

# A4440 Southern Link Road Phase 4 One Year Post Opening Evaluation

February 2025



A4440 SLR4 1YA Evaluation

<b>Project Name</b>	SLR4 Monitoring & Evaluation
<b>Report</b>	A4440 Southern Link Road Phase 4 – One Year After Evaluation
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## Contents

<b>1</b>	<b>Executive Summary</b> .....	<b>5</b>
<b>2</b>	<b>Introduction</b> .....	<b>13</b>
2.1	Background & Context .....	13
2.2	Scheme Description.....	14
2.3	Aims & Scope of Evaluation .....	16
2.4	Report Structure.....	17
<b>3</b>	<b>Evaluation Methodology</b> .....	<b>20</b>
3.1	Introduction .....	20
3.2	Intervention Logic .....	20
3.3	Impact Evaluation Approach .....	22
3.4	Evaluation criteria .....	22
3.5	Process Evaluation Approach .....	26
3.6	Value for Money.....	27
<b>4</b>	<b>Did the project remove capacity constraints along the A4440 Temeside Way?</b> .....	<b>29</b>
4.1	Introduction .....	29
4.2	What did we think was going to happen?.....	29
4.3	What change have we seen so far?.....	31
4.4	What caused this change? .....	33
4.5	Summary .....	36
4.6	Next Steps and Recommendations .....	37
<b>5</b>	<b>Did the project support the growth of Worcestershire and the surrounding area?</b> .....	<b>38</b>
5.1	What did we think was going to happen?.....	38
5.2	What change have we seen so far?.....	38
5.3	What caused this change? .....	40
5.4	Summary .....	41
5.5	Next Steps and Recommendations .....	42
<b>6</b>	<b>Did the project improve resilience to flood events?</b> .....	<b>43</b>
6.1	What did we think was going to happen?.....	43
6.2	What change have we seen so far?.....	43
6.3	What caused this change? .....	47
6.4	Summary .....	47
6.5	Next Steps and Recommendations .....	48
<b>7</b>	<b>Did the project support delivery of planned growth?</b> .....	<b>49</b>
7.1	What did we think was going to happen?.....	49
7.2	What change have we seen so far?.....	51
7.3	What caused this change? .....	52
7.4	Summary .....	54
7.5	Next Steps and Recommendations .....	54
<b>8</b>	<b>Did the project improve the attractiveness of the A4440 SLR as a bypass for Worcester City Centre?</b> .....	<b>55</b>

8.1	What did we think was going to happen? .....	55
8.2	What change have we seen so far? .....	56
8.3	What caused this? .....	62
8.4	Summary .....	62
8.5	Next steps and recommendations .....	63
<b>9</b>	<b>Did the project improve access to the Strategic Road Network and key hubs? .....</b>	<b>64</b>
9.1	What did we think was going to happen? .....	64
9.2	What change have we seen so far? .....	64
9.3	What caused this change? .....	66
9.4	Summary .....	66
9.5	Next Steps and Recommendations .....	67
<b>10</b>	<b>Did the project contribute to environmental and safety objectives? .....</b>	<b>68</b>
10.1	What did we think was going to happen? .....	68
10.2	What change have we seen so far? .....	69
10.3	What caused this change? .....	73
10.4	Summary .....	75
<b>11</b>	<b>Process Evaluation .....</b>	<b>78</b>
11.1	Project Build .....	78
11.2	Delivered Project .....	80
11.3	Costs and Timescales .....	81
11.4	Summary .....	82
11.5	Next Steps and Recommendations .....	83
<b>12</b>	<b>Value for Money Assessment .....</b>	<b>85</b>
12.1	2021 Economic Assessment (What did we think was going to happen?) .....	85
12.2	Methodology (How are we going to calculate what has happened so far?) .....	87
12.3	Results (What has actually happened so far?) .....	89
12.4	Outturn Costs .....	90
12.5	Benefit Cost Ratio .....	92
12.6	Next Steps and Recommendations .....	92
<b>13</b>	<b>Summary and Recommendations .....</b>	<b>94</b>
13.1	Evaluation Limitations .....	95
13.2	Next Steps and Recommendations .....	95

# 1 Executive Summary

## Scheme Background

This report is the one-year after opening evaluation of the A4440 Southern Link Road Phase 4 (SLR4) Improvement scheme. The project was completed and opened to traffic in August 2022 and was the final phase of a four-stage programme to upgrade the A4440 Southern Link Road (SLR) to dual carriageway standard.

The SLR4 scheme aimed to unlock the full benefits of Phase 1-3 improvements by providing greater highway capacity and resilience between the A4440 Powick and Whittington Junctions, improving the route as a bypass to the City of Worcester and delivering a more reliable connection to the Strategic Road Network (SRN) at M5 Junction 7. The delivered scheme included a 1.2 mile dual-2 standard carriageway at the A4440 Temeside Way, junction capacity improvements at the A4440 Ketch and Powick junctions, a widened segregated cycle/footway on the northern side of the SLR4 section and two improved, grade separated active mode crossings.

The objectives for the project, set out in the full business case for the project, were:

1. Unlock the potential of the A4440 Worcester SLR by removing the capacity constraint at Temeside Way.
2. Support the growth of the economy of Worcestershire and the surrounding area by reducing travel times and costs imposed on businesses, transport operators and other network users by the current and forecast traffic congestion on the A4440 Worcester SLR.
3. Improve the resilience of the transport network to extreme weather events and unforeseen disruptions, particularly flood incidents.
4. Support the delivery of the planned growth set out in SWDP up to 2030. This includes development sites, such as Worcester West urban extension and North-East Malvern (totalling 3,000 dwellings and 15 hectares of employment land).
5. Improve the performance and attractiveness to users of the A4440 Worcester SLR as a bypass for Worcester City centre, thereby helping to better manage traffic conditions in the constrained central area.
6. Improve access to the Strategic Road Network from areas to the west and northwest of Worcester, including Malvern Hills District, Herefordshire and parts of the Welsh Marches.
7. Improve access to key hubs, including Birmingham International Airport and Worcestershire Parkway Station (and therefore further improving important links to Manchester, Cross Country the south).
8. To reduce transport-related emissions of carbon dioxide and other greenhouse gases in Worcester City centre.

A4440 SLR4 Improvements (Looking north towards Powick Roundabout)



### Evaluation Scope and Objectives

The aim of this evaluation is to understand the initial performance of the scheme one year after opening, against the project objectives set out in the scheme Full Business Case (FBC). This report tests the intended Theory of Change (ToC) against the observed outcomes at the one-year post scheme opening stage, in accordance with the SLR4 Monitoring and Evaluation Plan (MEP)<sup>1</sup>, incorporating an impact evaluation, a process evaluation and an economic evaluation to assess the likely Value for Money (VfM) of the project.

### Overview of Evaluation Approach

To support this one-year after evaluation, data was collected in November 2021 (pre-intervention) and November 2023 (post-intervention). A ToC has been used as a basis for the evaluation. Based on the principles of contributory analysis, qualitative and quantitative evaluation methods have been used to provide an early understanding of the intended and unintended impacts of SLR4. Stakeholder engagement has been used to support the evaluation. Worcestershire County Council (WCC) conducted questionnaires and in-person workshops to find out the views from the public and key stakeholders. This approach allowed us to compare the collected data with stakeholder thoughts.

### Summary of Observed Impacts

The impact evaluation for one-year after opening indicates that the scheme project has made positive contributions to project specific objectives as outlined in the FBC. The impact evaluation findings at the one year after opening stage are summarised below.

#### Summary of the key SLR4 One Year After evaluation findings

Objective	RAG <sup>2</sup>	Summary
<b>Did the project remove capacity constraints along the A4440 Temeside Way?</b>	Likely to meet objective	Following the improvements, the A4440 Temeside Way has been able to accommodate more traffic whilst improving journey times for road users.  Traffic growth on the A4440 Temeside Way has increased by 85%, whilst average journey times have reduced by at least 1 minute and 45 seconds in both directions in the morning and evening peak periods.

<sup>1</sup> Submitted as part of the SLR4 FBC

<sup>2</sup> RAG assessment = Red Amber Green

Objective	RAG	Summary
<b>Did the project support the growth of Worcestershire and the surrounding area?</b>	Likely to meet objective	Marked improvements in economic indicators align with the opening of the SLR4, suggesting the scheme could support wider economic growth ambitions. This was supported by positive stakeholder feedback. However, despite the positive impact of the project other factors have also had a large influence on the economy of Worcestershire.
<b>Did the project improve resilience to flood events?</b>	Too early to conclude	The SLR4 has added resilience to the network by adding capacity to the Highway Network across the River Severn. The evaluation has demonstrated that the A4440 was resilient enough to provide reliable journey times along the SLR during flood events, with minimal delays or disruptions beyond 'non-flood' journey times. However, there has been flooding on the A449 Northbound approach to Powick roundabout. There has only been one flood event on the network since opening, therefore, it is too early to conclude if resilience has improved.
<b>Did the project support delivery of planned growth?</b>	Too early to conclude	More dwellings homes have been built in and around Worcestershire up to 2022 than forecast in the SLR4 Business Case, many of which were dependent on the SLR4 improvements. However, this may be due to external factors such as increased housing demand.
<b>Did the project reduce City Centre impacts?</b>	Too early to conclude	Whilst the A4440 SLR route is now a more attractive route, with increased capacity and improved journey times, the A44 route through the city centre has seen limited change in traffic conditions since the opening of the SLR4 scheme.
<b>Did the project improve access to the SRN and key hubs?</b>	Likely to meet objective	Journey times have decreased whilst journey reliability and congestion have improved along the SLR. This has afforded motorists easier access between the west of the River Severn and the rest of the country by improving access to the M5. It has also improved access to key destinations such as Worcestershire Parkway Rail Station and Birmingham Airport.
<b>Did the project contribute to environmental and safety objectives?</b>	Too early to conclude	Local authority monitoring in close proximity to the project suggests that local air quality is better than predicted but may be slightly worse than predicted in the city centre, although the contribution of the project to this conclusion cannot be determined. The absence of traffic composition and speed data from the available forecast and observed traffic data means the impact of changes in traffic due to the project on air quality levels cannot be determined though it is noted that 2023 observed flows are lower than 2023 forecast flows on the A4440 to the east and west of the project.  Lower observed AADT numbers in 2023 compared to forecasts suggest greenhouse gas emissions may be lower than predicted. However detailed traffic data is not available, meaning a confident conclusion of scheme impacts on greenhouse gases cannot be drawn.

	<p>Safety along the SLR has improved with the average number of collisions a year reducing from 22.7 before intervention to 12.0 post opening.</p> <p>The one long-term noise monitoring site indicates that the increase in measured noise levels is slightly smaller than was expected, though weather conditions could be a contributory factor. At the short-term monitoring sites, the increase in measured noise levels is higher than might be expected from the impact of the project. However, given the limitations of the available 2016 data, uncertainties due to the influence of the weather, and the very short-term nature of the monitoring, it is not possible to reach a firm conclusion on the impact of the project on noise levels based on the measured noise levels.</p>
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### **Journey Times**

Our analysis demonstrates improvements to journey times along the improved SLR4 section, whilst accommodating for a higher traffic flow across all periods of the day and in both directions. This indicates the SLR4 route has successfully removed capacity constraints along the route. The impact evaluation demonstrates clear journey time benefits in the post-intervention scenario, with average journey time savings of 2 minutes and 45 seconds along the A4440 Temeside Way eastbound in the PM peak, reducing journey times by almost 50% from the 2021 baseline. The scheme has improved journey time reliability along the A4440 SLR, reducing variability of journey times in both directions and time periods.

### **Network Resilience**

The SLR4 has added resilience to the network by adding capacity across the River Severn. A public survey has shown that a majority of respondents think that the scheme has improved the resilience of the network to extreme weather events. However, stakeholders have noted localised flooding events on the approach to SLR4, south of Powick roundabout on the A449. It is worth noting that these events also occurred prior to the project opening.

### **Wider Economic and Regeneration Impacts**

The economy of Worcestershire improved in 2022, the year that the SLR4 project opened. From stakeholder feedback, it was noted that the reduction in journey times and congestion along the SLR have improved access to a wider area and caused an increase in investment to the region, as predicted in the Business Case for the SLR4. However, despite the positive impact of the project, other factors have also had a large influence on the economy of Worcestershire in recent times, (such as increased development and the impacts of COVID-19 recovery) so it is not possible to attribute the level to which SLR4 has benefited local businesses and the economy.

More homes have been built in and around Worcestershire than forecast in the SLR4 Business Case (33% higher than forecast). This has mainly occurred in Malvern and Wychavon districts. As recognised in the SLR4 Business Case, stakeholder workshops and the South Worcestershire Development Plan, many of these developments would not have been able to happen without the SLR4. The increased capacity on the road network has made the properties there more desirable. Therefore, the growth in the region whilst not solely due to the SLR4, has been facilitated by the completion of the project.

### **City Centre Route Impacts**

Whilst the A4440 SLR route is now a more attractive route with increased capacity and improved journey times, the A44 route through the city centre has seen limited change in traffic conditions since the opening of the SLR4 scheme. It is likely that increased development in Worcestershire and Worcester City Centre have impacted travel conditions in the city centre.

### **Access to Network Hubs**

The scheme has allowed motorists easier access between the west of the River Severn and the rest of the county by improving access to the M5. It has also improved access to key destinations such as Worcestershire Parkway Rail Station and Birmingham Airport. The scheme has delivered new active travel infrastructure in the form of a new bridge, underpass and segregated walking and cycling path along the A4440. These improvements form a good basis for future improvements, but wider active travel improvements should be considered to maximise the full benefit of the new infrastructure by improving onward connectivity to cycle routes.

### **Noise Impacts**

At the short-term monitoring sites the increase in measured noise levels from 2016 to 2024 is higher than might be expected from the impact of the Scheme predicted in the ES. However, given the uncertainties due to the influence of the weather, and the very short-term nature of the monitoring, it is not possible to reach a firm conclusion on the impact of the Scheme on noise levels at the short-term monitoring locations based on the measured noise levels.

At the one long-term site, taking account of the change in the position of the monitoring between 2016 and 2024, the increase in measured noise levels is slightly smaller than might be expected from the impact of the Scheme predicted in the ES. Though again there are uncertainties due to the influence of the weather.

### **Safety**

Safety along the SLR has improved, with the average number of collisions a year reducing from 22.7 before intervention to 12.0 post opening. This reduction is better than expected in the Business Case and consists of multiple slight improvements to safety along both the carriageway and at the roundabouts, as well as improved cycling facilities. It is however noted that there is only 16 months of post-opening collision data, so emerging trends should be monitored and reviewed during the next evaluation stage using a larger data set.

### **Air Quality**

Local authority monitoring in close proximity to the project suggests that local air quality is better than predicted but may be slightly worse than predicted in the city centre, although the contribution of the project to this conclusion cannot be determined.

The absence of traffic composition and speed data from the available forecast and observed traffic data means the impact of changes in traffic due to the project on air quality levels cannot be determined, nor therefore can comparisons be made to the ES predictions. Though it is noted that 2023 observed flows are lower than 2023 forecast flows on the A4440 to the east and west of the Scheme (no observed data is available for the Scheme).

Similarly, although lower observed Annual Average Daily Traffic (AADT) numbers in 2023 compared to forecasts suggest that greenhouse gas emissions may be lower than predicted, a definitive assessment cannot be made without compositional data such as average speed and percentage of heavy goods vehicles (%HDV).

### **Process Evaluation Findings**

In addition to evaluating the project's performance against its objectives, we have also reviewed the construction process and lessons learned. This was primarily done through an interview and questionnaire with the project's delivery Project Manager (PM). By examining the construction process, we have identified best practices and areas for improvement. Throughout the project lifecycle, risk was managed effectively with a contingency funding pot in place. Flood risk was anticipated and the project team identified a best practice approach to minimise impact by locating compounds in areas of high ground. Despite this, the project's programme was impacted by five severe flood events in exceedance of forecast risk based upon historic data. The project was further impacted by the suspension of works due to COVID-19 pandemic and by design changes due to unchartered statutory undertakers' equipment.



**A4440 SLR4 Flood Event during construction**

Regular communication led to stakeholders feeling informed and abreast of the key information throughout the project. An area of best practise was the identification of an added value activity to undertake bearing replacement and concrete repair works to the existing Carrington Bridge & Powick Common Viaduct, maximising the efficiency of planned road closures.

Key challenges were around staff and knowledge retention during significant change in key Contractor personnel as the project moved away from scheme development and became construction focused. After restarting works after COVID delays, there was also significant change in key management and site staff of the contractor. Changeover of contractor staff meant the continued impacts of the pandemic were felt both in terms of material supply and working practices. A learning point from this is that retention of key staff is essential to improve resilience and minimise delays in procurement; not doing so can result in procurement delays.

### **Cost Evaluation**

The funding requirement of the scheme increased by £7.65m to £69.65m to forecast costs (see Section 12.4) in the project FBC. Project overspend was funded by WCC. The greatest variances in cost were due to:

- Statutory Utility delays at the start of the project leading to a delay to programme and increase in costs.
- Unknown statutory utilities found during the works – increase in costs due to diversions and/or design amendments.
- Severe flooding of the site (above that which would reasonably have been forecast by the contractor based on historical data) resulting in delays to programme and increased costs.
- COVID-19 was an unexpected risk initially realised in March 2020. This (ongoing) event resulted in delays and increased costs to the project.
- The change to the target price due to inflation was higher than anticipated due to the extended programme and significantly higher than average inflation during the life of the project, due to external factors (such as COVID-19).
- Contractor costs exceeded the target price resulting in pain share (maximum of 5% of the final target price). The quantum will be determined as part of the agreement of the final account. This was partly due to loss of key personnel at the contractor over a relatively short period of time, leading to loss of project knowledge with consequential project delays and increased costs.
- Additional works were carried out to replace bridge bearings. This work, outside of original project scope and funded by WCC, was undertaken alongside the SLR4 works to maximise efficiency of contractor on site and minimise future road user impacts.

### **Value for Money**

The project build data and current performance of the SLR have been used to work out the project's expected value for money at the one-year mark and to determine whether the project is on track to provide value for money. To calculate this we reviewed project costs against forecast, how well the intervention is working and the overall benefits to the public. Based on the evidence from the first year, the SLR4 outturn scheme provides a positive economic case and provides High Value for Money. The outturn benefits of the scheme are lower than anticipated. This is part attributed to COVID impacts resulting in lower than forecast traffic volumes using the SLR4 route and, given it was not appropriate to repeat the extensive transport modelling undertaken during the business case, in part attributable to the proportionate evaluation methodological limitations.

### **Recommendations**

It is expected that the evaluation of the SLR4 project will be revisited five years after opening. This will allow a more comprehensive evaluation using trend data over a longer period. In addition, findings from this one-year evaluation have identified areas of best practise and improvements that could be applied to future WCC projects:

#### **Stronger Future Business Cases**

- The SLR4 scheme has provided improved active travel infrastructure within the scheme extents. Worcestershire County Council should consider wider active travel improvements to improve active travel connectivity and maximise the benefit of SLR4 improvements. This should be incorporated into future Local Cycling and Walking infrastructure Plans (LCWIPs) in the form of a review of future needs of active travel desire lines through the scheme.
- The programme and cost of the scheme was impacted by statutory utility delays and the discovery of unmapped services. For future Business Cases WCC should consider whether suitable cost and programme contingency is included for these items. Utilities moved during the SLR4 works should be logged and recorded for future works consideration.

#### **Appraisal Accuracy and Approaches**

- One of the objectives of the project was to improve the SLR as a bypass for Worcester City Centre. Whilst the impact valuation demonstrates that the SLR is now more attractive there has been limited change to travel conditions in Worcester City Centre. This could be due to external factors such as increased development in the city centre. For future projects aimed at removing particular movements, Automatic Number Plate Recognition (ANPR) surveys could be considered. Pre and post-intervention ANPR surveys could be used to isolate the desired movement of vehicles and provide a comparison, allowing for a clear attribution of outcomes.

#### **Evaluation Enhancements**

- Journey time reliability data for the A4440 Temeside Way should be obtained, to understand to what extent SLR4 improvements drive reliability improvements on the wider route (as noted in Section 8).
- Background traffic growth should be reassessed at the next evaluation stage to provide a longer term understanding of how much of the observed traffic impacts can be attributed to COVID-19 impacts.
- Business group stakeholders should be engaged at an earlier stage via stakeholder interviews and questionnaires, in order to overcome limitations of quantitative employment data availability and to contextualise wider trends.
- Resilience should be reassessed at the next evaluation stage, as this may present an opportunity to draw conclusions from a wider range of flood events
- Active business growth trends should be reassessed in the next evaluation stage, to investigate trends of decline that do not align with wider Worcestershire growth.
- Development data should also be sourced for the Worcester West and South Urban Extension, to understand the changes in SLR traffic impact against build out rates of these key local developments.

### **Organisation Change**

- The process evaluation identified areas of best practise which could be applied to future WCC projects including:
  - Mitigation of flood impacts to minimise the impact of flood events. The best practice approach of locating site compounds above flood levels could be built into procurement requirements for future projects.
  - Coordination of Asset management and construction work to provide cost efficiency and minimise user delays. This should be a consideration as part of the construction planning for future WCC schemes.
- Regular communication led to stakeholders feeling informed and abreast of the key information throughout the project. As part of continuous improvement, WCC should consider stakeholder co-design sessions to increase stakeholder buy-in to projects.
- The process evaluation identified that as the project moved away from scheme development and became construction focused, there were challenges around knowledge retention within the Contractor. This meant it was challenging to ensure that key issues identified in the development stages were properly addressed. To minimise this risk on future projects, WCC should consider the retention of scheme development teams into the Design and Build stage to allow for a more informed transition.
- The SLR4 baseline data was collected during a period where temporary traffic management was in place during the construction of the scheme. This has made the attribution of SLR4 benefits challenging in some cases. Where possible, future WCC projects should programme Baseline surveys in advance of works via effective Monitoring and Evaluation Plans. This will improve the robustness of future evaluations.

### **Acknowledgements**

Worcestershire County Council would like to extend gratitude to the Department for Transport for the advice and collaborative approach adopted during the delivery of this evaluation, and to National Highways for the sharing of data which has supported this evaluation.

## 2 Introduction

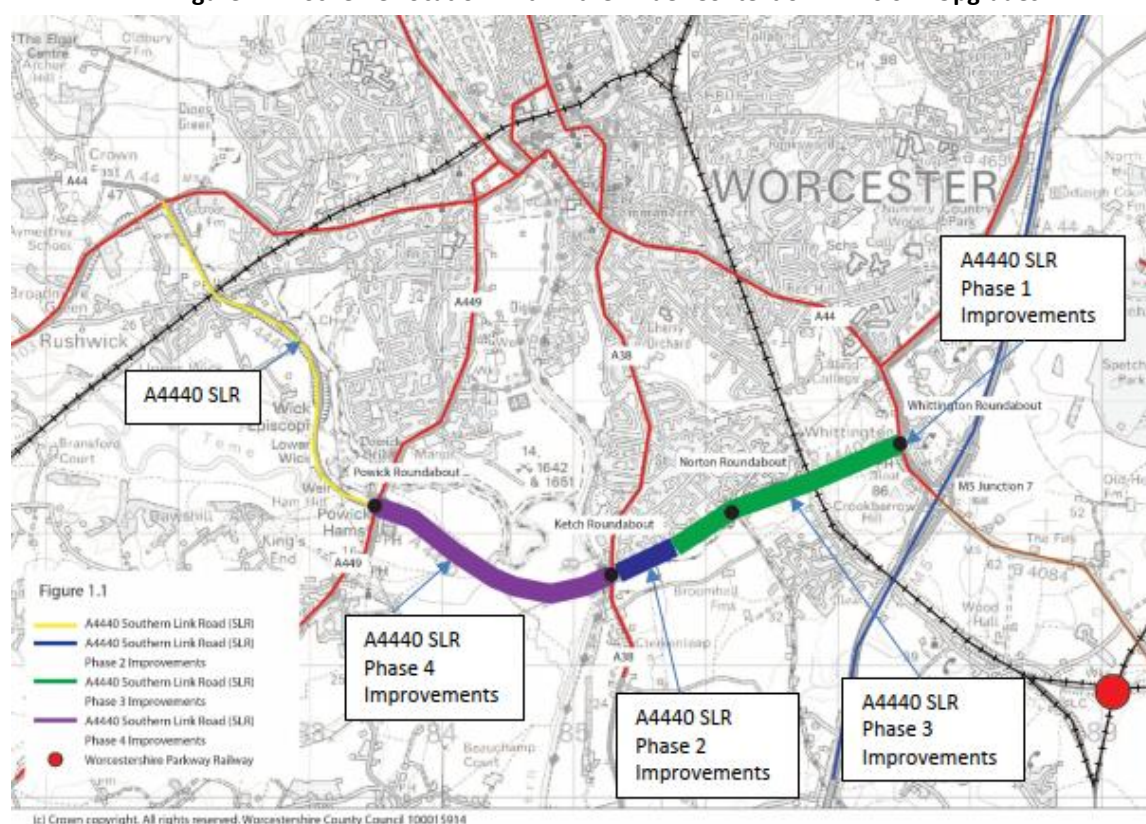
This report sets out the findings of the one-year after evaluation carried out as part of the A4440 Southern Link Road Phase 4 (SLR4) Monitoring and Evaluation. Construction works commenced in Spring 2019 and the route opened to traffic in August 2022.

This evaluation has been completed in accordance with the approach set out in the scheme's Monitoring and Evaluation Plan<sup>3</sup>. A Theory of Change (ToC) has been used as a basis for the evaluation. Based on the principles of contributory analysis, qualitative and quantitative evaluation methods have been used to provide an early understanding of the intended and unintended impacts of SLR4.

### 2.1 Background & Context

Located to the south of Worcester, the A4440 Southern Link Road (SLR) is 4.6-mile-long and was designed to support east-west traffic bypassing Worcester City Centre (see Figure 2-1).

**Figure 2-1 - Scheme Location Within the Wider Context of A4440 SLR Upgrades**



As a key part of the Worcester Transport Strategy (WTS), SLR was a key intervention identified as necessary to address traffic and development pressures. The corridor improvements were delivered to act as a catalyst for unlocking planned housing and employment growth, whilst protecting the region's productivity by providing access to the M5 motorway at Junction 7.

Historically the route has suffered from capacity constraints along the single carriageway route and poor resilience. This regularly resulted in unreliable journey times on the corridor itself and re-routing of traffic on to less suitable corridors. These issues are particularly problematic during flooding events. Poor journey times and reliability was regarded as a barrier to attracting business into the area and thus economic growth and regeneration opportunities in the area. There have been historic challenges in meeting planned housing targets in Worcestershire, despite employment sites being developed into housing sites. To meet these targets,

<sup>3</sup> The project MEP can be found in Appendix R of the A4440 SLR4 Full Business Case (FBC).

sites in Wychavon, Malvern and the west of Worcester needed to be made more attractive to encourage development, such as by improving access to local hubs. Furthermore, several sites required improvements to the SLR so that the local road network in Worcester had enough capacity to cope with the number of trips from them.

There are only two crossings over the River Severn in the City (Carrington and Worcester Bridges). Therefore, during times of heavy traffic flow, congestion was often prevalent in Worcester City Centre. The lack of capacity over Carrington Bridge also caused issues during flood events. During Worcester Bridge closures, the only alternative river crossing was to use the congested Carrington Bridge. Between 2000 to 2014, Worcester Bridge was shut 5 times due to flooding, which led to business downtime. This also caused concerns about what would happen if a flood caused Worcester bridge to close for a longer period of time, with £1.8 million of GVA<sup>4</sup> being at risk every week the bridge was shut due to the number of employees who reside in west Worcester.

## 2.2 Scheme Description

The SLR4 scheme is the final phase of a four-phase programme to upgrade the A4440 SLR, dualling the A4440 between Ketch and Powick Junctions. The investment into upgrading Phase 4 is expected to help realise the full benefits of Phases 1-3 upgrades, as well as improve the attractiveness of the route as an alternate route for east-west movements travelling through the City Centre. (Table 2-1) presents a summary of the phased improvements of the A4440 SLR.

**Table 2-1 - A4440 Worcester SLR Phased Improvements**

Phase	Scheme	Status
Phase 1	Whittington Junction minor Improvements	Completed in 2012
Phase 2	Ketch Junction improvements and provision of 600 metres of duelling towards Norton Roundabout	Completed in 2016
Phase 3	Norton Roundabout improvements and completion of dualling between Whittington and Ketch junctions	Completed in 2020
Phase 4	Further capacity enhancement between Powick Junction and the M5 including dualling between Powick and Ketch junctions	Completed in 2022

Phase 4 primarily involved dualling the A4440 Temeside Way, which includes the section of the SLR between the Ketch and Powick roundabouts (see Figure 2-1). This final phase of works comprised of upgrading A4440 Temeside Way to dual carriageway standard, enhancing the capacity of both the Ketch and Powick roundabouts and improving active mode facilities (including a new pedestrian and cycle overbridge over Hams Way). The full set of improvements is illustrated in Figure 2-2 and are as follows:

- Improvements at Powick Roundabout; including new road markings and some widening
- Upgrade of dedicated left hand turn at Powick roundabout towards Malvern to a fully segregated facility
- Provision of a foot/cycle bridge linking the north and south cycle routes at Powick roundabout (located on the west approach)
- Widening of the existing footway along A4440 Temeside Way to a shared pedestrian/cycle route on the northern side
- a new bridge structure along A4440 Temeside way at Powick Common Viaduct
- widening of the SLR to provide a dual carriageway between Ketch roundabout to Powick roundabout
- New bridge structure at Carrington bridge
- Capacity improvements at Ketch roundabout and junction revisions to allow dual carriageway connections

<sup>4</sup> SLR4 Full Business Case Main Document Section 2 Page 19

Figure 2-2 - SLR4 Interventions

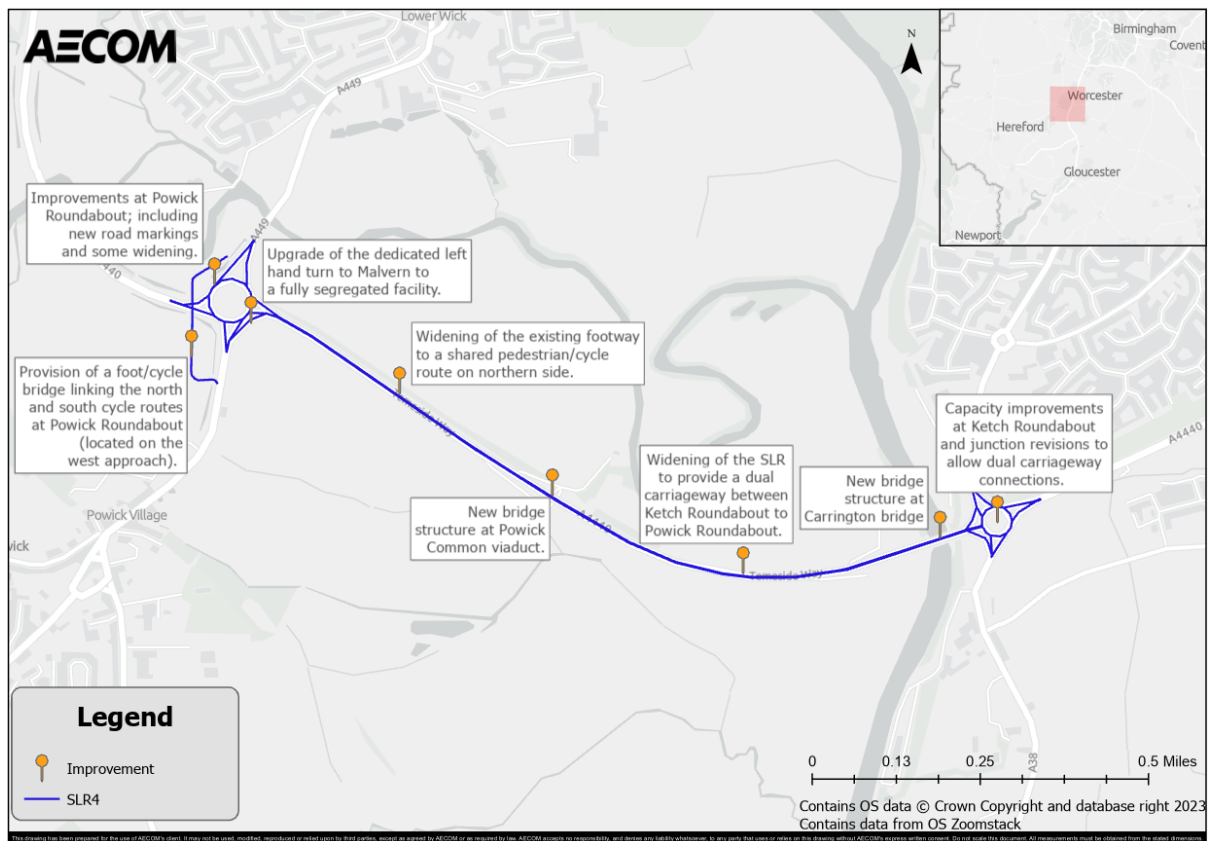
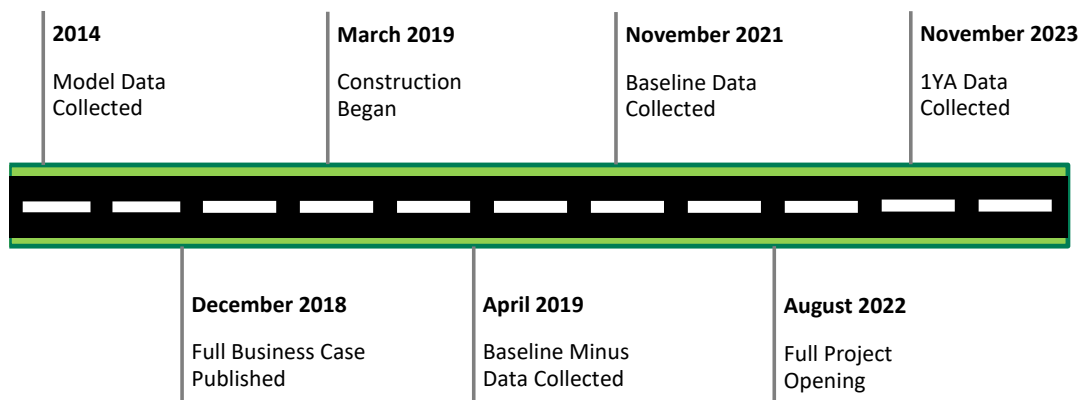


Figure 2-3 shows a timeline of the development of the SLR4, against key evaluation dates. Construction of the SLR4 took place between 2019 and 2022. The scheme was completed and opened in phases from July 2022 and was fully open to traffic in August 2022. The baseline data (2021) has been compared against the one year after data (2023) to understand initial impacts generated by the scheme.

