

LEEDS SITE ALLOCATIONS PLAN
PUBLICATION DRAFT JUNE 2015

BACKGROUND PAPER –
TRANSPORT

(10 June 2015)

1 Summary

- 1.1 This report summarises the forecast impacts of the proposed developments in the Site Allocations Publication Draft Plan on the transport network in Leeds.
- 1.2 The population of Leeds is forecast to increase by 15% between 2012-28 and alongside increased car ownership it is considered that this will result in an increase in traffic of between 15-23% across the District. However, at the same time the level of investment in transport infrastructure is increasing substantially.
- 1.3 Schemes prioritised in the West Yorkshire Plus Transport Fund, together with existing major transport schemes such as City Connect, Kirkstall Forge station and NGT, represent an investment of over £830M. On top of this Highways England and the rail industry are also investing in additional capacity on the strategic road and rail networks.
- 1.4 In combination these programmes are being delivered to support the economic growth of Leeds, to provide good alternatives to the private car and to reduce carbon emissions, in line with the objectives of the Local Transport Plan and the Core Strategy.
- 1.5 In addition, a number of further interventions have been identified to mitigate the forecast impacts of growth at key junctions across the Leeds highway network. It is expected that contributions will be obtained from developers towards the delivery of these interventions, alongside contributions towards schemes within the WYPTF.
- 1.6 It is proposed that support for public transport, walking and cycling schemes will mainly be sought through the Community Infrastructure Levy.

2 Introduction

- 2.1 This report sets out the work undertaken to understand the impacts of the proposed development sites contained within the Site Allocations Plan (Publication Draft) upon the transport system of Leeds. It documents the current conditions for travel, provides an overview of planned interventions and a forecast of conditions at the end of the plan period in 2028 if all development is delivered.
- 2.2 The evaluation assumes that all Identified and Allocated sites in the Plan will be built out by 2028. No sensitivity tests have been undertaken around the delivery timetable.
- 2.3 The sections below examine the transport changes from a high level, strategic view across the main road network in Leeds. Local issues and appropriate mitigation are assumed to be dealt with via the development control process of transport assessments.

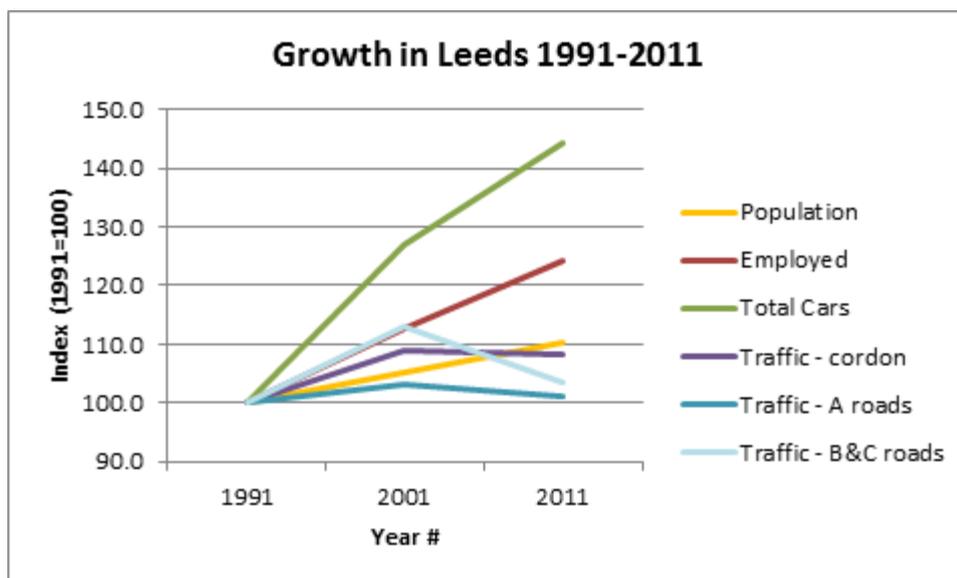
3 Background

- 3.1 In recent years there has been a step change in devolved decision making affecting the delivery of transport investment across the Leeds City Region. The West Yorkshire Combined Authority (WYCA) was set up in 2014 to manage the £1 billion West Yorkshire Plus Transport Fund and support economic growth. In addition, as a member of RailNorth, WYCA will also be involved with the management of the Northern and TransPennine rail franchises from April 2016 onwards.
- 3.2 WYCA is currently in the process of developing a Single Transport Plan for West Yorkshire. The new plan will be a twenty year vision for developing an integrated transport network that supports the Leeds City Region Enterprise Partnership's Strategic Economic Plan for sustained and healthy economic growth - especially for jobs and housing. The Single Transport Plan will update the current West Yorkshire Local Transport Plan (LTP3) and will set out a step change in the quality and performance of the transport system within West Yorkshire, and our connections with the rest of the UK.
- 3.3 Transport for the North (TfN) is a new partnership involving the northern city regions, LEPs and Government. In combination with Highways England, Network Rail and HS2 Ltd, TfN is aiming to transform the Northern economy and create a 'Northern Powerhouse' through a long term investment in transport networks and infrastructure.
- 3.4 These significant changes will enable local decision makers to have a much greater level of control over transport investment, enabling the delivery of the key pieces of infrastructure required to support the Leeds Core Strategy and accompanying Site Allocations Plan.

4 Historic Trends and Current conditions

- 4.1 The Core Strategy housing allocations represents a significant increase in population for Leeds District of around 15% between 2011 and 2028. Past trends in Leeds, however, show that despite significant increases in population, employment and car ownership, traffic growth has not been as great.
- 4.2 Figure 1 shows that over the twenty years from 1991 the population of Leeds grew by 10%, the number of employed residents by 24% and the number of cars by 44%. However, all day traffic levels over the same period grew by only 8% on radial roads approaching Leeds city centre, while growth on a sample of A, B and C roads across the District was less than 5%.
- 4.3 An examination of peak traffic levels on radial routes approaching the city centre shows that the trend has been more marked with peak hour flows actually falling and peak period flows increasing by less than all day traffic. These changes reflect greater flexibility in the labour market, the growth of part time jobs, a shift away from the traditional 9-5 working day and the consequent growth in peak spreading. Figure 2 shows morning peak traffic levels since 1990.

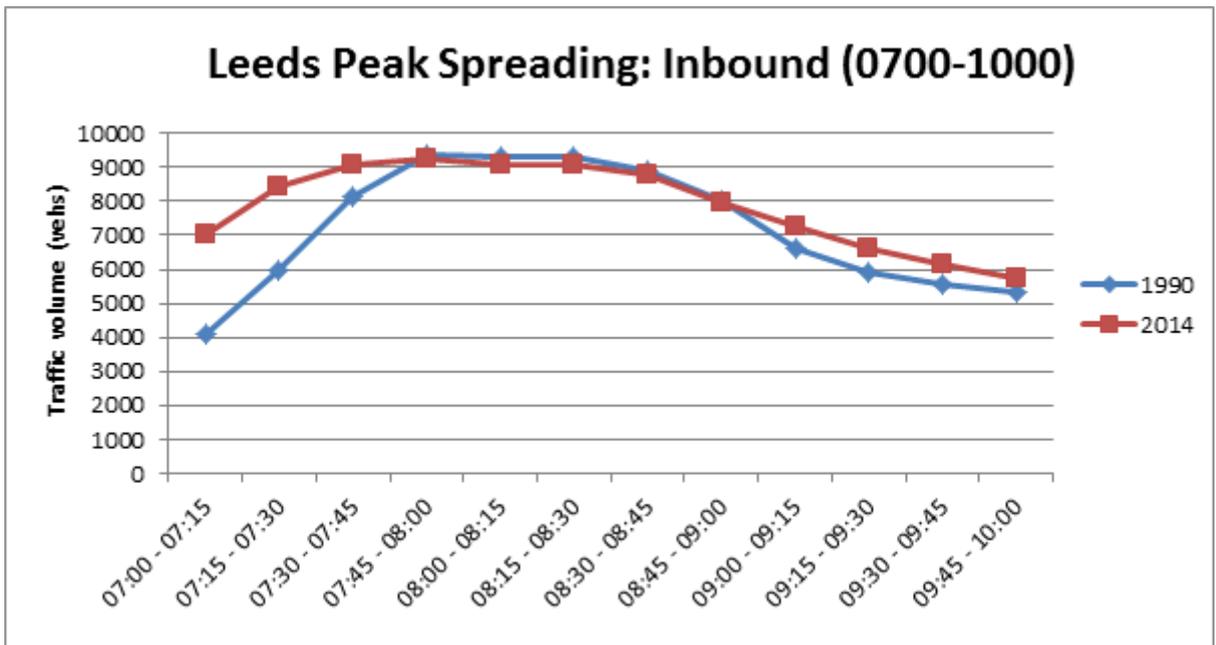
Figure 1



Source: Census, Leeds Central Monitoring Cordon and LCC Note 13.

Note cordon data relates to 1992, 2002 and 2012 as data not available for all years.

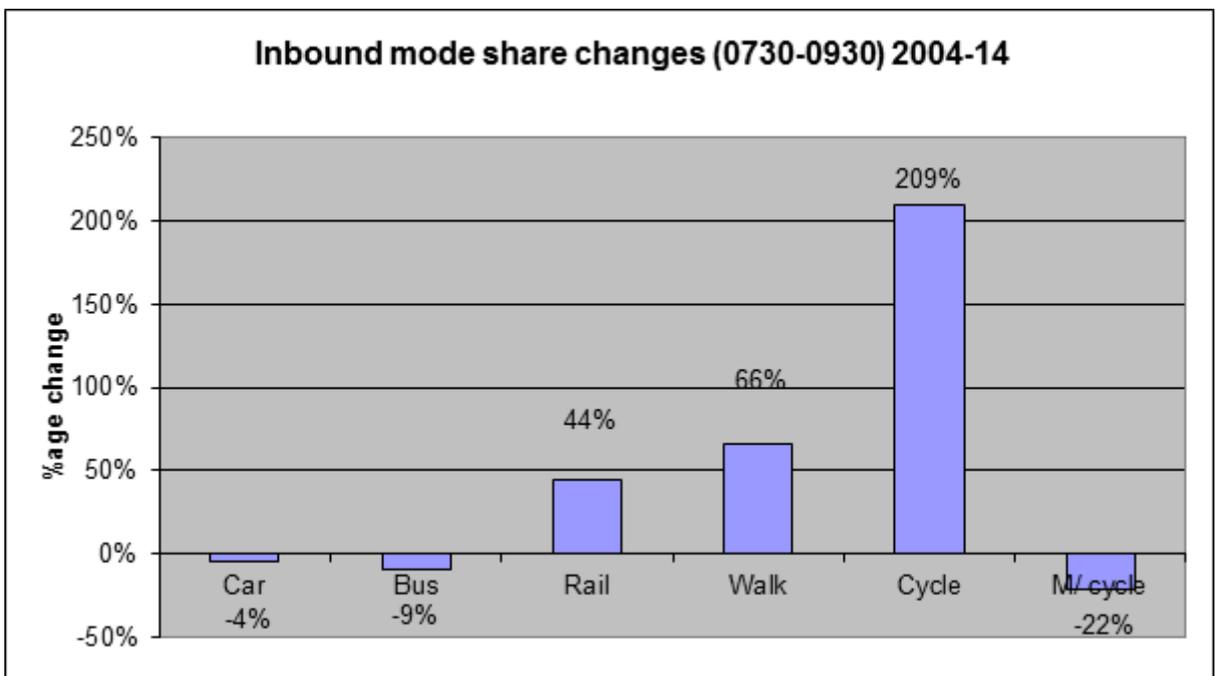
Figure 2



Source: Leeds Central Monitoring Cordon

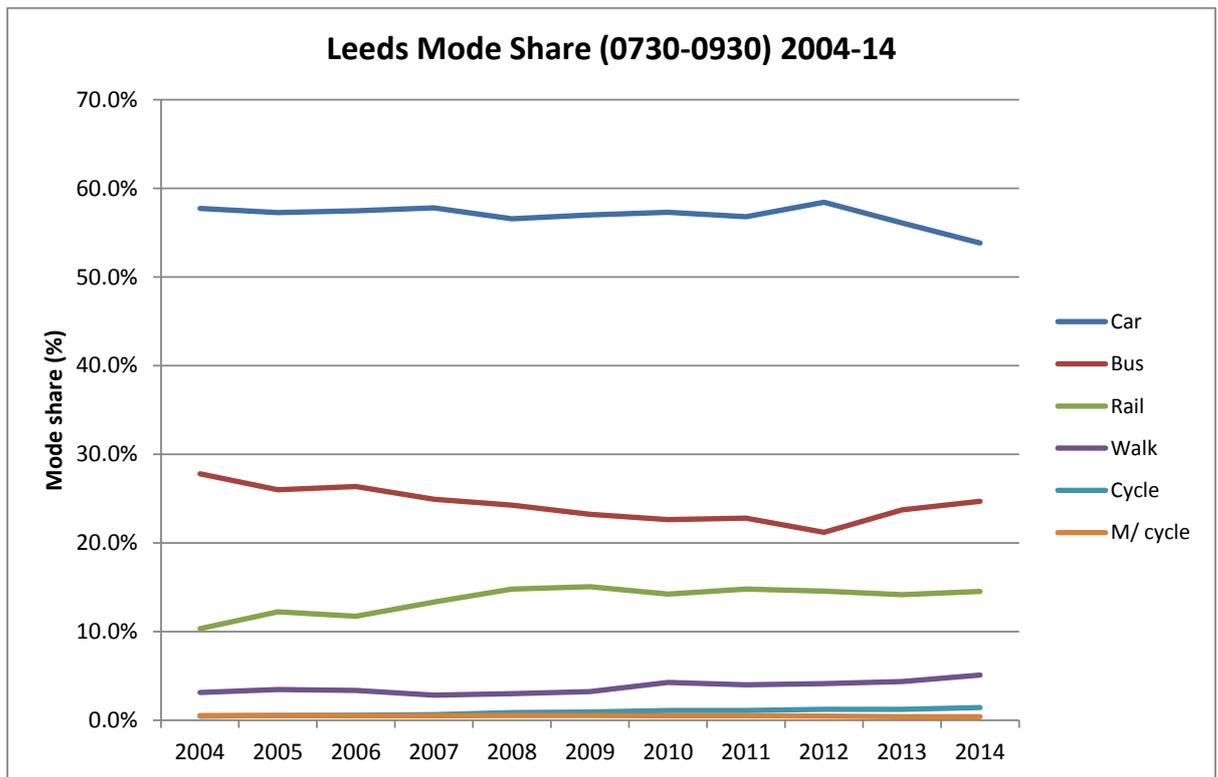
- 4.4 Over the past decade modal split surveys covering morning peak period journeys approaching the city centre show that there has been a significant growth in cycling, walking and rail usage, while bus, car and motorcycle usage have all fallen – see Figures 3 and 4.

