);
- Cyclist (n=20);
- Motorcycle (n=19);
- Pedestrian (n=18);
- LGV (n=3);
- HGV (n=2); and
- Bus (n=1).

The number of KSI casualties in Warrington between 2011 and 2015 is presented in Figure 107. The results show peaks in 2011 and 2012, before a fall in 2013 and 2014 and a slight rise in 2015. Similarly, across the North West the number of KSI casualties fell between 2011 and 2013 but increased in 2014 and 2015.

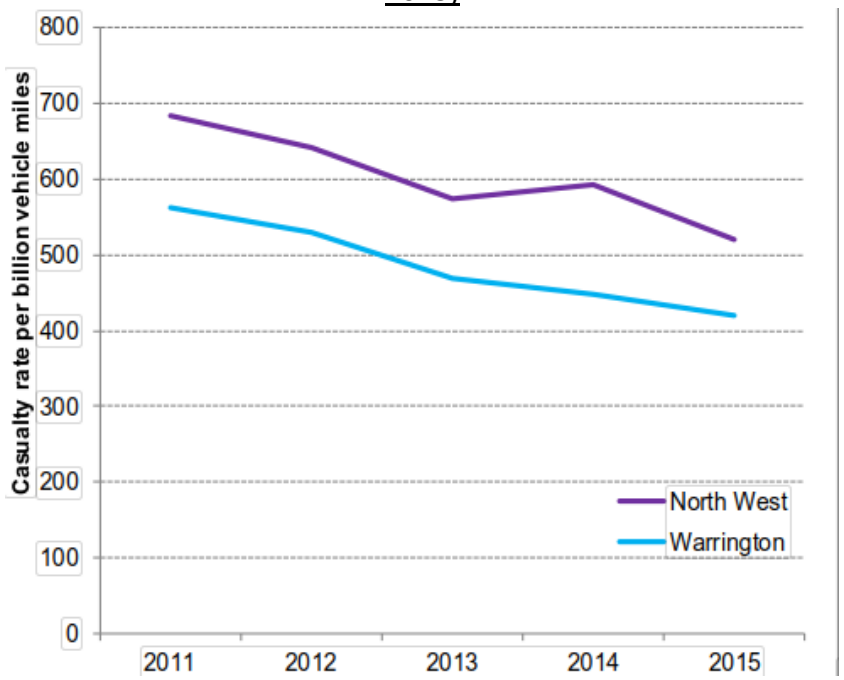
Figure 107 Killed or seriously injured casualties in Warrington (2011-2015)



Source: DfT Report Road Casualities Report (2016)

Finally, the report also provides the reported casualty rate per billion vehicle miles by local authority. Figure 3.30 shows this rate was lower in Warrington compared with the whole of the North West. Furthermore, the rate has fallen in Warrington and the North West between 2011 and 2015.

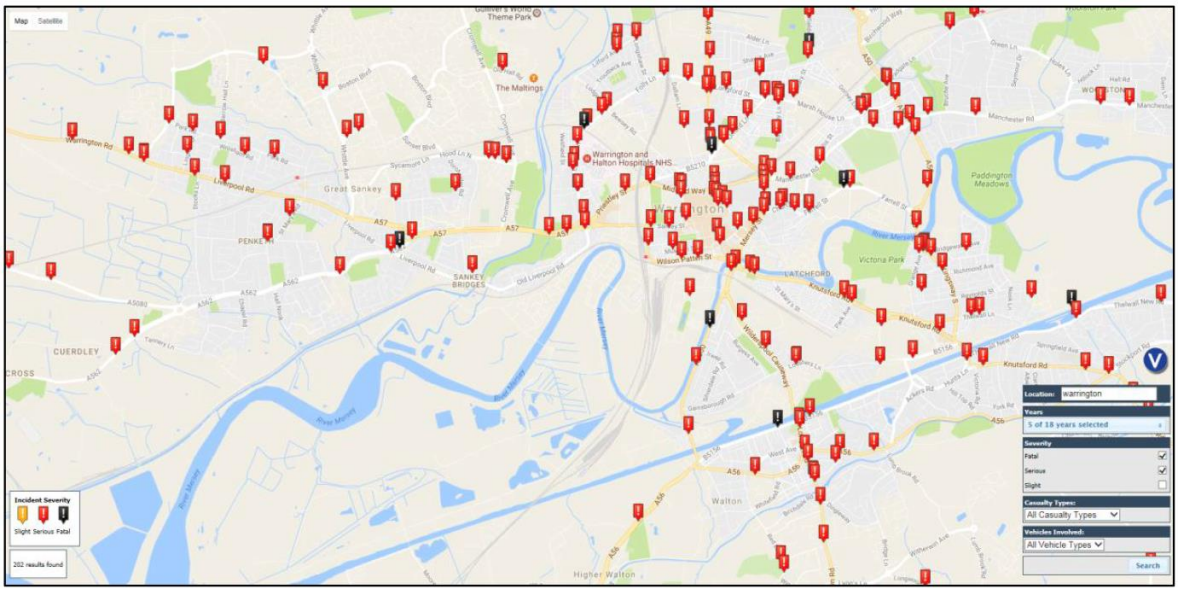
Figure 108 Casualty rate per billion vehicle miles in North West and Warrington (2011-2015)



Source: DfT Report Road Casualities Report (2016)

The location of fatal and serious road traffic accidents in inner Warrington for the period 2011-2016 were mapped. As Figure 107 shows, Warrington town centre is a significant 'hotspot' for road traffic accidents, particularly in locations such as Winwick Street, Cockhedge Green roundabout and Lovely Lane. To some extent, this pattern is to be expected given the high volumes of traffic that are present within the town centre.

Figure 109 Fatal and serious road traffic accidents in inner Warrington 2011-2016



Source: CrashMap

4.21.1 Key findings of highways safety

The key findings of highways safety are:

- Warrington's roads can be viewed as being increasingly safer for highways users.
- The number of KSIs in Warrington has fallen between 2011and 2015;
- 42.6% of KSIs that occurred in Warrington 2015 were active travel users;
- The casualty rate per billion vehicle miles was lower in Warrington compared with the whole of the North West. This trend is also showing to be falling.
- Warrington town centre is identified as accident hotspot.

What does this mean for LTP4?
Warrington's roads become increasingly safer. LTP4 should continue to improve highways safety, with particularly emphasis on active travel safety. Focus should be given to reducing the level of conflict between active travel users and vehicles. Segregation of cyclists on high volume or speed roads could help reduce the likelihood of accidents. Traffic calming measures and improved junction design in high pedestrianised areas could also help increase highways safety.

4.22 Car parking

The data collection for the Warrington Multi-Modal Traffic Model included parking data. Car park occupancy surveys were conducted between 07:00 and 19:00 at 10 sites:

1. Town Hall (public)
2. Warrington Market / Time Square (public) 3: Warrington Bank Quay (Slutchers Lane)
3. Dallam Lane
4. Winwick Street
5. Cockhedge
6. Old Road
7. Cobden
8. Museum Street
9. Orford Lane
10. Church Street

Sites 1 to 7 were off-street car parks whilst sites 8 - 10 were on-street. Appendix A presents the car park occupancy profile for each site. The findings of the car park occupancy data are summarised below:

- Significant early morning demand at Warrington Bank Quay car park with 52% of spaces full at 07:00. The car park remained more than half full (55%) at 18:45. This reflects the use primarily by rail users which includes those making longer trips and greater likelihood of overnight parked vehicles compared with the other sites.
- The car park at Cobden was just over a third (34%) occupied at 07:00 and by 09:15 was fully occupied. It remained full throughout the survey period with some evidence of additional vehicles parking in the car park with 116% occupancy at 18:45. It is likely the popularity of this car park reflects the free parking available.
- The Town Hall and Cockhedge car parks were busiest during the inter-peak; with the Town Hall car park 50% utilised at 09:15 but fully occupied by 10:45 though this fell to 77% by 12:15. Similarly, the Cockhedge car park was at least 80% utilised from 10:15 to 15:00.
- Occupancy at the Old Road car park peaked at 26% and therefore was considerably lower than the other sites. Although the cost of parking is reasonably low, the site is near Riverside Retail Park (which has 3 hours free parking), is not at a convenient location for accessing the town centre and has a similar cost to alternative more central parking.
- Greater occupancy of on-street parking during the interpeak between 10:00 and 16:30 compared with peak periods.

4.22.1 Car parking proposals

Warrington Means Business 2017, the town's regeneration framework, outlines several new parking proposals for the town. These are intended to be position at key gateways into the centre of the town. The parking proposals are outlined below in Table 31:

Table 31: Car parking proposals for Warrington town centre

Location	Description
Time Square	Now open, the car park has a capacity of 1,200 spaces.
Stadium Quarter (phase1)	Intended 1000 space capacity development
Bank Quay	As part of the redevelopment of Bank Quay Gateway. Capacity to be confirmed.
Southern Gateway	As part of the redevelopment of this area. Capacity to be confirmed.
School Brow/Cockhedge	As part of the redevelopment of this area. Capacity to be confirmed.
Centre Park	As part of the redevelopment of this area. Capacity to be confirmed.

Source: Mott MacDonald Western Link Strategic Case

4.22.2 Key findings of car parking

The key findings of the car parking evidence are set out below:

- There is significant demand to access parking for Warrington's rail stations, indicating multi-modal trips are taking place for longer distanced journeys;
- There is significant demand to use the towns car parking facilities; Cobden, Town Hall and Cockhedge car parks are seen to be at or nearing full capacity;
- On street car parking is more widely used during the inter peak periods; and
- Various new car parking developments are being planned for the Town Centre. This will add to the preference to use the private car to access the town centre.

What does this mean for LTP4?
LTP4 should consider revising parking standards to better coordinate parking around the Borough and ensure it fits with the Vision for LTP4.

4.23 Asset condition

Highways asset conditions were obtained from the Highways Asset Management Strategy. The strategy focuses on the following principles: a safe network; a serviceable network; a sustainable network; and informed and satisfied customers.

The highway network is by far the single most valuable asset in the control of the Council, with an estimated replacement value of at least £980 Million. Currently, Warrington has in excess of 1200km of publicly maintained highways, 221 highway bridges and approximately 13,000 street lights.

The Council also maintains some 220 km of Public Rights of Way, consisting of 210 Km of footpaths, 6.2 Km of bridleway and 3.4 Km restricted byway. Warrington's outstanding

highways assets are presented below in Table 32.

Table 32: Warrington highways assets

Highway Network	Length	Footway Network	Length
A Class Roads	198Km	Bituminous Footway	983 Km
B Class Roads	68Km	Flagged Footway	38 Km
C Class Roads	159Km	Concrete Footway	1.6 Km
U Class Roads	639Km	Paved Footway	15.4Km
Dual Carriageways	37Km		
Passageways	37Km		
Roundabouts approx.	6Km		
Total Highway Network	**1137Km**	**Total Footway Length**	**1038 Km**

Source: Warrington Borough Council Highway asset management strategy 2015

What does this mean for LTP4?
LTP4 should continue to support an asset management strategy for Warrington's extensive highways network.

4.24 Local Plan consultation responses

The responses from the July 2017 Local Plan Preferred Development Option Consultation were reviewed to provide an understanding of what transport issues are affecting Warrington residents and stakeholders. This section summarises the key transport issues and problems which were commonly cited in the consultation process, as well as transport solutions which participants suggested.

4.24.1 Key transport issues

A summary of the current transport issues expressed by members of the public and key stakeholders is given below.

Congestion

Congestion and traffic were identified as a major issue. Of the public consultees who referenced current transport issues, 64% referred to the town's congestion and traffic problem, 17% also referred to the traffic problems caused by motorway closures and 8% referred to the inconvenience caused by the swing bridges and river crossings.
Many saw the town centre as a hot spot for traffic, other areas which were frequently cited included: Stockton Heath; Knutsford road; Thellwall; Grappenhall; A50; Chester Road; Lymm; and the A49.

Car dominance

Warrington's car dominant culture and preference to use the car was suggested to create a poor environment to live and work in, as well as setting a poor impression for visitors; 10% of public consultees referred to these issues. Many also referred to the effect that the large number of cars has on other travel options; some stated it was harder to walk and cycle within Warrington, with further concerns over road safety and impacts from pollution.

Public transport

Many expressed the view that the public transport offer in Warrington was poor and was a key reason for choosing to travel by car. The bus system was described as having limited services, being infrequent and expensive. This was particularly evident for those who live or work in Warrington's outlying areas, such as Rixton, Glazebrook and Lymm.
Some said it was difficult to travel to train stations by bus. Others said there was poor signage to existing stations and the lack of rail connectivity in south Warrington was a key barrier to travel.

Active travel

Many referenced the poor walking and cycle links within the town centre, as well as the poor rights of way for active travel users, this included horse riders. Many described the car intensive environment and poor air quality to be barriers to walking. The lack of cycle routes and protection from traffic were also referenced as a major problem.

Air, noise and light pollution

There were large concerns over transport pollution; 34% of respondents cited transport's impact on air quality, irritable noise and light pollution. This came with worries over health and the increased likelihood of developing long-term disease and ill health. Many stated Warrington was an unhealthy place to live with problems of lung and heart disease.

Parking

Some saw parking to be too expensive within the town centre. Others referred to the limited parking in Lymm and Stockton Heath. Car parking on the road and pavement was also mentioned to be a problem and barrier to those who use the footway.

4.24.2 Priorities for transport investment

The responses from both the public and stakeholder Local Plan Preferred Development Option consultation process, who referred to how Warrington's transport system could be improved are summarised below.

<u>Dealing with congestion and traffic</u>

18% of the public who referred to specific transport improvements, referenced the need for additional highway capacity to address the congestion problem. Some stakeholders suggested that a serious programme of public transport and highways works is required to increase connectivity between the centre and the wider Warrington region. An additional river crossing was described as being essential to Warrington's future transport system. However, many of the public responses felt the past approach of road building was inadequate in addressing the towns transport problems and does not offer a viable and worthy transport solution for the town. More road building was often expressed as only to

incite congestion and not the answer to limiting transport pollution. Rather, many referenced the need for pursing greener modes of transport.

Highways

Some felt the surrounding motorways needed to be improved as well as the management of diversions through Warrington in times of incidents and closures. Others felt that Warrington was in desperate need of another Manchester Ship Canal crossing. However, the use of the disused rail line over the ship canal remained a contentious issue. A new MSC crossing designed for cars was heavily discouraged, others were more accepting of a crossing which would only support greener travel options.