Figure 2-3 - Timeline of SLR4 Development & Evaluation Activities



The scheme Project Manager (PM) confirmed that the A4440 SLR4 scheme elements were delivered as planned (Figure 2-4).

**Figure 2-4 - Overview of Powick Roundabout post Completion**



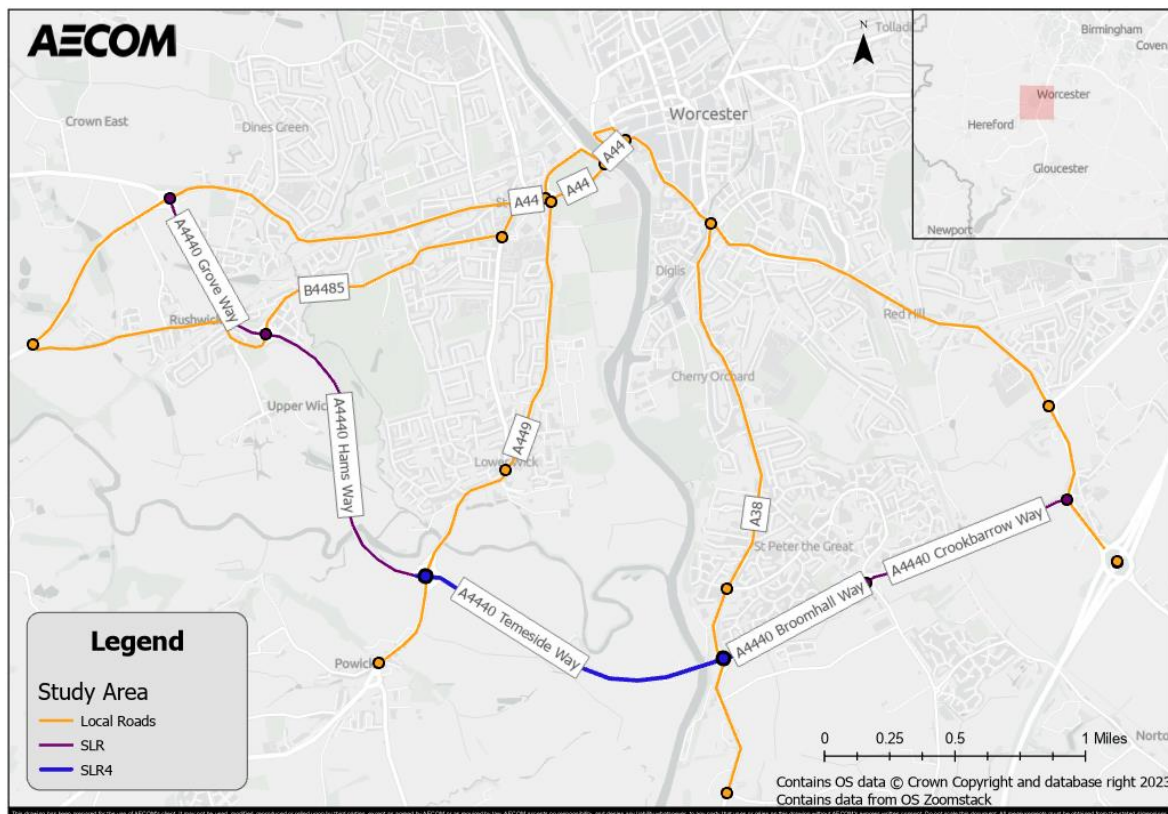
### **2.3 Aims & Scope of Evaluation**

The purpose of this evaluation is to document the initial performance of the scheme one year after opening. The evaluation specifically considers observable performance against the project objectives set out in the scheme Full Business Case (FBC) and as follows:

- Did the project remove capacity constraints along the capacity constraints along the SLR4?
- Did the project support the growth of Worcestershire and the surrounding area?
- Did the project improve resilience to flood events?
- Did the project support the delivery of planned growth?
- Did the project improve the attractiveness of the A4440 SLR as a bypass for Worcester City Centre?
- Did the project improve access to the Strategic Road Network and key hubs?
- Did the project contribute to environmental and safety objectives?

It is not proportionate to replicate modelling undertaken at the appraisal of a project. The evaluation study area covers the likely impact areas of the scheme and includes the A4440 route and intersecting radial routes into the city. The extent of the project evaluation is presented in Figure 2-5.

Figure 2-5- Evaluation Study Area



The data collected around the project build and how it is currently performing have been used to work out the project’s expected value for money at the one-year mark and to determine whether the project is on track to provide value. To do this we reviewed project costs against forecast, how well the intervention was working and the overall benefits to the community. These evaluations help us spot any areas that might need attention to make sure the project meets its objectives and offer the best value as it moves forward.

The report has been prepared in compliance with the Department for Transport (DfT) guidelines titled “Local Authority Major Schemes: Monitoring and Evaluation Framework,” as well as the DfT’s Magenta Book and HM Treasury’s Green Book. Adhering to these guidelines ensures that our evaluation is thorough, systematic, and aligned with national standards. By aligning with these standards, the learnings from the project can more easily be applied to other projects and policies across the county.

The Full Business Case for the project was supported by extensive traffic modelling to determine the forecast impacts of the SLR4. The level of transport modelling and associated data collection required to update the FBC transport model to a position, whereby it was suitable to reforecast an outturn Value for Money evaluation of SLR4 using the FBC methodology, would have required substantial work. This additional work would not have provided WCC with a cost-effective approach, nor provided a proportional increase in the level of assurance associated with the Value for Money evaluation. An alternative proportionate approach (detailed in 12.2) was developed, in consultation with the Department for Transport<sup>5</sup>.

## 2.4 Report Structure

The evaluation has been presented in five parts with constituent sections that break down the intervention background, evaluation methodology, impact evaluation, process evaluation, VfM assessment and conclusions. This one-year after evaluation report is structured as follows:

<sup>5</sup> Meeting with the DfT held 8<sup>th</sup> March 2024

Part A - Methodology

- Section 3 – Evaluation Methodology

Part B – Impact Evaluation

- Section 4 – Did the project remove capacity constraints along the capacity constraints along the SLR4?
- Section 5 – Did the project support the growth of Worcestershire and the surrounding area?
- Section 6 – Did the project improve resilience to flood events?
- Section 7 – Did the project support the delivery of planned growth?
- Section 8 – Did the project improve the attractiveness of the A4440 SLR as a bypass for Worcester City Centre?
- Section 9 – Did the project improve access to the Strategic Road Network and key hubs?
- Section 10 – Did the project contribute to environmental and safety objectives?

Part C – Process Evaluation

- Section 11 – Process Evaluation

Part D – Value for Money

- Section 12 – Value for Money Assessment

Part E - Conclusion

- Section 13 – Conclusions and Recommendations

# Part A - Methodology

## **3 Evaluation Methodology**

### **3.1 Introduction**

This section provides an overview of the evaluation approach used to carry out a one year after opening evaluation of the SLR4 scheme.

The Magenta Book identifies three core strands of evaluation (i) process; (ii) impact and (iii) value for money. This three-strand approach is designed to provide a full understanding of whether an intervention works, how, why and for whom, at what cost.

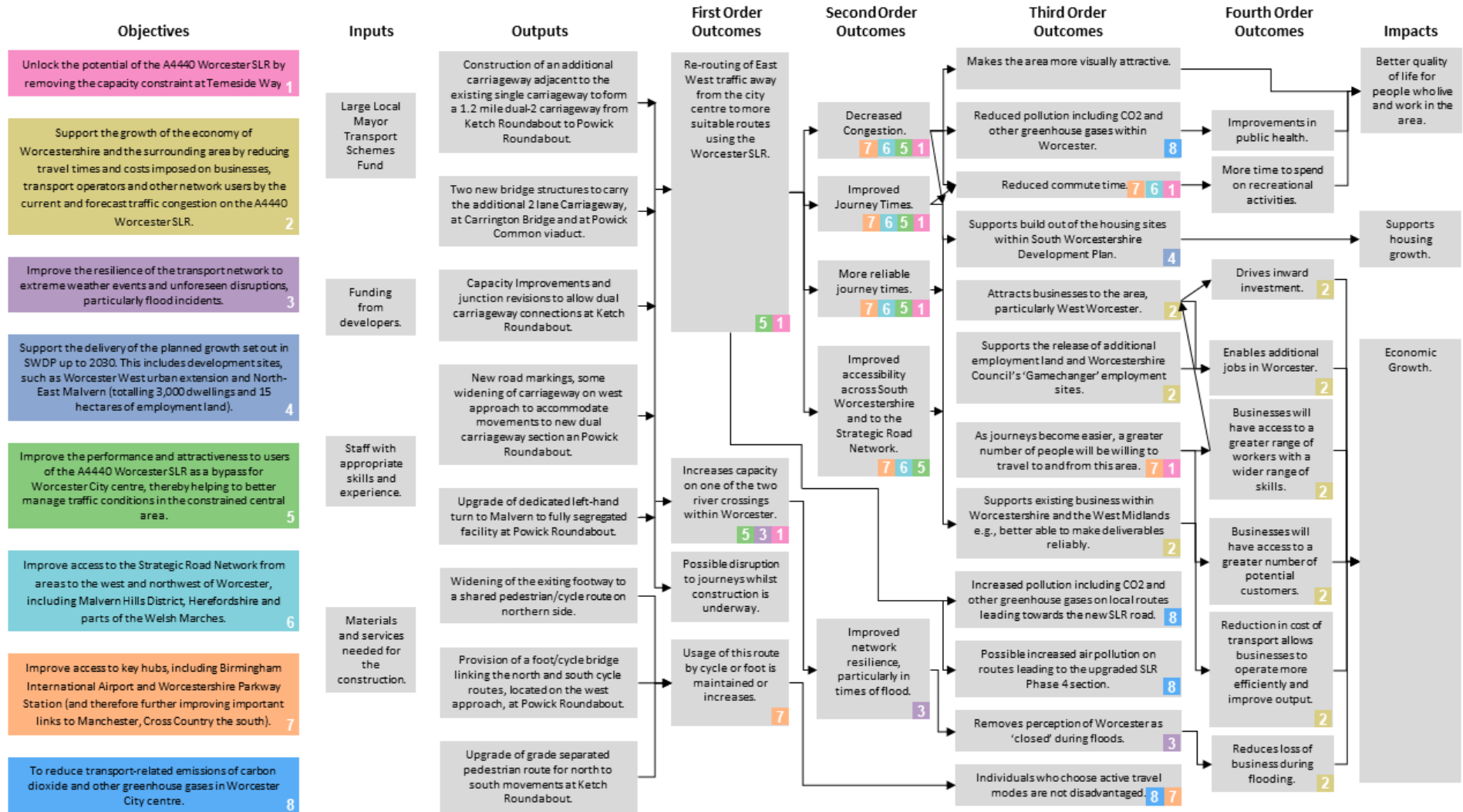
Our approach includes a high-level review of national, regional and local datasets to understand wider background trends. This contextual narrative is aimed establishing background trends in traffic and economy, to support the attribution of benefits to the SLR4. This section will also include a breakdown of methodologies for the three core strands of the one year after evaluation.

### **3.2 Intervention Logic**

Having identified the key issues and what the main objectives of the project were, the actual outputs of the project needed to be identified. The aim of this is to see how the outputs of the project (such as adding an additional carriageway to the A4440 Temeside Way) will affect Worcestershire, and what potential outcomes might be. Potential outcomes are worked out through causal pathways, which set out the logical impacts of an output. For example, upgrading the cycle route along the A4440 carriageway encourages people to cycle ensuring that people using active travel are not disadvantaged. After that, we have an idea of how each of the outputs affects the area and whether any changes should be made to the project to help it align with the objectives further. This is known as the SLR4 theory of change, set out in the project logic map (see Figure 3-1).

The objectives from the Full Business Case have also been labelled 1 to 8. These numbers have been placed against the outcomes which will allow the objective to be completed. This shows how the intervention aligns with the objectives and what the expected outcomes of the project were.

Figure 3-1 - SLR4 Theory of Change



### 3.3 Impact Evaluation Approach

An impact evaluation considers what difference the project has made, by gaining an understanding of the changes in measurable outcomes (intended and unintended) and the extent to which outcomes can be attributed to the delivered investment. This also explores whether, and why, particular groups of people have been impacted in different ways, as well as how contextual factors may have influenced the observed changes.

### 3.4 Evaluation criteria

The impact evaluation methodology has been devised based on the SLR4 MEP (Appendix R of the Full Business Case) and the scheme logic map (see Figure 3-1). The impact evaluation is structured using the project objectives outlined in Section 2.3 **Error! Reference source not found.**, where each sub-section will report against each outcome and impact marked against that objective in the project logic map. Each objective has been used to segregate the impact evaluation into distinct sections, as described in Table 3-1.

**Table 3-1 - Impact Evaluation Structure Using Scheme Objectives**

Section	Objective	Section Content
4	Did the project remove capacity constraints along the A4440 Temeside Way?	Analyses traffic impacts on the SLR4 (A4440 Temeside Way, between Ketch and Powick junctions).
5	Did the project support the growth of Worcestershire and the surrounding area?	Considers the impact of the scheme upon local businesses and the severance effect on Malvern. Analysis of local economic indicators in the wider region.
6	Did the project improve resilience to flood events?	Analysis of the traffic impacts in Worcester during flood events only, including the City Centre and the wider A4440 SLR.
7	Did the project support delivery of planned growth?	Analysis of housing build outs and the number of active businesses.
8	Did the project improve the attractiveness of the A4440 SR as a bypass for Worcester City Centre?	Analysis of traffic impacts on the wider SLR to determine if the route has attracting more bypassing east-west traffic. Analysis of impacts in Worcester City Centre, to determine if the attractiveness of the SLR has reduced congestion in central areas.
8.5	Did the project improve access to the Strategic Road Network (SRN) and key hubs?	Considers stakeholder feedback around perceived impacts of the scheme upon travel catchments.
10	Did the project contribute to environmental and safety objectives?	Analysis of air quality, noise and safety data.

Pre and post project opening data has been collected in November 2021 and November 2023 to support the impact evaluation. The data sourced for the impact evaluation aligns with the seven main sources of data outlined in the scheme MEP:

- M1 – Traffic Volumes
- M2 - Junction Operation
- M3 - Journey Time Data
- M4 - Stakeholder Feedback
- M5 - Developments

- M6 - Economic indicators
- M7 - Collision Data
- M8 - Environmental monitoring data

The following sub-sections provide further information around the quality of the seven data sources, along with any assumptions or limitations that have been considered during analysis and evaluation against objectives.

Each objective will use available data to answer the following questions:

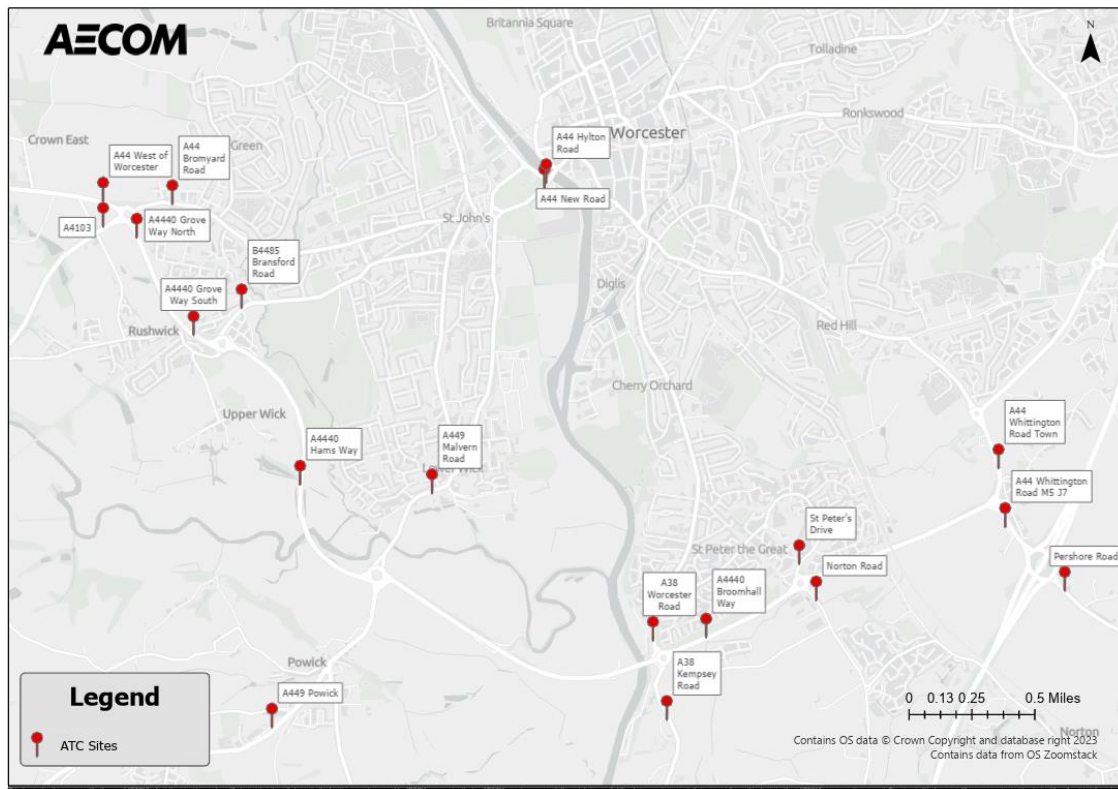
1. **What did we think was going to happen?** Here we will investigate scheme forecasts set out in the Business Case and accompanying forecast reports to determine what we expected would happen in the baseline (2021) and one-year after stage (2023), both with and without intervention where possible.
2. **What actually happened?** Here we will use available data to compare forecast with observed impacts. Where possible, Do Minimum (DM) forecasts will be compared against observed pre-intervention data (November 2021) and Do Something forecasts will be compared against observed post-intervention data (November 2023).
3. **What caused this change?** Here we will consider contextual factors that could have caused the changes seen post-scheme opening to determine which impacts could be attributed to the scheme and the influence of external factors.

### 3.4.1 M1 - Traffic Volumes

Traffic volume data is largely comprised of two-week Automatic Traffic Count (ATC) surveys. Pre-intervention surveys were carried out between 23<sup>rd</sup> November 2021 and 6<sup>th</sup> December 2021. Post intervention surveys were carried out between 14<sup>th</sup> November 2023 and 27<sup>th</sup> November 2023.

Worcestershire County Council (WCC) provided supplementary ATC data for the impact evaluation. Baseline data comes from a two-week period between 22<sup>nd</sup> November 2021 and 6<sup>th</sup> December 2021. Similarly, the one-year after data was collected for a period of two weeks, from 14<sup>th</sup> November 2023 to 28<sup>th</sup> November 2023. Together, the two datasets provide traffic flow data for the sites shown in Figure 3-2.

Figure 3-2 - Traffic Count Sites



Flow data provided by WCC included some anomalous counts, where very little or no flow was recorded on some routes during certain time periods. The following ATC surveys were discounted from the analysis for this reason:

- A44 Bromyard Road, Week 1 baseline counts
- All B4485 Bransford Road baseline counts
- A4440 Hams Way, one-year after counts

The baseline data was collected in November-December 2021 and therefore flows were likely impacted by COVID-19 lockdowns and travel restrictions. This time period also coincides with the construction of the SLR4 and therefore there were traffic management measures and speed restrictions in place at the time of data collection. These factors affect the likelihood that November 2021 data is representative of pre-intervention traffic. However, the wider A4440 SLR has been experiencing construction works related to the phased improvements since 2012 (construction of Phase 1), therefore, it is not possible in this case to obtain pre-intervention traffic data without construction impacts within a reasonably recent period of the SLR4 scheme. Any conclusions drawn from the post-intervention scenario should consider that impacts will partly be attributed to COVID-19 recovery and the removal of construction works.

### **3.4.2 M2 – Junction Operation**

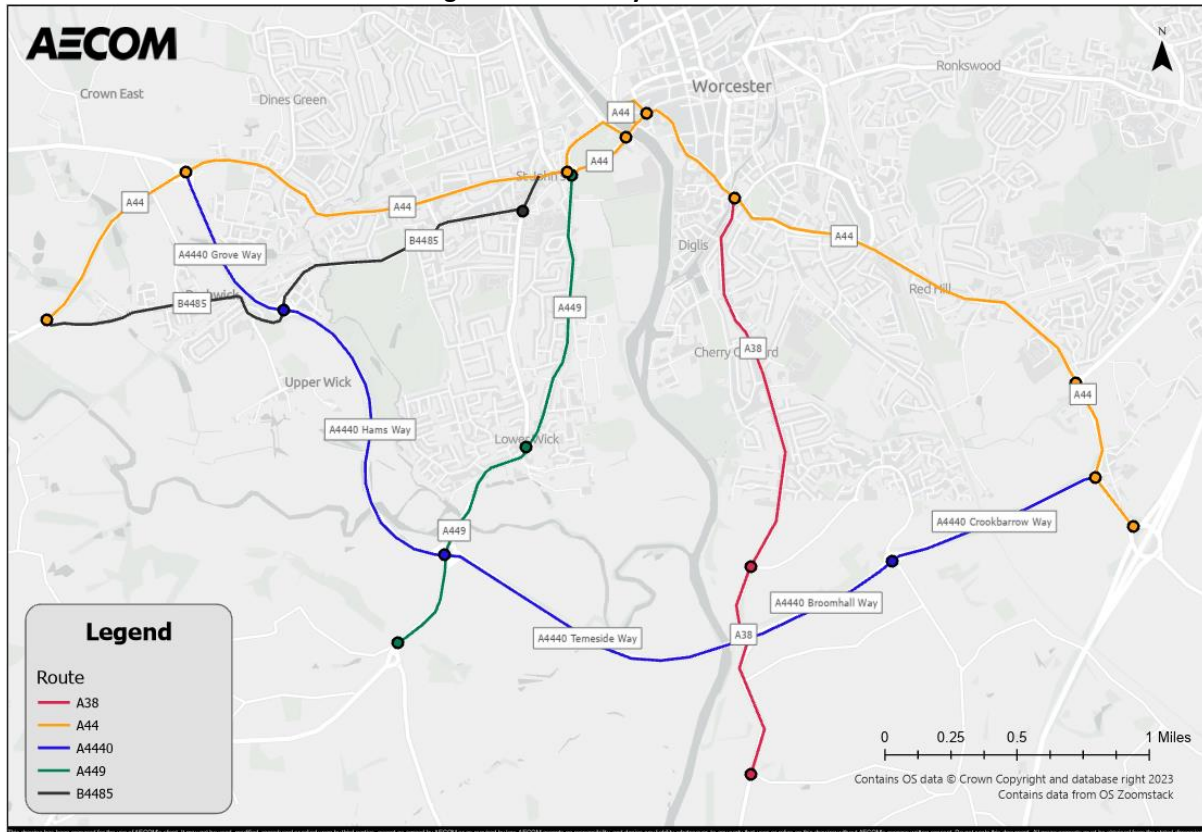
Junction operation data is comprised of three datasets: Manual Classified Turning Counts (MCTC), Queue length surveys and link count surveys. Link counts were only conducted at the one-year after stage from 15<sup>th</sup> November 2023 to 28<sup>th</sup> November 2023. This dataset measures traffic volumes between roundabouts and was used to check the accuracy of the MCTC surveys.

MCTC surveys were conducted on two days between 1<sup>st</sup> December 2021 and 2<sup>nd</sup> December 2021 for the baseline period. For the one-year period they were conducted on 15<sup>th</sup> November 2023. This means this data is more prone to be affected by circumstances on that day (e.g. school holidays, festivals, collisions etc.). However, the data shows good correlation with adjacent link count data and is considered to be robust. Queue length surveys were conducted on the same days as the MCTC surveys for both the before and one-year after period.

### **3.4.3 M3 – Journey Time Data**

Journey time data was sourced using TomTom GPS data. This was collected for routes along the A44, A4440, B4485, A38 and A449 (see Figure 3-3). The data was collected in November 2021 for the baseline, November 2023 for the one year after period and January 2024 for the flood event. Additional data was also collected for these routes in April 2019, for the purposes of establishing a “Baseline Minus” period. April 2019 was identified as a time where there was no construction taking place on the SLR4 section (however construction was taking place in Phase 3). This data was used in the VfM analysis to ensure a robust assessment of post-intervention benefits.

Figure 3-3 - Journey Time Routes



TomTom data provided a series of journey time outputs for analysis, including:

- Journey times
- Cumulative journey times
- Journey time reliability

### 3.4.4 M4 – Stakeholder Feedback

Stakeholder feedback was collated from key groups via a number of workshops held both digitally and in-person. All stakeholder workshops began with providing attendees with an overview of the SLR4 scheme and evaluation objectives. The aim of the workshops was to provide a platform for stakeholders to feedback on perceived impacts post scheme opening and what they thought the impacts could be attributed to.

A business interest group workshop was arranged, with only one attendee representing the Worcestershire Growth Hub (WGH), therefore the outputs of this workshop were limited. Further information was sought from WGH via a set of follow up questions, including a request for qualitative excerpts from business interviews and quantitative data around online business queries (this information has not been received at the time of writing).

A stakeholder workshop was also held for Councillors representing the wider Worcestershire area. This workshop was attended by six councillors representing areas adjacent to the scheme (St. Peter's, Kempsey and Whittington) and areas in south Worcestershire (Malvern Hills District & Wychavon). A further workshop was arranged for local authority officers, attended by five officers. Representatives included officers from South Worcestershire Councils (SWC) and Herefordshire County Council.

A workshop was also held for special interest groups, however this was only attended by a representative from The Ramblers and by the Director of Operations at Nunnery Wood High School. The outputs of the workshop were detailed, with Ramblers providing a range of feedback regarding walking and cycling with respect to the project. However, the outputs only represent the views of one group.

The in-person workshop took place in County Hall on 23<sup>rd</sup> March 2023 from 14:30 to 15:30. This was mainly attended by Local Authority Leaders or Cabinet Members, who will be affected by local politics. Attendance of MPs may have been affected by the announcement of a UK General Election on 22<sup>nd</sup> March 2023.

Follow up questions from these workshops were sent out to local Schools, Sustrans and local developers.

Further to this, an online resident's questionnaire was sent out in March 2024, which closed for comments on 12<sup>th</sup> April 2024. This asked for opinions on the project and its objectives and included topics such as air quality and network resilience. A 'free text' comments box was also included to allow residents to voice their perceptions of the project.

Whilst stakeholder data is important to assess the impact of the project, information collated via the workshops was largely comprised of anecdotal evidence, which was used to contextualise data findings.

#### **3.4.5 M5 – Developments**

Local development data was supplied by local planning authorities to provide an understanding of actual numbers of houses built per annum in Wychavon District, Malvern Hills and Worcester between 2015 and 2022. This was supplemented by data sourced from the Office of National Statistics (ONS) on the number of active businesses, reported on an annual basis, on a local (Worcestershire), regional (West Midlands) and national (England) level.

#### **3.4.6 M6 – Economic Indicators**

Data regarding the economy of Worcestershire was collected regarding employment rate and gross weekly pay from UK government sources such as the ONS. These are considered exceptionally reliable datasets and have been used to look at how the economy of Worcester has changed since the project opened.

#### **3.4.7 M7 – Collision Data**

Collision data (STATS19) was provided by WCC, between the dates of 1<sup>st</sup> January 2014 and 30<sup>th</sup> June 2024. This data has been considered in two parts for the one year after evaluation. The pre-intervention baseline data is considered as any collision data available between 1<sup>st</sup> January 2014 to 30<sup>th</sup> June 2022. Due to the phased opening of the scheme between July and August 2022, these months have been discounted from the analysis. The post-opening collision data was taken from 1<sup>st</sup> September 2022 to 30<sup>th</sup> June 2024. Limitations of the pre-intervention data are that the number of collisions may have been impacted by reduced flows during the COVID-19 pandemic. Whereas post-intervention data is likely to be limited due to only one year of collision data being available for analysis; typically, collision trends are analysed over a longer period.

#### **3.4.8 M8 – Environmental Monitoring Data**

Two main datasets were used for Environmental Monitoring, noise and air quality monitoring. Air quality monitoring came from regular monitoring taken place between 2018 and 2022. This includes sites across Worcestershire, but not many are near the SLR4. Meanwhile, noise data came from a range of long term and short-term monitoring sites in September 2016 for baseline data and in March 2024 for the one-year after evaluation. It is noted that the baseline noise monitoring aligned to the scheme appraisal baseline, rather than the evaluation baseline of 2021.

### **3.5 Process Evaluation Approach**

A process evaluation reviews the activities involved in the delivery of a programme/scheme to understand what went well and what lessons can be learned. A process evaluation is multi-faceted and typically utilises both qualitative and quantitative approaches to understand objective issues (e.g. the costs and programme) as well as subjective issues (e.g. perception of the implementation). Limited risk and financial information were available throughout the delivery of the scheme, therefore the primary sources of information used to carry out the SLR4 process evaluation were a written questionnaire and an interview with the WCC Project Manager.

Both methods of data collection were designed to obtain qualitative and quantitative information around project build, risk, programme, cost and delivered project. The questionnaire was developed to answer the following key questions defined in the project MEP:

- Was the project delivered to costs and timescale?
- What lessons can be learnt to help shape future transport strategies for the WCC?

The Project Manager's written responses were of high quality and detail. These responses enabled the evaluation team to focus on key areas of delivery evaluation including key cost and programme variances, best practices and lessons learned. The findings of the process evaluation can be harnessed to guide the planning and execution of future projects, fostering a culture of continuous improvement within the council.

### **3.6 Value for Money**

A value for money assessment is conducted to see how the project returns benefits on the investment (costs). This section looks at the cost of building the project as well as direct and indirect benefits to the economy. Reduced journey times adds value to the economy by giving people more time to spend money whilst reducing bills such as travel costs. Meanwhile, improved safety and supporting businesses improves the economy by allowing more people to work and to stay working for longer. Similarly, impacts to the environment can impact the economy by contributing to health problems and to climate problems (such as increased flooding).

These together create a Benefit Cost Ratio (BCR) that says how much money was put back into the economy for every pound spent on the project. Of course, there are other factors to consider outside of this such as how a project helps other goals for both the council and the country.

The value for money assessment has been undertaken using a variety of sources mentioned above. The sources of data used are journey time data (M3) and traffic volume data (M1) which have been used to calculate journey time benefits and impacts to the environment.

As part of the SLR4 FBC, a Monitoring and Evaluation Plan (Jacobs, December 2018) was created to provide a strategy for assessing the scheme against objectives identified. The plan sets out the evaluation strategy for the SLR4 scheme. In collaboration with the Department for Transport, a revised proportionate approach was derived which made best use of available data.

Given the proportionality considerations and the availability of baseline/outturn data, the approach to evaluate the outturn transport economic efficiency (TEE) element of the Value for Money used observed journey time and flow data on selected links to derive a ratio quantification of the area wide benefits. This approach compared the baseline and outturn traffic flows and journey times on selected links along with a comparison of Do Minimum (without scheme) and Do Something (with scheme) traffic flows and journey times on the same links from the opening year Worcestershire Transport Model (WTM) forecast models. This allowed a quantified assessment of the outturn TEE benefits over the wider area using a ratio approach.