Figure 3



Source: Leeds Monitoring Cordon Mode Split Surveys

Figure 4



Source: Leeds Monitoring Cordon Mode Split Surveys

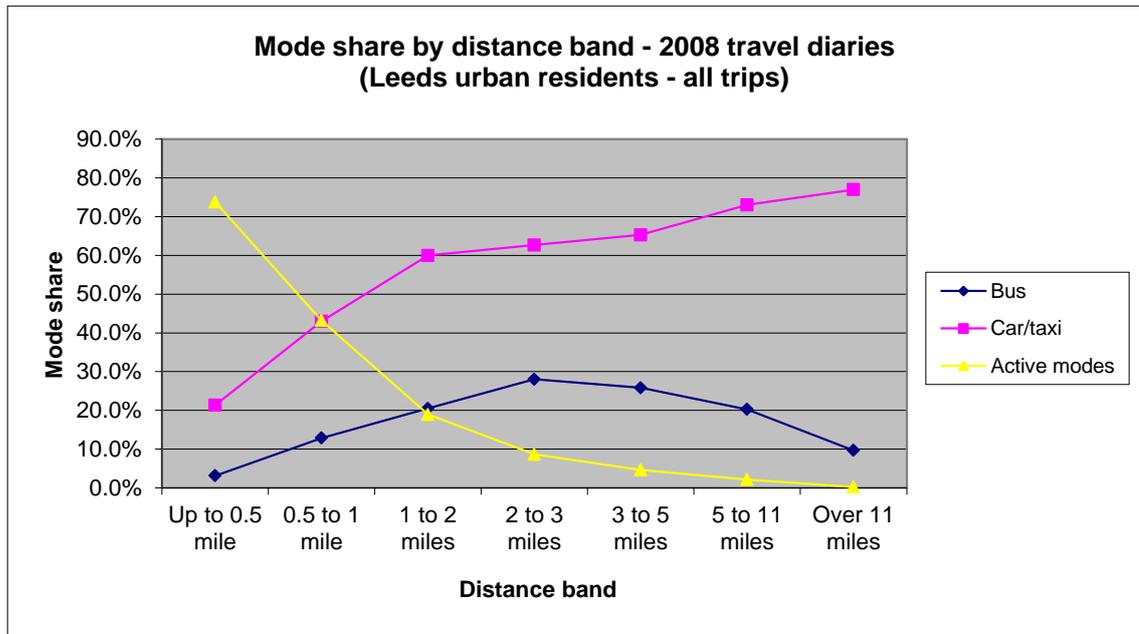
- 4.5 Although car remains the principal mode it should be noted that not all the journeys recorded here are to the city centre as many vehicles use the inner ring road and M621 to travel to other destinations within the city. Census data shows that between 2001 and 2011 car commuting to the city centre fell in absolute terms by 9% although the number of people working there rose by 4%.
- 4.6 One key trend in terms of the city centre has been the growth in city centre living. Although not everyone who lives there works in the city centre, the majority of residents travel to work by sustainable modes so that only 24% travel by car compared with 65% across Leeds District¹.
- 4.7 As a major city within a wider city region Leeds' transport activity reflects the many employment options available to residents. Analysis of census data² shows that 25% of Leeds residents (with a fixed place of employment) work outside the District and that 31% of people working in Leeds travel in from outside. This rises to 37% for those working in the city centre.
- 4.8 Within Leeds District 20% of residents either work at/from home or stay within their own ward; 18% work in the city centre. A very significant proportion therefore are travelling either to another ward within Leeds or outside the District. Catering for these journeys by sustainable modes is challenging and this is reflected in the high car mode share for these trips (75%).

¹ 2011 census QS701EW (excludes those working at/from home)

² 2011 census WU03EW

4.9 Like other urban areas in the UK a high proportion of journeys made by Leeds residents are relatively short. Surveys in 2008 covering the main urban area of Leeds revealed that almost half (48%) were less than 2 miles and 72% were less than 4 miles. A high proportion of these short journeys are made by car as illustrated in Figure 5.

Figure 5

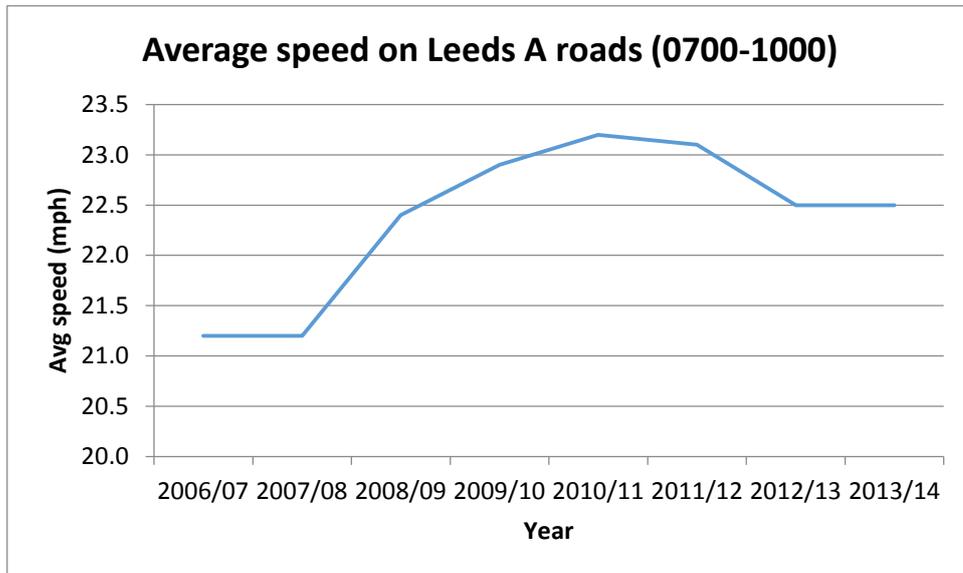


Source: Transport for Leeds Travel Diaries (2008)

4.10 The Department for Transport (DfT) provide all local authorities with data on vehicle travel times that has been collected from vehicles with GPS devices. This information is currently supplied to the DfT by TrafficMaster and allows average journey times and speeds to be analysed by individual road and time of day.

4.11 DfT published statistics show that average morning peak period (0700-1000) speeds on all local authority A roads in Leeds are faster than other comparable cities in England and have improved by around 6% between 2006-07 and 2013-14. See Figure 6.

Figure 6



Source: DfT Cgn0201a

- 4.12 Leeds City Council officers have undertaken a detailed analysis of the TrafficMaster data to derive journey times on radial and orbital routes in Leeds for the academic year 2011-12 (weekdays excluding school holidays). This shows that the highest levels of peak congestion in 2011-12 occurred on the A61 N, M621 E, A62, A647, A65 (between Rawdon and the Inner Ring Road) and the A660.
- 4.13 When average peak hour journey times are compared with daytime free flow conditions congestion adds at least 80% to travel times on these routes – see Table 1 below. Across the whole urban main road network congestion adds 68% to journey times on inbound radial routes (0800-0900) and 60% to outbound radials (1700-1800).

Table 1 - Routes where congestion adds 80% or more to journey times (2011-12)

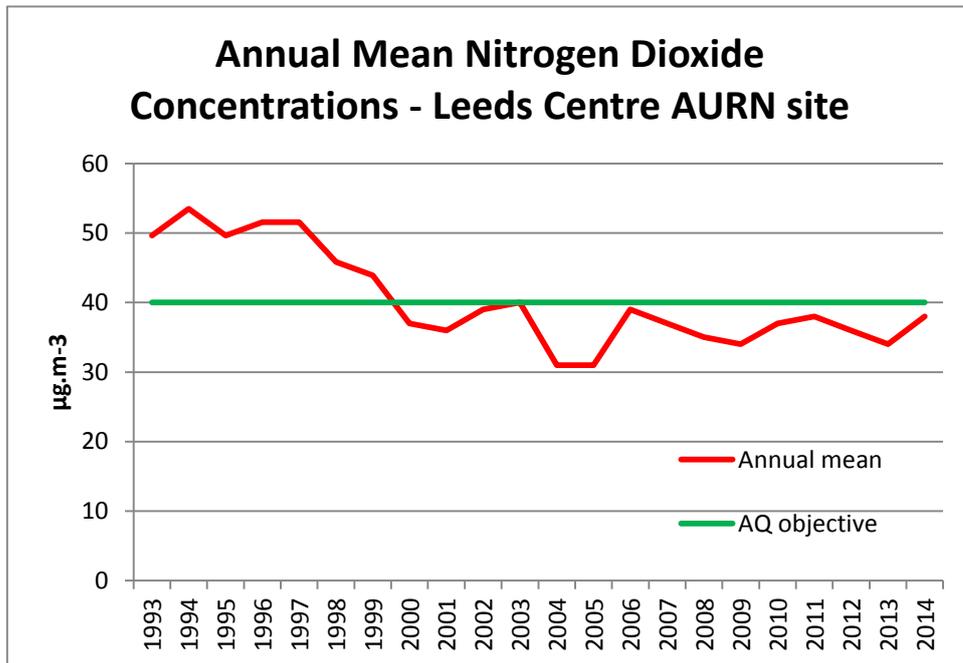
Route	Level of Congestion Delay	
	0800-0900 inbound	1700-1800 outbound
A61 (N)	Over 100%	Over 100%
M621 (E)	Over 80%	Over 80%
A62	Over 80%	
A647	Over 80%	
A65b #	Over 100%	Almost 80%
A660	Over 100%	Over 100%

Notes: # Rawdon to City Centre – affected by A65 QBC roadworks

- 4.14 Using the same journey time data, junctions that are seen as congestion hotspots have been analysed to gauge the current levels of delay. 96 sites were examined for weekday morning and evening peak hour delays as well as 12 hour delays from 7am to 7pm.
- 4.15 Figure 7 shows the location of the sites, highlighting those with the greatest levels of delay. The majority of these junctions are within the main urban area of Leeds. Sites marked in orange ‘with notable delays’ have at least one approach with more significant delays than the other legs of the junction. In the main, junctions within the city centre were not assessed. Further details of these sites are included in Appendix 1.
- 4.16 Carbon emissions across the local authority road network are estimated annually by the government. This shows a sustained downward trend in recent years in Leeds District and across West Yorkshire. The most recent data shows that between 2005 and 2012 carbon emissions due to traffic on local roads fell in Leeds by 13% and in West Yorkshire by 12%. These changes are in line with national trends.
- 4.17 Results from the city centre monitoring site for nitrogen dioxide (NO₂) show that background air quality improved significantly during the 1990s but there has been little change since 2000 (Figure 8). Although background concentrations are unlikely to exceed EU Directive or UK AQ Regulation objectives, air quality remains a concern. Currently, there are six Air Quality Management Areas in Leeds (where residential properties close to heavily trafficked roads are exposed to concentrations of NO₂ in excess of the AQ objective) and there are parts of the city failing to meet the EU Directive for NO₂. In addition, while the

standards set for particles (PM10 and PM2.5) are achieved, any reduction in these pollutants will have health benefits for the whole population.

Figure 8

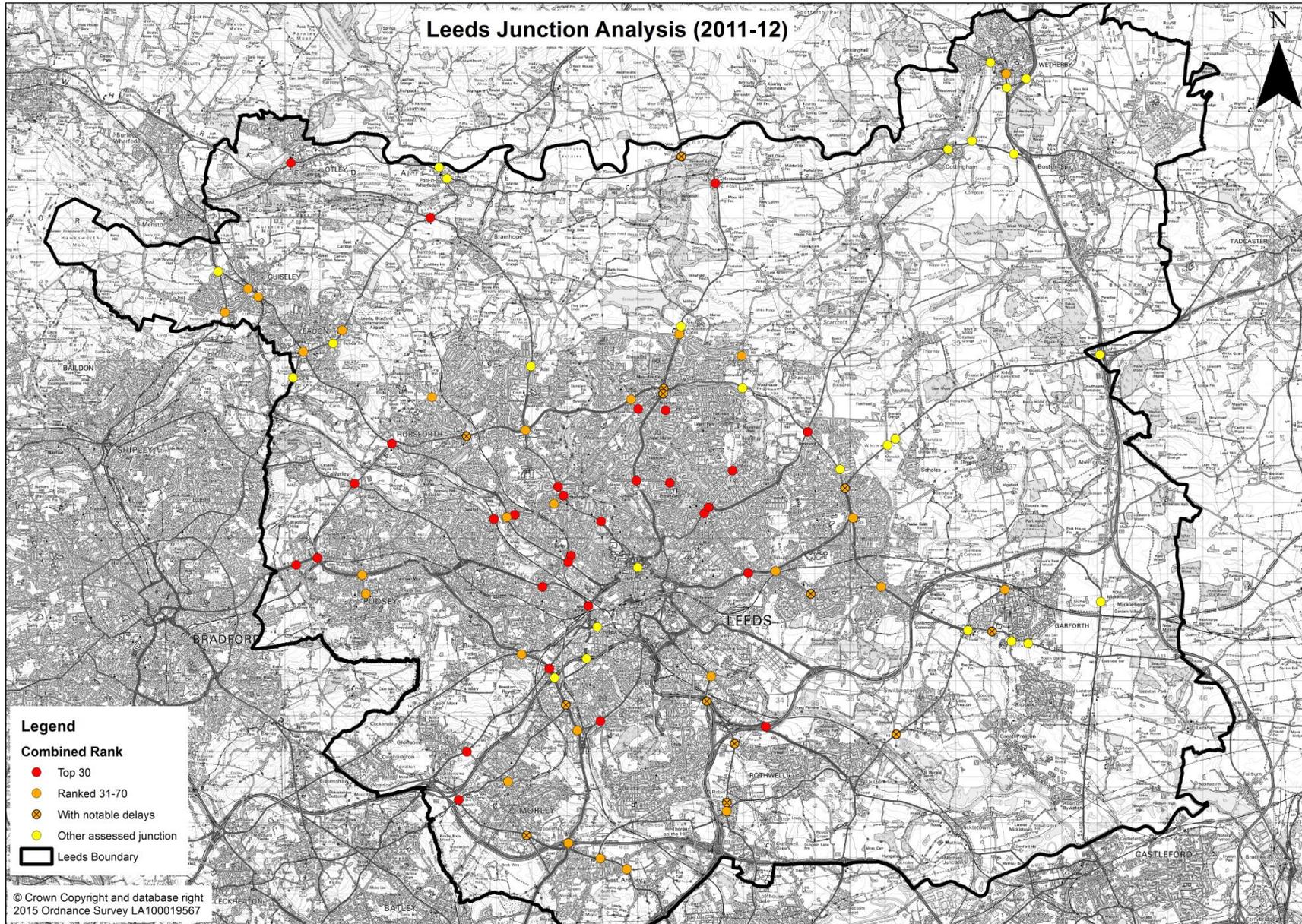


Summary of significant trends:

- Traffic growth over the past two decades has consistently been significantly less than growth in car ownership and employment;
- Peak spreading and changes in employment patterns mean that peak hour flows on radial routes around Leeds city centre are lower now than in 1990;
- Rail and cycling levels have risen significantly over the past decade;
- Bus usage has fallen overall, however, there are signs of growth since 2012;
- A significant proportion of Leeds residents work outside Leeds District and equally a high proportion of jobs in Leeds are undertaken by people commuting into Leeds;
- Almost half of all the journeys made by residents within urban Leeds are less than 2 miles long;
- Morning peak traffic speeds on A roads across Leeds are faster than in other Core Cities, however, on the most congested radials journey times are twice as long in the peak as at other times of the day;

- Carbon emissions due to transport on Leeds' roads have fallen since 2005, however, previous falls in NO2 emissions have levelled off and there has been no improvement since the year 2000.