Public transport

Many believed it would be more effective to focus on improving public transport rather than road building. Some stated that public transport investment is needed to the centre, in order to make the area a more welcoming and clean environment. Of the public responses who suggested priorities for transport investment, 60% referred to improvements to public transport.

Stakeholders expressed the need for sustainable transport to be at the heart of Warrington's development plans, as well as the protection of corridors for future rail improvements such as HS2 and Northern Powerhouse Rail.

Mass transit

Stakeholders referred to the need for Warrington to consider major investment in a new mass transit network. Of the public responses who suggested priorities for transport investment, 23% referenced the need to introduce mass transit services and low-carbon modes of transport such as trams or guided bus way. It was thought that introducing a more modern and higher quality mass transit system, would provide a more attractive travel option to the car than the current public transport system can provide.

Parking

Some ascribed to the need for cheaper and greater availability of short stay visitor parking within the town centre to make it easier to visit and support town centre retailers. Others referenced the need for more parking at crucial services and amenities, such as the hospital. Some thought it would be better to have out of town carparks with shuttle buses and trams providing connection to Warrington's main areas.

Walking and cycling

Waking and cycling was a high priority for transport improvements; 24% referenced the need for improved walking environment and 31% referenced the need for improved cycling. Many referred to the need for improved walkways in the centre and investment in walking trails.

Many felt that there needs to be greater investment in the cycle network to help encourage more people to do exercise. This included the introduction of more cycle lanes and measures to reduce traffic within the town centre to create safer cycling conditions.

5 The Future

5.1 'The future' key findings and implications

Future growth in Warrington

- The growth proposed in the Draft Local Plan will see Warrington become home to substantial numbers of new residents and workers.
- Pinch point improvements and congestion relief alone will not be enough to support the planned growth of houses and employment land.

Locations for growth

- The Waterfront area will require new access arrangements.
- New transport infrastructure will be required to support development in Warrington's green belt such as the Garden City Suburb and the South West Extension.

Cheshire and Warrington growth plans

- There will be increased demand to reach employment destinations in the Atlantic Gateway and Cheshire Science Corridor: Birchwood Park; Warrington Waterfront; Omega; Lingley Mere; and Sci-Tech Daresbury. Large levels of car commuting already occur to some of these locations, a more sustainable transport strategy will need to be in place to ensure sustainable growth.

The future of the North

- New Northern Powerhouse rail services could see the development of a line between Liverpool and the HS2 Manchester Spur via Warrington. There will be greater demand to reach Warrington's stations, particularly Warrington Bank rail hub.
- The TfN Strategic road study plans to upgrade and improve journey times, east-west connectivity, safety, and user experience on the M6, M62 and M56.
- There will be greater number of people travelling to and from motorways access points in north, south and east Warrington.

Future transportation

- A total of 1121 ULEVs were licensed within Warrington in 2017. This encompasses 1.04% of all cars licensed within Warrington. The number of ULEVs licensed has also grown at a faster rate within Warrington compared with the North West.
- Lithium ion battery densities are increasing and prices are falling, thus raising the attraction to purchase ULEVs. It will be important for Warrington to investigate current use of ULEVs and consider changing the policy environment to help support the growing use of the vehicles.
- Autonomous vehicles could be on UK roads as early as 2021 and form an essential part of the future UK economy, with market worth £28 billion to the UK by 2035.
- Mobility as a Service is a new technological innovation disrupting the transport industry. The widespread use of smartphones have generated new opportunities to engage with travellers and the way they influence the demand on the network.

5.2 The future

This section investigates Warrington and the wider regions future growth plans. It is important to consider how Warrington's population, workforce and urban form could be influenced by growth agendas set out for the town and the North.

There are several new transport technologies which are causing uncertainty within the sector over how people will travel in the future. This section also explores emerging transport technologies that may need to be considered for Warrington's future transport system.

This section reviews the following data sources: growth forecasts and projections; statutory planning documentation; regeneration programmes; proposals; research papers; and scientific journal articles.

5.2.1 Future growth

In the time of undertaking the LTP4 evidence review, Warrington Preferred Development Option 2017 (PDO) was the most up to date planning document concerning Warrington's Local Plan. It was anticipated that the PDO would not be too dissimilar to the final Local Plan in terms of locations for growth and housing and employment targets. Therefore, the PDO was used as a proxy for determining how new housing and employment space across Warrington may impact the future transport system.

Once the Local Plan has been formulated it will become available on Warrington Borough Council's website: https://www.warrington.gov.uk/info/200564/planning-policy
It is also worth noting that through the LTP4 development process, more detailed transport modelling will be undertaken to test the Local Plan's impact on the transport network. This will be achieved through the use of Warrington's Multi Modal Transport Model. For now, the PDO provides a good proxy for analysing future growth of Warrington.

5.2.2 Housing growth

The Housing Growth proposed in the Draft Local Plan between 2017 and 2037 is shown in Table 33.

Table 33: Housing Growth Proposed in Draft Local Plan

Annual Target	945
2017-2037	18,900
Flexibility at 10%	1,890
Total Requirement	20,790
Urban Capacity	13,726
Green Belt Requirement	7,067

The council is proposing a stepped housing trajectory to allow for major infrastructure investment to facilitate green belt release. There will be a relatively lower level of housing delivery for the first 5 years of the Plan Period given that land will remain in Green Belt until the Plan is adopted and to allow for key enabling infrastructure to be delivered.

5.2.3 Employment growth

The employment land growth proposed in the Draft Local Plan is: Over the 20 year Plan period from 2017 to 2037 provision will be made for a minimum of 362 hectares of land for B1, B2 and B8 uses to support both local and wider employment needs

What does this mean for LTP4?
The growth proposals for new residential and employment developments for Warrington Borough will place added pressure on to an already congested highways network. With many of the proposed new residential developments being on the south-eastern and south-western edges of the urban area, the propensity to default to car-dominant travel is high unless viable, high-quality alternatives are provided.

Therefore, LTP4 must explore a range of high-quality transport alternatives to the car to help encourage the sustainable movement of Warrington's existing and future population. Appropriate demand management strategies may also need to be explored to help effectively aid a modal shift to a prospective transformed public transport and active travel network.

5.3 Autonomous vehicles

Autonomous and connected vehicles (CAV) concern vehicles which can communicate live information with one another and which can drive themselves through an 'autopilot mode'. These vehicles use on board sensors to detect their immediate environment. Networking systems are then used to speak between vehicles and relay information on their position, highways, and traffic and weather conditions. This information sharing is thought to help increase the efficiency of the highways network, deliver more effective routing, increase safety and make better use of available road space[5].

The Centre for Connected and Autonomous vehicles was established in 2015 to help ensure the UK remains a world leader in developing and testing CAVs. A range of projects are being funded across the UK, as well as four city driverless car projects taking place in Bristol, Coventry, Greenwich and Milton Keynes. It is anticipated that autonomous vehicles could be on UK roads as early as 2021 and form an essential part of the future UK economy, with market worth £28 billion to the UK by 2035.[6]

Below is a list of some of the major international companies currently developing self-driving car technology:

[5] Atkins (2016) research on the impacts of Connected and Autonomous Vehicles on Traffic flow
[6] Centre for Connected and Autonomous Vehicles (2017) Market forecast for connected autonomous vehicles

- Toyota AImotive
- BMW Aptive
- Ford Argo
- Aurora
- Hitatchi - Clarion
- Audi – Delphi
- Audi – Nvidia
- Google – Waymo
- Linux
- Intel
- NuTonomy
- Lexus - Torc

The vehicles have huge potential in generating a number of transport and safety benefits[7]

- Offer those who might be less mobile or unable to use private vehicles greater opportunity to travel;
- 90% of accidents involve driver error, CAV have the potential to reduce the number of highways accidents and road casualties through automation, with maximum during full automation;
- Reduce congestion by enabling cars to drive closer together and make more use of available road capacity;
- Improve emissions by enabling vehicle platooning which reduces air resistance following vehicles, and sharing information with traffic signals to help optimise speeds; and
- Improved road safety could reduce the need for crash barriers and signage, this could help highways become less cluttered and improve overall road design; and
- Release of space through reduced ownership of private vehicles and parking.

What does this mean for LTP4?

Autonomous vehicles could help increase the opportunity to travel in Warrington and help raise network efficiency. The emerging technology has the potential to reduce the number of incidents along the network and raise network resilience. Vehicles could also be connected and provide real time data that could be used to streamline traffic and manage movements across the network.

Autonomous vehicles could significantly change the way the town travels in the future, particularly as Warrington's existing transport system is dominated by car movements. Therefore, it will be important for Warrington to monitor developments in the CAV industry and investigate how the technology could be best used in the town.
CAVs also pose an opportunity to be developed for other modes; they could help improve a better quality of service for public transport, as well as being used for freight to help improve the efficiency and coordination of logistics operations.

[7] Atkins (2016) Connected & Autonomous Vehicles Introducing the future of mobility

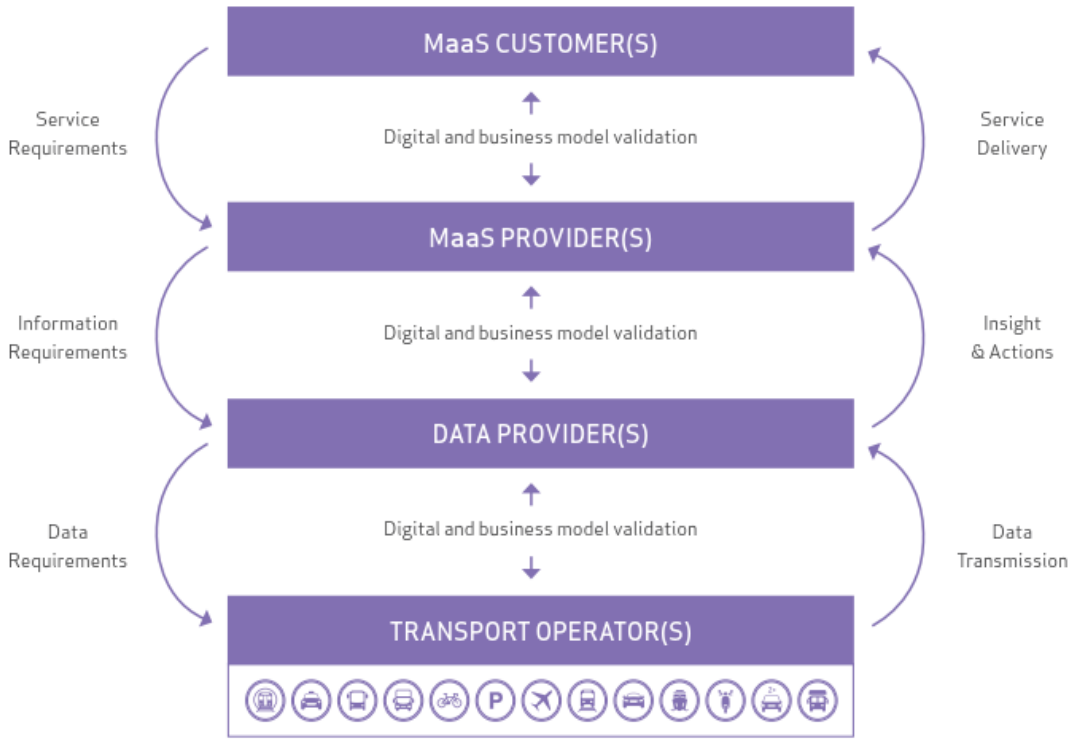
5.4 Mobility as a service

Mobility as a service (Maas) can be defined as the full integration of private and public mobility services in a seamless manner that meets the objectives and requirements of a variety of stakeholders including[8]:

- Customers;
- Mobility services, providers and operators; and
- And local city transport authorities.

There is rising global interest in Maas both in public and private sectors as it offers an opportunity to improve how people and goods move, as well as providing crucial real-time information that can further support transport authorities policy and decision making.
The service is mostly thought as a digital interface that would enable any type of travel using and type of transport service both public and private. It changes the conceptual model of transport towards one which is focused on the customer.

Figure 110 Mobility as a service (MaaS) value chain



Source: Transport Systems Catapult, The Transport Data Revolution: Investigation into the data required to support and drive intelligent mobility

[8] KPMG (2017) Reimagine Places: Mobility as a Service

There are two core strengths to the MaaS business model: servitisation, whereby the MaaS Provider creates a value proposition that comprises a 'bundle' of different mobility services; and Data Sharing, whereby the MaaS Provider shares data on the mobility needs of customers, to help Transport Operators improve their service[9].

Evidence that MaaS growth requires policy intervention, may be found in the 'narrow' set of features available in current MaaS offerings. For example, although taxi service apps have gained customers by offering some MaaS features e.g. easier transactions, they have not significantly improved multi-modal journeys. There are several reasons for this and barriers have been identified which may prevent the MaaS ecosystem from reaching its potential in the short-term. One outcome is the scenario where MaaS Providers offer consumers a service focussed on car vehicle transport e.g. taxi, car share and rideshare services. The other outcome is a scenario where consumers are offered a fully multi-modal service. A key question for policy makers is therefore 'what type of MaaS do they want to see grow.

The UK Government's Transport Systems Catapult have identified key findings that should be consider by policy makers when examining the MaaS opportunity[9]:

MasS could change travel behaviour:

- The impact of MaaS is unknown. MaaS could result in more journeys and distances travelled by car or potentially less; it could support national and local transport policy or challenge it but further research is needed.
- MaaS offers the potential to address many of the transport challenges facing society by engaging new business models and technology – it offers policy makers an opportunity for achieving travel behaviour change and managing travel demand.

MasS could change the transport sector:

- Existing transport operators face significant opportunities but also threats from MaaS growth. Transport operators may move away from a business to consumer model, to focussing on supplying transport capacity directly to MaaS Providers.
- MaaS has the potential to provide transport authorities with rich data to help them manage their transport systems and networks.

MasS growth could benefit from policy intervention:

- There are significant barriers that are preventing MaaS growth and policy interventions may be required to address them.
- The benefits of MaaS success are compelling and there are many potential pathways for policy makers to engage the private sector to achieve desired MaaS outcomes.
- MaaS value propositions can be developed to suit a range of target customers, however the private sector may develop business models that do not align with existing policy goals.

[9] Transport Systems Catapult (2015), The Transport Data Revolution: Investigation into the data required to support and drive intelligent mobility

What does this mean for LTP4?
The transport technology available to local authorities is rapidly changing. Recent innovations in technology and the widespread use of smartphones have generated new opportunities to engage with travellers and the way they influence the demand on the network.

