Very Light Rail Network

Strategic Outline Case

Prepared for Stoke-On-Trent City Council

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7	03	Revision	XM	KJ	KJ
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Executive Summary

Introduction & Scheme Overview

The City of Stoke-on-Trent Council, through recent planning (Local Plan development) and transport funding applications (Transforming Cities, Active Travel) has identified the need for transport improvements over a ten-year horizon which are affordable, deliverable, and should support economic growth, residents' mobility, wellbeing, and the environment. This could be achieved by a rapid transit network that would better connect key areas of Stoke-on-Trent. Previous studies have considered rapid transit schemes in the city, culminating in the proposed Streetcar Bus Rapid Transit (BRT) proposals for which development was suspended in 2010, when DfT announced no further funding bids from local authorities were welcomed. Since then, new modes and technologies have been developed which have the potential for a strong case for investment in Stoke-on-Trent. Very Light Rail (VLR) is one of these emerging technologies.

VLR is a public transport system that can be designed and delivered rapidly and at a lower cost than traditional rail or light rail (tram) options. Routes can be designed to utilise existing road and rail infrastructure allowing much more flexibility than traditional railway networks. VLR schemes are also designed to have low or zero CO2 emissions. The largest cost savings of a VLR network compared to a typical tram system stem from their lightweight nature not requiring the need to move existing utilities, as track can be laid on a pre-cast base on the surface of the carriageway. This means that VLR capital costs could be 30 to 50% cheaper than a tram system. Conversely capacities are limited to less than 60 persons per vehicle compared to a typical tram which carries 250 passengers. This limitation could be overcome either through higher frequency services or use of new technologies where two vehicles could move together.

VLR has currently only been implemented in Qatar however Coventry have received funding through the City Regional Sustainable Transport Settlements to further develop their proposals. Plans for the first route in Coventry are under development and will connect major employment and education sites with the city centre and integrate with the bus and railway stations. Coventry City Council are working with the VLR Centre in Dudley for testing the integrated system. The Centre will allow testing and development of Coventry VLR vehicles in the West Midlands including a test track and workshop to support research and development.

This Strategic Outline Case (SOC) aims to assess and appraise the potential for a VLR network to serve the city, based on the Coventry example, focusing on the Strategic and Economic cases, with a light-touch Commercial, Management and Financial case.

Stoke-on-Trent is polycentric, with a chain of six towns - City Centre (Hanley), Stoke, Tunstall, Burslem, Fenton and Longton - lacking connectivity and accessibility. The proposed scheme location is shown in Figure 1.1.

As identified in the Transport Strategy & Delivery Plan (2022), the VLR network will connect and serve the City Centre, the Inner Urban Core, and the Outer Urban Core (see Appendix A, Figure A.1). The route of the VLR will be planned to provide a comprehensive service, connecting residential areas with key destinations such as employment and retail centres. The VLR network will also connect to key transport hubs such as railway and bus stations to create opportunities for interchange and to enhance the existing network and travel options improving the overall resilience of the Stoke-on-Trent public transport network.

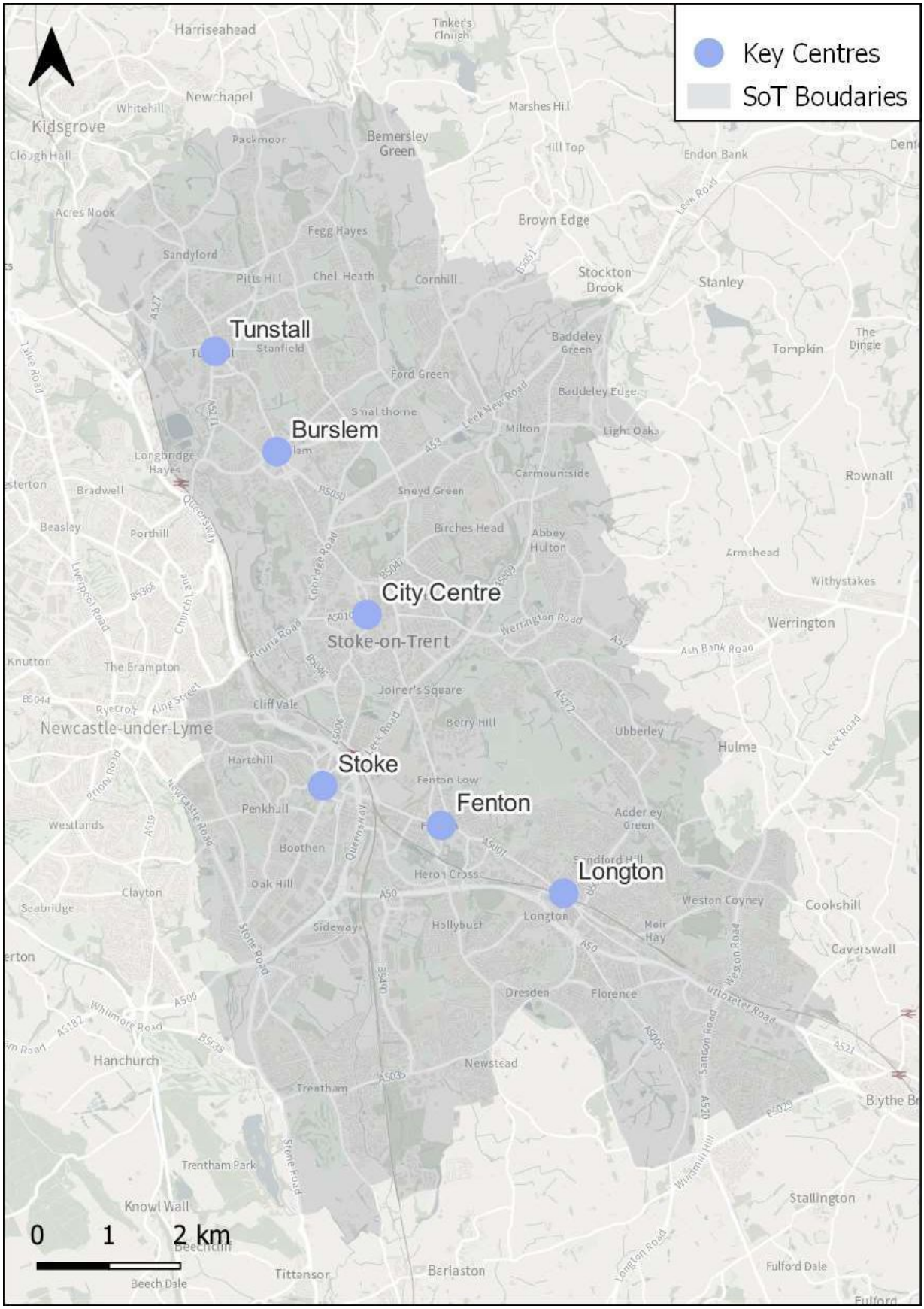


Figure 1.1 Proposed Scheme Location

Multi-criteria analysis has been undertaken on a long list of VLR route options to sift down to a short list of VLR route options. Transport modelling, economic and environmental appraisal has been carried out on the shortlisted options. The long list and short-listed options are illustrated in Figures 1.2 and 1.3.

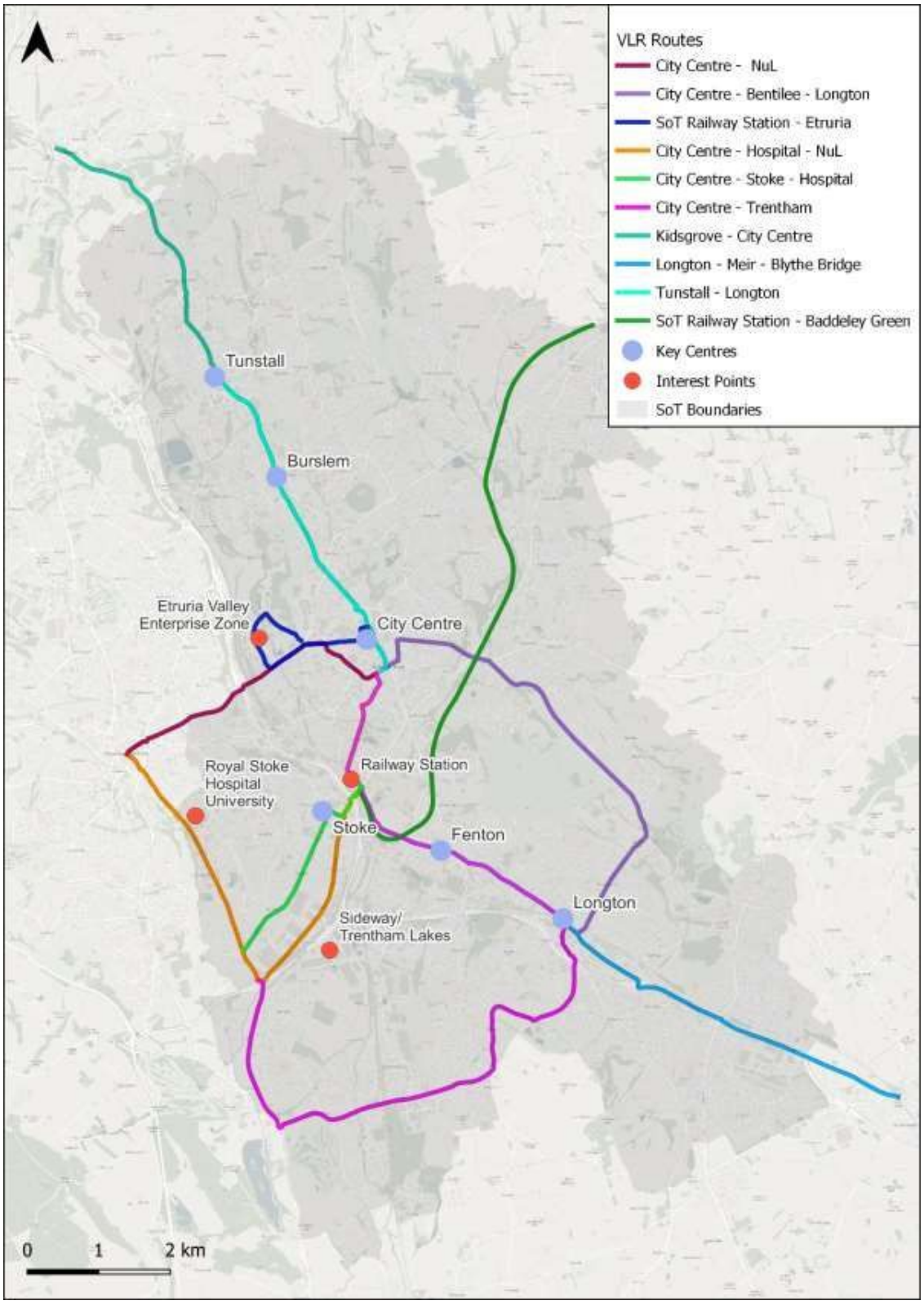


Figure 1.2 Proposed VLR Routes (long list)

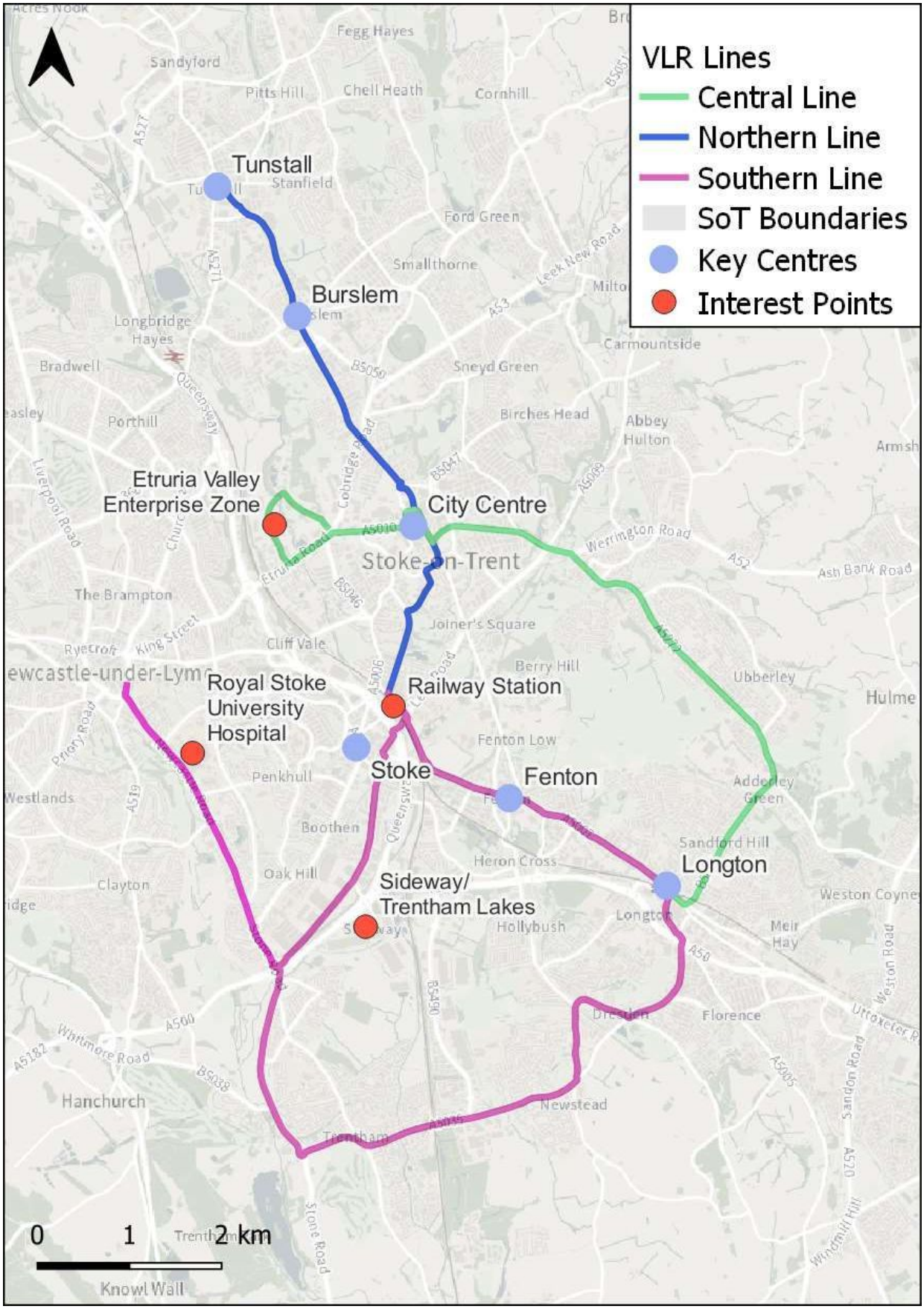


Figure 1.3 VLR Routes after assessment (short list)

An initial sifting assessment has been undertaken to derive a short list of VLR routes from a longer list of options (Figure 1.2) and to assess the feasibility of each option based on the City's topography in comparison with the bus network, the socioeconomic information, population, and employment density, predicted future demand and consideration of large trip generators/attractors. Several potential VLR corridors have been identified across the city. Indicative routes have been identified by using travel data – including the North Staffordshire Multi-Modal transport model – and compared against other routes in terms of costs and income. Where possible, this was aligned with the work being undertaken concurrently on Multi-Modal Hubs, Park & Ride and Bus Partnership proposals (see the Multi-Modal Hubs SOC, Net Zero bus fleet proposal). It is important that any future VLR network should complement the bus network rather than compete with it. This could be overcome through a bus franchise agreement.

This sifting has resulted with the short list of VLR route options, shown in Figure 1.3, which centre on the Northern, Central and Southern lines across the city. This network and the individual routes are assessed in more detail, including more detailed demand forecasting of both VLR usage, modal shift from the car and bus patronage abstraction, as well as a high-level appraisal including quantifiable and non-quantifiable benefits and costs. Using knowledge of the latest technological developments relating to very light rail, the costs of building and operating an initial line in the city will be established.

The three routes that provide good coverage across Stoke-on-Trent were selected based on a range of criteria including topographical constraints, how they connect the main centres and parts of the city not served by the local rail network. The modal shift analysis illustrates that the impact of the new network in certain corridors is significant, with the car mode split for trips between Tunstall and the City Centre and Trentham and Newcastle-under-Lyme town centre approximately halving in the morning peak. Last, the city council should be able to explore a phasing delivery of the VLR network. Based on the demand analysis, the Northern line appears to have the highest demand and it would be the most promising line for Phase 1 of the delivery plan.

Whilst the objective is the delivery of an affordable, rail-based mode, it is recognised that a similar uplift can be achieved through the provision of Bus Rapid Transit (BRT), like the Glider system in Belfast, utilising significant segregation from general traffic. BRT is sometimes proposed as a first step towards light rail, but it is unlikely to provide the potential for modal shift – and the significant step change in the public's perception of public transport required - that a modern rail-based system such as VLR could produce. This is because the public generally prefer the permanence and comfort of a rail-based system over a bus-based alternative.

Strategic Case

The Strategic Case sets out the case for change, underpinned by national and local evidence which presents justification for the selection of a preferred option to solve underlying problems. The evidence presented in this report outline the justification as to why a network of VLR routes will provide the desired outcomes. The Strategic Case shows how the proposed investment fits into a wider strategy for economic growth and regeneration of the city and surrounding region and demonstrates that it will further the strategic objectives of Stoke-on-Trent City Council and the SSLEP. It describes how the proposed scheme has been identified and together with the other cases explains why investment is needed now to address existing problems and capitalise on opportunities for economic growth and development.

The Strategic Case has identified the following key issues across the study area:

- Traffic congestion, resulting in queuing and delays to journeys
- Inadequate access to the dispersed employment areas
- An underperforming economy and high levels of deprivation in some areas of Stoke-on-Trent
- Poor access to opportunities from deprived areas
- Poor connectivity between the inner and outer urban areas of Stoke-on-Trent
- Bus services experiencing unreliable journey times
- Future development sites constrained by network limitations
- High levels of road accidents
- Impact of traffic on air quality
- Impact of traffic on CO2, and greenhouse gas emissions
- A two-tier society, those with and without access to a car
- Lack of resilience of the local transport network
- Changing travel patterns of the work population
- Limited planned improvements towards sustainable transport

Without interventions, traffic will continue to rise, exacerbating all the key issues outlined above (I.e. poor local air quality, public transport unreliability etc). Future modelling based on committed schemes and developments show a transport network within Stoke-on-Trent still heavily reliant on the car, with a low mode share for public transport and sustainable modes. This will result in:

- Longer journey times for cars and buses
- Connectivity and accessibility issues will remain or worsen
- Negative impact on local air quality
- A failure to address greenhouse emissions and the need to reach net zero
- Inability to support the populations movement needs including access to employment and services

The strategic case sets out a series of objectives and measures of success which have been used to determine the preferred rapid transit solutions. This process found that the VLR project will have a significant and beneficial impact on accessibility and air quality, and this will give rise to a range of benefits, helping to deliver the scheme's objectives. These benefits include:

- Reduced traffic congestion due to modal shift from car to public transport, especially to key centres and corridors within the city

- Improved access to key employment sites, especially for those without access to a car

- Journey times on key routes will be reduced
- Journey time reliability will be improved for car traffic due to modal shift to VLR
- Internal connectivity will be improved
- Access to key centres and employment zones from areas of deprivation will be improved
- Public transport users will benefit from less congestion on existing routes
- Local air quality will be improved due to modal shift away from car use including at known exceedance locations
- Greenhouse gas emissions will be reduced due to modal shift away from car use
- Light rail is known to stimulate urban development and economic activity

Economic Case

The Economic Case provides evidence of how the scheme is predicted to perform, in relation to its stated objectives, identified problems and targeted outcomes. The Economic Case determines if the proposed scheme is a viable investment, describing the common appraisal criteria and assumptions used to determine the scheme's economic worth and value for money (VfM).

The North Staffordshire Multi-Modal (NSMM) transport model has been developed in accordance with appropriate DfT guidance (i.e., TAG) and has been used to inform the design and appraisal of the VLR Project.

The following benefit streams have been considered and feed into the overall value for money assessment:

- Bus passenger journey time savings
- Public transport journey time savings
- Scheme capital costs and operational and maintenance costs

The scheme currently generates a present value benefit (PVB) of £655.33 million and a present value of costs (PVC) of £652.94 million under Scenario A and a present value of benefits (PVB) of £753.17 million and a present value of costs (PVC) of £555.97 million under Scenario B. This results in a BCR of between 1.00 and 1.35 respectively which, as per the DfT Value for Money Framework, is categorised as low value for money. However, the scheme's purpose is far greater than value for money categorisation, it is the step change in public transport offer it brings to the city coupled with the positive environmental impacts, which are of upmost importance.

At this early stage there are other monetised and non-monetised impacts which have not been appraised yet including environmental (noise, air quality and greenhouse gases), delays due to construction and social and distributional impacts. These will be included once the project develops further and more detailed information becomes available. Inclusion of the above would have significant positive impacts on the case for VLR and should be assessed as the scheme progresses through the next stage of the business case development, where more a detailed assessment is needed.

Financial Case

A high-level assessment of the VLR scheme's capital expenditure/investment cost is approximately £415m (outturn costs in 2022 prices) and this covers the whole VLR Network (i.e., all three lines – Northern, Central and Southern). This assumption is based on a £10m per km expenditure for a total network length of 40km. However, these costs will be updated as the scheme progresses and develops through the next stages of the business case development process.

Operating costs which include lifecycle asset replacement over 30 years, mobilisation costs and an overall operating and maintenance costs over 60-year are estimated to be around £3,258m. It is estimated that the operating costs will be covered through VLR fare revenue.

However, when total local public transport fare revenue (VLR + bus) is considered following the introduction of VLR, allowing for a reduction in bus fare revenue, given passenger abstraction onto the VLR, there is a funding gap between revenue and operating costs. Further work would be needed to look at options which could consider changes to the bus network through a bus franchising arrangement, additional revenue generation through advertisements on VLR vehicles and stops and potential exploration of other revenue streams such as a workplace parking levy as implemented in Nottingham, which is used to help fund the Nottingham Express Transit System.

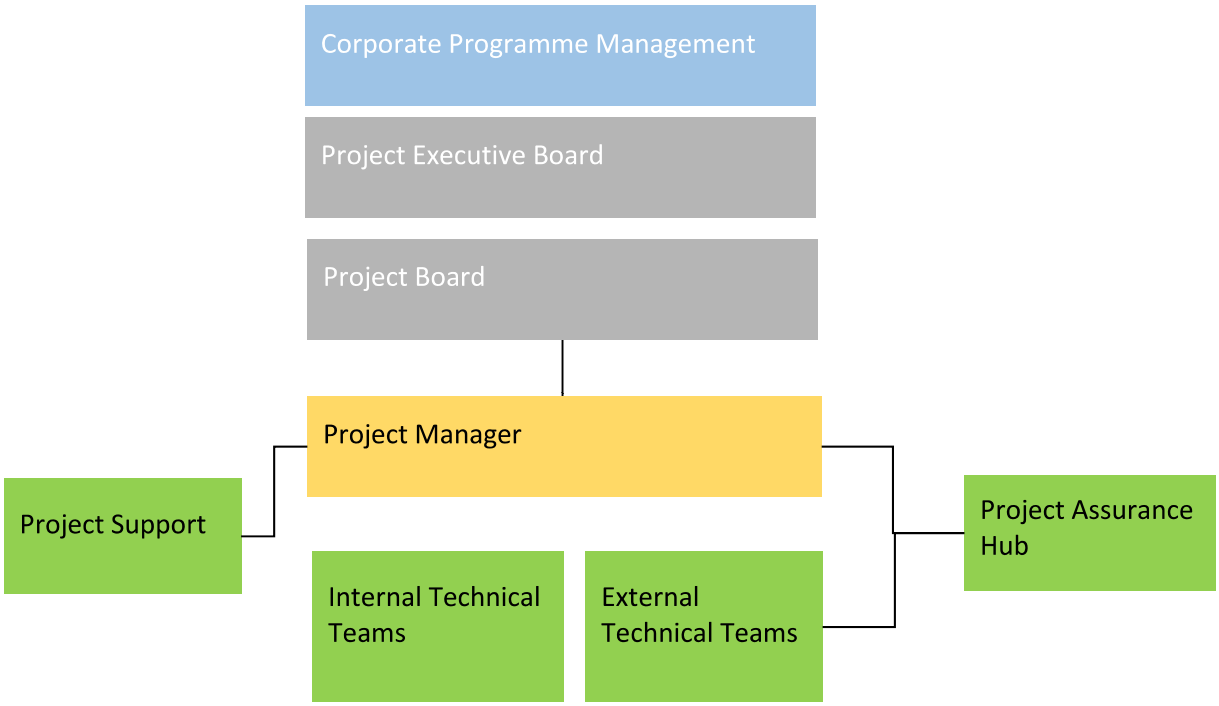
At this stage of the project, details of the funding arrangement for the scheme's investment costs is not confirmed but it is envisaged that some of the funding will be required from the DfT but this will be confirmed at the later stages of the business case development process.

Commercial Case

The Commercial Case provides evidence on the commercial viability of the proposal and the procurement strategy that will be used to engage the market. It presents evidence on risk allocation and transfer, contract timescales and implementation timescales as well as details of the capability and skills of the SoTCC team delivering the project.

Management Case

The management of the VLR Project will be with the Council's transport policy and planning team. The Project Management team will be accountable for the delivery of the VLR Project and the proposed project management structure is shown below:



1 Introduction

1.1 Background

The Very Light Rail (VLR) network development project and SOC has been undertaken alongside the Transport Strategy & Delivery Plan (2022-2031) for Stoke-on-Trent City Council (SoTCC). The delivery of such infrastructure presents great opportunities for Stoke-on-Trent to enhance accessibility to employment sites, support economic growth and capture the visitor economy. In addition, it would improve local air quality through modal shift away from the car and health by encouraging walking to and from stops, as well as interchange.

The scheme is a strategic transport project which aims to provide a comprehensive service, connecting residential areas with key destinations such as employment and retail centres. It will connect to key transport hubs such as railway, bus stations, park & ride to create opportunities for interchange and to enhance the resilience of the existing network and the offer of travel options.

The scheme will additionally address safety[1], health and environmental concerns. Stoke-on-Trent was designated as an Air Quality Management Area in 2006 for NO2 (the main source of which is vehicle emissions) and subsequently was ordered under a Ministerial Direction (2018) to submit plans to address air quality issues. Thus, the introduction of a low emission public transport network helps address this local air quality issue. In addition, it will support the Council's efforts and goal to reach net zero carbon by 2050.

This SOC demonstrates that Very-Light Rail will help to address several problems and challenges in Stoke-on-Trent regarding environmental and connectivity issues. It will provide the basis of a public transport spine for the city, permitting interchange with other modes at key locations. It will be important that the very light rail network complements the bus network rather than the two modes competing with one another to provide a resilient and reliable public transport system that serves efficiently the local and visitor population.

1.2 Report Purpose

This document therefore forms the SOC for Stoke-on-Trent's Very Light Rail (VLR) network. It sets out the key transport and environment problems, needs, objectives and options which have been considered in the development of this scheme.

The SOC identifies objectives informed by evidence, sifting a long list of potential solutions, and identifying the preferred option including the reasons why it is being progressed and show that the decision making is based on extensive and robust technical work.

1.3 Document Structure

This SOC has been developed in accordance with the Treasury Green book and the Department for Transport's (DfT) Transport Analysis Guidance (TAG), and The Transport Appraisal Process (May 2018). As per the guidance the SOC will focus on the case for change with an emphasis on the Strategic and Economic cases, developed in proportionate detail.

The structure of the SOC has been developed in accordance with the DfT's Transport Business Case Guidance and therefore sets out how the scheme will achieve the following criteria:

- Supports a robust case for change that fits with the wider policy objectives – The Strategic Case
- Demonstrates Value for Money – The Economic Case
- Is Financially Affordable – The Financial Case

[1] In the five years from 2014 to 2018 there were 359 police-reported vehicle incidents in the project area, of which 10% resulted in injuries classified as Serious or Fatal

- Is Commercially Viable – The Commercial Case; and
- Is Achievable – The Management Case

The remainder of the document is structured as follows:

Section 2 – Scheme Overview

Section 3 – Strategic Case

Section 4 – Economic Case

Section 5 – Financial case

Section 6 – Commercial case

Section 7 – Management case

Section 8 – Summary and conclusions

Appendix A – Spatial Themes

Appendix B – SWOC Summary Table

Appendix C – Initial VLR Route Sifting

Appendix D – Financial Case (Methodology)

Appendix A – Very Light Rail Accessibility Analysis

2 Scheme Overview

2.1.1 Scheme Description

Very Light Rail is a form of light rail tram system substantially cheaper than conventional light rail systems that are already in operation in a number of UK cities (Birmingham, Manchester, Sheffield, Edinburgh and Croydon). It is a low emission transport mode and a potential future solution for cities the size of Stoke-on-Trent where it is difficult to justify a light rail scheme which would cost >£40m per km to construct. A network of VLR routes, serving high demand corridors would contribute to alleviating traffic congestion by offering a high-quality alternative with reliable journey times to the private car. As per the designs being progressed by the VLR Innovation Centre in Dudley and Coventry City Council, it is proposed that the system will operate on a lightweight precast track form, with no need to divert utilities away from the alignment and served by lightweight vehicles with capacity for circa 50-60 passengers in total.

The proposed VLR network consists of three routes – Central, Northern and Southern lines. The VLR network is planned to provide a comprehensive service, connecting residential areas with key destinations such as employment and retail centres. The VLR network will also connect to key transport hubs such as railway and bus stations to create opportunities for interchange whilst enhancing transport choice within Stoke-on-Trent.

The VLR scheme, with its three routes, is presented in Figure 2.1.

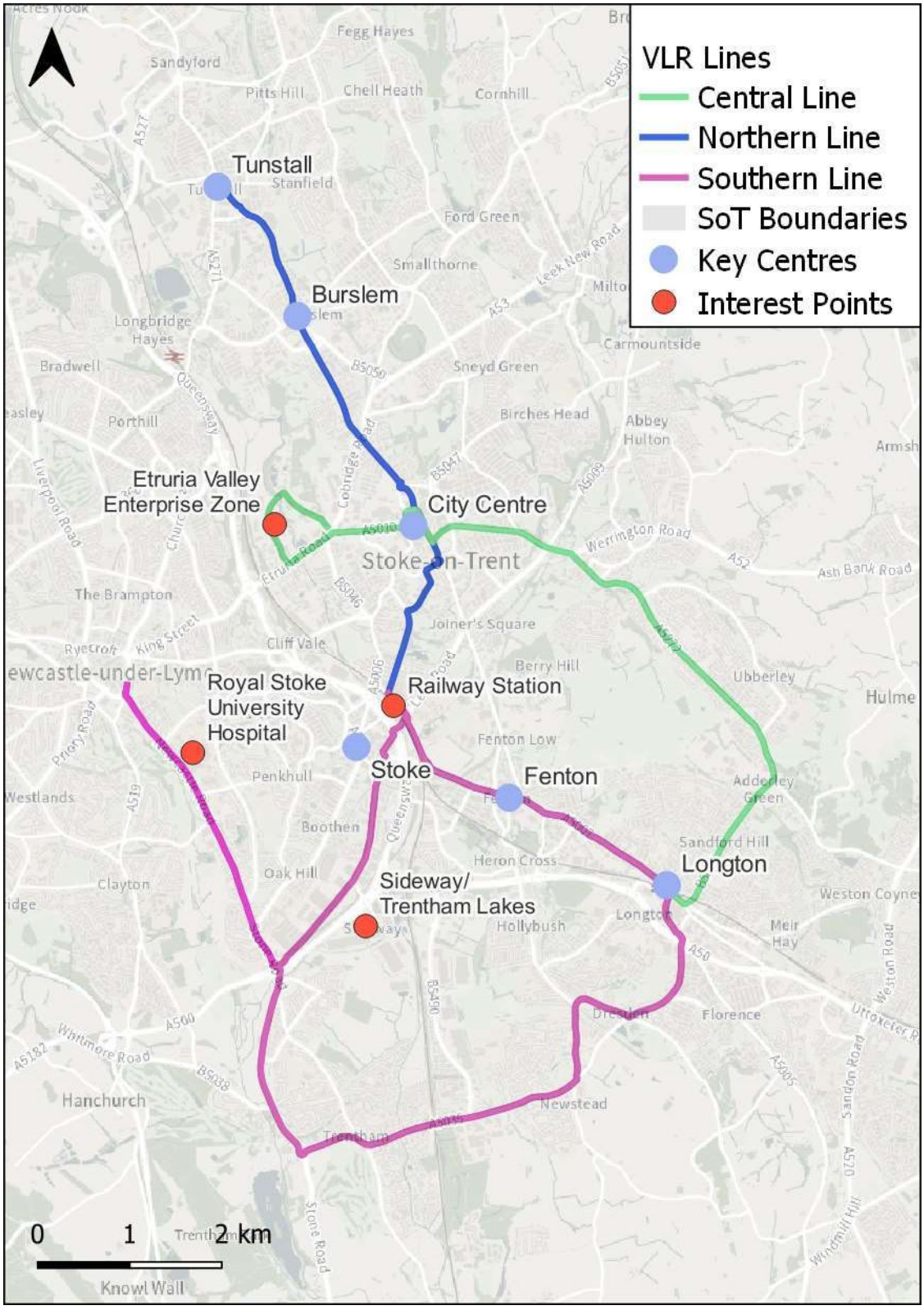


Figure 2.1 Scheme Overview – VLR Network

As illustrated above, the network extends across the city and will serve all the key centres and employment zones. This provides an alternative to the car. It represents an emission-free, public transport option that will enhance connectivity and facilitate residents' travel needs.

3 Strategic Case

3.1 Introduction

The Strategic Case sets out the reasons why the VLR network scheme is needed. It describes how the proposed scheme has been identified and explains the need for the intervention to address existing problems and the potential for economic growth and development.

3.2 Local context

This section summarises the local situation of Stoke-on-Trent and its future development. By considering the below socioeconomic aspects, alongside the national, regional priorities and local transport policies, an assessment of the feasibility of the VLR scheme (including funding and acceptability) can be achieved.

Stoke-on-Trent is a polycentric city with a chain of six towns. As shown in Figure 3.1, there is significant population density in and around the town centres and city centre. Each town is distinctive and to a lesser or greater degree creates travel demand into the town centre from the adjacent residential areas. Each contributes independently and collectively to the area's economy and movement patterns to the key interest points (i.e., employment zones, Stoke-on-Trent Railway Station, Staffordshire University). Smaller clusters of population are formed around employment areas such as the Royal Stoke University Hospital and the Sideway employment zone.

However, there are also some densely populated areas in the Outer Urban Core, most on main transport corridors. Much of the Outer Urban Core remains low density, however. Overall, half the resident population of Stoke-on-Trent reside in suburban residential areas and are not well-connected by public transport.

To maximise the societal benefits of the existing residential population, interventions will need to deliver improved connectivity to the six towns and provide access to key employment areas as well as support sustainable access for those in the peripheral areas.

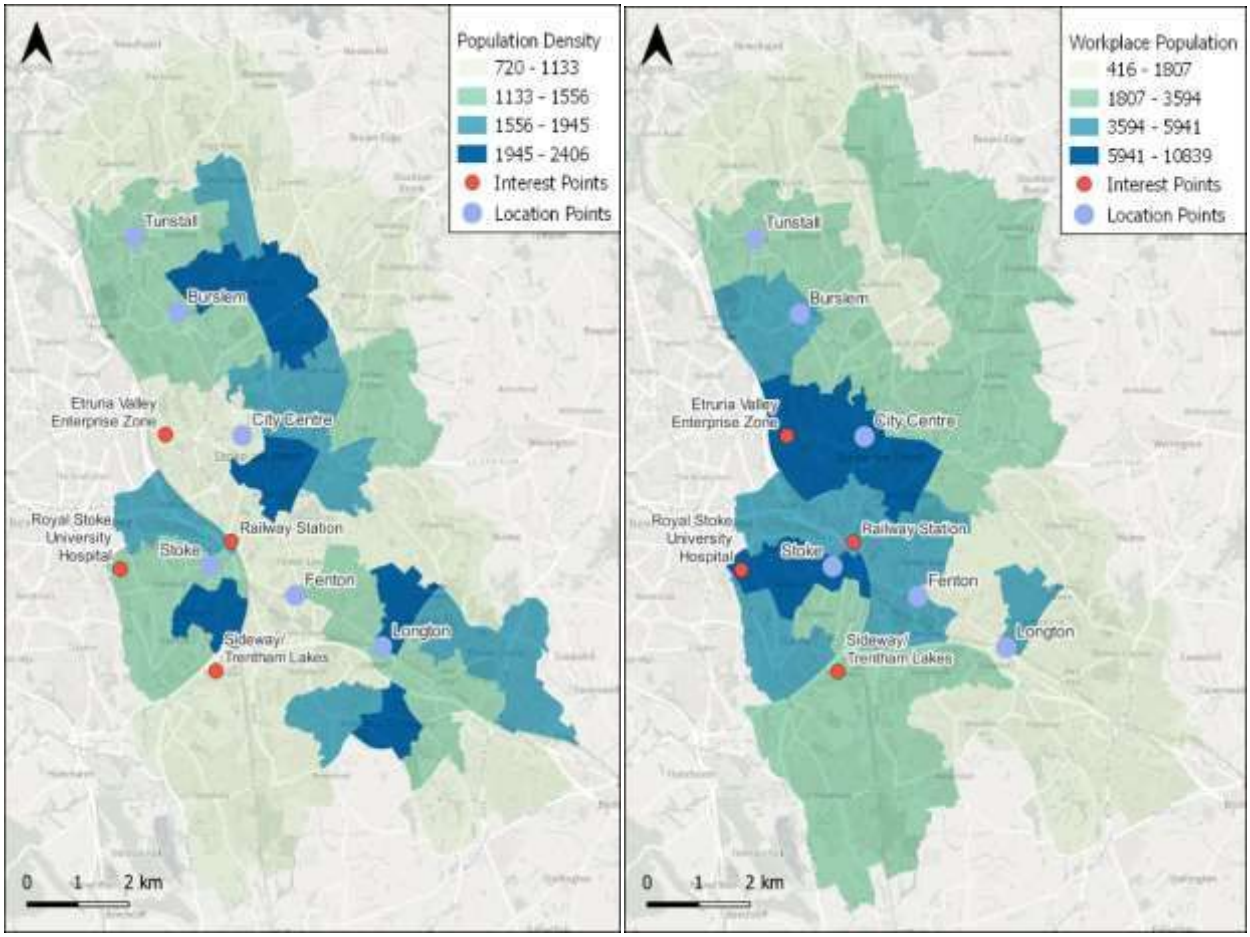


Figure 3.1 Population Density[2] and Workplace Population

With an employment sector dominated by wholesale, manufacturing, and health services, the main employment locations are quite dispersed. Yet a substantial proportion of growth is focused on the Inner Urban Core allowing for potential to encourage sustainable travel options and offer alternative public transport links to the main employment areas. Stoke-on-Trent's growth is particularly focussed on several enterprise zones, underlining the need to deliver high quality transport infrastructure that connects these locations to both where people live within Stoke-on-Trent as well as to key transport hubs.

Prominent industry hubs within the city, include:

- Staffordshire University
- Etruria Valley Enterprise Zone
- Sideway Employment Zone
- Royal Stoke University Hospital
- Trentham Lakes Employment Zone

Thus, growth areas in the south and north of Stoke-on-Trent would benefit from improved strategic transport links such as VLR and improved connectivity to the rail network to reach these key destinations efficiently (less interchange, more reliable).

[2] Source: SoTCC from MOSAIC-7, Experian 2020

As shown in Figure 3.2, the social geography of Stoke-on-Trent is diverse with the highest levels of deprivation predominately occurring around Burslem, Bentilee, and Meir. This pattern aligns with areas of low annual income and car ownership, which places higher importance on the need to access good quality public transport services and active travel links. Public transport interventions thus should consider improving access to areas with low car access to provide alterative transport options. Conversely, as shown in Figure 3.2 (car/van availability), there are also high levels of multiple car ownership per household in the outer urban areas (particularly edge of town, shift-based employment. Therefore, providing attractive public and active transport options would reduce multiple car ownership having a positive impact on air quality and the residents' health.

Figure 3.2 Index of Deprivation 0-10% Most deprived[3] and Car/Van Availability per 000s households[4]

This can balance the two-tier society of Stoke – with or without a car. Although the city's congestion is relatively less than some other cities, combined with the poor public transport connectivity, it is why access by car to employment is relatively easy and attractive. This makes car/taxi dependency quite high putting pressure on the congestion issues and the road safety.

The volume of collisions increases in urban areas, with the highest concentration occurring in the Inner Urban Core as well as around key corridors that provide access to the City Centre. Based on 2020 road safety data, half of the accidents in Stoke-on-Trent have occurred on class 3 roads meaning roads that distribute traffic between the principal residential, industrial, and business districts of the town such as the A34, A50 and A53 etc[5]. The increased concentration of collisions in the inner urban areas is likely to reflect the presence of more traffic, more junctions, and a higher number of vulnerable road users. Thus, focusing on intracity public transport improvements is

[3] Source: SoTCC from Indices of Deprivation, MHCLG 2019
[4] Source: SoTCC from ONS 2011
[5] Road Safety Data (Casualties, Vehicles, Accidents) 2020, DfT

needed to connect the population to economic opportunities in a sustainable way and at the same time help reduce the number of road collisions and casualties.

It is important to note Stoke-on-Trent's role as a logistics hub on the national highway network given its central location, good highway links and low cost for distribution hubs. This has led to a shift towards distribution and service industries, leading to increasing freight needs and home deliveries. This has affected the employee journey patterns and shift style employment as there are several warehouse style employees with 24hr shift employment in the City. Alternative travel options to single occupancy car usage should consider the new work patterns and congestion issues that can occur in the peak hours.

Lastly, Stoke-on-Trent's polycentric and dispersed nature has led to high levels of car usage in the area which results in high levels of carbon emissions and local air quality issues emanating from transport. More sustainable transport measures are needed to address issues from car traffic and encourage modal shift to non-car modes. Impacts from climate change such as flooding will need additional mitigation work on both existing and new infrastructure. However, the development of new infrastructure creates the opportunity to add in flood defences. With a high number of waterways in the area, there is an opportunity to harness the benefits of blue/green infrastructure to enhance not just movement but placemaking. Complementing existing heritage sites and green corridors with sustainable transport (i.e., transport corridors – active travel and very light rail, green bridges, and eco-tunnels) as well as with active travel schemes to expand their utilisation.