Figure 7 - Leeds Congestion Hotspot Junctions (2011-12)



5 Strategy

- 5.1 Core Strategy Spatial Policy 11 provides a strategic framework for the delivery of new transport infrastructure across Leeds in line with the objectives of LTP3 and the Leeds City Region Transport Strategy. Specifically the delivery of schemes to enhance radial public transport, including rapid transit and park and ride, and targeted highway improvements to expand orbital capacity and target congestion hotspots. Interventions to improve access to the Aire Valley and Leeds Bradford international Airport are also included, as well as measures to support new developments and improve connectivity for cyclists and pedestrians.
- 5.2 SP11 also references interventions to address the needs of people with impaired mobility, improve road safety, address accessibility and support low carbon technologies. Lastly the policy supports the delivery of HS2 and the substantial connectivity enhancements that it will deliver in the longer term.
- 5.3 Transport Policies T1 and T2 contain measures to manage travel demand by the use of travel plans, the control of parking, requirements for developments to be located in accessible places and to contribute to infrastructure to mitigate their impacts and ensure that developments do not materially add to existing problems
- 5.4 The aim of the strategy is to provide choice and ensure that suitable alternatives to the private car are available – in particular for journeys to local services, education, employment, shopping and to the city centre – and to therefore increase the proportion of these trips made by sustainable modes. As shown earlier, the relatively high car mode share for many short journeys means that there is significant scope for increasing the use of walking and cycling; equally the high public transport accessibility of the city centre (together with planned improvements) should ensure that car usage can be reduced.
- 5.5 For travel to work the diversity of destinations outside the city centre makes it hard to cater for direct travel to these locations by public transport (unless residents live on the route of a direct bus or train service) and therefore it is important that they are linked directly to major public transport interchanges (such as the city centre) to facilitate these journeys. This is reflected in the Accessibility Standards in the Core Strategy. It is nevertheless recognised that for many people car will remain the primary mode for a high proportion of these journeys and therefore the provision of additional orbital highway capacity will be a key outcome of the strategy.
- 5.6 City centre living forms an important component of the spatial distribution of the housing locations in Leeds with a planned 11,500 dwellings being allocated to the city centre in the Site Allocations Plan. Census data shows that although not all city centre residents chose to work in Leeds city centre, the availability of good alternatives to the private car means that the vast majority (76%³) use sustainable modes to travel to work.

³ 2011 census QS701EW (LSOA within Leeds IRR, excludes those working at/from home)

- 5.7 It has long been recognised that the interaction of transport and land use can have a significant effect on travel patterns. Thus delivery of significant infrastructure can encourage people to move to the local area to make use of the new facilities to access employment elsewhere. Historically rail investment around London led to the growth in commuting. It has been estimated that people on average change jobs every 3 years and move home every 7 years – this means that there is significant scope for individuals and families to change their travel patterns during this process. It is considered that investment in NGT, park and ride and rail will in turn have an effect upon local travel in and around Leeds and Leeds City Region.

6 Transport Interventions

Local Projects

- 6.1 The first West Yorkshire Local Transport Plan (LTP) was adopted in 2001 and since then investment in local transport has been guided by the strategies and policies within the plan and its two successors. The current plan (LTP3) runs from 2011-26. As highlighted in section 3 the WYCA is in the process of creating a Single Transport Plan that will update and incorporate LTP3.
- 6.2 A number of key interventions have been delivered in Leeds in recent years to address existing problems and to cater for future travel demand resulting from a growing economy. Key amongst these was the completion of Leeds Inner Ring Road in 2008; the opening of the A63 East Leeds Link Road in 2009; the delivery of the A65 Quality Bus Corridor in 2012; and the opening of the 800 space park and ride site at Elland Road in 2014. Further works to signalise three key roundabout junctions to the west of the city: Thornbury Barracks, Rodley and Horsforth are due for completion during 2015.
- The Inner Ring Road scheme, in combination with the M621, for the first time completes a full ring road around the city centre. Future plans for the city centre, described below, will build upon this to remove through traffic and enhance the urban realm and local environment so that the city is better able to attract new investment.
 - The East Leeds Link Road (ELLR) provides a dual carriageway link through the Aire Valley between the city centre and the M1 to the east. This scheme therefore forms a key component in opening up the Aire Valley to investment in employment and housing, and supporting the Local Enterprise Zone. Plans are already well advanced to open a 1000 space park and ride site adjacent to the ELLR in 2016 (see below).
 - The A65 Quality Bus Corridor (QBC) has significantly enhanced bus priority on this major radial route, complementing previous investment on the A61 Scott Hall Road and the A64 and A63 in east Leeds. The provision of good local bus services that are insulated from future congestion by priority measures is an important component of the city's transport strategy.
 - Although rail based park and ride is common across West Yorkshire, Elland Road represents the first major investment in bus based park and ride in

Leeds. Providing a good alternative for car commuters to reach the city centre is key to reducing traffic levels on congested radial routes and improving the environment within the city centre.

- The roundabout improvement and signalisation schemes at Thornbury Barracks, Rodley and Horsforth will support housing growth in the west of the city.

- 6.3 As a city Leeds has a good track record of delivering major transport schemes however, this has to some extent been constrained by the need to seek government funding on a project by project basis and the lengthy timescales involved in gaining approval. Recent significant changes in government policy has led to the City Deal, the creation of the West Yorkshire Combined Authority, RailNorth and Transport for the North. These changes will facilitate more local decision making and in combination with the West Yorkshire Plus Transport Fund will result in a significant increase in investment and a more streamlined delivery process.
- 6.4 The £1 billion West Yorkshire Plus Transport Fund comprises £600m of Government funding over 20 years, £183m of other devolved transport funding previously secured through the City Deal and local contributions. It will underpin growth by improving the City Region's roads and railways and connecting people to jobs and goods to markets seamlessly.
- 6.5 Managed by the West Yorkshire Combined Authority (WYCA), the fund will be targeted at reducing congestion, improving the flow of freight and making it easier for people to commute to and from expected major growth areas. A package of transformational transport schemes which meet the WYCA and the LEP's aims of supporting economic growth has been identified and includes a number of major projects in Leeds. Four of these have been prioritised for early implementation: East Leeds Orbital Route and Outer Ring Road junction Improvements; A65-Airport-A658 Link Road; Leeds City Centre Package; and Aire Valley Temple Green Park and Ride.
- 6.6 The WYPTF projects will build upon other major schemes that are being delivered through direct investment by the Department for Transport and local contributions. These include: Major Maintenance on Leeds Inner Ring Road; Leeds Station Southern Entrance; Leeds Rail Growth Package; City Connect Cycle Superhighway and New Generation Transport.
- 6.7 In total these nine schemes represent a substantial £610M investment in the city's transport infrastructure that will act as a catalyst and driver for Leeds and the City Region's economic growth and regeneration. All the schemes are in line with the transport infrastructure investment priorities specified in Core Strategy Spatial Policy 11.
- East Leeds Orbital Route (ELOR) is a proposed dual carriageway road from M1 Jn 46 to the A6120 to the west of the A58 Wetherby Road. The southern section of this route – Manston Lane Link – is to be provided by the Thorpe Park development. This scheme is directly tied to the East Leeds Extension housing proposals and will provide direct traffic relief to

the existing outer ring road through Cross Gates and Seacroft. In addition to ELOR, improvements to four junctions on or adjacent to the A6120 are also contained within this package (A6120/King La; King La/Stonegate Rd; A6120/A61 Harrogate Rd and A6120/Roundhay Park La). In combination with ELOR these schemes form part of the Council's proposals for enhancing orbital highway capacity on the outer ring road.

- A65-Airport-A658 Link Road is a proposed single carriageway road linking the A65 west of Horsforth with Leeds Bradford Airport and the A658 to the north. This proposal would also include bus priority measures on the A65 eastbound approach to the A6120. This scheme represents a key transport intervention to facilitate growth of the airport and reduce traffic levels on local roads, in line with Core Strategy Spatial Policies 11 and 12. Further work is also being undertaken to investigate options for a future heavy/light rail link to the airport.
- Leeds City Centre Package is a key component of the emerging city centre transport strategy. The proposed scheme will provide additional orbital capacity on the inner ring road (specifically at Armley Gyratory) and the M621 to facilitate orbital movements and to enable traffic levels to be reduced within the city centre. To support this it is proposed to close City Square to general traffic and to reduce the scale of highways within the South Bank, reallocating road space to pedestrians, cyclists and public transport. The growth in city centre living and employment contained within the Core Strategy will require a new approach to the transport networks and urban realm to accommodate the greater levels of walking, cycling and public transport use associated with this growth. The emphasis here is to significantly enhance the city centre as a place and reduce the dominance of highway infrastructure. The scheme is a key project to enable the city to be HS2 ready and will complement the proposals to increase rail usage, the Council's plans for park and ride (including NGT) and the enhanced cycling network contained within City Connect.
- The Temple Green Park and Ride proposal is scheduled to be operational by the spring of 2016 and represents the first phase of the Aire Valley Enterprise Zone Package. This scheme will provide a 1000 space car park served by a dedicated bus service to the city centre which will also serve other locations within the Aire Valley. This scheme, in combination with the Council's other park and ride proposals (including NGT), is a key element in supporting the growth of the city centre as well as directly enhancing public transport connectivity to the Enterprise Zone.
- The Leeds Inner Ring Road Major Maintenance Scheme is due to be completed by the end of 2015 and will ensure the continued availability of the critical Woodhouse tunnel. The inner ring road carries up to 85,000 vehicles per weekday and performs a vital component of the city's highway network, not only for traffic heading for the city centre but also facilitating city wide movements within the main urban area.

- The Leeds Station Southern Entrance scheme will provide a new entrance to the City Station from the Holbeck/South Bank area and is due to be completed by autumn 2015. This will directly support the Core Strategy's employment and residential growth plans for the city centre, and by enhancing rail connectivity forms a key element of the emerging city centre transport strategy.
- Leeds Rail Growth Package comprises two new stations with associated car parks on the electrified Airedale and Wharfedale lines. These are due to open during the autumn on 2015. Apperley Bridge station will provide an alternative option for travel to Leeds city centre (and other wider destinations) from the north west of Leeds and communities to the north east of Bradford and alongside Kirkstall Forge station will work to relieve traffic levels on the A65 Kirkstall Road. Kirkstall Forge station will directly support the associated residential and employment developments.
- The City Connect Cycle Superhighway scheme will provide 23km of segregated cycle superhighway connecting Bradford to East Leeds via Leeds city centre, upgrades to the canal towpath between Kirkstall and Shipley and additional city centre cycle parking. The scheme is due to open by the end of 2015 and represents a significant step change in provision for cycling and the Leeds Core Cycle Network. In addition further funding has been awarded for a second phase covering works in and around Leeds city centre, including the direct approaches from the north, with delivery planned by 2018. These schemes will directly support the increased use of sustainable modes across the city as well as the emerging city centre transport strategy.
- New Generation Transport (NGT) comprises a two line trolleybus network with associated park and ride sites that will link Stourton (M1 Jn 7) and Holt Park/Boddington with Leeds city centre. The scheme is currently subject to the result of a public inquiry. NGT represents a transformational enhancement to the city's public transport network. It represents a key component of the emerging city centre transport strategy as well as connecting people to key employment sites, education, health and leisure facilities across the wider city.

6.8 In addition to the interventions outlined above, a further £220+M worth of Leeds projects have been prioritised within the West Yorkshire Plus Transport Fund as well as a number of other schemes where a proportion of the investment will have a direct role to play in facilitating the economic growth of the city. These comprise:

- Leeds Outer Ring Road A6110 – junction improvement package
- A653 Leeds-Dewsbury Corridor – bus priority measures, highways efficiency, express bus service and local safety scheme
- Aire Valley Enterprise Zone Package Phase 2 – provision of a new north-south cross river link road between B6481 Pontefract Rd and A63

- NGT Trolleybus Line 3 to Aire Valley – trolleybus link to the Aire Valley Enterprise Zone from Leeds city centre and City Station
- East Leeds Parkway – strategic rail park and ride site east of Leeds
- Leeds City Station Gateway – enhancements to public realm and accessibility in line with the emerging station masterplan
- Rail Park and Ride Package – 2,000 additional spaces at stations across West Yorkshire (including Horsforth, Morley and Garforth) to accompany DfT investment in additional rail capacity.
- Core Bus and Highway Network Upgrade – targeted interventions to address key corridors and congestion hotspots
- Highway network efficiency programme – improvements to traffic signals control systems

Strategic Road Network Projects

6.9 Significant investment in the Strategic Road Network (SRN) by Highways England (formerly the Highways Agency) has also been undertaken in recent years and will continue through their Route Strategies. Key interventions comprise:

- M62 Smart Motorway Upgrade (Jn 25-30) – open autumn 2013
- M1 Jn 44 pinch point scheme – open spring 2015
- M1 Smart Motorway Upgrade (Jn 39-42) – completion planned autumn 2015
- M1 Jn 45 improvement – start on site 2017
- M621 (Jn 1-7) localised improvements and widening – start on site by 2020 (elements of this form part of the Leeds City Centre Package)
- M1/M62 Lofthouse Interchange reconstruction (2020-25)

Rail Investment

6.10 New rail franchises for the Northern and TransPennine services are due to start on 1 April 2016 and will be managed jointly by a RailNorth / DfT partnership team based in the North of England. RailNorth is a Limited Company set up by the 29 Local Transport Authorities in the north of England, including the West Yorkshire Combined Authority. The Northern franchise will run for nine years with the option of a one year extension. The TransPennine franchise will run for seven years with the option of a two year extension.

6.11 As shown earlier, there has been a substantial growth in rail travel in recent years and the industry is now planning for further growth into the future. This is

reflected in the requirements for the new franchises which require the provision of additional capacity for travel into and out of Leeds during the peak periods. By December 2019 this will deliver space for at least an additional 5,900 standard class passengers. Based on DfT passenger counts for autumn 2013 this represents approximately a 25% increase over existing levels of demand. Further capacity expansion requirements are expected through the DfT High Level Output Specification for 2019-24.