Warrington will need to engage with both private and public sector to consider how on demand services can be used and benefit Warrington. The quality and level of service could vary for different areas of the town, for example the MaaS would be different within the urban core and centre compared with Warrington's out of town more suburban and rural areas. Warrington will have to closely monitor developments in the industry to ensure they control and influence a MaaS system that could best suit the town.

5.5 Alternative fuels

Vehicles powered by alternative fuels are becoming increasingly more popular in the industry. The vehicles pollute less and offer a 'greener' way of travelling.

The motivation to increase their use has come from a range of environmental and health pressures; the Committee on the Medical Effects of Air Pollutants (COMEAP) estimated that long term exposure to air pollution had an effect equivalent to 29,000 deaths a year in the UK in 2008. Increasing the use of ultra-low emission vehicles (ULEVs) has been identified as key way to help address local air quality issues.

The government has also pledged to end the sale of non-hybrid petrol and diesel cars by 2040 and for almost all cars and vans on the roads to be zero emission by 2050[10]. Therefore, it will be key for the country to look to support the use of these vehicles by influencing market conditions and delivering infrastructure that can help make them a viable alternative to petrol and diesel powered vehicles.

A list of common alternative fuel powered vehicles can be found below:

- **Hybrid vehicles** – Self charging hybrid (charge sustaining) - these vehicles use a conventional internal combustion engine (ICE), an electric motor, and a small battery that provides less than 1 mile of pure electric range. They can't be plugged in to recharge; the small battery is charged via regenerative braking and / or the ICE. They are found to achieve better fuel efficiency by blending conventional and electric power and typically pollute less than ICE petrol/diesel powered vehicles.
  Plug-in hybrid (charge depleting) - a plugin hybrid fundamentally works in the same way as a charge sustaining hybrid. The key difference is that a larger battery is used which can typically provide between 15 – 30 miles of electric running before the system switches to charge sustaining mode. Due to the larger battery capacity these vehicles need to be plugged in to recharge the battery and typical recharge at a maximum rate of 3.6 kW.

[10] https://www.gov.uk/government/news/uk-government-pledges-bold-ambition-for-electric-cars

- **Electric vehicles** – vehicles powered by batteries. Pure electric cars use larger capacity batteries than plug-in hybrids and typical provide ranges of 100 – 390 miles between charges. Due to the larger battery sizes they require faster recharging equipment and will commonly recharge at 7 kW at home through a dedicated home charge point and up to 50 kW – 150 kW at dedicated public charge points depending on the model of car. Pure electric vehicles require dedicated recharging infrastructure to recharge in an acceptable amount of time and to ensure safe recharging at high loads.
  Range Extended Electric Vehicles (series hybrid) – These vehicles are electric vehicles but additionally contain a small generator which is typically petrol powered. There is no mechanical connection between the generator and the wheels, the generator is used to make electricity which is fed into the batteries to maintain the state of charge to provide additional driving range when the batteries are depleted. The generator is only intended to be used infrequently when recharging isn't possible. The vehicle is always electrically driven but will produce regulated and CO_2 emissions when the generator is running.

- **Hydrogen powered vehicles** – **Hydrogen Fuel Cell** – a fuel cell vehicle stores hydrogen in high pressure tanks which is fed into a fuel cell which combines hydrogen with oxygen from the atmosphere to produce electricity. Fuel cell vehicles typically also contain an energy storage device (a battery or a super capacitor) to cope with transient loads. Fuel cell vehicles are electric vehicles but rather than storing electrical energy in a battery, energy is converted into hydrogen which is then converted to electricity in the fuel cell. Because of this, a fuel cell electric vehicle has more components than a battery electric vehicle. Whilst battery electric vehicles produce no exhaust emissions, a fuel cell electric vehicle does produce water vapour, but doesn't produce any other exhaust emissions.
  Hydrogen ICE - these vehicles use an internal combustion engine which burns hydrogen. Unlike a fuel cell vehicle this does produce engine out NOx emissions which need controlling. An ICE powered vehicle retains the hydrogen tanks, but doesn't have a fuel cell and also doesn't need any form of energy storage.

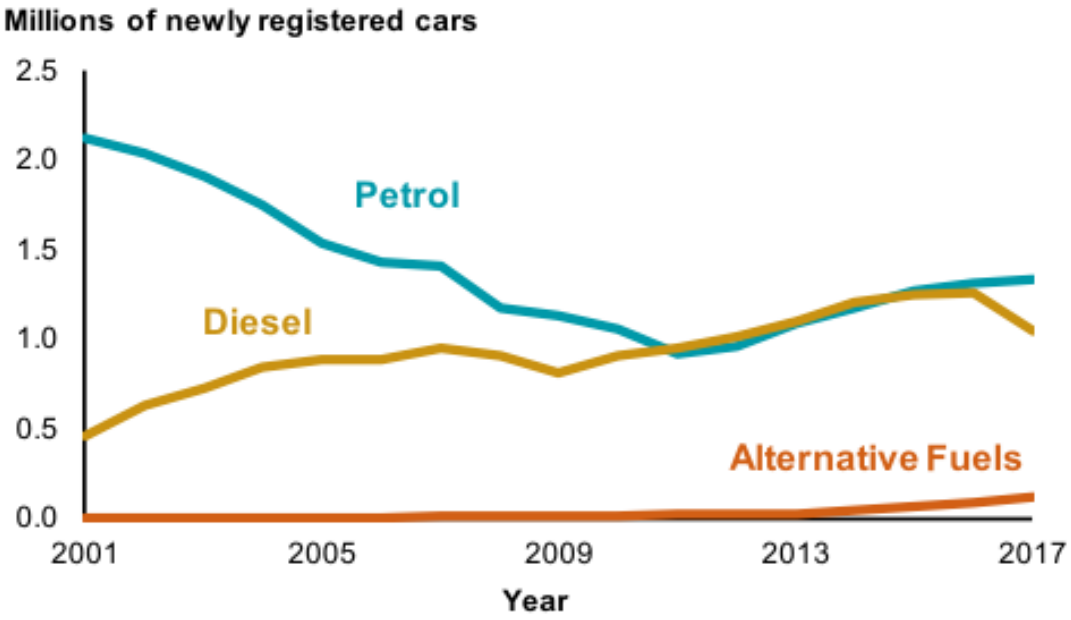
At the moment, alternative fuel vehicles encompass a small percentage of the vehicles on the road. However, they are rising; the number of newly registered vehicles by year for the UK is shown in Figure 111 and the number of ultra-low emission vehicles as a percentage of new registrations is show in Figure 112. The analysis shows a rapid increase in the number of registered ULEVs in recent years.

During 2017, over 53,000 new ULEVs were registered in the UK, showing an increase of 27% on 2016. New registrations of ULEVs have been rapidly increasing since 2013[11]. ULEV licensed in Warrington and the North West are explored in Figure 113.

A total of 1121 ULEVs were licensed within Warrington in 2017. This encompasses 1.04% of all cars licensed within Warrington. The number ULEVs licensed has also grown at a faster rate within Warrington compared with the North West.

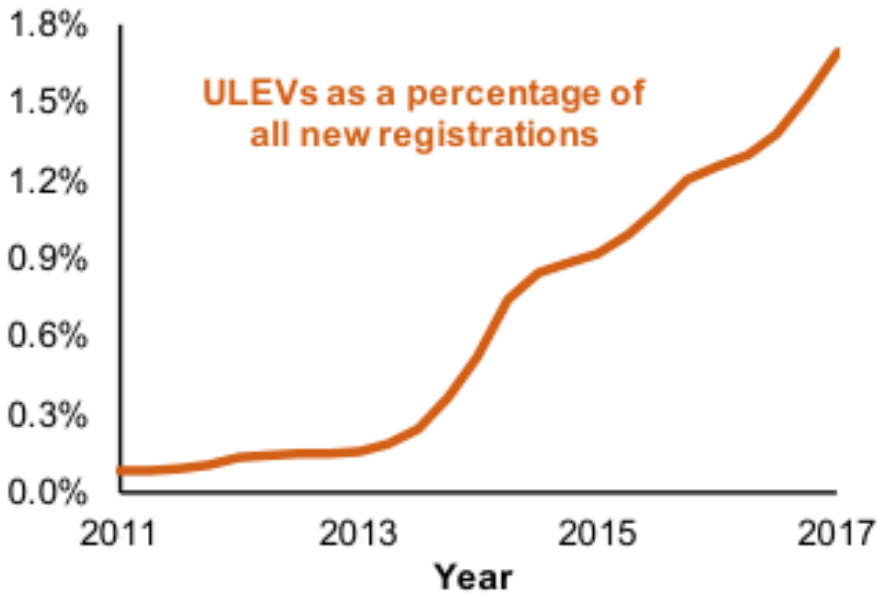
[11] DfT Vehicle Licensing Statistics Annual 2017

Figure 111 Millions of newly registered cars in the UK



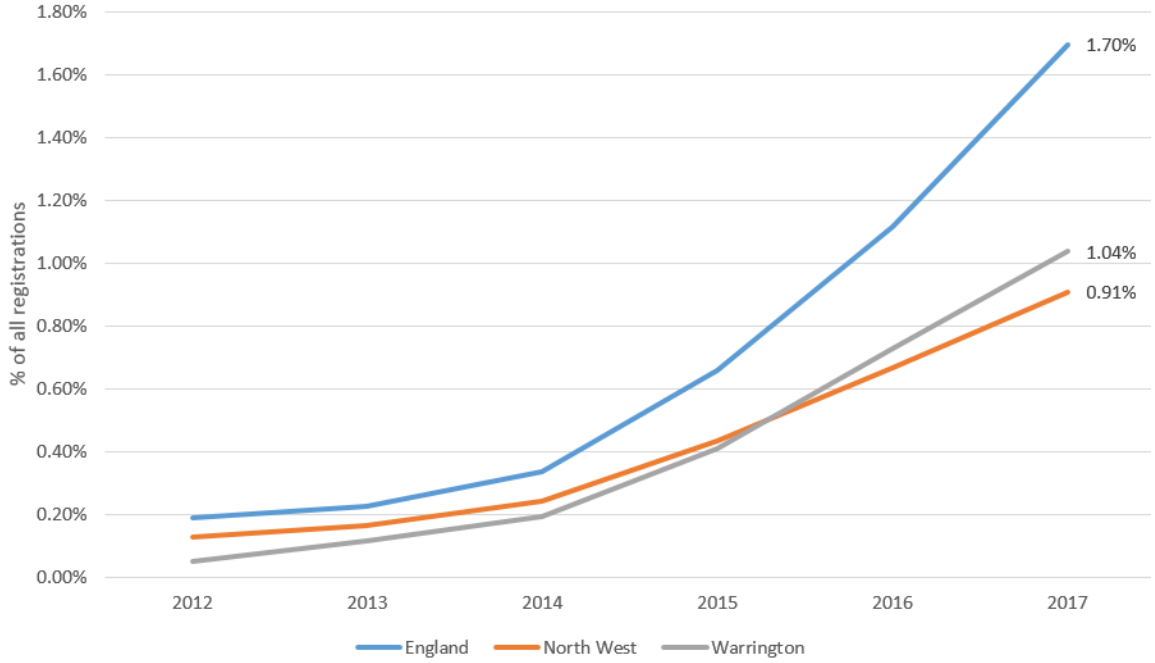
Source: DfT Vehicle Licensing Statistics Annual 2017

Figure 112 Ultra-low emission vehicles as a percentage of all new registration



Source: DfT Vehicle Licensing Statistics Annual 2017

Figure 113 Ultra-low emission vehicles as a percentage of all new registration



Source: DfT Vehicle Licensing Statistics Annual 2017

Alternative fuel powered vehicles offer serious environmental benefits. The vehicles are typically associated with less CO_2 emissions and emission of harmful air pollutants. Currently, the capital costs of ULEVs are typically higher than the conventional car. However, the running costs are typically lower due to more efficient engines, tax breaks on alternative fuels and even lower costs charging using the national gird.
Electric Vehicles and Hydrogen powered vehicles are explored in greater detail in the sections below.

5.5.1 Electric vehicles

Electric cars

Electric cars are becoming increasingly more popular within the transport industry. Nissan, Tesla, BMW, Renault, Jaguar and Audi are just some of the major car manufacturers that have developed electric vehicles (EVs) in the past few years. Furthermore, the competitive and fast-pace motorsport Formula-E has helped bring EVs into the public eye. Nissan's popular electric car, the Nissan Leaf is shown below.

Figure 114 Nissan's popular electric car – The Nissan Leaf

Source:Nissan https://www.nissan.co.uk/vehicles/new-vehicles

Electric vehicles offer a much more energy efficient way of travelling and pollute less emissions than conventional petrol/diesel cars[12]. Emissions associated with transport can be split into direct and life cycle emissions.

Direct emissions are those that are emitted through the tail pipe and are associated with greenhouse gases such as CO_2 and CO, as well as those emissions that affect local air quality such as NOx and particulate matter (PM). Electric vehicles produce zero direct emissions, which specifically helps improve air quality in urban areas and offer a less environmentally intrusive way of travelling[12].

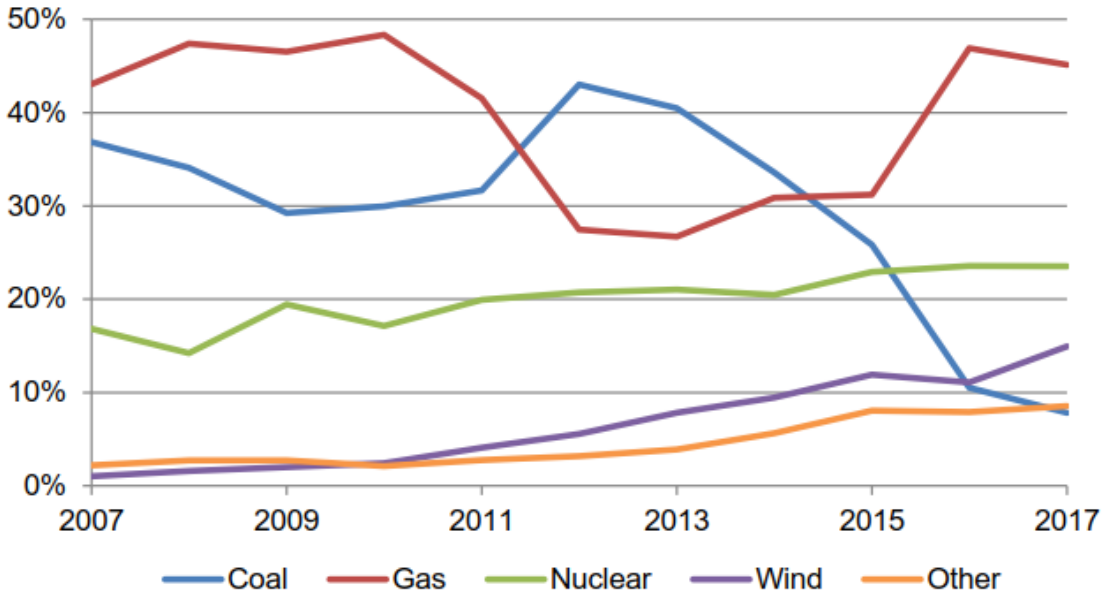
Life cycle emissions include all emissions related to fuel and vehicle production, processing, use, and recycling/disposal. For example, for a conventional petrol/diesel vehicle, emissions are produced when petroleum is extracted from the ground, refined, distributed to stations, and burned in vehicles.