3.2.1 Summary

In a multi-centred city with low urban density, it is unlikely that a large mass transit transport system (i.e., tram or Metro) will be viable. To 'level up', the opportunities are around developing high quality high priority corridors for bus or equivalent scale transport modes (i.e., very light rail) as well as active travel, whilst balancing against the need to support car access for those who need it. A step change is needed in transport connectivity to support regeneration schemes and signal the City's repositioning nationally and internationally and to attract new residents and businesses into the city. This may point to a need for a flagship transport initiative to change how people perceive getting around Stoke without a car.

The evidence base identifies the need for intracity public transport improvements to connect the disparate population to economic opportunities in a sustainable way, whilst also encouraging densification around the 6 town centres to continue in Stoke-on-Trent. There is also a need to enhance connectivity with rail to make the most of the committed investment. Highway schemes will need to be focussed on key congestion hotspots, taking a multi-modal perspective.

Ultimately the future schemes will need to bridge the connectivity gap for those with and without cars in Stoke-on-Trent, whilst also achieving tangible benefits in terms of sustainability. In order to grow Stoke-on-Trent, future schemes will have to facilitate Stoke-on-Trent retaining and growing its productive workday population.

3.3 Policy Background

3.3.1 Transport Strategy Context

Stoke-on-Trent City Council has developed a new Transport Strategy & Delivery Plan document (2022). This is intended to be a refreshed ten-year strategy document to inform delivery priorities through to 2031. It outlines how the authority will develop and deliver transport proposals in line with three overarching objectives relating to the economy, the environment and health.

This document also provides an up-to-date foundation for current challenges and priorities to facilitate the drafting of LTP4, in 2023-24, as required by the government's Department for

Transport (DfT). Whilst new guidance is emerging, it is known that LTP 4 will require LTAs to provide an assessment of carbon lifecycle emissions and reductions, as part of commitment for decarbonising the transport network.

The overall aim and ambition of Stoke-on-Trent City Council (SoTCC) is to deliver a better-connected city with transport options that currently do not exist, delivered within a ten-year period. The key focus of the strategy will be to improve the public transport offer, including the opportunities for introduction of light rail; better integration of different modes of travel, through the development of a multi-modal hub network in the city; and developing a net-zero emission pathway that will have a focus on major contributors to transport based pollution and includes electric and hydrogen fleet opportunities in the city.

The Transport Strategy & Delivery plan document illustrates the current local situation and local transport offer, addresses the barriers to growth and presents targeted improvements including the Very Light Rail as potential opportunity to consider.

Thus, this SBC will further explore the feasibility of a Very Light Rail network in Stoke-on-Trent.

3.3.2 Policy Overview

Current national priorities for transport are driven by the policy context. Key policies and strategies are described in the Local Transport Plan Review (May 2022) and are set out in Figure 3.3 below.

Figure 3.3 Policy diagram

Across these policies and strategies, the key themes of economic development, decarbonisation, and health feature strongly and provide direction for this Transport Strategy and Delivery Plan. This policy direction is particularly evident in the DfT's Transport Investment Strategy, Outcome Delivery Plan and Transport Decarbonisation Plan. Mode specific national strategies (such as Bus Back Better and Gear Change) provide further direction to how bus and active travel can support economic development, decarbonisation, and improved health.

Within Stoke-on-Trent's levelling up prospectus, these themes follow through with transport and connectivity seen as a necessity to enable Stoke-on-Trent to achieve its growth ambitions.

The three goals of the Stoke-on-Trent City Council LTP3 are aligned with current emerging policy:

1. Economy - improving the local economy through increasing productivity for existing businesses and encouraging new investment by making Stoke-on-Trent more attractive.

2. Environment - improving the local environment through reducing the impact of traffic (air and noise) and moving towards more sustainable transport technology and modes, coupled with improving the appearance of local areas.
3. Health - caring for local health through improving access to transport, transport safety and encouraging walking and cycling.

The proposed scheme to improve public transport capacity and connectivity aims to add value in all three goals of the City Council due to its positive impact on the economy – creating links to key employment destinations, increase visitor economy and inclusive economic prosperity and encourage new investment, the environment – effectively responds to the city's climate emergency and air quality crisis (low emission transport option) and health – shift towards a sustainable transport mode with connectivity to active travel options.

3.3.3 Policy Drivers

3.3.3.1 Overview

The proposed scheme is closely aligned with national, regional, and local transport plans and policies, including:

- National Infrastructure Strategy
- National Industrial Strategy
- Transport Investment Strategy
- Future of Mobility: Urban strategy
- Climate Change Act and Low Carbon Transport: A Greener Future
- Transport Decarbonisation Plan
- Decarbonising Transport Setting the Challenge
- Ten Point Plan for a Green Industrial Revolution
- Midlands Connect Strategic Transport Plan
- Stoke-on-Trent and Staffordshire Local Enterprise Partnership (SSLEP) and Strategic Economic Plan (SEP)
- Staffordshire Local Transport Plan 2011 (SLTP)
- Newcastle-under-Lyme and Stoke-on-Trent Core Spatial Strategy (2006 – 2026)
- North Staffordshire Local Air Quality Plan

Based on the Transport Investment Strategy, a reliable and more sustainable network is needed. A VLR network is aiming to support the local community on its journey to key destinations by offering a reliable and affordable alternative to car, improving air quality, and enhancing connections with active travel options.

The VLR scheme would provide an attractive public transport option and potential for integration with existing modes, increasing opportunities for mode shift away from private car and thus further reducing emissions. Green public transport is key in numerous current policies (Decarbonising Transport Setting the Challenge, Transport Decarbonisation Plan, Ten Point Plan for a Green Industrial Revolution) along with modernising fares and improving rail journey connectivity with walking, cycling and other modes of transport. This is some of the main aspects of the proposed scheme.

The scheme follows the Midlands regional policies as well as the local ones by targeting on the green transport goals by contributing on the improvement of the regional carbon emissions and the decarbonisation of the regional transport links. A VLR network would enhance the quality of life for Midlands' residents and the integration with the local and national network while enabling business and employment growth. It would further support the local joint plans with Newcastle-under-Lyme

and the efforts on air quality while creating resilient links to support their local workplace population and economy.

3.3.3.2 National Infrastructure Strategy

The National Infrastructure Strategy sets out plans to transform UK infrastructure in order to level up the country, address transport inequalities across and achieve net zero emissions by 2050. There is going to be a shift in spending towards regions other than the southeast of the UK.
The Command Paper notes that many of the UK's largest cities have below average productivity relative to their size and population and that this is part due to high congestion and poor local transport links. It states that a well-designed public-transport network is fundamental to the operation of any city, but in regional cities public transport provision lags behind. It commits the Government to invest in public transport as part of its effort to rebalance the national economy. To support its decarbonisation plans, the Command Paper states that the Government wants to increase the share of journeys taken by public transport, cycling and walking, as well as decarbonise public transport.

Policy alignment with VLR

The proposed scheme reflects the Government's view that high quality transport infrastructure and a well-designed network is needed to improve productivity, support jobs and growth. It will further fulfil the pertinent goals for an urban transit system related to clean growth (low emission transport) by increasing the quality of public transport modes as well as facilitating a well-connected network with interchanges to active travel options.

3.3.3.3 National Industrial Strategy

This strategy sets out a long-term plan to boost the productivity and earning power of people throughout the UK with a focus on five foundations:

- Ideas – the world's most innovative economy
- People – good jobs and greater earning power for all
- Infrastructure – a major upgrade to the UK's infrastructure
- Business environment – the best place to start and grow a business
- Places – prosperous communities across the UK

The strategy also sets out four Grand Challenges:

- AI & Data Economy - to put the UK at the forefront of the artificial intelligence and data revolution
- Clean Growth - to maximise the advantages for UK industry from the global shift to clean growth
- Future of Mobility - to become a leader in the way people, goods and services move
- Ageing Society - to harness the power of innovation to help meet the needs of an ageing society

The strategy highlights the essential role of infrastructure investment to have transformational effects on places, businesses, and society. The document clearly states that transport investment must seek to create a more reliable, less congested, and better-connected transport network to build a stronger, more balanced economy. It also highlights that investment should seek to support the Grand Challenges.

Policy Alignment with VLR

The development of a rapid transit network will improve linkages between the City Centre and the six main residential areas to key employments zones and destinations. It will also help improve productivity through a more efficient segregated network, that will help unlock development sites

and lead to job creation. It is significantly related to "Clean growth" and the "Future of mobility" as it supports the shift towards clean transport and new technologies.

3.3.3.4 Transport Investment Strategy

The Investment Strategy sets out how the government will respond to current challenges whilst delivering the aims of the Industrial Strategy and putting the travelling public at the heart of the choices made.

The strategy states that investment must seek to:

- **create a more reliable, less congested, and better-connected transport network** that works for the users who rely on it
- **build a stronger, more balanced economy** by enhancing productivity and responding to local growth priorities
- **enhance our global competitiveness** by making Britain a more attractive place to trade and invest
- **support the creation of new housing**

The strategy discusses a range of priorities including:
Enhancing connectivity by adding new capability - the document acknowledges that the connectivity of our transport system is a fundamental component of the positive economic contribution it can make. The strategy refers to a need to invest to add new capability to the network, which transforms travel in a particular corridor or provides opportunities for the travelling public to make journeys in a new way.

Policy Alignment with VLR

The VLR proposed network is expected to take a proportion of car trips off the local congested highway network and reduce car use on these corridors, enabling a more efficient use of road space, reducing congestion, and improving journey reliability by all modes. Thus, creating a better connected and less congested network.

The potential VLR scheme will further create new links between communities and workplaces to deepen local labour markets, connect housing developments to the network and provide new routes on city and commuter networks.

3.3.3.5 Future of Mobility: urban strategy

The 'Future of mobility: urban strategy' outlines the Government's approach to maximising the benefits from transport innovation in cities and towns. It acknowledges that modern technologies are emerging that within a generation will transform journeys.
It sets out nine principles that will guide the Government's response to emerging transport technologies and business models, and guide decision-making going forward. Key principles are:

- Walking, cycling and active travel must remain the best options for short urban journeys
- Mass transit must remain fundamental to an efficient transport system
- New mobility services must lead the transition to zero emissions
- Mobility innovation must help to reduce congestion through more efficient use of limited road space, for example through sharing rides, increasing occupancy, or consolidating freight

Policy Alignment with VLR

The proposed VLR network aims to reduce car use on key corridors, enabling a more efficient use of road space, reducing congestion, and improving journey reliability. It is an alternative transport mode that will improve local air quality and support fully the transition to zero emissions.

3.3.3.6 Climate Change Act and Low Carbon Transport: A Greener Future

The policy intends to enable the UK to meet the requirements of the carbon budgets set under the Climate Change Act 2008. The strategy sets out the need for action in respect to climate change and transport emissions, areas of focus including supporting a shift to new technologies and cleaner fuels, promoting lower carbon choices, using market mechanisms to encourage a shift to lower carbon transport.

Policy alignment with VLR

The strategy states its commitment to changing the way long-term transport planning decisions are made including considering CO2 and other greenhouse gas emissions as one of the five goals that will guide future transport policymaking and infrastructure investment decisions. The delivery of a transport scheme such as a VLR network, can support this commitment.

3.3.3.7 Transport Decarbonisation Plan

Government has now set a net zero target. It has undertaken to bring forward a Transport Decarbonisation Plan which will set out how transport will contribute to this cross-sectoral goal. In advance of completing the Plan, in Decarbonising Transport Setting the Challenge, Government has set out its six objectives including accelerating modal shift to public and active transport, place-based solutions for emissions reduction.

Policy alignment with VLR

The transport scheme would provide an attractive public transport option and potential for integration with existing modes, increasing opportunities for mode shift away from private car and thus further reducing emissions.

3.3.3.8 Decarbonising Transport Setting the Challenge

In March 2020 the Department for Transport set out what it sees as the challenges to decarbonise transport. Goals include accelerating modal shift to public and active transport, decarbonising road vehicles and adopting place-based solutions.

Policy alignment with VLR

As mentioned above, the VLR networks is a low emission scheme that would increase opportunities for mode shift away from private car and thus reduce greenhouse gas emissions.

3.3.3.9 Ten Point Plan for a Green Industrial Revolution

The Government's November 2020 sets out steps it will take to meet its commitment for net zero by 2050. Steps include promoting green public transport, cycling, and walking which is a commitment to further invest in the enhancement of local public transport in cities.

Policy alignment with VLR

The proposed scheme would support the commitment on promoting green public transport and active travel while creating a better-connected network.

3.3.3.10 Midlands Connect Strategic Transport Plan

Midlands Connect is a pan-Midlands partnership of local transport authorities, local enterprise partnerships and local business representatives working with the Department for Transport and its key delivery bodies. The delivery of the Midlands Connect vision will help to secure a £1 billion-a-year boost to the regional economy, create 300,000 additional jobs and save businesses £500 million.

The Strategy identifies North Staffordshire including Stoke-on-Trent as one of four Strategic Economic Hubs. Furthermore, Stoke-on-Trent forms part of two Intensive Growth Corridors, towards Birmingham and towards Derby and Nottingham.

The updated challenges of this plan are:

- Levelling up and strengthening the region and UK
- Decarbonising transport and adapting to climate change
- Driving resilient economic growth

Policy alignment with VLR

The proposed scheme directly aligns with the decarbonisation of transport and promoting economic growth. The deliverables of this plan will support the levelling up of Stoke-on-Trent.

3.3.3.11 Stoke-on-Trent and Staffordshire Local Enterprise Partnership (SSLEP) and Strategic Economic Plan (SEP)

The Stoke-on-Trent and Staffordshire LEP was created in 2011 and it is ongoing with its main target to support businesses which wish to start up, grow or relocate to drive economic growth.
The SSLEP SEP identifies the City of Stoke-on-Trent as the focus for innovation-led economic growth, founded on competitive connectivity, sector growth and a skilled workforce.

The SEP Strategic Framework is underpinned by the following key goals:
Stoke-on-Trent as a Core City – rapid, planned growth of the conurbation centred on the City of Stoke-on-Trent.
A Connected County – to build on Stoke-on-Trent's central location, excellent external connectivity, and existing peri-urban sites to harness the rapid economic growth of the Midlands Engine.
Competitive Urban Centres – to ambitiously enhance growth opportunities for an attractive and thriving City of Stoke-on-Trent.
Sector Growth – ensure globally competitive innovation, investment, and enterprise-led expansion in large and small businesses across priority sectors.
Skilled Workforce – to develop a modern and flexible skills system which enables all people to up-skill and re-skill to meet the needs of growth sectors.

Policy Alignment with VLR

The proposed network also aims to support economic growth by enhancing connectivity in North Staffordshire conurbation and improving accessibility to key destinations, including employment zones.

3.3.3.12 Staffordshire Local Transport Plan 2011 (SLTP)

The Staffordshire LTP (Local Transport Plan) priority objectives are:

- Supporting growth and regeneration
- Making transport easier to use and places easier to get to
- Improving safety and security
- Reducing road transport emissions and their effects on the highway network
- Improving health and quality of life
- Respecting the environment

Policy alignment with VLR

The objectives of this scheme align with the SLTP in terms of improving health and reducing emissions in North Staffordshire as well as enhancing accessibility and economic growth.

3.3.3.13 Newcastle-under-Lyme and Stoke-on-Trent Core Spatial Strategy (2006 – 2026)

The Core Spatial Strategy sets out a broad framework for the future development of the whole of Newcastle-under-Lyme and Stoke-on-Trent. It seeks to ensure that public and private investment is properly co-ordinated, with a focus on promoting the principles of sustainable development. The relevant key aims, principles and policies of the Core Spatial Strategy are as follows:

Core Spatial Strategy Strategic Aims

- SA2 – To facilitate delivery of the best of healthy urban living in the development of the conurbation
- SA3 – To reduce the need to travel, improve accessibility and increase the opportunities for development of sustainable and innovative modes of travel to support regeneration
- SA7 – To enhance the City Centre of Stoke-on-Trent's role as sub regional commercial centre
- SA12 – To renew the fabric of urban and rural areas to promote the best of safe and sustainable urban and rural living
- SA17 – To minimise the adverse impacts of climate change in the move towards zero carbon growth through energy efficiency

Core Spatial Strategy Spatial Principles

- SP1 – Target Regeneration
    - New housing sites have been identified in significant urban centres, such as Newcastle-under-Lyme town centre
    - Staffordshire University, the University Hospital, Keele University, and Science Park will continue to be the focus for high value business growth
- SP2 – Economic Development
    - Diversification and modernisation of the centres for new business investment, particularly in terms of retailing, education, leisure, entertainment, culture, office development and residential development
    - Improvement in the levels of productivity, modernisation, and competitiveness of existing economic activities, whilst attracting new functions to the conurbation
- SP3 – Movement and Access
    - Improving the accessibility and therefore the social inclusion of previously poorly connected communities to maximise the range of services and facilities available to people
    - Maximising the accessibility of new residential, employment, retail, development, health and education centres, green open space, leisure, and sport facilities as well as strategic transport interchanges, such as railway stations, by walking, cycling and public transport

Core Spatial Strategy Area Spatial Policies

- ASP2 – Stoke-on-Trent inner urban core
    - The proposal of multiple transport infrastructure improvements including Stoke town centre highway improvements (the Inner Relief Road), and cycleway improvements.
- ASP3 – Stoke-on-Trent outer urban area
    - Better public transport connections to the town centres of Stoke-on-Trent
    - Bus priority measures along routes from Stoke, Longton, Bentilee, Tunstall, Sneyd Green and Burslem to City Centre
    - The enhancement of the built and natural environment, together with increased access to greenspace and watercourses as well as the realisation of brownfield development opportunities

<u>Policy alignment with VLR</u>

There is potential for a rapid transit network, focusing on improving accessibility and providing a sustainable travel option to maximise social inclusion in the city. The approach to identifying a solution will be evidence based and will target underserved areas as well as providing better

connections to the town centres to support regeneration and sustainable development. Lastly, there is potential to serve the target regeneration areas mentioned in the Core Spatial Strategy, thus supporting further the economic growth and productivity regeneration of the area, unlocking the viability of sites currently poorly connected to the public transport network.

3.3.3.14 North Staffordshire Local Air Quality Plan

The NSLAQP plan will help to protect and promote the health of the local population by improving air quality and reducing the impact of air pollution on the environment. In so doing, the local authorities are complying with the UK Air Quality Plan and bringing NO2 air pollution within statutory limits in the shortest possible time. The joint approach has also been necessary because it is recognised that air pollution does not respect local authority boundaries and therefore a consistent and co-ordinated approach is required to maximise air quality benefits for all people living and working in North Staffordshire. By working together, the authorities can also minimise the risk of unintended consequences and help to ensure, as far as possible, alignment between the NSLAQP and wider authority strategies.

Policy alignment with VLR

A key objective of this scheme is to improve air quality by delivering transport infrastructure which serves the local area and provides an alternative to motorised transport. Innovations in transport technology are developing rapidly and there is potential for the new system to be both zero emissions at point of use, and later driverless.

3.3.4 Related Studies

3.3.4.1 Trams for Bristol

A pre-feasibility study was produced as a contribution to the Zero West/Transport for Greater Bristol (TfGB) *Moving Bristol Forward* campaign. The report is divided into four components:

- the re-introduction of trams in Bristol
- an assessment of the contribution of TfGB 2020 report Rapid Transit Plan
- a pre-feasibility assessment of two TfGB proposed pilot tram routes
- recommendations for future work

As Bristol is a car dependent city, air pollution, congested roads, and long journey times along with the unequal access to transport options and low levels of active travel have negatively impacted the local economy. Hence, the 'in principle' approach for an attractive well-connected public transport network is necessary for a large-scale switch from car journeys.

The report highlights the 'in principle' argument that a mass rapid transit system based on tram-plus-local train network complemented by BRT and buses could lead to the transformation of the public transport system and support the radical reduction of pollution and congestion. This approach aims to increase modal shift from private car to public transport by enhancing the public transport links and interchanges and offering a reliable, resilient, and inclusive public transport network.

The study further explores the recent development of Very light rail, which is now being developed in Coventry, but on a larger scale. This would mean that the per kilometre costs of VLR could be up to 50% less than the costs incurred in the cities which are extending their second-generation tram networks. This creates an opportunity for Bristol to take advantage of the new technology and become the first major city to use the new technology.

Stoke-on-Trent is experiencing similar issues to Bristol and would benefit from an integrated public transport network (VLR, local rail and bus services). However, in a polycentric city with low urban density, it is unlikely that a large mass transit transport system (i.e., tram or Metro) will be viable. It

would be beneficial though to develop a mix of high quality - high priority corridors for bus or equivalent scale transport modes (i.e., very light rail) combined with active travel (sharing road space with cyclists), whilst balancing against the need of car access for those who need it. A very light rail network would be cost efficient, offer reliable connectivity, further improve the streetscape, and create a more pleasant experience for pedestrians and small businesses.

3.3.4.2 Coventry Very Light Rail

Coventry has highlighted the need for attractive alternatives to the car, due to the city's high car dependency, poor air quality as well as future population growth and development plans. To enable sustainable economic growth, Coventry has identified the need for a rapid transit scheme.

As Coventry City Council is committed to reducing its emissions and tackling all the above issues, it is currently developing the Coventry Very Light Rail (VLR). It has been recognised in the "Decarbonising Transport – A better, greener Britain" plan, as a step towards the West Midlands becoming a world-class business investment location.

The Coventry VLR programme is envisaged to cost only £10m per km with a shuttle capacity of 56 passengers. An affordable integrated tram system that consists of an innovative track and a lightweight, low-cost vehicle. The vehicles are planned to be operated without a driver which will further reduce the future operating costs.
Coventry City Council is looking at a "total system" approach considering last mile solutions (e-scooters, transport hubs) as well as autonomous operation. The main goal is modal shift away from the private car, supporting decarbonisation and growth of the local and regional economy.

Coventry is a relevant case study for Stoke-on-Trent, due to both cities having similar issues such as high car dependency, limited connectivity, and deprivation, leading the way for the demonstration of the VLR route option. Indeed, Coventry's first step is to open a demonstration VLR line across the city to raise awareness.

3.4 Problems

3.4.1 Introduction

This section identifies the problems which the scheme will address. In accordance with DfT TAG and Supplementary Guidance regarding the Transport Investment Strategy this section presents evidence of their severity and impact and sets out the reasons why the intervention is needed. Transport problems within Stoke-on-Trent are listed below and described in more detail in sections 2.4.1 to 2.4.

- Traffic congestion, resulting in queuing and delays to journeys
- Inadequate access to the dispersed employment areas
- An underperforming economy and high levels of deprivation in some areas of Stoke-on-Trent
- Poor access to opportunities from deprived areas
- Poor connectivity between the inner and outer urban areas of Stoke-on-Trent
- Bus services experiencing unreliable journey times
- Future development sites constrained by network limitations
- High levels of road accidents
- Impact of traffic on air quality
- Impact of traffic on CO2, and greenhouse gas emissions
- A two-tier society, those with and without access to a car
- Lack of resilience of the local transport network
- Changing travel patterns of the work population

- Limited planned improvements towards sustainable transport

All these problems are related to the form and operation of the existing road network.

3.4.2 Traffic congestion, resulting in queuing and delays to journeys

Traffic congestion is highlighted as a key challenge in the LTP3, and addressing congestion is a priority as the associated problems have significant detrimental impact on economic growth and compound accessibility issues. Furthermore, congestion results in unreliable journey times and causes significant costs to existing businesses in Stoke-on-Trent and Staffordshire, it also reduces the efficiency of local labour markets and inhibits the ease of access to education.

It can be quite difficult to measure congestion in absolute terms, however, investigations using the NSMM Transport Model (2015 base year model) have been used to illustrate the congestion problems on road links and junctions within the city. Figures 3.4 shows the sources of link (over-capacity links) and junction (significant junction delay) delays in the AM and PM peak hours for 2015. In particular, the Davenport Street, A53 Cobridge Road and Etruria Road, Waterloo Road, Potteries Way, A52 Leek Road, A52/A5008 Bucknall Road, A527 Dividy Road, Werrington Road, A50 Victoria Road, King Street, Weston Road and A50 Uttoxeter Road and the A34 corridors experience congestion and delay.

This demonstrates that the network is experiencing significant congestion problems during the peak hours – it must be noted that the actual level of congestion experienced is likely to be significantly worse as a result of issues such as blocking back which will affect the operation of downstream links and junctions and result in queues and delays on these routes.

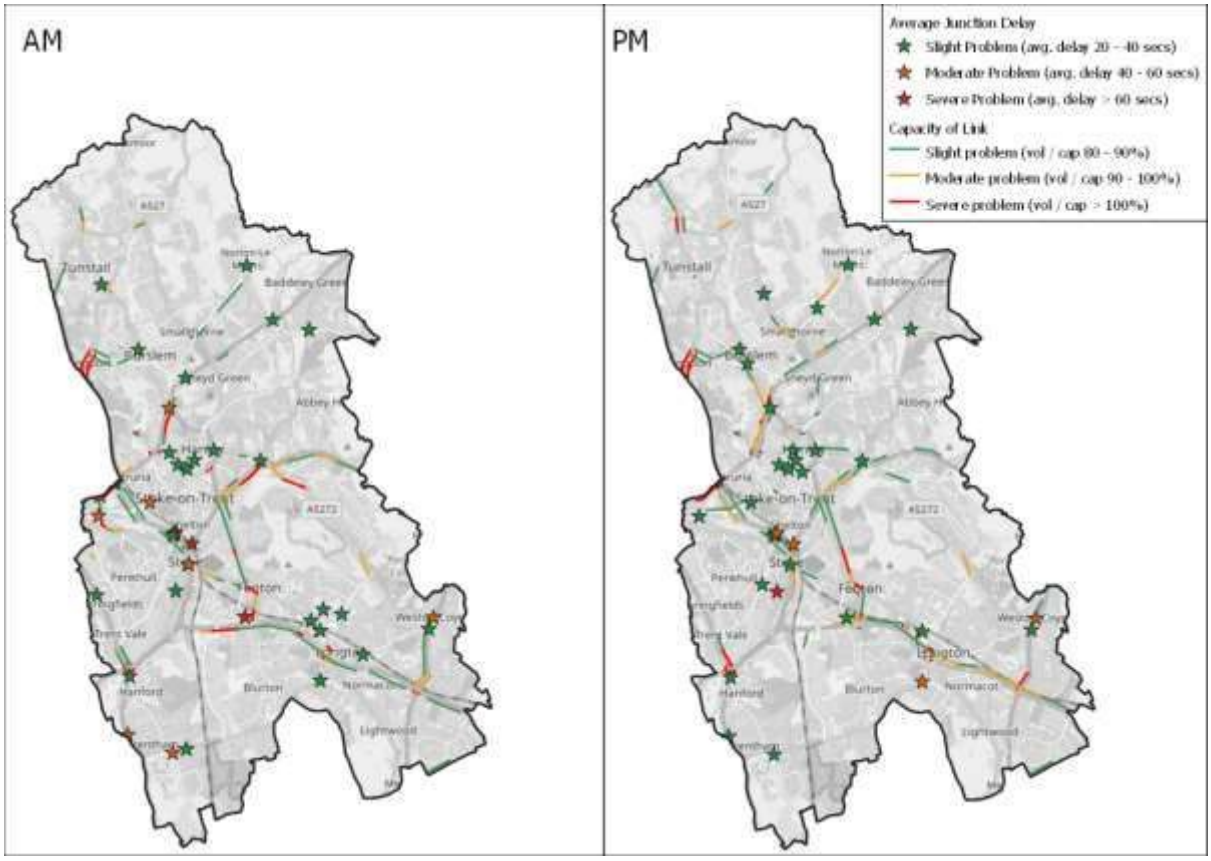


Figure 3.4 2015 AM/PM Peak – Over Capacity Links and Significant Junction Delays

As demonstrated by Figure 3.4 the existing network experiences issues, with noticeable delays, particularly for inbound travel in AM peak hours and outbound travel in PM peak hours at the following locations:

- Davenport Street from/to Burslem. There is severe congestion on the inbound and outbound movements through Longport. This hinders access to Longport rail station and the centres of Burslem and Tunstall impacting the ability for interchange and regional connectivity. It also affects access to services and retail areas.
- A53 Cobridge Road / Etruria Road. This route connects Etruria enterprise zone, the western edge of the City Centre and Festival Retail Park with the A500 and Newcastle-under-Lyme beyond. Congestion and delay which is impacted by the Cobridge traffic lights hinders accessibility to key employment destinations.
- Waterloo Road (Northbound) to Burslem. Northbound movement from Etruria / City Centre towards Burslem (PM peak hour). There are few alternative traffic routes for this well trafficked corridor which has moderate congestion on Waterloo Road. This slows journey times and accessibility to and from key centres and employment hubs (i.e., Etruria – Bet 365).
- Potteries Way (south of Hanley). This serves as a partial ring road around the City Centre, with a key junction at Lichfield Street. Congestion hampers north-south movements and access to destinations such as Hanley Bus station.
- A52 Leek Road from Joiner's Square to Limekiln junction. This will constrain north-south movements to and from Stoke-on-Trent; inhibit access to key destinations such as Staffordshire University, the rail station and surrounding town centres; and hinder strategic connectivity to the A500 and therefore the M6.
- A52 Bucknall Road / A5008 Bucknall New Road Corridor. This is route queues into the City Centre and is also adversely impacted by congestion at the Limekiln and A52 Werrington Road / Dividy Road junctions.
- A5272 Dividy Road. This will constrain east-west movements across the eastern suburbs of Stoke-on-Trent to areas such as Bentilee impacting the ability for residents to access employment and services.
- A52 Werrington Road. There are very few alternative routes east to west between the City Centre, eastern suburbs and further out to the East Midlands. Therefore, congestion along this road severely impacts the ability and capacity for people to travel from the suburbs into the city.
- A50 Victoria Road. This is a key route to the A50 Trunk Road and presents issues as it is the only access point for Fenton Industrial Estate, and because it feeds into the A50 Lichfield Road which is a primary corridor to the City Centre.
- King Street. There is severe congestion towards Fenton hindering the access towards the city and one of the key centres and further to the Fenton Industrial Estate.
- Severe congestion along the end of the Weston Road and the A50 Uttoxeter Road. This will constrain southwest to north movements to and from Stoke-on-Trent; inhibit access to the rail station and surrounding town centres.
- A50 congestion towards the A500. This route experiences severe congestion in the morning peak hindering strategic connectivity to the A500 and therefore the M6 and thus, affecting the reliability of journey times towards Sideway and out of the city.
- A34 Stone Road (Trent Vale). Has severe problems during the evening peak, which are slighter in the morning peak along the A34 which can impact access to the A500 and the M6 as well as journeys to key workplace destinations such as Newcastle-under-Lyme and the Royal Stoke University Hospital.

The above congested routes impact bus services and their journey time reliability. Congestion affects all road users including bus passengers, cyclists, and pedestrians as well as car users. Pedestrians are also affected by the long traffic signal cycle times needed to handle demand at junctions.

As mentioned in the LTP 3, it is forecast that congestion will have a serious future impact on the city and its future traffic condition[6]. The impact on these forecasts due to Covid-19 is currently uncertain, although any reduction may We can assume that this situation was affected by Covid-19 as traffic levels significantly decreased due to the restrictions. These declines are likely to be only temporary with most pre-pandemic car travel patterns returning, especially for Stoke-on-Trent where there is predominantly manual and location-based work that cannot be easily done remotely and where alternatives to car use are currently limited.

The VLR network will facilitate connectivity, affordability and reliability aiming to alleviate traffic congestion by shifting people away from the private car. Routes that link residents to key employment sites and centres are important to regulate the congestion at peak hour times. Creating safe and less congested spaces for all users (PT passengers, cyclists, pedestrians) is the end goal.

3.4.3 Inadequate access to the dispersed employment areas

The employment centres are concentrated around the City Centre (Hanley), Etruria (Etruria Valley Enterprise Zone including large trip attractors such as bet365 corporate offices), Stoke (which includes the Civic Centre) and the Royal Stoke University Hospital as well as Burslem and Longton. These areas include large retail centres, council offices, commercial high streets, hospitals, and healthcare provision. The area between Stoke and the City Centre hosts several large educational facilities including Staffordshire University, which are major sources of employment.

There are pockets of high employment within more peripheral areas of Stoke-on-Trent such as in the southwest where the Sideway/Trentham Lakes Employment Zone is located. This includes significant logistics employment, being adjacent to the Strategic Road Network.
Overall, though, employment centres are dispersed across the city which results in car dependence due to the inadequate public transport links. Few residents travel to work by train or bicycle – or work at home – compared with both regional and national averages. Almost two-thirds (65.6%) of Stoke-on-Trent's working population usually travel to work by car or van compared with 57% nationally.

The VLR network will improve connectivity and access to the dispersed employment centres as well as improve public transport commuting times. This could potentially facilitate a modal shift from the car to public transport improving the nearby residential environment and alleviating the wider network.

3.4.4 An underperforming economy high levels of deprivation in some areas of Stoke-on-Trent

The Delivering a Sustainable Transport System (DaSTS) North Staffordshire Connectivity Study collated evidence about how poor internal connectivity causes a drag on economic growth, in particular to the local economic issues of:

- Slow transition to a knowledge economy
- Low levels of inward investment
- Low skills base
- Lack of enterprise

[6] LTP3 2010, SoTCC

It is widely recognised that the local economy has steadily declined since the latter half of the 20th century due to the demise of specific industries, thus detrimentally shaping the economic and social landscape. This is typified by the fact that the average weekly earnings for Stoke-on-Trent are significantly lower than the national average (£363.20 compared to £448.60). Furthermore, the proportion of the local population who are deemed to be economically active in Stoke-on-Trent is over 5% lower than the national average and over half (50.4%) of inhabitants in Stoke-on-Trent are living in the 20% most deprived Super Output Areas in the country.

The SEP identifies 'Internal connectivity constraints, including peak hour congestion' as an economic weakness, and identifies accessibility as a market failure constraining economic growth.

The VLR is a transport improvement that can encourage investment in the local economy and facilitate regeneration to create accessible opportunities for all. The VLR Network will improve connections and accessibility to key destinations to enhance the economic attractiveness and viability of the City Centre. The VLR Network offers improved connectivity and access to help make the area more attractive to potential businesses, developers, and homeowners as at present the routes are slow, congested, and unreliable.

3.4.5 Poor access to opportunities from areas of deprivation

In Stoke-on-Trent, transport connectivity is a recognised barrier to employment for residents on low incomes in parts of the city that are currently not served well by public transport networks. For Stoke-on-Trent to overcome these long-standing challenges, significant transport improvement schemes are required to support regeneration and signal the city's repositioning nationally and internationally to attract new residents and businesses. Interventions are necessary that focus on levelling up within the city and uplifting the more deprived areas by offering efficient public transport and access to key economic opportunities (employment zones).

Thus, the VLR network aims to better the accessibility to key employment zones from areas of deprivation (e.g, Burslem, Bentilee, Fenton) through better public transport services. This would give an alternative option to these deprived areas that broadly align with areas of low annual income and car ownership.

3.4.6 Poor connectivity between the Inner Urban Core and Outer Urban Area of Stoke-on-Trent

Congestion and delays along important transport corridors across Stoke-on-Trent along with a distinct lack of alternative routes contribute to journey time unreliability and thus impact on businesses in the area.

There is poor connectivity between the Inner Urban Core and Outer Urban Area of Stoke-on-Trent and access to the City Centre is limited from other town centres, the wider North Staffordshire and Staffordshire regions, especially from the south-east and north-east of the conurbation.

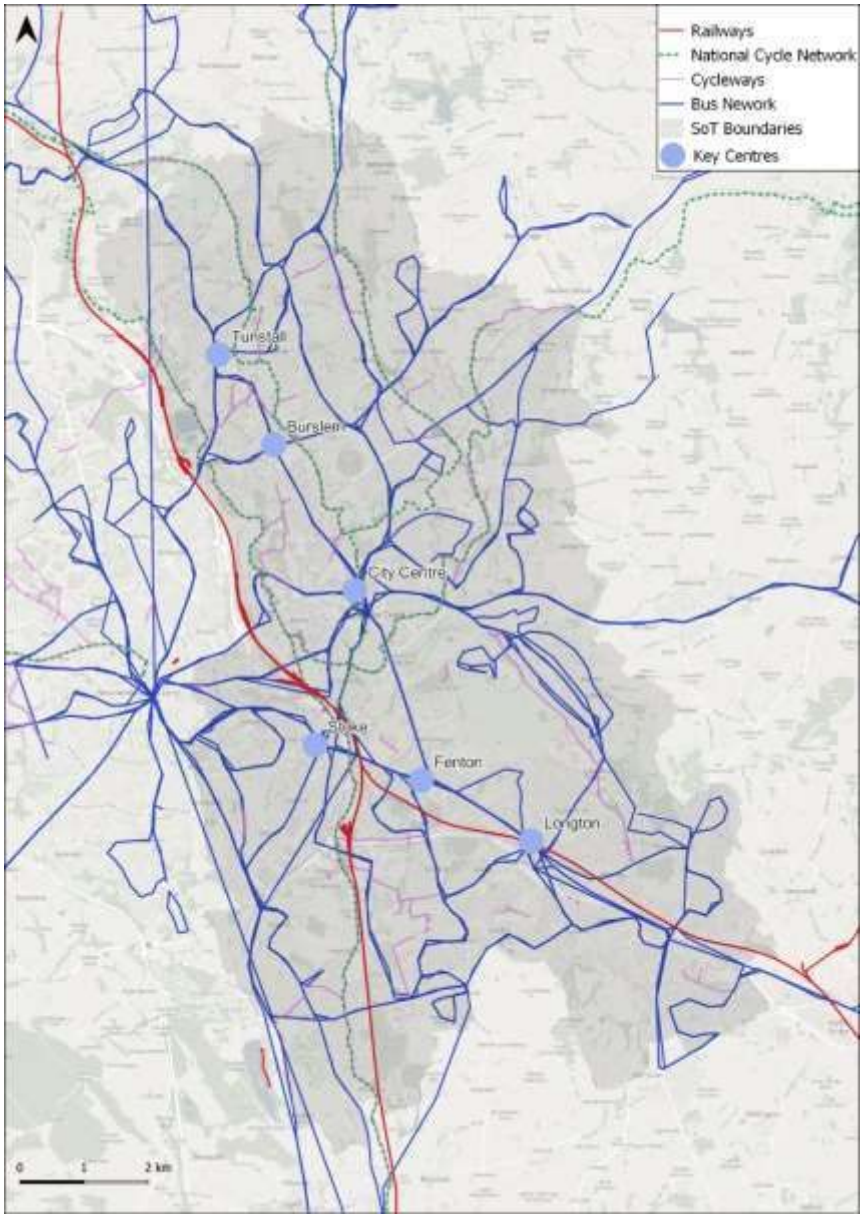


Figure 3.5 Current Stoke-on-Trent Network

This has resulted in high car dependency and limited access to the Inner Urban Core from the congested corridors of the A500, A50, A52 and A5272/A5008.

Current travel patterns and behaviours indicate that, in general terms, residents tend to work relatively close to the home location with 76% of all trips in Stoke-on-Trent and Newcastle-under-Lyme originating and ending within the main urban area. This high level of 'local' commuting plus the polycentric nature of the conurbation results in congestion and delay at junctions causing significant loss of connectivity across the urban area given the lack of alternative routes.

The scheme offers improved connectivity, and resulting agglomeration benefits, between the major urban area to surrounding town centres, and tourism assets. It also offers alternative routes and transport modes to reduce the car usage in the commonly used corridors complementing the bus network offer and its reliability. It would provide interchange potential at bus and railway stations as well as having its own VLR park and ride.

3.4.7 Bus services experience unreliable journey times

Delivering improved facilities for buses along key corridors into the City Centre and between key residential and employment areas is a priority to help encourage mode shift. However, punctuality and journey time reliability remain an issue for the bus services in Stoke-on-Trent, primarily caused by traffic congestion on major bus routes. Furthermore, the LTP refers to passenger surveys which highlight the need to improve punctuality and reliability as the top priority.

There are very limited frequent routes. The routes with less than 20 minutes frequency are serving the connection between the City Centre, Stoke-on-Trent Railway Station and Newcastle-under-Lyme and Keele University as well two routes covering two corridors north and northeast. Corridors to the south and east of the City Centre form the core bus network corridors are significantly underserved and mainly use high-traffic routes namely: A5007 City Road / King Street, A5008 Bucknall New Road to A52 Werrington Road / A5272 Dividy Road and A50 Lichfield Street / Victoria Road through the city and into the surrounding county. These congested routes lead to poor journey times between the major urban area of northern Staffordshire to surrounding towns of Leek, Ashbourne, Cheadle and Uttoxeter; as well as to tourism assets in Staffordshire such as the Peak District and Alton Towers resort. Figure 3.6 illustrates the PM peak hour bus frequency highlighting that the east and south area of the city is lacking connectivity (low bus frequency service) to the rest of the city. Areas such Bentilee, Meir, Trentham, Abbey Hulton and Baddeley Green would benefit from an additional alternative public transport mode.