6.12 The franchises will deliver at least 120 new-build carriages for use on non-electrified routes and the modernisation of all remaining Northern trains. The Pacer units currently in use on the Northern network will be completely phased out by 2020. Trains will be longer with more seats, particularly on the most crowded routes into the North's largest cities. Northern stations will be improved, with at least £30 million of investment across the franchise.

6.13 In addition to these changes, Network Rail are working in parallel to increase the proportion of the electrified rail network within West Yorkshire. Electrification of the TransPennine route from Manchester to Leeds and York, along with the line from Leeds to Selby, was announced in 2011. Completion of these works is expected by 2020.

Transport for the North

6.14 Transport for the North (TfN) is a new partnership between northern city regions, LEPs and Government working closely with Highways England, Network Rail and HS2 Ltd. The Partnership's aim is to transform the Northern economy through the long term investment in transport networks to create the 'Northern Powerhouse'. TfN will allow the Northern cities to speak with one voice about our future vision and to be clear with Government about where investment is needed.

6.15 A TfN Partnership Board has been established to oversee the development of a Northern Transport Strategy. Key elements include:

- Rail Plan – fast frequent and quality high speed TransNorth (or 'HS3') rail services connecting the northern cities, and committing to the full HS2 Y shaped network which should be delivered as soon as possible. For the Leeds/Manchester/Sheffield triangle, journey times of 30 minutes between the 3 cities are envisaged including looking at new route options across the Pennines. The study (to report in autumn 2015) to find the best solution to integrate HS2 and TransNorth with local services at Leeds Station is a critical part of the plan.
- Highways Plan – a core free flowing east-west motorway network with a 'mile a minute' typical journey times for more reliable journeys between the major cities. This plan draws on Highways England's Roads Investment Strategy (RIS1) which includes upgrading the M62 to 4 lane 'smart' motorway between Leeds and Manchester and tackling hotspots around the M621. Strategic studies into upgrading key trans-Pennine road links that could relieve pressure on the M62 will be undertaken for the A66/A69 and a new road/tunnel link between Sheffield and Manchester. There is

also a commitment to look at the capacity of the M62 itself alongside these studies.

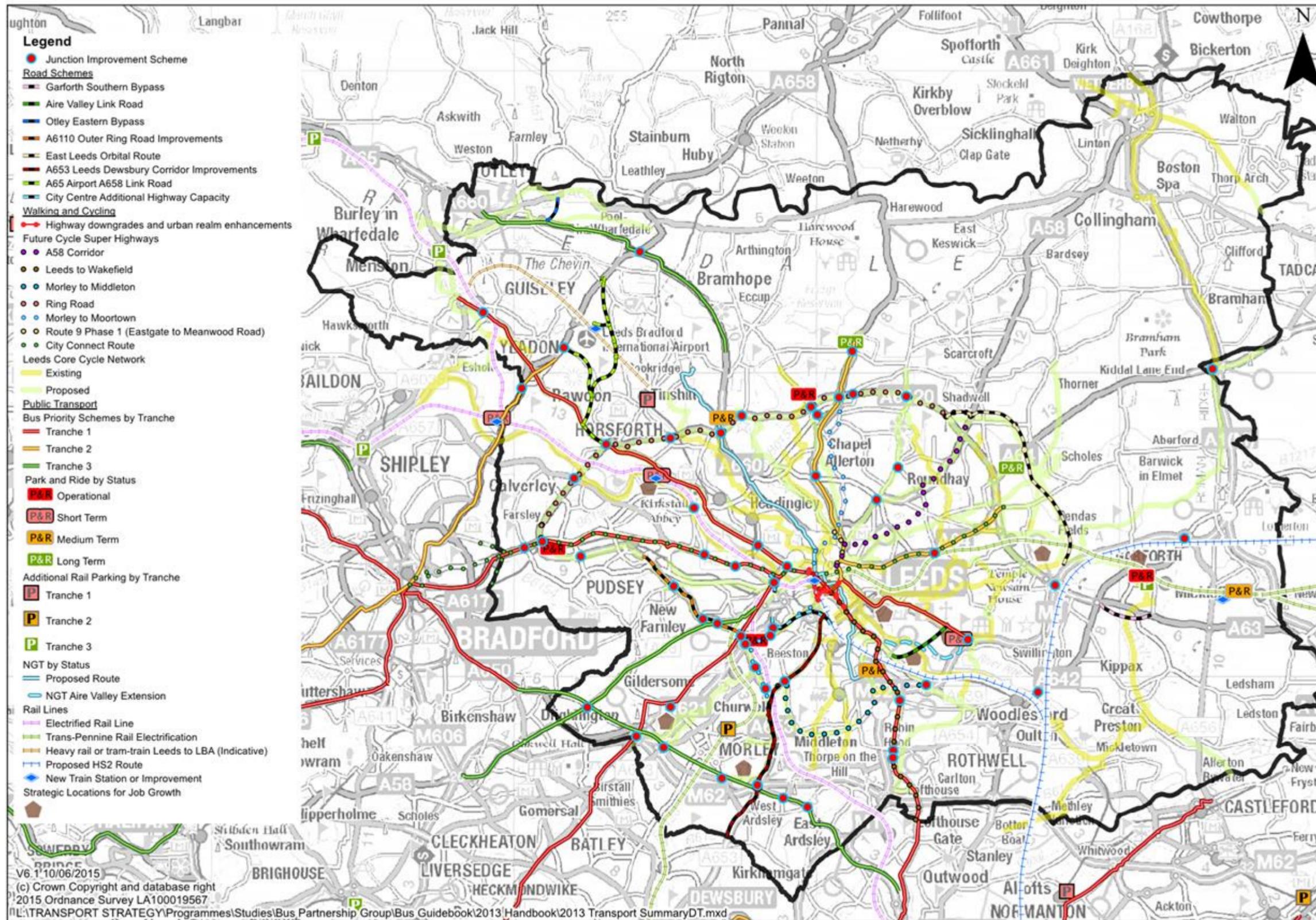
- Freight and Logistics Plan – that covers both road and rail networks will be developed over the next year including ports, warehousing and distribution networks.
- Integrated and Smart Travel Plan – a vision for an integrated single smart ticketing and fares solution across the North that works on all modes of public transport with pan-Northern customer travel information. TfN will start to take immediate action to simplify rail fares and align the different tickets and approaches in the different cities, including building on our successful MCard smart ticketing scheme.
- Airports Plan – to encourage more destinations served from the North’s intercontinental and regional airports, and to work with individual airports, such as Leeds-Bradford, to improve surface access connectivity.
- Local Connectivity Plan – high quality local road and public transport connectivity is essential so that all parts of the city region can benefit from the core city to city improvements. For West Yorkshire and York, the focus is on the creation of a one network ‘metro’ style rail, bus and rapid transit network and a good quality strategic road network as reflected in the draft Single Transport Plan. This is particularly important for our polycentric mix of towns and cities in WY and York. The Government will look to support local connectivity improvements through future Growth Deals.

Additional Schemes Arising Directly from the Site Allocations

6.16 In order to inform the Plan site requirements the Leeds Transport Model (LTM) has been used to forecast future highway conditions in 2028. The model tests included all the residential and employment sites contained within the Site Allocations Plan. This has enabled the potential contribution of significant housing and employment sites to traffic growth and congestion at key junctions to be estimated. For the purposes of this exercise all residential development sites of 50 or more dwellings and significant employment sites have been assessed. In addition, locations where there is a cumulative impact have also been identified. This analysis has led to the identification of a number of transport interventions that are likely to be required during the Plan period. These mitigation measures are deemed to be key schemes to facilitate the delivery of the housing targets. Once feasibility studies have been completed for these junctions a clearer picture of the scale and cost of these interventions will be available. At this stage, however, it has not been possible to model the schemes and assess the cumulative impact on the wider network.

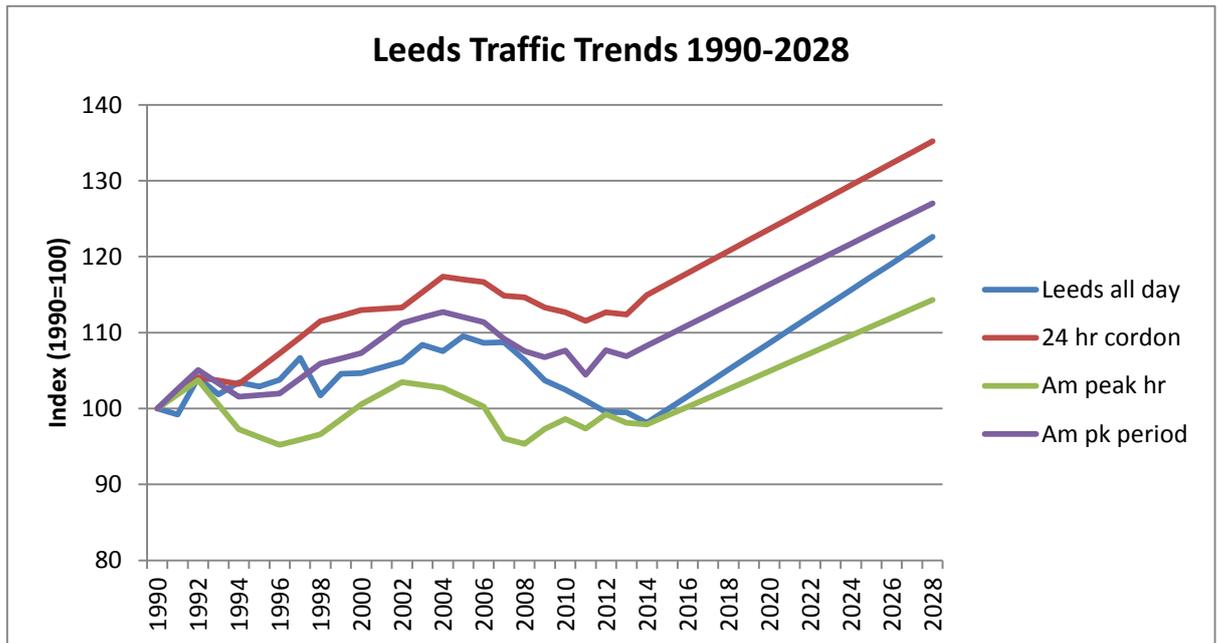
6.17 Figure 9 shows these identified interventions, together with other major transport schemes, the planned WYPTF schemes and those from Network Rail.

Figure 9 – Transport Interventions in Leeds



- 6.18 Model tests have been run containing the majority of the major interventions described in the previous sections, including NGT and a number of the WYPTF schemes (where sufficient information is available to define them in the model). Once feasibility work has been completed it is planned to run a full Do Something test to show the forecast impacts of the Plan and supporting transport investment.
- 6.19 The model tests indicate that by 2028 all day traffic levels within Leeds will grow by around 23% from 2012 levels with traffic on radials approaching the city centre increasing by 20%. Growth in the peak hours is forecast to be lower than this, with peak hour traffic forecast to rise by around 15% on the same radial routes. These are broadly in line with forecasts from the National Trip End Model (NTEM) which predicts a 25% increase in weekday car traffic in Leeds, however, it should be noted that the latter reflects a 22% increase in population, well above the 15% contained in the Core Strategy.
- 6.20 Historically, traffic growth forecasts at both a national and local level have tended to significantly over estimate growth. For example the NTEM suggests that weekday car traffic in Leeds rose by 24% between 2001-14, when in fact the Leeds Monitoring Cordon around the city centre shows only a 2% increase since 2000 (data is not available for 2001) and data from DfT surveys covering A roads across the District shows a similar 2% growth between 2001-13. These forecasts therefore need to be viewed with some caution. It is considered that both the model and NTEM forecasts represent very much a worse case in terms of traffic growth, in particular with regards to radial peak hour traffic.
- 6.21 Figure 10 illustrates this, showing historic traffic from 1990-2014 and the forecast up to 2028. Although the impact of the economic downturn will have influenced traffic levels it is notable that the fall in Leeds commenced several years prior to 2008. It is also worth noting that the historic growth in all day traffic across the Leeds cordon has consistently exceeded the growth in peak period traffic.
- 6.22 Bearing in mind the past trends, it is considered that weekday traffic growth is likely to grow by at least the rate of population growth (15%) with the forecast of 23% from the Leeds Transport Model representing the upper limit. Peak traffic growth is likely to be less than this and within the main urban area significantly less.

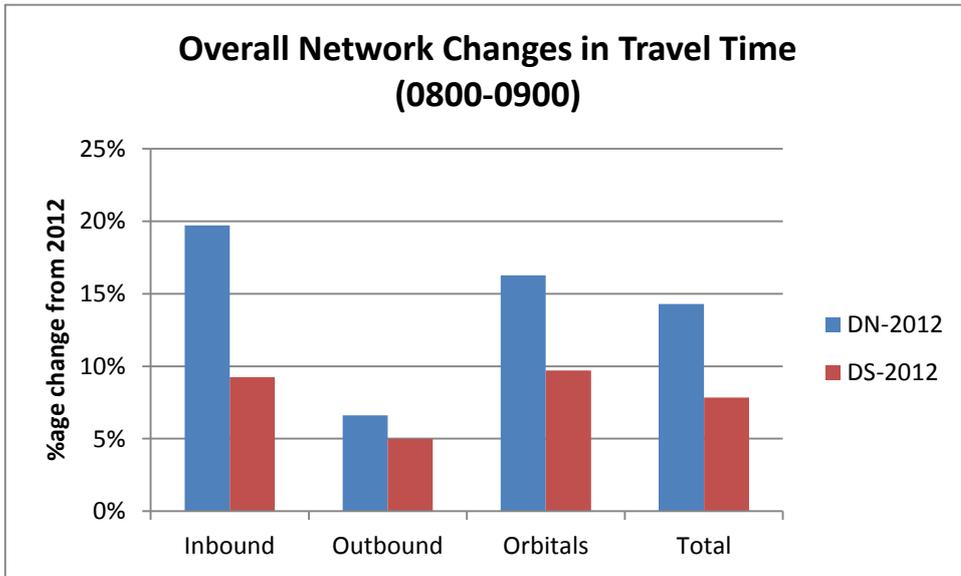
Figure 10 – Historic and forecast traffic growth in Leeds (1990-2028)



Sources: 24 hr cordon, am peak hr and am peak period – Leeds monitoring cordon (1990-2014); Leeds all day – Note 13 all sites (1990-2014)

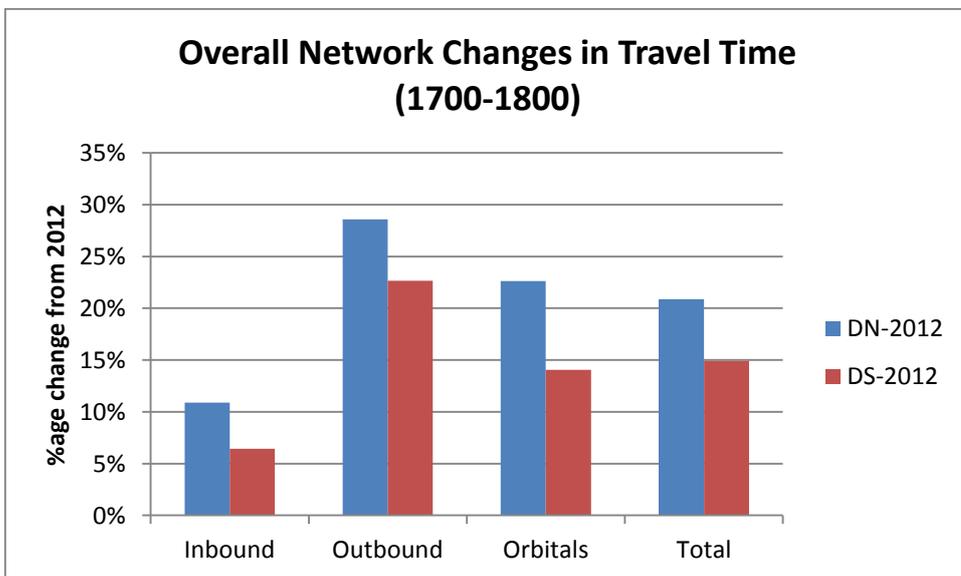
- 6.23 Public transport trips to the city centre are forecast in the Leeds Transport Model to increase by 27% while overall public transport use is forecast to rise by 23%, the same as vehicle traffic.
- 6.24 Peak journey times are forecast to increase by 2028, however, as Figures 11 and 12 demonstrate the WYPTF and other major scheme interventions, as well as schemes delivered since 2012, will have a significant impact on mitigating the impacts. The figures show the difference between a 2028 Do Nothing scenario where the network only includes schemes in place in 2012 and a 2028 Do Something scenario with the inclusion of planned interventions.
- 6.25 It should be noted that this analysis does not include the schemes identified during the modelling process, and that therefore the combined impact of all the proposed interventions will be greater. There will nevertheless remain additional congestion caused within Leeds that cannot be effectively mitigated against.