EVs typically produce fewer life cycle emissions than conventional vehicles because most emissions are lower for electricity generation rather than burning petrol or diesel[13]. The exact amount of EV life cycle emissions are dependent on the UK's generation of electricity (Figure 115).

It can be seen that the UK's energy mix has become increasingly decarbonised during the past 10 years, with the rise of renewable generated electricity and the reduction of coal generated electricity. Therefore, the lifecycle emissions associated with electric vehicles have been reducing during the last 10years. A continuation of the previous trends would see lifecycle emissions associated with EVs become increasingly decarbonised.

[12] Energy Saving Trust - http://www.energysavingtrust.org.uk/transport-travel/electric-vehicles
[13] Energy Saving Trust - http://www.energysavingtrust.org.uk/transport-travel/electric-vehicles

Figure 115 The UK's share of electricity generation from major power producers



Source: Department for Business, Energy & Industrial Strategy 2017

It is useful to note at this point, that like all other highways vehicles, electric vehicles contribute to some non-exhaust emissions. Non-exhaust emissions include emissions caused by brake, tyre, clutch, road surface wear and resuspension[14]. These are largely associated with particulate matter.

EVs contribute to the resuspension of PM like other vehicles; as they travel of the road surface, they kick-up PM which has settled on the road surface back into the air. However, EV's impact in producing non-exhaust emissions is substantially less than diesel/petrol powered vehicles. This is for several reasons:

- Particulates produced from braking are greatly reduced in EVs as much of the deceleration of the vehicle is achieved through regenerative braking rather than the mechanical brakes (which do produce PM)[15];
- And then combined on a front wheel drive car with rear drum brakes (which capture the vast majority of PM within the drum stopping it from being emitted to the air) it can significantly reduce PM emissions in urban environments;
- EVs have no clutch, which eliminates PM's caused by this source; and
- Low rolling resistance tyres are common on electric cars, these wear more slowly further reducing non-exhaust emissions.

Therefore, it is still widely acknowledged that whilst EVs offer real benefits in limiting PM emissions compared to conventional diesel/petrol vehicles they don't eliminate PM. The

[14] Timmer.V, Achten.P (2016) Non-exhaust PM Emissions from electric vehicles, Atmospheric Enviornment, Vol 134, Pg10-17
[15] Thorpe, A., Harrison, R., 2008. Sources and properties of non-exhaust particulate matter from road traffic: a review. Sci. Total Environ. 400 (1-3), 270-282.

best way to reduce PM emissions is by reducing the number of motorised vehicles on the road and pursuing active travel modes.
The lithium ion battery packs in electric cars remain a significant part of the cost of electric vehicles. Nevertheless, the price of these have fallen by about 80% since 2010 and are also expected to continue to fall [16]. This could offer further financial benefits for users and help increase the attraction of owning an electric car.

Energy densities of batteries are also increasing, thus cars are capable of travelling greater distances[17]. A list of EV cars and their driving range can be found in Table 34. The battery technology within current EV models are capable of providing driving distances between 115 to 393 miles. Thus, some EVs can match the driving range of their petrol/diesel competitors which typically run for 300-400miles on a tank of fuel.

The global outlook for EVs indicates that the costs of battery technology will continue to decrease and the performance increase[18]. Therefore, a positive view can be taken – advances in battery technology over the next few years may soon enable EVs to travel distances comparable, possibly further, than the conventional petrol/diesel car.

Table 34: Electric Car driving range

Car model	**Range**	**Approximate Price (Before UK plug-in grant)**
Tesla Model S	393 miles	£65,000+
Tesla Model 3 (Available 2019)	310 miles	£27,000 (expected)
Jaguar I-Pace	298 miles	£64,000
Tesla Model X	295 miles	£70,000
Nissan Leaf	150 miles	£27,235
Volkswagen e-Golf	125 miles	£32,075
Hyundai Ioniq Electric	124 miles	£28,995
BMW i3	114 miles	£33,340
Ford Focus Electric	115 miles	£33,500

Source: Carbuyer

Whilst the initial upfront purchase price of an electric or plug-in hybrid vehicle can be higher - the cheapest four door electric cars are priced between £16,000 and £26,000 - the initial price is offset by lower running costs over the lifetime of the vehicle. There are also several grants available in the UK to assist with the initial purchase[19]:

- Plug-in vehicle grant;
- Electric Vehicle Home charge scheme;
- Workplace Charging scheme; and
- On-street residential charging scheme.

[16] McKinsey & Company 2017: Electrifying insights: How automakers can drive electrified vehicle sales and profitability
[17] International Energy Agency: Global EV Outlook 2017
[18] International Energy Agency: Global EV Outlook 2017
[19] https://www.gov.uk/plug-in-car-van-grants

Plug-in cars also offer a number of potential savings compared to conventional vehicles including:

- Driving 100 miles in an EV will cost £2 to £4. Driving 100 miles in a petrol or diesel car will cost around £13 to £16 in fuel, which is around four times the cost of the electric car[20].
- There are fewer mechanical components in an electric vehicle when compared with conventional vehicles, which often results in lower servicing and maintenance costs[14].
- The lower or zero emissions of plug-in vehicles means that they will attract lower charges from Clean Air Zones being implemented around the UK and the Ultra-Low Emission Zone in London[21]

Electric vehicles also have good performance with the vehicles being able to react quickly, generating very good torque and being very responsive in acceleration and breaking. Moreover, compared with their other ULEV comparators, they are far more practical, with there being a variety of options available for charging: at home, at work or on the road. The performance of electric cars are expected to increase and the cost of batteries to fall[22]. Policy support for electric vehicles is indispensable to the uptake of EVs, and perhaps will become of even greater importance in the mid to long term when subsidies for electric cars will not be economically sustainable with large sale volumes[22].

Therefore, it will be important for central government, local government, planners and developers to deploy preferential planning measures for EV's to help drive the incentive of purchasing and owning a vehicle. To match the advances in battery technology, it will be crucial to supply the necessary charging infrastructure to support the growth of EVs.
As electric vehicles become more common and their share of the car market grows, it will also place increasing pressure on the grid to supply electricity. It may be important for regions to consider diversifying their energy mix and identifying additional renewable electricity sources to provide for the additional electricity demand.

Electric buses

Air pollution has risen up the political agenda in the UK, it is a major public health hazard and has been proven to increase deaths and ill-health[23]. Air pollution has been a major driver for transitioning to electric buses, as they produce zero tailpipe emissions and offer a promising alternative to conventional diesel buses which are a major source of air pollution[24].

There are several types of electric bus available: battery electric bus; plug-in hybrid electric bus; and hybrid electric bus[25]. Among these, battery electric buses are the dominant type. In

[20] Energy Saving Trust - http://www.energysavingtrust.org.uk/transport-travel/electric-vehicles
[21] DfT Ultra Low Emission Zone - https://tfl.gov.uk/modes/driving/ultra-low-emission-zone
[22] International Energy Agency: Global EV Outlook 2017
[23] Department for Health http://www.publications.parliment.uk/p/cm2,00910/cmselect/cmenvaud/229/229ii.pdf
[24] Low Carbon Vehicle Partnership: A green bus for every journey. Case studies showing the range of low emission bus technologies in use throughout the UK
[25] ZeEUS eBus Report: An overview of electric buses in Europe

2017, the UK had the largest number of battery electric buses in Europe, with operational and ordered numbers standing at 234[26].
The UK electric bus market is dominated by the British automotive manufacturer Optare which produces a range of single-deck electric buses. Other electric bus manufacturers include Wrightbus, Volvo and Irizar[24].

Figure 116 An electric bus being used for services in London

Source: Low Carbon Vehicle Partnership: A green bus for every journey. Case studies showing the range of low emission bus technologies in use throughout the UK

The current electric buses operate using a lithium battery for propulsion. The buses have been deployed in various locations around the country, this includes London; Manchester; Birmingham; Glasgow; Nottingham; Milton Keynes; Inverness; and York.

Through the use of battery technology, it enables a cleaner and quieter way of travelling. In Nottingham electric buses have reduced carbon dioxide emissions by over 1,000 tonnes compared to the conventional diesel buses[24]. The buses have also received positive reviews from passengers, with the vehicles providing quieter and smoother transportation. Running costs are also significantly cheaper - around one-third of the cost of a diesel bus - and servicing costs are also lower[24].

However, the current battery technology does not cater for long driving ranges[24]. The industry standard Optare electric bus has a maximum range of 95miles. Resultantly, the limited range of the vehicles has operational implications. The buses often require a combination of 'top-ups' throughout the day using rapid charging infrastructure, and then slow charging overnight. This subsequently means more capital to purchase charging infrastructure. Milton Keynes have even deployed wireless (inductive) charging at bus stops to help provide for services.

The lack of EV charging infrastructure and cost of the buses are hindering the penetration of electric buses across the UK[27]. Charging infrastructure can be costly to install. Similarly,

[26] Transport Network - https://www.transport-network.co.uk/UK-leading-Europe-in-electric-bus-deployment/13663
[27] P&S Market Research -

electric buses remain more expensive upfront than those fuelled by diesel or compressed natural gas[27]. This means the purchasing and use of the vehicles is largely dependent on receiving grants or funding from central government[24].
Electric buses also require a significant quantity of electricity to charge their batteries, and significant upgrades to the local electricity network – along with the associated time and cost – are often required to cope with charging a depot of electric buses[24]. To implement the technology, it requires early consultation with Distribution Network Operator who require an understanding of when large change in power demand are likely to occur through the charging of vehicles.

In summary, the current battery powered electric buses available can provide an enhanced, cleaner and greener means of bus travel. Yet, they are often only viable when they are supported by grants and subsidies to assist with the up-front costs of vehicles. This means at present there is some restriction to the uptake of the vehicles. It is expected that electric buses will become more competitive in price with diesel buses by 2026, when battery prices fall and in tandem the upfront vehicle costs decline too[28].

Electric goods vehicles

Diesel powered goods vehicles are a major source of pollution and there is potential for EV good vehicles to help minimise the environmental impact of freight and logistics movements. Advances with the EV passenger sector has led to progression with electric goods vehicles. There are several types of electric goods vehicles:

- Catenary mains power plus battery– these are powered by overhead wires and have been used for several years in mining. They typically have slow speeds and operate on a limited circuit.
- Plug-in hybrid electric vehicle and pure hybrid – a number of models already in use, these are typically used for short haul trips with a large number of start-stop actions which facilitate regenerative charging
- All electric drive (battery or fuel cell) - most battery electric vehicles (BEVs) available today are intended for urban distribution, with a daily range of less than 180miles. An example of a BEV goods vehicle can be found below in Figure 117.

[28] Bloomberg New Energy Finance: Electric Buses in Cities: Driving Towards Cleaner Air and Lower CO2

Figure 117 Electric Van – Renault Kangoo Z.E. 33 Van

Source: Renault - https://www.renault.co.uk/vehicles/new-vehicles/kangoo-ze.html

Electric vans present a small proportion of electric vehicles[29], but their share is expected to grow as environmental and air quality issues are continuing to move up the political agenda. UK cities and towns are starting to consider and implement low emissions zones to help tackle harmful air pollutants arising from transport.

There are five low emission zones currently in place (with these only affecting local buses, London being the exception) and there are in total 16 cities considering setting up clean air zones[30]. The zones are a designated area which sees tolls imposed on vehicles which enter that do not meet the specified emission standard.

As a result, business and private buyers will come under increasing pressure to adopt e-mobility solutions to help qualify travelling within the low-emission zones. Electric goods vehicles will henceforth become an increasing more sought solution.

Several big car brands are developing their own electric systems for commercial vehicles including Nissan, Renault, Citoren and Peugeot. EV technology is rapidly growing and so is the driving range of vans. The table below displays the different type of EV vans available and their related driving range.

[29] Parkers Electric Van Guide - https://www.parkers.co.uk/vans-pickups/advice/2018/electric-van-guide/
[30] RAC - https://www.rac.co.uk/drive/advice/emissions/low-emission-zones-what-you-need-to-know

Table35: Electric Van driving range

Electric Van	Type/size	Official driving range
Renault Kangoo ZE 33	Small van	170 miles
Nissan e-NV200 40kWh	Small van	174 miles
Citroen Berlingo Electric	Small van	106 miles
Peugeot Partner Electric	Small van	106 miles
Renault Master ZE	Large van	120 miles
LDV EV80	Large van	127 miles
Iveco Daily Electric	Large van	Varies with batteries

Source: Parkers Electric Van Guide - https://www.parkers.co.uk/vans-pickups/advice/2018/electric-van-guide

With their operation, the electric van holds the advantage of producing zero CO_2 and NOx tailpipe emissions. The battery technology also means the vehicles operate much more quietly, this lends the opportunity for deliveries to be made during 'unsocial' hours without causing disruption. The vehicles also qualify for tax breaks and grants are available for purchasing electric vans.

The benefits associated with the vehicles are further summarised in the table below.

Table 36: Benefits of EVs

Category	Benefit
Environmental	• Produce zero CO2 or NOx tailpipe emissions • Quieter vehicles which opens up the opportunity for unsocial-hours delivery
Cost	• Lower cost per mile for fuel (electricity) • Lower maintenance costs due to fewer moving parts and less strain on the breaks • Government van plug in grant which can help discount vehicles up to 20% of asking price, with the potential saving of £8,000 • Exempt from congestion charge in London
Practicality and performance	• Preferential parking in some locations • Electric motors deliver instant torque they get shifting smoothly and quickly • Able to set air-conditioning to preferred temperature whilst charging

Electric vans are currently limited to short to medium ranges, with battery capacity capable of supporting distances between 100-170 miles (Table). Subsequently, careful planning would be needed when undertaking longer distance deliveries to coordinate charging. Rapid charging could help increase the resilience of business operations, as the process is capable of charging the vehicles up to 80% within 40minutes[31].