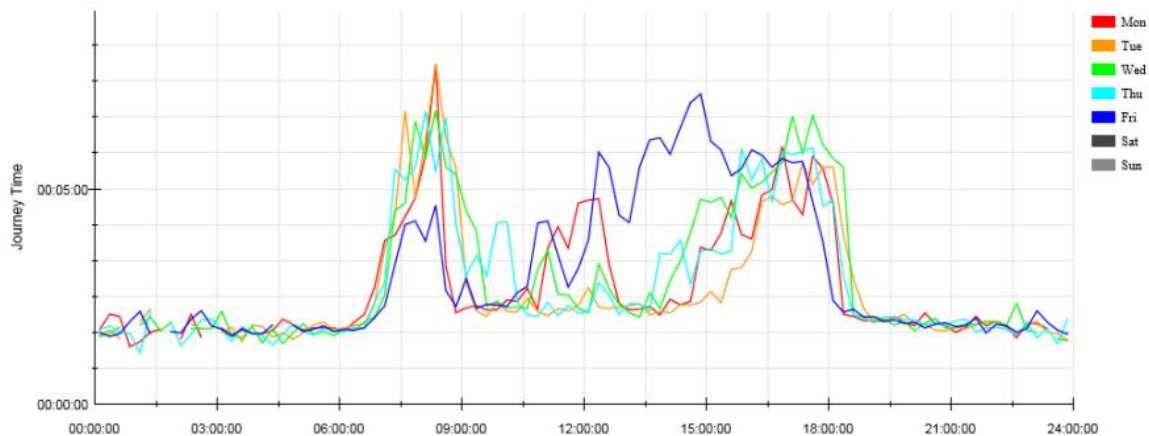
The approach is set out in Figure 12-1 in Section 12.

# Part B – Impact Evaluation



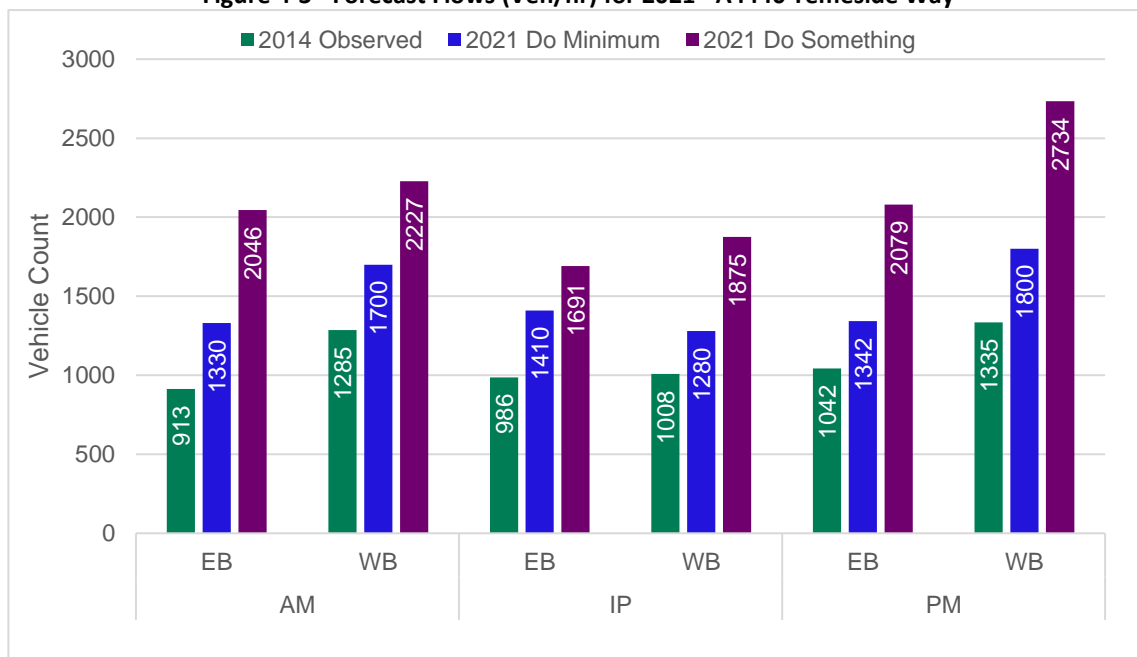
Furthermore, average journey time and speed data indicate the Eastbound section of the SLR4 suffered from congestion to a greater extent, with data showing irregular journey times were experienced between 0630-1000 and 1400-1800, broader than the traditional weekday peak periods (see Figure 4-2).

**Figure 4-2 - Pre-intervention 24-hour Journey Time Plots on the A4440 Temeside Way Section (Eastbound)<sup>6</sup>**



The SLR4 Full Business Case (FBC) included a modelling exercise to quantify potential impacts both with (Do Something (DS)) and without (Do Minimum (DM)) intervention. From the forecasting data presented in the FBC, we expected flows in both directions and all time periods to increase. Figure 4-3 shows the predicted flow increases in 2021, with and without scheme. This data indicates that, without intervention, existing congestion in the baseline was likely to exacerbate over time, with existing capacity concerns limiting the growth in traffic along the A4440. In the DS case, it was predicted that the SLR4 would attract up to 52% more traffic onto the route (A4440 Temeside Way eastbound, PM peak). This suggests that the scheme was expected to unlock capacity and accommodate additional traffic growth, or that the dualling of this route would make the SLR4 more attractive and draw in additional traffic from other routes.

**Figure 4-3 - Forecast Flows (Veh/hr) for 2021 - A4440 Temeside Way**



<sup>6</sup> Source: Worcestershire County Council C2 Data, August-September 2015. Journey times are averaged over 15-minute periods.

The Volume to Capacity ratio (V/C ratio) of a route provides us with a measure of the traffic flow against the available capacity, indicating whether the route provides sufficient capacity to accommodate traffic flow. The V/C ratio is an indicator of the level of congestion. As a link V/C ratio approaches 100%, delays and speed reductions are likely. Modelling assessments indicated that without intervention, the A4440 Temeside Way would have continued to be under pressure, with V/C ratios between 97-118% indicating that congestion was expected to worsen up to the forecast year of 2031.

The forecast data indicates that upgrading the A4440 Temeside Way would attract more traffic onto the wider A4440 route (Figure 4-3). Alongside this, the FBC presents predicted a 53% improvement in peak journey times in 2031. With the implementation of the scheme, the V/C ratio of the link was forecast to reduce to between 65-80% in all time periods except in the 2031 AM scenario<sup>7</sup>.

Modelled data therefore indicates that the SLR4 was forecast to remove capacity constraints at A4440 Temeside Way in the year 2031, enabling the route to accommodate more vehicles<sup>8</sup> whilst operating with greater spare capacity and delivering more reliable journey times.

As a result of the intervention, it was expected that capacity constraints along the A4440 Temeside Way would be relieved, helping the local economy, residents and businesses with providing the region with greater access to opportunities by decreasing peak journey times along the route.

### **4.3 What change have we seen so far?**

Traffic data was collected in November 2021 to establish a pre-intervention baseline to assess traffic flows. This data was collected prior to the SLR4 scheme opening in August 2022. Additional traffic data was collected in November 2023, to understand the one-year after performance of the scheme.

Observed data indicates that traffic flows on the A4440 Temeside Way were lower than model forecasts in both pre-intervention (November 2021) and post-intervention (November 2023) scenarios. This trend is evident in all time periods and in both eastbound and westbound directions.

It should be noted that modelled impacts were forecast prior to the COVID19 pandemic and therefore do not take account of changes in travel behaviours and volumes in the post COVID19 context. Observed flows on A4440 Temeside Way are lower than forecast, in each direction and time period, both 2021 and 2023. This is likely due to the national and regional impacts of COVID-19 (see Section 4.4, Figure 4-8).

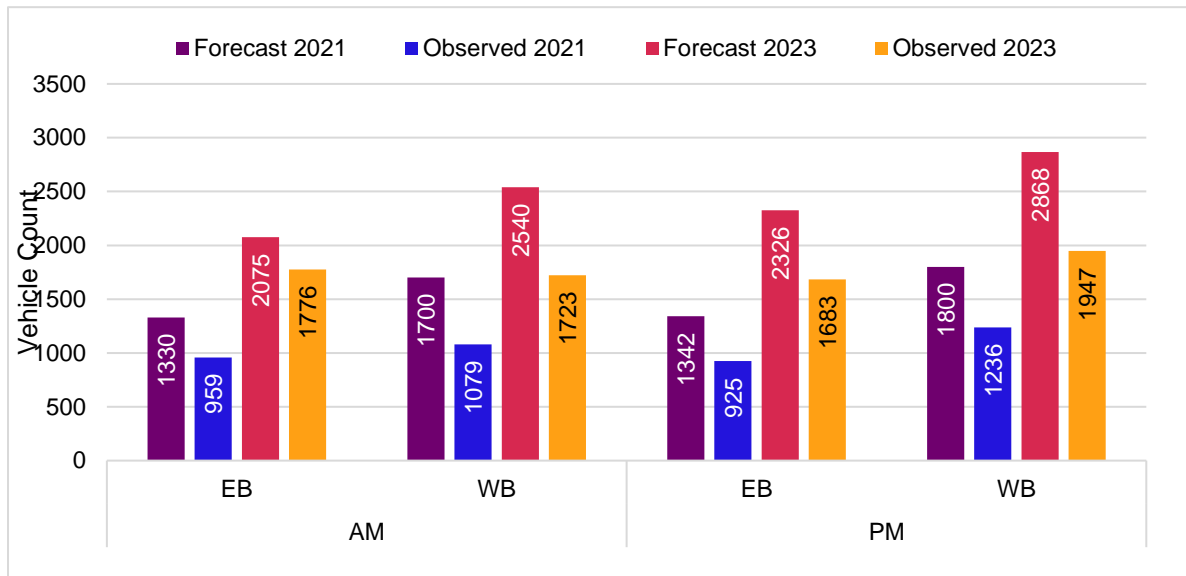
However, observed data demonstrates a trend of recovering traffic flows between 2021 and 2023 at a rate that exceeds forecast growth in most cases. A4440 Temeside Way traffic flows have grown by 85% and 82% between 2021 and 2023 in the AM and PM peaks respectively, compared with forecast respective growth of 55% and 73%. It is likely that whilst part of observed traffic growth is attributed to COVID-19 recovery, the increased capacity of the A4440 has supported traffic growth in the corridor.

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<sup>7</sup> In the 2031 AM with intervention scenario, the section between Ketch & Powick junctions is forecast to experience a V/C that exceeds 100% in the eastbound direction, as a result of the Ketch roundabout junction operating at capacity.

<sup>8</sup> Source: A4440 SLR FBC, Table 3.2. Model results shows AM Peak A4440 Temeside Way eastbound traffic flows in the 2031 Without project forecast increase by 54% from baseline, compared with an increase of 114% from baseline forecast in the 2031 With project scenario.

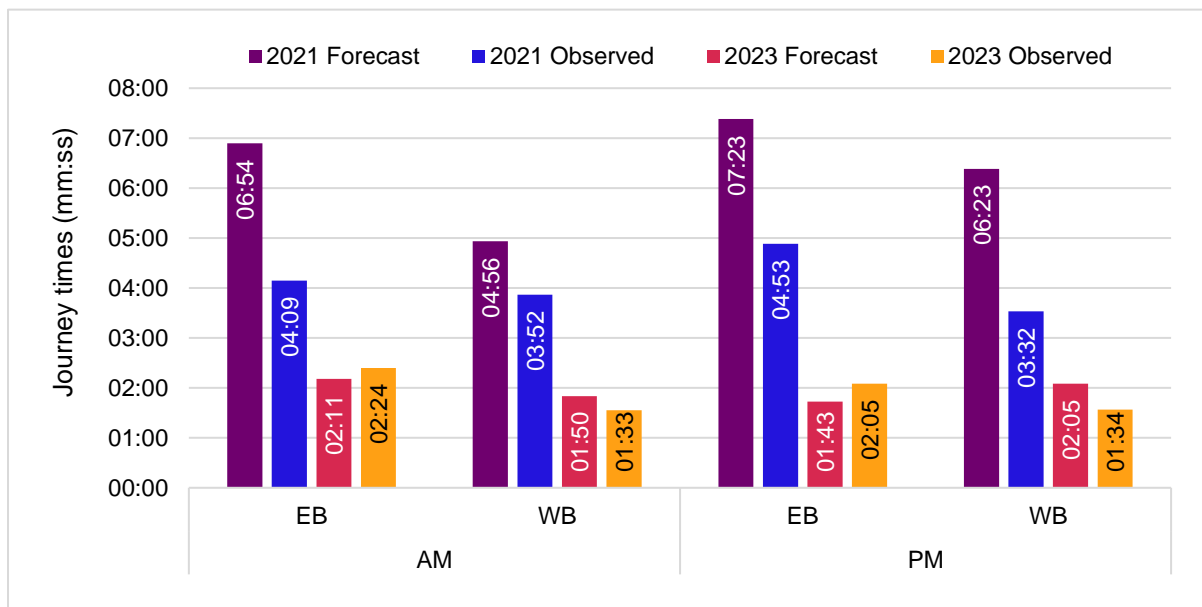
**Figure 4-4 - Forecast vs Observed Flow Comparisons on the A4440 Temeside Way, During Baseline (2021) and 1YA (2023)**



To further determine whether capacity constraints were removed on the A4440 Temeside Way, observed traffic flows were considered alongside journey time impacts. Data sourced from TomTom GPS data indicates observed journey times on the SLR4 section were quicker than forecast in both the baseline and one year after opening scenarios.

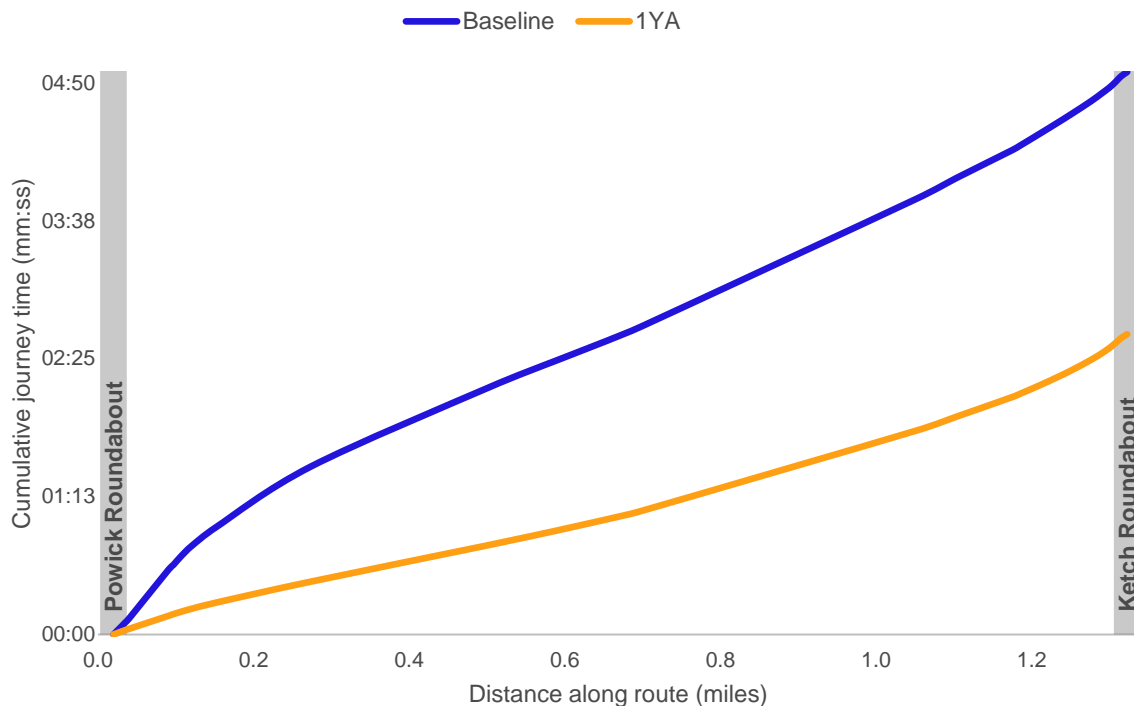
Figure 4-5 shows the difference in observed journey times in 2021 and 2023. There has been a reduction in journey times along the A4440 Temeside Way following the SLR4 improvements in both directions in both the morning and evening peaks. Observed average journey times in the morning peak improved by 1 minute 45 seconds in the eastbound direction and 2 minutes 19 seconds in the westbound direction following the SLR4 improvements. Similarly, observed average journey times in the evening peak improved by 2 minute 48 seconds in the eastbound direction and 1 minutes 58 seconds in the westbound direction following the SLR4 improvements. This indicates that the project has increased capacity at the A4440 Temeside Way, as the route has been able to accommodate greater flows whilst improving journey times for road users.

**Figure 4-5 - Observed and Forecast Journey Time on the A4440 Temeside Way (TomTom)**



Cumulative journey times can highlight any pinch points along a route that contribute to delay. Figure 4-6 shows that in November 2021 (pre-intervention), users were experiencing a long journey time and lower speeds for the length of the A4440 Temeside Way, which was worse in the eastbound direction. Further delay was observed approaching Ketch roundabout. A similar trend was observed in the westbound direction, with lower speeds for the duration of the route. Post-intervention journey times show improvements along the A4440 Temeside Way in both directions, with a notable reduction in delay after Powick Roundabout and on the approach to Ketch Roundabout. Increased speeds along the A4440 Temeside way indicates less congestion along the route.

**Figure 4-6 - Journey Times Along the A4440 Temeside Way Eastbound**



Overall, observed data for the SLR4 section in 2021 and 2023 indicates that the A4440 Temeside Way accommodates far more traffic than the baseline pre-intervention case. Despite this, observed journey times have reduced by almost 50% from the pre-intervention base in all directions and peak time periods. Together, these measures of traffic indicate that capacity constraints along the A4440 Temeside Way section have been released, allowing the route to provide greater capacity whilst providing better certainty of journey times.

#### 4.4 What caused this change?

There are several factors that likely contributed to the changes seen along the A4440 Temeside Way, most prominently the dualling of the route, as this directly added extra capacity, eased congestion and allows for a greater number of vehicles to use the route before reaching operating capacity. This in turn leads to a reduction in queuing and an improvement in journey times.

There are a number of limitations in the data and wider contextual factors that reduce the certainty that baseline data is truly representative of the pre-intervention scenario. As noted in Section 3.3, pre-intervention baseline traffic data collected is likely to be limited due to the following occurring in November 2021:

- SLR4 construction, including a contraflow arrangement on the SLR4 section
- COVID19 Pandemic

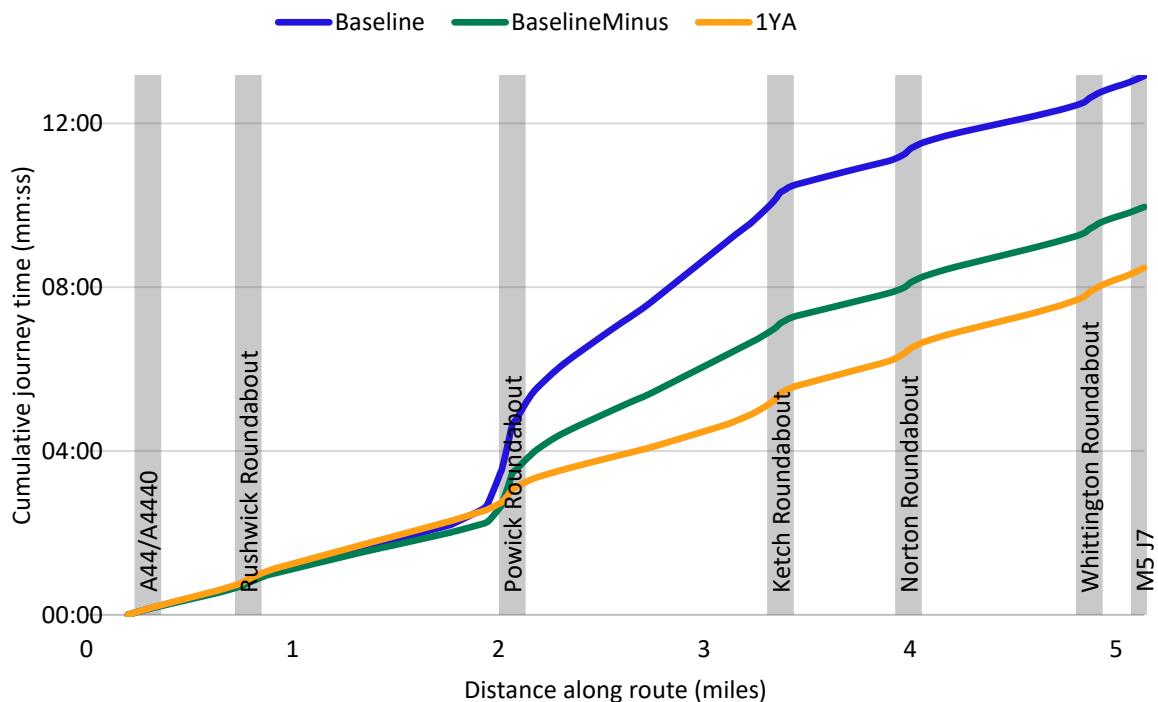
These limitations indicate that baseline data may underestimate demand in the pre-intervention scenario. It is also likely that these factors overestimate pre-intervention journey times, given that this data was collected

during the SLR4 construction period when contraflow arrangements and speed restrictions were in place. Therefore, it should be considered that growth in observed traffic between pre- and post-intervention is likely partly attributed to “recovery” of traffic flow from a COVID restriction and construction situation to a post COVID and post-construction traffic situation.

As the wider A4440 SLR has been experiencing continuous construction works related to phased improvements since 2012 (construction of Phase 1), it is not possible to obtain pre-intervention traffic data without construction impacts within a reasonably recent period of the SLR4 scheme. Additional journey time data from April 2019 was used for the purpose of establishing a “Baseline Minus” period for sensitivity testing. April 2019 was identified as a time where there was minimal construction taking place on the SLR4 section (however construction was taking place in Phase 3).

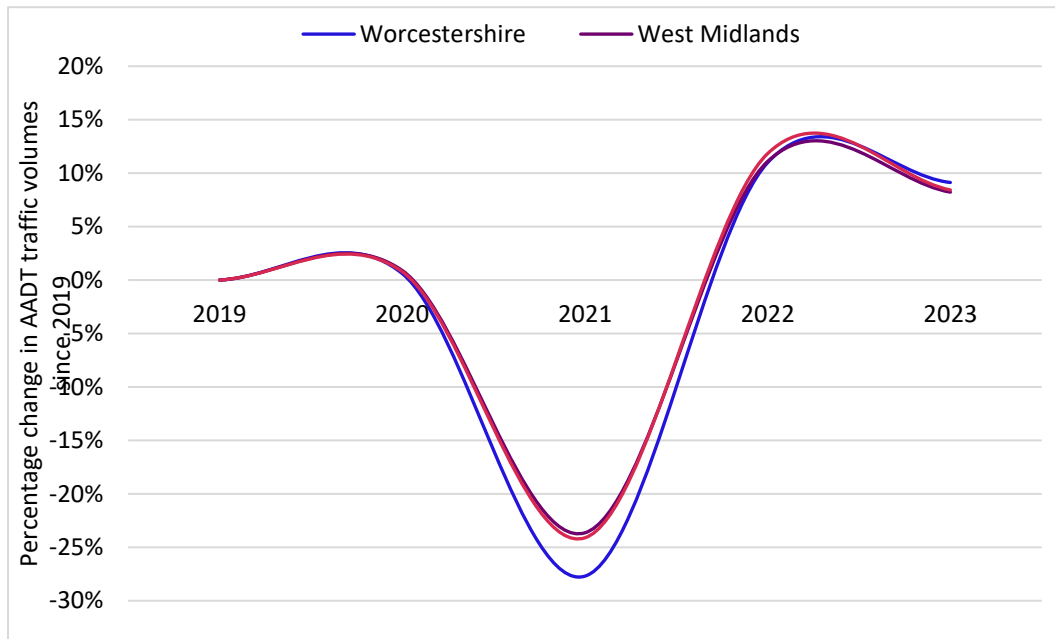
Figure 4-7 compares journey times on the wider A4440 SLR for baseline, “Baseline Minus” and one year after scenarios. The data shows that pre-intervention baseline journey times were higher than “Baseline Minus” journey times, indicating that the SLR4 construction may have led to slower journey times through the SLR4 extents. The post intervention still represents improved journey times on the A4440 SLR, but to a lesser extent when compared with the “Baseline Minus” scenario. This “Baseline Minus” analysis provides confidence that the SLR4 improvements are responsible for journey time improvements.

**Figure 4-7 - Journey Times Before, During and After Construction (A4440 Eastbound, PM Peak)**



To contextualise the potential limitations of pre-intervention data, Figure 4-8 shows the background change in traffic growth at a national, regional and local level between 2019 and 2023. It shows that traffic volumes decreased by 19% in England and 27% in Worcestershire during 2021. This was largely due to the effects of pandemic restrictions that were in place in England from March 2020 until February 2022. By 2023, traffic had recovered by 10% compared to the 2019 baseline. This data indicates that Worcestershire suffered a decline in traffic at a rate that was 8% higher than the national average.

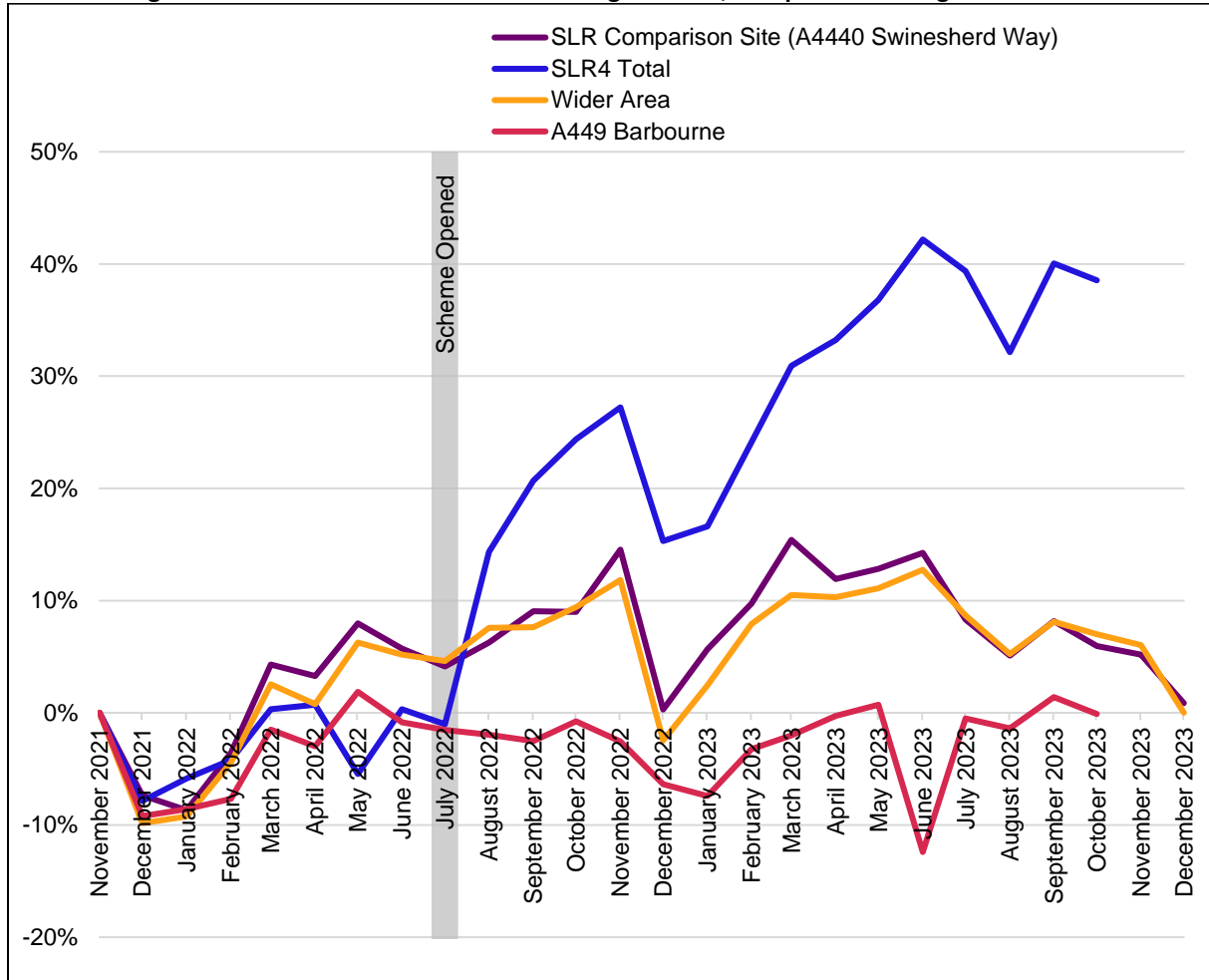
**Figure 4-8 - National, Regional and Local Trends in Background Traffic Growth, Relative to 2019 Annual Averaged Daily Traffic Volumes (AADT)**



Given the baseline data was collected in November 2021, the increase in traffic volumes post-intervention is likely partly attributed to COVID recovery. However, growth along the SLR is higher than elsewhere in Worcester suggesting the project still played a large role in the increased traffic growth on the SLR4.

Growth in traffic volumes on a local level have been assessed to ascertain any unique trends on the SLR4 section, when comparing to other sites across the Worcestershire road network (see Figure 4-9). Before July 2022, growth of traffic flows remained low, with traffic volumes across Worcestershire experiencing steady recovery rates following a number of lockdowns and travel restrictions. However, after the project opened in July 2022, traffic increased on the SLR4 much faster than in other parts of Worcestershire. Traffic volumes along the SLR4 increased by 40% from November 2021 to October 2023, compared to a 10% increase in the wider area.

**Figure 4-9 - Growth of Traffic Volumes Along the SLR4, Compared to Background Flows**



Stakeholders agree with this, saying that additional capacity had been added to the SLR, making the route more attractive to car users. Therefore, whilst the baseline may not be fully representative of the pre-intervention scenario, the opening of the project has contributed to relieving capacity constraints on the A4440 Temeside Way and has supported a substantial growth in flows and improvements in journey times.

#### 4.5 Summary

Overall, all metrics analysed along the SLR4 section demonstrate improvements to journey times, whilst at the same time accommodating higher traffic flow on the route across all periods of the day and in both directions. This indicates the SLR4 route has successfully removed capacity constraints along the route. Stakeholders agreed that there has been a reduction in journey times and congestion along the SLR4 supporting the conclusion that one year after opening, the SLR4 project is on track to deliver Objective 1 outcomes.

**Table 4-1 - Summary of How the A4440 SLR4 Project has Delivered Objective 1 Outcomes**

Outcome	RAG	Justification
Decreased congestion	On track to deliver expected outcome	There is a clear reduction in congestion, with more trips using the SLR4 section. Cumulative journey time graphs show lower journey times and smoother curves, demonstrating less queuing on the approach to junctions. Section 8 also demonstrates improved reliability along the wider SLR.

Outcome	RAG	Justification
<b>Improved journey times</b>	On track to deliver expected outcome	Journey times have improved in all time periods and in both directions.
<b>More reliable journey times</b>	On track to deliver expected outcome	Wider journey time reliability analysis in Section 8, show improvements to reliability along the A4440 SLR, with a reduction to the shortest, average, and longest journey times.
<b>Reduced commute times</b>	On track to deliver expected outcome	There is a reduction in journey times and an increase in reliability during peak commuter periods.
<b>As journeys become easier, a greater number of people will be willing to travel to and from this area</b>	On track to deliver expected outcome	There has been an increase in the volume of trips using A4440 Temeside Way that coincides with the increased capacity of the SLR4 route.

#### 4.6 Next Steps and Recommendations

The following elements should be considered at the five years after evaluation:

- 1) Journey time reliability data for the A4440 Temeside Way was not available at one-year evaluation stage. It is recommended that this data is obtained during the next evaluation stage, to understand to what extent SLR4 improvements drive reliability improvements on the wider route (as noted in Section 8).
- 2) Background traffic growth should also be reassessed at the next evaluation stage to provide a longer term understanding of how much of the observed traffic impacts can be attributed to COVID-19 impacts.

A further consideration for future Worcestershire County Council evaluation projects is to programme baseline data collection prior to construction. The SLR4 traffic evaluation was collected during construction, which makes the attribution of outcomes challenging.

## 5 Did the project support the growth of Worcestershire and the surrounding area?

### 5.1 What did we think was going to happen?

South Worcestershire<sup>9</sup> is an area with relatively high levels of economic participation and low levels of unemployment, with the SLR providing a key economic function to support the movement of goods and people across the region. South Worcestershire also benefits from good interregional transport links via the Strategic Road Network (SRN) (the M5, M42 and M50), which provides connections into key economic hubs in London, Birmingham, Bristol and Wales. However, a concern reflected in the Full Business Case was that access to the SRN was constrained by the SLR, meaning that settlements that rely on the SLR were struggling to attract business.

Malvern, located to the southwest of Worcestershire, is particularly remote from the SRN and relies upon access to the SRN via the A4440 SLR. Without intervention, congestion and reliability of the route was expected to worsen causing a severance effect on Malvern from the SRN. It was expected that the severance effect would also continue to impact existing business in Malvern and negatively effect the attractiveness of Malvern as a location for new business. These concerns were echoed by the Malvern Hills Science Park (MHSP), the who stated: “The variability of journey times between MHSP and the M5 is now a cause for concern and may limit the growth of the MHSP. It is 9.7 miles from here to Junction 7 of the M5 and it can take anywhere from 16 minutes to 50 minutes, depending on the time of day.... If we are to succeed as a business, we need this problem addressed in the very near future.”