Figure 11 – Forecast changes in morning peak hour travel times between 2012 and 2028 (Do Nothing and Do Something)



Note: Network covers all main radial and orbital A and M roads. DN = 2028 Do Nothing (no changes from 2012); DS = 2028 Do Something (with planned interventions)

Figure 12 – Forecast changes in evening peak hour travel times between 2012 and 2028 (Do Nothing and Do Something)



Note: Network covers all main radial and orbital A and M roads. DN = 2028 Do Nothing (no changes from 2012); DS = 2028 Do Something (with planned interventions)

6.26 Table 2, below, lists junctions where congestion is forecast to worsen significantly by 2028 and interventions will be potentially required in addition to those already planned. It also includes a number of other junctions immediately adjacent to developments. A number of these schemes have been identified within the WYPTF and contributions will be required to support their delivery. Other junctions can be linked directly to specific developments while others experience cumulative impacts that are relatively modest from individual sites but in combination have a marked impact on congestion. Direct contributions

have been identified where the site adds 5% to traffic on the affected approach to the junction; cumulative contributions where the site adds 10 vehicles or more.

6.27 The Site Requirements contains details of the locations where contributions towards improvements will be required from the Allocated sites. Sites previously included in the Unitary Development Plan (Identified sites) where development has not yet commenced and where planning permission has not been granted or has lapsed or new permissions are sought will also be expected to contribute towards these schemes in line with the requirements for adjacent Allocated sites.

6.28 Due to their scale some sites have a potentially greater cumulative impact across the wider network than others (for example East Leeds Extension, the East of Garforth site and Headley Hall). In these cases the cumulative impact threshold has not been comprehensively applied. With the former, the site forms part of the Identified sites and funding will be required towards East Leeds Orbital Route. In the case of Garforth and Headley, comprehensive transport studies will be required and these will need to consider both direct and cumulative impacts.

6.29 It should be noted that there are very likely to be some locations on this list where site constraints will preclude a comprehensive solution. Feasibility studies will be required to establish options. Some indication of the constraints is given in the status column. In addition, there are locations on this list where the junctions concerned effectively shelter adjacent downstream junctions from congestion. The implication of unlocking these bottlenecks will have to be reviewed as part of a corridor approach to prevent queues from simply being transferred to the next junction.

6.30 The locations are listed in a clockwise direction starting with the A61 Harrogate Road.

Table 2 – Identified Interventions

Location	Status	Site Requirements
A61/Alwoodley La	Top 70 hotspot – very constrained site	Direct contributions (1 site)
A61/A6120 Moortown	Top 70 hotspot – very constrained site. WYPTF scheme	Cumulative contributions (1 site)
A61/Potternewton La	Top 30 hotspot – constrained site	No sites identified
A6120/Shadwell La	Constrained site.	No sites identified
A6120/Roundhay Park La	Unconstrained site. WYPTF scheme	No sites identified
Roundhay Rd/Oakwood La (Oakwood Clock)	Top 30 hotspot – very constrained site	No sites identified
A58/Harehills La (Fforde Green)	Top 30 hotspot – very constrained site	No sites identified
A1 (M) Jn 45/A64		Contributions from Headley Hall site – subject to comprehensive transport study
A64/B6159 Halton Dial	Top 70 hotspot – very constrained site	Direct contributions (1 site) cumulative (1 site)
M1 Jn 46/A63 Colton	Highways England improvement associated with Thorpe Park and East Leeds Extension	Contributions from East of Garforth site – subject to comprehensive transport study. Cumulative contributions (2 other sites)
M1 Jn 47/A642 Garforth		Direct contributions from East of Garforth site – subject to comprehensive transport study. Cumulative contributions (5 sites)
A63 Garforth southern bypass	Top 70 hotspot – very constrained site (Lidgett)	Subject to comprehensive transport study for East of

Location	Status	Site Requirements
	La/A63)	Garforth site
M1 Jn 45/A63 East Leeds Link Road	Highways England improvement scheme scheduled for 2017 start	None – due to delivery of planned scheme
A642/Bullerthorpe La	Top 70 hotspot – very constrained site	No sites identified
A61/A654 Leadwell La	Top 70 hotspot - constrained site	Cumulative Contributions (6 sites)
A61/Sharpe La	Top 70 hotspot - constrained site	Cumulative Contributions (5 sites)
A61/Wood Lane	Top 70 hotspot - unconstrained site	Direct contributions (1 site) cumulative (5 sites)
A650/Common La	Top 70 hotspot - constrained site	Cumulative Contributions (3 sites)
A650/Thorpe La	Top 70 hotspot – unconstrained site	Direct contributions (1 site)
M62 Jn 28/A653 Tingley	Top 70 hotspot – constrained site. WYPTF A653 Corridor scheme	Direct contributions (1 site) cumulative (4 sites)
A653/Ring Road Middleton (Tommy Wass)	Top 30 hotspot – very constrained site. WYPTF A653 Corridor scheme	No sites identified
A650/A6039 Rein Rd	Top 70 hotspot – very constrained site	Cumulative Contributions (5 sites)
A650/A643 Bruntcliffe La	Top 30 hotspot – constrained site	Cumulative Contributions (2 sites)
A643/A6110	Top 70 hotspot – constrained site. Potential addition to WYPTF A6110 scheme	Direct contributions (1 site) cumulative (1 site)
A643/Wesley St	Constrained site.	No sites identified
A643/M621 Jn 2	WYPTF City Centre Package scheme	No sites identified

Location	Status	Site Requirements
A6110/M621 Jn 1	Very constrained site. Potential addition to WYPTF A6110 scheme	No sites identified
M62 Jn 26/A62 Gildersome		Cumulative contributions (2 sites)
A62/Asquith Ave	Top 30 hotspot – constrained site	Cumulative contributions (5 sites)
A58/B6135 Drighlington	Very constrained site	Direct contributions (1 site)
A58 Domestic Rd/Domestic St	Very constrained site. Potential addition to WYPTF City Centre Package scheme	No sites identified
A6110/Branch Rd	Constrained site. Potential addition to WYPTF A6110 scheme	Cumulative contributions (4 sites)
A6110/Tong Rd	Constrained site. Potential addition to WYPTF A6110 scheme	Cumulative contributions (4 sites)
A647/B6154 Thornbury Barracks	Top 30 hotspot – very constrained site. Current pinch point scheme completed 2015	None – due to delivery of current scheme
A647/A6120 Dawson's Corner	Top 30 hotspot - constrained site. Potential WYPTF Leeds-Bradford Corridor scheme	Cumulative contributions (6 sites)
A647/B6155 Richardshaw Lane	Top 70 hotspot – very constrained site	No sites identified
A647/Armley Ridge Rd	Constrained site. Potential WYPTF Leeds-Bradford Corridor scheme	No sites identified
A647/Ledgard Way	Top 30 hotspot – very constrained site. Potential WYPTF	No sites identified

Location	Status	Site Requirements
	Leeds-Bradford Corridor scheme	
A647/A643/A58 Armley Gyrotory	Top 30 hotspot – very constrained site. WYPTF City Centre Package scheme	Direct contributions (4 sites) cumulative (3 sites)
A658/Micklefield La	Constrained site	Cumulative contributions (2 sites)
A658/Bayton La	Top 70 hotspot – constrained site. Affected by WYPTF A65-Airport-A658 Link Rd scheme	Cumulative contributions (3 sites)
A65/Oxford Rd	Top 70 hotspot – very constrained site	Cumulative contributions (1 site)
A65/A6120	Top 30 hotspot – very constrained site. Current signalisation scheme due for completion 2015	Direct contributions (2 sites) cumulative (9 sites)
B6157 Bridge Rd/Wyther La	Top 30 hotspot – very constrained site	No sites identified
A65/Willow Rd	Top 30 hotspot – very constrained site. A65 QBI completed 2012	Direct contribution (1 site)
A65/A58 Inner Ring Rd	Very constrained site. A65 QBI completed 2012	Direct contributions (2 sites) cumulative (3 sites)
A6120/Low La	Top 70 hotspot - constrained site	Cumulative contributions (2 sites)
East of Otley Relief Road	Top 30 hotspot – severely constrained site (A659/Kirkgate)	To be delivered through East of Otley housing site (UDP requirement)
A660/A658 Dyneley Arms	Top 30 hotspot – unconstrained site. Potential addition to WYPTF A65-Airport-	No sites identified

Location	Status	Site Requirements
	A658 Link Rd scheme	
A660 Corridor	Three top 30 and one top 70 hotspots. NGT trolley bus scheme awaiting outcome of public inquiry.	No sites identified
A6120/Weetwood La	Constrained site.	Cumulative contributions (2 sites)
A6120/King La	Top 70 hotspot - constrained site. WYPTF scheme	No sites identified

6.31 It is anticipated that contributions towards the implementation of these schemes will be required from site developers. In addition, it is proposed that schemes to deliver enhanced facilities for public transport, walking and cycling will be mainly funded through the Community Infrastructure Levy (CIL). See below.

6.32 Public transport and cycling schemes:

- Elland Rd park and ride expansion
- A61 Alwoodley park and ride
- A64 Grimes Dyke park and ride
- New Pudsey station car park expansion
- Morley Station car park expansion (WYPTF scheme)
- Horsforth Station car park expansion (WYPTF scheme)
- A61(N) Bus Corridor enhancements (WYPTF corridor scheme)
- A58 (N) Bus Corridor enhancements
- A64 Bus Corridor enhancements (WYPTF corridor scheme)
- A639 Bus Corridor enhancements (WYPTF corridor scheme)
- A61(S) Leeds – Wakefield Bus Corridor (WYPTF corridor scheme)
- A653 Leeds – Dewsbury Corridor (WYPTF scheme)
- A62 Bus Corridor enhancements (WYPTF corridor scheme)

- A58 Bus Corridor enhancements (WYPTF corridor scheme)
- A647 Leeds – Bradford Corridor (WYPTF corridor scheme)
- A65 Bus Corridor enhancements (WYPTF corridor scheme)
- A660 (Adel-Otley) Bus Corridor enhancements (WYPTF corridor scheme)
- Cycle Superhighway: Leeds – Shadwell
- Cycle Superhighway: Morley – Moortown
- Cycle Superhighway: Morley – Middleton
- Cycle Superhighway: Leeds – Wakefield
- Cycle Superhighway: Leeds Outer Ring Road Corridor
- Leeds Core Cycle Network

7 Conclusions

- 7.1 This report summarises the forecast impacts of the proposed developments in the Site Allocations Publication Draft Plan on the transport network in Leeds.
- 7.2 The population of Leeds is forecast to increase by 15% between 2012-28 and alongside increased car ownership it is considered that this will result in an increase in traffic of between 15-23% across the District. Past trends, however, suggest that traffic growth has tended to be well below forecasts, particularly in the peak hours, and so these figures must be regarded as a worst case scenario.
- 7.3 Nevertheless a significant step change in transport investment is planned across the city and the wider city region to support the economic growth of Leeds, provide good alternatives to the private car and to reduce carbon emissions. Schemes prioritised in the West Yorkshire Plus Transport Fund, together with existing major transport schemes such as City Connect, Kirkstall Forge station and NGT, represent an investment of over £830M. On top of this Highways England and the rail industry are also investing in additional capacity on the strategic road and rail networks.
- 7.4 In addition to these projects, a number of further interventions have been identified to mitigate the forecast impacts of growth at key junctions across the Leeds highway network. It is expected that contributions will be obtained from developers towards the delivery of these interventions, alongside contributions towards schemes within the WYPTF.
- 7.5 As well as sites that have a direct impact upon specific junctions, sites have also been identified where the additional traffic generations are lower, but in combination with other sites have a cumulative impact at these junctions and

along corridors. It is expected that contributions will also be obtained from these sites to support appropriate improvements.

- 7.6 It is proposed that support for public transport, walking and cycling schemes will mainly but not exclusively be sought through the Community Infrastructure Levy.

APPENDIX 1

Analysis of Congestion Hotspots in Leeds District

CONGESTION HOTSPOTS IN LEEDS

Executive Summary

1. A comprehensive analysis of congested junctions across Leeds District has been undertaken. In total 96 junctions have been evaluated. The use of TrafficMaster data has enabled the average delay for each approach to be determined for seven time periods during an average term time weekday. The resulting outputs have enabled the junctions to be ranked on the basis of total delay.