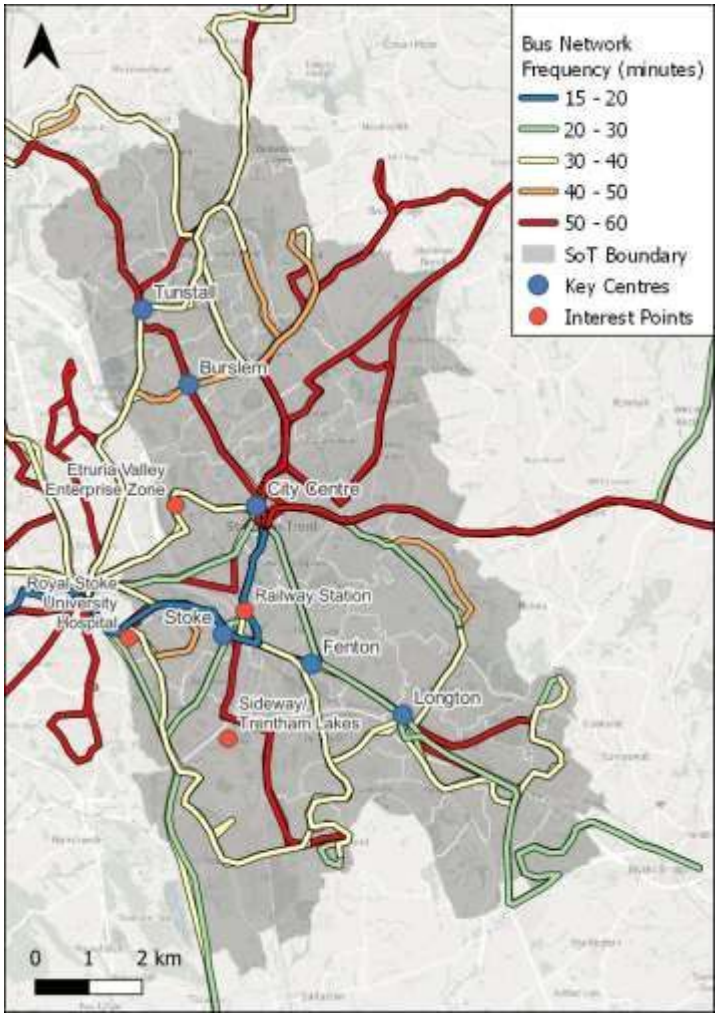


Figure 3.6 Bus Network Frequency (Peak Hour PM)

The proposed scheme is aiming to create an environment to sustain mode shift away from the private car by complementing the bus network. In that way, the reduced car traffic in the main corridors will enhance the journey time reliability of the bus services. Additionally, the VLR network will offer frequent service and multiple interchange locations to help facilitate multi-modal journeys by public and active transport and make a more integrated transport network while supporting locations with less frequent bus routes (including the problematic south and east area).

3.4.8 Future development sites constrained by network limitations

The significant potential development land in the six town centres and across a number of wider sites are constrained by the congested highway network. The current level of congestion and lack of highway capacity means many sites are unattractive to developers. The lack of 'available and viable' land was the most cited barrier to the supply of new homes in the FMB House Builders' Survey 2015-2018.

The DfT Transport Investment Strategy highlights the benefits of enhancing connectivity by adding new capability to create new links between communities and workplaces to deepen local labour markets, connect housing developments to the network or providing new routes on city and commuter networks. The document includes the HS2 example stressing the need of an integrated network to boost productivity.

The proposed scheme will address the future passenger demand for key locations by increasing connectivity between the six town centres, key employments zones and the outer urban area.

3.4.9 High levels of road traffic accidents

238 road collisions occurred in 2020 from which the 83.2% was classified as "slight" and the 16.4% as "serious". Compared to the national average (78.3% and 20.1% respectively) Stoke's serious incidents are lower, while the collisions classified as slight are higher.

13% of road traffic incidents in 2020 in Stoke-on-Trent involved cyclists, of these incidents 40% were classified as "serious", with 12% pupils travelling to/from school. The majority of these incidents occurred on A roads and at junctions.

The volume of collisions increases in the inner urban areas, with the highest concentration occurring in areas such as Etruria, Hanley and Stoke. This increased concentration of collisions in urban areas is likely to reflect the presence of more traffic, more junctions, and a higher number of vulnerable road users. Outside the main urban areas there are several locations where a high number of collisions have occurred. This includes Meir, Tunstall and Burslem.

A future increase in traffic is likely to have an adverse impact on the number of road collisions and casualties in the study area. Corridor improvement packages for specific roads could help reduce the number of road collisions and casualties.

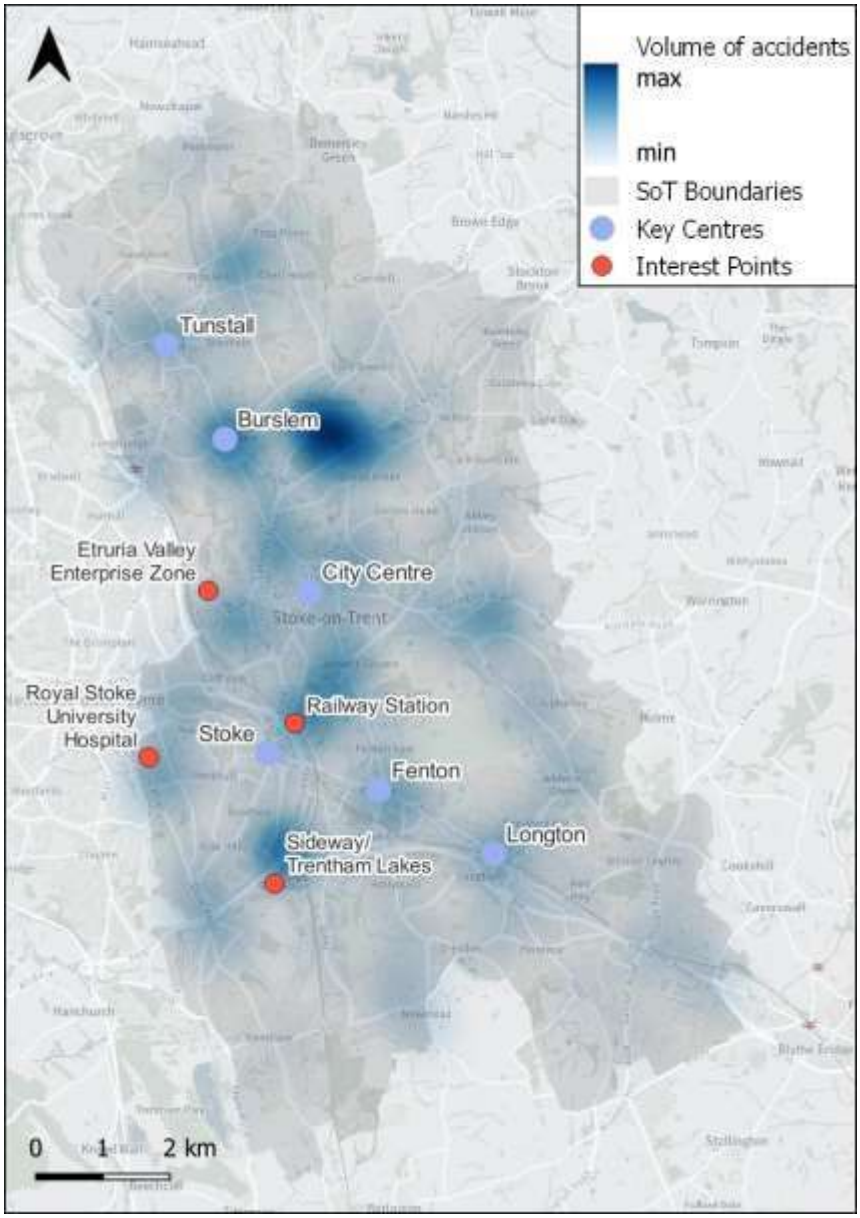


Figure 3.7 Road collision heatmap

The proposed VLR network is expected to reduce overall distances travelled in and around the Project area, and therefore reduce exposure to accident risk, leading to a net reduction in casualties. As passengers shift from using routes with higher-than-average accident rates to the new public transport alternative, further reductions will occur. The VLR routes will be designed to appropriate design standards.

3.4.10 Impact of traffic on air quality, CO_2 and greenhouse gas emissions

The scientific consensus is that increases in carbon dioxide (CO2) and other greenhouse gases are causing climate change. Other emissions, especially particulates, are associated with serious risks to health. Transport is a major source of CO2 and other emissions. Changes in the volume and type of road traffic, and the performance of the local road network will therefore have a significant impact on local air quality and the emission of greenhouse gases. By local air quality we mean the ambient air quality outside people's homes, or in areas where people spend a large amount of time. Poor air quality is caused by increased concentrations of gases such as nitrogen dioxide (NO2) or particles (PM) that are harmful to people and habitats, causing harm to health and, as a consequence of climate change, more extreme weather and flooding.

Stoke-on-Trent is an AQMA and both Stoke-on-Trent City Council and Newcastle-under-Lyme Borough Council have been ordered under Ministerial Direction to submit plans by October 2019 (subsequently revised to May 2020) to address their air quality issues. Both authorities have been given a compliance year of 2022 (subsequently revised to 2023) when plans needed to address the air quality issues need to be in place.

Figure 3.8 shows monitored NO2 exceedance locations across Stoke-on-Trent and Newcastle-under-Lyme at various levels of severity in 2017. This shows that pollution exceedance locations are generally spatially diverse, however, the map also shows that there are several exceedance points located within the project area including the intersection of A5272 Dividy Road / A52 Werrington Road, A50 Potteries Way / A5008 Bucknall New Road, A50 Potteries Way / Lichfield Street and Joiners Square roundabout as well as along the A50 Victoria Road. As can also be seen there is significant correlation between air quality exceedances and congestion problems.

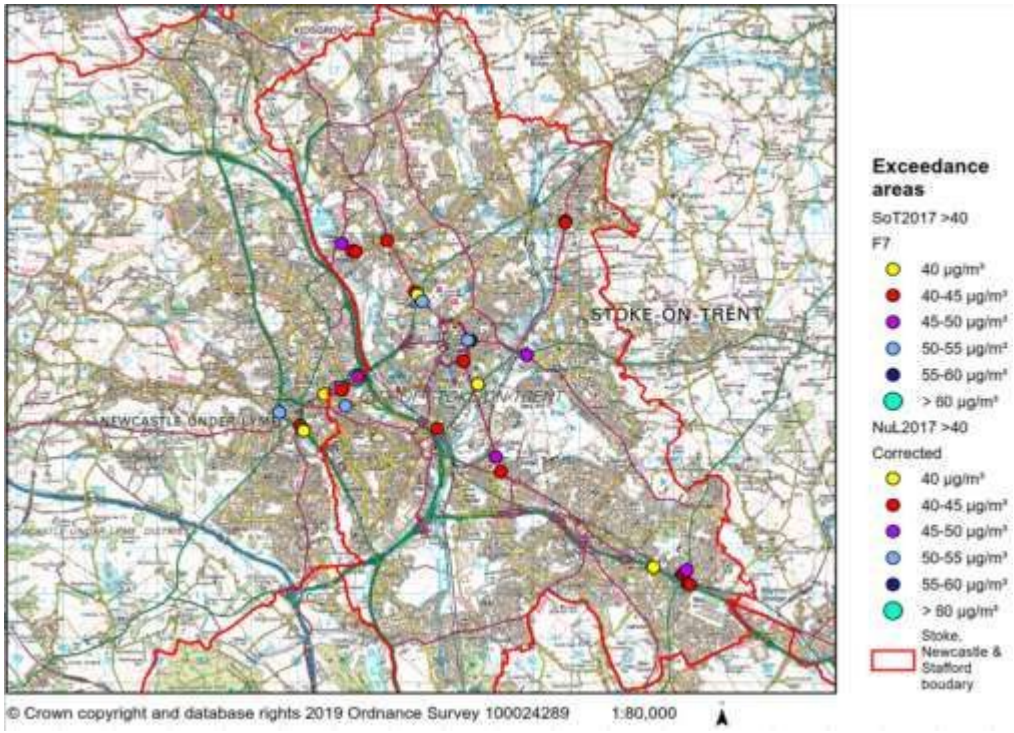


Figure 3.8 Air Quality Exceedance Areas

The scheme will have a significant impact on traffic conditions and patterns. By offering shorter, more sustainable, and reliable journeys, the scheme is expected to reduce emissions delivering significant benefits to the urban environment along existing corridors through reductions in noise and emissions from the shift of private car usage towards a sustainable transport mode as well as creating the right environment for complementing active travel (Multi-modal hub locations).

3.4.11 Lack of direct walking and cycle routes

Encouraging walking and cycling is key to achieving the goals of the LTP and helping to address challenges across the Stoke-on-Trent urban area, in particular health, air quality and access to employment.

Figure 3.9 shows the National Cycle Routes and local cycle ways which run through the district and shows how they primarily connect the centres of Tunstall, Burslem, Hanley and Stoke. There are currently no cycle paths linking to Fenton or Longton. Most cycle paths follow existing A roads and are not segregated from road traffic. There are no cycle routes which allow for direct, segregated cycle journeys between key destinations which would promote commuting by bicycle. The

topography of Stoke-on-Trent also presents a barrier to cycling particularly around Stoke and Burslem which have steep roads which may discourage journeys by bicycle.

Thus, the delivery of Stoke-on-Trent's Local Cycling and Walking Infrastructure Plan (LCWIP) is a key part of improving the active travel network, which will improve connectivity to key employment, education, retail, leisure, and healthcare opportunities and integrate with key public transport interchanges such as Stoke-on-Trent's rail and bus station to make a more integrated transport network.

It is important that cycle networks provide high quality connections between residential areas, employment areas and public transport interchanges to help facilitate multi-modal journeys by public and active transport.

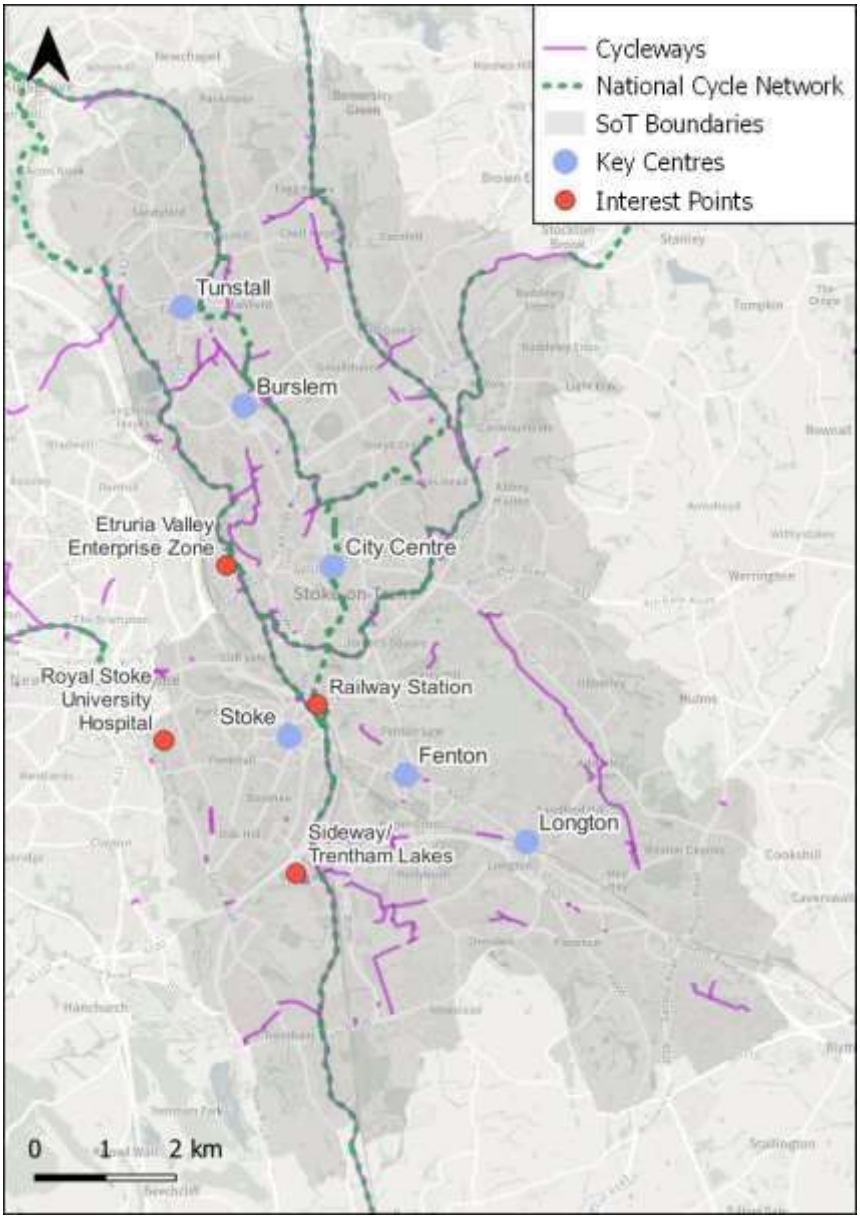


Figure 3.9 Cycling Network[7]

The VLR routes would provide connections with other transport modes such as cycling and walking on desire lines to increase cycle mode share as it would provide a direct, high-quality, and fit for

[7] Source: Staffordshire open data

purpose link between the city centre and key employment and residential areas. The VLR network would complement an active travel network, helping to promote walking and cycling to and from stops.

3.4.12 Lack of resilience in the local road network

Resilience in a transport network has been defined as "the ability to absorb shocks gracefully". It may be understood in terms of the way different components of the network work complement each other:

- Redundancy - Different components serving the same function
- Diversity - Components are functionally different
- Efficiency - Network performance is optimised
- Autonomy - Components are able to function separately
- Strength - Ability to withstand a disruptive event
- Collaboration - Information and resources shared amongst components
- Adaptability - Flexible, able to learn from past experiences
- Mobility - Ability to reach destinations with an acceptable level of service
- Safety - Exposes fewer users to hazards
- Recovery - Level of service can be restored quickly

Lack of resilience is a problem if a transport network is unable to cope with disruptive events, such as surges in demand, accidents, extreme weather conditions or road works. The more common the event, the more important it is for the network to be able to recover quickly to restore an acceptable level of service and avoid compounding the problem.

Lack of resilience is a problem in Stoke-on-Trent because of a lack of east-west connectivity; a lack of alternative routes between the City Centre and areas to the south and east of the city; the congested nature of the road network; and the multi-centred form of the urban area. The problems arise because of the frequency, or severity of the disruptive events combined with the inability of the existing network to cope and recover.

The provision of additional links would greatly increase the resilience of the local public transport network. In terms of the factors identified above, it would provide:

- Redundancy - An alternative, more direct route to key centres
- Diversity - Routes in different locations
- Efficiency - Shorter, more direct routes for many journeys
- Autonomy – One route would cover a significant amount of area
- Strength - Ability to withstand a disruptive event
- Collaboration - Complementing the bus network and the Park & Ride locations
- Adaptability - Capacity to cope with present and future demand
- Mobility – More reliable access to key centres, Ability to reach destinations with an acceptable level of service
- Safety - Designed to modern standards will reduce exposure to accident risk
- Recovery - Level of service can be restored quickly

3.5 Opportunities

The SoTCC's Transport Strategy and Delivery Plan (2022) outlines the City's current situation on different levels – People, Place, Connectivity. A summary of the strengths, weaknesses, opportunities, and challenges for the study area is outlined, highlighting the significant challenges faced due to the high levels of car dependency, poor public transport connectivity and the polycentric geography of Stoke-on-Trent.

This further provides insights on the opportunities (see Appendix. Table A-1) that the proposed scheme could focus and deliver on. Based on the SWOC analysis of Stoke-on-Trent's current situation, there is great potential for an alternative and sustainable transport mode. Key issues such as deprivation, air quality, poor connectivity and high car dependency could be tackled with a low-cost sustainable transport project with focus on connecting the project area.

Very light Rail is a public transport system that can be designed and delivered rapidly and at a lower cost than traditional rail options. Routes can be designed to utilise existing road and rail infrastructure allowing much more flexibility than traditional railway networks. Very light rail schemes are also designed to have low or zero CO2 emissions which set a great foundation to address the air quality management issue in the inner urban area due to the currently limited travel options and poor connectivity.

The routes of the very light rail will be planned to provide a comprehensive service, connecting residential areas with key destinations such as employment (Staffordshire University, Etruria Enterprise Employment Zone, Royal Stoke Hospital University) and retail centres creating attractive circumstances to expand the already existing highly skilled workforce.

The routes will also connect to key transport hubs such railway, bus stations, park & ride, and bike shares to create opportunities for interchange and to enhance the existing network and active travel options. There is great potential for modal shift due to the distances travelled by residents as well as creating an environment of hybrid working which can help to promote a decarbonised transport network.

3.6 Future Problems

3.6.1 Covid 19 Recovery

The Covid-19 Pandemic saw an arrival of a shock event that has resulted in a shift of societal and business functions. Changing mobility trends (Working from home – WfH, active travel, increased deliveries) resulted whilst the governmental restrictions were in place, and these have remained including related operational changes such as:

- Investing in IT systems to support remote working
- Expansion of capacity of home delivery services
- Contactless payment preference
- Bus services reduced in medium to long term
- Reduced local services due to closing down

3.6.1.1 Public Transport

Public Transport use was significantly reduced, and the public has been reluctant to return to its use due to the increased physical interaction required. Transport Focus's latest research from March 2022[8] found that 87% of train passengers feel safe in relation to COVID-19; however only 68% of non-rail passengers would feel safe if they had to make a rail journey and 88% of bus passengers feel safe in relation to COVID-19; however only 62% of non-bus passengers would feel safe if they had to make a rail journey.

The safety concerns expressed by non-rail and bus users is likely to be a significant barrier to encouraging mode shift and encouraging greater use of public transport. Careful consideration will need to be given to how public attitudes on the safety of travelling by rail and bus can be improved.

[8] https://d3cez36w5wymxj.cloudfront.net/wp-content/uploads/2022/03/04092502/Travel-during-Covid-19-survey-%E2%80%93-4-March-2022.pdf

3.6.1.2 *Working from Home*

The increased usage and attractiveness for work from home (WFH) has introduced new travel patterns and behaviours. Companies have established policies to support this flexibility and embrace the WfH as a choice. This would mean that the total commuting in the corridor will fall (less business travel, online meetings, less resident-work travel) leading to several future transport and development impacts:

- Significantly reduced greenhouse gas emissions from reduction in commuting. COVID-19 lockdown led to a 42% reduction in Nitrogen Dioxide levels.
- Changes to the way offices are structured, Savills found that office vacancy rate increased from 4.9% to 8.4% from early 2020 to 2021.

A reappraisal of travel habits will be required post Covid to understand what long-term impacts this will have on need for transport interventions. SoTCC should invest in more smart technology to capture changes in trends from ongoing surveys of people and vehicle movements, as well as wider metrics around air quality and economic spend in the area.

A VLR network has great potential to attract the public by offering an alternative sustainable, affordable, and reliable means of transport.

3.6.2 Congestion

Traffic levels are expected to increase from present levels over the coming years. Without intervention, the problems described in Section 2.2 will inevitably worsen.

Figure 3.10 shows the sources of link (over-capacity links) and junction (significant delays) congestion problems for the AM and PM peak hours, respectively, as derived from the NSMM transport model 2027 future year reference case model. This demonstrates that the network will experience significant congestion problems during the PM peak hours – it must be noted that the actual level of congestion experienced is likely to be significantly worse because of issues such as blocking back which will affect the operation of downstream links and junctions and result in queues and delays on these routes.

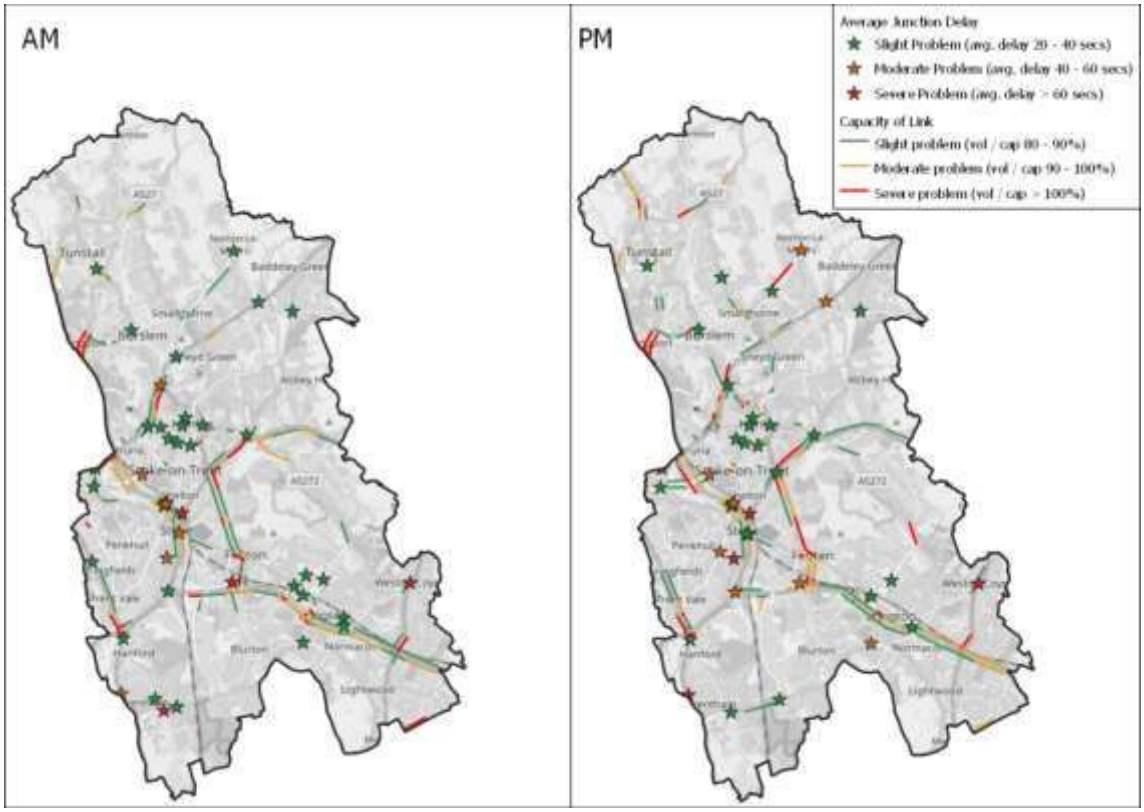


Figure 3.10 2027 AM/PM Peak – Over Capacity Links and Significant Junction Delays

These figures illustrate that a significant portion of the network are expected to experience problems and it is noted that the operation of the existing congested network as described in Section 2.2 will worsen.
As a consequence of this congestion journeys for cars, freight and buses will experience longer delays and will become less reliable. Thus, there is great opportunity for a sustainable modal shift to alleviate the highly congested corridor and shift passengers towards public transport.

3.6.3 Air Quality

As it was mentioned in section 3.4.10, air quality is one of the major issues of the project area and a concern for its future. The impact of vehicle emissions on people's health from poor air quality has become a prominent issue. Stoke-on-Trent formulated its Air Quality Action Plan (AQAP, 2014) and has set certain goals under the local authority responsibilities including:

- Reduce congestion encourage less car usage
- Traffic management improvements
- Implement corridor improvements for bus, pedestrian, and cyclist access
- Tackle local congestion problems caused by journeys to schools
- Promote safe and sustainable modes of transport
- Implement parking strategies
- Promote active travel

The steps leading to the achievement of these goals have been slow. The evidence shows that there are opportunities to invest in transport measures that help deliver improved air quality. In addition to the goals set out in the AQAP, ultra-low and zero-emission propulsion technologies and transport have an important role to play in improving air quality and decarbonising Stoke-on-Trent and the surrounding areas. Attractive alternatives to the car, such as the proposed scheme, are of the essence to achieve net zero.

3.7 Objectives

To achieve the Council's strategic aims, and in response to the opportunities and problems identified, clear objectives have been established for the scheme. In line with TAG, we have distinguished between the desired high-level or strategic outcomes, the specific or intermediate objectives, and the operational objectives

The strategic objectives are:

To facilitate economic growth through supporting development, help to deliver the Joint Local Plan, and providing a safe and efficient transport system to support existing businesses

- To improve linkages between the City Centre and the surrounding Inner Urban Core
- To improve outer urban connectivity and improve access to employment by reducing severance for all modes of travel
- Positively contribute to North Staffordshire's clean air and reduction of greenhouse gas emissions and noise
- Encourage transport choice and sustainable transport

The specific objectives are:

- Support the route to net zero through modal shift to improve local air quality and noise impacts
- To improve access to key centres and locations for employment, services, and facilities for all modes of transport
- To support development in the Inner Urban Core of Stoke-on-Trent and outer urban area of city
- Improve accessibility to current and future employment sites from areas of deprivation
- To improve journey time reliability
- To improve access for pedestrian and cycle trips on new and existing routes
- To improve resilience of the local public transport network
- Provide a high quality, rapid public transport alternative to existing car users
- Provide the basis of a public transport spine for the city with interchange with other modes at key locations
- Complement and maximise the benefits of other transport schemes and programmes in development and delivery

The operational objectives are:

- Provide a high quality, rapid public transport alternative to existing car users
- Provide the basis of a public transport spine for the city with interchange with other modes at key locations
- Reduce overall journey times and delays
- To minimise environmental impact, compulsory purchase, and demolition of residential and commercial property
- To increase the number of people that have access to the City Centre within 30 minutes travel time by public transport
- To protect the local historic environment in a manner that is appropriate to the significance of the local and national designated heritage assets
- To protect and preserve the quality of landscape and townscape through appropriate design

3.8 Measures of Success

It is important to consider from the outset what constitutes successful delivery of the objectives, as this informs the development and appraisal of the scheme, the selection of the preferred option, and the monitoring and evaluation of the scheme's performance after construction. A programme of

monitoring and evaluation will be put in place prior to construction to establish a baseline, then typically again at one-year and five-year post construction. It is envisaged that monitoring will include before and after conditions in relation to:

- Passenger demand on the corridors and compared to a non VLR control corridor
- Journey times by mode in those corridors where routes have been improved
- Passenger feedback on service quality and performance
- Operating reliability
- Stakeholder feedback

In general, it is easier to measure achievement of the objectives (e.g., changes in traffic volume or journey time) than the strategic outcomes (e.g., facilitate economic growth) because the latter often takes time to achieve and can be influenced by factors other than the proposed scheme. Further details and a monitoring and evaluation plan will be developed if the proposed interventions progress to an Outline Business Case.

3.9 Scope

3.9.1 The geographic area

Given the problems, issues and objectives identified in previous sections it is clear that any intervention(s) should aim to have a beneficial impact on the Inner Urban Core and Outer Urban Area and improve access to the City Centre, key locations and employment zones as well as enhancing connectivity in the region by linking key stops (bus, rail) to the VLR network. It should be mentioned that defining a transport network is not limited to a local authority and there are great benefits from an integrated transport system. Stoke-on-Trent and its neighbouring areas such as Newcastle-under-Lyme have already established a well-connected network due to the resident population that travel to work outside of SoT as it is demonstrated in Figure 3.11. For this reason, connectivity with the surrounding areas was considered.

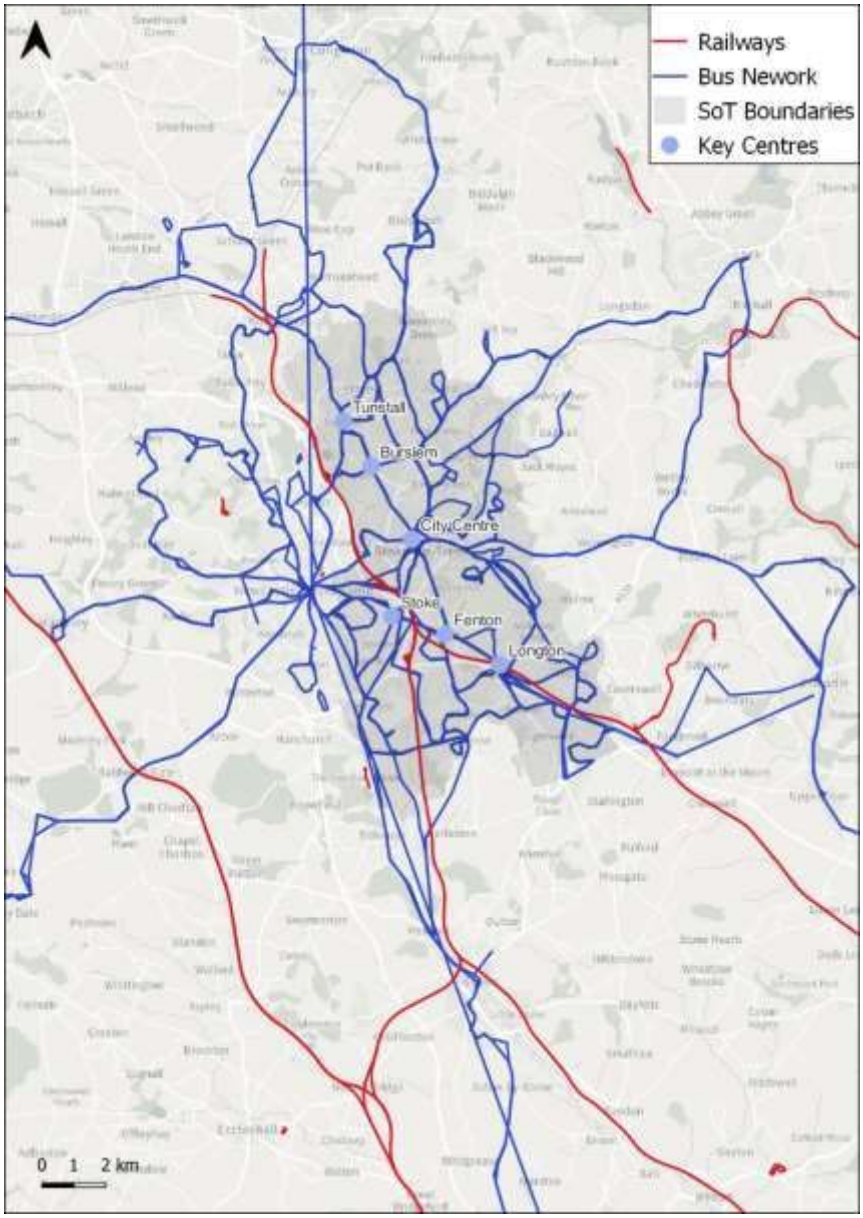


Figure 3.11 Stoke-on-Trent Bus and Railway Network connectivity

The geographic area of impact should therefore encompass the area which covers:

- Access to Stoke-on-Trent City Centre (Hanley)
- Access to key employment and residential areas such as Etruria Employment Zone, Royal Stoke Hospital University, Sideway, Trentham Lakes
- Access to Stoke-on-Trent Railway Station to enhance connectivity to the region
- Access to Newcastle-under-Lyme, Kidsgrove and Blythe Bridge
- Connectivity between all the outer urban areas (southeast, southwest, northeast, northwest)

3.9.2 VLR Network

The Very Light Rail is a concept that UK cities have been considering recently. Based on the Coventry and Bristol studies, it has been identified as the preferred option to maximise Stoke-on-Trent's potential and achieve the SoTCC's objectives and vision.

The city would benefit from an integrated public transport network (VLR, local rail and bus services). Preferred Scheme.

Options testing has been carried out between different route options, the preferred scheme for the VLR Network consists of the following elements:

- Central Line
- Northern Line
- Southern Line with three services – Full Route Service, Hospital Service and Trentham Service
- Higher Parking Charges in the City Centre
- Doubling of the rail service frequency to 2tph between Stoke and Derby

The proposed preferred option is shown in **Figure 4.1.**

3.9.3 Alternative Modes

There are alternative modes that could be explored and/or compared to a VLR network which we refer to in this section.

Bus Rapid Transit is a bus-based transport system which provides additional highway capacity to improve reliability and journey times (through road space reallocation, widening and junction improvements. This can reduce delays and enhance the reliability of the journey. Its aim is to combine speed, lower cost, and flexibility. There are a range of interpretations of what BRT constitutes in schemes across the world, from fully segregated routes with articulated hybrid vehicles, dedicated stops, to lower cost and specifications where minimal bus priority is provided.

Personal Rapid Transit is a system based on providing "podcars" (which can carry circa 4 passengers in each vehicle) on a fixed track using automated vehicles. Due to the automation these systems have to operate as closed systems, they cannot integrate with other transport modes or pedestrians for safety reasons. This type of system works well in an area of high traffic flows between multiple origins and destinations, and to date the only example in the UK links Heathrow Airport Terminal 5 to its business passenger car parks.

Both VLR and BRT systems can provide somewhat reliable and affordable journeys. It is worth mentioning that the BRT would have higher capacity than the VLR. The BRT though would continue to negatively impact the city's air quality and carbon emissions whilst the VLR would suffice as a long-term sustainable transport solution and measure to support the emergent sustainable development goals and the city's goal to reach net zero by 2050. VLR, being a rail-based mode with its associated comfort and permanence is more likely to achieve modal shift from the car compared to a bus-based alternative.

3.10 Constraints

3.10.1 Introduction

The following constraints have been considered:

- Physical
- Environmental
- Financial
- Contractual
- Public and stakeholder acceptability

Each of these is discussed in sections 3.11.2 to 3.11.6.

3.10.2 Physical

The main physical constraints are:

- The topography of Stoke-on-Trent consists of areas with high elevation. This could be problematic for the feasibility of the operation of a very light rail network.
- The need to acquire land due to the need for depot.
- The potential flooding zone associated with the River Trent and Causley Brook
- There are Public Rights of Way (PROW) that any route will likely cross

3.10.3 Environmental constraints

Environmental constraints will be detailed in an Environmental Options Assessment Report as part of future scheme development.

3.10.4 Financial Constraints

The Council does not have the resources to deliver the VLR without funding support from external parties, with the most likely source being the DfT. SoTCC will partially contribute to advancing the scheme through the business case process. Further work would be needed regarding looking at funding gaps between public transport revenue (bus and VLR) and operating costs.

3.10.5 Contractual constraints

The Commercial Case describes the type of procurement route proposed for the delivery of the scheme.. There are no existing contractual constraints which would inhibit delivery of the scheme however further work is needed in this area.

3.10.6 Public and stakeholder acceptability constraints

There are also constraints to consider regarding the public and wider stakeholders. This would include National Highways, local residents (through local residential groups and committees), affected landowners, businesses and bus operators, as well as the general public.

To date, consultation on the delivery of the VLR has not taken place. Future engagement and consultation activities will ensure all stakeholders have a voice that is heard, allowing concerns to be addressed at an early stage to ensure a successful outcome.

3.11 Consultation

3.11.1 Stakeholders' engagement

Stakeholders have a crucial role in the successful delivery of the scheme. Effective engagement and consultation give all stakeholder groups a voice that is heard and allows concerns to be addressed at an early stage to ensure a successful outcome. The stakeholder engagement process will provide further evidence of the strong local and political support for the VLR project.

SoTCC will build on engagement undertaken to date and stakeholders will continue to be involved throughout the development and delivery of the scheme. A Stakeholder Management Plan will be developed as part of the wider Engagement, Consultation and Communication Strategy for the scheme which would be produced at OBC stage.

3.11.2 Public and stakeholder support

Consultation on the delivery of the VLR is yet to be planned and formed after the finalisation of the SOC development.

3.12 Options

3.12.1 Introduction

As part of the scheme assessment process, an Option Appraisal will be developed, setting out the VLR routes options considered for the delivery of the project. These options have been developed and assessed and have been included within this SOC.

3.12.2 Option generation & assessment

The proposed scheme has been identified only after consideration of a wide range of options. An initial long list of potential routes was drawn up as shown in Figure 3.12, and these have been, sifted, refined, and evaluated to ensure that the proposed routes are the best possible option (see **Figure 4.1**).

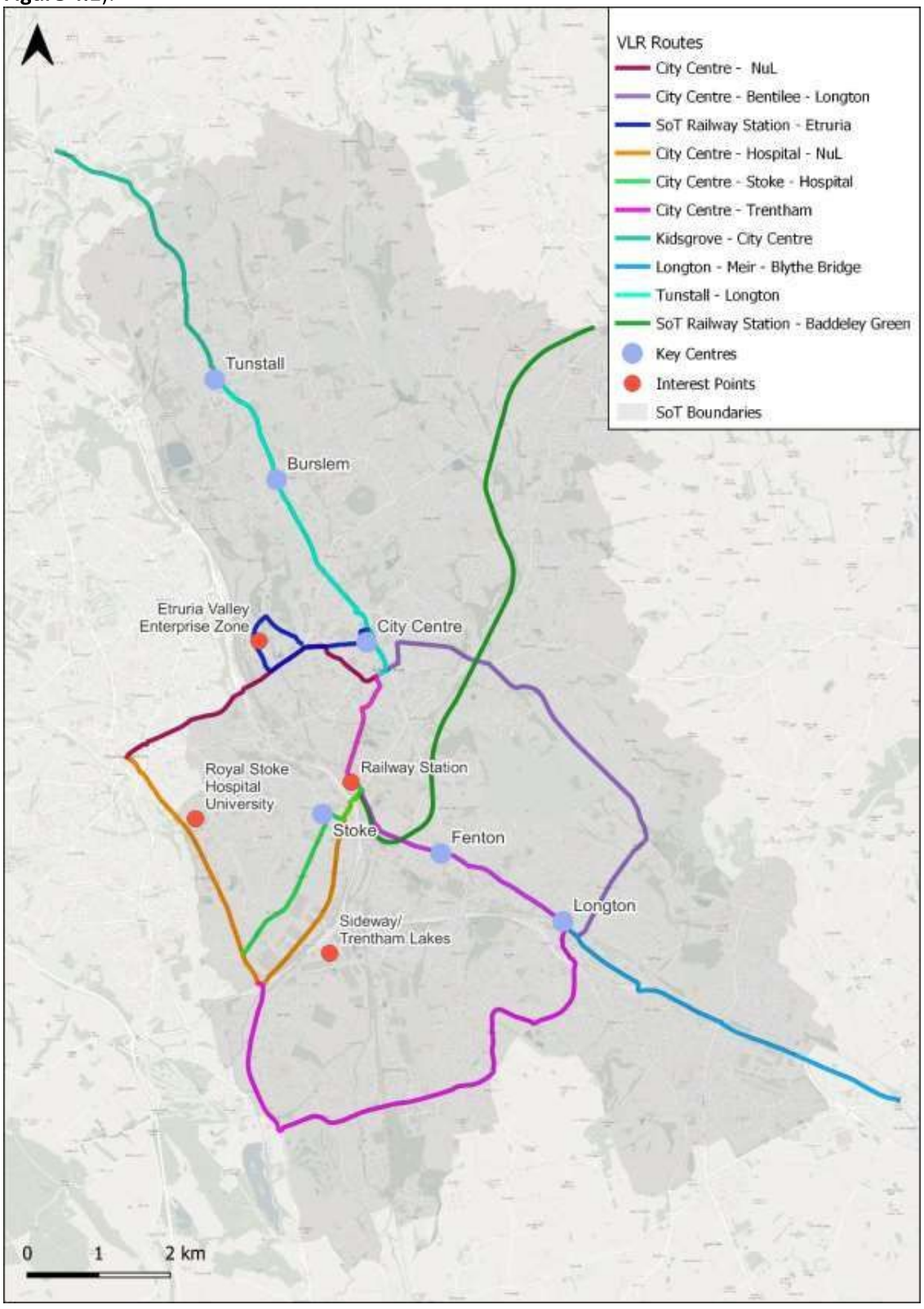


Figure 3.12 Initial Long List of VLR Route Options

After consultation with the client, the decision-making process for VLR has been informed using a ranking method. A total of ten routes were evaluated by using multicriteria analysis which can be found in detail in Appendix C. A total of 13 criteria have been selected, which cover key aspects of the project impacts, including social, economic, environmental, transportation and construction related criteria. At this stage, each criterion has been treated as equally important in the scoring, no weightings have been applied. This process will be detailed in the Options Appraisal section. The additional route options have therefore been scored and sifted to allow for the inclusion of these options within this SOC.