Implementing the SLR4 project was expected to complete long-term plans to dual the A4440 SLR between Whittington to Powick junctions. The Business Case forecast that the project would result in less congestion both in the City Centre and on the A4440 SLR, resulting in reduced travel times and benefiting commuters, haulage and travellers. It was also expected that the project would reduce the road user cost due to time savings for users pre- and post-project.

It was also expected that the dualling of the route would provide employment growth due to the creation of additional network capacity and providing a more resilient and reliable transport network. Improved connectivity and reliability across south Worcestershire would thus be expected to reduce the cost of congestion and delay on businesses. In turn this would drive investment, create additional jobs, give businesses greater access to customers and employees and provide residents with improved access to jobs in the surrounding area.

### 5.2 What change have we seen so far?

At the one year after stage, there is limited data to inform any SLR4 impacts on wider growth across Worcestershire and the surrounding area. National and regional wage and employment data sets can inform general trends and signal early indications but the extent to which SLR4 delivers growth is likely to be better determined at a later evaluation date, once more robust local data becomes available.

#### 5.2.1 Median Weekly Pay

Median weekly pay data is a useful measure of changes in the local economic landscape, as it provides us with an understanding of the impact of economic factors on the pay earned by residents. This data was sourced from the Office for National Statistics (ONS) between 2017 and 2023 (see Figure 5-1) to understand wider trends in resident pay on a local, regional and national level.

Data demonstrates a consistent trend of increasing weekly pay from 2017 through to 2023 across all geographies. However, the West Midlands and Worcestershire resident earnings consistently fall below the national average, earning up to £30 less per week pre-COVID.

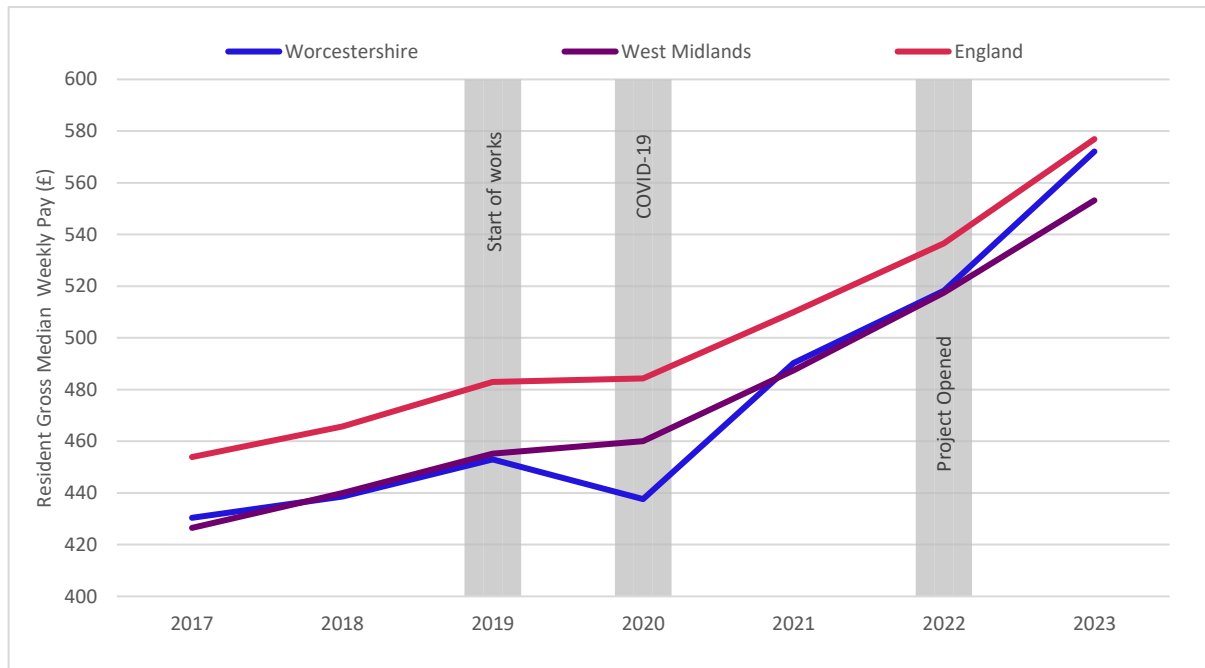
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<sup>9</sup> South Worcestershire covers the largely rural districts of Malvern Hills, Wychavon and the predominantly urban area of Worcester City.

Furthermore, resident earnings in England and the West Midlands were stable and continued to benefit from marginal annual increases of 4.8% and 1.3% in the West Midlands and England respectively. In contrast to this trend, Worcestershire resident earnings suffered a significant decline of 15.4% in 2020, where resident earnings were £46.70 lower than that national average at the time (compared to West Midlands being £24.30 lower than the national average in 2019).

Resident earnings have shown to recover in the post-COVID scenario, with Worcestershire and West Midlands figures returning to up to £20 below the national average. However, earnings in Worcestershire benefit from a marked increase since the opening of the SLR4 project. In 2023, Worcestershire resident earnings have increased by £53.90 in a single year, bringing Worcestershire earnings to within £4.80 of the national average.

**Figure 5-1 - Gross Median Weekly Pay of Residents<sup>10</sup>**



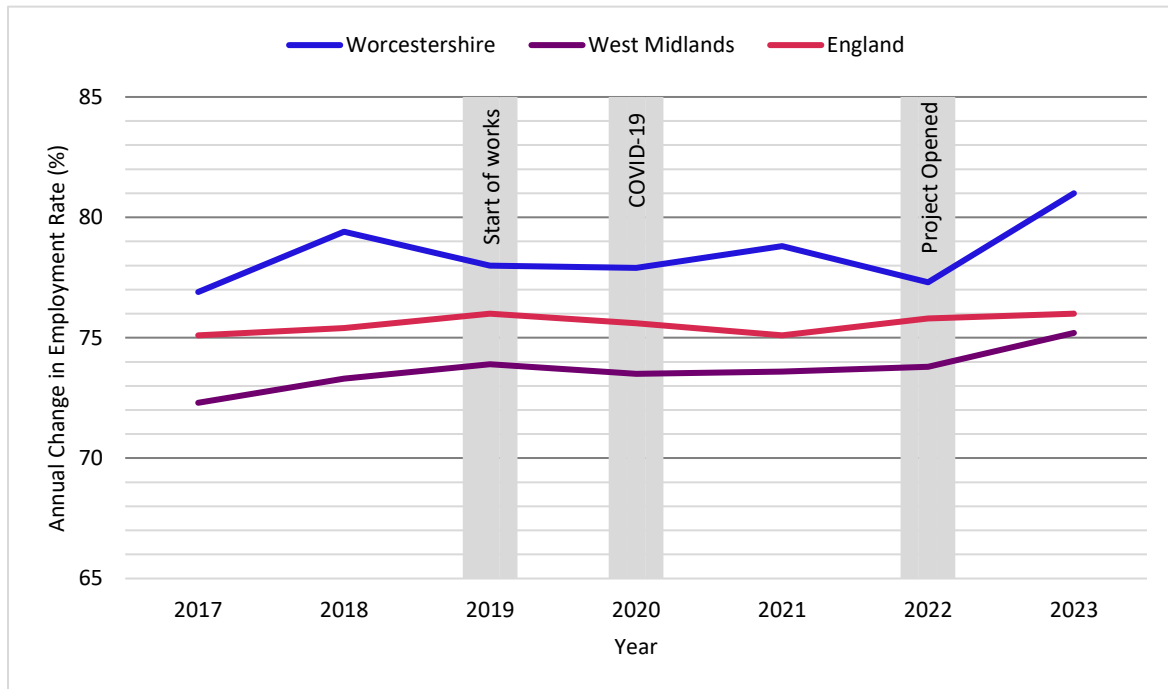
### 5.2.2 Employment Rate

National employment rates have remained steady, remaining between 74% and 75% from 2017 to 2023 (see Figure 5-2). The West Midlands as a region has lower employment rates than the national average but has seen a general upward trend and in 2023 rates were within 0.8% of the national average.

Despite the wider region underperforming, Worcestershire employment rates are consistently 2% higher or more than the national average. Employment rates in Worcestershire continued to remain fairly steady through the COVID-19 pandemic, however the area suffered a decline to 77.3% in 2022. Notably, Worcestershire had an increase of 5% in employment rates between 2022 and 2023, aligning with the SLR4 project opening.

<sup>10</sup> Local, regional and national weekly pay statistics from ONS: <https://explore-local-statistics.beta.ons.gov.uk/indicators/gross-median-weekly-pay> – Accessed on 03 June 2024.

Figure 5-2 - Employment Rate from 2017 to 2023<sup>11</sup>



### 5.3 What caused this change?

Section 4 demonstrates that journey times through the SLR4 have decreased and that the capacity constraint of the SLR has been released. Providing reliable transport for businesses and residents has the potential to impact productivity and promote economic growth. Despite the success of Worcestershire improving its economic performance since the project has opened, it is hard to determine how much of this can be attributed to the project itself and how much is due to other external factors. Improvements in the Worcestershire economy could be due to:

- Changes in national or local government policies
- Businesses moving into the area due to other factors, such as location or rates
- Other social impacts such as the COVID recovery and demographics of the city

Stakeholder workshops were effective in providing key groups with a platform to discuss anecdotal evidence around perceived impacts of the SLR4 project. These forums were also effective in helping to identify the role of SLR4 in improved productivity of local businesses.

The wider impact of a more reliable and resilient SLR4 was a common theme discussed amongst stakeholders within the workshops. In particular, local authority officers, councillors and businesses have said that the SLR4 has supported businesses in the local area. A number of stakeholders emphasised that reduced congestion and more reliable journey times have been well received by businesses and residents, stating that the dualling of the SLR4 has potentially led to *“a massive increase in enquiries from the Malvern area, which may be a direct result of this”*. Several stakeholders also reported feedback from local businesses and residents, including that:

- Residents benefit from wider travel horizons to access employment opportunities
- Businesses benefit from easier movement of goods due to improved access to the SRN
- Businesses benefit from access to an expanded labour market

Below are a number of key excerpts from local business and resident stakeholder interviews around discussions of the impact of SLR4 on local businesses and residents:

<sup>11</sup>Local, regional and national employment statistics for 16 to 64 year olds from ONS: <https://explore-local-statistics.beta.ons.gov.uk/indicators/employment-rate> – Accessed on 03 June 2024.

- *“Massive improvement in access to jobs*
- *“...improving the work-life balance and the overall wellbeing of employees”*
- *“Easier commute for their staff”*
- *“Easier access to M5 has been transformative”*

In the workshops, stakeholders believed the project has allowed more distribution businesses to be set up due to the easier access to the M5. However, this may be due to changes in the economy caused by COVID-19 related restrictions.

In the last decade, one of the largest factors on the economy of an area has been due to the restrictions from the COVID-19 Pandemic. The restrictions limited people from leaving the house other than for essential purposes and for daily exercise, whilst the furlough project provided 80% of a person’s salary at the start of the project. Furthermore, local restrictions were in place during July to December 2020 that caused separate restrictions to be in place in different counties. Therefore, the impact was not felt evenly across the country. As we can see from the ‘what changed’ section, the pandemic caused a reduction in income larger than the rest of the country in 2020. The lockdown restrictions were in place until 2021 with further restrictions and support being in place until 2022. This may explain part of the increase in wages in 2022, as well as the decrease in the number of active businesses.

Other factors that have improved businesses in the area may be due to the support WCC is providing to the community. This includes start up and growth support as well as a focus on increasing tourism to the area. This support for businesses will also have an impact on the economy. In addition, many economic plans have been set out for the area via initiatives such as Worcester City Council’s Worcester City Centre Masterplan and the Strategic Economic plan set out by the Worcestershire Local Enterprise Partnership (WLEP). These aim to improve the economy via infrastructure improvements (of which the SLR is a part of), but also from apprenticeships, gamechanger sites and other means of business support.

It is also noteworthy that the demographics of Worcestershire have not changed significantly over the past 5 years.

## 5.4 Summary

Overall, the economy of Worcestershire improved in 2022, the year that the SLR4 project opened. From stakeholder feedback, it was noted that the reduction in journey times and congestion along the SLR have improved access to the wider area and caused an increase in investment to the region. This is as predicted in the Business Case for the SLR4.

However, despite the positive impact of the project, other factors have also had a large influence on the economy of Worcestershire in recent times, so it is not possible to attribute the level to which SLR4 has benefited local businesses and the economy.

**Table 5-1 - Summary of How the A4440 SLR4 Project has Delivered Objective 2 Outcomes**

Outcome	RAG	Justification
<b>Drive inward investment</b>	On track to deliver expected outcome	Stakeholders indicated they thought there has been an increase in investment, particularly in Malvern.
<b>Enable additional jobs in Worcester</b>	Too early to conclude	Wages and employment rates in Worcestershire have risen faster since the project opened and compared to other areas. However, this may also be attributable to other factors.

Outcome	RAG	Justification
<b>Businesses will have access to a greater range of workers with a wider range of skills</b>	On track to deliver expected outcome	Businesses have said reduced commute times has improved employee satisfaction and therefore allowed them to get more and better workers.
<b>Businesses will have access to a greater number of potential customers</b>	On track to deliver expected outcome	Due to reduced journey times and an increase in distribution businesses in Worcestershire, businesses will be able to access more customers.
<b>Reduction in cost of transport allows businesses to operate more efficiently and improve output</b>	On track to deliver expected outcome	Reduction in journey times and improvements to reliability will likely lead to a reduction in transport costs and this was supported by stakeholders.
<b>Reduces loss of business during flooding</b>	Too early to conclude	No severe flood events have occurred since the project opened and one event did partially shut the one of the approaches to the SLR

## 5.5 Next Steps and Recommendations

The following should be considered ahead of the five years after evaluation:

- 1) It is recommended that business group stakeholders are engaged early via stakeholder interviews and questionnaires, in order to overcome limitations of quantitative data availability at this stage.

## 6 Did the project improve resilience to flood events?

### 6.1 What did we think was going to happen?

Worcester Bridge and the A4440 Carrington Bridge are the only two road bridges in Worcester that cross the River Severn. Worcester Bridge provides a city centre crossing point, but the route is regularly impacted by flood events. The A4440 Carrington Bridge forms part of the A4440 SLR. Before the project, both were over capacity. Before the project was completed, traffic regularly used Worcester Bridge due to the limited capacity of Carrington Bridge. This not only limited development, but if access to Worcester Bridge was restricted due to flooding (as occurred in 2000, 2003, 2007, 2012, 2014, 2016, 2019) then it was difficult to get from the west to east of the city. The SLR4 Business Case also noted a concern of what would happen if Worcester bridge were ever damaged or “*destroyed by floodwater*”<sup>12</sup>. Furthermore, disruption due to flooding leads to a business downtime, harming the local economy and deterring businesses and residents from the area.

It was expected that SLR4 improvements would improve capacity, reliability and flood resilience at Carrington Bridge. These improvements were anticipated to reduce the impact of flooding on the city by providing additional capacity to the second Severn crossing. This was expected to reduce network pressure and ease disruption to the city on the instances Worcester Bridge closed due to flooding. Key stakeholders reinforced these expectations stating “*The dualling of this route would substantially improve flood resilience.*”<sup>13</sup>

### 6.2 What change have we seen so far?

In 2018, WCC implemented an improvement to New Road to further improve flood resilience. The works included raising the carriageway level of New Road in order for it to be more resilient against flooding from the River Severn and allow continued access to Worcester City centre. In the event of flooding on Hylton Road and North Parade, resilience on New Road allows for the installation of a contraflow on the A44, maintaining access across Worcester Bridge into and from Worcester city. The scheme commenced in 2018 and was completed in summer 2018.

Since SLR4 opening, one flood event occurred in January 2024. Therefore, limited information is available to determine the resilience of the improved route. However, during this flood event there were closures around Worcester Bridge but, also a partial closure on the A4440 Temeside Way. During this event, the A449 between Powick Roundabout and Powick flooded and the A4440 Temeside Way was reduced to contraflow, with the cycle lane closed.

Stakeholders said that “In the last 12 months the A4440 approach to the Ketch has been shut several times, so resilience is questionable” and that “It still suffers from flooding in the most extreme events.” Stakeholders felt the issue would have been resolved had the height of Powick roundabout been raised during the SLR4 construction. Comments received at the stakeholder workshops noted that they believe the SLR4 project hasn’t made a large impact, with one saying, “Whether it’s made a difference on flooding, I’m not seeing it.” However, some questionnaire respondents were more positive saying that it has helped wider network resilience from flooding despite the flooding at Powick Roundabout. Results from the questionnaire (see Figure 6-1) show that a majority of residents agree that the project has improved the resilience of the network to extreme weather events.

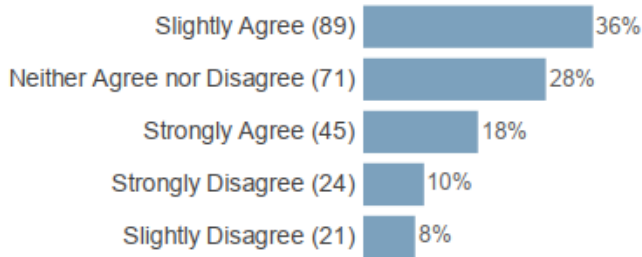
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<sup>12</sup> A4440 SLR4 Full Business Case, Section 2.6.4.

<sup>13</sup> A4440 SLR4 Full Business Case, Section 2.14.2. Quote from MP for Worcester, October 2015.

Figure 6-1 - Excerpt from SLR4 Resident's Questionnaire

To what extent do you think Phase 4 SLR has improved the **resilience of the transport network to extreme weather events?**



To test stakeholder perceptions, an analysis of network performance during flood events was undertaken. OneNetwork is an online platform that is used by WCC to monitor and manage traffic disruption. The OneNetwork Traffic Replay function records and stores real-time delay information across the Worcestershire Road network. The evaluation team worked with WCC's Traffic Management team to use this tool to assess network delays during the January 2024 flood event. It should be noted that the data held by OneNetwork Traffic Replay does not extend far back enough to understand pre-intervention network delays during flood events. Therefore, analysis is limited to comparing anecdotal evidence from stakeholder interviews against recorded network delays in the January 2024 flood event.

**6.2.1 City Centre and Wider Impact**

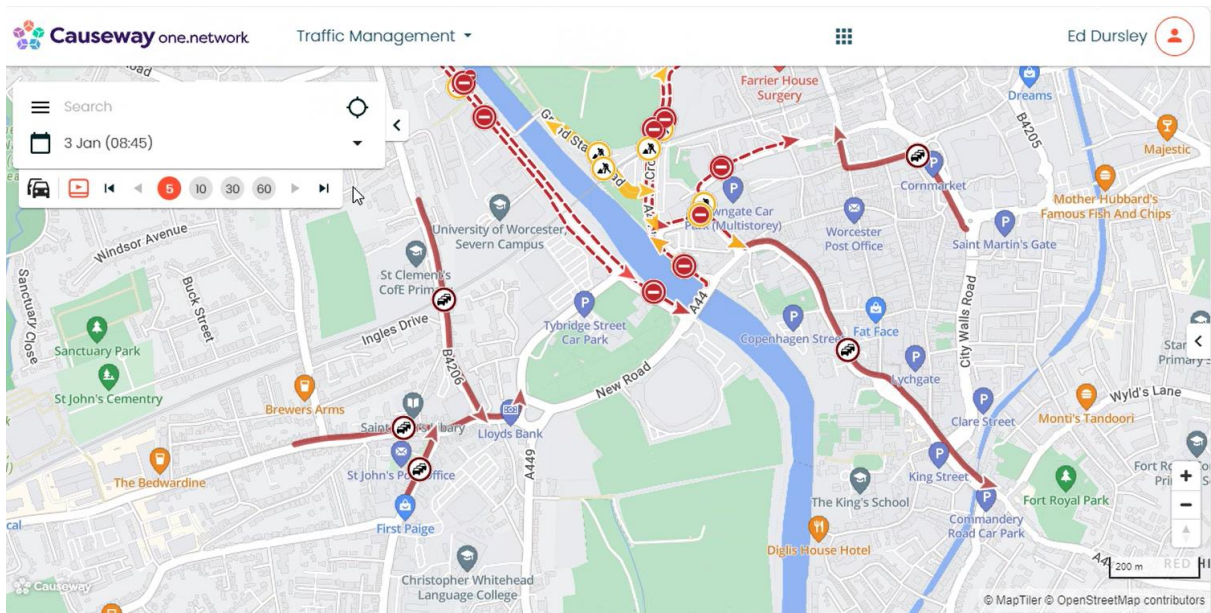
The Traffic Replay tool was used to assess delays and disruptions during peak hours in the flood event that occurred between 3<sup>rd</sup> January 2024 and 5<sup>th</sup> January 2024. During this period, the contraflow on New Road was in place, to allow traffic to avoid flooding on Hylton Road and North Parade/Croft Road.

Disruption information shows widespread delays experienced around the Worcester bridge in the City Centre during the AM peak of the January 2024 flood event (see Figure 6-2). A contraflow arrangement was in place on the A44 New Road & A44 Bridge Street, reducing road capacity of the roads approaching the Worcester Bridge crossing. The flood event and subsequent reduction in road capacity resulted in delays of:

- 10 minutes on Henwick Road
- 6 minutes out of St. John's to Worcester Bridge
- 3 minutes on A44 Deansway to A44 London Road

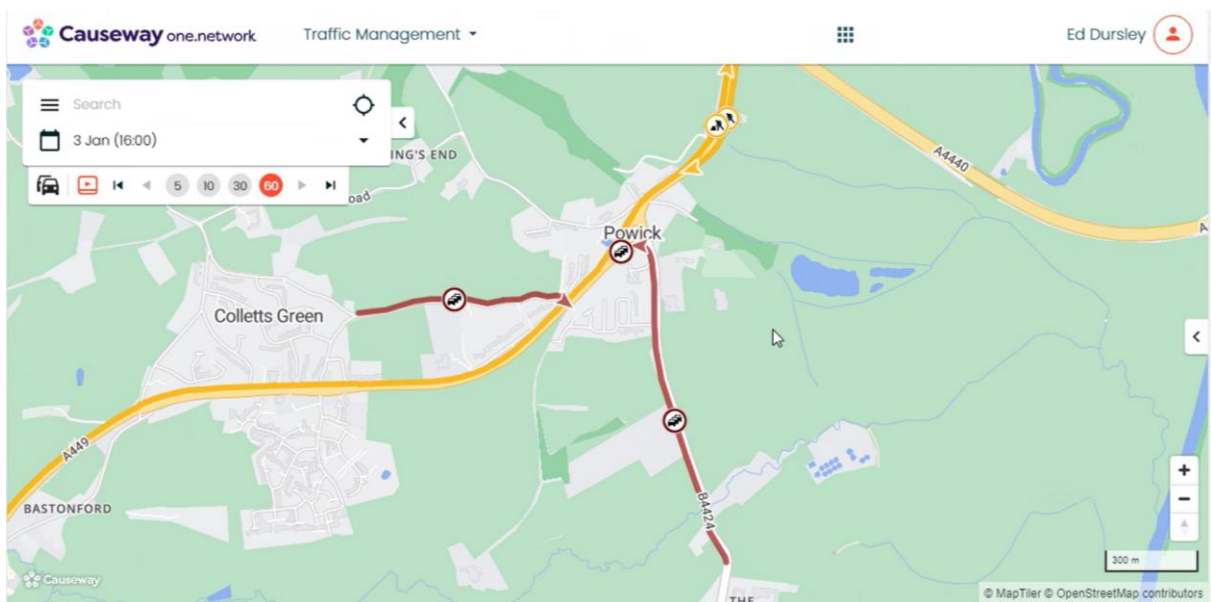
Traffic Replay data showed that the impacts felt during the AM peak hour extended for longer than usual, with widespread delays evident past 10:15. This indicates that the Worcester Bridge and wider City Centre area suffer from congestion and delays across peak periods during flood events.

**Figure 6-2 - Delays and Disruptions in Worcester City During the January 2024 Flood Event**



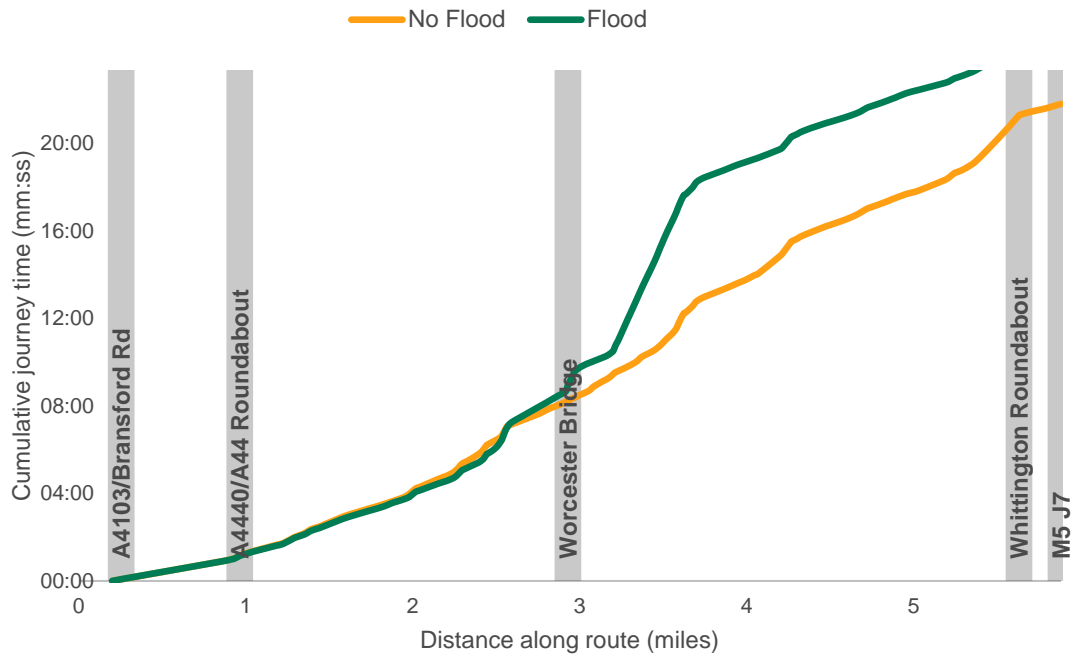
Additionally, the perception of poor flood resilience of the A449 in Powick expressed by stakeholders was evident in Traffic Replay. Disruption data showed extensive queuing beginning to form on the A449 south of the Powick junction leading up to the PM peak period of the first day of flooding. A contraflow arrangement was put in place on the A449 south of the SLR4 to manage flood impacts. This, along with temporary traffic management (including temporary signals) caused worsening queues of up to 103 minutes of disruption on the A449 Worcester Road (northbound) and residual disruption on Upton Road northbound (21 minutes) and Collett's Green (20 minutes). Despite this, the impacts of the flood event did not dissipate onto the A4440, with all disruption on the A449 being felt south of the Powick junction only. The operation of the A4440 route was largely unaffected by flood events, though it is clear that access onto the A4440 via Powick junction was made difficult due to partial road closures on the A449 Worcester Road.

**Figure 6-3 - Severe Network Disruption on the A449 During the January 2024 Flood Event**



TomTom cumulative journey time data was obtained to understand how flooding affects the A44 (including the City Centre). Limited effects were seen on the wider A44 routes in the AM peak, indicating limited impacts of the flood upon A44 journey times. In the PM peak, cumulative journey times on the A44 westbound section show a likely pinch point at Worcester Bridge. At this point in the network, flood event journeys progress much slower (see Figure 6-4).

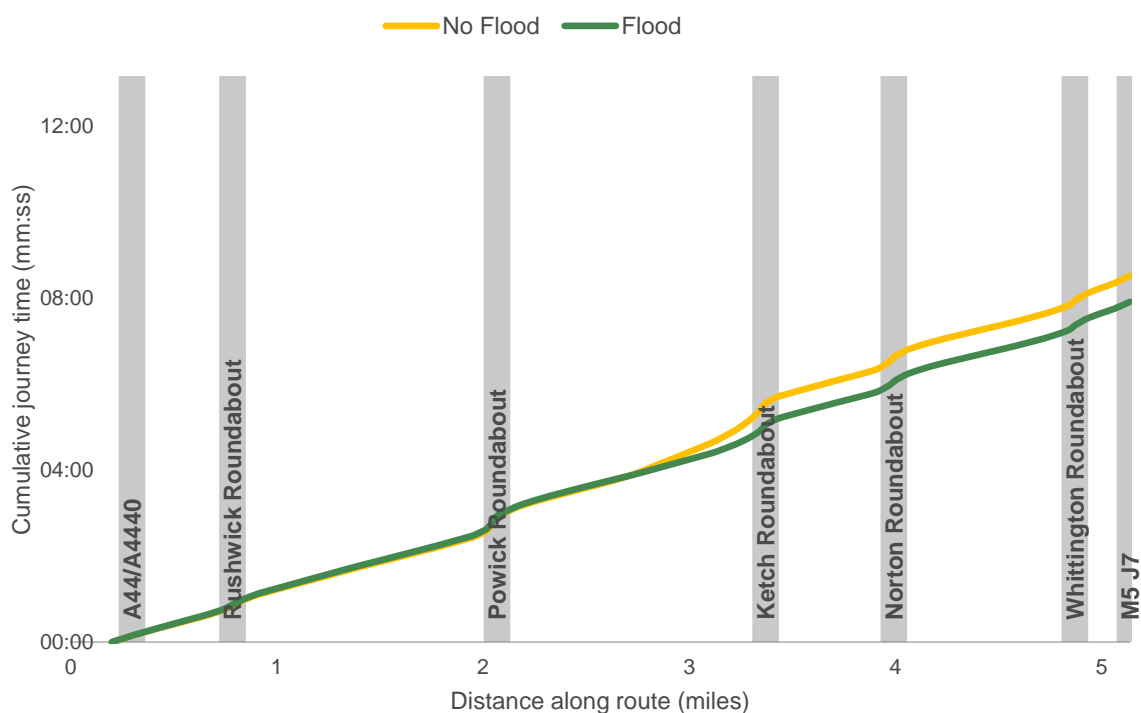
**Figure 6-4 - A44 Eastbound – 1YA Flood vs No Flood (PM Peak)**



### 6.2.2 A4440 SLR Impacts

TomTom cumulative journey time data was obtained for the A4440 during the flood event, as shown in Figure 6-5. This supports the Traffic Replay data, showing the A4440 eastbound journey times were very similar in both the flood event and non-flood events. This indicates that the A4440 SLR in the post-intervention scenario was resilient enough to provide reliable journey times during flood events, with minimal delays or disruptions beyond non-flood journey times.

Figure 6-5 - A4440 Eastbound – 1YA Flood vs No Flood (PM Peak)



### 6.3 What caused this change?

Section 4 demonstrated that the project has resulted in improved capacity along the SLR4. This gives additional resilience to the road network by providing an alternative crossing for the River Severn at Carrington Bridge, in case of city centre flooding. The improved route has also been used when the M5 has been shut, providing additional resilience in a way that was not forecast. However, from discussions with stakeholders there are still issues around flooding which are evidenced for the A449 Worcester northbound approach to Powick.

### 6.4 Summary

Overall, the SLR4 has added resilience to the network by adding capacity across the River Severn. However, from discussions with stakeholders, the overall impression is that it has not improved the network during flood events due to the flooding south of Powick roundabout. Results from the questionnaire show that a majority of residents agree that the project has improved the resilience of the network to extreme weather events.

Limited data is available at this stage to assess the resilience of the SLR4 to flood impacts, given only one flood event has occurred in the first-year post project opening. Resilience should be reassessed at the next evaluation stage, as this may present an opportunity to draw conclusions from a wider range of flood events.

**Table 6-1 - Summary of How the A4440 SLR4 Project has Delivered Objective 3 Outcomes**

Outcome	RAG	Justification
<b>Improved network resilience, particularly in times of flood</b>	On track to deliver expected outcome	Delay data indicates that in the post-intervention scenario, no delays were experienced on the SLR4 or wider SLR during flood events, despite heavy congestion further south along the A449
<b>Removes perception of Worcester as 'closed' during floods</b>	Too early to conclude	Based on comments with stakeholders, the A4440 has had increased capacity during floods. Furthermore, only one severe flood event has occurred since the project opened.

## 6.5 Next Steps and Recommendations

The following elements should be considered at the five years after evaluation:

- 1) Given the limitation around the collection of historic traffic trends during flood events, for future Worcestershire County Council's evaluation projects the collection of baseline data should be collated ahead of the evaluation. This will enable the evaluation to better attribute outcomes. This data could also be used to support the Business Cases for future projects.

## 7 Did the project support delivery of planned growth?

### 7.1 What did we think was going to happen?

The South Worcestershire Development Plan (SWDP) sets out South Worcestershire's vision and objectives through to 2030, to ensure Worcestershire continues to be a competitive place to live and work. The 2030 vision includes the ambition of improved accessibility for residents and businesses, highlighting the emphasis of major improvements to the A4440 as being central to unlocking this vision.