Introduction

2. The Department for Transport (DfT) provide all local authorities with data on vehicle travel times that has been collected from vehicles with GPS devices. This information is currently supplied to the DfT by TrafficMaster and allows average journey times and speeds to be analysed by individual road and time of day.
3. Leeds City Council officers have undertaken a detailed analysis of radial and orbital routes in Leeds for the academic years 2009-10 and 2011-12 (weekdays excluding school holidays). This shows that the highest levels of peak congestion in 2011-12 occurred on the A61 N, M621 E, A62, A647, A65 (between Rawdon and the Inner Ring Road) and the A660.
4. As a follow up to this route analysis further work has been undertaken to quantify delays at individual junctions using the 2011-12 data. A total of 96 junctions across Leeds District have been analysed to determine average delays. These junctions were selected on the basis of officer knowledge supported by a review of the radial/orbital average speed plots and also online data from Google Traffic.
5. In the light of the analysis it is clear that a number of the 96 junctions only suffer from very marginal levels of congestion while others are severely congested. Total junction delays summed across all approaches during both the morning and evening peak hours range from 0.5 minutes to just under 23 minutes. It must be recognised that these figures represent an average over all term time weekdays and over full hours. Delays at the peak of the peak are likely to be much greater, however, this analysis does provide a robust evaluation of congestion on a comparable basis that allows future interventions to be targeted at locations with the greatest need.
6. Junctions within Leeds City Centre have not been included; the only exceptions being Domestic Rd/Domestic St and Woodhouse Lane/Clay Pit Lane. Junctions within this area will all be affected by the proposed WYPTF City Centre Package.
7. TrafficMaster data was utilised for weekdays during 2011-12 (September-July), excluding bank holidays and school holidays, and covering seven time periods:
 - A1 – 0700-0800
 - A2 – 0800-0900
 - A3 – 0900-1000
 - IP – 1000-1600
 - P1 – 1600-1700
 - P2 – 1700-1800
 - P3 – 1800-1900

8. For each junction data was extracted for each approach going back as far as the previous significant junction – usually a roundabout or signals. This was subsequently reviewed to ensure that this didn't include any notable intermediate congestion points. The average distance covered per approach was just under one kilometre, although some were significantly shorter.
9. Once journey time had been extracted the level of 'congestion delay' was determined for each approach and time period. This approach was developed for the radial and orbital route analysis and is calculated by comparing travel times with daytime 'free-flow' times (determined from the minimum observed times for each highway segment between 7 a.m. and 7 p.m.). This provides a representative figure for uncongested travel and is considered more appropriate than using night-time or inter-peak data.
10. In order to rank the sites the congestion delay outputs were summed to obtain the total level of delay on all approaches to each junction during the morning and evening peak hours. In addition, the total level of daytime (0700-1900) delay was also calculated. Two rankings were therefore derived: a peak hour and a 12 hour figure. In many cases the results were similar, but for some sites there were notable differences with 8 sites changing by more than 20 places.
11. In order to obtain a single ranking therefore, the peak hour and 12 hour delay data was added together (so that the peak hours were counted twice to give more emphasis to these time periods) and the resulting rank calculated. It must be emphasised that this is effectively a presentational tool and that junctions with lower levels of delay but higher traffic volumes may merit interventions more than other sites, where for example all the delay relates to minor arms.
12. In addition to the overall combined ranking an examination was also made of the sites to determine whether there were junctions with perhaps one approach that suffers from excessive levels of delay while the others are relatively congestion free. A threshold of a 2 minute peak hour delay or an 8 minute daytime (12 hour) delay was utilised for this – these represent the top 10% of individual delays. This identified 14 junctions outside the top 30 with this level of delay on at least one approach.

Analysis Results

13. Table 1 lists the sites ranked within the top 30 (based on the combined ranking). Seven of the top 10 are also within the top 10 in both the peak and 12 hour rankings.

Table 1 – Leeds Top 30 Congestion Hotspots (2011-12)

Combined rank	Junction	Peak delay (mins)	12 hour delay (mins)	Peak rank	12 hour rank	Peak delays >2 mins	12 hr delays >8 mins
1	A6120 / A657 Rodley La	22.8	50.1	1	1	6	3
2	A647 / Ledgard Way	16.7	46.7	5	3	3	3
3	A660 / B6157 North La	13.4	48.5	8	2	2	2
4	Armley Gyratory	19.1	41.8	2	4	3	2
5	A6110 / A62 Gelderd Rd, W heatsheaf	17.3	37.4	3	6	3	2
6	Burley Rd / Cardigan Rd	15.8	38.1	6	5	3	2
7	A6120 / A65 Rawdon Rd, Horsforth	16.7	33.6	4	8	3	2
8	A58 / Harehills Rd	8.4	36.5	17	7	2	2
9	A660 / B6157 Shaw La	12.8	29.7	9	11	2	2
10	Wetherby Rd / Princes Ave, Oakwood	12.8	29.7	10	12	2	1
11	A660 / Hyde Park Rd	7.1	32.4	25	9	1	1
12	B6157 Leeds & Bradford Rd / Wyther La	13.6	25.8	7	13	3	1
13	A659 / B6451 Clapgate, Otley	6.7	31.4	28	10	0	2
14	A58 / B6159 Harehills La, Fforde Green	8.3	25.7	18	14	1	1
15	A650 / A643 Bruntcliffe La, Morley	11.9	21.7	11	16	2	0
16	A6120 / A58 Wetherby Rd	11.5	20.3	12	21	2	1
17	A61 / B6159 Potternewton La	11.2	19.9	13	22	3	0
18	B6157 Kirkstall La / Morris La	7.8	21.6	20	17	1	1
19	M1 (J44) / A639 Leeds Rd, Rothwell	10.0	18.3	14	27	2	1
20	A6120 / A647, Dawsons Corner	7.0	20.7	27	19	0	1
21	Harrogate Rd / B6159 Harehills La	6.4	21.2	33	18	0	0
22	A653 / Ring Rd Beeston Park	6.6	20.6	30	20	1	0
23	A647 / B6154 Galloway La	9.3	17.8	15	29	3	0
24	A64 / B6159 Harehills La	4.9	22.0	47	15	0	2
25	B6157 Stonegate Rd / King La	8.0	18.6	19	26	1	1
26	A65 / Willow Rd	7.6	18.7	22	25	1	1
27	A61 / A659 (E), Harewood	7.4	18.8	23	24	1	1
28	A62 / B6126 Asquith Ave, Gildersome	8.5	16.8	16	33	2	0
29	A660 / A658, Dyneley Arms	7.1	17.7	26	30	0	0
30	Harrogate Rd / Street La	4.3	19.5	54	23	0	0

Note: Ranking based on total delay and takes no account of traffic levels. Combined ranking double counts peak hour delays to give more emphasis to these time periods.

14. Table 2 lists the sites ranked from 31 to 70. Four junctions fall outside the top 30 although they rank within it on the basis of either peak hour or 12 hour delays. This list contains all the remaining sites where peak or 12 hour delays exceed 2 and 8 minutes respectively on at least one approach. Figure 1 shows the locations of all the evaluated sites.
15. A number of the junctions in this evaluation have improvement schemes that are either currently being implemented or are planned. The vast majority, however, are constrained so that significant improvements would require third party land and or property demolition. Tables 3-5 provide comments for each site covering these points, with further detail being available in Appendix A.

Table 2 – Leeds Congestion Hotspots 31-70 (2011-12)

Combined rank	Junction	Peak delay (mins)	12 hour delay (mins)	Peak rank	12 hour rank	Peak delays >2 mins	12 hr delays >8 mins
31	A658 / Bayton La, Yeadon	6.2	17.2	34	32	0	0
32	A61 / Alwoodley La	6.1	16.7	35	34	0	0
33	A647 / Richardshaw La, Pudsey	5.3	17.4	41	31	0	0
34	A6120 / B6159 Selby Rd, Colton	7.6	13.8	21	43	0	0
35	B6155 Lidget Hill / B6154 Church La, Pudsey	3.1	18.2	66	28	0	0
36	Station Rd / Long Row, Horsforth	6.0	15.2	37	38	0	0
37	A63 / B6137 Lidgett La, Garforth	5.2	15.8	42	35	0	1
38	A650 / Common La, East Ardsley	5.3	15.6	40	36	0	0
39	A61 / Sharp La, Robin Hood	7.2	13.5	24	45	2	0
40	A6029 / A650 / B6127 Bridge St, Morley	6.6	13.8	31	42	1	0
41	A650 / Thorpe La, Tingley	5.7	14.5	39	41	0	0
42	A642 / B6137 Main St, Garforth	4.8	14.7	50	40	0	0
43	M621 (J7) / A61 / A639, Stourton	6.4	13.1	32	47	2	0
44	A65 / Oxford Rd, Guiseley	4.1	15.4	58	37	0	0
45	A6120 / A660 Otley Rd, Lawnswood	6.0	13.2	36	46	0	0
46	A6120 / Low La, Horsforth	6.6	12.5	29	50	1	0
47	A65 / B6153 Park Rd, Guiseley	4.1	14.8	57	39	0	0
48	A65 / Kirkstall La	4.9	13.7	45	44	0	0
49	A6120 / A61 Harrogate Rd, Moortown	5.9	11.8	38	52	1	0
50	A6120 / A64 York Rd	4.3	12.7	55	48	1	0
51	A61 / Wood La, Rothwell	5.2	11.7	43	53	1	0
52	M62 (J28) / A653 / A650, Tingley	4.9	11.9	48	51	0	0
53	A6120 / King La	4.9	11.4	46	54	0	0
54	A6120 / A64 Barwick Rd	5.1	10.8	44	58	0	0
55	Shadwell La / Wike Ridge La, Shadwell	3.1	12.6	68	49	0	0
56	A61 / A659 (W), Harewood	4.4	11.1	53	56	1	1
57	B6159 / Primrose La, Halton	4.1	11.2	56	55	1	0
58	A65 / A658 Green La, Rawdon	4.6	10.3	51	60	0	0
59	A6110 / A58 Whitehall Rd, Ringways	4.8	9.8	49	62	0	0
60	B6126 Brunswick St / B6127 Chapel Hill, Morley	3.1	11.1	67	57	0	0
61	A6110 / Millshaw Rd / White Rose (N)	3.9	10.3	59	61	0	0
62	B6157 North La / Cardigan Rd	3.3	10.4	65	59	0	0
63	A61 / Harrogate Rd	3.8	9.6	61	64	1	0
64	A639 / B6481 Pontefract Rd	3.4	9.7	64	63	0	0
65	A6110 / A643 Elland Rd (S)	4.4	8.1	52	73	1	0
66	A64 / B6159 Selby Rd, Halton Dial	3.4	9.0	63	66	0	0
67	A6038 / B6153 Park Rd, Guiseley	3.5	8.5	62	69	0	0
68	A61 / A654 Leadwell La, Robin Hood	3.0	9.0	69	67	0	0
69	A661 / Boston Rd / High St, Wetherby	2.2	9.4	81	65	0	0
70	A642 / Bullerthorpe La, Woodlesford	2.8	8.4	70	70	1	0

Note: Ranking based on total delay and takes no account of traffic levels. Combined ranking double counts peak hour delays to give more emphasis to these time periods.

Figure 1 – Leeds Congestion Hotspot Junctions (2011-12)

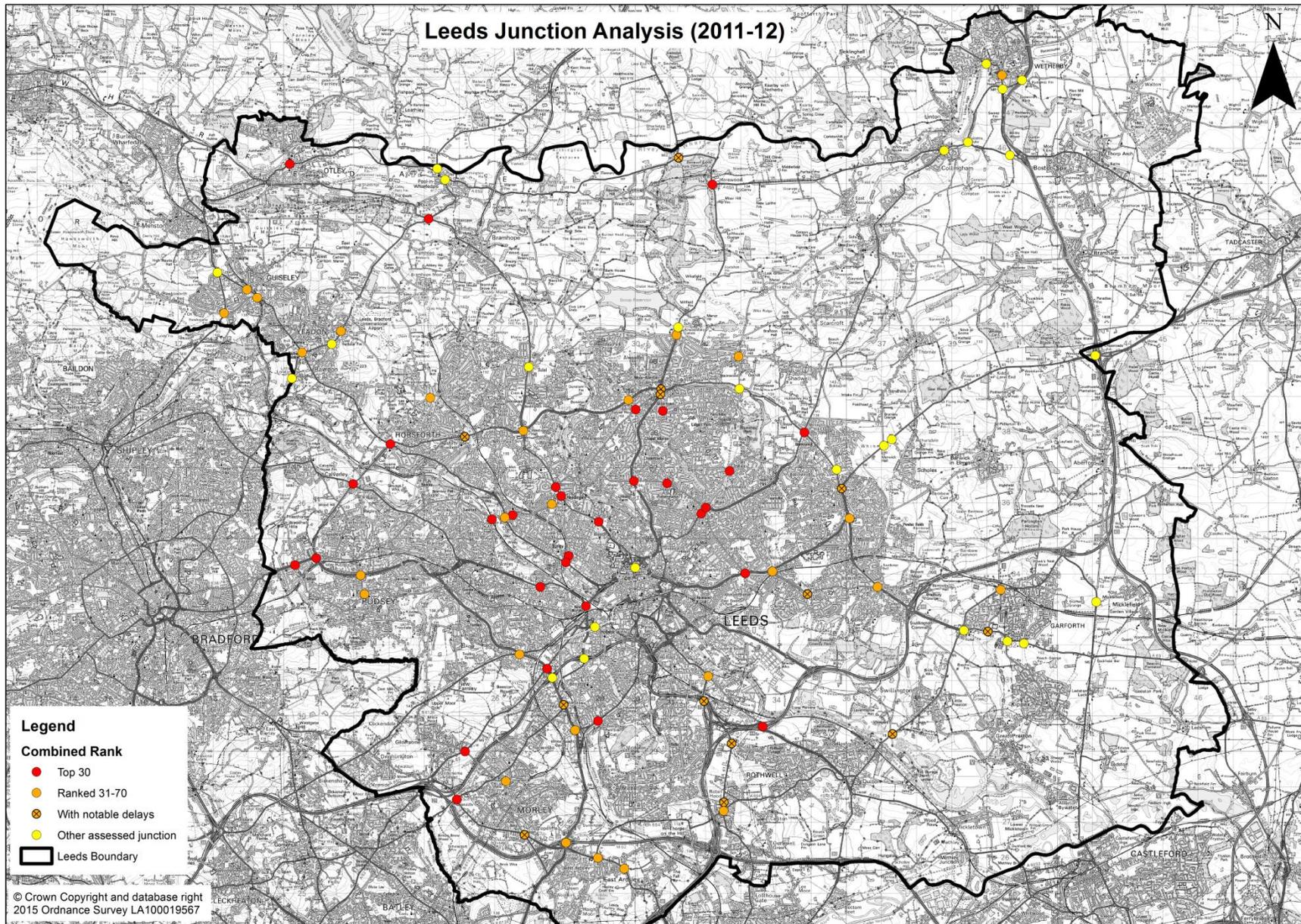


Table 3 – Interventions and Constraints (Sites 1-25)