The 13 criteria are:

1. Route Gradient (0-5% -Low, 5-10% Medium, above 10% - High).
2. Population Density: Successful rapid transit routes/schemes have demand distributed along the route in addition to end to end trips.
3. Index of Multiple Deprivation areas: National and local economic and transport policy to improve accessibility from those suffering economic and transport poverty.
4. Number of lanes, length of route and number of junctions: High capacity is a key constraint when proposing a new fixed rail mode due to impact on congestion and delays and potential costs to mitigate traffic disbenefits.
5. Length of route: From a construction and delivery perspective a shorter route may perform better, as indicated by Coventry plans for a short demonstrator route initially.
6. Expected impact on mode shift by car users: Identifying areas with low car ownership who may be a captive market as well as locations with higher-than-average car ownership which have the potential for modal shift.
7. Bus Network Commercial Impact.
8. Predicted employment density in 2027: including uncertainty log data provided by SoTCC. this allows us to include a measure of economic growth.
9. Level of disruption to road traffic: based on Google Map traffic conditions in the PM peak hour.
10. Accessibility to railway stations: this is a measure of regional and national connectivity to prioritise routes which provide good interchange with the rail network.
11. Accessibility to proposed park & ride locations: a measure to reflect where car to VLR interchange could lead to benefits and modal shift.
12. Accessibility to proposed MMH locations.
13. Political support based on input from SoTCC (positive, neutral, and negative). Based on our discussions with officers and deputy leader of the council.

The total score and the resulting ranking for each route are shown in the table below, followed by a short description of the five best routes.

Route Line	Route Name	Total Score	Rank
1	Kidsgrove - City Centre	2.46	10
2	Tunstall - Longton	3.38	3
3	City Centre - Hospital to NuL	3.31	4
4	City Centre - NuL	2.77	9
5	City Centre - Bentilee - Longton	3.31	4
6	City Centre - Longton - Trentham	3.54	1
7	Longton - Meir - Blythe Bridge	2.92	7
8	City Centre - Etruria - SoT Railway Station	3.46	2
9	City Centre - Hospital (London Rd) - NuL	2.92	7
10	SoT Railway Station - Baddeley Green	3.31	4

Table 3.1 Total Route Score and Ranking

Route 6 (City Centre - Longton – Trentham) received the highest score (3.54), mainly as a result of favourable access to railway stations and park and ride locations, political support and a good route topology.

Route 8 (City Centre - Etruria - SoT Railway Station) received the second highest score (3.46) due to providing good access to jobs and service, relative ease of construction and access to SoT railway station. Route 8 is also recommended as a pilot scheme for the system, as it is a relatively short route.

Route 2 (Tunstall - Longton) received the third highest score (3.38) as a result of good access to SoT railway station and park and ride locations, good access to jobs and services, and political support.

Route 3 (City Centre - Hospital to NuL) received the fourth highest score (3.31) due to relative ease of construction, access to SoT railway station, and good access to services, such as the hospital.

Route 5 (City Centre - Bentilee - Longton) received the fourth highest score (3.31) and is tied with Route 3, thanks to relative ease of construction, access to park and ride locations, and relatively low level of disruption to car traffic.

Route 10 (SoT Railway Station – Baddeley Green) also received the fourth highest score (3.31) and is tied with Route 3 and Route 5 due to the high feasibility of construction, low traffic disruption and low bus network commercial impact.

The above routes are recommended for detailed analysis through multi modal modelling using the North Staffordshire Strategic Model. The routes comprise a logical and comprehensive public transport system.

The remaining routes (Route 1, 4, 7 and 9) are not recommended for further analysis.

The six best scoring routes for Stoke-on-Trent City Council rapid transit system were taken further to an initial demand analysis through multi-modal modelling using the North Staffordshire Strategic Model and based on the demand outputs and consultation with SoTCC, we have combined them into three proposed lines:

- **Northern Line** : Route 2
- **Central Line** : combination of Route 8 and Route 5
- **Southern Line** : combination of Route 6 and Route 3 with start/end at the SoT Railway Station and three service options as described below.

Three service options can operate on the Southern Line (using same track):
Full route : SoT Railway Station - Longton – Trentham – Hospital - NuL
Hospital : SoT Railway Station – Hospital - NuL
Trentham : SoT Railway Station – Longton – Trentham – SoT Railway Station

4 Economic Case

The Economic Case provides evidence of how the scheme is predicted to perform, in relation to its stated objectives, identified problems and targeted outcomes. The Economic Case determines if the proposed VLR Network is a viable investment through the common appraisal criteria used to determine the scheme's economic worth and value for money (VfM).

4.1 Options Appraisal

The Strategic Case of this SOC has presented the key issues that Stoke-on-Trent is facing. The provision of a VLR network will have a significant and beneficial impact on the journey times in the city, and this will give rise to a range of benefits, helping to deliver the scheme's objectives.
The strategic case further provides a longlist of options that have been considered as part of the optioneering process. A summary of the short list of options which have been considered for more detailed options appraisal are presented below:

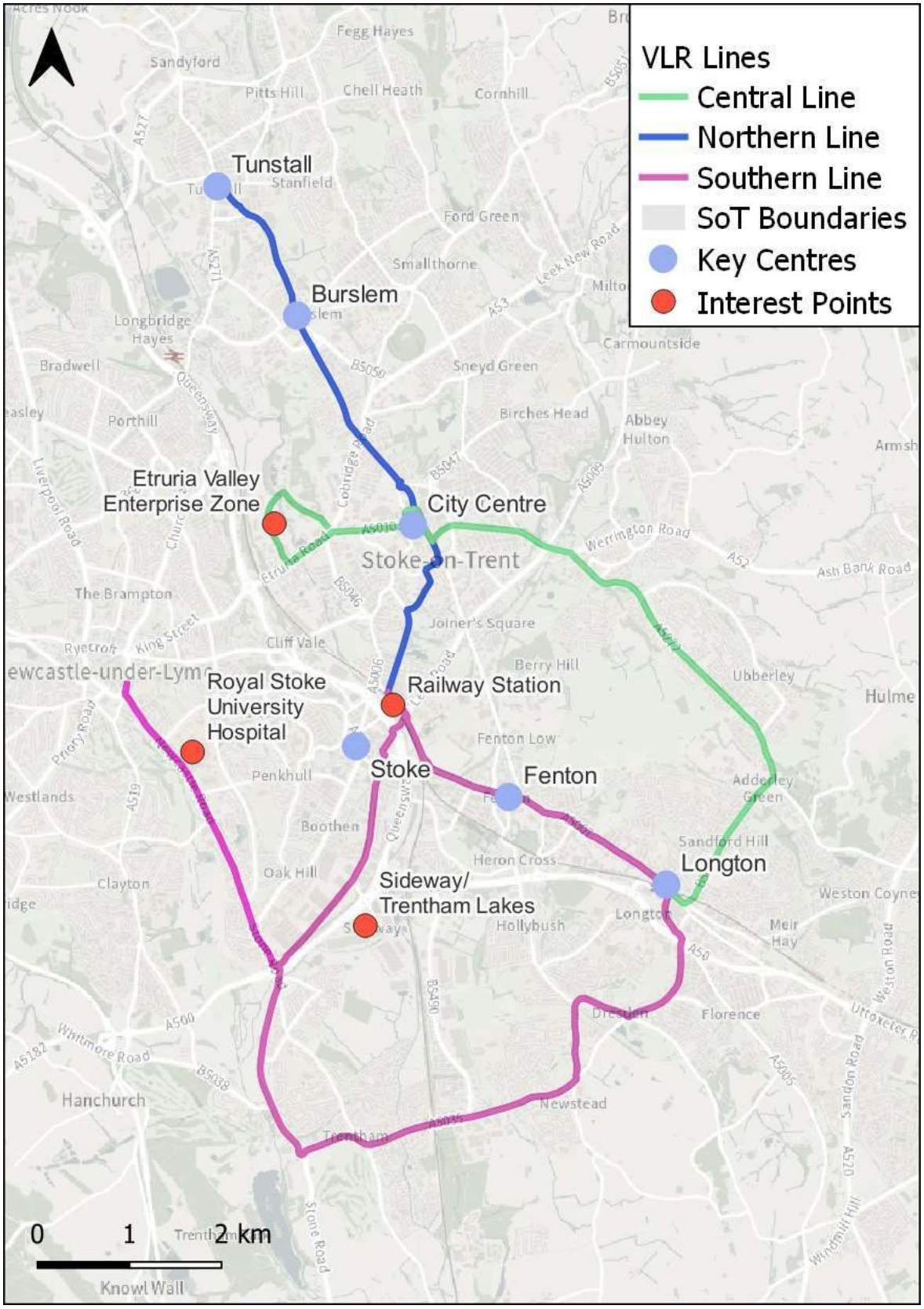


Figure 4.1 Short list of VLR Route Options

This constitutes the Preferred Option and includes the Northern, Central and Southern lines which aim to provide connectivity and accessibility across Stoke-on-Trent, including to key employment

zones and centres. As mentioned, the Southern Line is further divided into three separate services – Full Route Service, Hospital Route Service, Trentham Route Service.

The above network has been taken further for modelling and assessed under two Do-something scenarios:

- **DS Scenario A**: VLR network with reduced frequencies on parallel / competing bus services
- **DS Scenario B**: VLR network with doubled parking charges in the City Centre and doubling of rail service frequencies between Derby and Stoke-on-Trent (in both directions).

Although the network has been assessed altogether, demand forecasting and modal shift analysis for each line has been explored further to identify a phased delivery programme which will be presented in the upcoming sections.

4.2 Assessment Approach

The NSMM Transport Model

The NSMM transport model has been created to allow the impact of proposed planning and infrastructure developments to be forecast. The transport model has been developed in accordance with appropriate TAG guidance and has been used to inform the design and appraisal of the VLR Project.

The NSMM transport model has been developed entirely in CUBE Voyager and covers the whole of the urban areas of Stoke-on-Trent and Newcastle-Under-Lyme with both road and public transport (bus and rail services) modelled.

The modelling suite consists of the following three main modules:

- Highway Assignment Model
- Public Transport Assignment Model
- Variable Demand Model

The modelled time periods are as follows:

- AM Peak-Hour (08:00 - 09:00hrs)
- Inter-Peak Hour (14:00 - 15:00hrs)
- PM Peak-Hour (17:00 - 18:00hrs)

For traffic forecasting, the NSMM transport model splits the modelled traffic flows into different vehicle categories and journey purposes. The future year highway trip matrices consist of three vehicle type and journey purpose combinations ('User Classes') as follows:

- User Class 1: Car, all purposes, all person-types
- User Class 2: Light Goods Vehicles (LGVs), business, all person-types
- User Class 3: Heavy Goods Vehicles (HGVs/OGVs), business, all person-types

NSMM Transport Model Update

For the purpose of this SOC, the modelling undertaken is based on a 2015 calibrated and validated base year model, which was updated from 2009 for the modelling to inform the Business Case for the Etruria Valley Link Road (EVLR) Project. This required new data collection and recalibration and validation of the NSMM model including the demand and highway assignment models. More

information can be found in the appended reports. Given the timeframes for this work and that it is at the SOC stage, there was not time to further update the NSMM model although clearly an update will be undertaken as the project progresses and would be outlined in an Appraisal Specification Report.

For this SOC the future year reference case models come from the EVLR Project work, which have been used as a starting point for the transport modelling of options, which include committed schemes and developments as per TAG Unit M4. Therefore, the results presented offer a high-level assessment that was used to inform decisions during this initial feasibility stage of the project.

4.3 Demand Analysis

Following the transport modelling work, demand analysis of the forecasts has been undertaken for each line (both directions) and time period (AM, IP, PM). The demand analysis shows the maximum hourly VLR patronage for each direction of the line and could help inform a phased delivery plan of the VLR Network, which could be further examined in the future.

Tables 4.1 and 4.2 below show the demand for each of the DS scenarios for the morning peak. In both scenarios, the Northern Line has the greatest demand measured by the maximum two-way total volume (AM Peak), followed by the Central Line and the Hospital Service of the Southern Line.

This could potentially suggest a phased delivery plan as follows:

- Phase 1: Northern Line
- Phase 2: Central Line
- Phase 3: Southern Line – Hospital Service (3A)
- Phase 4: Southern Line – Full Route (3) and Trentham Service (3B)

VLR Route	Route Description	Max Hourly Patronage	2-way sum max hourly patronage
1 Northern Line NB	Tunstall - City Centre - Station - Longton	1216	2150
1 Northern Line SB		934	
2 Central Line EB	Etruria - City Centre - Bentilee - Longton	459	1184
2 Central Line WB		725	
3 Southern Line NB	Station - Longton - Trentham - Hospital	249	606
3 Southern Line SB		357	
3A Southern Line NB	Station – Hospital	431	1076
3A Southern Line SB		645	
3B Southern Line EB	Station - Longton - Trentham - Station	133	464
3B Southern Line WB		331	

Table 4.1 DS Scenario A AM Demand

VLR Route	Route Description	Max Hourly Patronage	2-way sum max hourly patronage
1 Northern Line NB	Tunstall - City Centre - Station - Longton	1313	2282
1 Northern Line SB		969	
2 Central Line EB	Etruria - City Centre - Bentilee - Longton	444	1241
2 Central Line WB		797	
3 Southern Line NB	Station - Longton - Trentham - Hospital	241	593
3 Southern Line SB		352	

3A Southern Line NB	Station - Hospital	431	1069
3A Southern Line SB		638	
3B Southern Line EB	Station - Longton - Trentham - Station	130	464
3B Southern Line WB		334	

Table 4.2 DS Scenario B AM Demand

4.4 Modal Shift Analysis

Table 4.3 shows the mode spilt between Car and Public Transport (PT) for the reference case and the two DS scenarios. With the introduction of the VLR network a 3% modal shift from car to public transport is achieved for all trips within Stoke-on-Trent. This climbs to a 5% modal shift with the doubling of parking charges in the city centre and the introduction of a more frequent Stoke-Derby rail passenger service in scenario B.

Additionally, we have examined the modal split for specific key origin-destination movements that would be most affected by the introduction of the new VLR network.

The modal shift is more pronounced with the VLR Network for certain corridors, with the car mode split for trips between Tunstall and the City Centre and Trentham and Newcastle-under-Lyme town centre approximately halving in the morning peak. There is an overall modal shift towards public transport in both scenarios. A more detailed breakdown of the modal spilt by route and corridor is given in Table 4.4.

Stoke-on-Trent	**Reference Case**		**DS Scenario A**		**DS Scenario B**	
	CAR	PT	CAR	PT	CAR	PT
	80.2%	19.8%	77.2%	22.8%	75.7%	24.3%

Table 4.3 Aggregate modal shift for both DS Scenario A and DS Scenario B

Corridor Mode 2027		**Reference Case**		**DS Scenario A**		**DS Scenario B**	
		CAR	PT	CAR	PT	CAR	PT
Northern Line							
Longton	Stoke	73%	27%	63%	37%	64%	36%
Longton	City Centre	61%	39%	63%	37%	44%	56%
Stoke	City Centre	75%	25%	69%	31%	24%	76%
Tunstall	City Centre	53%	47%	28%	72%	18%	82%
Tunstall	Stoke	83%	17%	67%	33%	68%	32%
Longton	Tunstall	81%	19%	79%	21%	80%	20%
Burslem	City Centre	65%	35%	58%	42%	17%	83%
Fenton	Longton	76%	24%	71%	29%	72%	28%
Fenton	City Centre	56%	44%	47%	53%	21%	79%
Central Line							
Etruria	City Centre	90%	10%	87%	13%	48%	52%
City Centre	Bentilee	85%	15%	74%	26%	54%	46%
Bentilee	Etruria	84%	16%	65%	35%	65%	35%
Bentilee	Longton	69%	31%	56%	44%	57%	43%
Longton	Etruria	90%	10%	85%	15%	86%	14%
Southern Line							
Trentham	City Centre	79%	21%	69%	31%	58%	42%
Trentham	Longton	85%	15%	76%	24%	77%	23%
Trentham	Stoke	77%	23%	58%	42%	59%	41%

Trentham	Fenton	94%	6%	92%	8%	92%	8%
Trentham	Hospital	56%	44%	60%	40%	61%	39%
Trentham	NuL	42%	58%	17%	83%	18%	82%
NuL	Hospital	96%	4%	95%	5%	95%	5%
NuL	City Centre	95%	5%	87%	13%	88%	12%
NuL	Stoke	95%	5%	85%	15%	85%	15%
City Centre	Hospital	100%	0%	99%	1%	99%	1%
NuL	Longton	96%	4%	94%	6%	94%	6%

Table 4.4 Modal shift by Route

4.5 Economic Appraisal Approach

This economic assessment has been carried out using standard procedures and economic parameters as defined in TAG Unit A.1.1 – Cost-Benefit Analysis (July 2021) to quantify and monetise the costs and impacts of the VLR Project where appropriate. All present values reported in this economic case are in 2010 prices, discounted over a 60-year appraisal period to 2010 and are quoted in the market price unit of account, unless otherwise stated.

The appraisal of the road user journey time impacts – (i.e. changes in travel time and vehicle operating costs) - has been undertaken using the DfT's Transport User Benefit Assessment (TUBA) software package, based on volume, time and distance matrix information output from the NSMM transport model. Public transport user time impacts have been quantified due to changes in travel time as a result of the proposed scheme. Fare and operator revenue have been captured outside of TUBA.

Elements that are not able to be quantified at the SOC stage include:

- Construction & maintenance impacts – impacts on road user travel time and vehicle operating costs during scheme construction.
- Noise and air quality impacts
- Static and dynamic wider economic impacts
- Greenhouse gas impacts (Including embodied carbon impacts arising from construction)
- Social and distributional impacts

These elements would be further assessed qualitatively with the intention to quantify where possible at the Outline Business Case stage.

4.6 Economic Appraisal Inputs and Assumptions

Level 1 Benefits

TUBA

TUBA provides a complete set of default economic parameters in its standard economics file, including values for variables such as values of time, vehicle operating cost data, tax rates and economic growth rates as set out within the TAG Databook. TUBA v1.9.17 has been used along with the latest economics parameter file (v1.18) which is aligned to the May 2022 TAG Databook.

The scheme related parameters in the TUBA scheme file were largely determined by the parameters used in the forecasting model, namely:

- Current appraisal year - 2022
- First year – 2031 (scheme opening year)
- Design year – 2046 in TUBA (2027 input matrices used for the TUBA appraisal)

- Last year – 2090 (60 years from opening year)

The TUBA software has default time periods (time slices) built into the economics file shown as below:

- AM Period (weekday 07:00 - 10:00 hrs)
- IP Period (weekday 10:00 - 16:00 hrs)
- PM Period (weekday 16:00 - 19:00 hrs)

TUBA requires that any modelled time periods are converted to TUBA time periods and then annualized in order to calculate the benefits/costs across an entire year. Appropriate expansion factors have been derived to convert the modelled peak hour time periods of the NSMM transport model to the above time slices. The derived expansion factors were converted to annualization factors based on the assumption that there are 365 days per year. The resultant annualization factors are summarised in **Error! Reference source not found.**Table 4.5 and 4.6.

It is emphasised that the predicted benefits of the VLR Project are likely to be underestimated as they do not include any potential benefits that will accrue during any weekend periods.

Period	Modelled Peak Hour	TUBA Time Period	Hour to Period Factor	Annualization Factor
Weekday AM	08:00–09:00hrs	07:00–10:00hrs	2.13	1403
Weekday Inter-Peak	14:00–15:00hrs	10:00–16:00hrs	8.65	3157
Weekday PM	17:00–18:00hrs	16:00-19:00hrs	2.4	876

Table 4.5 Annualization Factors for TUBA Time Slices – Highways TUBA assessment

Period	Modelled Peak Hour	TUBA Time Period	Hour to Period Factor	Annualization Factor
Weekday AM	08:00–09:00hrs	07:00–10:00hrs	2.74	1000
Weekday Inter-Peak	14:00–15:00hrs	10:00–16:00hrs	7.14	2606
Weekday PM	17:00–18:00hrs	16:00-19:00hrs	2.77	1011

Table 4.6 Annualization Factors for TUBA Time Slices – Public transport TUBA assessment

For the purpose of carrying out the economic assessment, the modelled user classes were further disaggregated by trip purpose for both public transport and highway user classes. The split of trips between purpose for Cars, Bus, Light and Heavy Rail (business, commuting and other) and LGVs (personal and freight) for all time periods were based on the default proportion split as per Table A1.3.4 of the TAG Data Book. The split of trips between OGV1 and OGV2 were based on local count data. Vehicle occupancies were also based on TUBA default values for all vehicle types. The following user classes for highways and public transport were therefore used in the TUBA assessment.

Public transport user classes:

- User Class 1 – Bus Business
- User Class 2 – Bus Commute
- User Class 3 – Bus Other
- User Class 4 – Light Rail Business
- User Class 5 – Light Rail Commute

- User Class 6 – Light Rail Other
- User Class 7 – Heavy Rail Business
- User Class 8- Heavy Rail Commute
- User Class 9- Heavy Rail Other

Highways user classes:

- User Class 1 – Car business
- User Class 2 – Car Commute
- User Class 3 – Car Other
- User Class 4 – LGV Freight
- User Class 5 – LGV Personal
- User Class 6 – OGV1
  User Class 7 – OGV2

The following transport model scenarios have been modelled for each of the forecast years:

- Do-Minimum Networks – these take account of proposed transport schemes which are expected to be completed by each forecast year
- Do-Something Networks – these are the same as the relevant Do-Minimum networks but include the VLR Project and associated mitigation and other improvement measures.
- Two DS scenarios have been appraised within TUBA as follows:
  - DS scenario A – Introduction of the VLR scheme
  - DS scenario B – Introduction of the VLR scheme + Increased parking charges + doubled frequency of main rail line between Stoke and Derby

4.7 Economic Appraisal Results

4.7.1 Journey Time Benefits

Journey time savings have been assessed in the study area. The public transport and highway benefits by sub-mode are displayed below for both the DS scenario A and DS scenario B in millions of GBP.

User class	Purpose	Grand Total, £million
Public Transport		
Bus	Business	£13.05
	Commuting	£119.58
	Other	£275.32
Light Rail	Business	£49.32
	Commuting	£392.54
	Other	£328.49
Heavy rail	Business	£1.84
	Commuting	£3.58
	Other	£4.46
Highway		
Car	Business	-£8.39
	Commuting	-£11.28
	Other	-£30.88
LGV	Personal	-£8.20
	Freight	-£1.21
OGV1	Business	-£0.49
OGV2	Business	-£1.09

Grand Total		£1,126.64

Table 4.7 DS scenario A - Journey time benefits by sub-mode

User class	Purpose	Grand Total, £million
Public Transport		
Bus	Business	£14.04
	Commuting	£127.21
	Other	£296.96
Light Rail	Business	£50.76
	Commuting	£403.94
	Other	£337.71
Heavy rail	Business	£0.88
	Commuting	£1.92
	Other	£2.08
Highway		
Car	Business	-£9.06
	Commuting	-£12.62
	Other	-£32.51
LGV	Personal	-£10.22
	Freight	-£1.49
OGV1	Business	-£0.62
OGV2	Business	-£1.35
Grand Total		£1,167.63

Table 4.8 DS scenario B - Journey time benefits by sub-mode

4.7.2 Value for Money Assessment

The VLR proposed scheme is expected to improve journey times particularly for public transport users around the area and on the wider network. The added provision of interchange options with improved walking and cycling facilities, bus and park & ride options will further help to create a more liveable area that has a healthier and more productive workforce who can access key destinations within Stoke-on-Trent without the private vehicle. All together the proposed improvements with the VLR scheme will help to regenerate local areas and boost the economy whilst providing sustainable modes of transport.

Error! Reference source not found. below shows the benefits and costs of scenario A and B of the VLR scheme. It can be seen the proposed scheme under Scenario A generates a present value of benefits (PVB) of £655.33 million and a present value of costs (PVC) of £652.94 million and under Scenario B a present value of benefits (PVB) of £753.17 million and a present value of costs (PVC) of £555.97 million.

Based on the Net Present Value (NPV), Scenario B would be the preferred option of the VLR scheme, meaning a VLR network with doubled parking charges in the City Centre and doubling of rail service frequencies between Derby and Stoke-on-Trent (in both directions).

Analysis of Monetised Costs and Benefits Table, £millions		
Item	**Scenario A**	**Scenario B**
User Benefits		
Economic efficiency: consumer users (commuting)	£373.19	£347.99
Economic efficiency: consumer users (other)	£568.05	£595.65
Economic efficiency: business users and providers	-£285.91	-£190.47
Wider Public Finance (indirect taxation)	£0.000	£0.00
Present Value of Benefits	**£655.33**	**£753.17**
Broad Transport Budget		
Revenue	-£292.84	-£389.81
Operating costs	£615.67	£615.67
Investment costs	£330.11	£330.11
Broad transport budget present value of costs (PVC)	**£652.94**	**£555.97**
Net present value (NPV)	**2.39**	**197.20**
Benefit Cost Ratio	**1.00**	**1.35**

Table 4.9 Analysis of Monetised Costs and Benefits

It must be noted that there are a wide range of potential but important monetised and non-monetised impacts have not yet been appraised at this initial stage, and these include:

- Environmental impacts, including greenhouse gas emissions including whole life carbon impacts, air quality and noise - Following the introduction of the VLR Network scheme, it is forecast that there will be modal shift across key / sensitive areas of the network. This is likely to reduce not only air pollution in the area, but also limit noise pollution too. In addition, as an alternative to car, emission-free option it will improve the overall air quality of the area and health of the residents
- Wider economic impacts - Journey time savings will lead to a bigger more productive labour force that will produce significant additional economic output for Stoke-on-Trent.
- Accident savings – safety benefits generated due to mode shift from car to public transport
- Journey time reliability – more reliable journeys by both public transport and car due reduced congestion
- Social and distributional impacts - Through the implementation of the scheme, there will be improvement in accessibility and connectivity in peripheral and deprived areas of Stoke-on-Trent, especially to key centres and employment zones. The social and distributional indicators are not likely to be adversely affected but there is the potential to give all vulnerable groups equal opportunity to experience the benefits that the scheme brings.
- Active modes – Create a more liveable area that has a healthier more productive workforce that can access key destinations without the private vehicle.

The above impacts would have significant positive impacts and will be assessed as the scheme progresses through the next stage of the business case development.

5 Financial Case

5.1 Introduction

The Financial Case focuses on the affordability of the VLR network proposal through an assessment of scheme costs and funding arrangement.

5.2 Scheme Costs & Operating and Maintenance costs

A high-level estimation of scheme's capital expenditure and operational and maintenance (O&M) costs have been made in absence of any detailed cost information, due to the proposed intervention being at a very initial stage. These estimates are based assumptions and methodology adopted from a similar scheme (Coventry Light Rail system) to estimate costs (see Appendix D - Methodology).

The high-level scheme's capital expenditure/investment cost is approximately £415m (outturn costs in 2022 prices) and this covers the whole VLR Network (i.e. all three lines – Northern, Central and Southern). This assumption is based on a £10m per km expenditure for a total network length of 40km. However, this will be updated as the scheme progresses/develops through next stages of the business case development.

Operational and maintenance costs which include lifecycle asset replacement over 30 years, mobilisation costs and an overall operating and maintenance costs over 60-year is estimated to be around £3.25billion. It is estimated the VLR operating costs will be covered by VLR fare revenue.

However, when total local public transport fare revenue (VLR + bus) is considered following the introduction of VLR, allowing for a reduction in bus fare revenue, given passenger abstraction onto the VLR, there is a funding gap between revenue and operating costs. Further work would be needed to look at options which could consider changes to the bus network through a bus franchising arrangement, additional revenue generation through advertisements on VLR vehicles and stops and potential exploration of other revenue streams such as a workplace parking levy as implemented in Nottingham, which is used to help fund the Nottingham Express Transit System.

Certain high-level assumptions have been allowed to calculate the below costs:

Capital Expenditure assumptions:

- £10m per km (2022 prices) has been used for a length of 39.83km
- Construction costs have been profiled from 2026 to 2031 with scheme opening year in 2031
- Allowance for construction specific and general inflation is allowed

Operating and Maintenance costs assumptions:

- O&M costs have been considered over a 60-year period from 2032 (i.e one year after the scheme opening year)
- Lifecycle asset replacement over 30-year period
- Mobilisation costs
- Allowance of general inflation
- Fleet size has been assumed to be 67 vehicles (including three spare)
- Operator margin of 10% has been assumed
- Contingency allowance of 5% has been applied
- Assumptions on staffing levels, annual maintenance, utilities and expenses and other cost inputs have been derived from the Coventry Light Rail system and where possible adapted to the Stoke VLR scheme

Table 5.6 summarises high level costs estimates for the capital expenditure and O&M.

Cost elements, £million	
Scheme investment costs	
Capital expenditure	£415
Operating and Maintenance Costs	
Lifecycle asset replacement	£410
Mobilisation Costing	£1.5
O&M costing (over 60 years)	£2,800
Total Costs	**£3,700***

**Figures may not match exactly due to rounding*

Table 5.6 Scheme capital expenditure and O&M

5.3 Operator Revenue

A high-level assessment of operator revenue has been estimated for the purpose of this SOC. Forecast hourly VLR revenue has been derived from the transport model outputs and then converted to 24 hour revenue using appropriate factors. The daily revenue by time-period is then multiplied by 365 to obtain a yearly revenue estimation and then calculated with a yearly adjustment factor for a 60-year period to obtain the total expected revenue across the scheme's appraisal period.

Calculated revenue is then re-based to 2022 prices using TAG Databook v1.18 GDP deflator series for consistency with the financial case reporting. It is estimated that fares will increase in line with inflation.

DS Scenario A					
Time period	Revenue (h)	Factor to 24h	Annualised Factor	Annualised Revenue 2031, £million	60-year Revenue, £million
AM	£12,177	2.74	1000	£14	£1,728
IP	£5,960	7.14	2606	£17	£2,204
PM	£13,706	2.77	1011	£16	£1,967
Total	-	-	-	**£47**	**£5,899**

Table 5.8 DS Scenario A: Expected operator revenue over 60 years

DS Scenario B					
Time period	Revenue (h)	Factor to 24h	Annualised Factor	Annualised Revenue 2031, £million	60-year Revenue, £million
AM	£12,611	2.74	1000	£14	£1,790
IP	£6,606	7.14	2606	£19	£2,443
PM	£14,982	2.77	1011	£17	£2,150
Total				**£50**	**£6,383**

Table 5.9 DS Scenario B: Expected operator revenue over 60 years

Over the course of 60-years, the VLR scheme is expected to generate approximately £5.9billion under DS scenario A and 6.4billion under DS scenario B. As the introduction of a VLR network will have impact on the bus network and its revenue, an estimation of net revenue is calculated for the whole public transport element (bus plus VLR) and represented below in Table 5.10.

Total Revenue, £million	DS Scenario A	DS Scenario B
Bus Reference Case	£13,718	£13,718
Bus DS scenario	£9,635	£9,753
VLR DS scenario	£5,899	£6,383
Total DS scenario	£15,534	£16,136
Net revenue Scenario	£1,816*	£2,418*

**Figures may not match exactly due to rounding*

Table 5.10 DS Scenarios: Net operator revenue over 60 years

It should be noted that this is a very high-level estimation of potential revenue generation and should be treated as conservative assumptions. A more detailed operator revenue estimation would need to allow for growth in passenger demand which this estimation does not consider. Additionally, as the business case progresses, further avenues will be explored in terms of revenues from advertisements and potentially a workplace parking levy to help cover the public transport (bus + VLR) funding gap with operating and maintenance costs of the scheme.

6 Commercial Case

6.1 Introduction

The Commercial Case provides evidence on the commercial viability of the proposal and the procurement strategy that will be used to engage the market. It presents evidence on risk allocation and transfer, contract, and implementation timescales as well as details of the capability and skills of the SoTCC team delivering the project.

6.2 Commercial Viability

At the next stage of business case development, it will be important for SoTCC to consider in greater detail the commercial viability of the VLR network through an analysis of various key project drivers including deliverability, cost certainty, risk allocation / transfer, procurement strategy and commercial delivery.

The SOC focusses on understanding the outputs of the project with regards to the project specification and highlighting an initial identification of risk and proposed approach to resource allocation.

6.3 Output-based specification

In line with DfT guidance for logic mapping, the connectivity and economic growth benefits of the VLR network have been combined and the key relationships defined as shown in Figure 6.1.

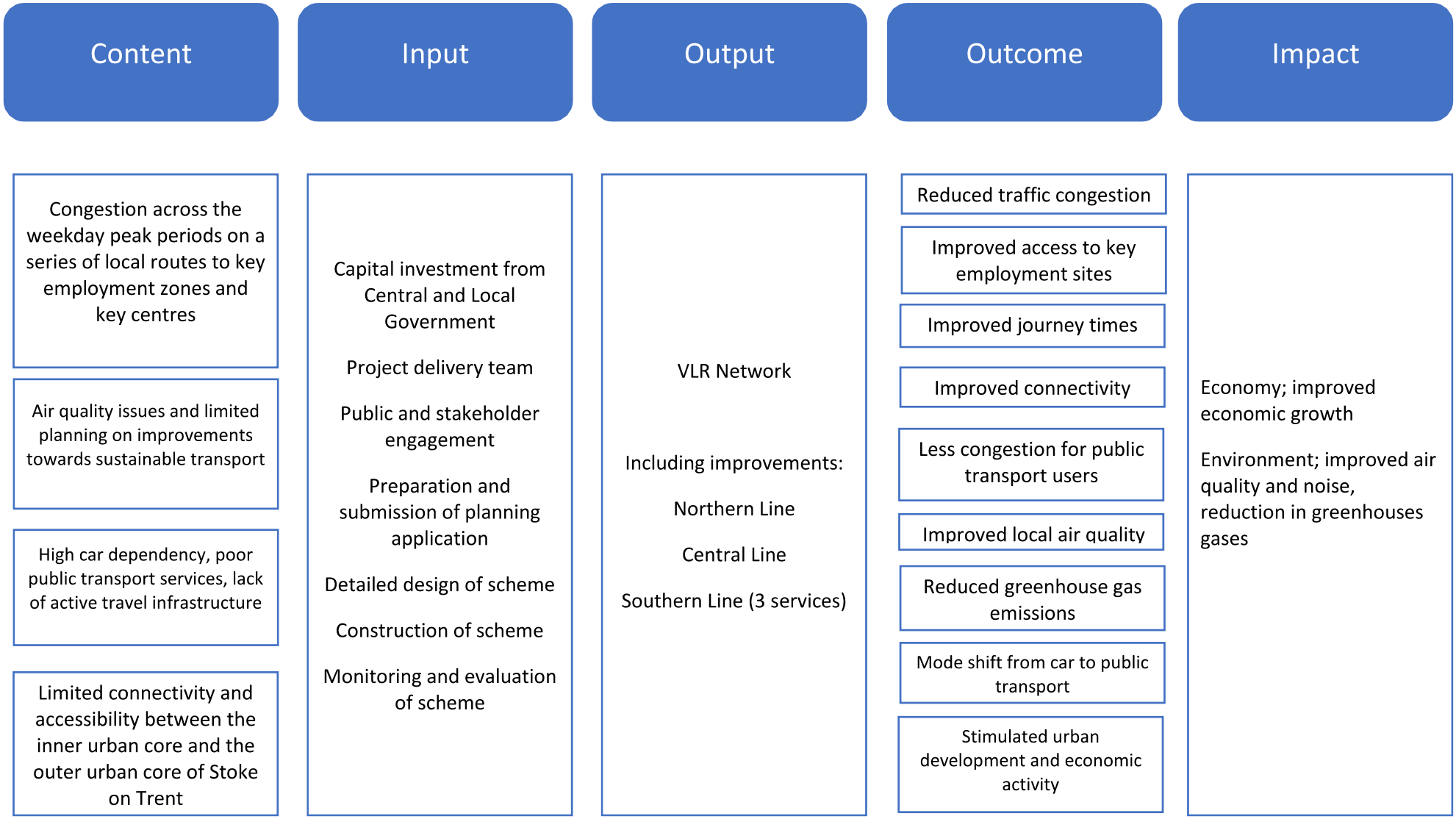


Figure 6.1 Logic mapping between Scheme outputs and Outcomes

6.4 Identification of Risk

Key project risks have been identified through a detailed analysis and understanding of risk on the project. At a later stage in the business case development process it will be important to establish a detailed risk register in order to identify and manage risk and assign ownership. Register.

Key project risks identified are summarised below:

- Topography
- Impact on bus operations and patronage raising issues of commercial viability of some bus services
- Funding gap between net public transport revenue and operating costs
- Traffic impact due to removal of road space on some key corridors to run the VLR on-street
-
- Unproven technology and system, a VLR network has never been introduced in the UK to date.
- Issues around funding the construction of the VLR network, without a clear central government funding pot

6.5 Risk Allocation

There are various options available to t promote the sharing of risks across the various parties involved on the construction project. The Procurement Strategy and contractual mechanisms through the proposed Form of Contract will ensure that all options for risks transfer are considered and applied where appropriate.

Through procurement and as part of scheme delivery, the contractor will produce a priced risk register. This will be reviewed as part of the process of target setting and decisions made on the mechanism for sharing risk between the contractor and SoTCC, ensuring that the proposed allocation provides the best value for money for the project for both SoTCC and the DfT.

The above approach builds on SoTCC experience with such delivery mechanisms on recently and successfully delivered schemes, with a clear understanding between contractor and authority of how they work and what their processes are. This is not just in terms of roles, but also agreed standards, mechanisms and clarity over risk and risk allocation and transfer through the design and construction phases.

Cost and time over-runs could have a significant impact on the delivery of the project. The list below details the primary ways in which both cost and time over-runs can be avoided:

- Set objectives that are realistic and not changed during the course of the VLR project and avoid changes in scope mid-way through the delivery process;
- Ensure that all cost estimates are realistic, and the appropriate allocation of contingency is applied, reviewed and managed throughout the VLR project’s life;
- Ensure a realistic programme is agreed for the delivery of the VLR project and all possible and foreseeable eventualities are proactively considered;
- Provide an agreed project brief that is complete, clear and consistent and most critically understood and agreed by all parties to the project;
- Ensure that a design is progressed that meets planning and other statutory requirements;

- Ensure that the design is fully and robustly coordinated and takes account of buildability, maintainability, health and safety and sustainability;
- Ensure all risk is quantified and allocated to all parties of the contract in an unambiguous and clear manner;
- Provide clear leadership, excellent project governance, swift decision making and appropriate and proportionate management controls; and
- Subscribe to simple payment mechanisms that incentivise all parties to achieve the common and agreed goal relating to the delivery of a high-quality project, on time and within budget.

7 Management Case

7.1 Introduction

The Management Case assesses whether the proposal is deliverable by reviewing the project planning, governance structure, risk management plan, communication, and stakeholder management.

At SOC stage the Management Case looks to confirm the deliverability of the VLR scheme. The Management Case also sets out key programme dates, project governance alongside the approach to communications and stakeholder management.

7.2 Programme & Project Dependencies

There are a number of key project dependences which have been considered by the Project Team and summarised within Table 7-1 below:

Description	Relevant Agency
Planning Permission / Environmental Statement	SoTCC
Transport & Works Act	DfT
Scheme Funding	DfT

Table 7.1 Project Dependencies

A high-level VLR project delivery programme is summarised below and outlines when each of the above project dependencies would be addressed and includes the key milestones for the VLR project.