The plan stipulates that delivering the quantum of development planned for south Worcestershire is dependent on significant investment in transport infrastructure, including the phased dualling of the SLR. The plan proposes a number Sustainable Urban Extensions (SUEs) which will deliver housing and employment needs for the region. Site allocation policies for the West Worcester Urban Extension (WWUE) and South Worcester Urban Extension (SWUE) state that the rate of delivery of over 5,000 dwellings is dependent upon dualling of relevant sections of the A4440 SLR.

Therefore, it was expected that the dualling of the A4440 Temeside Way would help unlock and accelerate the rate of delivery of major employment and housing development at the WWUE and SWUE. Furthermore, the project was expected to support growth in and around Worcestershire.

Better infrastructure was needed to accommodate planned development and to realise housing potential in west Worcestershire and nearby towns (such as Malvern). Furthermore, a total of 2,960 dwellings as part of SWDP allocations were dependent on the SLR, including sites at:

- Worcester Southern Extensions (SWDP 45/1)
- Worcester West Urban Extension (SWDP 45/2)

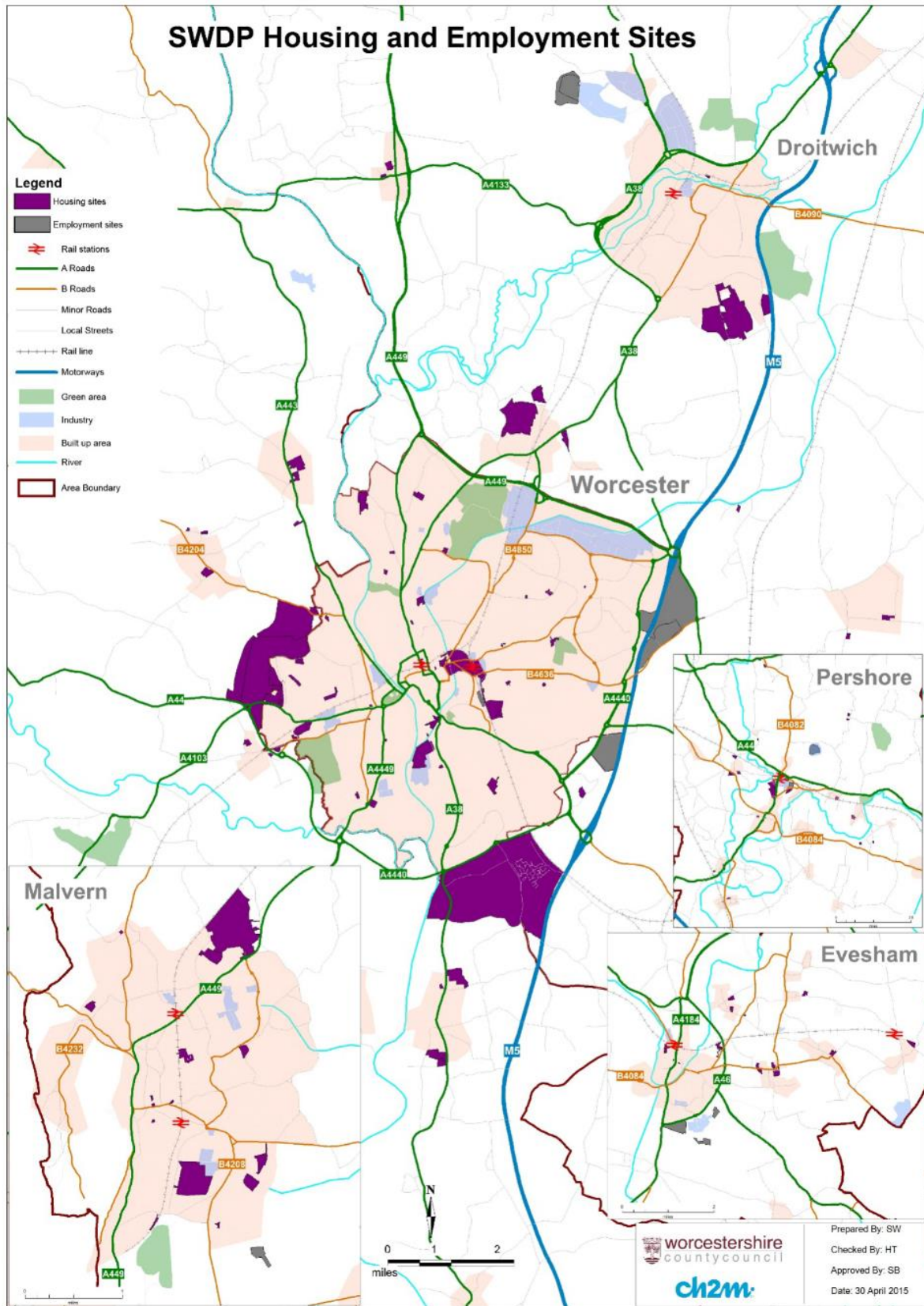
The SLR4 Business Case was developed on the understanding that 9,741 houses would be built by 2022, with 3,476 in Worcester City, 2,041 in Malvern Hills and 4,224 in the Wychavon district. Most of these come from small sites based on land allocations in the local plan.

**Table 7-1 - Predicted Number of Houses to be Built by 2022 in Each Area**

	Worcester City	Malvern Hills	Wychavon District	Total
<b>Forecast by 2022</b>	3,476	2,041	4,224	9,741

There were also major developments planned to the south and west of Worcestershire, with 700 and 811 houses to be built by 2021 respectively. Figure 7-1 shows all planned SWDP housing and employment allocations for the City of Worcester, as well as the major allocations to the south and west of Worcestershire.

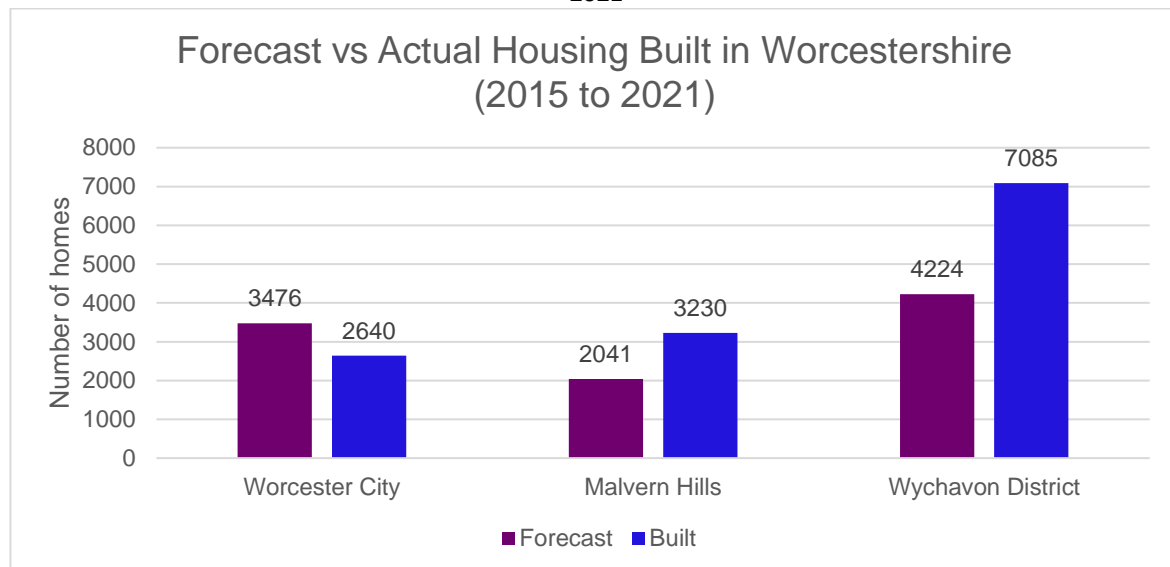
Figure 7-1 - Map of Worcestershire and Planned SWDP Housing and Employment Allocations



## 7.2 What change have we seen so far?

Data provided by local planning authorities, indicate that the actual build out rate of housing development in Worcestershire between 2015 and 2021 was higher than expected (33% higher than forecast). Local planning authorities have reported the actual number of homes built during this time period was 12,955, rather than the 9,741 as forecast (see Figure 7-2).

**Figure 7-2 - Comparison of Predicted and Actual Housing Trajectory in Worcestershire, Between 2015 and 2021**

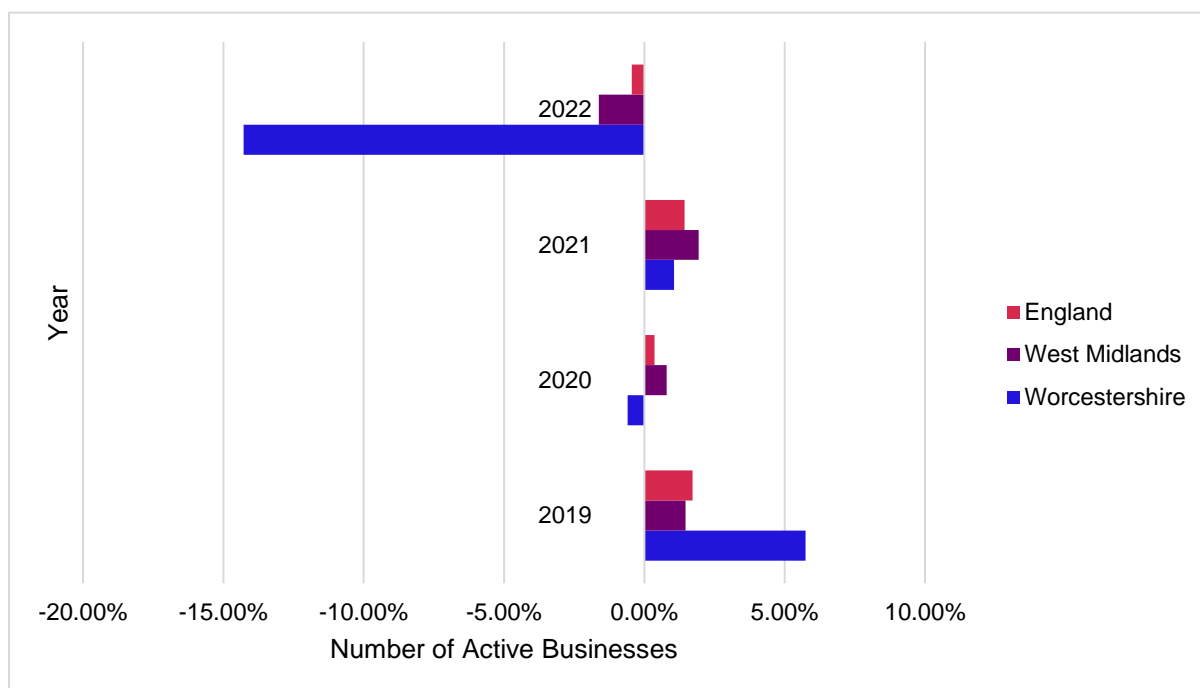


Most of this increase comes from the Wychavon district with the number of houses built being 68% higher than expected. Also, part of the increase can be attributed to the fact 16% of the housing built has come from developments with less than 10 homes. Despite this, the rate of housing build out has fallen 24% short of forecasts for the City of Worcester.

Although the project is in the direct vicinity of Worcester City, it should be noted that journey time reliability and improved resilience are benefits that were also expected to reduced severance impacts of the Malvern area from the Strategic Road Network. Data indicates that the number of homes delivered in Malvern Hills was 58% higher than forecast. In 2022, there was a 111% increase in the delivery of homes in Malvern Hills per year compared with 2015.

The annual growth in number of active businesses with Worcestershire, the West Midlands and England are presented in Figure 7-3. England and the West Midlands have similar trends with small increases in the number of active businesses during 2019-2021 and a small decrease in 2022. In Worcester the trend is slightly different, with a large growth in 2019 of over 5%, small changes in 2020 and 2021 and a decrease of over 14% in 2022. The decrease in 2022 is likely due to effects of COVID-19 restrictions.

**Figure 7-3 - Annual Growth of the Number of Active Businesses from 2019 to 2022**



Stakeholder workshops provided some additional anecdotal evidence to bridge the gap in local business data. One stakeholder workshop was held for representatives of local business interest groups to provide feedback of perceived impacts of the SLR4 project on business operations in the project vicinity and the wider Worcestershire region.

Active business data is only available up to 2022, therefore is unlikely to capture post-opening impacts of the SLR4 project. The trends evident in the active business dataset do not align with wider economic indicators in Worcestershire (see Section 5.2), therefore it is suggested that this is reviewed at the next evaluation stage. Reassessment of active business trends should be contextualised with further engagement with business groups at the next evaluation stage.

### **7.3 What caused this change?**

There is limited data available at the one year after opening stage to evaluate the project’s potential impacts upon planned growth in Worcestershire. Both the housing and active business data represent a limited amount of post opening data. Therefore, attribution of impacts to the project is challenging at this stage of the evaluation, particularly as the active business data is COVID impacted.

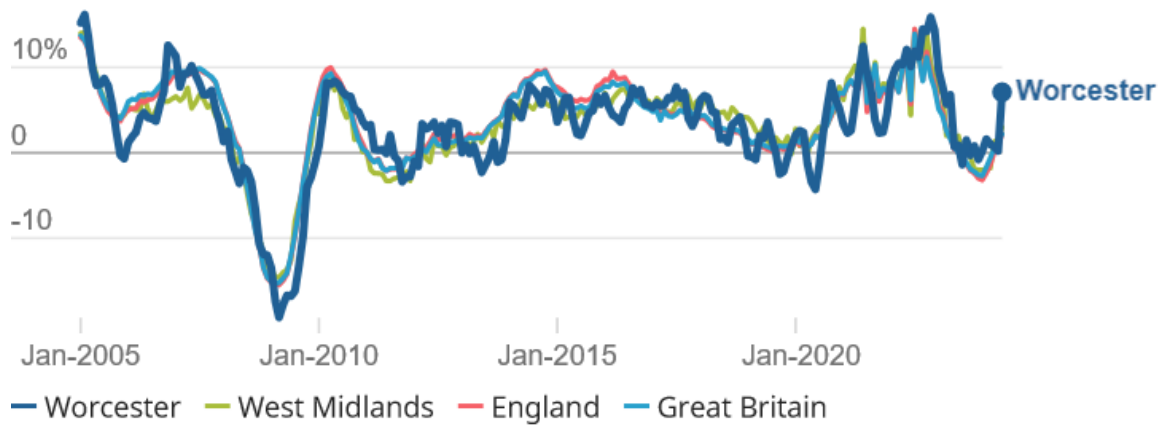
It is likely that the abrupt decline in the number of active businesses is attributable to the travel restrictions and reduced demand for services during COVID-19 pandemic. In addition to this, both WWUE and SWUE have built out fewer houses than the planned build out trajectory due to external factors.

Moreover, house prices across the UK have increased by a large amount year on year (see Figure 7-4), notably, with annual change regularly exceeding 10% between 2020 and 2024, meaning developers are encouraged to build houses. Similar trends have also been seen in Malvern.

Figure 7-4 – Annual Change in House Prices in Worcester<sup>14</sup>

## Annual change in house prices in Worcester

House price annual inflation, Worcester, January 2005 to May 2024



Source: UK House Price Index from Office for National Statistics and HM Land Registry

Notwithstanding, the SWDP states (Section 7.1) that the build out rate of some allocated development were dependent on the project being completed. In the absence of a complete dataset, this still emphasises the likely importance of the project and its influence on local development. This means that even with the high demand for housing across the region, that the houses could not be built at the required rate without the SLR4. It is recommended that this effect is investigated further in the next evaluation period.

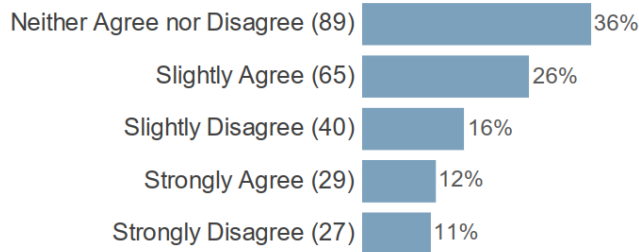
Development build out for Worcester City was lower than anticipated, but Malvern and Wychavon districts exceeded their forecasts by up to 58%. One possible explanation is that COVID-19 has changed the landscape of knowledge sector jobs, where homeworking is increasingly more common. A larger uptake in hybrid working means employment catchments have likely increased due to a reduced need to make commuting trips. This may have encouraged development in more rural areas, rather than populous urban areas like Worcester city.

Stakeholder workshops were also a useful forum to supplement our understanding of SLR4 impacts upon planned growth, given limited post-opening data. We found that stakeholders agree that the project has allowed more growth in Malvern and the west of the city, with one saying that *“The east is taking more growth than we anticipated,”*. Furthermore, stakeholders mentioned that the town centre would struggle to function without the SLR4 if the new developments had occurred. A majority (38%) of April 2024 public survey respondents felt that the Phase 4 SLR supported the delivery of planned growth.

<sup>14</sup> ONS Statistics on average house prices and rent based on data from HM Land Registry - <https://www.ons.gov.uk/visualisations/housingpriceslocal/E07000237/> - Accessed July 2024.

Figure 7-5 - Excerpt from SLR4 Resident's Questionnaire

To what extent do you agree that the Phase 4 SLR supports the delivery of the planned growth set out in SWDP up to 2030?



## 7.4 Summary

Overall, more homes have been built in and around Worcestershire up to 2022 than forecast in the SLR4 Business Case. This has mainly occurred in Malvern and Wychavon districts. However, as the Business Case, stakeholders and the SWDP stated, many of these developments would not have been able to happen without the SLR4 as it created capacity on the road network and made the properties there more desirable. Therefore, the growth in the region whilst not solely due to the SLR4, has been facilitated by the completion of the project.

Table 7-2 - Summary of How the A4440 SLR4 Project has Delivered Objective 4 Outcomes

Outcome	RAG	Justification
Support the build out of housing sites within the South Worcestershire Development Plan	On track to deliver expected outcome	Sites have built out faster than expected, including sites that were reliant on the project. However, this may be due to external factors such as increased housing demand.

## 7.5 Next Steps and Recommendations

Observed housing built out rates and active business data does not capture a full year of data post-project opening, therefore limited conclusions that can be drawn about the project's impact upon planned growth. Active business growth trends should be reassessed in the next evaluation stage, to investigate trends of decline that do not align with wider Worcestershire growth. Business interest groups should also be engaged with at an earlier stage (via stakeholder workshops and questionnaires) to capture quantitative data to contextualise wider trends.

## 8 Did the project improve the attractiveness of the A4440 SLR as a bypass for Worcester City Centre?

### 8.1 What did we think was going to happen?

Prior to intervention, the A4440 Temeside Way was causing severe capacity issues across Worcester. The A4440 SLR was designed to be a bypass of Worcester city centre, but the limited capacity of the A4440 Temeside Way historically deterred road users.

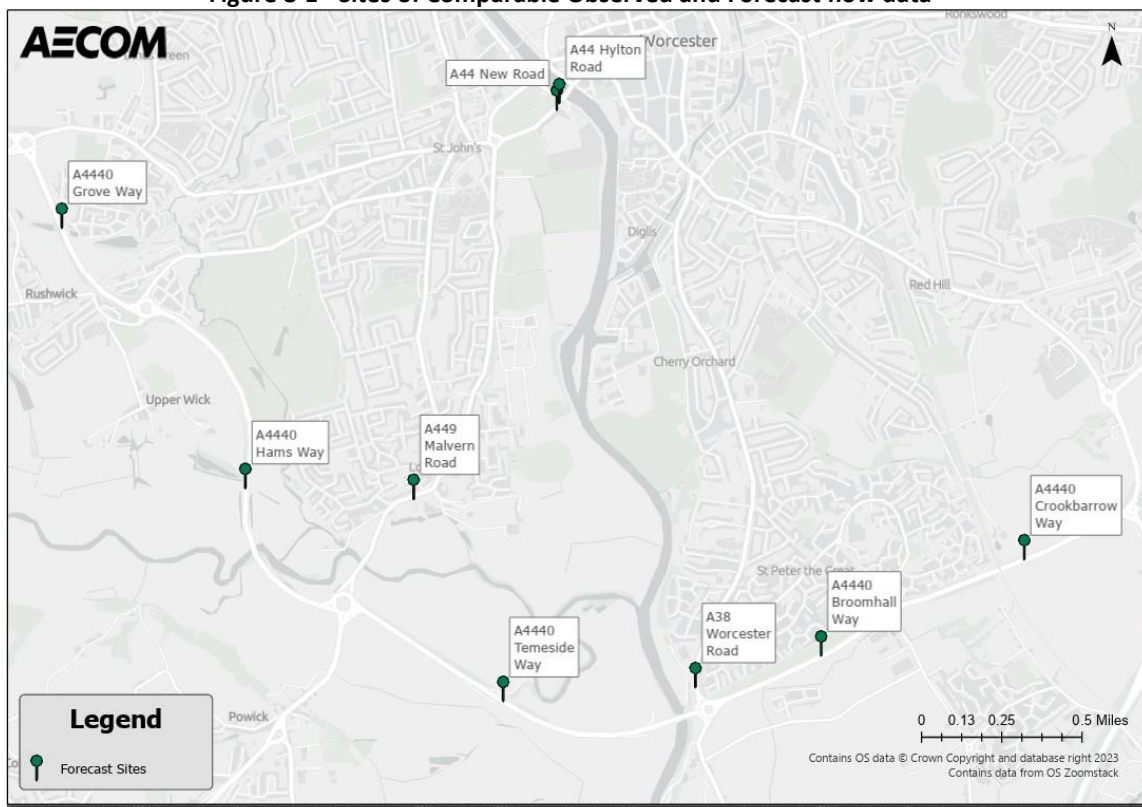
The SLR4 section suffered regular delays (see Section 4), causing road users to re-route into the city centre and back out again to avoid the SLR. Prior to the intervention, the A44 via the City Centre was a commonly used alternative route to the A4440 for east-west movements.

It was expected that flows on the A44 (City Centre) would remain very similar both pre- and post-intervention in the AM and PM peak, with only a slight increase forecast in the AM peak westbound. A decrease in forecast flows was expected in the Inter peak eastbound, with the westbound flows expected to increase slightly.

Although there are a number of flow forecasts available to determine what we thought was going to happen, we are limited in providing useful comparisons as observed flow data misaligned with forecast count locations (see Section 3.4.1). Therefore, the only locations where forecast and observed data can be compared are:

- A44 New Road & Hylton Road – to measure the change in flow across the Worcester Bridge in Worcester City Centre
- A38 Kempsey Road
- A449 Malvern Road
- A4440 Broomhall Way
- A4440 Grove Way

Figure 8-1 - Sites of Comparable Observed and Forecast flow data



The Business Case traffic forecasts predicted an increase in traffic flows at all sites along the A4440 SLR, with predicted increases of up to 29% on A4440 Broomhall Way (see Table 8-1). This aligned with expectations, as the SLR4 improvements were aimed at making the route more attractive to remove east-west traffic from City Centre routes.

**Table 8-1 - Forecast Traffic Flow Increases Along the A4440 SLR (2021 DM vs 2023 DS)**

Route	Direction	Forecast Increase in traffic flows from 2021 DM to 2023 DS AM	Forecast Increase in traffic flows from 2021 DM to 2023 DS PM
A4440 Broomhall Way	Eastbound	+29%	+29%
A4440 Broomhall Way	Westbound	+14%	+14%
A4440 Grove Way	Eastbound	+22%	+22%
A4440 Grove Way	Westbound	+6%	+7%

One of the objectives of the SLR4 project was to make the SLR an attractive bypass option for east-west movements across the City. By dualling the A4440 Temeside Way and unlocking the capacity constraint of the SLR, congestion on the SLR was expected decrease and traffic flows increase. It was predicted that the effect of this would be that less traffic would route through the City Centre to use Worcester Bridge as a crossing of the River Severn and instead use Carrington Bridge. These forecast changes can be seen in Table 8-2. This was expected to reduce congestion in the City Centre.

**Table 8-2 - Forecast Traffic Flow Changes Along the A44 in Worcester Town Centre (2021 DM vs 2023 DS)**

Route	Direction	Forecast Increase in traffic flows from 2021 DM to 2023 DS AM	Forecast Increase in traffic flows from 2021 DM to 2023 DS PM
A44 Hylton Road	Eastbound	-0.2%	-2.2%
A44 New Road	Westbound	+4.9%	-1.2%

## 8.2 What change have we seen so far?

### 8.2.1 A4440 SLR Impacts

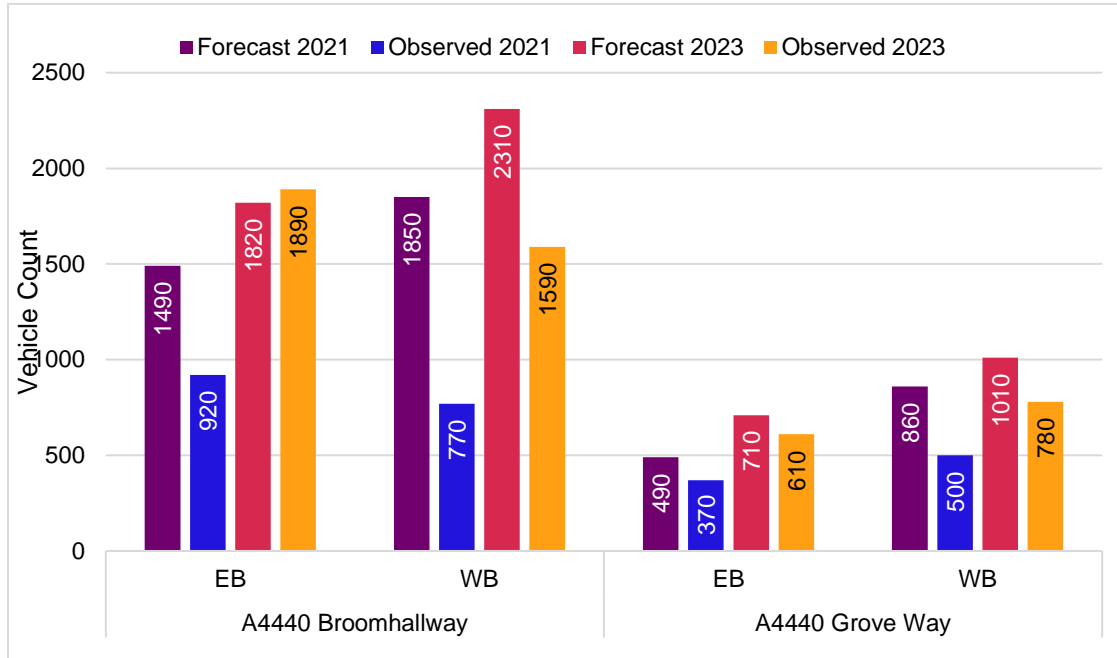
Analysis completed in Section 4 of this report demonstrated an increase in traffic flow along the A4440 SLR4, accompanied by a reduction in journey times.

Prior to construction, traffic growth forecasts were developed to support the Business Case for the project. Forecasts were made based upon a transport model that calculated likely changes to traffic levels 'with' and 'without' the project. Figure 8-2 compares the forecast traffic flows on two sections of the A4440. This further supports the conclusions in Section 4 that the observed pre-project flow levels were lower than forecast. This is likely due to the impact of COVID-19 travel restrictions and the SLR4 being in construction at the time of the baseline data collection.

Post opening flows were also lower than forecast with the exception of the eastbound movement on A4440 Broomhall Way in the PM peak hour which was observed to be slightly higher than forecast. In all time periods and directions, observed flow data shows that traffic flows have increased on the A4440 SLR at a rate that exceeds forecast traffic growth. The largest increase was on the A4440 Broomhall way, with traffic growth of 188% since the baseline, though it should be noted that part of this growth figure is likely attributable to post-COVID recovery, and the removal of construction works. This indicates that more people are using the SLR

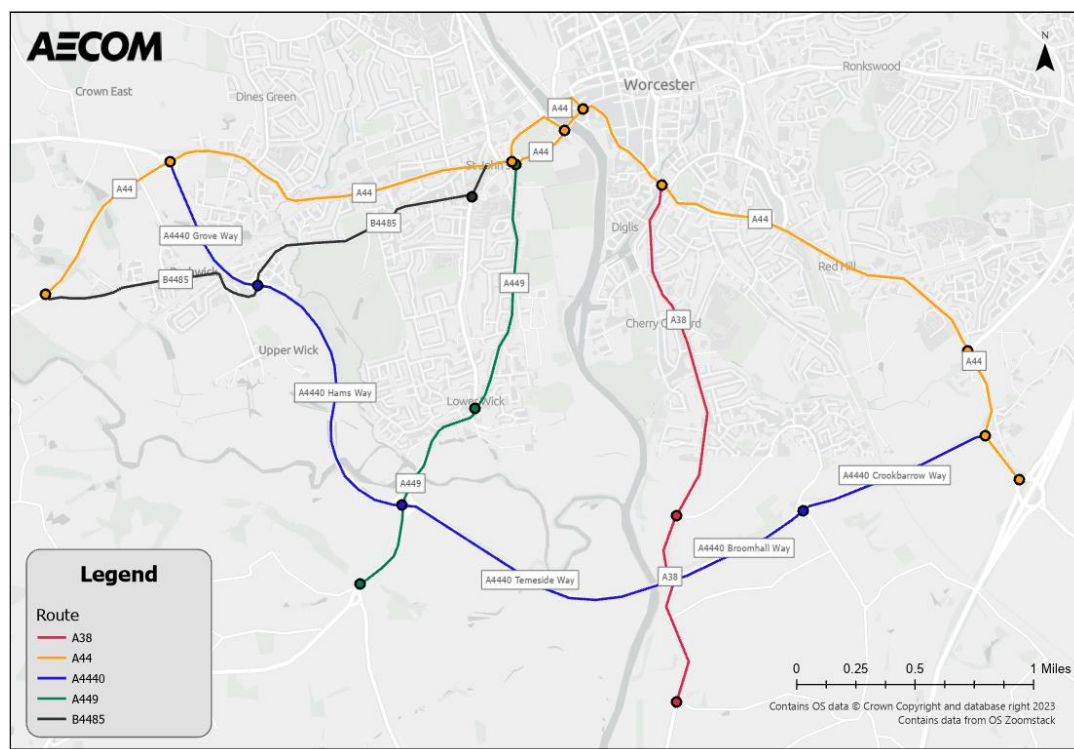
since the project has opened but not to the extent predicted (with the exception of A4440 Broomhall Way). Observed traffic growth on A4440 Broomhall Way and the A4440 Grove Way (105% and 56%) exceed local and national trends in background traffic growth (13% and 11% respectively). This indicates that the SLR could be attracting more traffic from the wider Worcestershire region.

**Figure 8-2 - Forecast vs Observed Traffic Volumes in the PM Peak**



To understand if capacity has increased across the wider SLR route, changes in traffic flow must be contextualised against changes in journey times and journey reliability. In this section, journey times and reliability along the wider SLR (marked in navy blue in Figure 8-3) will be considered.

**Figure 8-3 - Journey Time Routes Considered**



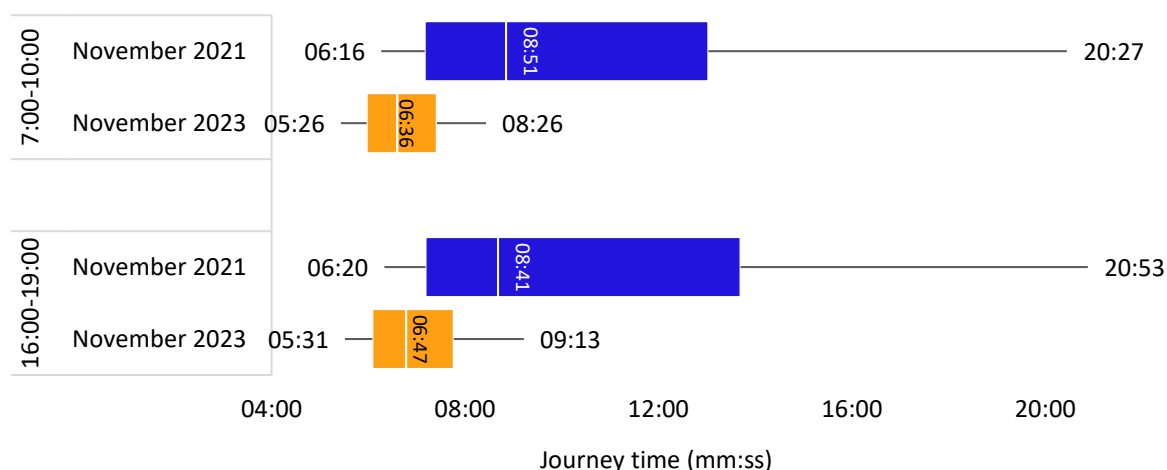
Journey times have decreased across the wider SLR by at least 3 minutes in all directions and time periods, as presented in Table 8-3.

**Table 8-3 - Observed Journey Time Savings Along the SLR (2021 vs 2023)**

Route	Direction	Observed Journey Time Savings (mm:ss)	
		AM	PM
A4440	Eastbound	03:26	04:41
A4440	Westbound	04:50	04:26

In order to assess the reliability of the route, it is useful to consider if there have been any changes in how variable journey times are. Figure 8-4 shows a positive change following the opening of the project, with journey times becoming less variable during peak periods. The box plots show that the difference between the 25<sup>th</sup> and 75<sup>th</sup> percentiles, known as the interquartile range, has reduced in the post-intervention scenario along the wider SLR route. Furthermore, the worst 10% of journeys on the A4440 SLR have decreased by between 7 to 13 minutes (both directions and peak time periods).