[31] Parkers Electric Van Guide - https://www.parkers.co.uk/vans-pickups/advice/2018/electric-van-guide

In light of the above, electric vans may be better positioned for town and city deliveries as the vehicles are more likely to be closer to rapid charging infrastructure. The electric vans could assist with the distribution of goods from freight consolidation centres as well as inter-city freight transport. Therefore, the vehicles could help support the growth of the logistics sectors without vehicles causing detriment to local air quality and noise levels within densely populated regions.

The market for large electric good vehicles is still in early development. There are only a few electric HGV's available on the market. Compared to a diesel HGV, the current electric goods vehicles would have to stop more often and spend time longer refuelling on longer distance journeys. Therefore, there are operational concerns over current electric goods vehicles.

BMW Group have three electric trucks operating between their Home plant in Munich. The vehicles have a range of 100km and top speed of 64km[32]. Their operation display strong environmental benefits as they are estimated to save 48tons of CO_2 annually. However, they are not in commercial production.
Instead, more promising opportunities could be on the horizon. Tesla are due to unveil their new electric HGV, 'Semi', in 2019. The company have claimed that the vehicles will be able to travel far greater distances in the range of 500miles. Similarly, Daimler and Volkswagen also look to unveil their own long-distance electric HGV in 2019[33].

Figure 118 Tesla Semi Electric HGV

Source: Tesla - https://www.tesla.com/en_GB/semi?redirect=no

Consequently, electric HGVs are still in early infancy. The opportunity for electric HGVs to be exploited in the logistics industry for long distance freight haulage are perhaps more likely to come to fruition over the next decade, with the advent of new goods vehicles shortly to be introduced into the market.

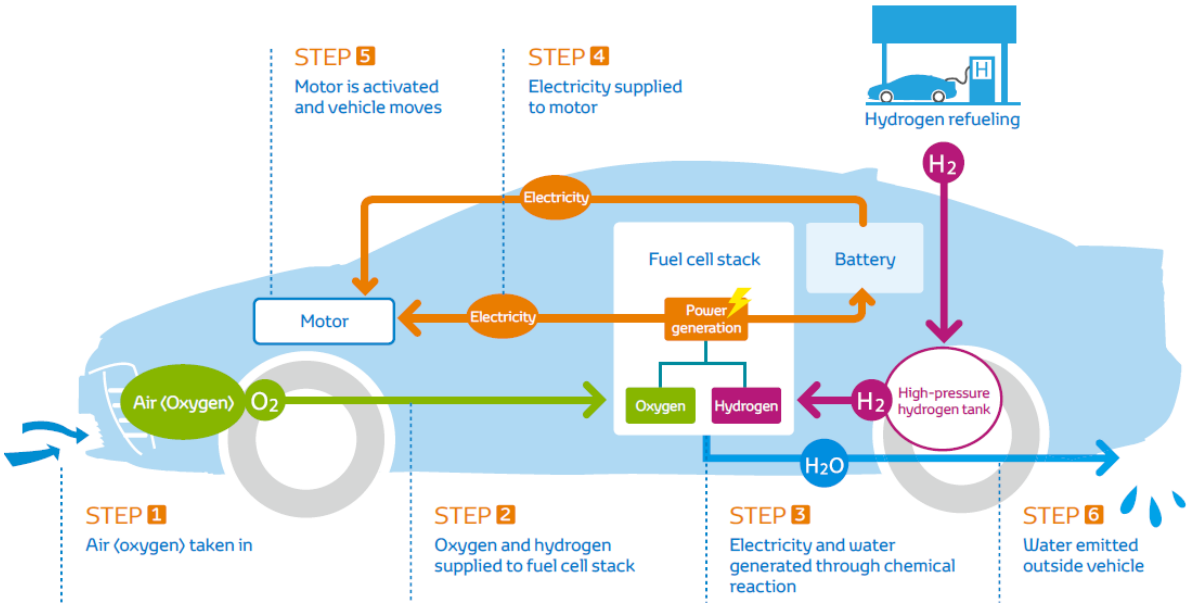
[32] BMW Group - https://www.press.bmwgroup.com/global/article/detail/T0276762EN/electric-trucks-for-bmw-group-plant-munich
[33] Wired

5.5.2 Hydrogen powered vehicles

Hydrogen fuel cell cars

Hydrogen fuel cell vehicles form another type of ULEV. The vehicles see a high-power fuel cell and motor combination provide propulsion in place of an internal combustion engine. The hydrogen fuel cell converts chemical energy (in this case hydrogen) directly into electrical energy, water and heat. A simplified diagram of the process is shown below.

Figure 119 Hydrogen powered fuel cell vehicle



Source: Toyata - https://www.toyota.co.uk/world-of-toyota/environment/fuel-cell-vehicle

The hydrogen-fuel cell vehicles are capable of travelling relatively long distances, with a full tank providing a range of 300miles[34]. Vehicle owners are also exempt from vehicle exercise duty.

This said, there is a distinct lack of hydrogen refuelling infrastructure for cars outside of the M25 and hydrogen fuel is currently quite expensive compared to its ULEV competitors; refuelling a full tank costs between £50 and £75[35]. The initial cost of the cars are also considerable, with the Toyota Mirai costing £60,000. Resultantly, in light of these factors, EVs still dominate the ULEV car market.

Hydrogen fuel cell buses

Currently, the hydrogen fuel cell powered vehicles offer a more viable option for public transport instead of the private car. A hydrogen fuel cell electric bus is an electric bus that includes both a hydrogen fuel cell and batteries/capacitors. In such hybrid architecture, the

[34] Hyundai - https://www.hyundai.co.uk/about-us/environment/hydrogen-fuel-cell?utm_source=google
[35] Car buyer - http://www.carbuyer.co.uk/tips-and-advice/144957/what-are-hydrogen-fuel-cell-cars

fuel cell provides all of the energy for the vehicle operation, whilst the batteries/capacitors are able to provide peak power to the motors to meet rapid acceleration and gradients. The by-product heat is stored on the brake resistors and is used to maintain heating passenger comfort and considerably increase energy efficiency.

There are currently two type of buses available on the market[26]:

- Standard buses (12 or 13 metre)
    1) buses with a small battery and a large fuel cell (for instance 120 kW)
    2) buses with a supercapacitor (instead of a battery) and a fuel cell (for instance 75kW)
    3) buses with a large battery and a fuel cell as range extender
- Articulated buses (18 metre buses)
    4) buses with a large battery and a fuel cell as range extender

The hydrogen tanks are usually stored on the roof of the bus, while the fuel cell and electric engine are located at the back of the bus (Figure 120).

Figure 120 Hydrogen powered fuel cell Bus

Source: Fuel Cell Electric Buses - https://www.fuelcellbuses.eu/category/concepts-0

The hydrogen fuel cells longer range of 300miles, regenerative braking system and responsive drive, means the vehicles are capable of meeting demanding urban bus service operation. They are also noted to provide an improved passengers experience through a quieter and smoother drive[36]. As a result, the vehicles ability to travel greater ranges stands them as a better competitor to the diesel bus than current EV buses.

The hybrid technology is also capable of almost completely reducing NOx and particulate emissions[31]. This is a major asset in helping local authorities address challenging environmental pressures and local air quality issues. The benefits of hydrogen-fuel cell buses have been summarised in the table below:

[36] Fuel Cell Electric Buses - https://www.fuelcellbuses.eu/category/concepts-0

Table 37: Benefits associated with Hydrogen fuel cell electric buses

Category	Benefit
Environmental	• They have zero toxic tailpipe emissions, only water vapour • Hydrogen can be produced from a range of ultra-low carbon routes, including renewable electricity, biomass and other hydrocarbons including carbon capture and storage. When fuelled by hydrogen produced via any of these routes, the fuel cell bus offers a completely zero carbon solution to public transport. • Hydrogen fuel cell technology is quiet and offers a noise reduction
Operational	• Fuel cell electric buses comply with demanding urban bus service operation • Amongst ULEV technology, they offer the longest range (> 300 km) with there being no need to return to the depot during daily service • Amongst ULEV technology, they have the shortest refuelling times (<10mins) • They have a performance comparable to conventional buses in terms of speed and acceleration • They have a regenerative braking system that allows for a better efficiency • There is also less vehicle vibration and subsequently offer a smoother driving experience
Geo-political	• They are a long-term solution for a sustainable technology, which does not limit productivity and quality of service • They serve as a tool to comply with EU, national and local regulations on low-carbon mobility and air quality • Serve as a long-term strategy focussed on reducing vulnerability to fossil fuel imports

Source: Fuel Cell Electric Buses - https://www.fuelcellbuses.eu/category/concepts-0

Within the UK, a number of locations are starting to introduce hydrogen fuel-cell buses. London has started to trial double decker hydrogen powered buses. Dundee and Aberdeen have also started to roll out the environmentally friendly buses. This has been part funded by a €25 million grant from the Fuel Cells and Hydrogen Joint Undertaking. Aberdeen currently has 10 hydrogen buses already, they are also to receive an additional 10 buses, making it one of the largest fleets in Europe[37].

The technology is also being used as an opportunity to attract investment and diversify the country's energy mix. Dundee plans to create a 'state of the art' integrated energy park deploying hydrogen fuel cell buses, fleet vehicles and hydrogen and alternative fuels

[37] Scottish Cities Alliance - https://www.scottishcities.org.uk/media/blog/dundee-successful-in-european-hydrogen-bus-funding

refuelling infrastructure, with energy being derived from renewable technologies[38]. This project will be one of a kind, the first in Scotland to combine heat, power and transport.

Hydrogen fuel cell goods vehicles

Hydrogen fuel cell technology has the potential to benefit the logistics sector; the driving range is competitive with premium electric vehicles and refuelling time is even faster. The technology could be particularly advantageous for heavy goods and other highly-utilised vehicles

Fuel cell companies have had the difficult task of designing a fuel engine that can withstand the severe shock and vibration from a heavy-duty application such as a drayage truck[39]. The vehicles also have to deal with limited fuelling infrastructure across delivery routes and are hence confined within their operation. However, Toyota have entered the market with its Project Portal, a class 8 truck powered by two fuel cell stacks (Figure 121).

The prototype has the capability of generating 670bph and 1,325 pound-feet of torque, and has a driving range of more than 200miles[39]. The vehicle is being trialled in America between the Port of Los Angeles and Long Beach terminal to surrounding rail facilities and warehouses.

Figure 121 Toyota Project Portal Class 8 truck

Source: WIRED - https://www.wired.com/2017/04/toyotas-still-serious-hydrogen-built-semi-prove

The current lack of hydrogen infrastructure available across the UK poses a serious barrier to the instant uptake and application of the alternative fuel in long-distance freight transfer. Instead, The Committee on Climate Change envisage that hydrogen fuel is the most likely

[38] http://www.governmentbusiness.co.uk/news/04042018/zero-emission-buses-dundee-and-aberdeen
[39] WIRED - https://www.wired.com/2017/04/toyotas-still-serious-hydrogen-built-semi-prove

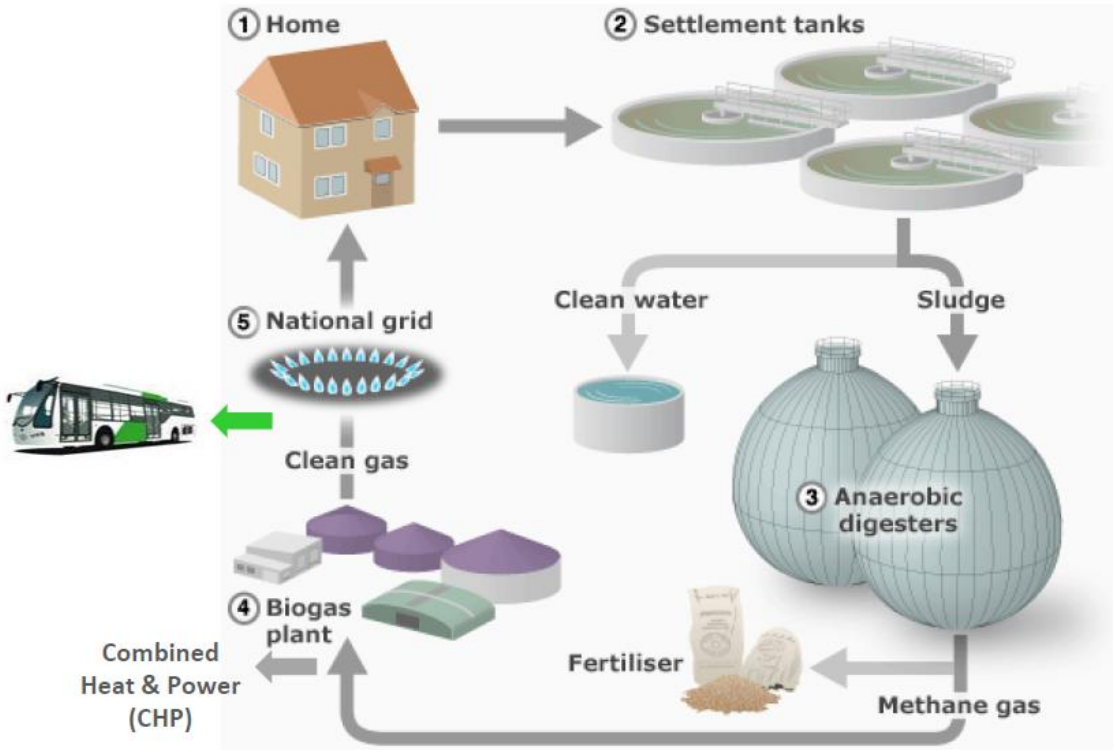
and effective option for reducing HGV emissions in the longer term from around 2030[40]. The Committee expect that advances in technology and investment in the required infrastructure will mean that by that time, hydrogen fuelled HGVs will be a realistic and competitive option for fleet operators.

Compressed natural gas buses

Vehicles can operate using hydrogen compressed natural gas (CNG) as an alternative to petrol/diesel fuel. CNG vehicles mainly compose of methane (CH_4) and use the fuel in a combustion engine. Contrary to fossil fuel derived methane, is biomethane.

Biogas is primarily made up of 60% methane and 40% CO_2[41]. Biogas is produced from organic matter in landfills, biogas plants and anaerobic digestion of organic waste[42]. These processes see organic matter broken down in an oxygen free environment to produce the gas. The gas can then be treated through scrubbing carried out at Biogas pants to remove impurities and upgrade the gas to over 96% methane at which point the product becomes known as biomethane[41]. This process then enables biomethane to be used as a fuel within vehicles, or to be pumped back into the national grid. This process is outlined in Figure 122.