Combined rank	Junction	Description	Schemes
1	A6120 / A657 Rodley La	Roundabout. Unconstrained site	Pinch Point signalisation (open 2015)
2	A647 / Ledgard Way	Signalled junction. Very constrained site	Leeds-Bd Corridor (WYPTF)
3	A660 / B6157 North La	Signalled junction. Severely constrained site	Traffic management with NGT gating
4	Armley Gytratory	Signalled gytratory. Very constrained site	City Centre Package (WYPTF)
5	A6110 / A62 Gelderd Rd, Wheatsheaf	Signalled junction. Very constrained site.	A6110 (WYPTF)
6	Burley Rd / Cardigan Rd	Signalled junction. OB bus lane. Very constrained site	
7	A6120 / A65 Rawdon Rd, Horsforth	Roundabout. Very constrained site	Signalisation (open 2015)
8	A58 / Harehills Rd	Signalled junction. OB bus lane. Severely constrained site	
9	A660 / B6157 Shaw La	Signalled junction. IB bus lane. Very constrained site	NGT (open 2020)
10	Wetherby Rd / Princes Ave, Oakwood	Signalled junction. Very constrained site	
11	A660 / Hyde Park Rd	Signalled junction. OB bus lane. Severely constrained site	NGT (open 2020)
12	B6157 Leeds & Bradford Rd / Wyther La	Signalled junction. Very constrained site	Small impt linked to a devt
13	A659 / B6451 Clapgate, Otley	Signalled junction. Severely constrained site	Otley Relief Rd
14	A58 / B6159 Harehills La, Fforde Green	Signalled junction. IB HOV Lane. Very constrained site	
15	A650 / A643 Bruntcliffe La, Morley	Signalled junction. Constrained site	MOVA
16	A6120 / A58 Wetherby Rd	Roundabout. Unconstrained site	ELOR (WYPTF)
17	A61 / B6159 Potternewton La	Roundabout. IB/OB guideways. Constrained site	
18	B6157 Kirkstall La / Morris La	Signalled junction. Constrained site	Scheme linked to adjacent development
19	M1 (J44) / A639 Leeds Rd, Rothwell	Roundabout. Unconstrained site	HE Pinch Point signalisation (open 2015)
20	A6120 / A647, Dawsons Corner	Signalled gytratory. Constrained site	
21	Harrogate Rd / B6159 Harehills La	Signalled junction. Very constrained site	
22	A653 / Ring Rd Beeston Park	Signalled junction. Very constrained site. Improved 2011	
23	A647 / B6154 Galloway La	Roundabout. Very constrained site.	Pinch Point signalisation (open 2015)
24	A64 / B6159 Harehills La	Signalled junction. IB bus la & OB guideway. Very constrained site	
25	B6157 Stonegate Rd / King La	Roundabout. Constrained site.	ELOR/ORR improvement (WYPTF)

Table 4 – Interventions and Constraints (Sites 26-50)

Combined rank	Junction	Description	Schemes
26	A65 / Willow Rd	Signalled junction. OB bus lane. Very constrained site. QBC 2012	
27	A61 / A659 (E), Harewood	Signalled junction. Very constrained site	
28	A62 / B6126 Asquith Ave, Gildersome	Signalled junction. Constrained site	
29	A660 / A658, Dyneley Arms	Signalled junction. Unconstrained site	Feasibility study ongoing
30	Harrogate Rd / Street La	Signalled junction. Very constrained site	MOVA scheme?
31	A658 / Bayton La, Yeadon	Signalled junction. Constrained site	LBIA Link Rd (WYPTF)
32	A61 / Alwoodley La	Signalled junction. Very constrained site	
33	A647 / Richardshaw La, Pudsey	Signalled junction. Very constrained site.	
34	A6120 / B6159 Selby Rd, Colton	Roundabout. Constrained site.	ELOR (WYPTF)
35	B6155 Lidget Hill / B6154 Church La, Pudsey	Signalled junction. Severely constrained site	
36	Station Rd / Long Row, Horsforth	Roundabout. Very constrained site	
37	A63 / B6137 Lidgett La, Garforth	Signalled junction. Very constrained site	Possible bypass linked to housing site
38	A650 / Common La, East Ardsley	Signalled junction. Constrained site	
39	A61 / Sharp La, Robin Hood	Signalled junction. Constrained site	
40	A6029 / A650 / B6127 Bridge St, Morley	Signalled gyratory. Very constrained site	
41	A650 / Thorpe La, Tingley	Signalled junction. Unconstrained site	
42	A642 / B6137 Main St, Garforth	Signalled junction. Very constrained site	Minor improvement scheme
43	M621 (J7) / A61 / A639, Stourton	Roundabout. Partly signalled. Constrained site.	NGT (open 2020). SB off slip widening (HE)
44	A65 / Oxford Rd, Guiseley	Signalled junction. Severely constrained site	Addition of pedestrian phase
45	A6120 / A660 Otley Rd, Lawnswood	Roundabout. Constrained site.	NGT signalisation (open 2020)
46	A6120 / Low La, Horsforth	Roundabout. Constrained site	
47	A65 / B6153 Park Rd, Guiseley	Signalled gyratory. Very constrained site	
48	A65 / Kirkstall La	Signalled junction. OB bus lane. Very constrained site. QBC 2012	
49	A6120 / A61 Harrogate Rd, Moortown	Roundabout. Constrained site.	ELOR/ORR improvement (WYPTF)
50	A6120 / A64 York Rd	Roundabout. Constrained site.	ELOR (WYPTF)

Table 5 – Interventions and Constraints (Sites 51-70)

Combined rank	Junction	Description	Schemes
51	A61 / Wood La, Rothwell	Signalled junction. Unconstrained site	OB bus lane
52	M62 (J28) / A653 / A650, Tingley	Signalled gyratory. Constrained site	HE scheme
53	A6120 / King La	Roundabout. Part signals. Constrained site.	ELOR/ORR improvement (WYPTF)
54	A6120 / A64 Barwick Rd	Roundabout Constrained site.	ELOR (WYPTF)
55	Shadwell La / Wike Ridge La, Shadwell	Signalled junction. Very constrained site	
56	A61 / A659 (W), Harewood	Priority junction. Unconstrained site	
57	B6159 / Primrose La, Halton	Signalled junction. OB bus lane. Very constrained site	
58	A65 / A658 Green La, Rawdon	Roundabout. Constrained site.	
59	A6110 / A58 Whitehall Rd, Ringways	Roundabout. Constrained site	A6110 (WYPTF)
60	B6126 Brunswick St / B6127 Chapel Hill, Morley	Signalled junction. Severely constrained site	
61	A6110 / Millshaw Rd / White Rose (N)	Roundabout. Constrained site.	
62	B6157 North La / Cardigan Rd	Signalled junction. Severely constrained site	
63	A61 / Harrogate Rd	Roundabout. Very constrained site	
64	A639 / B6481 Pontefract Rd	Signalled junction. Constrained site	
65	A6110 / A643 Elland Rd (S)	Roundabout. Constrained site.	A6110 (WYPTF)
66	A64 / B6159 Selby Rd, Halton Dial	Signalled junction. IB & OB guideways. Very constrained site	
67	A6038 / B6153 Park Rd, Guiseley	Priority junction. Constrained site.	
68	A61 / A654 Leadwell La, Robin Hood	Signalled junction. Constrained site	
69	A661 / Boston Rd / High St, Wetherby	Mini roundabout. Very constrained site	
70	A642 / Bullerthorpe La, Woodlesford	Priority junction. Very constrained site	

Appendix A - Interventions and Constraints

Definitions

This appendix attempts to classify congestion hotspots based on how constrained they may be by their location in terms of potential for unlocking capacity through widening, enlarging or relocating the junction. By nature, these definitions are subjective, but the following give an indication of the criteria considered.

Unconstrained:-

- There appears to be undeveloped land available (whether highway or otherwise) on most or all approaches to allow additional lanes to be added or the junction repositioned or enlarged.

Constrained:-

- There is retail or civic activity around the junction, high pedestrian flows and/or loading requirements, which could affect the potential for improvement.
- There is non-highway land adjacent to the junction and approaches which could be utilised, but the effect of the land take on the property is likely to be undesirable, e.g. removes car parking, landscape buffers etc.

Very constrained:

- There are buildings or engineering/ environmental constraints which make it quite uncertain whether an improvement is deliverable. Land take will be required.
- The junction has buildings in proximity to the junction or approaches, but they are set back and/or appear to be of lower intrinsic value to the function and quality of the local area, and hence there could be a medium to term long prospect of redevelopment (leading to a potential improvement line).

Severely constrained:

- The junction is surrounded by buildings which are an integral part of the character or function of the area and which presently seem very unlikely to be demolished.
- The junction is in very close proximity to one or more structures or topographical features, such as railway lines, rivers or environmental features which would appear to prevent substantial modification to the junction.

Junction Assessment

1) A6120 / A657 Rodley Lane (roundabout)

Unconstrained. Although there is development to the south and east of the junction, there is enough room to realign Rodley Lane (west arm) and the Ring Road (north) arm to provide a 'staggered' junction arrangement.

2) A647 / Ledgard Way (signalled junction)

Very constrained. The north and east arms have some prospect for widening, although the latter would have a greater impact and may ultimately not be deliverable without demolition. The south arm is tightly constrained between property whilst the west arm has softer constraints (bowls club lawn and off-street car parking). There are pedestrian facilities, and pedestrian demand, which will constrain improvements.

3) A660 / B6157 North Lane (signalled junction)

Severely constrained. At the heart of the thriving Headingley Centre, with very high pedestrian footfalls and buildings at or close to the back of footway. Ideally footways would be wider, and better cycle facilities provided, meaning that there is already significant pressure on accommodating non-motorised users in the event that more space did become available.

4) Armley Gyrotory (signalled gyrotory)

Very constrained. Presence of railway viaducts to the north and southeast, and major gas plant within the gyrotory mean that this otherwise large site has design limitations. The relocation of gas facilities would however help release opportunities. There is also some open space to the west, but the junction with the B6154 could constrain if this can be effectively used. The B6154 alignment, status etc could be reviewed.

5) A6110 / A62 Gelderd Road, Wheatsheaf (signalled junction)

Very constrained. There is some heavy electrical plant (substation?) to the southwest, which limits potential improvement lines to the adjacent M621 junction. New buildings to the east, including car showrooms on the northeast corner, limit the amount of widening which can be provided. To the west of the junction are low density industrial buildings with a degree of set back from the highway, which could offer some junction improvement potential. The proximity of the M621 junction 1 is an operational constraint which further constrains workable schemes.

6) Burley Road / Cardigan Road (signalled junction)

Very constrained. Although there is open space to the southeast, the railway bridge to the west and residential properties fronting the north arm effectively limit any potential improvement as they result in single lane approaches and exits on the west and north arms. Significant demolition or detrimental acquisition of private land would be required on the north arm. The small property on the southwest corner could potentially provide some scope for capacity improvements.

7) A6120 / A65 Rawdon Road, Horsforth (roundabout)

Very constrained. Although there is open space to the west, the skewed geometry of the approach roads and the location of housing and a petrol filling station on the A65 south arm limits the scope for enhancement.

8) A58 / Harehills Road (signalled junction)

Severely constrained. At the heart of a busy local centre with high pedestrian flows, demand for loading and retail premises on all corners of the junction. The only prospect for widening appears to be land take of private forecourts on the northwest side of the A58, but this will have impacts on the amenity of the area and on the properties concerned. All other locations are severely constrained by properties at or close to the highway boundary.

9) A660 / B6157 Shaw Lane (signalled junction)

Very constrained. High pedestrian and cycle flows. The NGT scheme is planning a capacity improvement to the junction through minor localised widening to accommodate pedestrian crossing islands on the side roads. A more substantial scheme would impact on the existing service access road for the shops on the northwest side, remove mature trees which are a key part of the streetscape, acquire front garden and could require demolition of retail property.

10) Wetherby Road / Princes Avenue, Oakwood (signalled junction)

Very constrained. Although, in theory, there is scope for widening on the northwestern (Princes Avenue) and northeastern (Wetherby Road) approaches, the impact on mature trees and good quality open space is likely to make any improvement line challenging to justify and difficult to deliver. The bustling local centre on Roundhay Road has high pedestrian demands, kerbside parking and loading and street activity and would make any further carriageway widening improbable, especially given that there are already three lanes at the stop line and the Gledhow Lane junction interferes with eastbound flow on Roundhay Road. Oakwood Lane is very constrained, with side turnings and premises on each side of the road.

11) A660 / Hyde Park Road (signalled junction)

Severely constrained. The junction is surrounded on three corners by retail premises, with generally narrow footways and moderately high pedestrian demands. Given the high cycle flows and lack of cycle lanes through the junction, it is already considered to be sub-optimal. The junction of Victoria Road to the northwest can impact on traffic progression through the junction. The NGT scheme is proposing to improve the junction by banning turns and accommodating these using the adjacent junctions. This scheme should release capacity and enable a shorter cycle time and it also signalises Victoria Road. Any further enhancement for capacity does not seem likely.

12) B6157 Leeds & Bradford Road / Wyther Lane (signalled junction)

Very constrained. The junction is on a bridge straddling twin track railway lines and the River Aire which effectively prevents any widening on all three approaches. Wyther Lane is restricted to one lane each way unless some land is acquired and property demolished from the premises to the east of the Wyther Lane / Broad Lane junction. East of the River Aire there is scope to widen to the south side but this will impact on a tree belt between the road and playing fields. In the long term, capacity

improvement is not out of the question, but there are significant obstacles requiring a significant investment.

13) A659 / B6451 Clapgate, Otley (signalled junction)

Severely constrained. The junction is surrounded by retail premises in the heart of Otley, with high pedestrian flows and narrow footways. Clapgate itself also has near right-angle bends in it, reducing the effective ability of the road to deliver higher flows through a signal junction. There is no scope for further capacity enhancement through road widening.

14) A58 / B6159 Harehills Lane, Fforde Green (signalled junction)

Very constrained. Adjacent to A58 / Harehills Road (number 8 above), this junction also has retail premises on all four corners of the junction. Some widening may be possible through the acquisition of private forecourts. Some widening on Harehills Lane (south) could be possible through land acquisition, but this will affect off-street parking for businesses and is not an easy option.

15) A650 / A643 Bruntcliffe Lane, Morley (signalled junction)

Constrained. The three houses on the northwest corner could present a significant obstacle to enlarging the junction, but on each arm there appears to be some scope for widening either within the highway or by taking private land (typically car parking), but with no further demolition. There may be an opportunity to protect an improvement line at this junction.

16) A6120 / A58 Wetherby Road (roundabout)

Unconstrained. Although there is no room to widen on the A58 (North) arm without acquiring private gardens, with an impact on trees, there is scope to realign the whole junction southwestwards, and scope to widen and realign the other three approaches.

17) A61 / B6159 Potternewton Lane (roundabout)

Constrained. Potternewton Lane to the west cannot be widened without acquiring gardens. Widening on Scott Hall Road (north arm) may require removal of the guided busway and an impact on mature trees lining the street. To the east and south there is scope for widening into the open space.