**Figure 8-4 - Journey Time Reliability Along the SLR (A4440 Westbound)**



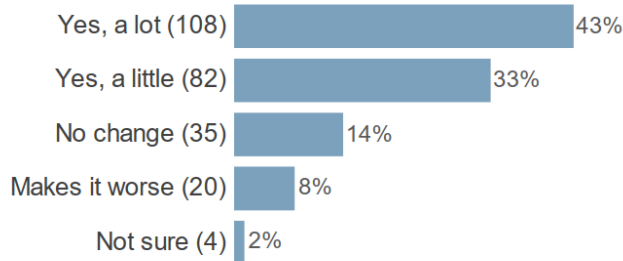
Turning count and queue data at Ketch and Powick roundabouts demonstrate that queues have decreased at most locations post-intervention (excluding the A449 Malvern and the A4440 Temeside Way). Some of the largest queues, that were in excess of 100 metres long, have been removed from the junction as a result of the increased capacity.

Increased traffic volumes, reduced queuing, improved journey times and improved reliability along the wider A4440 SLR4 route indicate that the route is now more attractive as a bypass route for east-west movements.

The data is reflected in the real-world experience of stakeholders, with one stakeholder stating, “...it just makes the journey really reliable.” Stakeholders also fed back that overall congestion has improved stating, “The traffic flow seems incredibly good and very consistent.” and “Now even at rush hour it’s no more than 5-10 minutes. A huge improvement.” This is also supported by the April 2024 public survey, where 76% of respondents felt that the SLR4 was an effective bypass of Worcester City centre.

Figure 8-5 - Excerpt from SLR4 Resident's Questionnaire

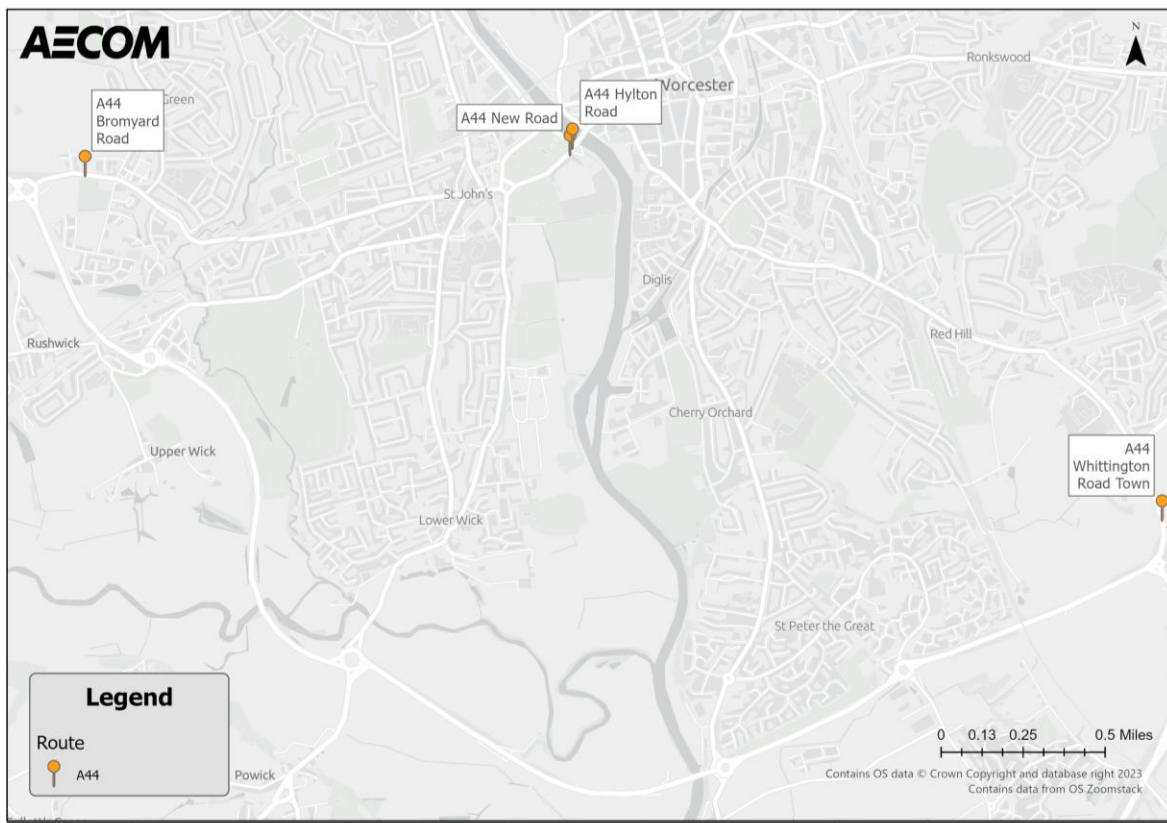
Does the Phase 4 SLR improve the performance for existing users of the A4440 Worcester SLR as a bypass for Worcester City centre? (By motorised vehicle)



### 8.2.2 City Centre Impacts

In this section, changes in traffic along the A44 have been analysed as an alternative to the SLR bypass, including the A44 west of Worcester bridge in the City Centre. The flow count locations can be seen in Figure 8-6.

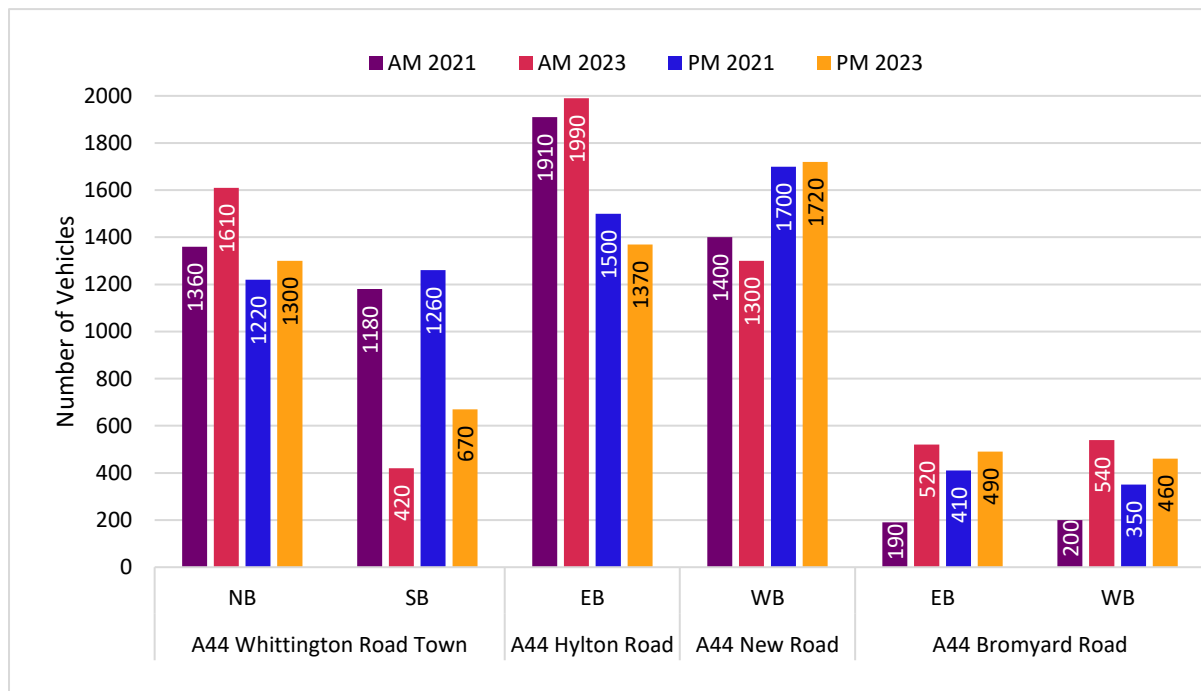
Figure 8-6 - Flow Count Locations on the A44



Growth trends between pre- and post-intervention are inconsistent across Worcester (see Figure 8-7). There was a large increase in traffic on the A44 Bromyard Road in the AM peak (174% increase), this trend is also evidenced in the PM peak in both directions but to a lesser extent (31% increase).

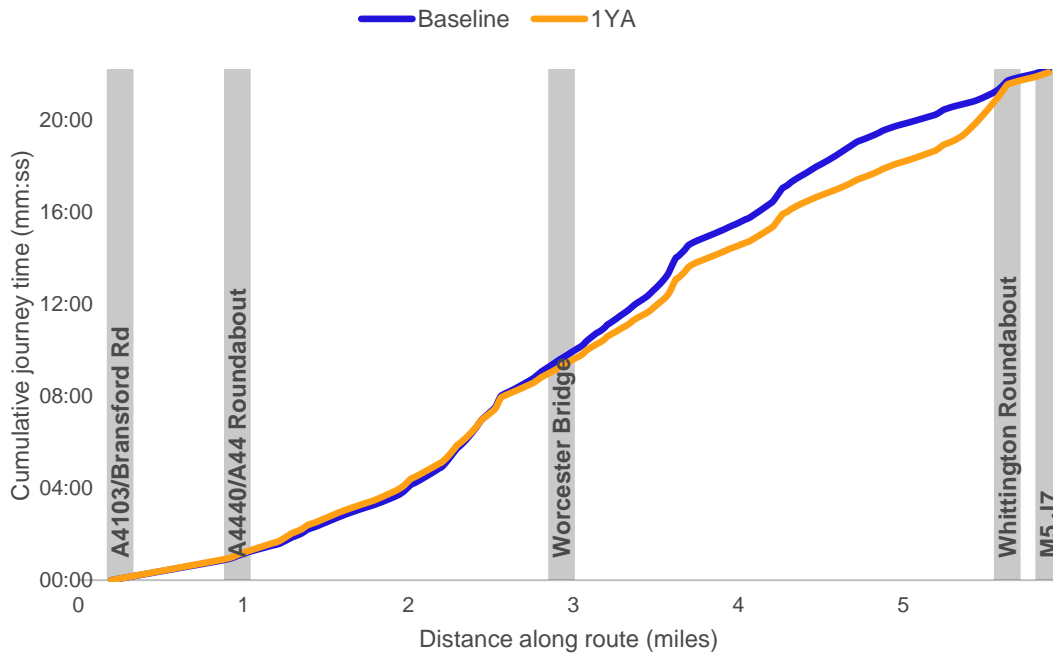
City Centre flows at the A44 Hylton Road and A44 New Road in the city centre demonstrate tidal growth trends. Growth in traffic is seen on A44 Hylton Road (eastbound) in the AM peak by 3% and on A44 New Road (westbound) in the PM peak by 1%, with the reverse direction in both cases experiencing a reduction in traffic of 8% and 7% respectively. It is also worth noting that despite the increase in traffic in some periods, city centre traffic growth consistently falls below local and regional background traffic growth (13% and 11% respectively). There has also been a decrease in traffic on the A44 Whittington Rd in the southbound direction. However, the SLR has seen growth in traffic (see Section 8.2.1) higher than background growth. Therefore, it is likely that to some extent, the SLR is being used as a bypass to the City Centre.

**Figure 8-7 - A44 Observed Traffic Flows – AM & PM Peak**



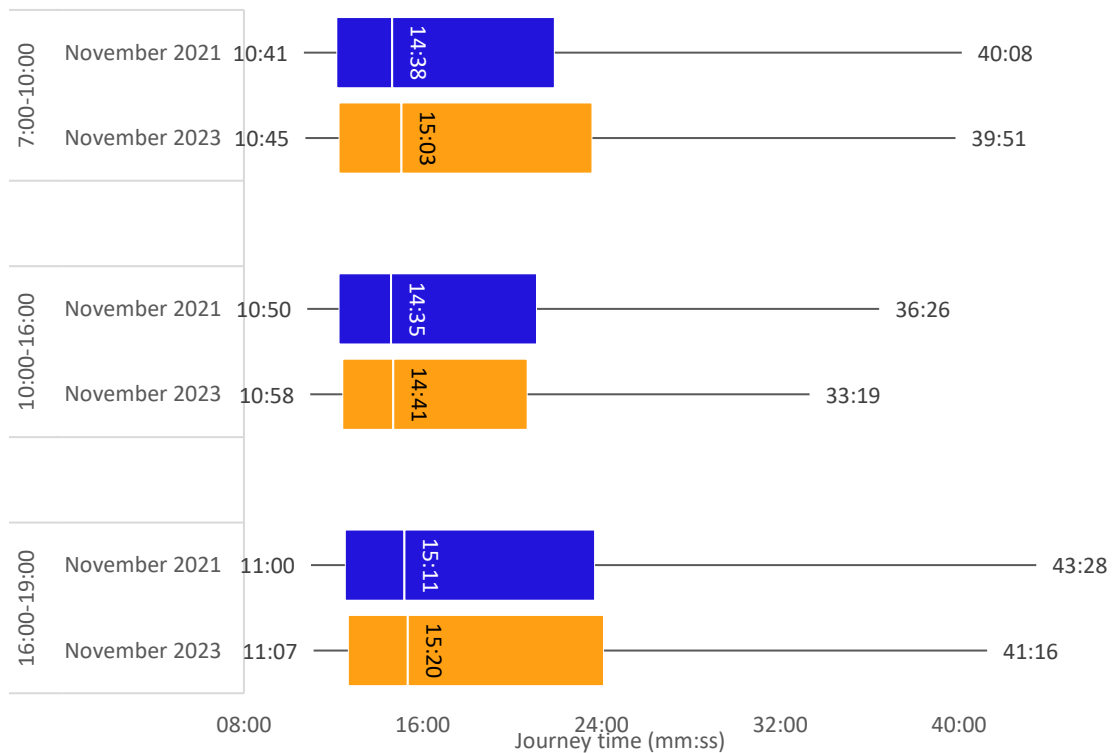
Cumulative journey time data along the A44 shows very little change between pre and post intervention (see Figure 8-8). In the eastbound direction, data indicates modest journey time improvements post-intervention through the City Centre (after the Worcester Bridge). However, the overall journey time on the A44 remains similar due to increased delay on the approach to the A4440 Whittington junction. In both directions, pre and post intervention, result in the same journey times across the full A44 route. Similar trends are observed in all time periods.

**Figure 8-8 - A44 Journey Times Eastbound – AM Peak**



Journey time reliability data shows that journeys on the A44 through the City Centre have become more variable since the project opening (see Figure 8-9). The average journey time has marginally increased by between 9 and 25 seconds in all directions and peak time periods. The longest journey times (95<sup>th</sup> percentile) for road users travelling eastbound reduced in all time periods. A similar trend is evident in the westbound direction, where the longest journey times decreased in the AM peak and Inter peak but increased slightly in the PM peak.

**Figure 8-9 - Journey Time Reliability – A44 Eastbound**

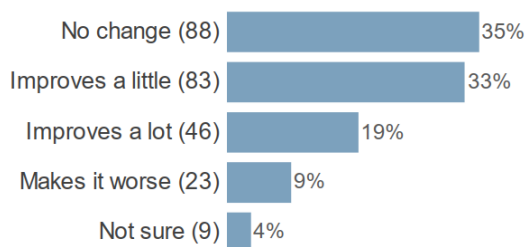


Overall, observed data shows that traffic conditions on the A44 through the City Centre have not improved following the opening of the SLR4. The volume of trips using the A44 to the west of Worcester bridge has not reduced and journey times, whilst similar to pre-project, have become slightly more unreliable. However, the level of traffic growth on the A44 through the city centre was lower than the local and regional background traffic growth. Given the lower levels of traffic growth within the city, and the SLR having growth in traffic (see Section 8.2.1) higher than local and regional background growth, it is likely that to some extent, the SLR is being used as a bypass to the City Centre.

In response to the April 2024 public survey question “To what extent do you think that Phase 4 SLR helps to better manage the traffic conditions in the constrained Worcester City Centre area?” 35% of respondents felt that there was no change to traffic conditions in Worcester City centre, 52% felt conditions had improved and 9% felt the SLR4 improvements had negatively impacted traffic conditions in the city centre.

**Figure 8-10 - Excerpt from SLR4 Resident’s Questionnaire**

**To what extent do you think that Phase 4 SLR helps to better manage the traffic conditions in the constrained Worcester City Centre area?**



**8.3 What caused this?**

Whilst the A4440 SLR route is now a more attractive route, with increased capacity and improved journey times, the A44 route through the city centre has seen limited change in traffic conditions since the opening of the SLR4 project.

Given the demonstrated improvements to the SLR4, it could be that trips travelling through the city centre have decreased due to trips being drawn onto the A4440 benefiting from improved journey times and increased capacity. This is supported by the increase in observed traffic using the SLR4 post opening (Figure 4-4). In turn, increased development in Worcestershire and Worcester City Centre (see Figure 7-1) could have taken up spare capacity on City Centre routes.

It is noted that Figure 4-9 demonstrates that the SLR4 had higher levels of traffic growth than other routes in the region. It is feasible, that the city centre routes may have experienced higher than observed traffic volumes had the SLR4 improvements not been delivered.

**8.4 Summary**

Whilst the A4440 SLR route is now a more attractive route, with increased capacity and improved journey times, the A44 route through the city centre has seen limited change in traffic conditions since the opening of the SLR4 project.

Respondents to the public survey agree with this finding and believe they have better access to local destinations and the project has made the SLR more attractive for car users whilst also improving its performance, with one saying “*This development has had a really positive effect on traffic congestion. Thank you.*” However, they believe it may be causing additional congestion in the long run. As one person put it “*The Phase 4 of the SLR has improved traffic flow along its section, however this increased traffic flow has now caused additional pressure on neighbouring routes.*”

Overall, we concluded that the objective has been met, with the capacity constraint along the SLR being removed, allowing for more road users to use it and for faster, less congested journeys; however, the expected outcomes of improved traffic conditions in Worcester City centre have not occurred. This may be due to additional development close to, and within the city centre.

Background traffic trends should also be assessed at the next evaluation stage to provide a more detailed understanding of how much of the observed traffic impact can be attributed to COVID-19 recovery to further isolate project impacts.

**Table 8-4 - Summary of How the A4440 SLR4 Project Has Delivered Objective 6 Outcomes**

Outcome	RAG (SLR4)	RAG (City Centre)	Justification
<b>Decreased congestion</b>	On track to deliver SLR4 outcome.	Not on track to deliver expected City Centre outcome.	The SLR4 project has improved the attractiveness of the SLR4 route as a bypass for Worcester City Centre. However, journey times show very little change along the A44 through the city centre. This suggests little change to congestion within the city.
<b>Improved journey times</b>	On track to deliver SLR4 outcome.	Not on track to deliver expected City Centre outcome.	There was a mixture of increases and decreases of overall journey times through the city centre.
<b>More reliable journey times</b>	On track to deliver SLR4 outcome.	Not on track to deliver expected City Centre outcome.	The city centre saw a mixture of increases and decreases to journey time reliability.
<b>Reduced commute time</b>	On track to deliver SLR4 outcome.	Not on track to deliver expected City Centre outcome.	Journey times through the city centre at peak times have remained relatively similar pre- and post-intervention.

## 8.5 Next steps and recommendations

Whilst the impact valuation demonstrates that the SLR is now more attractive there has been limited change to travel conditions in Worcester City Centre. This could be due to external factors such as increased development in the city centre. For future projects with objectives to remove targeted vehicle movements, Automatic Number Plate Recognition (ANPR) surveys could be considered. Pre and post-intervention ANPR surveys could be used to isolate the desired movement of vehicles and provide a comparison, allowing for a clear attribution of outcomes.

At the next evaluation stage, city centre signage could be reviewed to contextualise traffic conditions along the A44. A review of wayfinding and signage in advance of the next evaluation stage is recommended, to determine whether signage could be affecting the attractiveness of the SLR as a bypass route to Worcester City Centre.

## 9 Did the project improve access to the Strategic Road Network and key hubs?

### 9.1 What did we think was going to happen?

The Business Case raised concerns that access to the M5 was poor during peak periods due to congestion. This caused issues for businesses and developments in the west of Worcester. Furthermore, by improving access to the M5 J7, other sites would then be easier to access from Worcester such as Worcestershire Parkway Rail Station and Birmingham Airport. Congestion and unreliable journey times were expected to have a severance effect on Malvern (as discussed in Section 5), where stakeholders at the Malvern Hills Science Park stated that: *“The situation is so bad that some tenants have taken to heading south to Junction 8 in order to head north on the M5.”*

By dualling the A4440 Temeside Way and improving the surrounding roundabouts, the aim was to decrease congestion along the wider SLR. This would allow more people to access key hubs and reduce the time taken to do so. Therefore, as well as improvements to journeys, an increase in traffic and number of people using the route to access key hubs from Worcestershire was expected. The project was expected to support the Worcestershire Parkway Rail station by improving access from west of Worcestershire to the location of the new station, whilst supporting residents in accessing key hubs at Birmingham Airport and the proposed HS2 station at Birmingham Interchange.

### 9.2 What change have we seen so far?

Sections 4 and 8 demonstrate that journey times have decreased, and journey time reliability has improved across the wider SLR route, reducing the time taken to access places within Worcestershire and nearby. Therefore, journey times between the Welsh border, Malvern and the west of Worcester to key hubs such as the M5 J7, Worcestershire Parkway Rail station and Birmingham Airport have also improved.

**Figure 9-1 - Malvern Hills AONB, a Key Connection from the SLR**



Businesses had a positive reaction to the project due to easier access to the M5 allowing for more reliable commutes and reduced travel times. Similar comments were made by special interest groups and local authority officers, with one of local authority officers saying, *“It’s an awful lot easier to get from the M5 through the movement [along the SLR]”*. Similar comments were received from the in-person workshop and the questionnaire.

The stakeholders agree that this easier access can be attributed to the reduced journey times along the route, with one questionnaire comment stating *“Now even at rush hour it’s no more than 5-10 minutes. A huge*

*improvement.*” this anecdotal evidence aligns to quantitative analysis presented in earlier sections demonstrating that reduced travel times, particularly along the SLR4, support easier access between the M5 and the west of Worcestershire and Malvern.

Similarly, they believe access to key hubs has improved. Regarding Worcestershire Parkway Rail station, one stakeholder said by *“using the car park as a measure, it’s filling up faster than they had anticipated. Usage of the Parkway station is up quite a lot compared to other stations. I think it’s been successful so far.”* However, there have also been points that despite the increase in usage, Parkway is still difficult to access by active travel due to a lack of onward active travel connections from the project. The SLR4 active travel elements provide one element of improved connectivity to the Parkway station. It is noted that the Worcestershire Parkway Rail station has exceeded initial expectations; 544,270 journeys were made from the station between April 2022 and March 2023. This volume of trips was not expected to be achieved until 2034.

Access to key hubs is also contingent on how members of the public can get to them, not only by car but also by public transport (buses, trains etc.) and by walking and cycling. Whilst at the one year after stage public transport and cycling usage since the project opened was not available, the public and stakeholders were consulted to see how they think the project has changed access.

It is generally agreed that the project has improved active travel in the area by installing a new bridge over the A4440 Hams Way near Powick Roundabout as seen in Figure 9-2 and a new underpass under A4440 Temeside Way at the Ketch roundabout. It has also been improved via the segregated walking and cycling path along the A4440 Temeside way. Stakeholders agreed this has worked in part by *“Getting more and more not only persons walking but cyclists,”* and *“the new cycle footway along the northern side of phase four is brilliant, good surface.”* However, despite the improvements along the SLR, there were multiple comments about a lack of suitable onward connections beyond the project meaning the impact of the SLR4 active travel improvements were limited.

**Figure 9-2 - New Cycle Bridge Over Hams way**



A number of comments were received regarding the segregated walking and cycling path along the A4440 Temeside way including, *“It feels really, really unattractive from an active travel perspective. You’ve got high speed, dual carriageway right next to where you expect people to walk and cycle”* and *“the natural desire line though is not east-west for pedestrians or cyclists.”* It was acknowledged to stakeholders at the workshops that the wider active travel connectivity was beyond the scope of the SLR4 project and also that the improvements form a good basis for future improvements. However, to maximise benefit of the active travel infrastructure improvements, wider connectivity should be considered. This may include adding provision for safe cycle & walk routes between Kempsey and Ketch roundabout, and Malvern and Powick roundabout to connect into existing routes into Worcester city centre.

### 9.3 What caused this change?

Ease of access to key hubs has improved due to decreased journey times and improved reliability along the SLR. This change is mainly due to the dualling of the SLR along the A4440 Temeside Way between Powick and Ketch roundabouts. However, it is worth noting that ease of access has also been improved by previous phases of improvements along the SLR, which has including dualling other sections.

The increase observed of Worcestershire Parkway Rail station users may be mainly due to the fact the station is new and therefore the volumes of usage should be monitored over a longer period of time. However, reduced journey times along the SLR are still likely to have contributed by allowing easier access to it.

### 9.4 Summary

Overall, journey times have decreased whilst journey reliability and congestion have also improved along the SLR. This has afforded motorists easier access between the west of the River Severn and the rest of the country by improving access to the M5. It has also improved access to key destinations such as Worcester Parkway and Birmingham Airport.

However, whilst improvements have occurred to those using active travel, more active travel improvements should be considered to maximise the full benefit of the new infrastructure by improving onward connections to cycle routes.

**Table 9-1 - Summary of How the A4440 SLR4 Project has Delivered Objective 6 and 7 Outcomes**

Outcome	RAG	Justification
<b>Decreased congestion</b>	On track to deliver outcome	Congestion has decreased across the SLR as demonstrated in Section 4
<b>Improved journey times</b>	On track to deliver outcome	Congestion has decreased across the SLR as demonstrated in Section 4
<b>More reliable journey times</b>	On track to deliver outcome	Journey times decreased across the SLR as demonstrated in Section 4
<b>Reduced commute time</b>	On track to deliver outcome	Commute times decreased across the SLR as demonstrated in Section 4
<b>Individuals who chose active travel are not disadvantaged</b>	On track to deliver outcome	New footbridge and underpass have been built and the shared footway by A4440 is in line with LTN1/20 standards. By providing new active travel infrastructure, the project does not disadvantage active travel users, but ways of improving onward journeys beyond the project extent could be improved

## **9.5 Next Steps and Recommendations**

Public transport and cycling usage data should be available at the five-years after stage which could be used to supplement the evaluation. Worcestershire Parkway Rail station patronage data should be reviewed at the five-year after stage to determine whether the high level of use continues.

The SLR4 project has provided improved active travel infrastructure within the project extents. In line with stakeholder comments, Worcestershire County Council should consider wider active travel improvements to improve wider active travel connectivity and maximise the benefit of SLR4 improvements.

## 10 Did the project contribute to environmental and safety objectives?

### 10.1 What did we think was going to happen?

#### Air Quality

Section 6.6 of the Environmental Statement (ES) outlines the predicted air quality impacts and effects of the scheme in its construction and operational phases.

Air quality impacts of the operational phase of the scheme were quantified by assessing the difference in traffic flow with (DS - 2021) and without (DM - 2021) the scheme in place, and how this would impact local annual mean concentrations of NO<sub>2</sub> and PM<sub>10</sub>. Significance was assessed in accordance with the Institute of Air Quality Management (IAQM) guidance 'Land-Use Planning and Development Control', 2017. Out of a total of 258 sensitive receptors assessed, only 7 (all located on Bransford Road through Rushwick) were expected to experience a negative impact because of increased NO<sub>2</sub> concentrations in the DS scenario, and these were deemed to result in negligible effects. The remaining 251 were expected to experience positive impacts, 35 of those resulting in substantial positive effects, 15 moderate effects, 137 slight effects and 64 negligible effects. Thus, the scheme was expected to bring more beneficial effects than adverse effects relating to NO<sub>2</sub> concentrations.

Further analysis predicted that there would be no new exceedances of the NO<sub>2</sub> objective at any sensitive receptors. Indeed, there were no exceedances of the NO<sub>2</sub> objective at any sensitive receptors in the DS scenario. The scheme was expected to have significant benefits to air quality in Worcester city centre, where some exceedances of the NO<sub>2</sub> objective were expected in the DM scenario but not in the DS scenario. This includes sensitive receptors on College Street, Bridge Street, and North Parade. Two exceedances were also expected to be removed by the scheme on Broomhall Green, adjacent to Broomhall Way (A4440 east of the scheme).

Impacts of the scheme in the DS scenario on PM<sub>10</sub> concentrations were also assessed. It was determined that there would be 'negligible' effects at all assessed receptors.

At the ecological receptor 'The River Teme SSSI', a positive air quality impact was predicted which was determined to result in a negligible effect.

Furthermore, the ES predicted that the operational phase of the scheme would have no significant residual impacts on climate.

#### Noise

Figure 12.2 of the ES<sup>15</sup> illustrates the predicted change in traffic noise levels in 2021, the anticipated year of opening at the time of the ES in 2017. Moderate increases (3.0 to 4.9 dB) were anticipated over a wide area concentrated on the centre of the project, although as this area is predominantly open farmland moderate impacts were predicted at only three receptors: Temeside Cottage (+3.5 dB), Ketch Caravan Park (+3.3 dB) and Severn Motor Yacht Club (+3.0 dB).

A negligible (0.1 to 0.9 dB) increase in traffic noise levels in 2021 was predicted at the majority of residential properties on the edge of Worcester District to the north-east (St Peter the Great), and to the north-west (Lower Wick) and also on the A38 to the south-east. No change or a negligible decrease in traffic noise levels in 2021 was predicted in Powick Village to the south facades facing onto the A449 and B4424.

The traffic noise predictions assumed low noise surfacing was included on all carriageways of the A4440 as part of the project. A noise barrier on the north side of the A4440 Broomhall Way and extending around the

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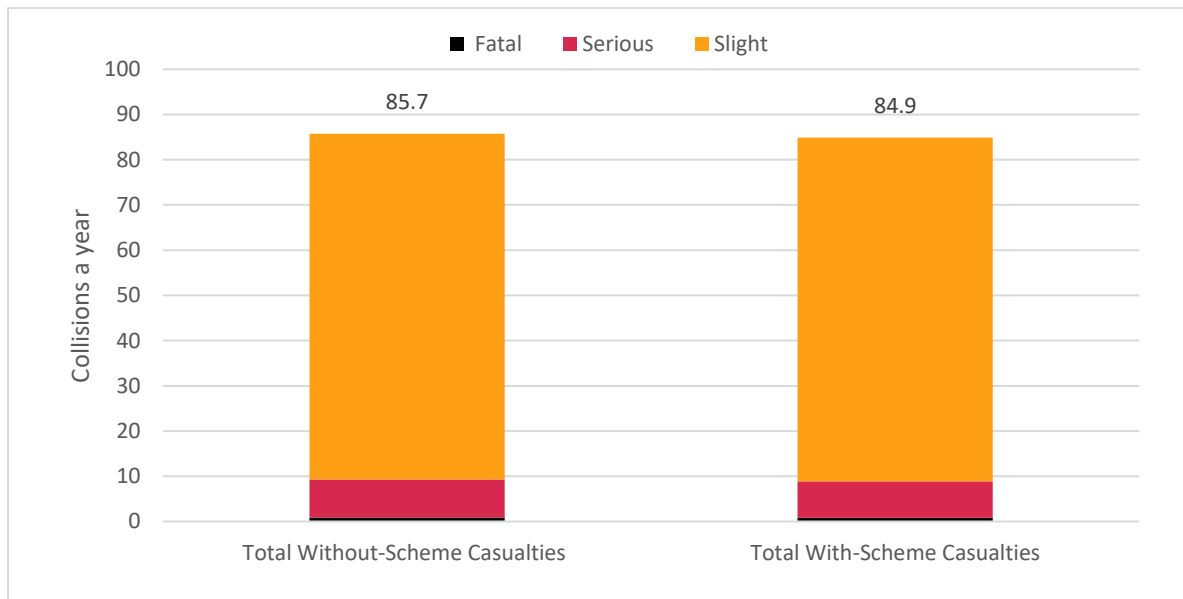
<sup>15</sup> [12.2 DS21 DM21 \(worcestershire.gov.uk\)](#)

north-east side of Ketch roundabout, proposed as part of the A4440 phase 3 works, was also assumed to be in place.

### Safety

As part of the Full Business Case, the number of collisions were forecast using the Department for Transport’s COBALT Tool, for a 60-year project span. This predicted that over 60-years, the number and severity of accidents would be slightly reduced with the project. This can be seen in Figure 10-1.

**Figure 10-1 - Collisions Per Year in the Vicinity of the Project With and Without the Project**



## 10.2 What change have we seen so far?

### Air Quality

No air quality predictions, based on observed traffic data with and without the project for the actual project opening year of 2022, or post opening, are available.

Traffic air quality predictions are based on the 24hr annual average daily traffic (AADT) flows, plus the corresponding percentage of heavy goods vehicles (HGVs) and mean traffic speed. Very limited forecast and observed AADT data is available for three sections of the A4440, consisting of the project itself and the A4440 to the east and west. No data on the traffic composition (percentage of HGVs) or traffic speeds are available, which are substantial contributors to the emission profile of the roads and therefore the pollutant concentrations at sensitive receptors.