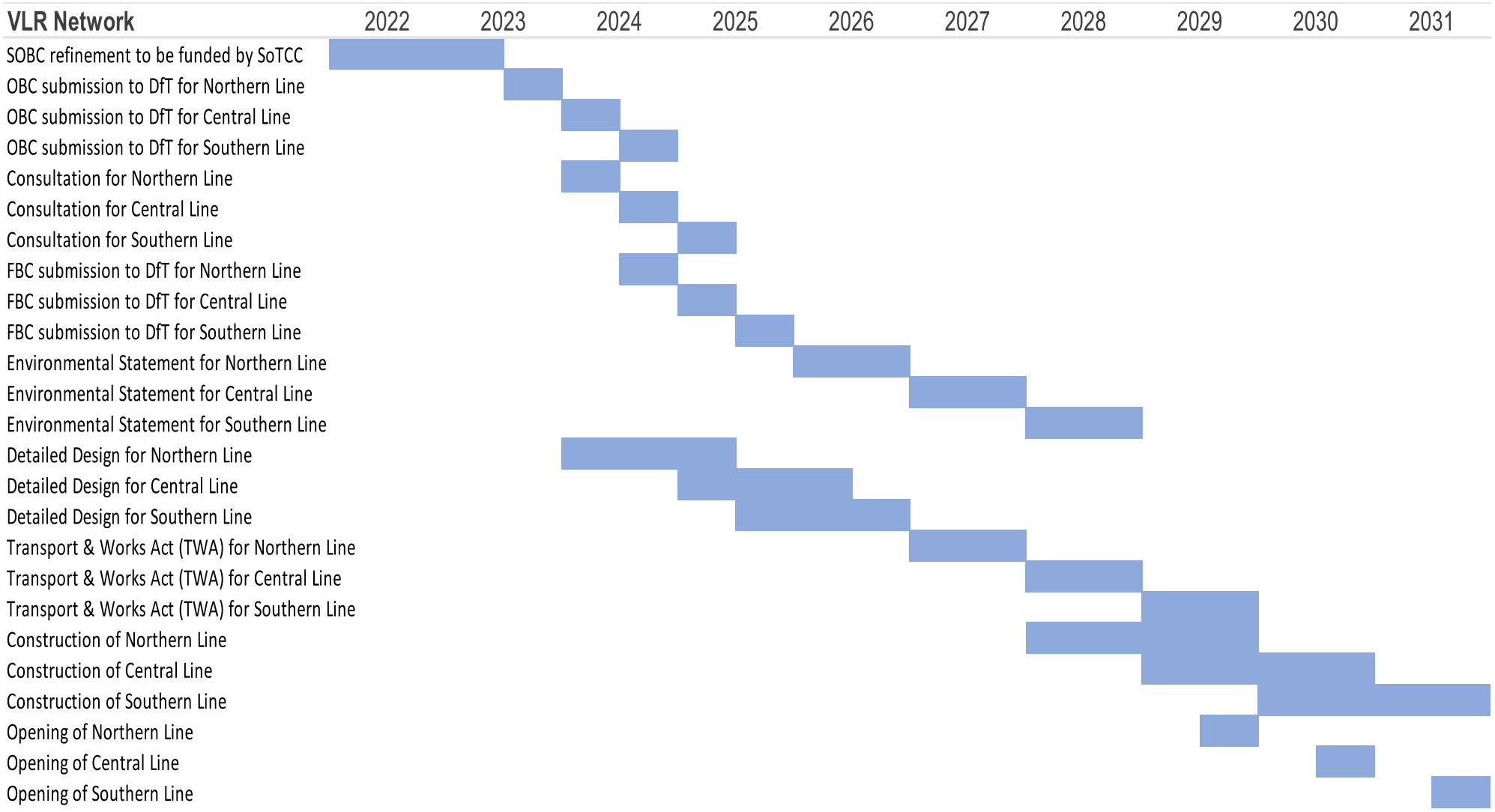


Table 7.2: Project key milestone

7.3 Project Governance & Project Plan

Management of the VLR Project will be with the Council's transport policy and planning team. The Project Management team will be accountable for the progression of the VLR Project. The proposed project management structure is shown at Figure 7.1.

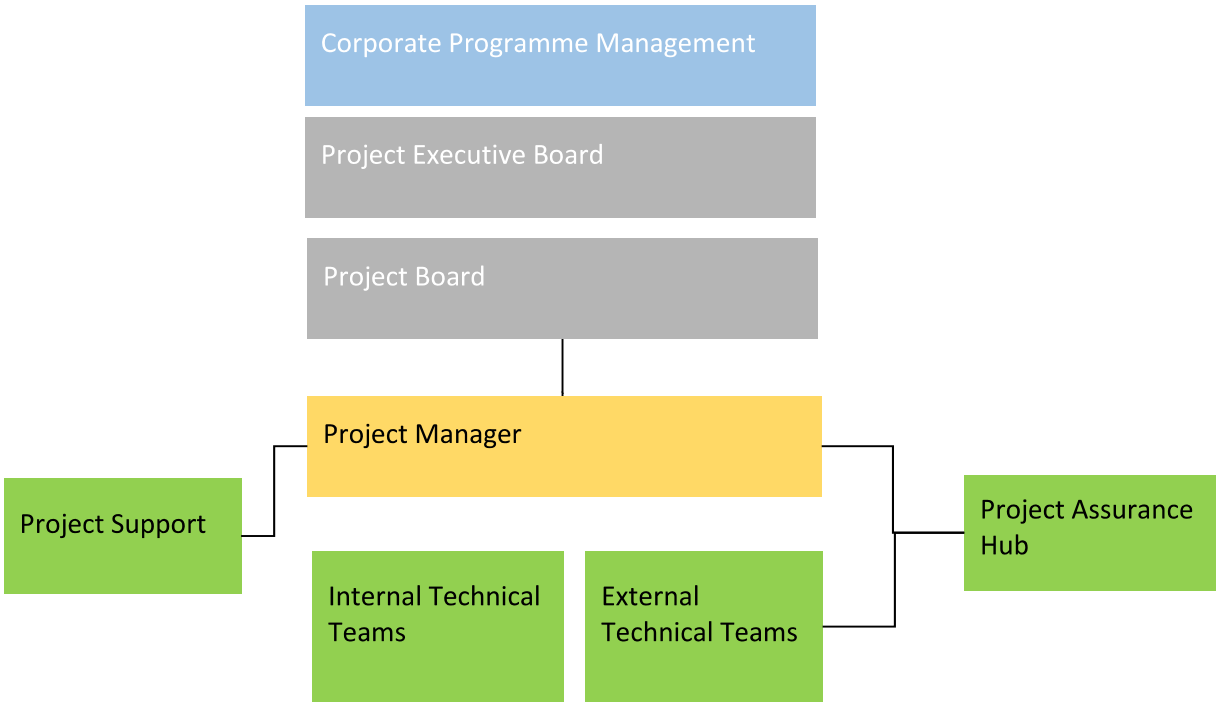


Figure 7.1 Proposed project management structure

Project Executive Board
The Project Executive Board manages the strategic direction of the VLR Project and its priority and progress with respect to other SoTCC projects. It also sets the limits of authority for the Project Board with respect to project change requests or project rescheduling.

The Executive Board will meet on a quarterly basis.

Project Board
Management and control of the VLR Project is the responsibility of the Project Board, which is chaired by Philip Cresswell Director of Place, Growth & Prosperity and attended by key members of Project Team and SoTCC's highway and planning officers.

The Project Board will meet on a four-weekly cycle.

Project Resource, Roles and Responsibilities

The SRO for the Project is Brian Edwards (Team Manager of Transport Policy & Planning at SoTCC). The SRO has overall responsibility for the delivery of the project.

The Project Manager for the VLR Project is Edwin Leigh (Transport Programme Manager

Transport Policy & Planning at SoTCC). Day-to-day responsibility for planning, resourcing and risk management lies with the nominated Project Manager who is required to:

- Identify and report issues / monitor risks;
- Track and report project progress;
- Track and report on project cost and spend;
- Ensure a programme of change management is fully implemented;
- Conduct regular briefings and prepare written progress reports for the Project Board / Project Executive Board; and
- Where necessary, raise exceptions requiring decisions or intervention from the Project Board.

A number of technical teams will need to be established to deliver the VLR Project. Both the external and internal technical teams are noted below:

External Technical Teams:

- Delivery Project Management Team
- Transport Modelling Consultants

Internal Technical Teams:

- Highways Team
- Transportation Team (including Transport Modelling)
- Planning Team
- Legal Team (including Procurement)

In addition to the above it is anticipated that the following external roles will be procured at a later stage to progress the project:

- Planning Consultant
- Lead Design Consultant
- Lead Cost Consultant
- Legal Consultant

7.4 Assurance & Approval Plan

SoTCC has a devoted Partnership and Project Assurance Hub which has a dedicated resource to input into key City Council projects. A summary of the services provided by the Assurance Hub is detailed in Table 7-3 below:

Service Provided by Assurance Hub	Description
Risk and Issue Management	Support, monitor and ensure appropriate Risk and Issue Management activities.
Reporting	Support producing timely programme and project progress reports and act as central point for Programme and Project Management (PPM) based information.
Project Hub	Establish and maintain an up to date and accurate central electronic repository of programme and project-based information.
Advice and Guidance	Provide advice and guidance to Programme and Project Management staff in terms of support for delivery activities such as Planning, Scoping, Business Case and Project Initiation Document (PID) development.
Document Management	Ensure appropriate version control, accessibility of all key programme and project documentation and support change management activities.
Resource Management	Support Finance in ensuring appropriate financial management and governance around funding and expenditure, including the completion of a "Needs and Funding Assessment" (NFA) template.
Programme and Project Management Methodologies	Develop and implement appropriate best practice processes and templates for programme management, project management, monitoring and reporting requirements.
Assurance and Monitoring	Monitor programme and project progress, co-ordinate, carry out and support appropriate PPM assurance reviews and ensure adherence to and alignment with defined processes and agreed procedures.
Gateway Approval Process	Develop and support the Gateway Approval Process to support project development and ensure monitoring and assurance review at appropriate stages throughout the project life cycle.

Table 7.3 Services Provided by Assurance Hub

The Partnership and Project Assurance Hub will play an important role in the governance of the VLR Project providing a dedicated resource to the Project Management Team. The Partnership and Project Assurance Hub will ensure that the project progresses through the Gateway Assurance process in an appropriate manner.

SoTCC has a well-established Gateway Assurance process for all capital projects and in line with DfT requirements, the Project Board will ensure that gateway reviews are undertaken by an independent entity.

A summary of Project Gateways is detailed in Table 7.4 below:

Decision Gateway	Gateway Description
00	Project Concept
01	Viability (Project Initiation Document)
02	Feasibility (Project Execution Plan)
03	Detailed Specification
04	Procurement
05	Delivery / Construction
06	Operations up to Completion of Defects
07	Operations from Completion of Defects

Table 7.4 Summary of Project Gateway

7.5 Communication and Stakeholder Engagement

A Consultation and Communication Plan for the overall VLR project will need to be developed and agreed with the Project Board. The plan will identify the stages of consultation and engagement that will be carried out by SoTCC as scheme promoter through the delivery of the project.
In conjunction with the production of the SOC, the Project Team will engage in a series of stakeholder meetings with those directly affected by the proposals.

7.6 Programme and Project Reports

Regular project meetings and progress reporting will be used by SoTCC to monitor project risks, to raise exceptions and issues, and to ensure that the project programme is aligned with the delivery process.

A daily project management log will be kept by the core Project Team in order to highlight any issues which arise regarding project delivery. A weekly project reporting template will also be completed by the project management team which highlights any key issues or concerns on the project.

In addition to the above, a monthly project report will be produced which is submitted and reviewed at Director level at a regular monthly meeting to review project progress on all key city council projects.

As noted previously, Project Boards will occur every four weeks with Project Executive Boards every quarter. Both Boards include a comprehensive review of project progress, issues, programme, costs and risk.

Any issues which are identified as presenting significant risks to successful delivery of the project will be fed back to the Project Board and, where necessary, Project Executive Board who will ensure that appropriate responses are mandated and actioned in a timely and efficient manner.

Appropriate levels of financial delegation and approval response times will be in place and will be in line with overall governance arrangements on the project.

7.7 Risk Management Strategy

SoTCC recognises that effective risk management is vital, alongside a continual process involving the identification and assessment of risk. A risk and opportunity register will need to be created at the next stage of the business case development process and to be reviewed on a monthly basis.

A summary of the key project risks, identified through the Risk Register are noted below:

- Project funding from Government is unavailable;
- Project costs escalate due to inflation across the timeframe of the project;
- Statutory approvals and reaching necessary agreements with key stakeholders' and third party land owners delays project delivery;
- Unable to secure the necessary contracting capacity to deliver the Project.

As the scheme progresses through to OBC stage, a contractor will be appointed to provide ECI service for the scheme. The chosen Contractor will work alongside the designers and their invested knowledge will be retained to support detailed design, prior to full procurement.

7.8 Project Management

SoTCC have successfully procured and delivered projects of varied size and complexity, and has comprehensive project management, governance, and assurance systems in place to deliver this project.

A Benefit Realisation Plan will be prepared and linked to the scheme objectives and desired outcomes. This will be used by SoTCC to ensure that the benefits and dis-benefits from the project can be planned, tracked, managed and realised (or where necessary mitigated).

A Monitoring and Evaluation Plan will be prepared, and this plan will be used to help demonstrate whether the scheme objectives identified in the Strategic Case are being achieved in terms of the desired 'measures for success'.

This Management Case has also outlined the ongoing Stakeholder Management plans and future communication strategy and programme.

This Management Case has also outlined the ongoing Stakeholder Management plans and future communication strategy and programme.

8 Summary and Conclusions

The City of Stoke-on-Trent Council, through recent planning (Local Plan development) and transport funding applications (Transforming Cities, Active Travel) has identified the need for transport improvements over a ten-year horizon which are affordable, deliverable, and should support economic growth, residents' mobility, wellbeing, and the environment.
This Strategic Outline Case (SOC) aimed to assess and appraise the potential for a VLR network to serve the city, based on the Coventry example, focusing on the Strategic and Economic cases, with a light-touch Commercial, Management and Financial case.

A VLR network has been developed covering the key centres and employment zones of Stoke-on-Trent consisting of three routes - Northern, Central and Southern, with the latter formed of three services (Full Route, Hospital Route, Trentham Route services) as shown in **Figure 4.1.**

- Northern Line (1) : Tunstall, City Centre, SoT Railway Station, Longton
- Central Line (2) : Etruria, City Centre, Bentilee, Longton
- Southern Line (3) : Three service options can operate on the Southern Line (using same track)
    - Full route (3) : SoT Railway Station, Longton, Trentham, Hospital, NuL
    - Hospital (3A) : SoT Railway Station, Hospital, NuL
    - Trentham (3B) : SoT Railway Station, Longton, Trentham, SoT Railway Station

The routes of the VLR are planned to provide a comprehensive service, connecting residential areas with key destinations such as employment and retail centres. The VLR network will also connect to key transport hubs such as railway and bus stations to create opportunities for interchange and to enhance the existing network and travel options improving the overall resilience of the Stoke-on-Trent public transport network.

The above network was assessed under two Do-something scenarios to provide further insights of the proposed scheme:

- **DS Scenario A**: VLR network with reduced frequencies on parallel / competing bus services
- **DS Scenario B**: VLR network with doubled parking charges in the City Centre and doubling of rail service frequencies between Derby and Stoke-on-Trent (in both directions).

<u>The key insights of this study are:</u>

- The VLR network will significantly improve the public transport offer in our city, improving accessibility and journey times for all and offering a real alternative to the car.
- It is forecast to achieve a modal shift of between 3 to 5% from car trips for all journeys within our city. For certain key corridors, such as Tunstall to the City Centre, Trentham to Newcastle-under-Lyme town centre, the car mode split is halving in the morning peak. This illustrates a great shift towards sustainable transport modes.
- Such a network will significantly improve access to jobs, especially for those without a car, providing wider economic benefits for our city.
- Being a low emission transport system that is battery powered it is a very clean form of transport and will therefore help improve local air quality and reduce our city's carbon emissions as we progress towards net zero.
- The revenue from the VLR would cover its operating costs however the majority of VLR patronage is forecast to come from existing bus passengers, the net operating costs for public transport due to this abstraction, will not be covered by total public transport

revenue. In order to address this funding gap, other sources of revenue should be investigated including advertising and potentially looking at parking revenue.

- It will be important to work closely with the bus operators to ensure an integrated public transport offer rather than one that competes, a bus franchising arrangement should be explored.
- Based on an initial demand analysis of each line, the delivery of the VLR network should be phased as follows:
    - Phase 1: Northern Line
    - Phase 2: Central Line
    - Phase 3: Southern Line – Hospital Service (3A)
    - Phase 4: Southern Line – Full Route (3) and Trentham Service (3B)
- Given the costs of such a network, funding would be needed from Central Government as well as support from our Council. Further work is needed to develop the business case, progressing it to OBC/FBC stage, including further liaison with Coventry City Council, the VLR Innovation Centre in Dudley and key stakeholders.

The scheme currently generates a present value benefit (PVB) of £655.33 million and a present value of costs (PVC) of £652.94 million under Scenario A and a present value of benefits (PVB) of £753.17 million and a present value of costs (PVC) of £555.97 million under Scenario B. This results in a BCR of between 1.00 and 1.35 respectively which, as per the DfT Value for Money Framework, is categorised as low value for money. However, the scheme's purpose is far greater than value for money categorisation, it is the step change in public transport offer it brings to the city coupled with the positive environmental impacts, which are of upmost importance.

It should be noted that this is an initial and very high-level assessment of benefits and costs of the VLR network, and further work is needed. There are a number of benefits currently excluded which should be calculated at the next stage of work. This would include the calculation of reliability, safety, environmental and wider economic benefits. In addition, quantification of the social and distributional impacts and an active travel appraisal should be undertaken. Inclusion of the above would have significant positive impacts on the case for VLR and should be assessed as the scheme progresses through the next stage of the business case development, where more a detailed assessment is needed.

Appendix

Appendix A – Spatial Themes

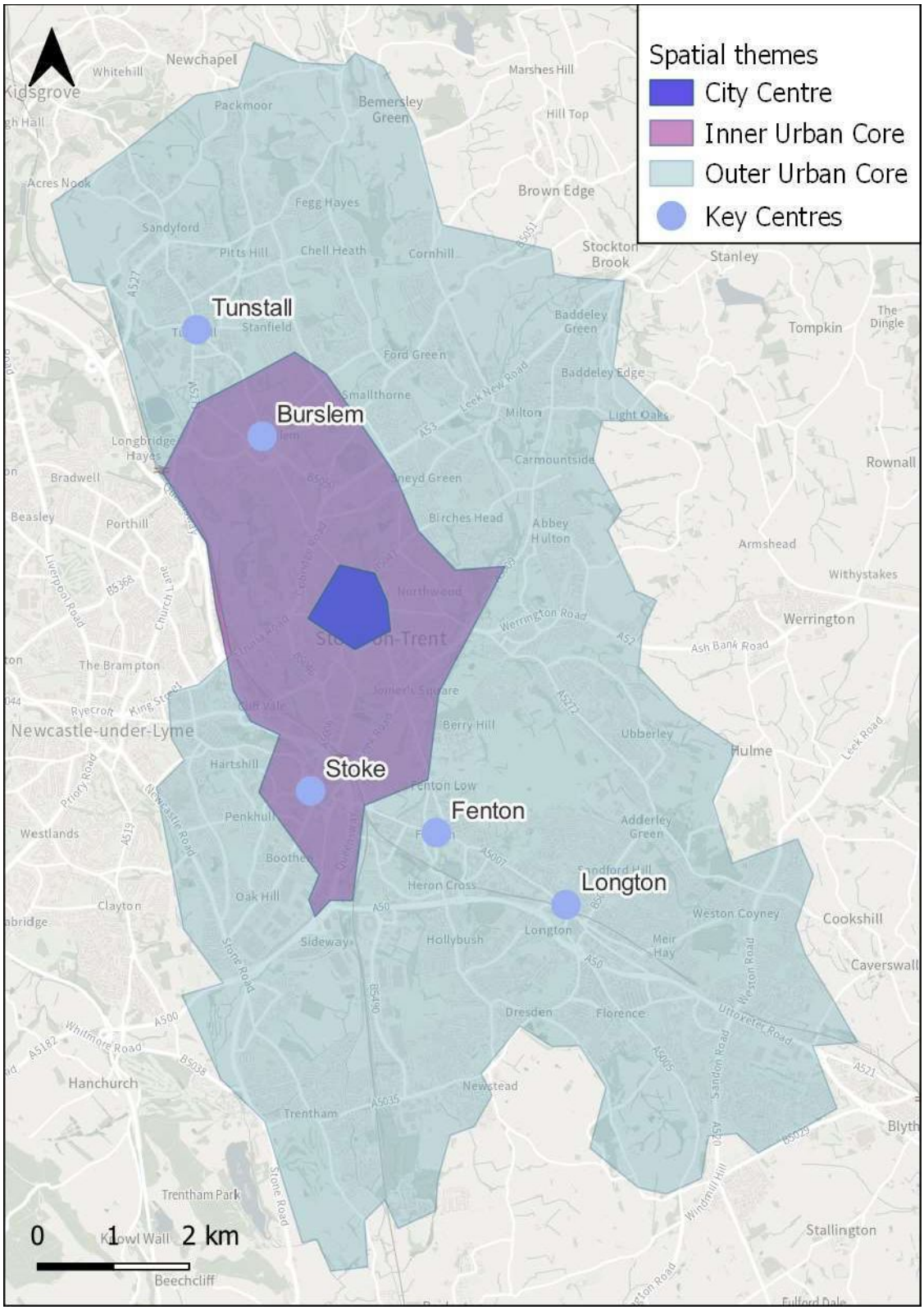


Figure A-1 Spatial Themes Stoke-on-Trent

Appendix B – SWOC Summary Table

A summary of the strengths, weaknesses, opportunities, and challenges for the study area has been identified and provided below. These insights can feed into the approach of the development of the SBC in terms of informing the objectives, the problems, and the need for intervention.

Strengths

- Stoke-on-Trent is home to over 256,600 people and is growing, resulting in a substantial 'addressable market' that will directly benefit from enhanced intra-urban and inter-urban connectivity
- Stoke-on-Trent is characterised by a skilled workforce in the areas of innovation and technology (two local universities with potential to better retain talent). Transport investment will enable employers to better attract and retain the right skills needed to drive economic growth
- Employment sites such as Staffordshire University, Etruria Enterprise Employment Zone, Royal Stoke University Hospital provide substantial opportunities for increasing active and sustainable travel
- Numerous green spaces, protected areas and other heritage and ecological sites
- The Citywide full-fibre gigabit network (113km citywide) has set the foundation for joining the network of Smart Cities
- Lower property prices in Stoke-on-Trent than Manchester or Birmingham make Stoke an attractive location for young couples and families to set up home and commute
- Stoke-on-Trent is a linear city with potentially strong public transit corridor
- Ideal location for a logistics hub between Birmingham and Manchester

Weaknesses

- Low population density
- There is a serious health deprivation issue with more than 50% of residents living in most deprived neighbourhoods of England[9]
- Two tier society with or without car access
- Rising costs of car use
- Low levels of non-car travel
- There are congestion and safety hot spots across the network as a result of high levels of car dependence, particularly in more rural areas of the study area
- Very poor air quality in the inner urban area
- Poor network connectivity as well as poor rail and bus frequencies to key employment areas and the city centre (failing public transport network)
- Lack of cross city bus routes, such trips are therefore forced to interchange
- Poor infrastructure for walking and cycling
- Hilly and steep topography (weakness in terms of active travel)
- Poor alternative links to the strategic road network
- Insignificant amount of an EV fleet and related charging infrastructure
- Very few ZEVs within the council fleet and across the local network
- Limited planned improvements towards sustainable transport
- Lack of a parking strategy with an abundance of cheap or free parking including in the centres

Opportunities

Challenges

[9] Stoke-on-Trent Health Profile 2015

- Improve active travel connectivity around the City Centre
- Increase connectivity to the Outer Urban Core through PT links such as VLR and improve connectivity in this area to the existing rail network
- Interventions to deliver improved PT connectivity between the six towns
- Interventions to support sustainable access to the six towns for those in less dense peripheral areas
- Improve PT to tackle demand in denser central areas as well as active travel connectivity to encourage short local trips by alternative modes
- Transport interventions to support sustainable access to the key employment destinations
- Improve accessibility to employment in areas of deprivation through better PT and active travel links
- Transport interventions in walking, cycling and passenger transport to increase levels of active travel for end-to-end journeys or as part of a longer trip by PT
- To reduce multiple car ownership, particularly where attractive public and active transport options and fast digital infrastructure already exists
- Improve transport options to areas with low car availability
- Corridor improvement packages for specific roads, especially in the Inner Urban Core, could help reduce the number of road collisions and casualties
- Support behavioural shift towards sustainable transport modes including a cleaner vehicle fleet, combined with a better digital infrastructure to reduce the need to travel
- Investment in transport measures that help deliver improved air quality in addition to what is planned for the NSLAQP which includes a charging CAZ C
- Delivering new infrastructure with includes flood defences
- Ensuring Stoke-on-Trent's natural and heritage assets are protected
- Complementing existing heritage sites and green corridors with sustainable transport (cycling, VRL) as well as with active travel schemes to expand their utilisation
- Use of Stoke-on-Trent's waterways for both local transport and freight
- Transport interventions to support the movement of workers to key employment destinations
- Transport interventions to facilitate the new journey patterns

- Accommodating population growth and associated transport needs
- Providing connectivity for a dispersed population
- Improving sustainable access to dispersed employment centres
- Improving access to opportunities from areas of deprivation (Burslem, Bentilee, Fenton)
- Improving health and wellbeing through increased active travel
- Providing attractive alternatives to private car travel
- Providing alternative transport options to areas with low car access
- Improving highway safety through corridor improvement packages
- Reducing carbon emissions from local transport to support the net zero target
- Improving air quality through emissions reduction
- Developing a local transport network that is resilient to the impacts of climate change
- Ensuring Stoke-on-Trent's natural and heritage assets are protected
- Delivering a transport network that supports Stoke-on-Trent's diverse industrial needs
- Delivering a transport network that support the changing travel pattern of workers
- Supporting the increasing need of retail and home deliveries
- Building on the full-fibre gigabit network to reduce the need to travel and/or enhance efficient journey times
- Building on the full-fibre gigabit network to provide digital connectivity
- Increasing local walking trips
- Improving cycle connectivity to facilitate an increase in trips by bike
- Developing a local bus network which is an attractive alternative to the private car
- Making the most of Stoke-on-Trent's rail infrastructure
- Taking advantage of the city's location to produce a freight strategy and deliver improvements for this vital and changing sector
- Providing a cleaner taxi fleet
- Offering more attractive alternative options to taxis
- Managing parking demand
- Reducing congestion on key arterial routes
- Supporting the change to zero emission modes

- Alternative transport options to keep up with the freight demand such as rail and water transport freight
- The rollout of superfast and ultrafast broadband and mobile internet in areas with lower average download speeds
- Create opportunities for multi-modal journeys through the development of apps that can be used for journey planning and ticketing (allowing for all the multi-modal routing options)
- Encourage increased trips on foot, particularly along key pedestrian desire lines located both in the City Centre and Outer Urban Core (Tunstall, Longton)
- Improve cycle infrastructure to provide direct, safe connections, particularly where there are key cycle desire lines present to increase cycle mode share
- Promote E- bike use as an alternative option due to the city's topography
- Bus options that deliver an attractive, high frequency and reliable transport offer
- Improve rail connectivity within Stoke-on-Trent and with the rest of the West Midlands region and Manchester
- A future freight strategy to develop key issues and solutions for this sector
- Initiate an electric charging point scheme to encourage the use of electric/hybrid taxis to replace ICE vehicles
- Improve the PT network with affordable fares to compete with the taxi offer
- Manage parking demand by making alternative modes more competitive through reviewing the parking charges.
- Explore PT and active travel interventions as an alternative to highway capacity improvement schemes along key corridors such as the A34, A50, A52 and A5272
- Offer incentives to increase take up of zero emission modes, including switching public and private vehicle fleets to zero emission vehicles
- Decarbonise PT
- Adopt a strategy on ZEVs
- Raise the profile of sustainable travel further including development of Travel Planning supplementary planning guidance, as well as implementation of behaviour change interventions

- Embedding sustainable travel behaviours in Stoke-on-Trent
- Improving connectivity between Stoke-on-Trent's five key local centres and opportunities in Hanley
- Improving connectivity between Stoke-on-Trent and the West Midlands region
- Improving connectivity to key employment locations to promote modal shift
- Supporting sustainable future population growth in Stoke-on-Trent
- Supporting sustainable development
- Taking a multi-modal approach to highway improvement
- Developing a transport network that is resilient to changes in travel habits
- Modest population growth
- Retrieving long time lapsed bus users
- A large car owning social class B-C demographic (owning small and medium sized cars), who appear to be the least likely to get out of their cars.

- Provide better connectivity between Inner and Outer Urban Core to the City Centre, where most of the commuter trips are (employment areas)
- Development of MMH to encourage trips by rail, bus, active travel, and VLR
- Provide alternative transport options to support sustainable access to key destinations for those in peripheral areas
- Connect the key locations and support focused transport interventions for sustainable travel to the clusters of where the future residential and employment sites are located
- Invest in smart technology to capture changes in trends from ongoing surveys of people's travel behaviour including public transport usage and vehicle movements, as well as wider metrics around air quality and economic spend in the area
- Growth beginning to be centred on brownfield sites so density coming back to places like Etruria

Table A-1 SWOC Stoke-on-Trent

Appendix C – Initial VLR Route Sifting

Introduction

Sweco have been commissioned by the City of Stoke on Trent Council to deliver a Transport Strategy and Delivery Plan. This includes three components around rapid transit, multi modal hubs and route to net zero, which will be presented in three separate Strategic Outline Business Cases. This document has been produced to conduct a short listing of a number of potential rapid transit corridors (agreed with SOT) based on empirical evidence and a range of assessment criteria. The outcomes of this work will be a short list of corridors / routes to progress into more detailed route assessment and modelling.

A Very Light Rail (VLR) route sifting took place in order to inform the Option Assessment stage of the SBC for the Rapid transit project for Stoke-on-Trent City Council (SoTCC).

Ten potential corridors were assessed from a holistic perspective based on the topography, socioeconomic data, demographics, bus network, demand data and key attractors of the project location.

Proposed Routes

Based on consultation with SoTCC and our own analysis, we defined a total of ten VLR routes. The proposed routes are shown in Figure 2.1. below. They are typically focused on key radial routes serving the city centre (Hanley) or connecting areas and key trip attractors together. For convenience, the individual lines are also outlined in the Appendix.

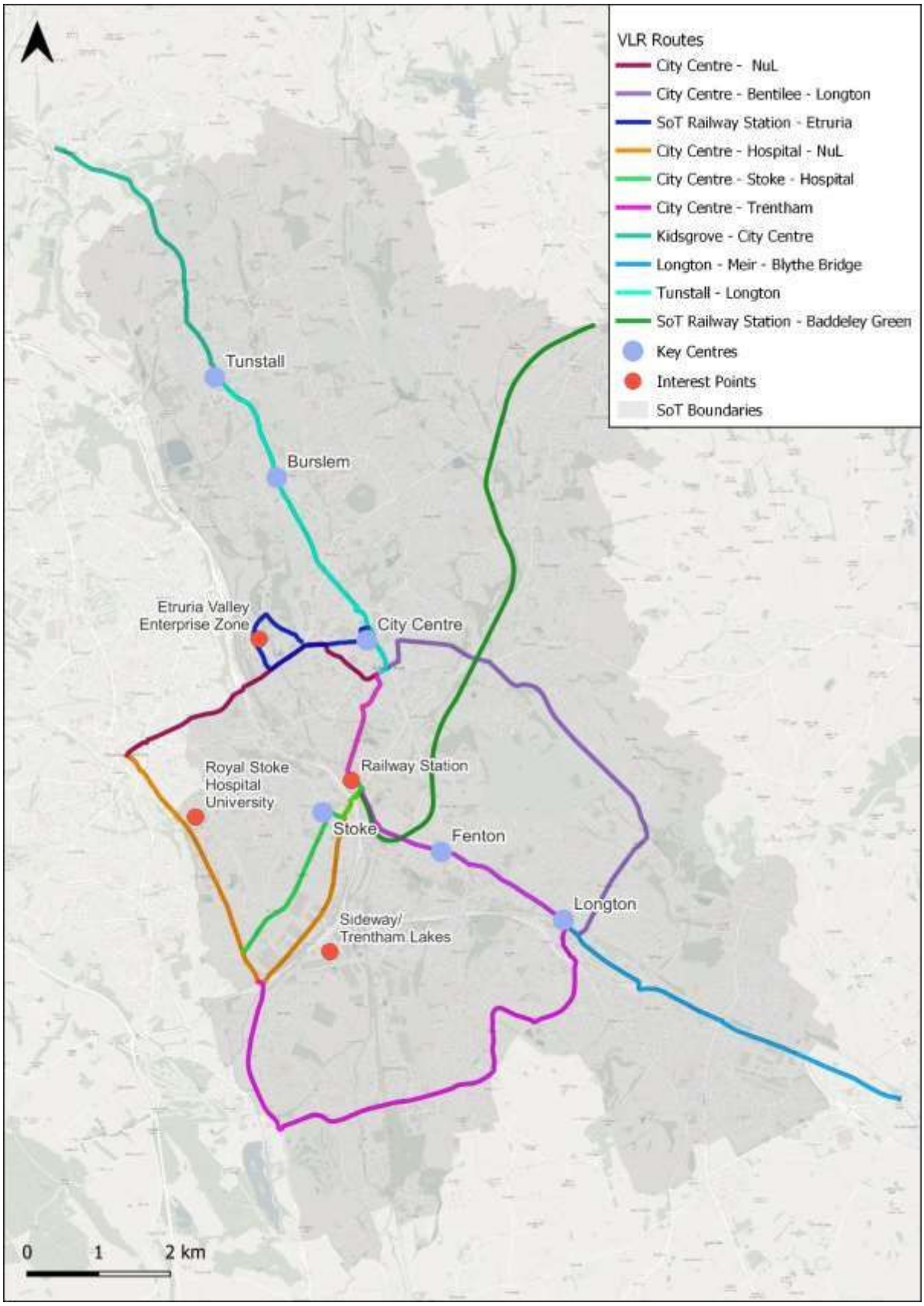


Figure 2.1 Proposed VLR Routes

Ranking Methodology

A total of ten routes were evaluated by using multicriteria analysis. A total of 13 criteria have been selected, which cover key aspects of the project impacts, including social, economic, environmental, transportation and construction related criteria. At this stage, each criterion has been treated as equally important in the scoring, no weightings have been applied. The criteria, the description and data sources used are summarised in the following table.

Criteria	Description & Data Used
Topography	Route gradient: (0-5% - Low, 5-10% - Medium, above 10% - High), using 1m "Lidar" slope data. Where isolated short sections of medium/high were identified we have assumed these can be resolved via an engineering solution or alternative route section
Population density	Population Density (total households/area), mapping in GIS with demographic data provided by the SoTCC (ward level). Importance of this criteria being that successful rapid transit routes/schemes have demand distributed along the route as well as end to end trips
Deprivation	Index of Multiple Deprivation: 0-10% Most deprived areas, mapping in GIS with data provided by the SoTCC (ward level). Consistent with national and local economic and transport policy to improve accessibility from those suffering economic and transport poverty
Feasibility of construction	Number of lanes, length of route and number of junctions, availability of right of way, derived from desktop research and GIS mapping. Highway capacity is a key constraint when proposing a new fixed rail mode to run mixed with general traffic on street – impact on congestion and delays and potential costs to mitigate traffic disbenefits
Cost of construction	Length of route: (derived from GIS data) and land use intensity (urban density). From a construction and delivery perspective a shorter route may perform better, as indicated by Coventry plans for a short demonstrator route initially.
Mode shift impact	Expected impact on mode shift by car users, based on low/high car ownership with data provided by SoTCC. Identifying areas with low car ownership who may be a captive market as well as locations with higher than average car ownership which have the potential for modal shift.
Bus network commercial impact	Bus network commercial impact: based on bus headway derived from GIS bus route data, using AM peak hour as a proxy for daily level of service (high – low). Taken into account the sections where there is overlap across diverging routes, or whether its directly following a service and therefore duplicating/competing
Access to jobs/services	Predicted employment density in 2027, including uncertainty log data provided by SoTCC. This allows us to include a measure of economic growth, both its
Traffic disruption	Level of disruption to road traffic: based on google map traffic conditions in the PM peak hour (fast traffic reflects low disruption, slow traffic reflects high
Rail access	Accessibility to railway stations (number of access points), data from GIS analysis. This is a measure of regional and national connectivity to prioritise routes which provide good interchange with the rail network
Park & Ride connectivity	Accessibility to proposed park & ride locations, provided by SoTCC. As above a measure to reflect where car to VLR interchange could lead to benefits and

MMH access	Accessibility to proposed MMH locations (number of access points), data from own analysis
Political support	Political support based on input from SoTCC (positive, neutral, negative). Based on our discussions with officers and deputy leader of the council.

Each criterion was measured against a quantitative indicator, such as population density, employment density, deprivation index, distance etc. The only except was the political support criteria, which is a purely qualitative indicator.

The ranking is between score 1 to score 5 and for each category, where 1 represents low/bad and 5 represents high/good level for each category respectively.

The total score is the unweighted average of all criteria.

Ranking results

The tables below the detailed results of the ranking for each criterion for each route, as well as the score we allocated to each route.

1.1 Topography

Rank Criterion: 1 – Long Sections of High Gradient, 5 – Only Low Gradient

Route Line	Route Name	Rank	Comments
1	Kidsgrove - City Centre	4	Low gradient
2	Tunstall - Longton	4	Low gradient
3	City Centre - Hospital to NuL	3	Medium gradient
4	City Centre - NuL	2	Medium gradient
5	City Centre - Bentilee - Longton	2	Medium gradient
6	City Centre - Longton - Trentham	4	Low gradient
7	Longton - Meir - Blythe Bridge	3	Medium gradient
8	City Centre - Etruria - SoT Railway Station	3	Medium gradient
9	City Centre - Hospital (London Rd) - NuL	3	Medium gradient
10	SoT Railway Station - Baddeley Green	2	Medium gradient

1.2 Population Density

Rank Criterion: 1 – Low population density, 5 – High population density

Route Line	Route Name	Rank	Comments
1	Kidsgrove - City Centre	2	Low
2	Tunstall - Longton	3	Medium
3	City Centre - Hospital to NuL	3	Medium
4	City Centre - NuL	3	Medium
5	City Centre - Bentilee - Longton	3	Medium
6	City Centre - Longton - Trentham	3	Medium
7	Longton - Meir - Blythe Bridge	3	Medium
8	City Centre - Etruria - SoT Railway Station	3	Low
9	City Centre - Hospital (London Rd) - NuL	3	Medium
10	SoT Railway Station - Baddeley Green	3	Medium

1.3 Index of Multiple Deprivation (IMD)

Rank Criterion: 1 – High index of deprivation, 5 – Low index of deprivation

Route Line	Route Name	Rank	Comments
1	Kidsgrove - City Centre	4	Low
2	Tunstall - Longton	3	Medium
3	City Centre - Hospital to NuL	2	High
4	City Centre - NuL	3	Medium
5	City Centre - Bentilee - Longton	3	Medium
6	City Centre - Longton - Trentham	2	High
7	Longton - Meir - Blythe Bridge	3	Medium
8	City Centre - Etruria - SoT Railway Station	3	High
9	City Centre - Hospital (London Rd) - NuL	2	High
10	SoT Railway Station - Baddeley Green	4	Low

1.4 Feasibility of Construction

Rank Criterion: 1 – Long route, two-lane road dominates the route, many junctions, lack of right of way, 5 – Short route, four-lane roads dominate the route, few junctions, availability of right of way

Route Line	Route Name	Rank	Comments
1	Kidsgrove - City Centre	2	long, mostly 2 lanes
2	Tunstall - Longton	3	medium, mostly 2 lanes
3	City Centre - Hospital to NuL	4	medium length, mix of 2 lane and 4 lanes, limited right of way location
4	City Centre - NuL	4	short, bus gate?
5	City Centre - Bentilee - Longton	4	medium, large sections of green space on Dividy Rd
6	City Centre - Longton - Trentham	3	long, mix of 2 lane road, long
7	Longton - Meir - Blythe Bridge	1	medium, mix of 2 lane road, lack of right of way
8	City Centre - Etruria - SoT Railway Station	4	short, some 4-lane road
9	City Centre - Hospital (London Rd) - NuL	3	medium, mix of 2-lane and 4-lane road
10	SoT Railway Station - Baddeley Green	5	Segregated from highway - disused transport link

1.5 Cost of Construction

Rank Criterion: 1 – Long route, highly land use intensity, 5 – Short route, low land use intensity

Route Line	Route Name	Rank	Comments
1	Kidsgrove - City Centre	3	Medium
2	Tunstall - Longton	2	High
3	City Centre - Hospital to NuL	4	Low
4	City Centre - NuL	5	Very Low
5	City Centre - Bentilee - Longton	4	Low
6	City Centre - Longton - Trentham	2	High
7	Longton - Meir - Blythe Bridge	4	Low
8	City Centre - Etruria - SoT Railway Station	4	Very Low
9	City Centre - Hospital (London Rd) - NuL	4	Low
10	SoT Railway Station -Baddeley Green	3	Medium

1.6 Mode Shift Impact

Rank Criterion: 1 – Low car ownership along the route, 5 – High car ownership along the route

Route Line	Route Name	Rank	Comments
1	Kidsgrove - City Centre	2	Low
2	Tunstall - Longton	3	Medium
3	City Centre - Hospital to NuL	3	Medium
4	City Centre - NuL	3	Medium
5	City Centre - Bentilee - Longton	3	Medium
6	City Centre - Longton - Trentham	4	High
7	Longton - Meir - Blythe Bridge	4	High
8	City Centre - Etruria - SoT Railway Station	2	Low
9	City Centre - Hospital (London Rd) - NuL	3	Medium
10	SoT Railway Station - Baddeley Green	3	Medium

1.7 Bus Network Commercial Impact

Rank Criterion: 1 – High frequency/ connected bus network, 5 – Low frequency/ bus unconnected network

Route Line	Route Name	Rank	Comments
1	Kidsgrove - City Centre	3	Medium
2	Tunstall - Longton	2	High
3	City Centre - Hospital to NuL	2	High
4	City Centre - NuL	2	High
5	City Centre - Bentilee - Longton	3	Medium
6	City Centre - Longton - Trentham	4	Low
7	Longton - Meir - Blythe Bridge	3	Medium
8	City Centre - Etruria - SoT Railway Station	3	Medium
9	City Centre - Hospital (London Rd) - NuL	2	High
10	SoT Railway Station - Baddeley Green	4	Low

1.8 Access to Jobs/Services

Rank Criterion: 1 – Low job density and lack of commercial areas, 5 – High job density and high availability of commercial areas

Route Line	Route Name	Rank	Comments
1	Kidsgrove - City Centre	2	Low
2	Tunstall - Longton	4	High
3	City Centre - Hospital to NuL	4	High
4	City Centre - NuL	4	High
5	City Centre - Bentilee - Longton	2	Low
6	City Centre - Longton - Trentham	3	Medium
7	Longton - Meir - Blythe Bridge	2	Low
8	City Centre - Etruria - SoT Railway Station	5	High
9	City Centre - Hospital (London Rd) - NuL	3	Medium
10	SoT Railway Station - Baddeley Green	2	Low

1.9 Traffic Disruption

Rank Criterion: 1 – High traffic disruption, 5 – Low traffic disruption

Route Line	Route Name	Rank	Comments
1	Kidsgrove - City Centre	2	High
2	Tunstall - Longton	2	High
3	City Centre - Hospital to NuL	3	Medium
4	City Centre - NuL	2	High
5	City Centre - Bentilee - Longton	4	Low
6	City Centre - Longton - Trentham	3	Medium
7	Longton - Meir - Blythe Bridge	4	Low
8	City Centre - Etruria - SoT Railway Station	3	Medium
9	City Centre - Hospital (London Rd) - NuL	3	Medium
10	SoT Railway Station - Baddeley Green	5	Low

1.10 Political Support

Rank Criterion: 1 – Negative client input, 3 Neutral client input, 5 – Positive client input

Route Line	Route Name	Rank	Comments
1	Kidsgrove - City Centre	1	Negative
2	Tunstall - Longton	5	Very positive
3	City Centre - Hospital to NuL	4	Positive
4	City Centre - NuL	1	Negative
5	City Centre - Bentilee - Longton	4	Positive
6	City Centre - Longton - Trentham	5	Very positive
7	Longton - Meir - Blythe Bridge	1	Negative
8	City Centre - Etruria - SoT Railway Station	4	Positive
9	City Centre - Hospital (London Rd) - NuL	3	Neutral
10	SoT Railway Station - Baddeley Green	3	Neutral

1.11 Rail Access

Rank Criterion: 1 – No access, 3 – Access to a local railway stations, 5 – Access to the SoT Railway Station

Route Line	Route Name	Rank	Comments
1	Kidsgrove - City Centre	3	Kidsgrove, minor station
2	Tunstall - Longton	5	SoT Railway Station
3	City Centre - Hospital to NuL	5	SoT Railway Station
4	City Centre - NuL	1	No direct access to rail
5	City Centre - Bentilee - Longton	3	Longton, minor station
6	City Centre - Longton - Trentham	5	SoT Railway Station
7	Longton - Meir - Blythe Bridge	4	Longton, Blythe Bridge, minor stations
8	City Centre - Etruria - SoT Railway Station	5	SoT Railway Station
9	City Centre - Hospital (London Rd) - NuL	5	SoT Railway Station
10	SoT Railway Station - Baddeley Green	5	SoT Railway Station

1.12 Park & Ride Access

Rank Criterion: 1 – No access, 5 – Multiple P&R locations access

Route Line	Route Name	Rank	Comments
1	Kidsgrove - City Centre	3	One location
2	Tunstall - Longton	5	Multiple Locations
3	City Centre - Hospital to NuL	3	One location
4	City Centre - NuL	3	One location
5	City Centre - Bentilee - Longton	5	Multiple Locations
6	City Centre - Longton - Trentham	5	Multiple Locations
7	Longton - Meir - Blythe Bridge	3	One location
8	City Centre - Etruria - SoT Railway Station	3	Route extension to potential site
9	City Centre - Hospital (London Rd) - NuL	1	No access
10	SoT Railway Station - Baddeley Green	3	One location

1.13 MMH Access

Rank Criterion: 1 – No access, 5 - Multiple MMH location access

Route Line	Route Name	Rank	Comments
1	Kidsgrove - City Centre	1	No access
2	Tunstall - Longton	3	Access to Longton
3	City Centre - Hospital to NuL	3	Access to Hospital
4	City Centre - NuL	3	Access to Etruria
5	City Centre - Bentilee - Longton	3	Access to Longton
6	City Centre - Longton - Trentham	3	Access to Longton
7	Longton - Meir - Blythe Bridge	3	Access to Longton
8	City Centre - Etruria - SoT Railway Station	3	Access to Etruria
9	City Centre - Hospital (London Rd) - NuL	3	Access to Hospital
10	SoT Railway Station - Baddeley Green	1	No access

Sifting Analysis Results

A total of ten routes were analysed with the purpose of selecting the six highest scoring routes. The six best routes are identified for evaluation in the Strategic Outline Business Case (highlighted in blue). The total score and the resulting ranking for each route are shown in the table below, followed by a short description of the five best routes.