Figure 122 Biomethane production and use within transport



Source: Arriva North West & Wales – Experience of operating Man EcoCity CNG Buses presentation

[40] Committee on Climate Change: Meeting carbon budgets – 2013 Progress Report to Parliament
[41] Molino et.al., (2013) Biomethane production by anaerobic digestion of organic waste, Fuel, Vol 103, Pg 1003-1009
[42] National Renewable energy laboratory – renewable hydrogen potential in the United States

Using Biomethane as a fuel within transport can offer a number of environmental benefits[42]:

- Biomethane production prevents the release of methane which is one the most potent greenhouse gasses;
- It reduces the amount of greenhouses gases that are released into the atmosphere when organic matter is left to decompose; and
- Use of biomethane reduces the need for fossil fuel burning.

Therefore, use of biomethane within transport offers a 'greener way' of travelling compared with the petrol/diesel vehicles.

Biomethane technology is being typically explored in larger vehicles which have the ability to carry and fit hydrogen CNG tanks. Arriva have deployed a number of biomethane buses across the North West & Wales. The services operate across Runcorn, Widnes and also travel into Warrington (Figure 123). Arriva currently have 10 biomethane CNG buses with a further 9 ordered[43].

The buses refuel at Runcorn gas station which was designed and built by gas bus alliance in 2014. The fuelling station has the capacity for 20 buses and runs on 100% biomethane. Thus, the public transport services have been fully decarbonised.

CNG buses are not too different to conventional diesel powered buses; they still use a combustion engine. This enables the buses to not be too dissimilar in price and makes it much easier for engineers to transition to working on the vehicles. This is a factor which electric and hydrogen-fuel cell buses do not possess, as the vehicle cost is typically higher due to battery costs[4427].

For Arriva specification, the buses are priced at £220,000, whereas the standard single deck bus is costed at £165,000[34]. Thus, the CNG buses are not priced too far away from the conventional bus.

Elsewhere with other operators, CNG buses are priced approximately 20% more than a conventional bus[45], which is slightly cheaper than the Arriva specification. It is also worth noting that over a 10 year lifetime, the extra purchasing cost is compensated by lower fuel costs, even when new infrastructure investments are required[45.] Therefore, at present, the vehicles offer a more viable alternative to diesel buses than EV and hydrogen-fuel cell can provide.

[43] Arriva North West & Wales – Experience of operating Man EcoCity CNG Buses presentation
[44] P&S Market Research -
[45] www.clean-fleets.eu A fleet of Biomethane Buses in Reading, UK

Figure 123 Arriva Hydrogen fuel cell bus - 70 passenger capacity

Source: Arriva North West & Wales – Experience of operating Man EcoCity CNG Buses presentation

The outcomes of the Biomethane Arriva operated buses are outlined in Table. Since Arriva deployed the vehicles, they have managed to produce operational savings of 24%, save 3.6million Kgs of CO_2 and enhance the passenger experience [29]. The CNG buses are also easier to maintain. Compared with diesel buses: there are longer intervals between engine oil changes; there are no messy fuel filters to replace; and there is no complex exhaust gas recirculation system to maintain. These factors all save on running costs and could be influential in improving the competitiveness of bus services against the private car.

Table 38: Benefits associated with CNG buses

Category	Outcome
Environmental	• 3.6million Kgs CO2 saved • Replaced Euro 3 & 4 buses which has helped reduce NOx and particulate matter by 95%
Cost	• There are longer intervals between engine oil changes, there are no messy fuel filters to replace, no EGR system to maintain, this all saves on running costs. • The running costs of Diesel buses is estimated at £0.48/mile whereas gas runs at £0.38mile. This is an initial saving of 22%. Arriva actually report savings of 24%.
Passenger experience	• The buses are notably quieter than a diesel bus by 2 DB • Less vibration • There is no diesel smell • Good heating and ventilation • Higher quality interior lighting
Driver experience	• Good cab ergonomics • Good driveability with the vehicles being responsive • An ‘effortless’ drive

Source: Arriva North West & Wales – Experience of operating Man EcoCity CNG Buses presentation

In summary, the CNG bus presents a practical alternative to diesel buses. They have the range, performance and minimal maintenance to provide an improved bus service. For now, whilst electric buses are at slight disadvantage by their high battery prices, shorter driving ranges and need to 'refuel' more frequently, the CNG buses provide a more practical and viable alternative to the conventional diesel bus.

What does this mean for LTP4?
The use of ULEV are rising. Warrington will need to cater for the growing market and ensure there is adequate infrastructure provision to support the use of the vehicles across the borough. It will be important for Warrington to investigate current usage and consider how changing the policy environment could help support their use.

6 Environment and well-being

6.1 Environment and well-being key findings and implications

Carbon dioxide emissions

- Transport is a major contributor of CO_2 emissions in Warrington.
- Cars, taxis and Lorries modes have poor transport energy efficiency. These modes are likely to be the main sources to the large CO_2 emissions arising from transport.

Climate change

- Climate change is taking place in Warrington. The daily mean temperatures, days of rain, total precipitation and extreme weather events have all increased since 1961 to 2006.
- Climate change events have been noted to affect the operation of transport in Warrington. In the past, climate change has disrupted public transport and highways movements, impacted emergency services and in doing so, disrupted the local economy.

Air quality

- National standards for NO_x are being exceeded on the motorway surrounding Warrington, the town centre and roads that lead into the centre.
- There are several transport behaviours that drive NO_x emissions, these are: Large traffic flows; congestion and idling behaviour; the private car is a key contributor, with diesel cars seeing the worst levels of NO_x emissions; and HGVs, LGVs and buses
- Increasing use of active travel modes, public transport, cleaner fuels and travel demand management strategies are required to tackle the town's air quality problems.

Flood risk

- Up to 1032 properties (890 residents, 117 business and 25 critical services) could be at risk from surface water flooding in a 1% (1 in a 100) annual probability rainfall event.
- Development and expansion of highways uses impermeable materials which increases the likelihood of flooding. SUDS should be increasingly sought in transport solutions.

Noise

- First priority locations for noise action planning on the approach and at motorway junctions, roads on approach the town centre and within the town centre.
- These are roads that typically see high flows of traffic, suffer from congestion and witness substantial HGV flows.
- These locations also exist within proximity to residential areas with high population density such as Great Sankey; Latchford; Callands; Hulme; and the town centre.

6.2 Environment and well-being

The purpose of this section is to investigate environmental issues being experienced across the Borough. Transport has the potential to cause detrimental effects to the local environment. Transport is the largest emitting sector greenhouse gas emissions within the UK economy accounting for 26% of UK greenhouse gas emissions in 2016[46]. Moreover, transport affects air quality at the roadside and has the potential to cause serious health implications.

Therefore, it is important to investigate the impact of transport in Warrington and how LTP4 could be used to mitigate the impacts of transport and protect the environment.

6.3 Carbon dioxide

The earth absorbs incoming visible light from the sun and this is named short-wave radiation. The earth then reradiates this energy as long-wave radiation. Greenhouse gases trap long-wave radiation and cause subsequent warming of the earth. This natural process is named the greenhouse effect.

Through the industrial revolution to the 21st century, human activity has increased the concentration of greenhouse gases, particularly CO_2 in the earth's atmosphere; CO_2 concentrations are now at a higher level than ever over the last 400,000 years[47]. CO_2 is emitted through the burning of fossil fuels (oil, gas and coal). Humans burning of fossil fuels has subsequently caused the continued thickening of the earth's protective layer of greenhouse gases.

As a result, Human activity has accelerated the greenhouse effect and has caused global surface temperature to increase. The planet's average surface temperature has risen about 0.9°C since the late 19th Century and this has been driven largely by increased CO_2 and other human-made emissions[48].

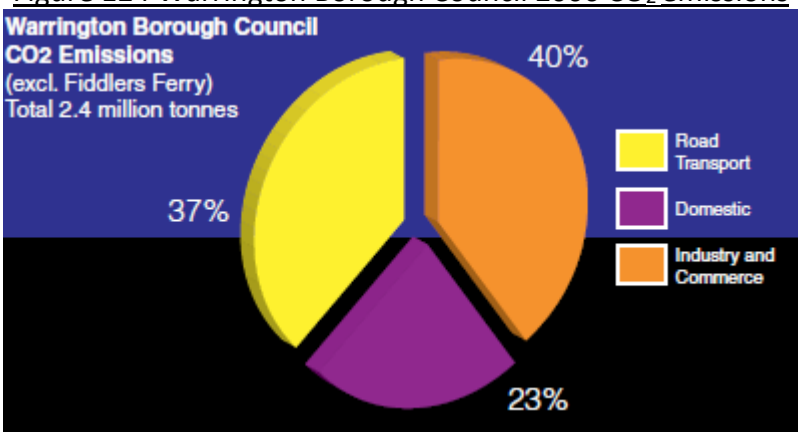
It is therefore useful to assess CO_2 emissions in Warrington and how transport may contribute to the Borough's overall emissions.

Warrington Borough Council's Climate Change Strategy for Warrington was used to extract information on CO_2 emissions within the Borough. Emissions in the wider Borough are dominated by Fiddlers Ferry Power Station (FFPS) which in 2006 emitted 8.7 million tonnes of CO_2 [49]. Of this, some 330,000 tonnes were from burning biomass fuels which has a neutral CO_2 impact, so the net emissions from FFPS was around 8.4 million tonnes. However, it is clear that most of the emissions do not 'belong' to Warrington since the electricity generated is mainly being used outside of the Borough.

[46] Committee on Climate Change (2017) Meeting Carbon Budgets: Closing the Gap
[47] https://climate.nasa.gov/climate_resources/24/
[48] NASA https://climate.nasa.gov/evidence/
[49] Warrington Borough Council (2006) A climate change strategy for Warrington

If FFPS emissions are excluded (except for electricity used within the Borough), the CO_2 emissions are as shown below.

Figure 124 Warrington Borough Council 2006 CO_2 emissions



Source: DEFRA and WBC emissions inventory

Total CO_2 emissions in the Borough (excluding FFPS) in 2006 were 2.4 million tonnes per year. 40% of this comes from the business sector, reflecting the presence of several intensive energy users (mainly the chemicals industry) in the town.

Road transport accounts for 37%, a figure which is almost certainly boosted by motorway traffic passing through the Borough, with the domestic sector making up the remaining 23%. Action is clearly needed in all three sectors if CO_2 emissions in Warrington are to be reduced.

6.3.1 Key findings of Carbon emissions in Warrington

The key findings of the review of carbon dioxide emissions in Warrington are:

- In 2006, road transport contributed to 37% of Warrington's CO_2 emissions, Industry and commerce accounted for 40% and Domestic activity accounted for 23% of emissions.

What does this mean for LTP4?
Making Warrington's transport increasingly energy efficient could help cut CO_2 emissions in the Borough. LTP4 should seek to:

- Increase energy efficient transport (active travel, bus, light rail, heavy rail and higher car occupancy);
- Reduce the demand to travel in Warrington;
- Remove network pinch points and associate idling behaviour;
- Support and advocate the use of electric vehicles and intelligent mobility; and
- Support development that reduces the need to travel.

1.1 Climate change

Warrington Borough Council completed a Local Climate Impact Profile in 2016. The study sought to acquire a more comprehensive understanding of past and projected climate change and what effects it would have on Warrington.

The study compiled and analysed past, present and projected data collected by the UK Meteorological Office for mean, maximum and minimum temperatures, sunshine hours, average rainfall, air frost, wind and snow days from 1910/1961 to 2016.

6.3.2 Warrington's climate

From observing past weather activity and high impacting events, the study was able to gain a comprehensive understanding of Warrington's vulnerabilities to climate change. Annual average change data for the NW of England from 1961 to 2006, based on a linear trend, were used to display how Warrington's climate had changed. Table 39 shows that as a whole, daily mean, maximum and minimum temperatures, days of rain and total precipitation have all increased since 1961 to present day.

Table 39: Annual average change data for the North West of England from 1961 – 2006 on a linear trend

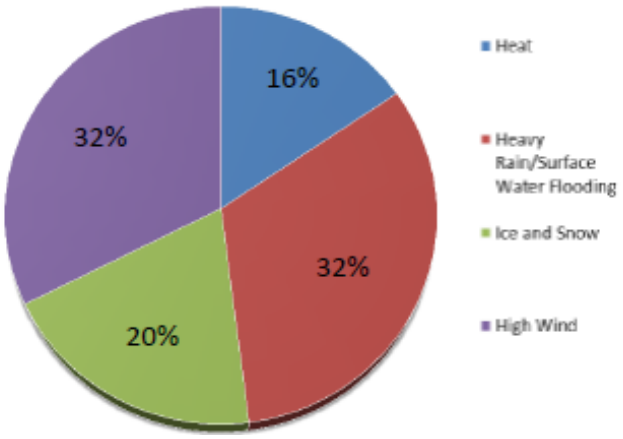
Daily Mean Temp (ºC)	Daily Min Temp (ºC)	Daily Max Temp (ºC)	Air Frost Days	Days of Rain ≥ 1mm	Total Precipitation (mm)
1.4	1.55	1.29	-24.4	7.5	8.8

Source: Warrignton Borough Council -A local climate change impact report 2016 ttp://ukclimateprojections.metoffice.gov.uk/23846?emission=low

6.3.3 Extreme weather events

Extreme weather events were also examined in the study. Warrington has been most vulnerable to the occurrence of heavy rain/flooding and high winds. These weather types compose of 32% each of total weather events, which is an increase in 1% of high wind events and 3% increases in heavy rain/flooding events. These two types of extreme weather events are summarised in greater detail below.