Forecasts for the 1YA year (2023) were made in 2024 by interpolating traffic data forecasts for 2021 and 2031 for the ES. This forecasted 24hr AADT values of 21,045 on Hams Way (A4440 west of the project), 50,347 on Broomhall Way (A4440 east of the project), and 55,683 on Temeside Way (the project itself). Observation data for 2023 shows that the forecasted AADT value was overestimated by 28% on Hams Way (16,505 observed), and by 37% on Broomhall Way (36,808 observed). There is no observational AADT data available in 2023 for the section of the A4440 that the project is located, therefore any conclusions about traffic flow related air quality impacts the project may have had cannot be made with confidence. However, based on the overestimations of AADT for the sections east and west of the project in 2023, it is likely that AADT is also lower than forecast on the project footprint for this evaluation.

Local authority air quality monitoring data for 2023 was used at locations in close proximity to the sensitive receptor locations outlined in the ES with predicted NO<sub>2</sub> concentrations for 2021 in the DS scenario. Due to the location of the project, there are a very select number of areas where this is the case.

In the Environmental Statement (ES), two sensitive receptors (73314 and 91601) on Broomhall Green, adjacent to Broomhall Way (A440 east of the project), were projected to exceed the NO<sub>2</sub> annual mean objective in the 2021 Do Minimum (DM) scenario, with concentrations of 40.3 and 40.9µg/m<sup>3</sup>, respectively. In the Do Something (DS) scenario, these concentrations were expected to decrease to 34.0 and 34.4µg/m<sup>3</sup>, respectively. A Local Air Quality Management (LAQM) monitoring site, operated by Worcester City Council and located within 60 meters of these receptors, recorded an average NO<sub>2</sub> concentration of 20.7µg/m<sup>3</sup> in 2021—significantly lower than expected. This may be in part due to the influence of lockdown policies to combat the Covid-19 pandemic. By 2023, this value increased to 23.6µg/m<sup>3</sup>, still well below the NO<sub>2</sub> annual mean objective of 40µg/m<sup>3</sup>. Additionally, Wychavon District Council operates an LAQM monitoring site within 200 meters of these receptors, which recorded average NO<sub>2</sub> concentrations of 20.3µg/m<sup>3</sup> in 2021 and 18.6µg/m<sup>3</sup> in 2023.

The ES identified 37 other locations within the city centre that were predicted to exceed the NO<sub>2</sub> objective in the DM scenario but not in the DS scenario. However, LAQM monitoring by Worcester City Council in 2023 recorded NO<sub>2</sub> exceedances at two sites: one in the city centre (But2) and another on Astwood Road (Ast3), over 1 km from the sensitive receptors identified in the ES. The exceedance at Ast3, with an adjusted concentration of 31.3µg/m<sup>3</sup> at the nearest receptor, is likely not directly related to the scheme. The But2 site recorded an average annual NO<sub>2</sub> concentration of 44.3µg/m<sup>3</sup> in 2023, up from 39.1µg/m<sup>3</sup> in 2021, although 2021 concentrations were likely lower due to the effects of COVID-19 lockdowns. This site is located near a sensitive receptor (233995) identified in the ES, which was predicted to have an annual mean concentration of 28.5µg/m<sup>3</sup> in the DS scenario—significantly lower than the LAQM measurement. Several other city centre locations also show higher 2023 NO<sub>2</sub> concentrations in LAQM data than those predicted for 2021 in the ES, particularly along the B4205 and A44.

However, since the nearest examples are located more than 2 km away from the project, and detailed traffic data is unavailable, it is not possible to determine whether the underestimated NO<sub>2</sub> concentrations are a direct operational effect of the scheme or reflective of the potential contributory factors identified in section 8.

In the absence of detailed traffic data, it is not possible to quantitatively assess the scheme's impact on greenhouse gas emissions. Notably, observed traffic flows in 2023 are lower than the forecasted flows for the A4440 to the east and west of the scheme (no observed data is available for the project itself). This suggests a likely reduction in greenhouse gas emissions; however, without compositional data such as average speed and percentage of heavy goods vehicles (HDV%), this conclusion cannot be made with confidence.

## **Noise**

No traffic noise predictions, based on observed traffic data with and without the project for the project opening year of 2022, or post opening, are available.

Traffic noise predictions are based on the 18hr annual average weekday traffic (AAWT) flows, plus the corresponding percentage of heavy goods vehicles (HGVs) and mean traffic speed. Very limited forecast (2014, 2016, 2021 and 2023) and observed (2014, 2019, 2021 and 2023) traffic flow data is available as 18hr AAWT and/or 24hr annual average daily traffic (AADT) flows. This included three sections of the A4440, consisting of the project itself and the A4440 to the east and west. No data on the traffic composition (percentage of HGVs) or traffic speeds, changes in which often have a much greater impact on traffic noise levels, are available. The ES predicted a change of +3.5 dB at Temeside Cottage in 2021 due to the project, whereas comparing the 2021 DM and 2021 DS forecast traffic flows on the project extent only indicates a +1.5 dB increase. The difference is likely due to higher speeds, due to reduced congestion, with the project in operation.

Based solely on the change in traffic flows, the increase in traffic noise levels from 2016 (forecast) to 2023 (forecast) is +2.3 dB on the project and on the A4440 to the west; on the A4440 to the east the increase is +1.9 dB.

However, the observed 2023 traffic flow is 22-27% lower than the forecast 2023 traffic flow on the A4440 to the east and west of the project (no observed data is available for the project). This reduces the expected increase in traffic noise levels based solely on the traffic flow changes to +1.3 dB to the west (assumed to be comparable to the project) and +0.6 dB to the east. As noted above, changes in the composition and speed with the project in operation have the potential to result in larger increases in traffic noise levels from 2016 to 2023 than those suggested based solely on the increase in flow, though it is not possible to quantify this without suitable traffic data.

Baseline noise monitoring was completed in 2016 for one long-term site (LT1-Temeside Cottage, five days) and eight short-term sites (ST1 and ST2-Monarch Way footpath, ST3, ST4 and ST8-Powick Village, ST5 and ST6 under Carrington Bridge on the project and ST7-River Severn, totalling 30 minutes to 1h-30 minutes at each). The summary of the measured 2016 levels, as reported in the ES, has been supplemented by the hourly data for the long-term site and weather data is from a Met Office site near Throckmorton, approximately 12 km to the east.

Post opening noise monitoring was completed in March 2024 at four long-term sites (LT1-Temeside Cottage, LT2-Begonia Close, LT3-Orchid Close and LT4-Heather Close, around seven days at each) and eight short-term sites (ST1-ST8, three 15-minute periods at each). The raw data is available for the 2024 survey as well as weather data from a Meteostat site in Gloucestershire approximately 30 km to the south.. No detailed information on the monitoring locations is provided in the ES, however it is understood that the 2024 survey aimed to use the same locations as were used in 2016 where applicable, with the exception of LT1. Due to changes at the property, access to the 2016 location at LT1 Temeside Cottage was not possible, therefore an alternative location approximately mid-way between the property and the A4440 was used in 2024. A further three hours of monitoring was carried out at a site on Tansey Close (LT5) to the north-east in 2024 but no co-ordinates are available to confirm the location.

The change in the measured  $L_{Aeq}$  levels between 2016 and 2024, rounded to the nearest whole decibel are summarised below:

- LT1 south of Temeside Cottage,  $L_{Aeq}$  +5 dB higher over the whole period of 5-6 days. However, the change in location to a position approximately half the distance from the A4440 would be expected to result in an increase in traffic noise levels of around 4 dB, regardless of the impact of the Scheme. The variation between the three weekday daytime levels ( $L_{Aeq,16h}$ ) in 2016 is small, around 1 dB and the wind direction was fairly consistently from the south. Whereas in 2024 the variation between the four weekday daytime levels is larger, over 3 dB and the wind direction was more variable including from both the north and south.
- ST1 and ST2 on the Monarch Way footpath to the north - average of the 15-minute  $L_{Aeq}$  levels +6 dB and +13 dB higher respectively
- ST3, ST4 and ST8 in Powick Village - average of the 15-minute  $L_{Aeq}$  levels +8 dB, +7 dB and +10 dB higher respectively
- ST5 and ST6 under Carrington Bridge - average of the 15-minute  $L_{Aeq}$  levels +5 dB and +9 dB higher respectively
- ST7 on the footpath along the River Severn to the south - average of the 15-minute  $L_{Aeq}$  levels +3 dB higher

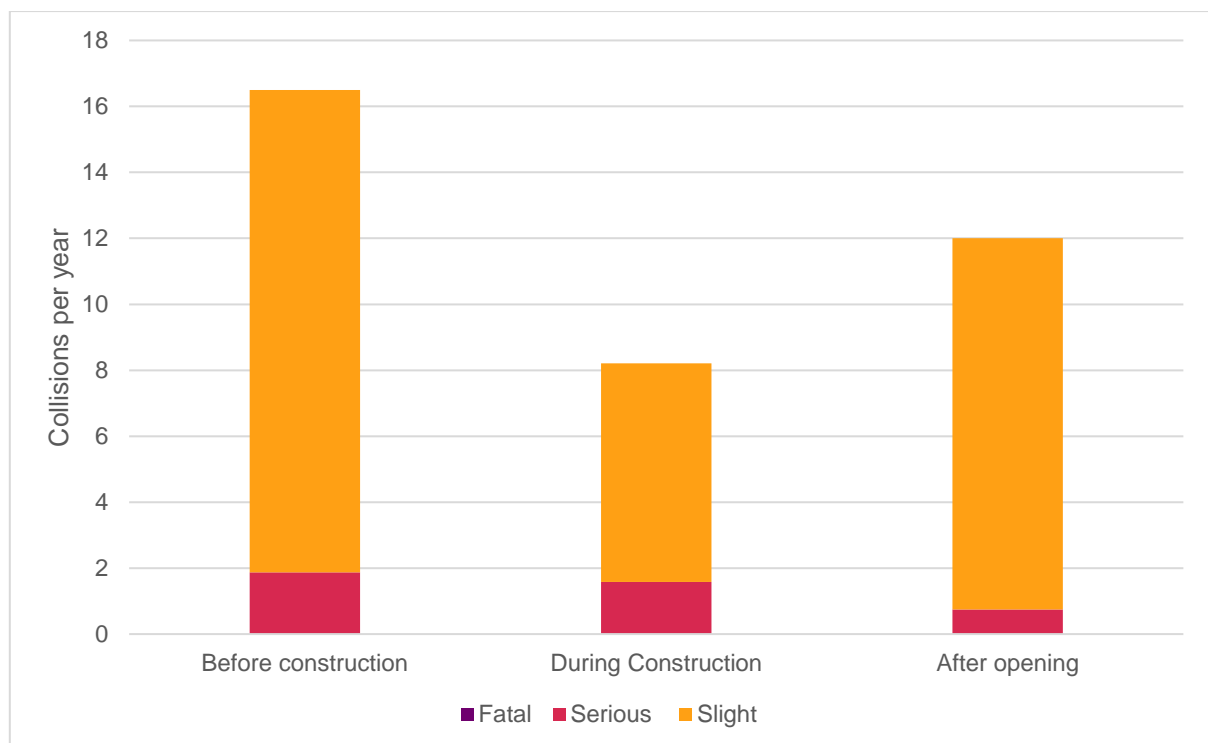
The 2024 survey includes monitoring at a further four locations within the housing area to the north-east of the project. However, as there is no corresponding 2016 baseline measurement data it is not possible to determine the change between 2016 and 2024.

There have also been concerns raised about noise from stakeholders. This is regarding the noise caused by speeding vehicles throughout the day, with a desire for speed cameras mentioned. However, the main concerns regarding noise came from people using the dual carriageway between Whittington and Powick roundabouts to travel at high speeds in the evening and early morning. This was raised across several of our stakeholder groups and the public with some comments including, "noise has seriously increased for residents...between Whittington & Powick" and "racing traffic late at night regularly so we can't even open windows in the Summer."

## Safety

Collision data from prior to the project opening has been obtained from STATS19 and supplied by WCC for the study area. Road traffic collisions from January 2014 to April 2019 (64 months) have been analysed to understand trends in collisions before the project was implemented. Then to assess the impact of the project on collisions, data during construction from May 2019 to June 2022 (38 months) and from after the project opened from September 2022 – June 2024 (22 months) was gathered. The number of collisions per year in each of these time periods can be seen in Figure 10-2.

**Figure 10-2 - Collisions Per Year Before, During and After Construction Along the A4440**

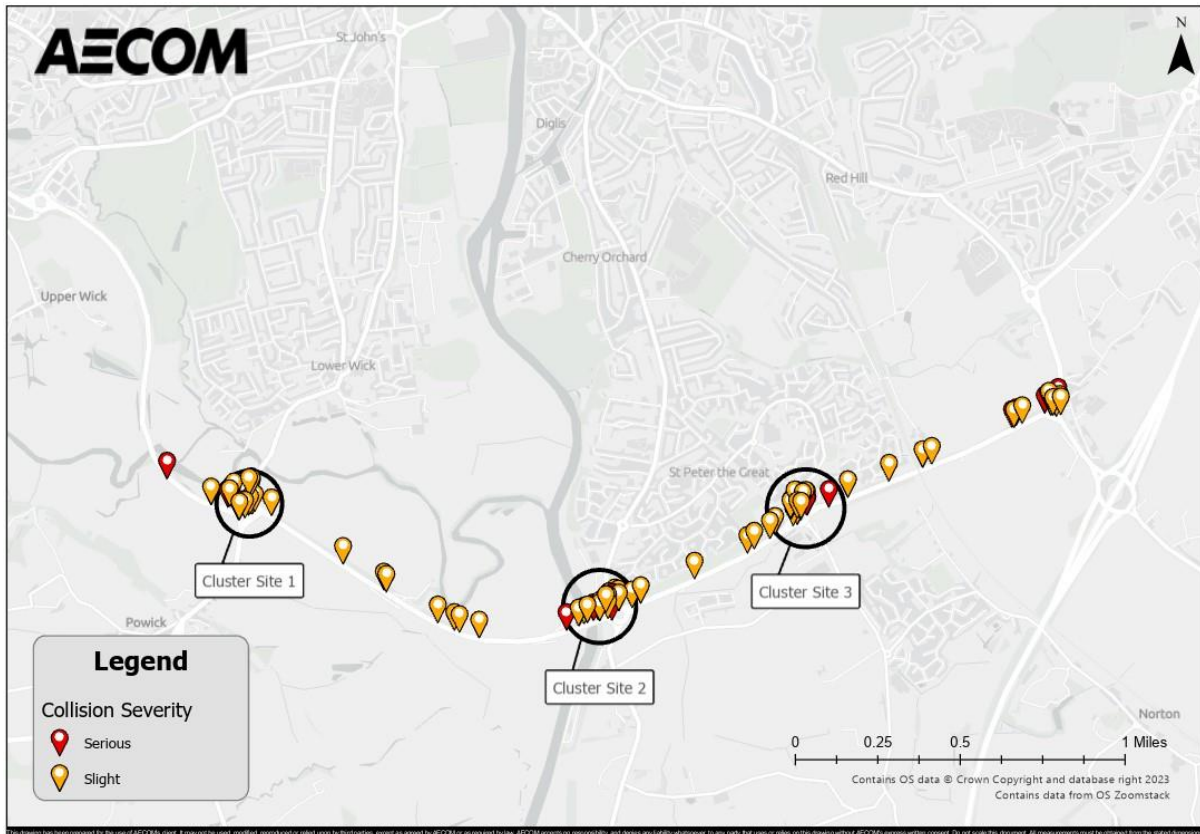


Before construction, there were an average of 22.7 collisions a year, with a rate of 1.9 serious collisions and 14.6 slight collisions per year. Construction took place during the pandemic which reduced overall traffic volumes. This combined with traffic measures put in place for the construction, led to an average of 8.2 collisions per year taking place within that time period.

After the project opened in August 2022, there was an average of 12.0 collisions per year, with 0.8 being serious. Therefore, the Killed or Seriously Injured (KSI) ratio has decreased from 8% to 6% between pre and post project. The collisions, along with where they are clustered are shown in Figure 10-3.

Stakeholders raised concerns about the safety of the A4440 Temeside Way, with some being surprised it had passed its safety audit. 37 respondents raised comments from the questionnaire around safety concerns. Stakeholders also raised concerns about turning onto Powick and Ketch roundabouts from the side roads and for lanes merging at Powick. Issues with signage have also been raised. Several respondents would like to have traffic lights at the roundabouts to help with these concerns. These concerns are reviewed in Section 8.

Figure 10-3 - Collisions in the Study Area (2018-2023) [Source: Stats19]



### 10.3 What caused this change?

#### Air Quality

The observed 2023 24hr AADT traffic flow is 28-37% lower on the A4440 to the east and west of the scheme, indicating the magnitude of the impact of the scheme on traffic air quality may be smaller than anticipated at the ES stage. However, without corresponding data on the traffic composition and speed this cannot be confirmed.

Without detailed traffic data, it is difficult to accurately determine the cause of the scheme's impact on local air quality using LAQM data alone. Although nearby LAQM sites have recorded lower NO<sub>2</sub> concentrations than anticipated, likely due to less traffic than predicted, some roads in the city centre that are part of the Affected Road Network (ARN) have shown higher NO<sub>2</sub> levels in 2023 than projected in 2021 in the ES. However, the true impact cannot be determined without more traffic data and targeted air quality monitoring.

Based on the available information it is not possible to accurately separate out the 'natural' growth in traffic over this period from the impact of the scheme. In addition, different weather conditions, in particular wind direction, can also significantly affect the measured air quality levels, especially at positions set back from the road.

#### Noise

The observed 2023 24hr average annual daily traffic (AADT) flow is 22-27% lower than forecast on the A4440 to the east and west of the project, indicating the magnitude of the impact of the project on traffic noise may

be smaller than anticipated at the ES stage. However, without corresponding data on the traffic composition and speed this cannot be confirmed.

Taking into account the change in position, the increase in measured average daytime noise levels from 2016 to 2024 at the single long-term site LT1-Temeside Cottage is around 1 dB, which is smaller than the anticipated increase in traffic noise levels in the opening year of +3.5 dB reported in the ES. Which again indicates that the magnitude of the impact of the scheme may be smaller than expected at the ES stage. However, different weather conditions may also be a factor, in 2016 the wind direction was predominantly from the south whereas in 2024 it was more variable including periods from the north and south.

Conversely, at the short-term sites the change in measured levels from 2016 to 2024 is larger than would likely be expected based on the predicted impact at the ES stage. This may be due, in part, to different weather conditions, both on the two days of the 2016 survey and between the 2016 survey and the 2024 survey. At ST3, ST4 and ST8 in Powick Village to the south the difference in the noise levels between the two days of monitoring in 2016 is very marked, over 10 dB at ST8. On the first day when noise levels are lower the wind was from a mainly southerly direction (i.e. from the monitoring positions towards the A4440) on the second day when noise levels were higher the wind was from a mainly northerly direction (i.e. from the A4440 towards the monitoring positions). During the 2024 monitoring at these short-term sites the weather data indicates the wind direction was from the east. In addition, based on the available weather data the short-term monitoring in 2016 was completed during a period of dry weather with low wind speeds, whereas in 2024 the weather data indicates high wind speeds at ST1 and ST2 on Monarch Way and ST3, ST4 and ST8 in Powick Village, which can result in elevated noise levels. In addition, the duration of the short-term monitoring at ST1-ST8 is very limited, around 45-minutes at each site in 2024 on one day and between 30 minutes and 1 hour 30 minutes split over two days at most sites in 2016. Noise levels will vary with the time of day and between different days and with different weather conditions, therefore any conclusions drawn from such a short sample of data must be treated with caution.

Stakeholder feedback identified instances of speeding and racing along the route, with associated noise pollution. However, these impacts are not likely to be reflected in average noise data as it mainly occurs in the early morning and late evening.

Finally, other changes in the ambient sound environment unrelated to the project can also affect the measured levels. The noise sources listed as being observed in 2016 are relatively consistent with those noted in 2024. With the exception of ST2, where in 2016 road traffic, birdsong and occasional aircraft were noted, but in 2024 farm machinery was noted as the dominant source, which may partially account for the considerably higher noise levels recorded in 2024 at ST2. At the long-term site LT1 observations were only made at the set out and collection of the equipment, therefore it is not possible to confirm if other noise sources occurred while the equipment was unattended.

The increase in measured noise levels from 2016 to 2024 is higher than might be expected from the impact of the project predicted in the ES. However, given the limitations of the available 2016 data, uncertainties due to the influence of the weather, and the very short-term nature of the monitoring at eight of the nine comparable sites, it is not possible to reach a firm conclusion on the impact of the project on noise levels based on the measured noise levels.

## Safety

Cluster site 1 is located at Powick Roundabout. One theme from stakeholder workshops were local concerns about safety at Powick junction. Data shows that there were a total of fourteen collisions at Powick roundabout in the pre-intervention scenario, with no serious collisions. The number of collisions that occurred in this location reduced to five collisions in post-intervention scenario, with no collisions of serious severity occurring after project opening. Post intervention collision data is only available for 22 months post opening, therefore collision trends at Powick should be reviewed at the next evaluation stage to understand the safety impacts of the project.

Collision data at Cluster site 1 also shows no change to collisions involving cyclists. One collision involving a cyclist occurred in the pre- project scenario and one collision involving a cyclist also occurred in the post-

project scenario. This suggests that the changes to the roundabouts have not caused an increase in the number of personal injury collisions, though this should be looked into further at a future stage, using longer term collision data.

Cluster site 2 is located at Ketch Roundabout. Data shows that there was a total of thirteen collisions at Ketch roundabout in the pre-intervention scenario, comprised of three serious collisions and ten slight collisions. Initial post intervention data indicates that the number of collisions that occurred in this location reduced to two collisions in the post-intervention scenario, with no collisions of serious severity occurring after project opening.

Cluster 3 is located at Norton Roundabout. This site was improved as part of the SLR Phase 3 project. A key improvement of Phase 3 was installing a bridge over the A4440 Broomhall Way. Before construction on the SLR4 began, there were five cycling collisions (two during SLR4 construction of the SLR4 and post-opening). Only one of these occurred since the new bridge opened. However, it should be noted that reductions in cycle incidents at this location may not be correlated with SLR4 project activities, given that Norton roundabout falls outside of the SLR4 project area.

Data shows that six collisions occurred on the SLR4 carriageway before construction, reducing to no collisions in the post-opening scenario.

## **10.4 Summary**

### **Air Quality**

The absence of traffic composition and speed data from the available forecast and observed traffic data means the impact of changes in traffic due to the project on air quality levels cannot be determined, nor therefore can comparisons be made to the ES predictions. Though it is noted that 2023 observed flows are lower than 2023 forecast flows on the A4440 to the east and west of the project (no observed data is available for the project).

Local authority monitoring in close proximity to the project suggests that local air quality is better than predicted in the ES but may be slightly worse than predicted in the city centre, although the contribution of the project to this conclusion cannot be determined.

In the absence of detailed traffic data, it is not possible to confidently determine whether the project has had a net positive or negative effect on total greenhouse gas emissions. Although lower observed Annual Average Daily Traffic (AADT) numbers in 2023 compared to forecasts suggest that greenhouse gas emissions may be lower than predicted, a definitive assessment cannot be made without compositional data such as average speed and percentage of heavy goods vehicles (%HDV).

### **Noise**

The absence of traffic composition and speed data from the available forecast and observed traffic data makes it impossible to estimate the impact of changes in traffic due to the project on traffic noise levels, and to compare these to the ES predictions. Though it is noted that 2023 observed flows are 22-27% lower than 2023 forecast flows on the A4440 to the east and west of the project (no observed data is available for the project).

At the short-term monitoring sites the increase in measured noise levels from 2016 to 2024 is higher than might be expected from the impact of the Scheme predicted in the ES. However, given the uncertainties due to the influence of the weather, and the very short-term nature of the monitoring, it is not possible to reach a firm conclusion on the impact of the Scheme on noise levels at the short-term monitoring locations based on the measured noise levels.

At the one long-term site, taking account of the change in the position of the monitoring between 2016 and 2024, the increase in measured noise levels is slightly smaller than might be expected from the impact of the Scheme predicted in the ES. Though again there are uncertainties due to the influence of the weather. Safety

Safety along the SLR has improved with the average number of collisions a year reducing from 22.7 before intervention to 12.0 post opening. This reduction is better than expected in the Business Case and consists of multiple slight improvements to safety along both the carriageway and at the roundabouts, as well as improved cycling facilities. It is however noted that there is only 22 months of post-opening collision data, so emerging trends should be monitored and reviewed during the next evaluation stage using a larger data set.

**Table 10-1 - Summary of How the A4440 SLR4 Project Has Delivered Objectives 8 Outcomes**

Outcome	RAG	Justification
<ul style="list-style-type: none"> <li>• <b>Reduced CO2 and other greenhouse gases within Worcester</b></li> <li>• <b>Possible increased air pollution on routes leading to the upgraded SLR4 section</b></li> <li>• <b>Increased pollution including CO2 and other greenhouse gases on local routes leading towards the new SLR4 road</b></li> </ul>	<p>Too early to conclude due to limited data</p>	<p>Local authority monitoring in close proximity to the project suggests that local air quality is better than predicted in the ES but may be slightly worse than predicted in the city centre</p> <p>The one long-term noise monitoring site indicates that the increase in measured noise levels is slightly smaller than was expected, though weather conditions could be a contributory factor. At the short-term monitoring sites, the increase in measured noise levels is higher than might be expected from the impact of the project. However, given the limitations of the available 2016 data, uncertainties due to the influence of the weather, and the very short-term nature of the monitoring, it is not possible to reach a firm conclusion on the impact of the project on noise levels based on the measured noise levels.</p> <p>Lower observed AADT numbers in 2023 compared to forecasts suggest greenhouse gas emissions may be lower than predicted.</p>
<p><b>Individuals who chose active travel are not disadvantaged</b></p>	<p>On track to deliver expected outcome</p>	<p>The SLR4 improvements have provide improved active travel infrastructure. The number of collisions involving cyclists is unchanged.</p>

# Part C – Process Evaluation

## 11 Process Evaluation

This strand of the SLR4 one year after evaluation aims to assess the processes employed to deliver the project, in order to identify challenges, lessons learnt and best practice for future projects. The process evaluation has largely been informed through engagement with the Client Project Manager (PM) of the project, via a questionnaire and follow up feedback session with the evaluation team.

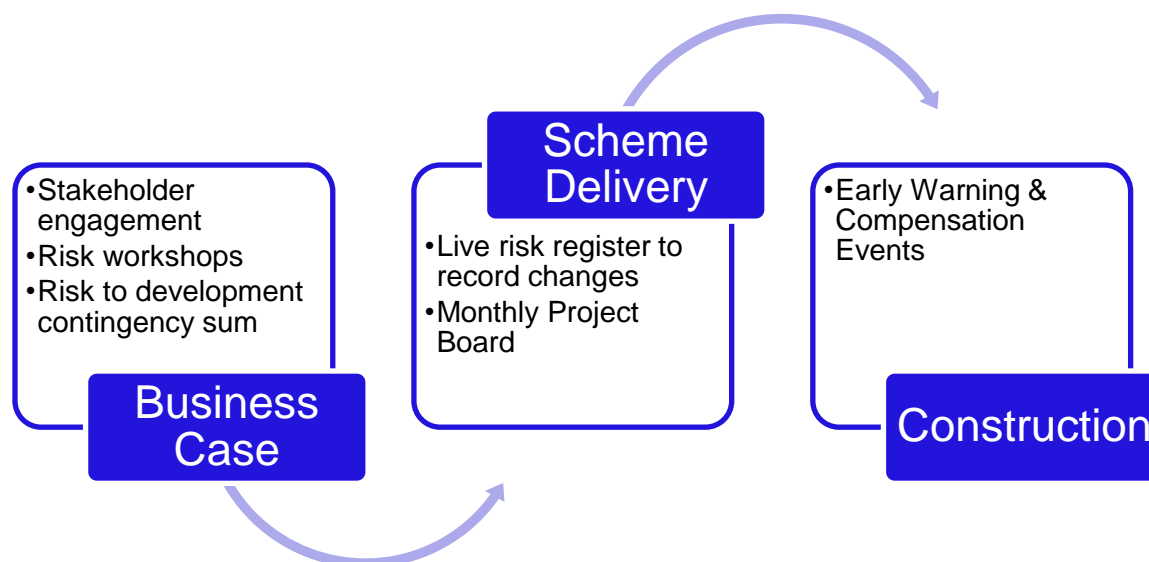
### 11.1 Project Build

#### 11.1.1 Risk

Risk was managed effectively throughout the lifecycle of the project. The Client PM considered risk at an early stage (Business Case development), engaging with relevant stakeholders in risk workshops. This was effective in developing an overall Quantified Risk Assessment (QRA) sum, which was run through the Risk tool to determine a suitable contingency sum for the project.

Changes in risk were documented through a live risk register, which was maintained throughout Business Case development and project build. Scrutiny of this risk register was provided by the Client PM through a monthly review and through a monthly Project Board, where key risks were presented. This process ensured transparency of any evolving risks and encouraged early support of mitigation measures.

**Figure 11-1 - Continued Assessment of Risk Throughout the Lifecycle of the SLR4 Project**



Early planning and continued assessment of project risk meant the main expenditure as a result of materialised risk was foreseen for the project build. A contingency funding pot was put in place for the construction period of the project, where funding was drawn down by:

1. Monitoring the contingency pot during construction
2. Deviation from original target price managed through an Early Warning and Compensation Event process as per NEC Option C contract
3. Agreed change in scope
4. Monetary and time change discussed and agreed with the contractor
5. Deduction from the QRA pot
6. Remaining QRA pot monitored and reported back to project board

Flood risk was anticipated and was minimised by ensuring the site compound was constructed above predicted flood levels. Flood risk was monitored by the site team via Met Office and Environment Agency flood alerts for

the Rivers Severn & Teme. When a flooding event was expected, equipment was moved to higher ground, minimising impact. This is demonstrated in Figure 11-2 below.

**Figure 11-2 – Flood event during SLR4 construction**



### 11.1.2 Programme

Key variances in programme were due to:

- Five severe flood events between October 2019 and February 2020, in exceedance of forecast risk based upon historic data.
- Suspension of works due to COVID-19 pandemic.
- Design changes due to unchartered statutory undertakers' equipment.

Generally, flood risk was anticipated and managed during the project by the site compound being constructed above predicted flood levels. Although the site team monitored flood forecasts and warnings closely, the number and severity of the flood events in the first year exceeded what could have reasonably been forecast from historic data. This led to delays to programme and increased cost.

**Figure 11-3 – Flood event during SLR4 construction**



Delays to programme were also incurred as a result of the COVID-19 pandemic, however the project team were successful in minimising the time the site was closed.

Engagement between the Client PM, the Contractor and WCC Streetworks ensured effective traffic management planning, including road space booking and road closures. This effectively mitigated traffic management delays and risks.

### **11.1.3 Procurement**

An Early Contractor Involvement (ECI) approach was determined to be the most suitable procurement option for the project. This procurement strategy provided the ability to fully engage with the Main Contractor early in the project development, facilitating innovation to address key project issues. Early input from the contractor at this stage meant that issues such as the functional flood plain, construction of a large embankment within the flood plain and the construction of a bridge over a navigable river could be minimised.

The procurement of the main contract comprised of three separate contracts as follows:

- Stage 1a Contract – Planning Preparation and Submission (Target Price)
- Stage 1b Contract – Completion of Statutory Requirements, Approvals, etc (Cost Reimbursable)
- Stage 2 Contract – Design & Build (Target Price)

The initial (tender) Stage 2 Target Price, was adjusted through agreed Evaluation Events that reflected project development and a final Target Price agreed ahead of award of the Stage 2 contract. This enabled both parties to understand and agree the implications of project development, including allocation of risk.

In general, Stages 1a and 1b progressed very well with good engagement from both the Contractor and their design partners. The commencement of Stage 2 oversaw a significant change in key Contractor personnel as the project became construction focused. As such, a key challenge was to ensure knowledge retention within the Contractor so that key issues identified in the development stages were properly addressed. Furthermore, this change in personnel meant that knowledge/familiarisation with council-specific policies was not retained.

Progress of the project was disrupted by the COVID-19 pandemic and resulted in the decision to temporarily suspend works due to difficulties securing plant, materials and resources from the supply chain, who had also struggled to stay open. Restarting works was also affected by a significant change in key management and site staff at the contractor. Changeover of contractor staff meant the continued impacts of the pandemic were felt both in terms of material supply and working practices. A learning point from this is that retention of key staff is essential to improve resilience and minimise delays in procurement; not doing so can result in procurement delays.

## **11.2 Delivered Project**

The final constructed asset and quality of the work was as anticipated. The project was delivered as proposed in the FBC. On the whole the project has been well received by the users of the highway with significant journey time savings and reliability realised immediately upon opening of the dual carriageway in August 2022. Risk did not impact the outputs of the proposed project. This meant that improvements to the highway and cycle network were implemented as envisaged.

Whilst on site, the Client identified an added value activity to undertake bearing replacement and concrete repair works to the existing Carrington Bridge & Powick Common Viaduct. These structures were retained as part of the project with new structures constructed alongside to carry the additional two new lanes.

The Project Board decided that, whilst the project was under construction, WCC would take the opportunity to replace the bearings and undertake the necessary concrete repairs to the two main existing structures. This work was outside the scope of the FBC and was funded by additionally secured WCC monies. This is an element of best practice that can be taken forward for future projects, as ensuring local authorities were kept up to date on works provided an opportunity to update expired assets whilst maximising the efficiency of planned road closures.