Route Line	Route Name	Total Score	Rank
1	Kidsgrove - City Centre	2.46	10
2	Tunstall - Longton	3.38	3
3	City Centre - Hospital to NuL	3.31	4
4	City Centre - NuL	2.77	9
5	City Centre - Bentilee - Longton	3.31	4
6	City Centre - Longton - Trentham	3.54	1
7	Longton - Meir - Blythe Bridge	2.92	7
8	City Centre - Etruria - SoT Railway Station	3.46	2
9	City Centre - Hospital (London Rd) - NuL	2.92	7
10	SoT Railway Station - Baddeley Green	3.31	4

Route 6 (City Centre - Longton – Trentham) received the highest score (3.54), mainly as a result of favourable access to railway stations and park and ride locations, political support and a good route topology.

Route 8 (City Centre - Etruria - SoT Railway Station) received the second highest score (3.46) due to providing good access to jobs and service, relative ease of construction and access to SoT railway station. Route 8 is also recommended as a pilot scheme for the system, as it is a relatively short route.

Route 2 (Tunstall - Longton) received the third highest score (3.38) as a result of good access to SoT railway station and park and ride locations, good access to jobs and services, and political support.

Route 3 (City Centre - Hospital to NuL) received the fourth highest score (3.31) due to relative ease of construction, access to SoT railway station, and good access to services, such as the hospital.

Route 5 (City Centre - Bentilee - Longton) received the fourth highest score (3.31) and is tied with Route 3, thanks to relative ease of construction, access to park and ride locations, and relatively low level of disruption to car traffic.

Route 10 (SoT Railway Station – Baddeley Green) also received the fourth highest score (3.31) and is tied with Route 3 and Route 5 due to the high feasibility of construction, low traffic disruption and low bus network commercial impact.

The above routes are recommended for detailed analysis through multi modal modelling using the North Staffordshire Strategic Model. The routes comprise a logical and comprehensive public transport system.

The remaining routes (Route 1, 4, 7 and 9) are not recommended for further analysis.

The six best scoring routes for Stoke-on-Trent City Council rapid transit system are shown in the Figure below.

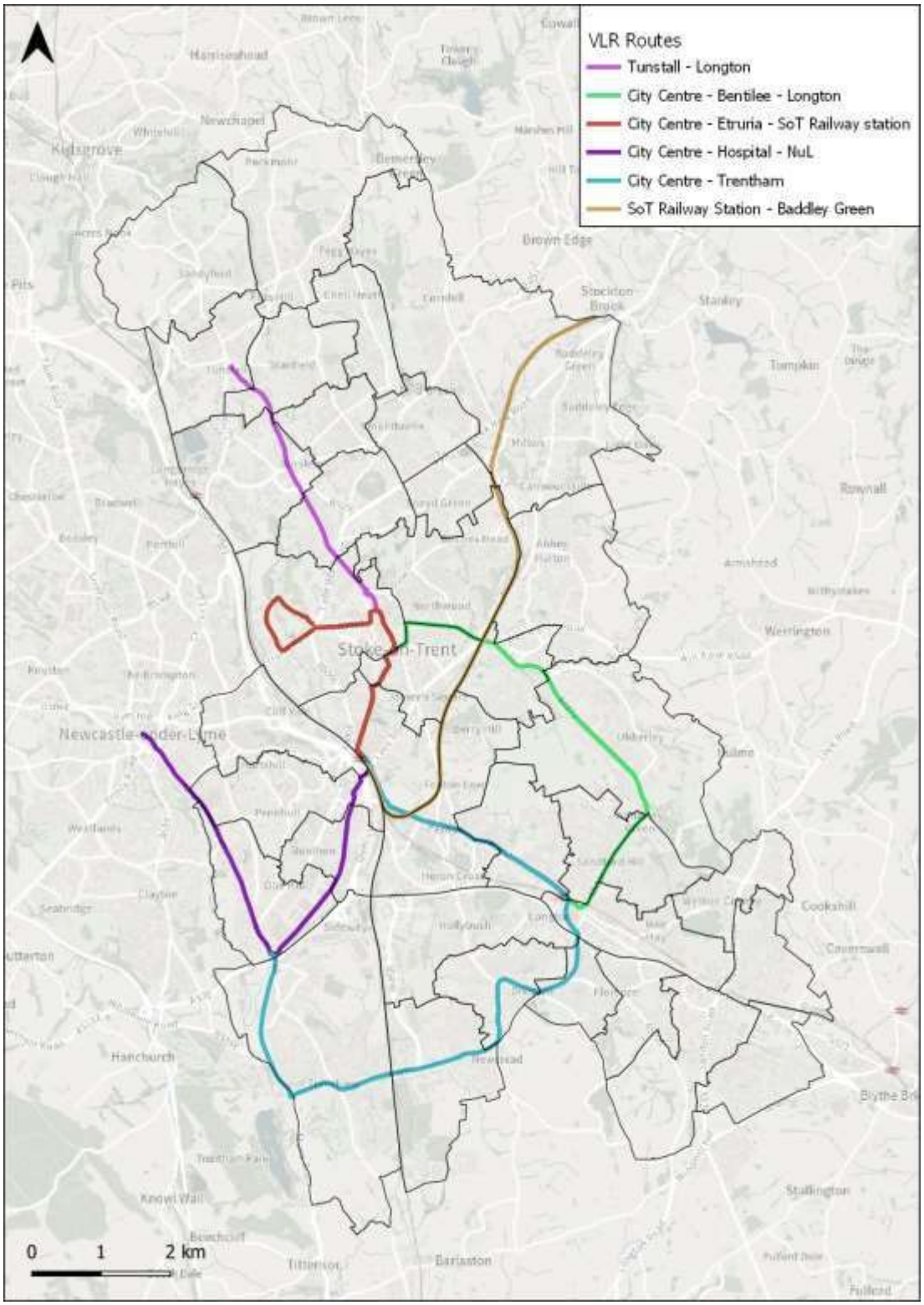


Figure 5.1 Proposed routes after sifting

Separate Route Lines

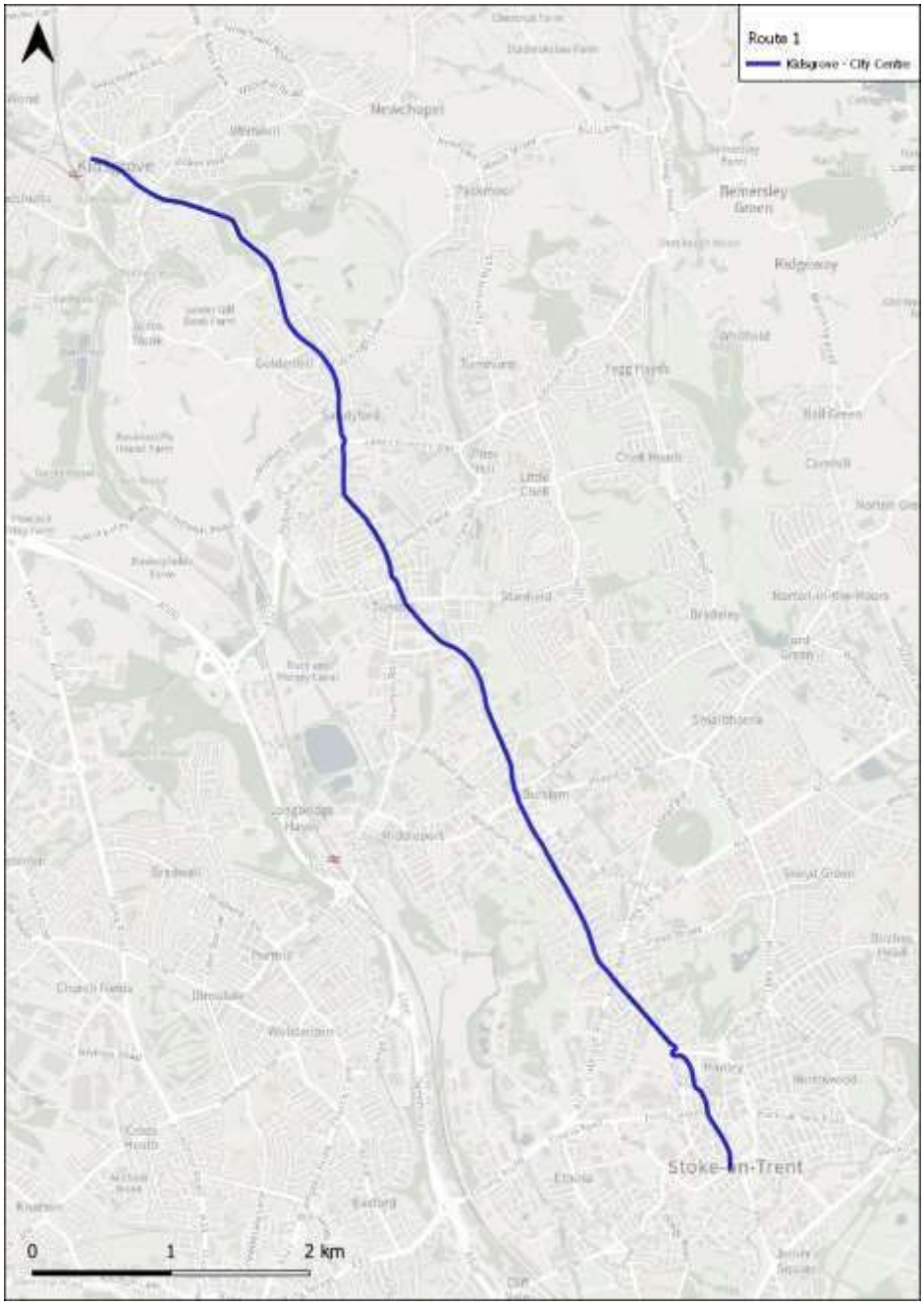


Figure A-1 Route 1 Kidsgrove - City Centre

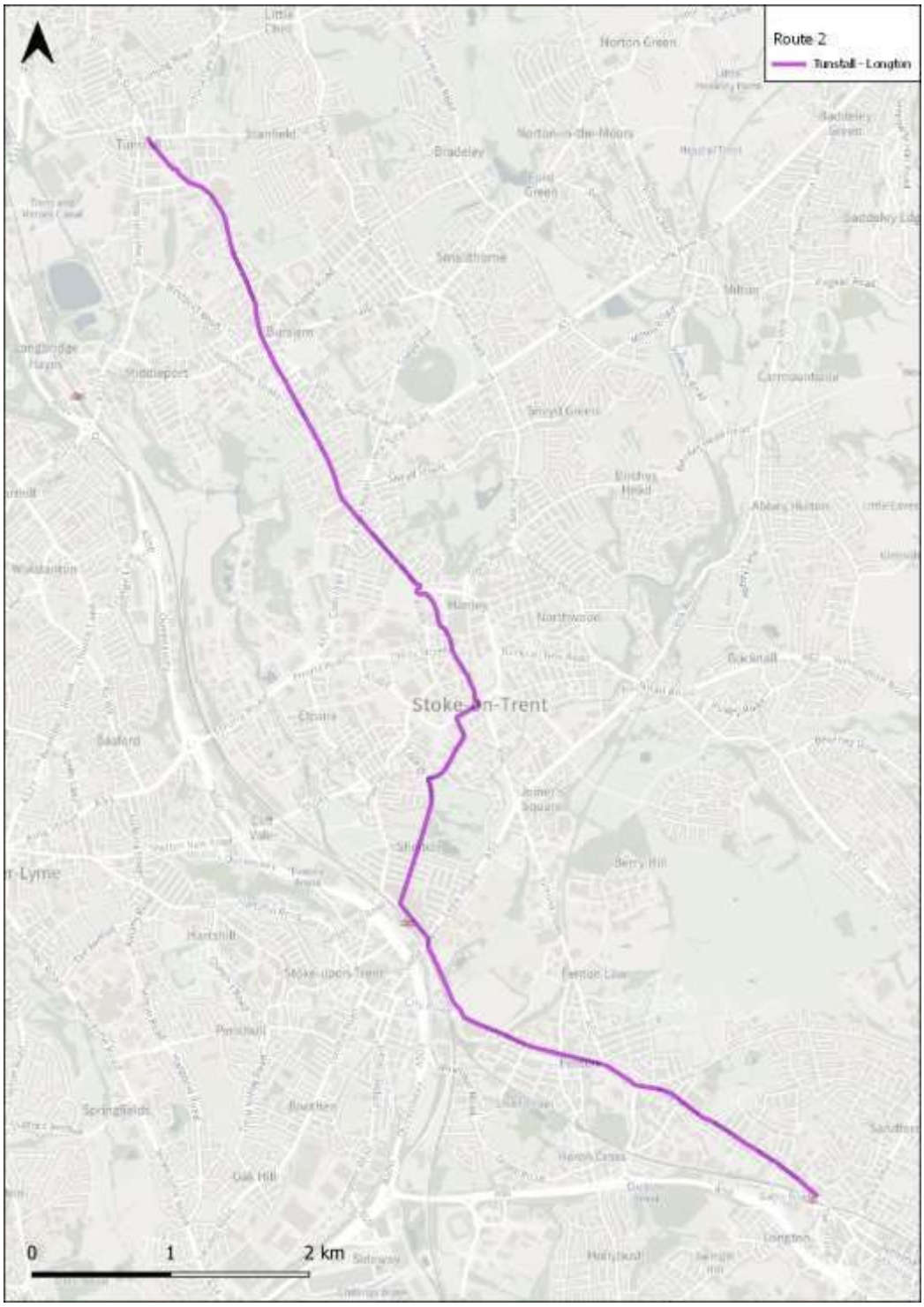


Figure A-2 Route 2 Tunstall - Longton

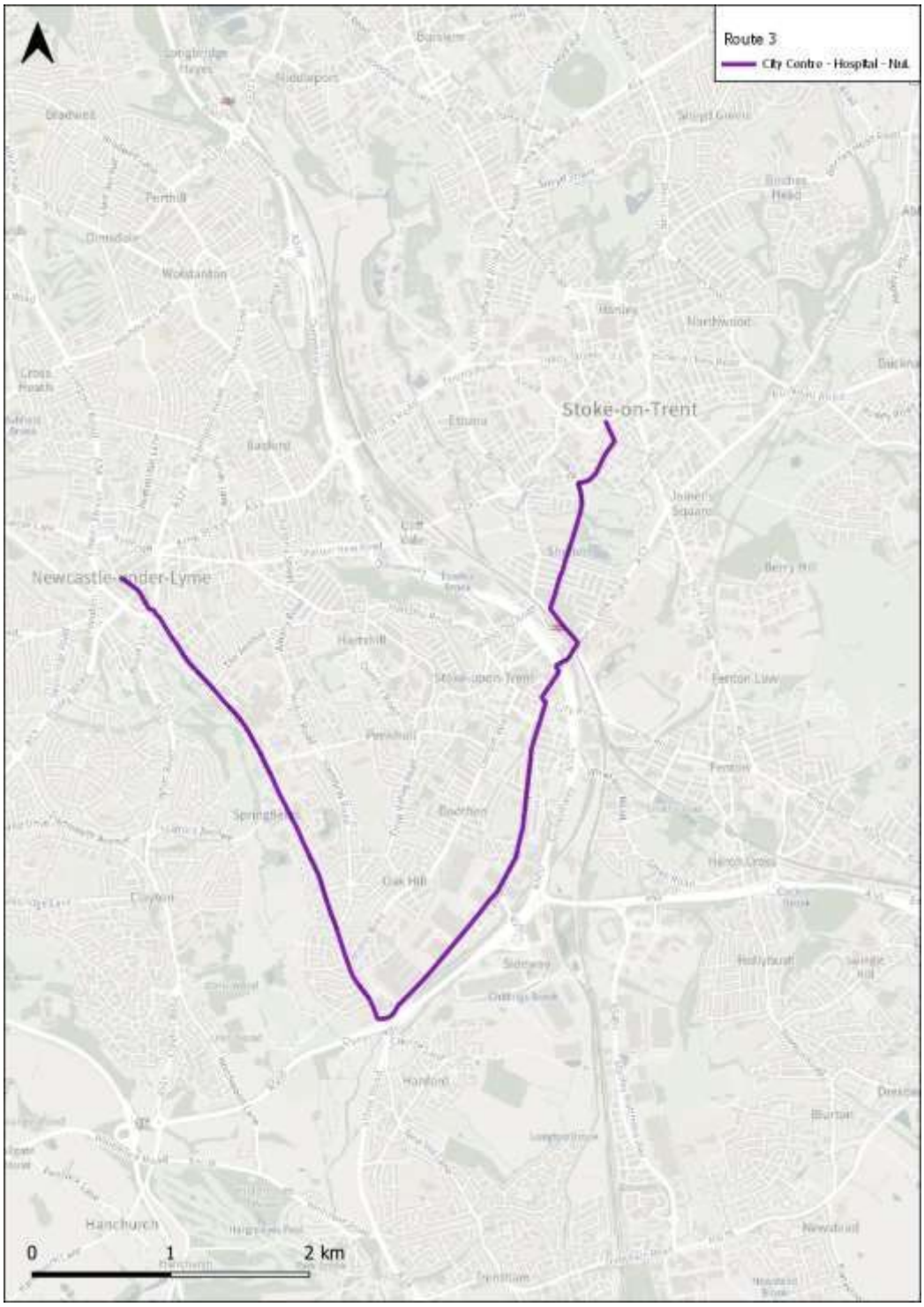


Figure A-3 Route 3 City Centre - Hospital - NuL

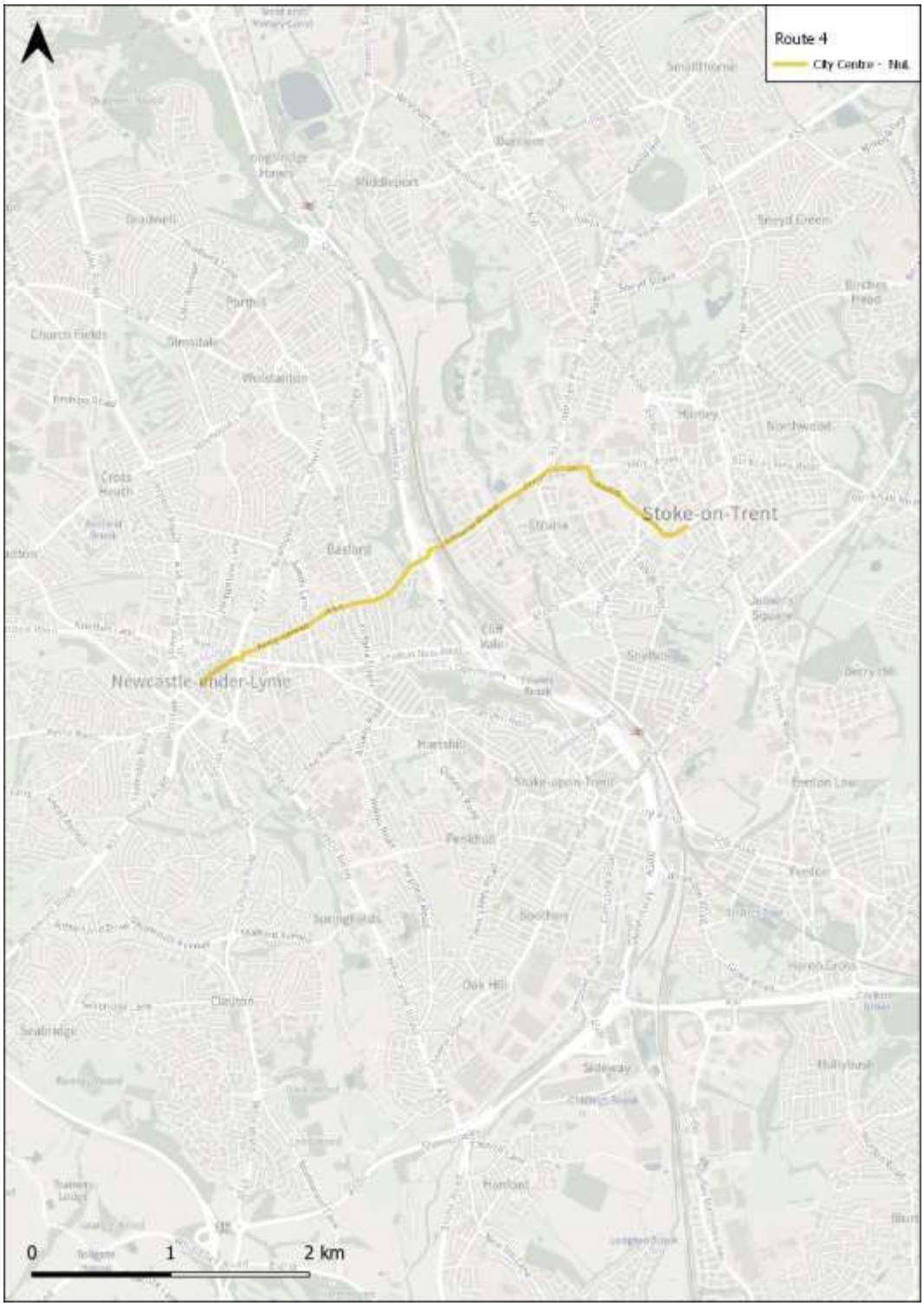


Figure A-4 Route 4 City Centre - NuL

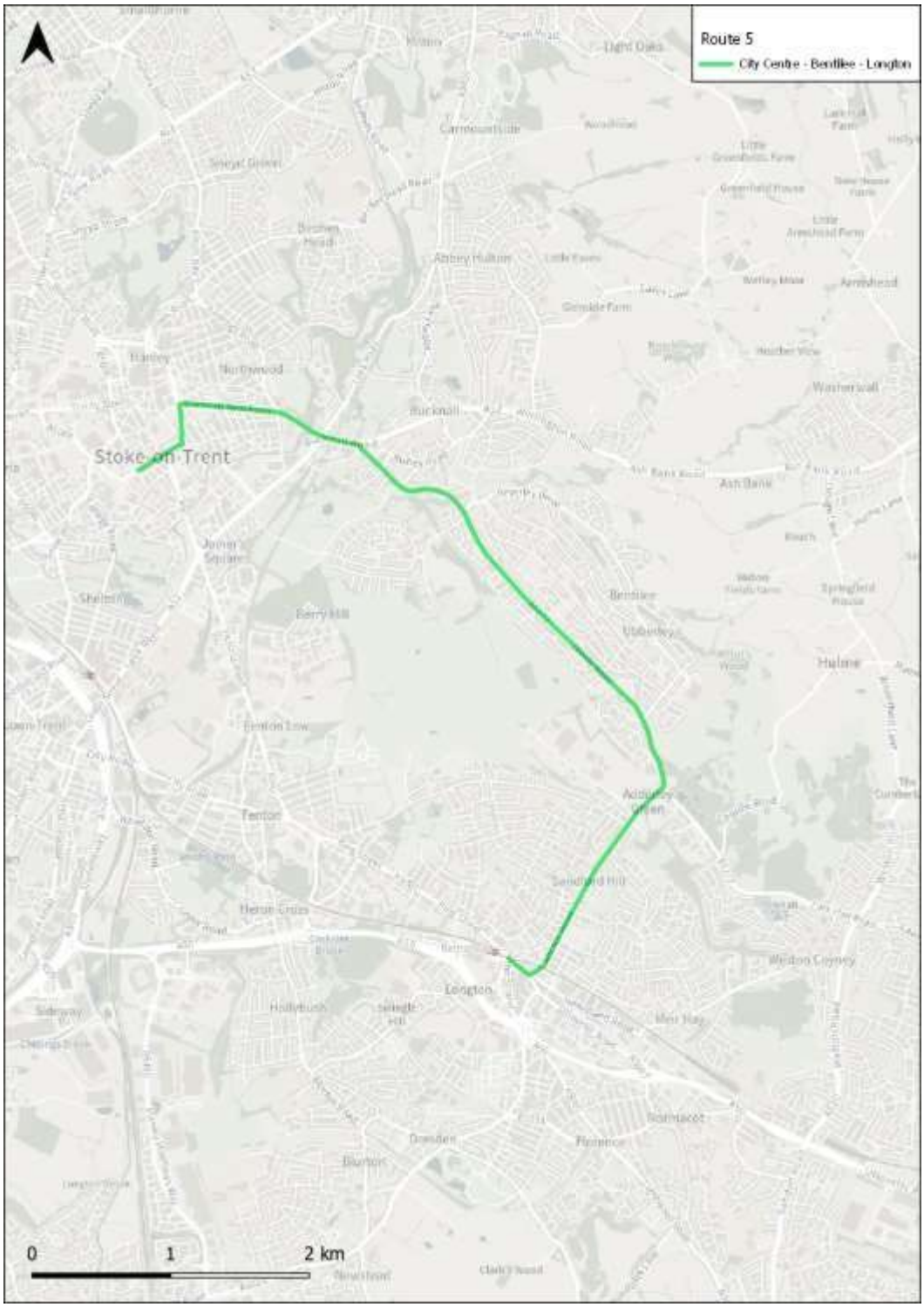


Figure A-5 Route 5 City Centre - Bentilee - Longton

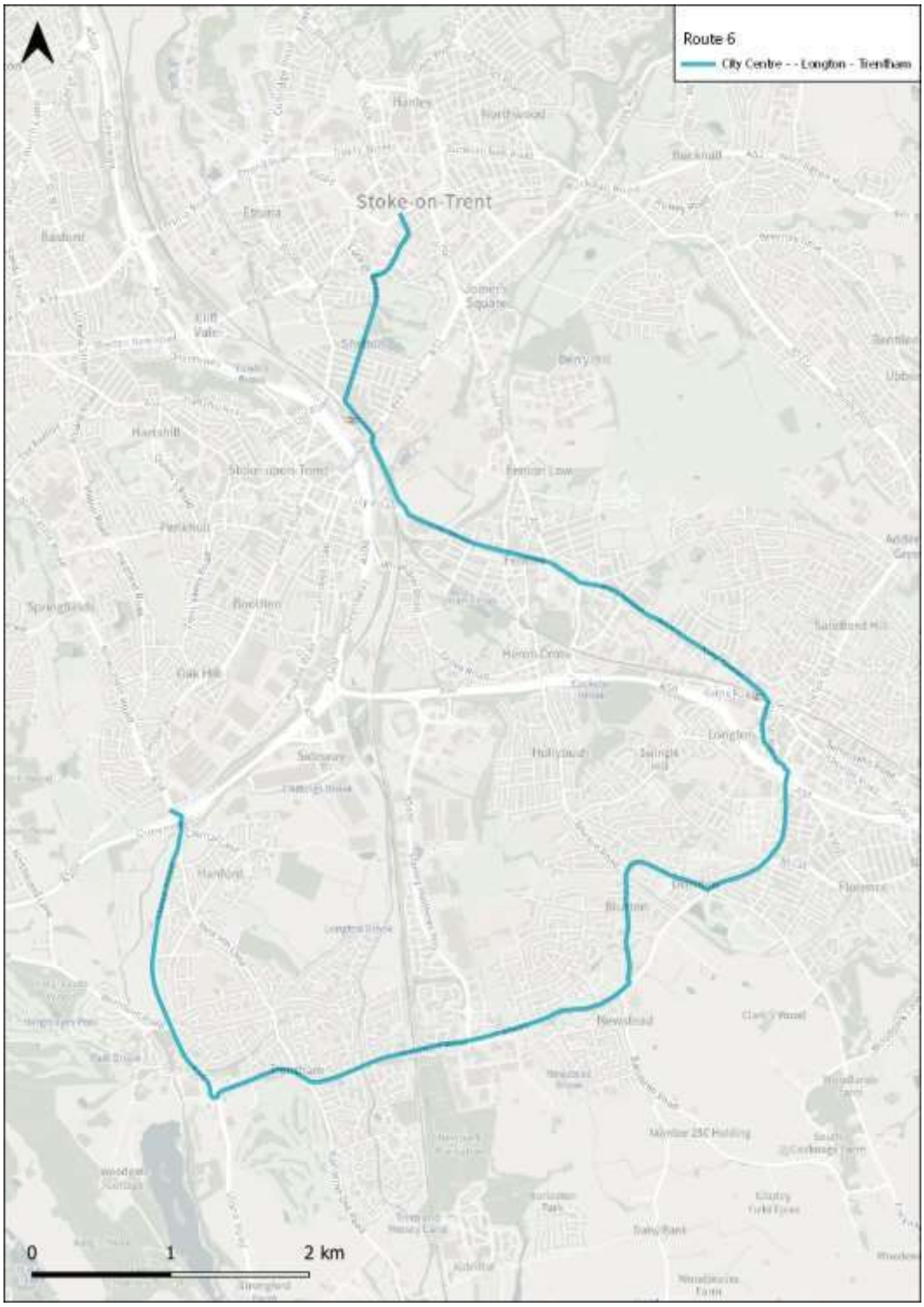


Figure A-6 Route 6 City Centre - Trentham

Figure A-6 Route 7 Longton - Meir - Blythe Bridge

Figure A-8 Route 8 City Centre – Etruria – SoT Railway Station

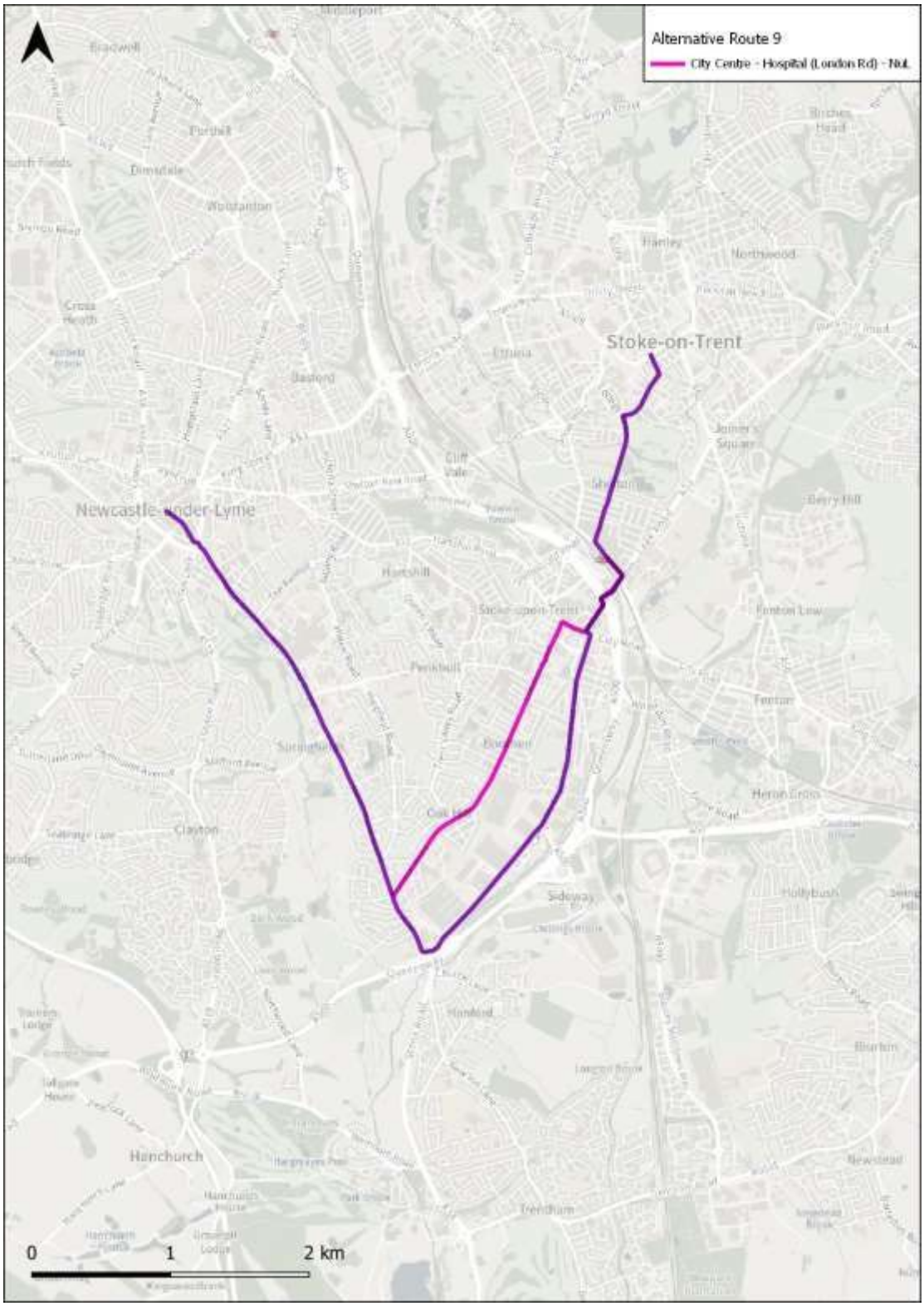


Figure A-9 Route 9 City Centre – Hospital – NuL (alternative route through London Rd. – pink line)

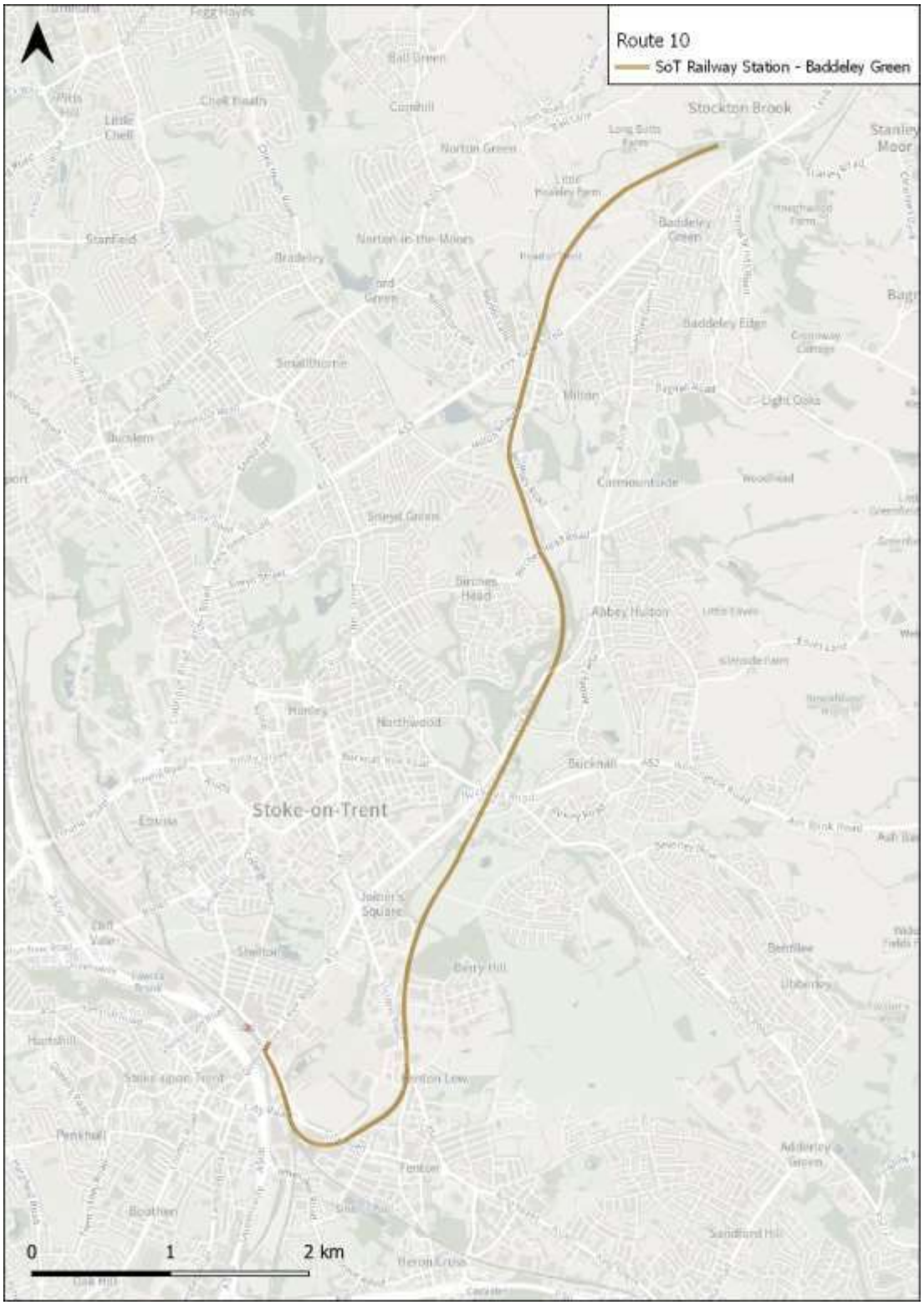


Figure A-10 Route 10 SoT Railway -Baddeley Green

Appendix D – Financial Case

Methodology

It should be mentioned that this is an initial assessment based on the costs of recent studies and examples with the assumption of that the scheme costs are £10m per km (in 2022 prices). This is subject to change with further research.

We have assessed the VLR network which includes the Northern, Central and Southern Lines consisting of a 39.83km total network length. In terms of construction, the costs have been profiled from 2026-2031 – Phase 2 construction phase and considered £10m per km (2022 prices) based on the total km length of 39.83, as shown in Table 5.1. We have then profiled costs from 2026-2031 based on spending profile assumptions and apply BCIS and GDP inflations – real and general. The Total capex comes at £398.3m.

Route	Distance in metres	Capital Cost per line
Northern Line	10066	£100,660,000
Central Line	10034	£100,340,000
Southern Line*	19730	£197,300,000
Total Network Length	**39.83**	
Total Costs in 2022 price	**£398,300,000**	**£398,300,000**

Table D.1 Construction Costs

**Part of the capital cost is included in the Northern Line as there is a route overlap*

Stoke VLR Capital expenditure	2025	2026	2027	2028	2029	2030	2031	Total
Total scheme costs	£15,213,553	£51,247,020	£108,435,930	£124,867,797	£78,634,977	£31,692,832	£5,322,248	£415,414,356

Table D.2 Total scheme costs

We have further assessed Mobilisation, Lifecycle Asset costing over 30 years period and Operation & Maintenance (O&M) costs over 60-year period with assumptions based on previous studies in absence of detailed information.

Based on the journey times derived from the NSMM model, we have created a timetable concept to examine the hourly vehicle capacity needed to serve the hourly forecasted demand. We have assumed the below vehicles parameters to derive the capacity needs and have compared it to two scenarios.