Figure 125 percentage number of weather related events for Warrington 2003-2016

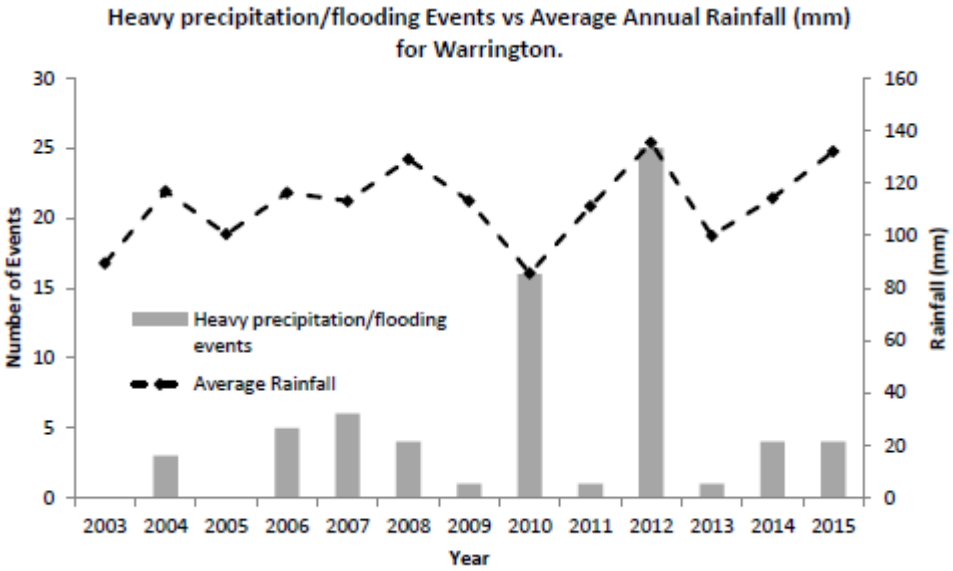


Source: Warrignton Borough Council - A local climate change impact report 2016

Flooding/Heavy precipitation

The Engineering and Flood Risk department at Warrington Borough Council, reported 55 flood & drainage issues to occur in 2013, 29 in 2014 and 24 in 2015. The survey revealed the unpredictable nature of the occurrence of flooding and heavy precipitation events, portrayed by the dramatic variability seen across the period analysed in Figure 12525.

Figure 126 Heavy precipitation/flooding events vs average annual rainfall (mm) for Warrington



Source: Warrignton Borough Council - A local climate change impact report 2016

The frequency of flood events are seen to decrease in the long-term (with the exception of 2010 and 2012) as a result of the new flood defences in Warrington. However, the study

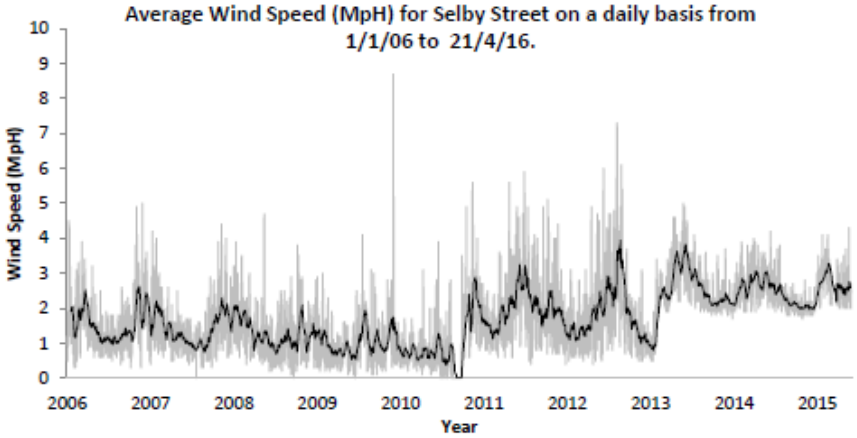
revealed that the vulnerability of the local population and infrastructure to the future occurrence of an extreme, high intensity event is increased without the implementation of further resilience based strategies.

High wind events

Linked to the occurrence of heavy precipitation, Warrington and the services provided by the Borough Council are severely vulnerable to high wind, specifically the public transport and infrastructure.

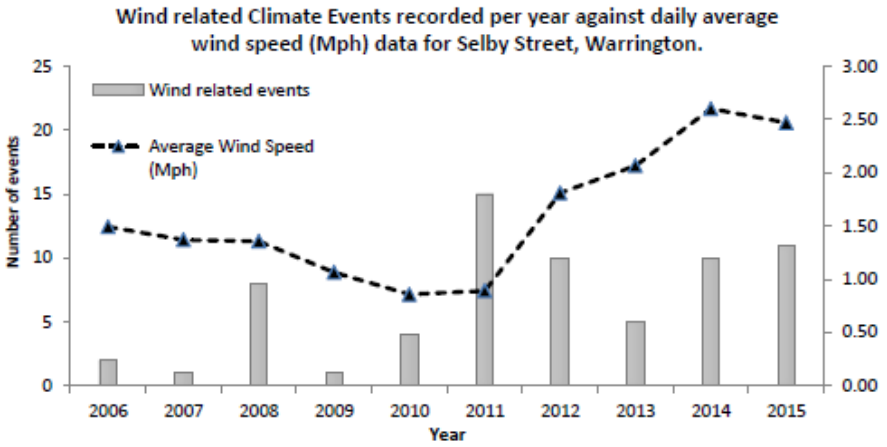
As seen in
Figure *127*, as in
Figure *128*, the occurrence of wind related weather events is variable across the period displayed. An increase can be seen since the composition of the last LCLIP In 2013, with 2014 and 2015 showing 10 and 11 events respectively. Since 2006, it can be observed that Warrington is experiencing a higher frequency of events per year with time. This is reflected in the fact that in this LCLIP, wind events see a 1% increase in the overall total number of events in comparison to 2013.

Figure 127 Average wind speed (Mph) 2006 – 2016 at Selby Street, Warrington



Source: Warrignton Borough Council - A local climate change impact report 2016

Figure 128 Wind related climate events recorded per year against daily average wind speed (Mph) Selby Street, Warrington



Source: Warrignton Borough Council - A local climate change impact report 2016

Impact of extreme weather events

The impact of extreme weather events were analysed in the 2016 Local Climate Change Impact Report. The occurrence of the events were identified to have varying impacts on different people, businesses and services. The impacts of weather events are summarised below in Table40:

Table 40: Impacts of weather events on services, local populations and businesses in Warrington

Weather Type	Effect on services	Effect on population and businesses
High Winds	• Road closures, specifically the Thelwall Viaduct, affecting the ability to limit congestion in the town. • Falling trees also cause congestion and damage to buildings and infrastructure. • Can impact power/ telephone lines. • Impact emergency service response times.	• Heavily impacted travelling time. • Damage to homes and businesses. • Risk to personal safety.
Heavy rain and flooding	• High pressure on drainage, sewage pipes and water quality. • Affects bin collection and waste management. • Damage to council property, open parklands and leisure facilities. • School closures. • Land-use planning. • Impacted emergency service response.	• Damage to homes, personal belongings and businesses. • Destruction of crops and risk to live stock. • Cancellation of events. • Disruption to travel. • Risk to personal safety. • Economic impact from closures.
Ice and Snow	• Impacted public transport services. • Inability for staff to reach social care clients. • School closures. • Disruption to infrastructure.	• Restricts the ability to travel. • Risk to personal safety. • Customers cannot access businesses. • Effects business logistics e.g. deliveries
Cold Spells	• Risk of burst pipes. • Effects to roads and infrastructure.	• Risk of burst pipes. • Risk to personal safety specifically the most vulnerable: elderly, disabled, young.
Heat	• Can cause fires in public spaces, putting pressure on emergency services. • Impacting water quality and supply services. • Waste collection and management. • Swing Bridges	• Risk to public health, specifically the most vulnerable: elderly, disabled, young. • Impact levels of comfort.

Source: Warrington Borough Council - A local climate change impact report 2016

The history of extreme weather events has revealed that Warrington is most vulnerable to both high winds and heavy rain/surface water flooding equally. By observing these events, the study was able to decipher their impacts on services and communities, these are summarised below:

- Disruption of public transport and highways
- Damage to council and private property
- Risk to public safety
- Disruption of businesses and local economy
- School closures

- Impacting emergency services response time
- Hindering council services
- Impacting water quality and supply services

With the additional pressure of projected climate change, these impacts are virtually certain to become more severe in the future. An example of this is that recent scientific research states 1 in 100 events, such as Storm Desmond in 2015, are 40% more likely to occur with climate change. The study states the only way to combat this change and prevent further impacts is through the application of more advanced adaptation and resilience strategies.

6.3.4 Future, projected climate change

According to the government's UK climate change risk assessment (2012) [50], since the 1970s the UK as a whole has experienced a one degree rise in average temperature and an increase in rainfall between 3-73% (location depending). If this rise continues to occur creating an increased amount of water vapour within a warmer atmosphere, it will result in the more frequent occurrence of heavy precipitation and high wind events in the future. Recent scientific research supports this by stating extreme precipitation and high wind events with a 1 in 100 year return (such as Storm Desmond in December 2015), will see an increase in the likelihood of 40% if climate change continues to occur at its current rate[51]. The Met Office future climate predictions as seen in Table *39*41, portrays the range of expected change for temperature and precipitation at 2020, 2050 and 2080.

Although the range displayed in Table *39*41 is broad, it can be stated that temperature and precipitation will change across the North West of England and Wales within the projected parameters with a 95% confidence.

The majority of scientific research for projected climate change in the UK focuses heavily on flood risk and precipitation, making adaptation plans a vital component of current and future disaster risk reduction strategies[52]. With Warrington already vulnerable to such events, understanding the implications of climate change is crucial.

Table *39*41 portrays an increase in winter rainfall of up to 50mm by 2080 for the North West, in correlation with temperature, alongside a decrease in summer precipitation by up to 51mm in correlation with rising temperatures. Not only does this cause an increase in precipitation events during winter months, but it will also impact evapotranspiration leading to changes in flow regimes and effecting water quality and availability during the summer months [53].

[50] https://www.gov.uk/government/publications/uk-climate-change-risk-assessment-government-report
[51] Van Oldenborgh, G.J., Otto, F.E.L., Haustein, J., Cullen, H. Climate Change increases the probability of heavy rains like those of Storm Desmond in the UK – an event attribution study in near-real time. Hydrol. Earth Syst. Sci. Discuss., 12, 13197 – 13216.
[52] Alfieri, L., Feyen, L., Dottori, F., Bianchi A. (2015). Ensemble flood risk assessment in Europe under high end climate scenarios. Glob Environ Chang. 35: 199 – 212.
[53] Watts *et al.,* (2015). Climate Change and water in the UK – past changes and future projects. Progress in Physical Geography. Vol. 39 (1). 6 – 28.

Table 41*:* The range of expected change with a 95% confidence for mean summer and winter temperature (°C) and precipitation (mm) for the 2020s, 2050s and 2080s for the North West of England

		Range of Expected Change (°C)	
	Decade	Lowest	Highest
Mean Winter Temperature (°C)	2020s	0.3	2.0
	2050s	0.8	3.3
	2080s	1.3	4.8
Mean Summer Temperature (°C)	2020s	0.6	2.5
	2050s	1.1	4.7
	2080s	1.3	7.3
Mean Winter Precipitation (mm)	2020s	–4	14
	2050s	–1	27
	2080s	3	50
Mean Summer Precipitation (mm)	2020s	–23	10
	2050s	–37	8
	2080s	–51	4

Source: http://ukclimateprojections.metoffice.gov.uk/23846?emission=low
Watts et al., (2015). Climate Change and water in the UK – past changes and future projects. Progress in Physical Geography. Vol. 39 (1). 6 – 28.

From this the rising occurrence of high precipitation/ wind events for winter months, and the risk of drought and open grassland fire during the summer months in Warrington can be confidently predicted. Therefore, Warrington will likely see an enhancement of the impacts caused by these events as outlined in Table.

6.3.5 Key findings of Climate change in Warrington

The key findings of climate change in Warrington are:

- In Warrington, daily mean, maximum and minimum temperatures, days of rain and total precipitation have all increased since 1961 to 2006.
- The history of extreme weather events has revealed that Warrington is most vulnerable to both high winds and heavy rain/surface water flooding.
- Past extreme weather events have impacted Warrington in the following way:
  - Disruption of public transport and highways
  - Damage to council and private property
  - Risk to public safety
  - Disruption of businesses and local economy
  - School closures
  - Impacting emergency services response time
  - Hindering council services
  - Impacting water quality and supply services
- Scientific research indicates that extreme precipitation and high wind events with a 1 in 100 year will see an increase in the likelihood of 40% if climate change continues to occur at its current rate. Warrington's existing vulnerability to high wind and precipitation events will therefore likely increase.

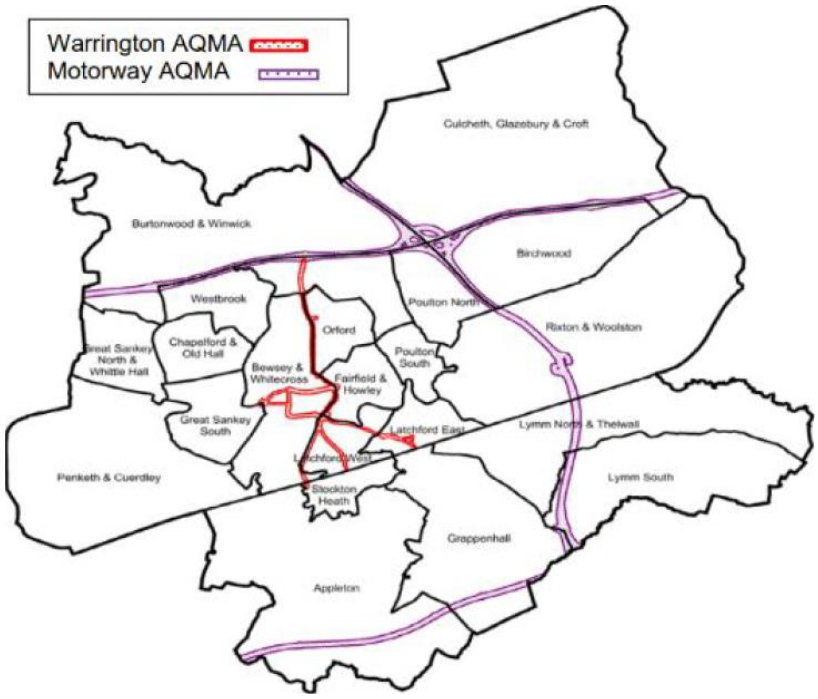
- Met Office future climate predictions see an increase in winter rainfall of up to 50mm by 2080 for the North West, alongside a decrease in summer precipitation by up to 51mm in correlation with rising temperatures

What does this mean for LTP4?
LTP4 should seek to reduce the contribution of the transport system by targeting a reduction in CO_2. The strategy should also look to include sustainable urban drainage systems in transport solutions to help mitigate the effects of extreme weather events.

6.4 Air quality

The Warrington Air Quality Action Plan (Draft - 2017) has been produced to outline how air quality in Warrington will be improved between 2017 and 2022, focusing on reducing nitrogen dioxide (NO2) levels within Warrington.
Whilst the majority of Warrington benefits from good air quality, two Air Quality Management Areas (AQMAs) are currently in place. The motorway related AQMA was designated in 2002, whilst there are areas close to the main arterial roads that lead into and around the town centre where national standards for NO2 are also being exceeded. This led to the creation of the Warrington AQMA in November 2016 (Figure 129).