### 11.2.1 Stakeholder Management

A Communications Strategy was prepared that identified key audiences to engage with during project deliver to provide both regular updates on progress and specific communications about relevant aspects of the project as follows:

- Department for Transport; to keep the informed of project progress
- Key County Councillor & Officers; to keep the informed of project progress
- Environmental Liaison Group; Keeping key statutory consultees and stakeholders abreast of the latest project developments and proposals
- Public Liaison Group; Providing local councillors up to date on progress and planned work. Allowing opportunities for feedback from local communities & encouraging dissemination of information
- Full-time Contractor Public Liaison Officer; To keep local resident and businesses informed of upcoming works and traffic management to address queries regarding the works
- Social Media; Various platforms used to engage with the public to keep them informed of keys aspects of the project, including upcoming traffic management

The planned Communication Strategy identified the stakeholders who held the responsibility for the engagement. It was implemented by the project team including key representatives from the council, the contractor and the designer and was highly effective. This was demonstrated in the positive feedback received from the different groups. The regular communication led to stakeholders feeling informed and abreast of the key information throughout the project and avoided issues that may have otherwise arisen.

### 11.3 Costs and Timescales

The SLR4 Full Business Case included a full breakdown of forecast cost, as shown in Table 11-1 which outlines the SLR Phase 4 project costs with inflation rates included (sourced from the A4440 SLR4 Full Business Case – FBC). These costs were based on Quarter 1, 2017 rates with inflation adjustments applied. Optimism Bias is excluded from these figures.

**Table 11-1 - A4440 SLR Phase 4 Project Costs (FBC)**

Cost Type	2017 Q1 Baseline Costs	2017/18	2018/19	2019/20	2020/21	2021/22	Total
Preparation	£4,659,759	£1,336,747	£1,336,747	£1,316,665	£595,592	£144,347	<b>£4,990,487</b>
Construction (incl. land)	£37,938,572	£535,958	£2,615,893	£19,091,809	£20,199,140	£1,493,246	<b>£43,936,047</b>
Site Supervision	£37,938,572	£0	£50,000	£903,567	£951,958	£166,252	<b>£2,071,777</b>
Total cost without QRA	£37,938,572	£1,872,705	£4,263,029	£21,312,041	£21,746,690	£1,803,845	<b>£50,998,310</b>
QRA	£9,354,067	£0	£248,237	£2,961,696	£6,304,315	£1,487,482	<b>£11,001,730</b>
Total cost including QRA	<b>£53,816,812</b>	<b>£1,872,705</b>	<b>£4,511,266</b>	<b>£24,273,737</b>	<b>£28,051,005</b>	<b>£3,291,327</b>	<b>£62,000,041</b>

The project spend-to-date, budget and forecast was reviewed monthly with adjustments made as necessary. This included adjustments due to: change in scope, compensation events, actual costs, resource changes, change in the contractor's forecast spend profile. A summary of the project finances, and any decisions to be made that would impact the finances (e.g. proposed changes to scope), were presented at the monthly project board.

The project risk allowance (contingency) was identified through the QRA process and the contingency actively monitored as an integral part of the whole project financial monitoring.

The funding requirement of the project increased by £7.65m to £69.65m to forecast costs in the project FBC. Project overspend was funded by WCC. The greatest variances in cost were due to:

- Statutory utility delays at the start of the project leading to a delay to programme and increase in costs.
- Unknown statutory utilities found during the works – increase in costs due to diversions and/or design amendments.
- Severe flooding of the site (above that which would reasonably have been forecast by the contractor based on historical data). This resulted in delays to programme and increased costs.
- COVID-19 was an unexpected risk initially realised in March 2020, just after the flood situation improved. This (ongoing) event resulted in delays and increased costs to the project. The quantum of this increase is part of ongoing discussions to agree the final project costs.
- The change to the target price due to inflation was higher than anticipated due to the extended programme and significantly higher than average inflation during the life of the project, due to external factors (such as COVID-19).
- Contractor costs exceeded the target price resulting in pain share (maximum of 5% of the final target price). The quantum will be determined as part of the agreement of the final account. This was partly due to loss of key personnel at the contractor over a relatively short period of time, leading to loss of project knowledge with consequential project delays and increased costs.
- Additional works were carried out to replace bridge bearings. This work, outside of original project scope and funded by WCC, was undertaken alongside the SLR4 works to maximise efficiency of contractor on site and minimise future road user impacts.

## 11.4 Summary

A summary of the process evaluation findings is presented in Table 11-2.

**Table 11-2 - Summary of the SLR4 One Year After Process Evaluation**

Outcome	RAG	Justification
<b>Risk</b>		Project risk was minimised by ensuring early and consistent revaluation of risk throughout the project lifecycle. Anticipated risk was planned for and mitigated effectively using the @Risk software
<b>Programme</b>		Key variances in programme were due to five severe flood events (exceeding historic forecast data), suspension of works due to COVID-19 and design changes due to unmapped statutory utilities.
<b>Procurement</b>		Stage 1 progressed well with good engagement from the Contractor and their design partners. Stage 2 was impacted due to COVID-19, leading to challenges around staff and knowledge retention.
<b>Stakeholder Management</b>		The Communication Strategy was implemented successfully, ensuring key stakeholders were engaged and informed throughout the project. This is reflected through positive feedback received from different groups.

Outcome	RAG	Justification
Costs & Timescales		The funding requirement of the project increased by £7.65m (to £69.65m). Project over spend was funded by WCC.

## 11.5 Next Steps and Recommendations

The programme and cost of the scheme was impacted by statutory utility delays and the discovery of unmapped services. For future Business Cases WCC should consider whether suitable cost and programme contingency is included for these items. Utilities moved during the SLR4 works should be logged and recorded for future works consideration.

The process evaluation identified areas of best practise which could be applied to future WCC projects including:

- Mitigation of flood impacts to minimise the impact of flood events. The best practice approach of locating site compounds above flood levels could be built into procurement requirements for future projects.
- Coordination of Asset management and construction work to provide cost efficiency and minimise user delays. This should be a consideration as part of the construction planning for future WCC schemes.
- Regular communication led to stakeholders feeling informed and abreast of the key information throughout the project. As part of continuous improvement, WCC should consider stakeholder co-design sessions to increase stakeholder buy-in to projects.

The process evaluation identified that as the project moved away from scheme development and became construction focused, there were challenges around knowledge retention within the Contractor. This meant it was challenging to ensure that key issues identified in the development stages were properly addressed. To minimise this risk on future projects, WCC should consider the retention of scheme development teams into the Design and Build stage to allow for a more informed transition.

The one year after evaluation captures the effectiveness of project delivery processes. Therefore, it is recommended the five years after process evaluation includes interviews that capture the handover, operation and maintenance of the project in the post-opening scenario.

# Part D – Value for Money Assessment

## 12 Value for Money Assessment

Once a project has been opened to traffic for a year, the evaluation monitors the construction costs and the trajectory of benefits to re-forecast these for the 60-year project life. It is not proportionate to replicate modelling undertaken at the appraisal of a project or to monitor benefits over the entire lifecycle, so we take an assessment based on the trends observed over the first year of operation and estimate the trend over the project life, based on these observations. This provides a useful indication and helps to identify opportunities for optimising benefits. In instances where it was not feasible to robustly compare forecast and observed impacts, the findings have been presented with relevant caveats.

The Full Business Case for the project was supported by extensive traffic modelling to determine the forecast impacts of the SLR4. The level of transport modelling and associated data collection required to update the FBC transport model to a position, whereby it was suitable to reforecast an outturn Value for Money evaluation of SLR4 using the FBC methodology, would have required substantial work. This additional work would not have provided WCC with a cost-effective approach, nor provided a proportional increase in the level of assurance associated with the Value for Money evaluation. An alternative proportionate evaluation approach (detailed in 12.2) was developed, in consultation with the Department for Transport<sup>16</sup>. This section provides a comparison of the predicted transport economic efficiency (TEE) against the outturn costs and benefits. The process of undertaking the comparison is set out in the flowchart in Figure 12-1 below.

### 12.1 2021 Economic Assessment (What did we think was going to happen?)

The transport modelling work undertaken to support the SLR4 Full Business Case (December 2018) has primarily been undertaken using the 2014 Worcester Transport Model (WTM). WTM is a detailed travel demand model using EMME4 software, linked to a highway assignment model developed in SATURN and public transport assignment model also in EMME4.

The forecast growth in travel demand was based on a combination of the housing and employment allocations as determined by the adopted South Worcestershire Development Plan (SWDP), which also contained information on completions and existing commitments, and also by comparison to NTEM (TEMPro v7.2) growth.

The Full Business Case concluded that the SLR4 offered very High Value for Money with an unadjusted BCR of 4.5. This increased to 12.7 when the quantified benefits of reliability and output change in imperfectly competitive markets were included in the adjusted BCR calculation.

The PVB and PVC for the project as presented in the Business Case are shown in Table 12-1.

**Table 12-1 - Economics from the Business Case**

	Core (£000s)
<b>Present Value of Benefits (PVB)</b>	226,605
<b>Present Value of Costs (PVC)</b>	50,177
<b>Net Present Value (NPV)</b>	176,427
<b>TUBA Benefits/Costs Ratio (BCR)</b>	4.516

In accordance with DfT guidance, benefits quantified from reliability, wider impact and dependent development have not been included in the economic assessment table reported above. The quantification of these benefits is less robust and therefore DfT states that they should only be included in the adjusted BCR. It should be noted that Wider Impact Benefits and the Housing Dependency Benefit calculations have been taken from the March 2017 Outline Business Case Addendum Report and not recalculated.

<sup>16</sup> Meeting with the DfT held 8<sup>th</sup> March 2024

Table 12-2 presents the impact of including the reliability and wider impact benefits and the adjusted BCR values.

**Table 12-2 - Adjusted Economics from the Business Case**

	Core (£000s)
<b>Present Value of Benefits (PVB)</b>	226,605
<b>Present Value of Costs (PVC)</b>	50,177
<b>Reliability Benefits</b>	22,648
<b>Wider Impacts Benefits</b>	26,610
<b>Housing Dependency Benefits</b>	361,164
<b>Adjusted PVB</b>	637,027
<b>Adjusted Net Present Value (NPV)</b>	586,850
<b>Adjusted Benefits/Costs Ratio (BCR)</b>	12.70

Whilst the adjusted values predict a much greater BCR than the unadjusted, the evaluation compares against the unadjusted, considering the change in travel time benefits.

The Business Case calculated the overall value for money of the project and presented these in an analysis of Monetised Cost and Benefits, which is summarised in Table 12-3.

**Table 12-3 - Analysis of Monetised Cost and Benefits from the Business Case**

Impact	Value (£000s)
<b>Noise</b>	-491
<b>Local Air Quality</b>	-155
<b>Greenhouse Gases</b>	-1,011
<b>Journey Quality</b>	0
<b>Physical Activity</b>	0
<b>Accidents</b>	4,903
<b>Economic Efficiency: Consumer Users (Commuting)</b>	62,333
<b>Economic Efficiency: Consumer Users (Other)</b>	90,240
<b>Economic Efficiency: Business Users and Providers</b>	68,716
<b>Indirect Taxation Revenue (ITR)</b>	2,069
<b>Present Value of Benefits (PVB)</b>	226,605
<b>Present Value of Costs (PVC)</b>	50,177
<b>Net Present Value (NPV)</b>	176,427
<b>Benefits/Costs Ratio (BCR)</b>	4.516

**Note: All values in 2010 prices and values**

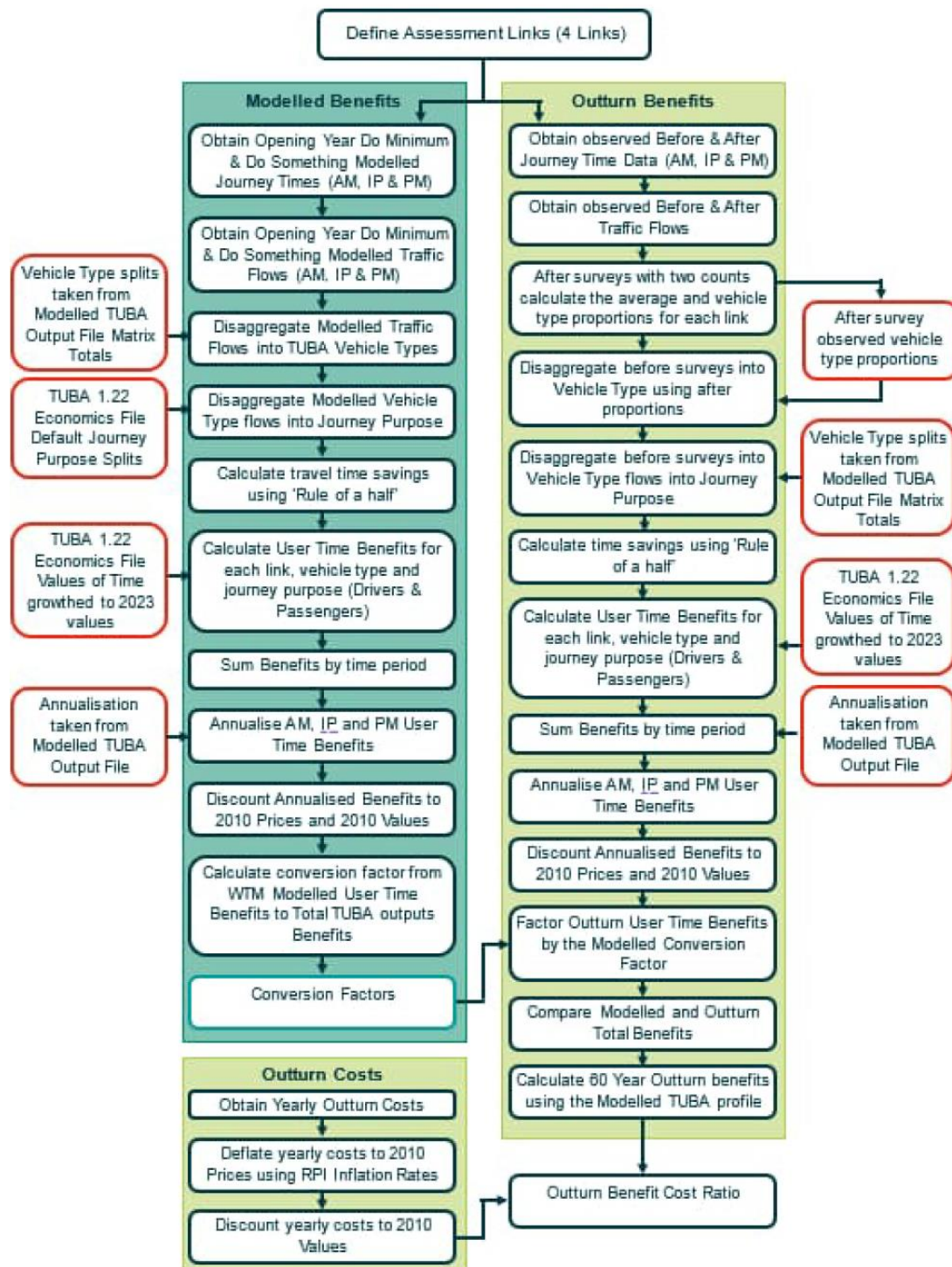
## **12.2 Methodology (How are we going to calculate what has happened so far?)**

The Value for Money evaluation of the SLR4 used a proportionate approach, making best use of both observed and appraisal data. The approach to inform a quantitative assessment of potential out-turn area wide benefits included a comparison of observed changes in traffic flows and journey times on selected links to inform a quantified comparison of localised journey time impacts. These were compared against select links from the WTM Opening Year forecasts, and a factored approach to defining the area wide benefits of the SLR4 was derived.

The methodology, as outlined in Figure 12-1 shows how each element was undertaken in turn. Firstly, the assessment considers the calculation of travel time savings and user benefits, pertaining to SLR4, for the modelled Do Minimum and Do Something opening year scenario. These are then compared with the total modelled TUBA benefits (as forecast) to produce an uplift factor. The process was then repeated to calculate the outturn travel time and user benefits for the as built SLR4 and the uplift factor applied to produce an outturn Present Value of Benefits. These were then compared to the outturn cost and an outturn Benefit Cost Ratio produced for comparison with the project economic forecasts presented in the Business Case.

As recognised in Figure 4-7, baseline journey time data was collected during the SLR4 construction period when contraflow arrangements and speed restrictions were in place. So as not to overstate the benefits of the SR4 improvements, the Value for Money evaluation used the April 2019 “Baseline Minus” journey time data.

Figure 12-1 - Value for Money Evaluation Methodology



The routes used to determine the impact of the SLR4 intervention were selected to represent the key areas of travel time impacts and include the A4440 corridor and adjacent routes. The links (both directions) used in the VfM assessment were:

- A4440 Temeside Way
- A4440 Broomhall Way
- A4440 Crookbarrow Way
- A4440 Hams Way

- A4440 Grove Way
- A44 Whittington Road
- A38 Worcester Road
- A449 Malvern Road
- B4485 Bransford Road

It is not proportionate to recreate all elements of the appraisal for the evaluation. For the purposes of the one year after value for money assessment, a number of impacts have been assumed as forecast. These include:

- Noise
- Local Air Quality
- Greenhouse Gas Emissions
- Journey Quality
- Physical Activity
- Accidents

### 12.3 Results (What has actually happened so far?)

Following the application of the methodology to calculate modelled and outturn user benefits, the opening year total outturn user benefits were compared with the appraisal TUBA outputs for the whole model area. The results shown were determined by taking the observed benefits across select links around the project and scaling the benefit based on the modelled data. This value was then rebased to 2010 prices and scaled to represent a 60-year appraisal period, allowing comparisons to the forecast benefit taken for the Business Case. Table 12-4 presents a summary of the Present Value Benefit.

**Table 12-4 - Comparison of Total Modelled TUBA vs Total Outturn Benefits**

Total Benefits	Forecast (£000s)	Outturn (£000s)	Difference (£000s)
<b>Present Value Benefits (PVB)</b>	226,604	106,879	-119,725

Table 12-4 shows that the outturn PVB is notably less than forecast.

If the trends observed at the one year after opening continue over the 60-year period, the monetised impact on journey times, for those using the road, would be £103million. This is lower than the £221 million forecast prior to project construction. There are several contributory factors to this finding:

- The re-forecast figure reflects journey time trends observed on the project extent, not the surrounding road network which would have been considered in the forecast appraisal.
- As demonstrated in Section 4, traffic flows on the A4440 were lower than model forecasts in both pre-intervention (November 2021) and post-intervention (November 2023) scenarios. This trend is evident in all time periods and in both eastbound and westbound directions. Fewer trips using the route than was forecast is contributing to lower than forecast journey time benefits.
- It was only possible to re-forecast journey time benefits representing the 12-hour period (including morning, daytime and evening peaks). Any journey time benefits associated with the overnight period (between 7pm – 7am) were not included owing to a lack of data. Whilst modest, the project would likely bring some journey time benefit even outside of peak periods.

Re-forecast monetised journey time benefits therefore likely under-value the true outturn journey time benefits of the SLR4.

## 12.4 Outturn Costs

During the Process Evaluation (Section 11.3), it was noted that the outturn project increased by £7.65m to £69.65m

The yearly expenditure of the project was provided by WCC's SLR4 consultant JACOBS and is presented in Table 12-5 below. It should be noted that Year 2024/2025+ includes costs associated with finalising commercial elements of the project with the contractor.

**Table 12-5 - Outturn Costs**

Year	Yearly Prices
2017/2018	£1,872,704
2018/2019	£3,885,801
2019/2020	£17,826,616
2020/2021	£17,783,953
2021/2022	£13,817,776
2022/2023	£12,540,079
2023/2024	£438,740
2024/2025 +	£1,484,331*
<b>Total</b>	<b>£69,650,000</b>

\* Forecast as 2024/2025 financial year not concluded at time of evaluation

The Business Case forecasted the Present Value of Costs at £50,177,000<sup>17</sup> (in 2010 prices and 2010 values). The Business Case states that a 44% optimism bias uplift was included in the PVC.

To develop an outturn Present Value of Costs that can be compared to the forecast value, the outturn cost was rebased to a 2010 price base and discounted to 2010 values. This is a two-step process.

Table 12-6 summarises the outturn cost rebasing method.

**Table 12-6 - Outturn Costs Price Rebase**

Year	Total	RPI Yearly Average	2010 RPI / Yearly RPI	2010 Prices / Yearly Values
2017/2018	£1,872,704	103.6	0.870	£1,628,674
2018/2019	£3,885,801	106.0	0.850	£3,302,931
2019/2020	£17,826,616	107.8	0.836	£14,899,611
2020/2021	£17,783,953	108.9	0.827	£14,713,812
2021/2022	£13,817,776	111.6	0.807	£11,155,749

<sup>17</sup> This is the PVC (present value cost) of the project. This means it is presented in 2010 prices, discounted to 2010 to be comparable with the other monetary values presented.

Year	Total	RPI Yearly Average	2010 RPI / Yearly RPI	2010 Prices / Yearly Values
2022/2023	£12,540,079	120.5	0.748	£9,376,441
2023/2024	£438,740	128.6	0.701	£307,391
2024/2025	£1,484,331	131.8	0.684	£1,015,091
<b>Total</b>	<b>£69,650,000</b>			<b>£56,399,700</b>

Once the costs have been rebased to a 2010 price base they were discounted to 2010 values. This is undertaken using the recommended TAG discounting method stated in TAG Unit 3.5.4.

$$Present\ Value = \frac{(Yearly\ Sum)}{\prod_{i=1}^n (1 + r_i)}$$

Where:

$r_i$  = The discount rate for year  $i$

$n$  = The year in which the sum is received

$n = 0$  is the present value year

Table 12-7 below presents the calculation of discount factors and discounted expenditure items in 2010 prices and 2010 values.

**Table 12-7 - Outturn Costs Discounted**

Year	Total	2010 Prices / Yearly Values	Discount Rate	2010 Prices / 2010 Values
2017/2018	£1,872,704	£1,628,674	0.786	£1,280,123
2018/2019	£3,885,801	£3,302,931	0.759	£2,508,284
2019/2020	£17,826,616	£14,899,611	0.734	£10,932,306
2020/2021	£17,783,953	£14,713,812	0.709	£10,430,898
2021/2022	£13,817,776	£11,155,749	0.685	£7,641,083
2022/2023	£12,540,079	£9,376,441	0.662	£6,205,172
2023/2024	£438,740	£307,391	0.639	£196,547
2024/2025	£1,484,331	£1,015,091	0.618	£627,105
<b>Total</b>	<b>£69,650,000</b>	<b>£56,399,700</b>		<b>£39,821,518</b>

The discounted outturn cost of the project is £39,821,518 (in 2010 prices and 2010 values). Initially this appears somewhat lower than the forecast PVC of £50,177,000. However, as the Business Case stated the forecast costs include optimism bias at 44%. Optimism bias adjustments are applied at the Business Case stage to confirm that the economic case remains robust were historically observed cost overrun trends occurred. As such optimism bias is not applied to outturn cost. Notwithstanding, applying a 44% uplift to the outturn costs, the total Present Value of Costs would be £57,342,985, which is more in line with forecast. This indicates that the Optimism Bias allowance included at the Business Case stage did not materialise, indicating a robust Quantified Risk Assessment.

## 12.5 Benefit Cost Ratio

Table 12-8 below presents the comparison of the FBC and outturn Present Value of Benefits, Costs, Indirect Taxation and the Benefit Cost Ratios.

**Table 12-8 - Comparison of Modelled and Outturn Economic Assessment (£000s)**

	<b>Full Business Case</b>	<b>Outturn</b>	<b>Difference</b>
<b>Present Value of Benefits (PVB)</b>	226,604	106,879	-119,725
<b>Indirect Taxation</b>	-2,069	-960	1,109
<b>Present Value of Costs (PVC)</b>	50,177	39,822	-10,355
<b>Net Present Value (PVB-PVC)</b>	176,427	67,057	-109,370
<b>Benefit Cost Ratio (PVB/PVC)</b>	4.516	2.684	-1.832

Note: All values in 2010 prices and values

The results in Table 12-8 highlight that the outturn situation is providing lower value for money than calculated at the appraisal stage. The driving factors behind the lower re-forecast BCR are the lower than forecast journey time benefits. The outturn project provides a positive economic case and provides high value for Money, as opposed to the very high value for money estimated in the FBC.

Overall, based on the evidence from the first year, the SLR4 project is currently on track to provide high value for money.

## 12.6 Next Steps and Recommendations

As the outturn value for money findings are partly attributed to COVID impacts resulting in lower than forecast traffic volumes using the SLR4 route the value for money assessment should be reviewed further at the five years after stage to determine if the anticipated value for money has been achieved when longer term post-COVID travel patterns are clearer.

## Part E – Conclusions

## 13 Summary and Recommendations

The impact evaluation found one-year after data indicates the project has made positive contributions to project objectives by delivering improved journey time reliability and increased capacity on the wider SLR. The impact evaluation findings at the one year after opening stage are summarised in Table 13-1.

**Table 13-1 - A Summary of the key SLR4 One Year After evaluation findings**

Objective	RAG	Summary
<b>Did the project remove capacity constraints along the A4440 Temeside Way?</b>	Likely to meet objective	Following the improvements, the A4440 Temeside Way has been able to accommodate more traffic whilst improving journey times for road users.  Traffic growth on the A4440 Temeside Way has increased by 85%, whilst average journey times have reduced by at least 1 minute and 45 seconds in both directions in the morning and evening peak periods.
<b>Did the project support the growth of Worcestershire and the surrounding area?</b>	Likely to meet objective	Marked improvements in economic indicators align with the opening of the SLR4, suggesting the project could be supporting wider economic growth ambitions. This was supported by positive stakeholder feedback. However, despite the positive impact of the project other factors have also had a large influence on the economy of Worcestershire.
<b>Did the project improve resilience to flood events?</b>	Too early to conclude	The SLR4 has added resilience to the network by adding highway capacity across the River Severn. The evaluation has demonstrated that the A4440 was resilient enough to provide reliable journey times during flood events, with minimal delays or disruptions beyond 'non-flood' journey times. However, there has not been a significant flood event since the opening of SLR4
<b>Did the project support delivery of planned growth?</b>	Too early to conclude	More dwellings have been built in and around Worcestershire up to 2022 than forecast in the SLR4 Business Case, many of which were dependent on the SLR4 improvements. However, this may be due to external factors such as increased housing demand.
<b>Did the project reduce City Centre impacts?</b>	Too early to conclude	Whilst the A4440 SLR route is now a more attractive route, with increased capacity and improved journey times, the A44 route through the city centre has seen limited change in traffic conditions since the opening of the SLR4 project.
<b>Did the project improve access to the SRN and key hubs?</b>	Likely to meet objective	Journey times have decreased whilst journey reliability and congestion have improved along the SLR. This has afforded motorists easier access between the west of the River Severn and the rest of the country by improving access to the M5. It has also improved access to key destinations such as Worcestershire Parkway Rail station and Birmingham Airport.
<b>Did the project contribute to environmental and safety objectives?</b>	Too early to conclude	Local authority monitoring in close proximity to the project suggests that local air quality is better than predicted but may be slightly worse than predicted in the city centre, although the contribution of the project to this conclusion cannot be determined. The absence of traffic composition and speed data from the available forecast and observed traffic data means the impact of changes in traffic due to the project on air quality levels

Objective	RAG	Summary
		<p>cannot be determined though it is noted that 2023 observed flows are lower than 2023 forecast flows on the A4440 to the east and west of the project Lower observed AADT numbers in 2023 compared to forecasts suggest greenhouse gas emissions may be lower than predicted. However detailed traffic data is not available, meaning a confident conclusion of scheme impacts on greenhouse gases cannot be drawn.</p> <p>Safety along the SLR4 has improved with the average number of collisions a year reducing from 22.7 before intervention to 12.0 post opening.</p> <p>The one long-term noise monitoring site indicates that the increase in measured noise levels is slightly smaller than was expected, though weather conditions could be a contributory factor. At the short-term monitoring sites, the increase in measured noise levels is higher than might be expected from the impact of the project. However, given the limitations of the available 2016 data, uncertainties due to the influence of the weather, and the very short-term nature of the monitoring at eight of the nine comparable sites, it is not possible to reach a firm conclusion on the impact of the project on noise levels based on the measured noise levels.</p>

The process evaluation found that risk was planned, monitored and managed effectively throughout the lifecycle of the project. There were variances in planned programme due to the COVID-19 pandemic and exceedances in flood forecasts based upon historic data. Areas of best practice included engagement between the Client PM, the Contractor and WCC Streetworks to ensure timely and effective traffic management, mitigating delays and risk, and the identification of an added value activity to undertake bearing replacement and concrete repair works to the existing Carrington Bridge & Powick Common Viaduct, maximising the efficiency of planned road closures.

Based on the evidence from the first year, the SLR4 outturn project provides a positive economic case and provides High Value for Money. The outturn benefits of the project are lower than anticipated. This is part attributed to COVID impacts resulting in lower than forecast traffic volumes using the SLR4 route and in part attributable to the proportionate evaluation methodological limitations.

### 13.1 Evaluation Limitations

A number of outcomes have not been evaluated due to a lack of data or forecast information, and conclusions in some cases have been based upon datasets that do not reflect a full year of opening. Pre-intervention baseline data limits the evaluation as the data was sourced during a time when SLR4 construction was taking place and the COVID-19 pandemic was ongoing. Despite this, the available evidence suggests that the A4440 SLR4 project has improved capacity and journeys across the SLR4 section and the A4440 as a whole. Anecdotal evidence from stakeholder workshops and public surveys indicates that improved reliability of the wider SLR has widened travel horizons for residents and increased labour markets and access to the SRN for local businesses.

### 13.2 Next Steps and Recommendations

It is expected that the evaluation of the SLR4 project will be revisited five years after opening. This will allow a more comprehensive evaluation using trend data over a longer period. In addition, findings from this one-year evaluation have identified areas of best practise and improvement that could be applied to future WCC projects:

### Stronger Future Business Cases

- The SLR4 project has provided improved active travel infrastructure within the project extents. Worcestershire County Council should consider wider active travel improvements to improve active travel connectivity and maximise the benefit of SLR4 improvements. This should be incorporated into future LCWIPs in the form of a review of future needs of active travel desire lines through the project.
- The programme and cost of the project was impacted by statutory utility delays and the discovery of unmapped services. For future Business Cases, WCC should consider whether suitable cost and programme contingency is included for these items. Utilities moved during the SLR4 works should be logged and recorded for future works consideration.

### Appraisal Accuracy and Approaches

- One of the objectives of the project was to improve the SLR as a bypass for Worcester City Centre. Whilst the impact evaluation demonstrates that the SLR is now more attractive, there has been limited change to travel conditions in Worcester City Centre. This could be due to external factors such as increased development in the city centre. For future projects aimed at removing particular movements Automatic Number Plate Recognition (ANPR) surveys should be considered. Pre- and post-intervention ANPR surveys could be used to isolate the desired movement of vehicles and provide a comparison, allowing for a clear attribution of outcomes.

### Evaluation Enhancements

- Journey time reliability data for the A4440 Temeside Way should be obtained, to understand to what extent SLR4 improvements drive reliability improvements on the wider route (as noted in Section 8)
- Background traffic growth should be reassessed at the next evaluation stage to provide a longer term understanding of how much of the observed traffic impacts can be attributed to COVID-19 impacts.
- Business group stakeholders should be engaged at an earlier stage via stakeholder interviews and questionnaires, in order to overcome limitations of quantitative employment data availability and to contextualise wider trends.
- Resilience should be reassessed at the next evaluation stage, as this may present an opportunity to draw conclusions from a wider range of flood events
- Active business growth trends should be reassessed in the next evaluation stage, to investigate trends of decline that do not align with wider Worcestershire growth.
- Further development data should also be sourced for the West Worcester and South Worcester Urban Extensions, to understand the changes in SLR traffic impact against build out rates of these key local developments.

### Organisation Change

- The process evaluation identified areas of best practise which could be applied to future WCC projects including:
  - Mitigation of flood impacts to minimise the impact of flood events. The best practice approach of locating site compounds above flood levels could be built into procurement requirements for future projects.
- Coordination of Asset management and construction work to provide cost efficiency and minimise user delays. This should be a consideration as part of the construction planning for future WCC projects.
  - Regular communication led to stakeholders feeling informed and abreast of the key information throughout the project. As part of continuous improvement, WCC should consider stakeholder co-design sessions to increase stakeholder buy-in to projects.
- The process evaluation identified that as the project moved away from project development and became construction focused, there were challenges around knowledge retention within the Contractor workforce. This meant it was challenging to ensure that key issues identified in the development stages were properly addressed. To minimise this risk on future projects, WCC should

consider the retention of project development teams into the Design and Build stage to allow a more informed transition.

- The SLR4 baseline data was collected during a period where temporary traffic management was in place during the construction of the project. This has made the attribution of SLR4 benefits challenging in some cases. Where possible, future WCC projects should programme Baseline surveys in advance of works via effective Monitoring and Evaluation Plans. This will improve the robustness of future evaluations.