Vehicle Parameters	
Parameter	**Value**
Seats	20
Standing capacity (standard, 4 people per m2)	30
Standing capacity (crush conditions, 6 people per m2)	50
Number of doors per vehicle	side 2 single leaf

Charging time at terminals	5 minutes
Total terminal dwell assuming charging, cleaning and drivers changing ends occurs at same time as charging	6 minutes maximum
Max daily operation for production vehicles	18 hours

Table D.3 Vehicle Parameters

Scenarios:

- Scenario 1: operating single vehicle units at a 6-minute frequency for each line and a 10-minute frequency for 3B Southern Line
- Scenario 2: operating double vehicle units at a 6-minute frequency for each line and a 10-minute frequency for 3B Southern Line

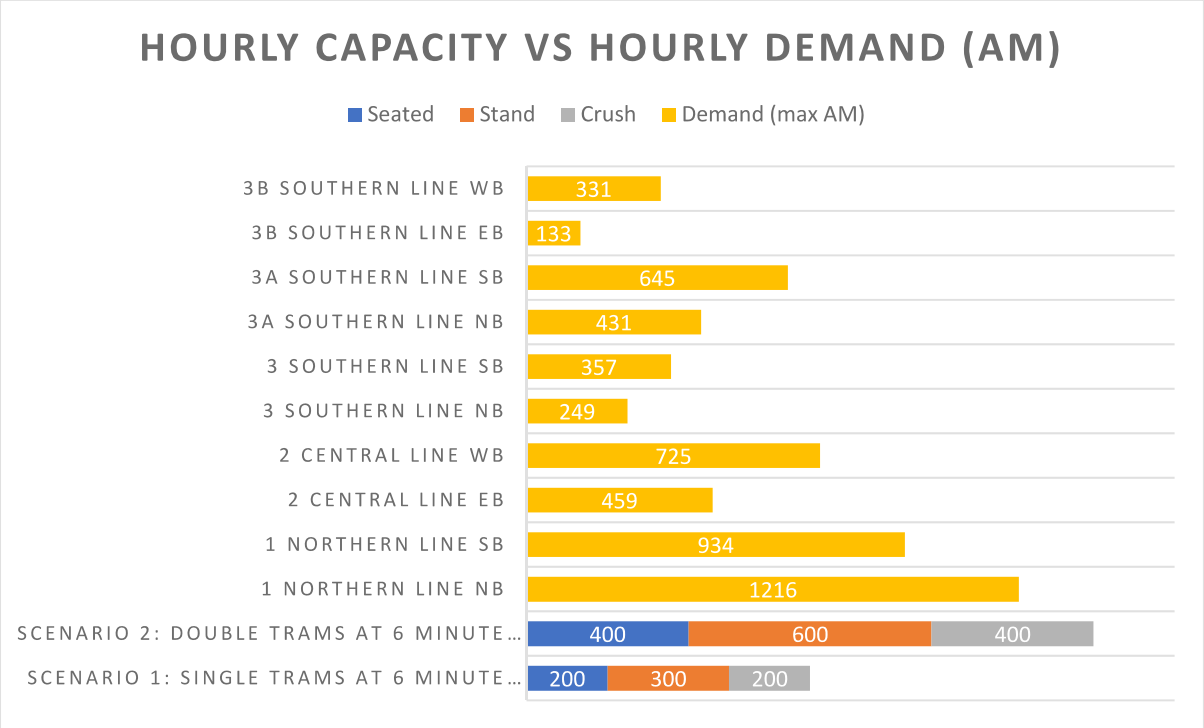


Figure D.1 Hourly Capacity vs Hourly demand (AM)

The results of this analysis are demonstrated in Figure D.1. This suggested that the majority of the lines will opt for Scenario 1 while the Northern line would be better served with double units.

An extract of a 6-minute headway timetable has been produced to illustrate the runtime needs:

Example of the first vehicle of the first service	
Northern Line	V1
Start	5:30 AM
Terminal	6:07 AM
Charging*	6:11 AM
Terminal*	6:12 AM
Start	6:49 AM
Charging	6:53 AM

Central Line	V1
Start	5:30 AM
Terminal	6:04 AM
Charging*	6:08 AM
Terminal*	6:09 AM
Start	6:43 AM
Charging	6:47 AM

Table D.4 First service runtime

**Assuming 4 min charging and 60 second dwell time in terminal*

Appendix E – Very Light Rail Accessibility Analysis

To analyse the impact of the proposed Very Light Rail services on public transport accessibility in the study area, accessibility analysis using TRACC has been undertaken. The 60-minute public transport maps with VLR are displayed in Figure B.1 through to B.21, with summaries for each site also provided. It should be noted that the summaries are comparative, referring to the existing situation outlined in Appendix E of the Transport Strategy and Delivery Plan 2022 – 2031).

Stoke-on-Trent Rail Station

The locations of Alsager, Madeley Heath, Froghall and Stone remain the outer extents of 60-minute public transport journeys from Stoke-on-Trent rail station. In the AM peak (Figure B.1), access has improved in the centre of Stoke, as Burslem and Trentham are now accessible in 20 minutes. Once again, access has improved in the centre of Stoke from the rail station during the inter-peak (Figure B.2), with Burslem now accessible in 20 minutes and Aston-by-Stone accessible within a 40-minute journey as opposed to 60 minutes. Access from the rail station at PM periods (Figure B.3) has improved in the centre of Stoke, as Burslem and Trentham can now be accessed 20 minutes.

City Centre (Hanley)

Accessibility from Hanley remains unchanged following the implementation of VLR during the AM peak (Figure B.4). During inter-peak periods (Figure B.5), Wetley Rocks and Stone are now within a 40-minute journey as opposed to 60 minutes. Connectivity within a 20-minute journey has improved to the south-east of Stoke towards Lightwood during the PM peak (Figure B.6). The extent of the area to the west of the site accessible in 40 minutes has also expanded.

Royal Stoke University Hospital

Accessibility from the Royal Stoke University Hospital remains unchanged following the implementation of VLR during the morning peak (Figure B.7). During inter-peak periods (Figure B.8), to the west of the Hospital, Wrinehill is now accessible within 60-minutes. The 60-minute public transport catchment remains unchanged in the PM peak (Figure B.9).

Trentham Lakes / Sideway Employment Zone

To the east of the Trentham Lakes and Sideway Employment Zone, during the AM peak (Figure B.10), there is improved accessibility as Kingsley now falls within the 60-minute catchment area. Accessibility from the Trentham Lakes is very similar following the implementation of VLR during inter peak periods (Figure B.11). During peak evening periods (Figure B.12), catchment improvements are evident for 40-minute journeys as Tunstall is now accessible within this time. The catchment is also greater in the area near Kidsgrove.

Etruria Valley Enterprise Zone (EVEZ)

Accessibility from EVEZ is very similar following the implementation of VLR during morning peak periods (Figure B.13). During inter-peak periods (Figure B.14), Kidsgrove and Wetley Rocks are now accessible within 40-minutes as opposed to the current 60 minutes. During the PM peak (Figure B.15), Buddulph and Wetley Rocks can now be accessed within a 60-minute journey. Longton can also be reached inside a 40-minute journey from EVEZ.

Longton

In the morning peak (Figure B.16), from Longton, Stone and Alsager can now be accessed in a 60-minute public transport journey when VLR is introduced. Accessibility from Longton remains unchanged following during inter-peak and evening peak periods (Figure B.17 and Figure B.18).

Tunstall

Fenton and Werrington are now within a 40-minute journey, following the introduction of VLR, from Tunstall during the AM peak (Figure B.19). Similar to the morning peak period, during the Inter-Peak (Figure B.20), Fenton and the beginning of Werrington are now within a 40-minute journey following the introduction of VLR from Tunstall. Trentham Lakes is now accessible in 60 minutes during the peak evening period (Figure B.21).

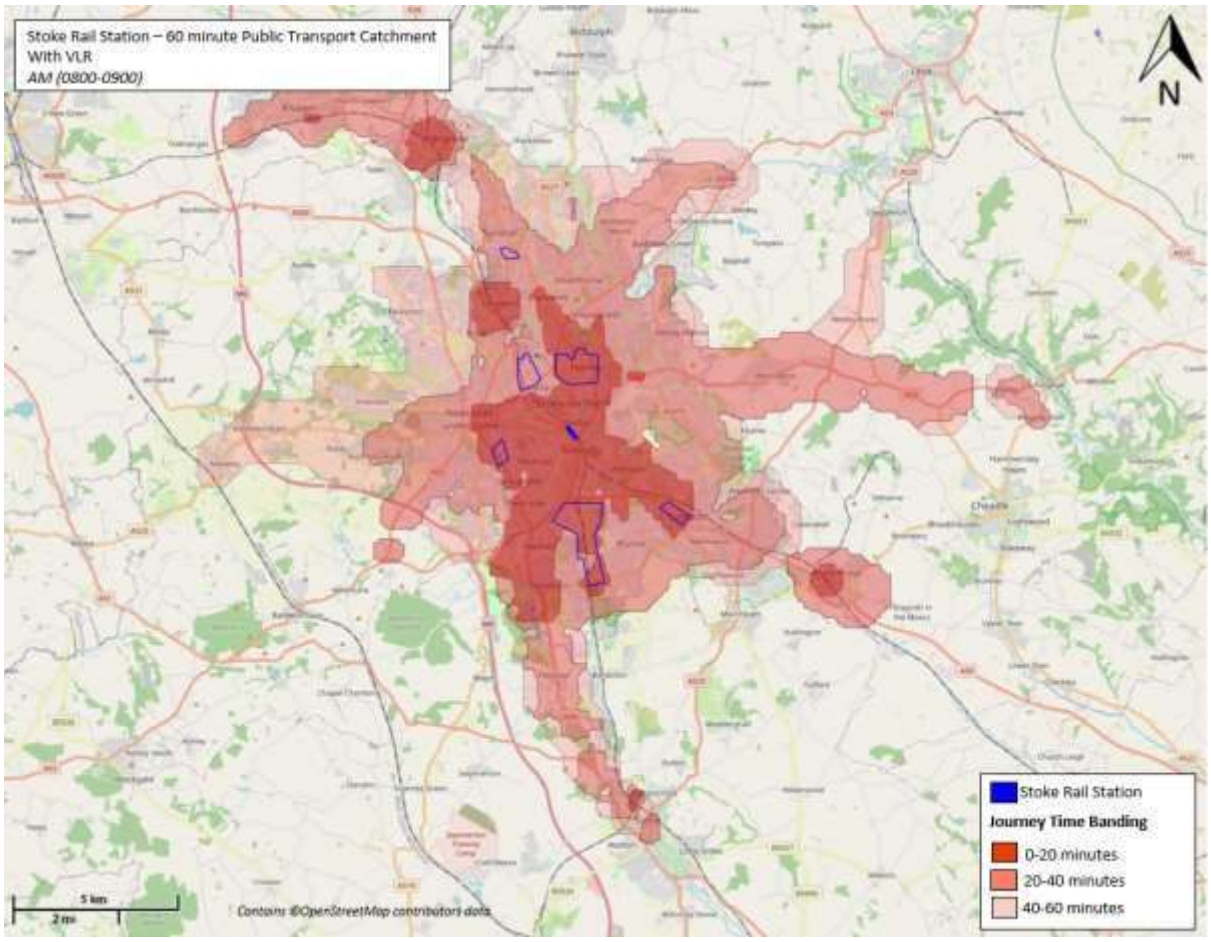


Figure B.1-Stoke-on-Trent Railway Station AM (0800-0900)

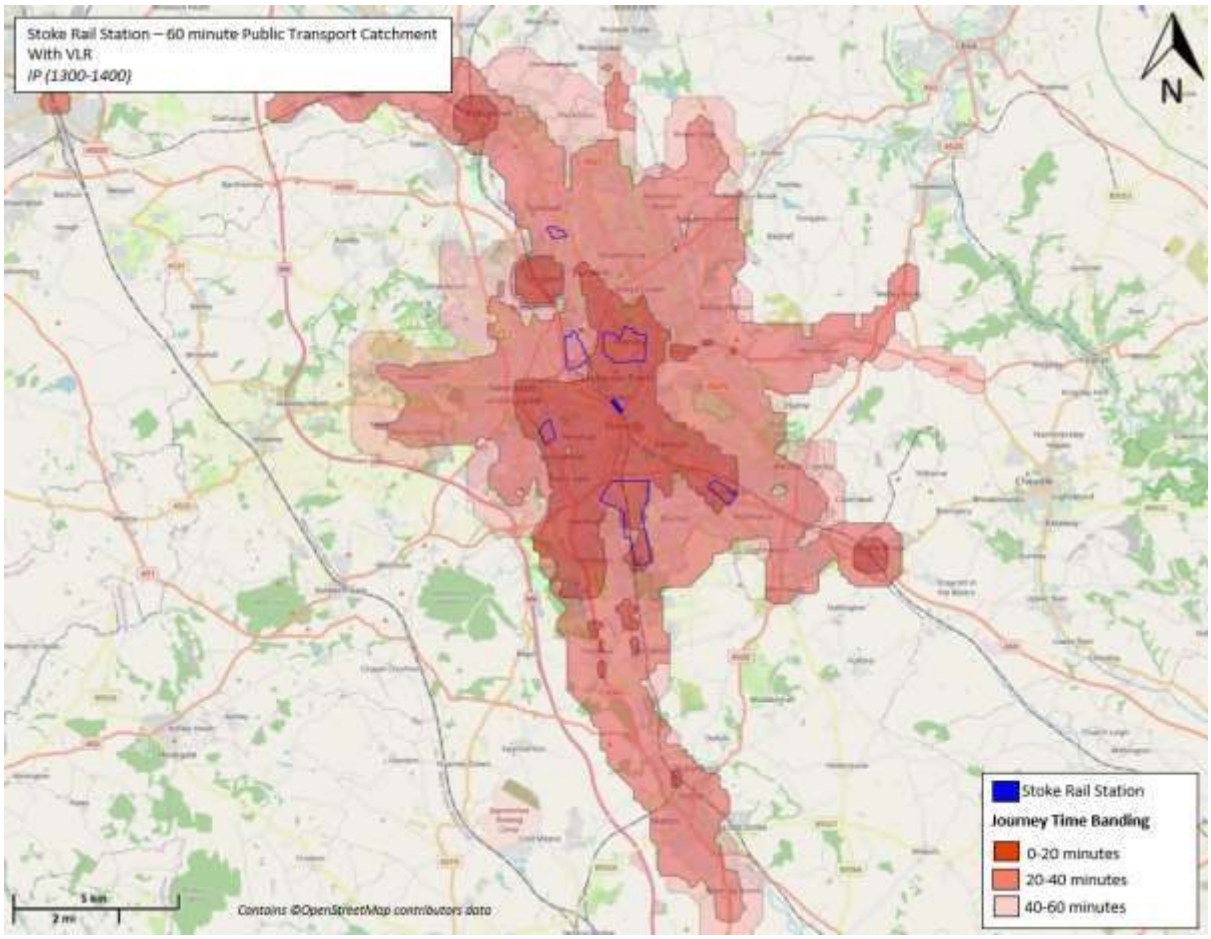


Figure B.2-Stoke-on-Trent Railway Station IP (1300-1400)

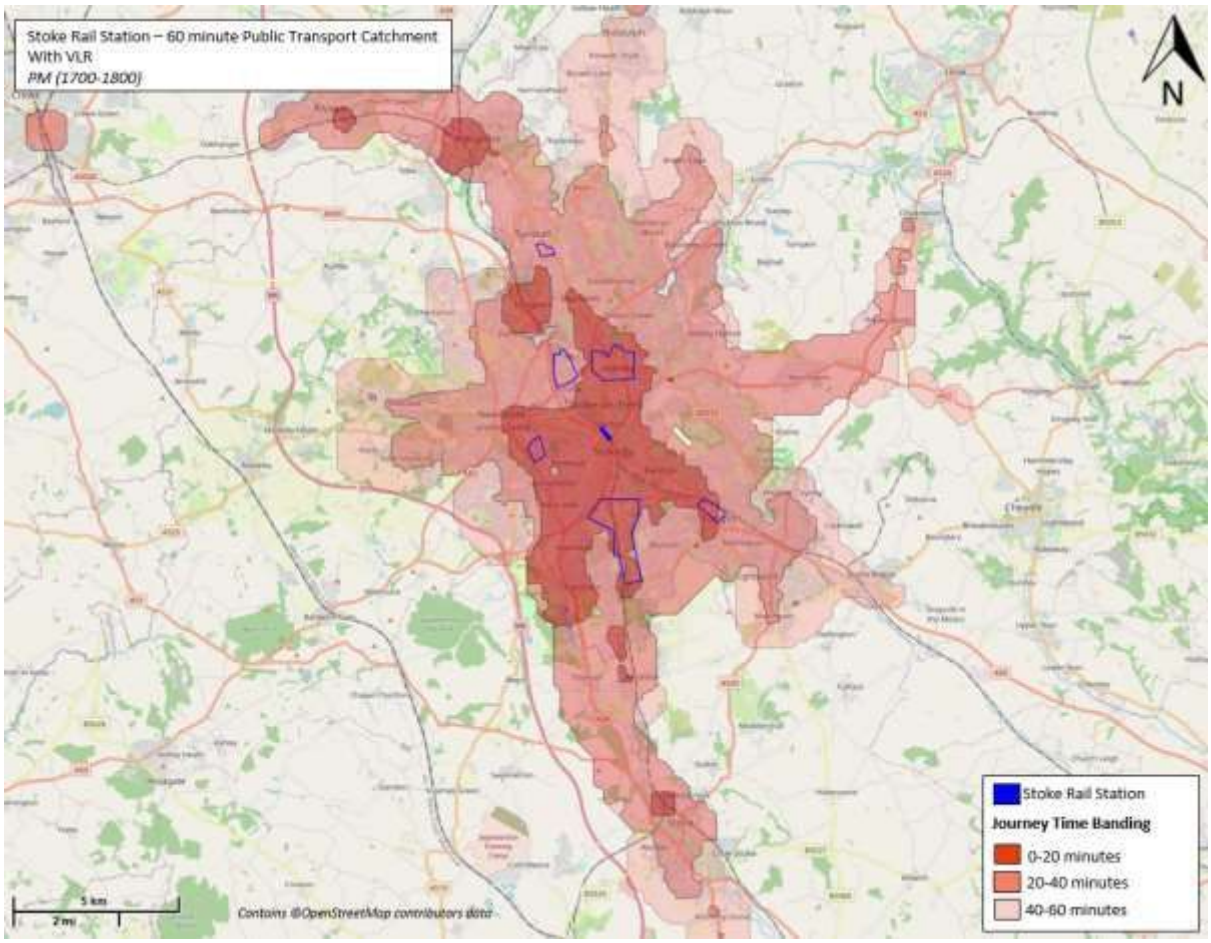


Figure B.3-Stoke-on-Trent Railway Station PM (1700-1800)

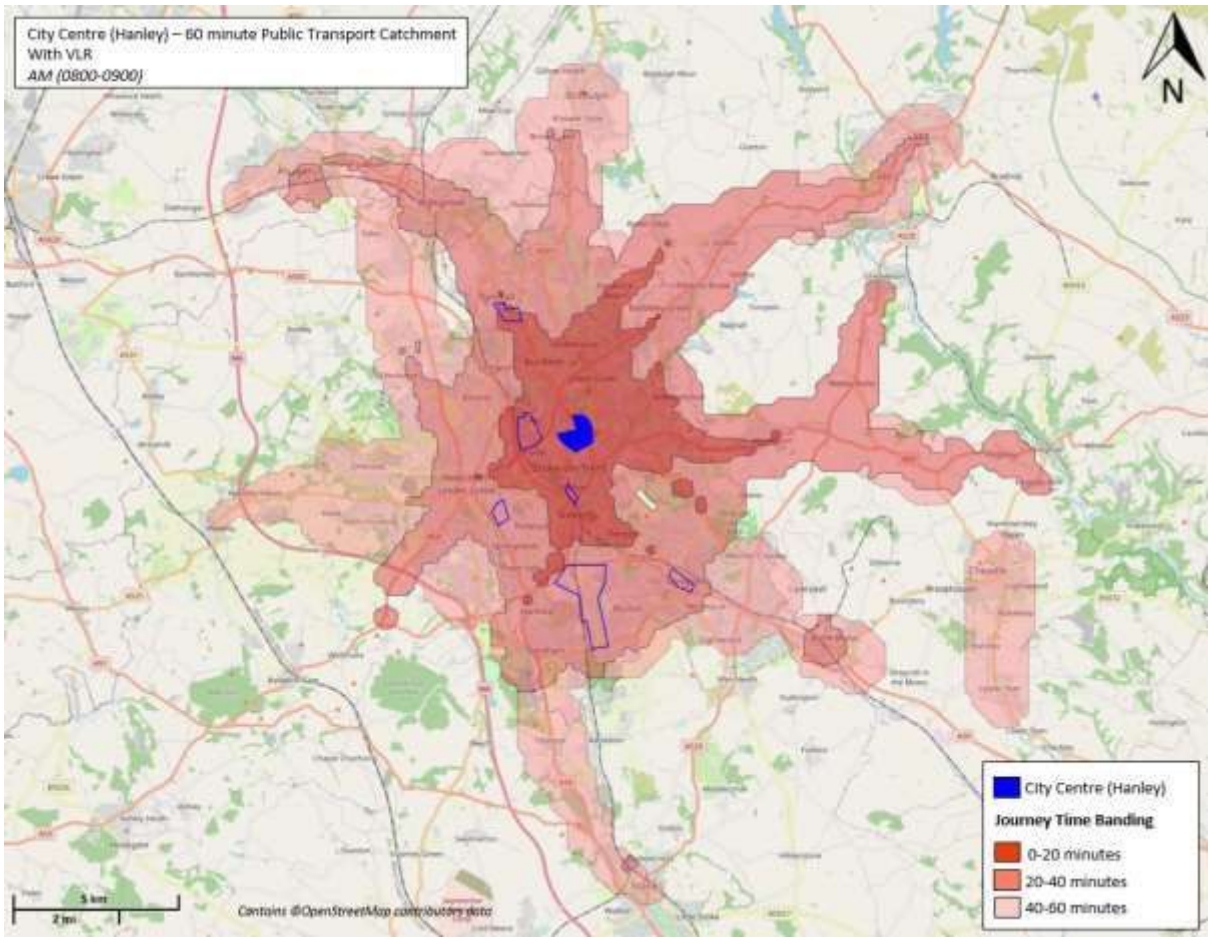


Figure B.4-City Centre (Hanley) AM (0800-0900)

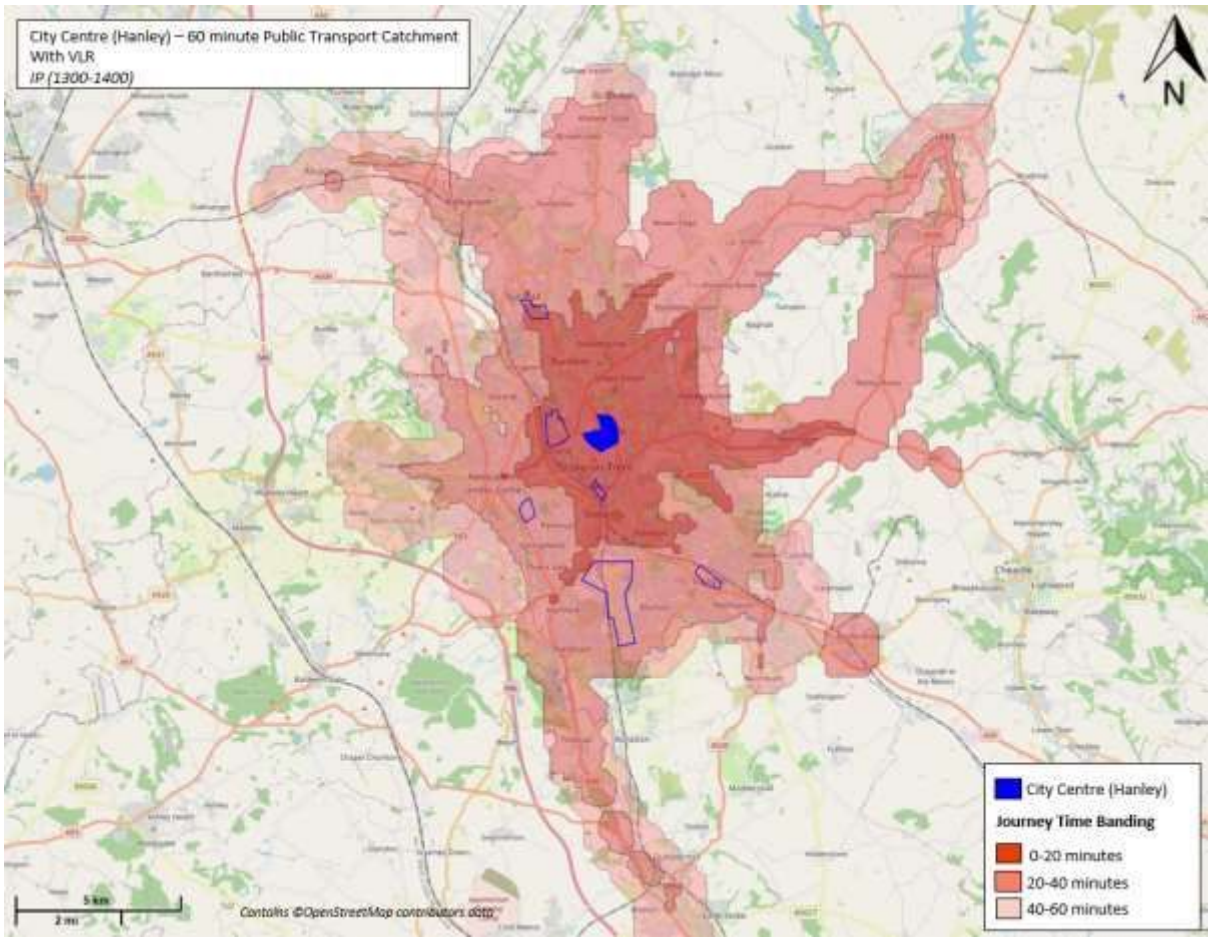


Figure B.5-City Centre (Hanley) IP (1300-1400)

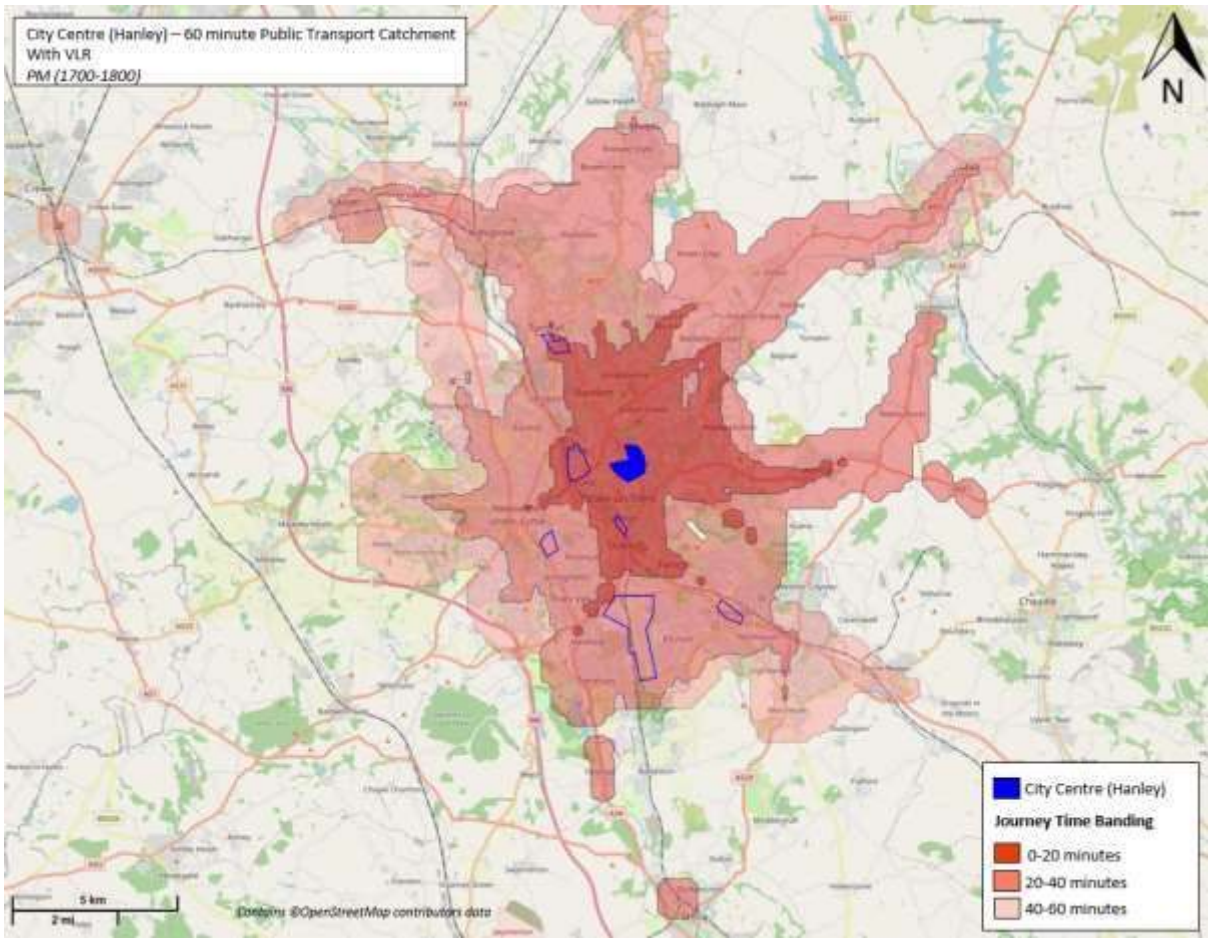


Figure B.6-City Centre (Hanley) PM (1700-1800)

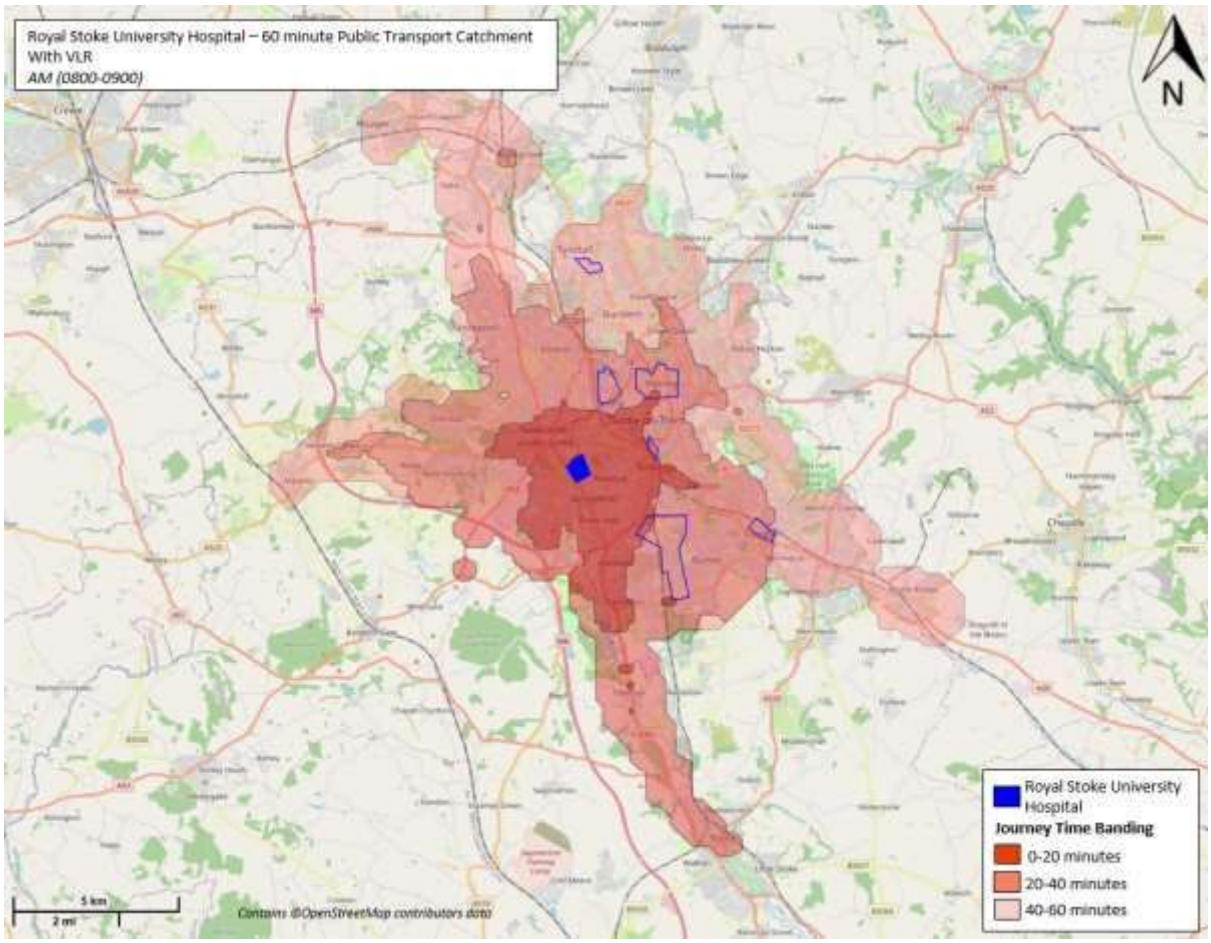


Figure B.7-Royal Stoke University Hospital AM (0800-0900)

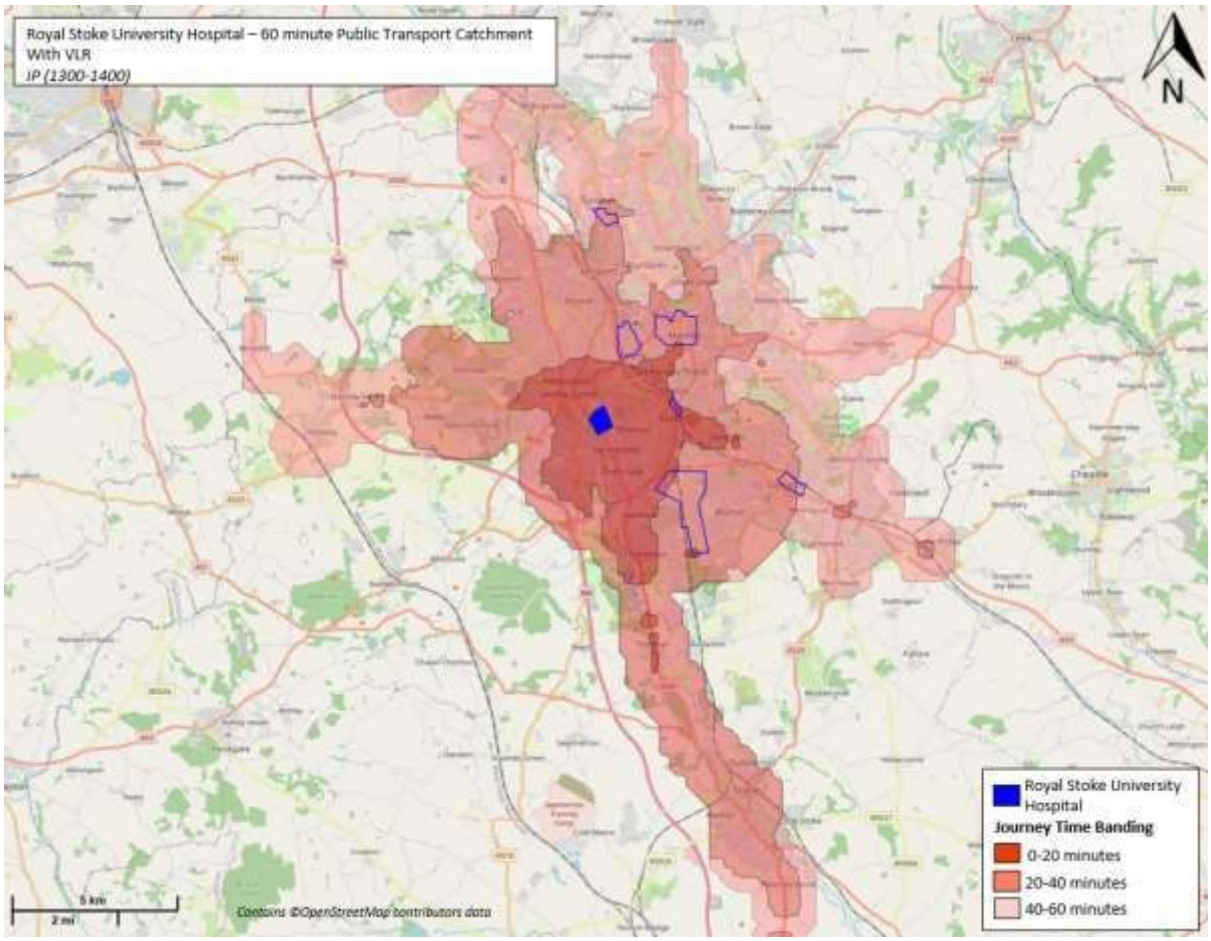


Figure B.8-Royal Stoke University Hospital IP (1300-1400)

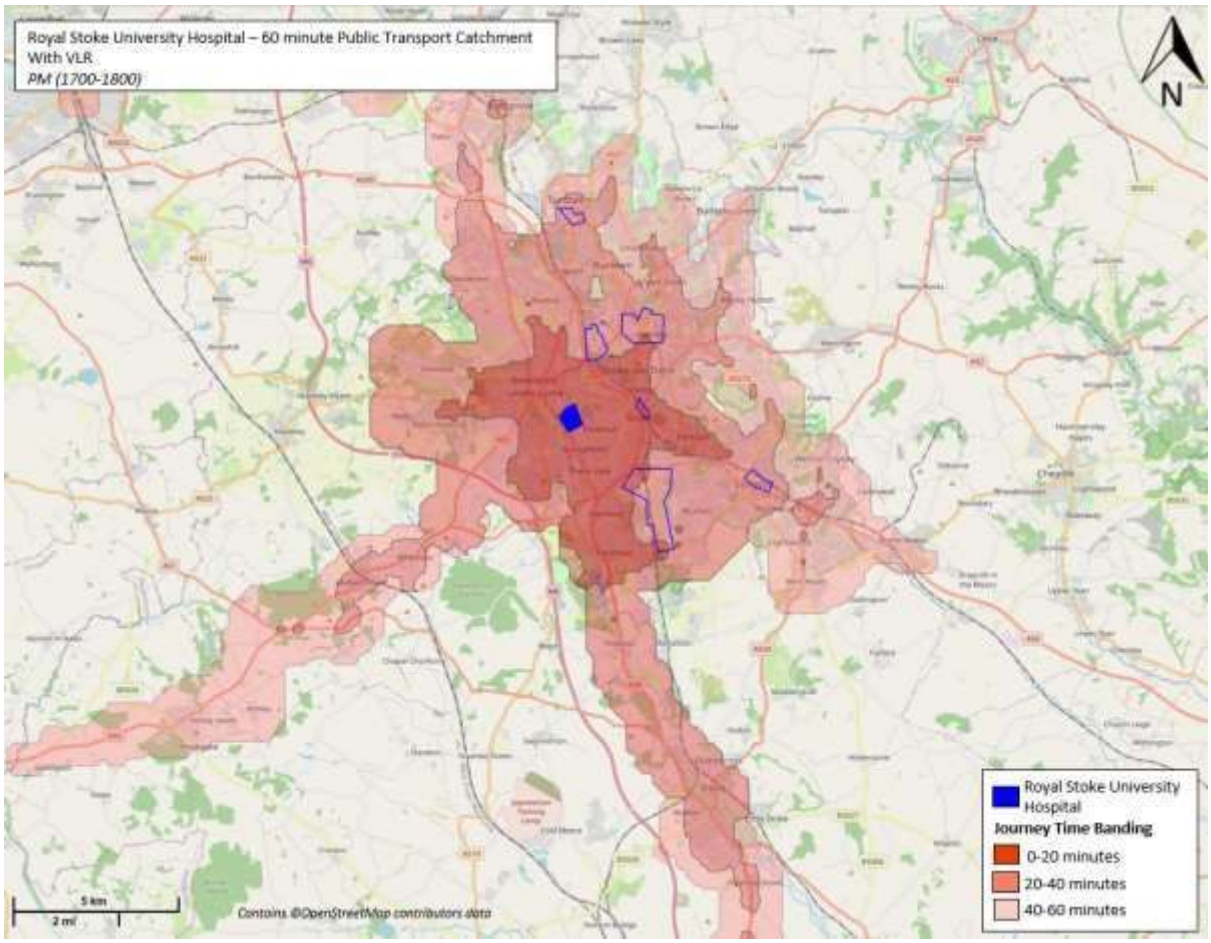


Figure B.9-Royal Stoke University Hospital PM (1700-1800)

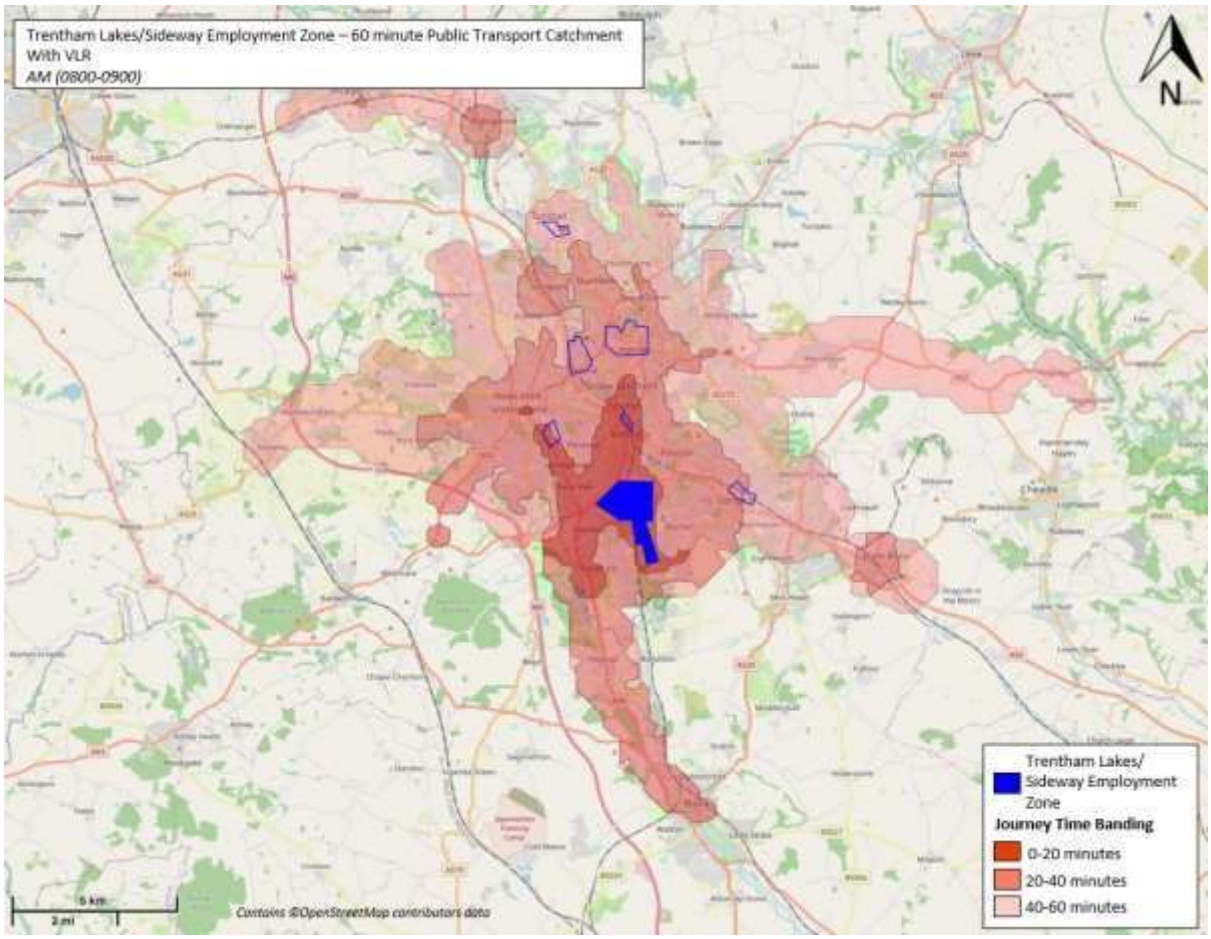


Figure B.10-Trentham Lakes/Sideway AM (0800-0900)