Figure 129 Map of Warrington's Air Quality Management Area



Source: Warrignton Borough Council

A detailed source appointment exercise was undertaken by Warrington Borough Council this identified that within the Motorway AQMA, the percentage source contributions for nitrogen oxides (NOx) were as follows:

- Road traffic contributed to approximately 70% of annual mean concentrations
- HGVs and LGV were the dominant road traffic mode source estimated to contribute 49% of concentrations

The source apportionment also assessed primary roads within the Borough in 2002 as follows:

- Road traffic contributed to approximately 40% to 50% of annual mean concentrations
- HGVs and LGVs contribute approximately 30% of annual mean concentrations
- Buses contributed approximately 3% of concentrations

The road transport component was further refined in 2013 as part of a Low Emissions Feasibility Study and used to inform the Detailed Assessment looking at the town centre and the main arterial roads. The data shows that whilst diesel cars are the predominant source, HGV and buses contribute a disproportionate amount of NOx compared to the distance driven. This showed that within the new Warrington AQMA, traffic mode sources could be apportioned for contribution above the background as follows:

- Petrol cars contribute approximately 11% and diesel cars 50% of NOx, and account for 90% of distance driven
- HGVs and LGV contribute 20% of NOx, yet account for only 9% of distance travelled.
- Buses contribute approximately 11% of NOx yet account for only 1% of distance travelled

The Air Quality Action Plan highlights that the motorway AQMA requires a 43% reduction in NO_2, with a 41% reduction for the Warrington AQMA. To help reduce concentrations of nitrogen dioxide within the AQMAs and across the wider Borough, a three-strand approach is highlighted within the Action Plan. This incorporates:

- **Policy actions:** A review of policies and procedures used by WBC is necessary to ensure that the effect on air quality is considered in all decisions. This includes the need to review and update Sustainable Transport Strategies and Programmes to further support low carbon travel, as well as ensuring that council procurement policies encourage and prioritise the use of Low Emission Vehicles.

- **Infrastructure improvements:** A range of infrastructure improvements have been identified to promote enhanced air quality including delivery of the Burtonwood to Omega cycling/walking link and development of the Warrington Intelligent Transport System which will monitor journey times and inform road users of traffic conditions to enhance route choice and help reduce congestion. These infrastructure improvements have also been allocated targets for overall pollution reduction.

- **Additional measures:** The Air Quality Action Plan also highlights a number of additional measures which will help support improvements to Borough wide air quality including publishing an air quality webpage to provide public information including advice for individuals and schools to reduce their emissions. Most significantly, this element of the Action Plan also includes the commitment to explore the introduction of a Workplace Parking Levy and Clean Air Zone. Whilst it is recognised within the Action Plan that these two concepts should be explored through dedicated studies, this Warrington

Transformational commission will provide an early assessment of both concepts in the demand management element of the report.

6.4.1 Key findings of air quality in Warrington

- The Air Quality Action Plan highlights that the motorway AQMA requires a 43% reduction in NO2, with a 41% reduction for the Warrington AQMA.
- The Air Quality Action Plan includes the commitment to explore the introduction of a Workplace Parking Levy and Clean Air Zone.

What does this mean for LTP4?
Warrington air quality action plan looks to improve air quality. The LTP4 should support the plan by:

- Implementing transport solutions that are increasingly sustainable such as public transport, cycling and walking.
- Develop sustainable transport strategies that look to: Increase cycling and walking close to schools and colleges; and improve the quality of junctions for pedestrians and cyclists.
- Develop a public transport strategy and programme. This should: make public transport a more attractive choice for people in Warrington; improve the current fleet of buses; review legislation that can help reduce idling behaviour at the central bus station; and increases the attractiveness of rail journeys.
- Develop a cleaner fuels strategy that promotes buying and use of electric vehicles, delivers supporting infrastructure and can promotes the use of EV car clubs.
- Smarter choices strategy and programme that looks to increase participation in the above strategies by undertaking: workplace and school travel plans; use of website and social media; bus real time passenger information; and implementation of car clubs.
- Taxi strategy and programme that seeks to reduce emissions, promotes low emission vehicles and reviews anti-idling enforcement at taxi ranks.

6.5 Flood risk

Warrington Borough council carried out a Preliminary Flood Risk Assessment (PFRA) in 2016 to manage local flood risk. The PFRA provides a high level overview of flood risk from local flood sources through a review of historic flooding incidents and the predicted future extents of flooding, based on the outputs of computer models from both Warrington Borough Council and the Environment Agency.

The PFRA assess flooding in regards to surface water, ground water and ordinary watercourses. LLFAs do not need to consider the risk of flooding from the sea, main rivers or reservoirs, except where these may affect flooding from another source.
Warrington Borough Council has decided that a flood of 'significant harmful consequences' would have one or more of the following characteristics:

Table 42: Flood event in Warrington of significant harmful consequences

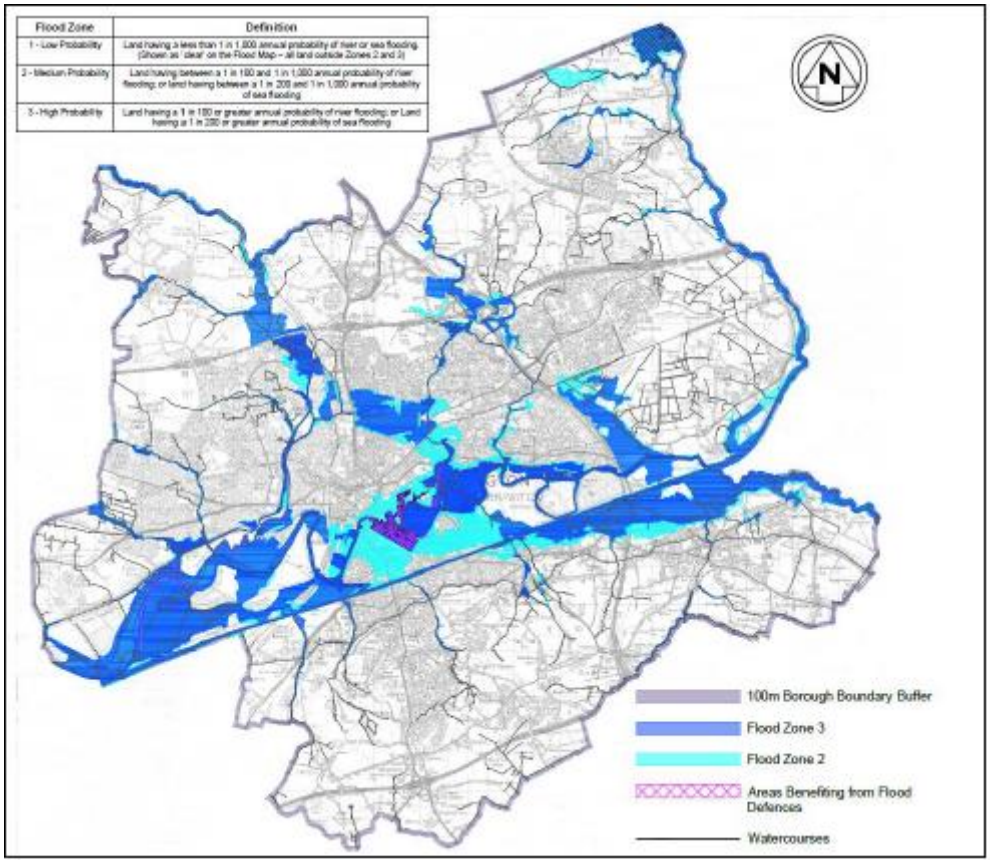
Impact of flooding on:	Category	Consequence
Human Health	Number of individuals	≥ 200
Economic Activity	Number of critical services	≥ 2
	Number of residential properties	≥ 83
	Number of non-residential properties	≥ 20

Source: Warrington Preliminary Flood Risk Assessment 2017-2023

An analysis of data available on future flood risk found that there could be flooding with adverse consequences as a result of surface water flooding. Modelling outputs provided by the environment agency indicated that up to 1032 properties (890 residents, 117 business and 25 critical services) could be at risk from surface water flooding in a 1% (1 in a 100) annual probability rainfall event.

The Environment Agency is responsible for the management of major rivers in the UK. Figure 130 shows the flood risk map for Warrington with identified Flood zones 2 and 3, with Flood Zone 3 showing the highest possibility of flooding. Warrington is at greatest risk from flooding in the south in Stockton Heath, Grappenhall and parts of Walton around the River Mersey and Manchester Ship Canal.

Figure 130 Environment Agency Flood Map of Warrington



Source: Warrington Borough Council

6.5.1 Key findings of flood risk in Warrington

The key findings of flood risk in Warrington are:

- Up to 1032 properties (890 residents, 117 business and 25 critical services) could be at risk from surface water flooding in a 1% (1 in a 100) annual probability rainfall event.
- Warrington is at greatest risk from flooding in the south in Stockton Heath, Grappenhall and parts of Walton around the River Mersey and Manchester Ship Canal.

What does this mean for LTP4?
Any future transport schemes that involve infrastructure changes should consider their proximity to flood zones identified by the Environment Agency.

LTP4 should seek to include green solutions and use of SUDS where possible. This is of particular relevance for existing and new transport infrastructure that may be introduced south of the town and in west Warrington.

6.6 Noise

Noise pollution can have a number of health implications included sleep disturbance, cardiovascular disease, elevated hormone levels and physiological problems
Potential Noise Impacts and Mitigation has been considered by Environmental Protection. A map of noise action planning areas can be seen below in Figure 131.

Typically in Warrington, first priority locations for noise action planning are located on roads with high flows, the locations are:

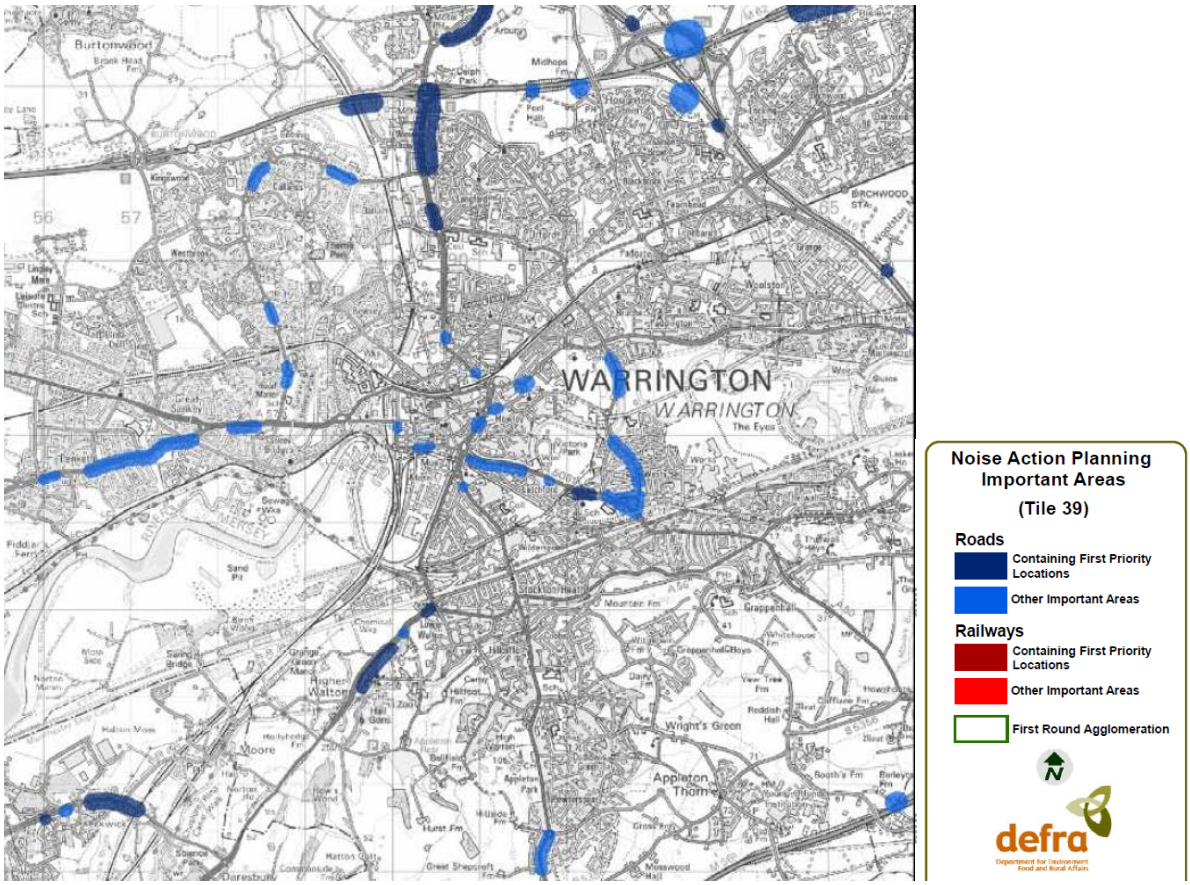
- Junction 9 and 11 of the M62
- Winwick Lane Road north of Junction 9 M62
- A49 on the approach to the Junction 9 M62
- A56 Chester Road near Higher Walton
- Knutsford Road near Latchford East

Noise action planning areas that are considered 'important areas' are also found on roads with substantial traffic flow. These are located:

- A57 Sankey Way
- Cromwell Avenue
- Within the town centre at Wilson Pattern Street and Mersey Street
- Knutsford Road
- A50 Kingsway street
- M62 Junction 10 /Junction 21A

Locations for noise action planning are located on roads with high flows that suffer from congestion and also see substantial HGV flows. These locations also occur in residential areas with high population density such as Great Sankey; Latchford; Callands; Hulme; and the town centre. Therefore, a reasonably large proportion are within close proximity to noise action planning areas.

Figure 131 Warrington Noise Action Planning Areas



Source: DEFRA Noise Action Planning Important Areas (Tile 39)

What does this mean for LTP4?

LTP4 should look to manage and reduce the effects of noise pollution arising from transport by introducing policy that can:

- Reduce traffic volumes and congestion;
- Redirect freight movements to low populous areas;
- Improvements to infrastructure that can dampen the impact of noise e.g. low noise road surfaces, noise barriers and soundproofing;
- Where appropriate, traffic calming and management; and
- A cleaner fuels strategy that advocates the use of EV technology.

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