18) B6157 Kirkstall Lane / Morris Lane (signalled junction)

Constrained. Widening opportunities exist on the eastern side of Morris Lane at and south of the junction and on the southern side of Kirkstall Lane west of the junction, through land acquisition. However, widening opportunities are limited on the other two arms – the eastern arm possibly allowing a short flare although the impact on the houses north of the road could be too significant. These limitations mean that it appears unlikely, upon initial inspection, that a step-change improvement in capacity could be realised without acquiring property, unless pedestrian crossing islands can be accommodated to replace the 'all-red' stage with walk-with-traffic.

19) M1 (J44) / A639 Leeds Rd, Rothwell (roundabout)

Unconstrained. Although the Motorway and overbridge are a constraint, there appears to be enough open land around the junction to the north and south to facilitate capacity improvements over and above the Pinch Point signalisation scheme recently implemented by the Highways Agency.

20) A6120 / A647, Dawsons Corner (signalled roundabout)

Constrained. There is open space to the southwest – where the dominant flow movements are – and some scope for acquiring land each side of the Ring Road. However, to the south there is the Bradford railway line which restricts widening on the northbound approach, plus property on the northwest and southeast corner.

21) Harrogate Road / B6159 Harehills Lane (signalled junction)

Very constrained. Although there are few properties hard up against the footway, the prospect for widening is limited as the buildings are in relatively close proximity to the highway on all arms except for Harehills Lane, and the impact of land take on the settings of the properties would appear to be significant. The junction operation is likely to be constrained by the adjacent junctions, meaning that the likelihood of significant operational gains is low.

22) A653 / Ring Road Beeston Park “Tommy Wass” (signalled junction)

Very constrained. The junction was upgraded in 2011. Opportunities for further capacity enhancements appear limited given the location of the Tommy Wass public house right on the corner and requirement for private forecourts and gardens to achieve any improvement line.

23) A647 / B6154 Galloway Lane “Thornbury Barracks” (roundabout)

Very constrained. Signalisation scheme on site. Housing on three sides, front gardens would be required for any widening on the approaches or enlargement of the roundabout. An improvement scheme would be more likely with redevelopment of the Barracks site fronting the roundabout.

24) A64 / B6159 Harehills Lane (signalled junction)

Very constrained. The junction already has banned turns and additional lanes on the approaches, and further improvement looks difficult to accommodate because of buildings on the southeast side of the junction. There is already a two-lane left turn out of Harehills Lane.

25) B6157 Stonegate Road / King Lane (roundabout)

Constrained. The King Lane (north) approach has scope for significant widening, but the junction configuration to the south and east constrains options, as it is effectively a 5 arm junction. Residential and church properties and mature trees surround the junction, meaning that, environmentally, the footprint of any junction improvement scheme is likely to be restricted.

26) A65 / Willow Road (signalled junction)

Very constrained. Although there is some open space to the north/east of the junction, effective alignments are constrained by the Harrogate Line viaduct across the A65 immediately to the west and properties had up against the sides of Viaduct Road to the south. The latter constraints could in the medium to long term be overcome if redevelopment takes place.

27) A61 / A659 (E), Harewood (Signalled junction)

Very constrained. The junction is surrounded by the old boundary walls to Harewood House and high quality residential boundaries of mature hedges and trees, at the current main entrance to Harewood House. Land take from gardens would be required to enhance the junction and it does not appear to be possible without a significant detrimental effect on the locality and residents.

28) A62 / B6126 Asquith Avenue, Gildersome (signalled junction)

Constrained. There is undeveloped land or commercial car parking which could be utilised to widen three of the four approaches, whilst the fourth approach (Branch End) is restricted particularly by a few terraced properties on the southwestern side.

29) A660 / A658, "Dyneley Arms" (signalled junctions)

Unconstrained. There is open space to the east and south which could be used to realign the A658, if widening is unacceptable on the A660 west arm south of the Dyneley Arms, because of the mature trees present.

30) Harrogate Road / Street Lane (signalled junction)

Very constrained. The junction is surrounded by retail and residential property, with reasonably high pedestrian flows and servicing requirements. In theory some widening of the approaches could be possible with land take from forecourts and front gardens, but in practice this seems unlikely to be tenable.

31) A658 / Bayton Lane, Yeadon (signalled junction)

Constrained. The A658 south arm is constrained away from the junction by property on each side of the road, although widening at the junction entry may be practical (with private land take). On the remaining three arms, some road widening may be possible using private land (car parking, front gardens) with an impact on a row of mature trees on the A658 (north) arm.

32) A61 / Alwoodley Lane (signalled junction)

Very constrained. The A61(N) arm is flanked closely by property which makes any widening impossible without significant acquisition and demolition. The remaining arms can only be widened by encroaching into private gardens, with a significant impact on established boundaries including hedges and mature trees. The eastern arm looks tight for space which is also likely to impact on potential improvement schemes.

33) A647 / Richardshaw Lane, Pudsey (signalled junction)

Very constrained. The junction is already grade separated. Properties on the south and north side of the junction, coupled with the width of the A647 overbridge, mean that the scope for improvement is limited.

34) A6120 / B6159 Selby Rd, Colton (roundabout)

Constrained. Although there is scope to widen both arms of the A6120 without property demolition, the two minor arms of B6159 Selby Road and Colton Lane – coupled with the property on the western corner – make significant capacity increases challenging (though not impossible). Widening of the eastern arm of the A6120 is likely to impact on mature trees in the bank of trees on the south side. It may be possible to reduce capacity of the minor arms and give it to the major arms (the B6159 was the A63 but has not been provided for by the East Leeds Link Road).

35) B6155 Lidget Hill / B6154 Church Lane, Pudsey (signalled junction)

Severely constrained. Significant property surrounds the junction, close to the trafficked highway, on three corners, restricting any potential improvement to redevelopment of the western corner and the potential to realign the highway to create a staggered junction. It is in the middle of a retail area with moderately high footfall.

36) Station Road / Long Row, Horsforth (roundabout)

Very constrained. A five arm roundabout in a suburban area with retail activity. Enlargement of the roundabout is restricted by adjacent buildings. The most likely opportunity for enhancing capacity could come from closing the two minor arms (St Margaret's Road and Brownberrie Avenue) and possibly signalling it.

37) A63 / B6137 Lidgett Lane, Garforth (signalled junction)

Very constrained. There appears to be some scope for widening the A63 on the public highway, but the presence of property right on the northeast corner and south side opposite it effectively make it unlikely without acquiring residential property.

38) A650 / Common Lane, East Ardsley (signalled junction)

Constrained. On the A650, there is scope for widening on both approaches, whilst on the western minor arm there is scope for a slight realignment and widening at the mouth to accommodate a pedestrian crossing island, using green space. However, the Country Baskets mill building and housing mean that there is no prospect of any widening or realignment on the northern minor arm. There are retail premises to the south with off-street parking and road widening could impact on these, making a substantial improvement scheme challenging.

39) A61 / Sharp Lane, Robin Hood (signalled junction)

Constrained. It appears possible to widen on all approaches without property demolition, although to do so will require land outside the highway boundary and (depending on the design) could affect mature trees, the edge of some allotments and on-street parking. There is a war memorial on the southwest corner which will need to be considered and it is too early to say whether this would be adversely affected.

40) A6029 / A650 / B6127 Bridge Street, Morley (signalled gyratory)

Very constrained. Surrounded by property on all sides, although some of the buildings are set back. There is a potential improvement line if the property to the north of the A650 is redeveloped, notably to get a better two lane approach on the B6127 (north) arm.

41) A650 / Thorpe Lane, Tingley (signalled junction)

Unconstrained. Although there is housing on the south side, the north side is open fields, with scope for enlarging the junction. The staggered side road Smithy Lane could also possibly be widened through land acquisition from the adjacent Primary School.

42) A642 / B6137 Main St, Garforth (signalled junction)

Very constrained. There is an opportunity to realign the A642 west of the junction and Barrowby Lane (north arm) to create a staggered junction, which could release capacity. However, the B6137 Main Street is tightly constrained between buildings, as is the eastern arm of the A642. These latter constraints will constrain the overall benefit of a significant junction improvement.

43) M621 (J7) / A61 / A639, Stourton (part-signalised roundabout-style junction)

Constrained. Although there is open space around most of the roundabout, there are constraints created by the adjacent railway, the freight terminal access location and the retaining wall on the northbound on-slip. In addition, the M621 overbridges themselves create a constraint which would be very expensive to replace or modify. The NGT scheme is proposing amendments to the junction which will accommodate extra traffic.

44) A65 / Oxford Road, Guiseley (signalled junction)

Severely constrained. There are properties close to the road on all corners of the junction in this local centre. Upon initial inspection there appears to be no realistic prospect for any enlargement of the junction.

45) A6120 / A660 Otley Road, Lawnswood (roundabout)

Constrained. The NGT scheme is proposing to upgrade the junction by signalising it and amending the geometry. Any further enlargement of the junction is constrained on the northwest former by housing, but enlargement on the remaining corners may be possible with land take, noting impact on mature trees and school grounds.

46) A6120 / Low Lane, Horsforth (roundabout)

Constrained. The junction is loosely surrounded by development, but the A6120 can be widened on its approaches. A larger roundabout may be unrealistic without property acquisition and demolition, but a signalled junction may be practical with land take on the east sides of both minor arms.

47) A65 / B6153 Park Rd, Guiseley (signalled gyratory)

Very constrained. Skew railway line passes underneath the junction and there are properties around the junction which constrain potential improvement lines.

48) A65 / Kirkstall Lane (signalled junction)

Very constrained. Property is very close or abuts three approaches to the junction, whilst the fourth (eastern) arm is on a gradient. The operation is restricted by the adjacent signals gaining access to Morrisons.

49) A6120 / A61 Harrogate Rd, Moortown (roundabout)

Constrained. There is a churchyard on the northeastern corner and the Scott Hall Road / Harrogate Road junction is in close proximity. There are significant banks of mature trees and retail premises on the south arm close to the highway. There is scope for some highway widening.

50) A6120 / A64 York Rd (roundabout)

Constrained. The York Road / North Parkway is close, and the two junctions' interaction will constrain capacity improvements. There are properties around the junction, although set back, meaning that improvement could be possible. The ELOR scheme will remove traffic from the junction.

51) A61 / Wood Lane, Rothwell (signalled junction)

Unconstrained. There are open fields to the west and south of the junction, meaning realignment and widening of both the A61 and Wood Lane is possible.

52) M62 (J28) / A653 / A650, Tingley (signalled gyratory)

Constrained. Housing and development to the south of the junction constrains any widening or realignment of the A653 and A650 approaches and to some extent the A650 also. Any scheme which affects the motorway overbridges will also jeopardise feasibility.

53) A6120 / King Lane (roundabout, part-signalled)

Constrained. Housing and development to the south and west, places side road accesses, places some constraints on any improvement scheme, although there is some open space to the north/east.

54) A6120 / A64 Barwick Road (roundabout)

Constrained. Although there is open space which could be used for a widening scheme, the housing and other development on Barwick Road and immediately south/east of the junction constrains potential alignment improvements. The ELOR scheme will remove traffic from this junction.

55) Shadwell Lane / Wike Ridge Lane, Shadwell (signalled junction)

Very constrained. Surrounded by housing and some retail, any enhancement to this junction looks like it would have a significant effect on surrounding property.

56) A61 / A659 (W), Harewood (priority junction)

Unconstrained. Although there is a house immediately south of the junction, the remainder of the frontage is open farmland and there is scope for realignment and widening. There is a potential issue with the alignment of the A61, which is 'bendy' here, which could increase scheme costs and impacts.

57) B6159 / Primrose Lane, Halton (signalled junction)

Very constrained. There is development on all corners of the junction which prohibits a whole-scale upgrade, although some widening may be possible without building demolition through use of Lidl car parking and private land. The Selby Road east arm, however, can only be widened a short way because of the retail centre / buildings.

58) A65 / A658 Green Lane, Rawdon (roundabout)

Constrained. There is scope for widening and/or reconfiguring the junction, the main constraint seems to be a church building on the eastern corner. Land take would likely be required.

59) A6110 / A58 Whitehall Road, Ringways (roundabout)

Constrained. There is very little scope for widening without land take, but there are opportunities to enhance the junction through using car parking and other land around the junction.

60) B6126 Brunswick St / B6127 Chapel Hill, Morley (signalled junction)

Severely constrained. The junction is surrounded by buildings against the back of footway and the highway alignment and topography further make future (long term) prospects very limited.

61) A6110 / Millshaw Rd / White Rose (N) (roundabout)

Constrained. This five arm roundabout is constrained by houses to the east, topography and (to a lesser extent) office development to the west.

62) B6157 North Lane / Cardigan Road (signalled junction)

Severely constrained. On the edge of the Headingley retail area and adjacent to Headingley Stadium, this junction is surrounded by property close to the back of footway and there would appear to be no prospect of any increase in highway footprint.

63) A61 / Harrogate Road (roundabout)

Very constrained. The junction is surrounded by houses and is in close proximity to the A6120 / A61 junction, with retail businesses between the two junction. Whilst there may be some options to explore, the scope for junction enlargement or road widening is limited.

64) A639 / B6481 Pontefract Road (signalled junction)

Constrained. There could be some opportunities for acquiring adjacent land to enlarge the junction, with no demolition.

65) A6110 / A643 Elland Road (S) (roundabout)

Constrained. Although there is scope for widening and enlarging the junction, the alignment of the A643 is at a skew angle which will limit widening options.

66) A64 / B6159 Selby Road, "Halton Dial" (signalled junction)

Very constrained. The railway line and bridge immediately to the south is already a restriction on junction performance and operation, whilst the busier western arm of the A64 is flanked by housing,

where some loss of bus lane or on-street parking would be required to facilitate any more traffic lanes.

67) A6038 / B6153 Park Road, Guiseley (priority junction)

Constrained. There is farmland to the south/southwest which could be used to turn the crossroads into a staggered junction to increase capacity. The width of the eastern (minor) and northern (major) arms look difficult to widen without impact on mature trees and private land.

68) A61 / A654 Leadwell Lane, Robin Hood (signalled junction)

Constrained. The Old Halfway House is right on the eastern corner of the junction. The western arm has property close to both sides. The northern arm could possibly be widened within the highway boundary, but widening of the southern arm will have an impact on adjacent properties (though without needing demolition).

69) A661 / Boston Rd / High St, Wetherby (mini-roundabout)

Very constrained. Immediately adjacent to the River Wharfe bridge, this four arm mini-roundabout is within Wetherby's busy retail area and near areas of high pedestrian flow. Although there is only property on one side immediately next to the back o footway, the location of property in the vicinity (plus the river) restricts any potential for enlargement of the junction.

70) A642 / Bullerthorpe Lane, Woodlesford

Very constrained. The location of property around the junction and its placement next to the bridge over the River Aire means that the site is very constrained and forming multiple lanes on the A642 seems undeliverable. An extra lane on the minor arm could be achievable subject to visibility issues.