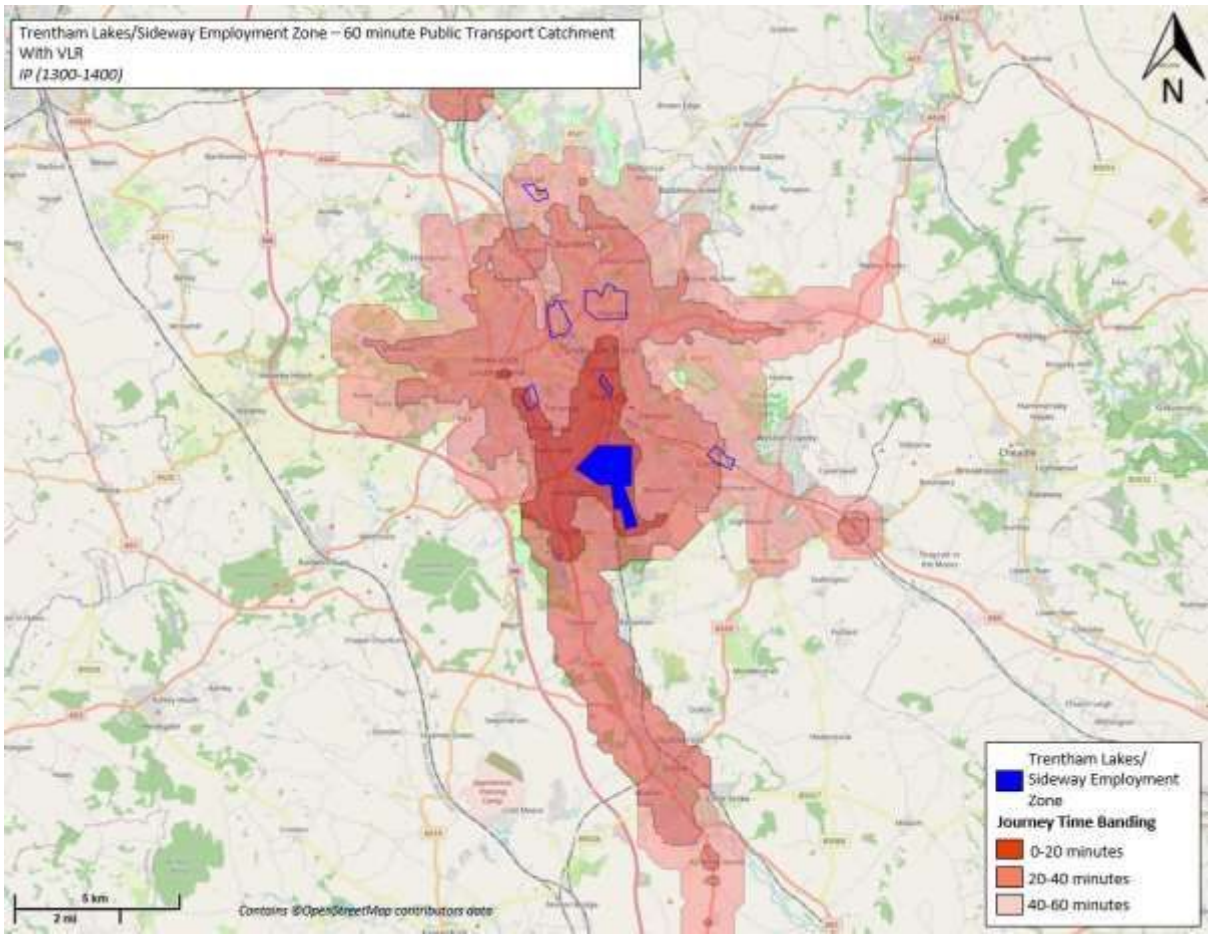


Figure B.11-Trentham Lakes/Sideway IP (1300-1400)

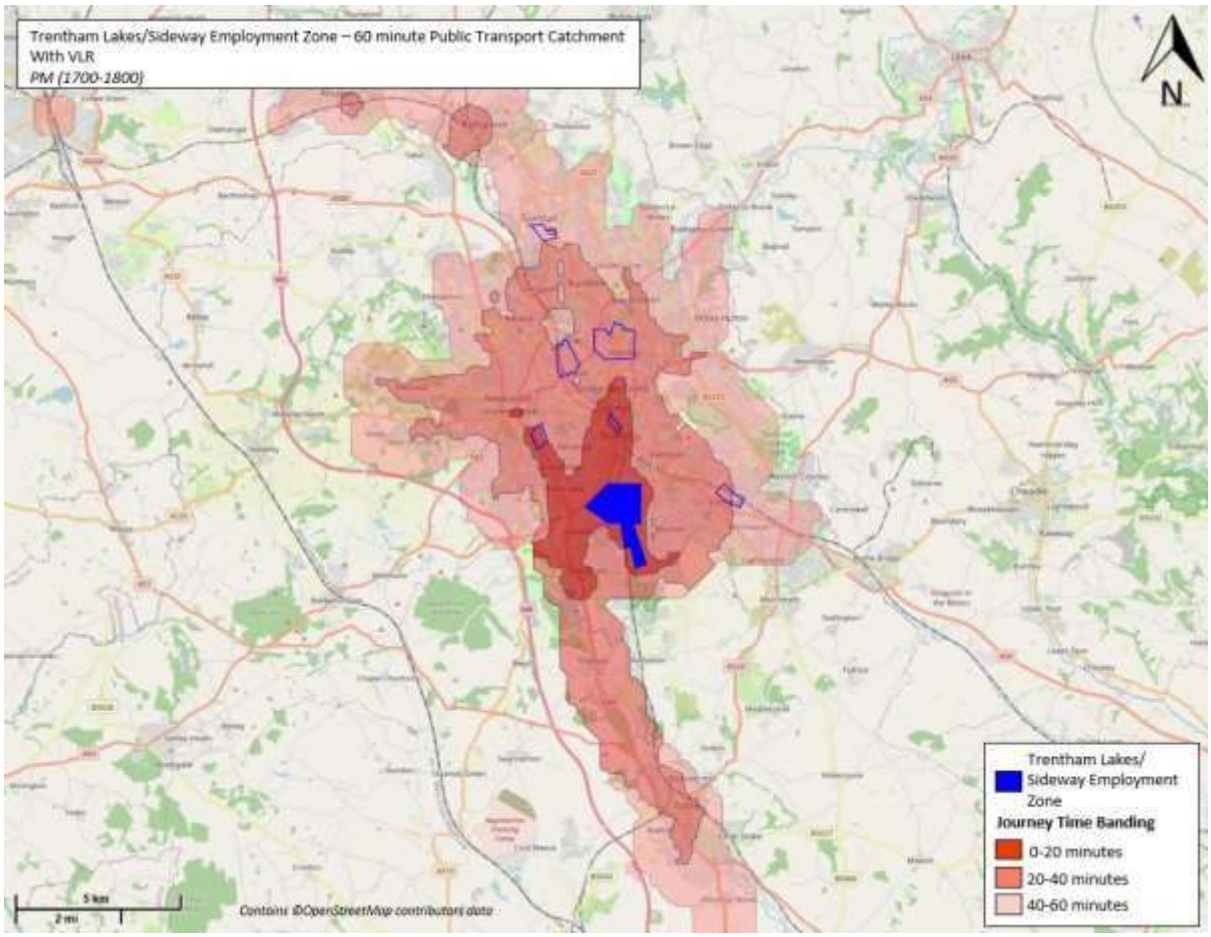


Figure B.12-Trentham Lakes/Sideway PM (1700-1800)

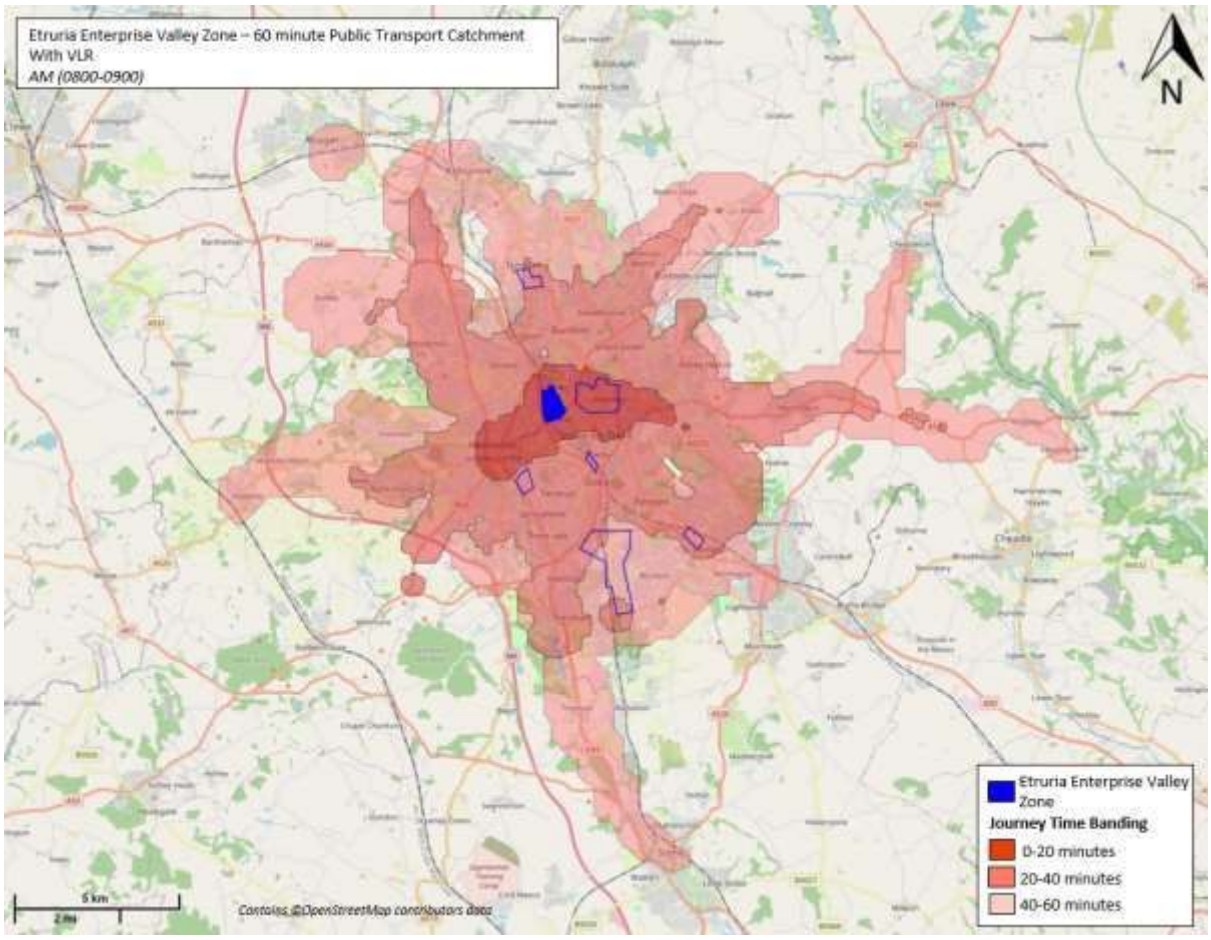


Figure B.13-Etruria Valley Enterprise Zone AM (0800-0900)

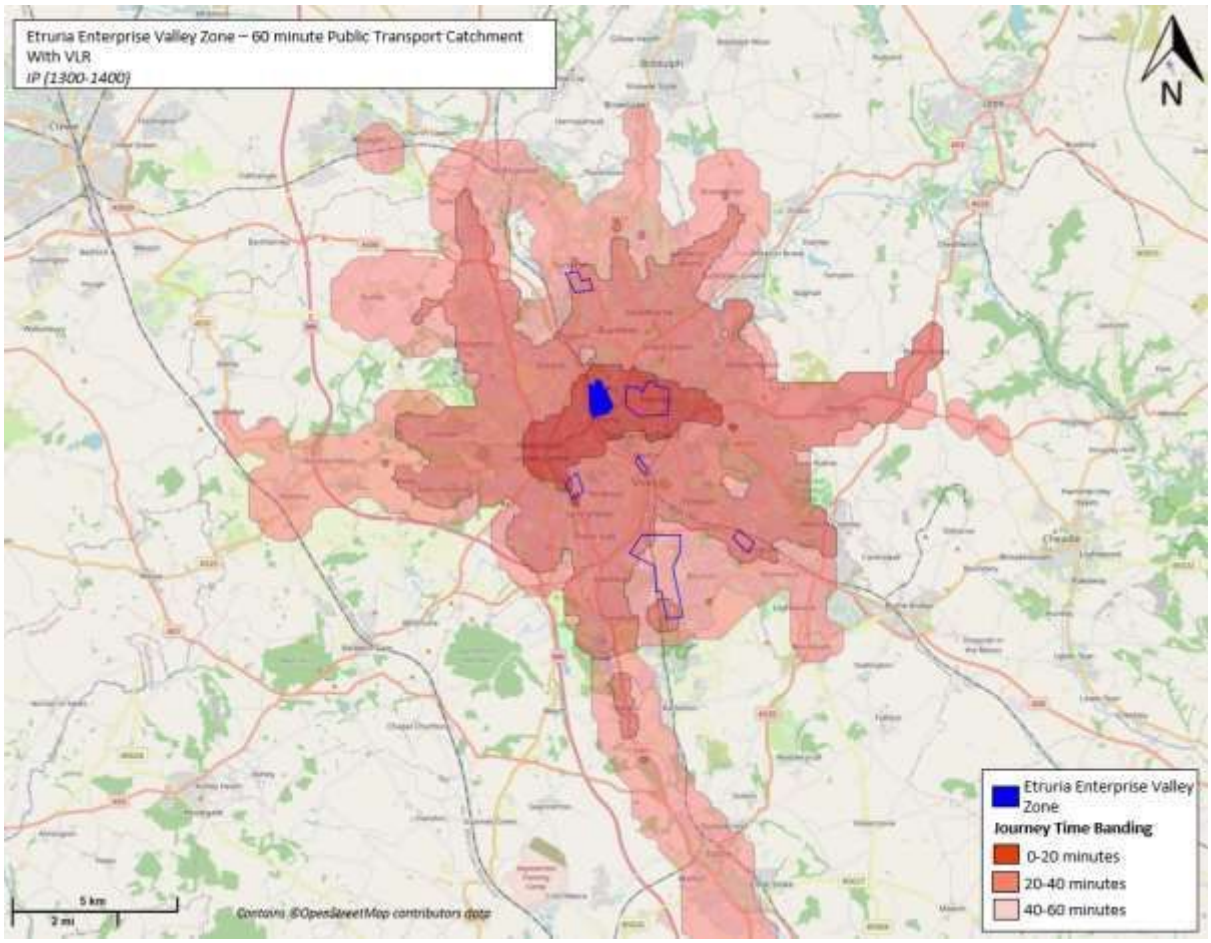


Figure B.14-Etruria Valley Enterprise Zone IP (1300-1400)

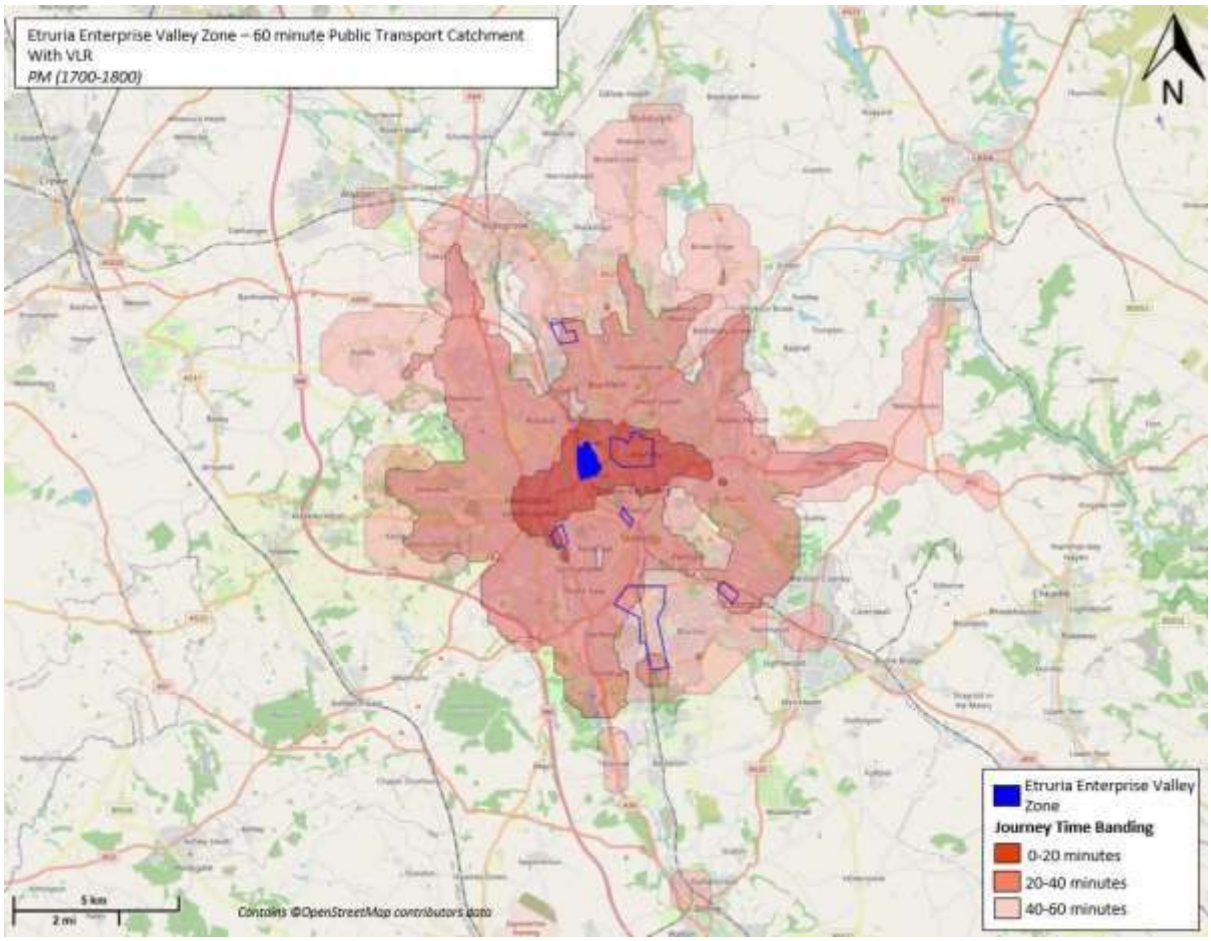


Figure B.15-Etruria Valley Enterprise Zone PM (1700-1800)

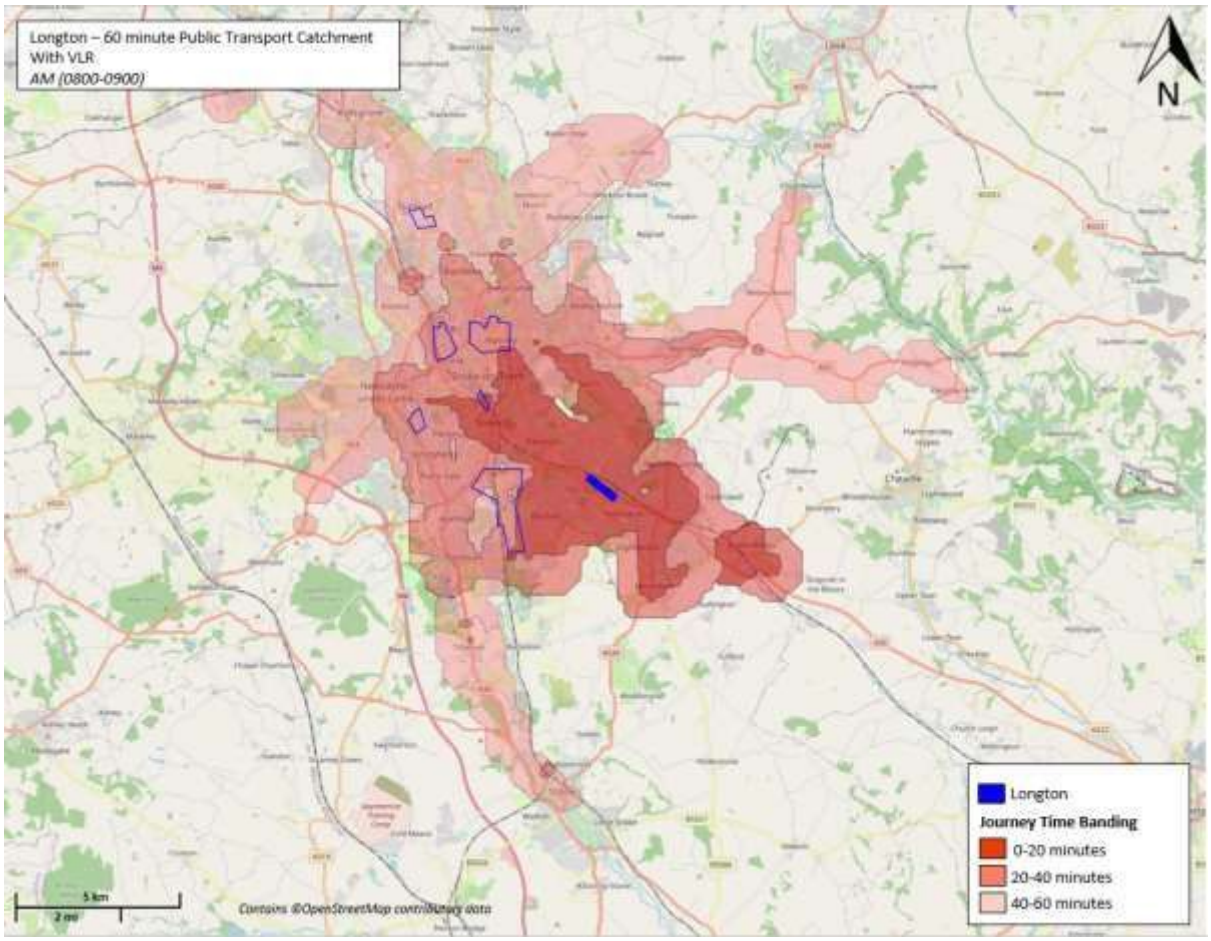


Figure B.16-Longton AM (0800-0900)

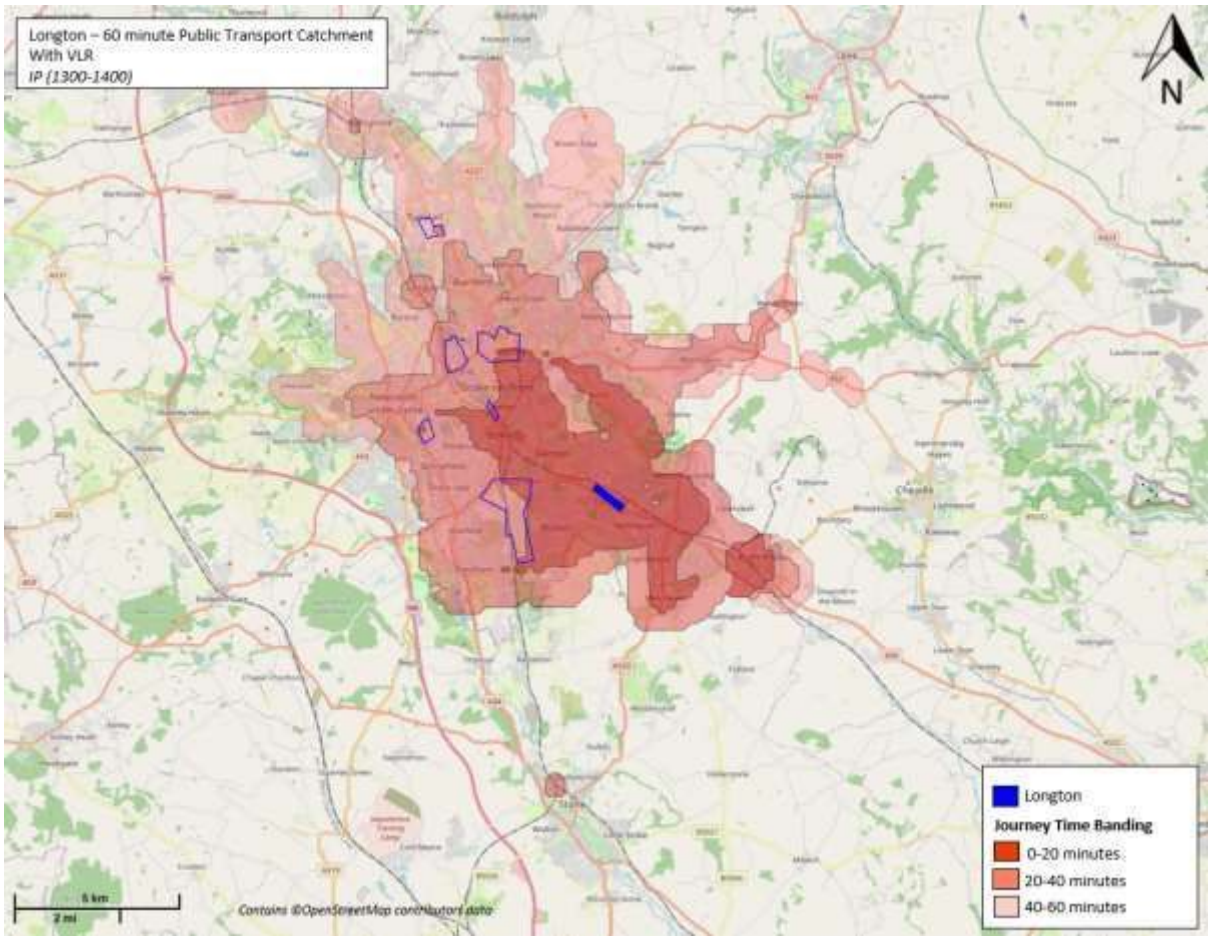


Figure B.17-Longton IP (1300-1400)

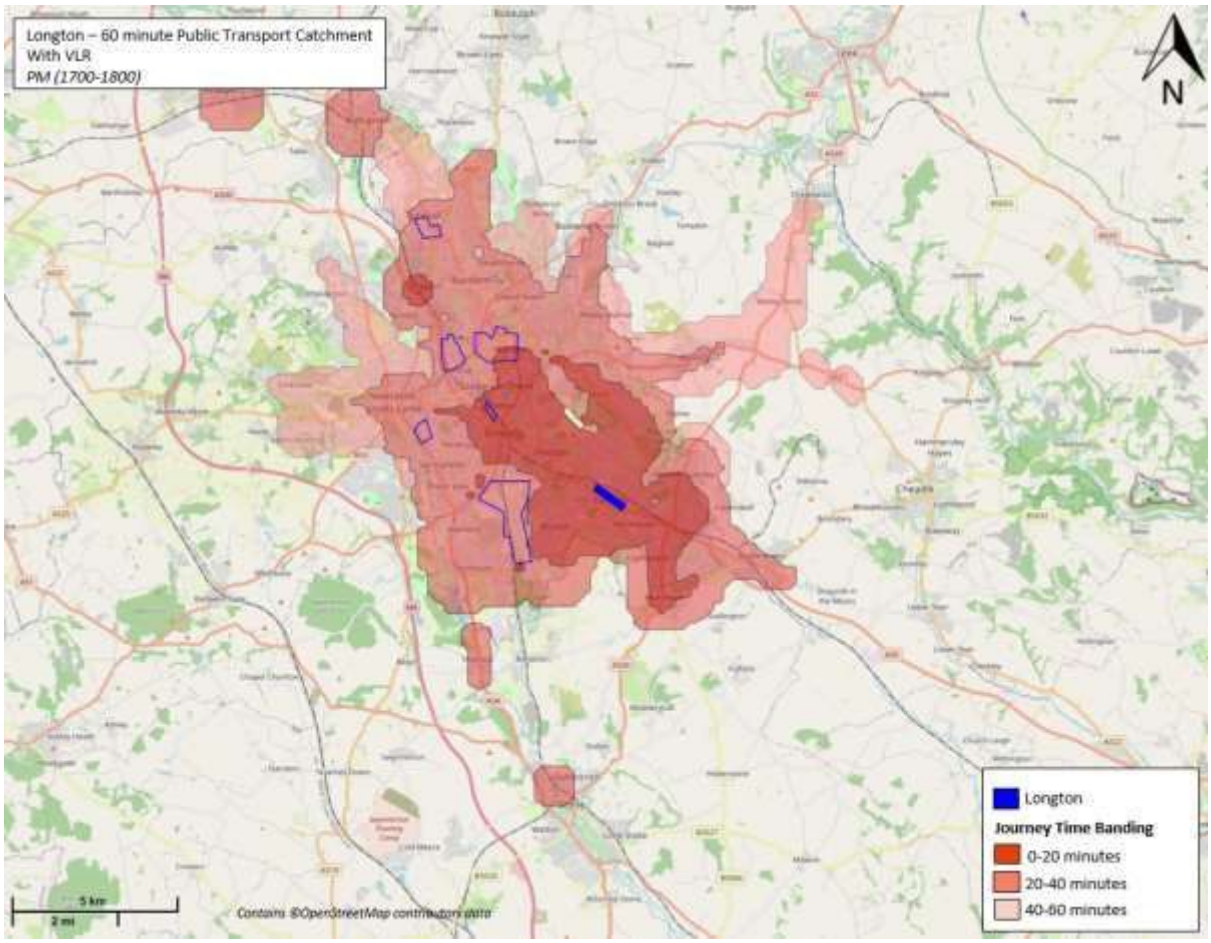


Figure B.18-Longton PM (1700-1800)

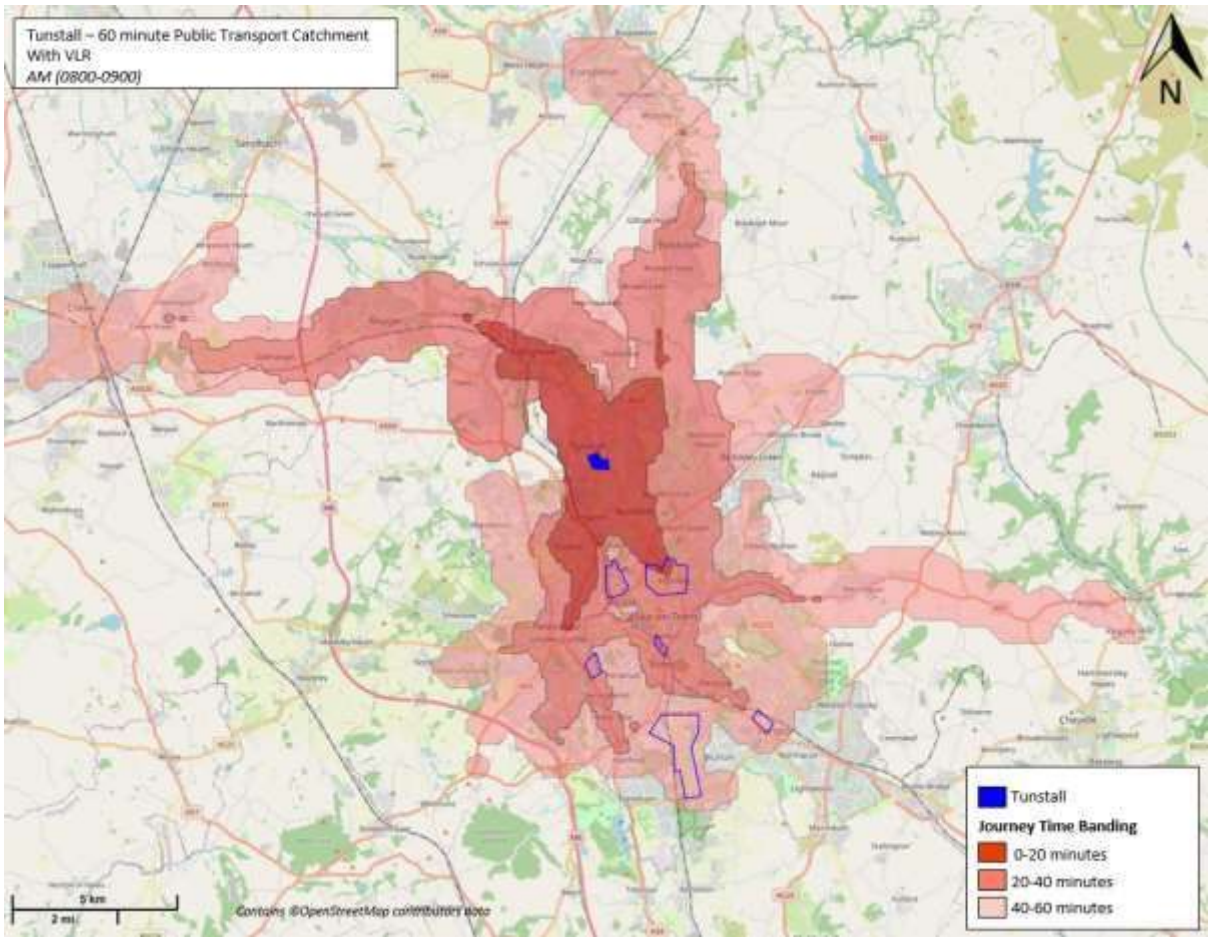


Figure B.19-Tunstall AM (0800-0900)

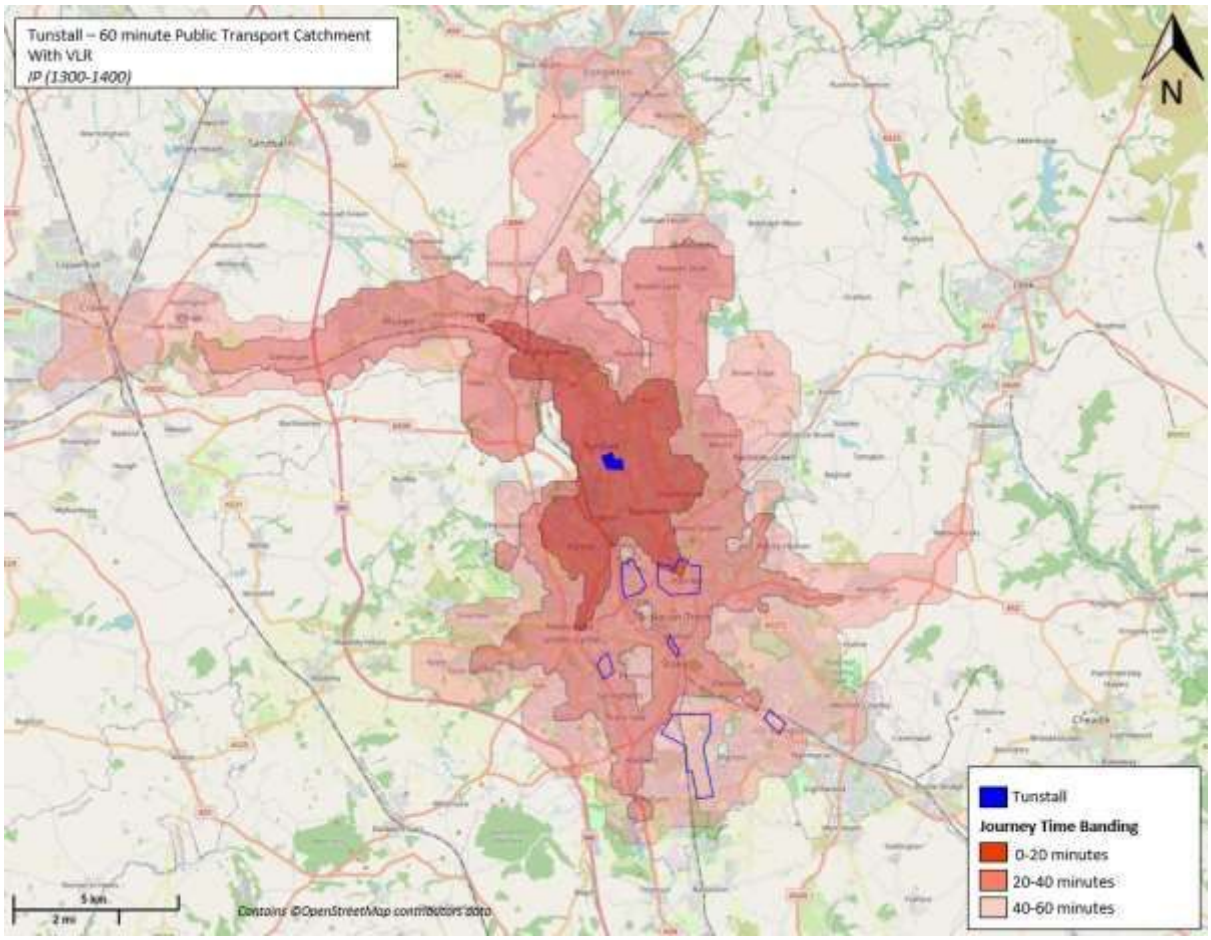


Figure B.20-Tunstall IP (1300-1400)

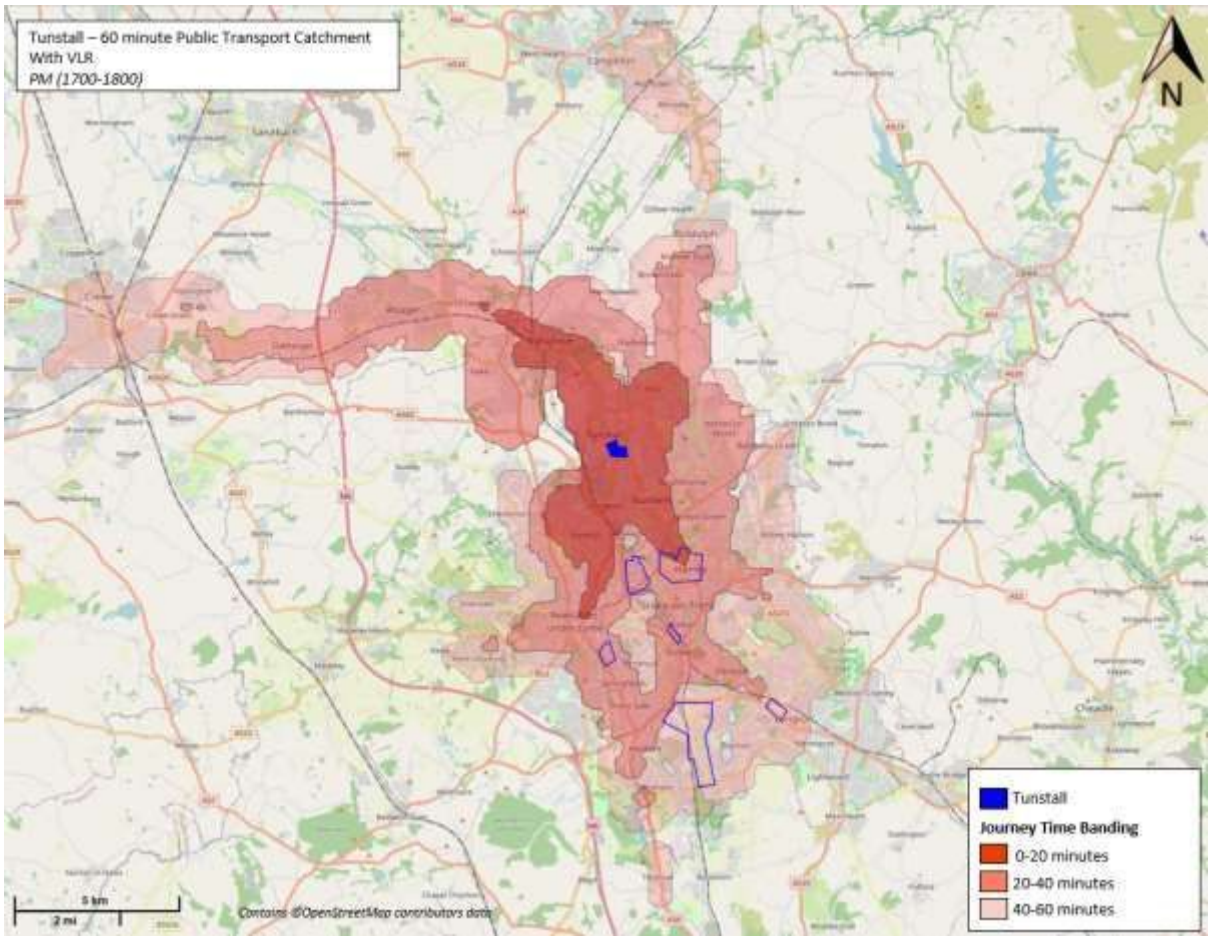


Figure B.21-Tunstall PM (1700-1800)