

Technical note

Project:	Stratford-upon-Avon Evaluation of Additional Road Capacity	To:	Warwickshire County Council (WCC)
Subject:	Recommended Approach	From:	Gary Oakes
Date:	19th August 2016	cc:	Adrian Taylor

1. Introduction

1.1. Background to the study

Atkins and Vectos has been commissioned by Warwickshire County Council (WCC) to undertake a study to evaluate the impact of additional highway capacity in Stratford-upon-Avon. This is in response to a number of existing transport issues within the area and to take account of the likely impact of Stratford upon-Avon District Council’s proposals for potential housing and employment growth sites identified in the recently adopted Core Strategy¹.

The study considers the traffic impacts, environmental impacts and economic impacts of a number of highway improvement options and was split into a number of discrete tasks, with different leads, as follows:

Table 1. Stratford-upon-Avon Additional Road Capacity Study Stages

Stage	Lead	Description	
1	Evidence Review	Atkins	To review existing datasets and reports to identify the existing and future transport problems within the area, including the impact of additional housing.
2	Road Capacity Options	WCC	To identify a number of scenarios to provide additional road capacity.
3	Assessment of Options	Vectos	To assess the impact of the various options using a Paramics traffic model.
4	Cost Assessment	Atkins	To identify the outline costs of the various proposals.
5	Cost Benefit Analysis	Vectos	To evaluate the costs and benefits of the scenarios and confirm whether the economic and traffic relief benefits of the various options would be enough to secure government funding.
6	High Level Environmental Assessment	Atkins	To make a qualitative assessment of the environmental impacts of the scenarios.
7	Town Centre Benefits	Vectos	To assess whether there are opportunities for reducing traffic dominance in the town centre as a result of the provision of additional highway capacity through the various route options.
8	Recommended approach	Atkins	To recommend a preferred approach based on the outcomes from earlier stages of the study.

This Technical Note presents the findings from **Stage 8 – Recommended Approach**. Technical Notes/Reports have also been produced for all of the other stages with the exception of Stage 2.

¹ Stratford-upon-Avon District Core Strategy, 2011-2031, Stratford-upon-Avon District Council, 11th July 2016.

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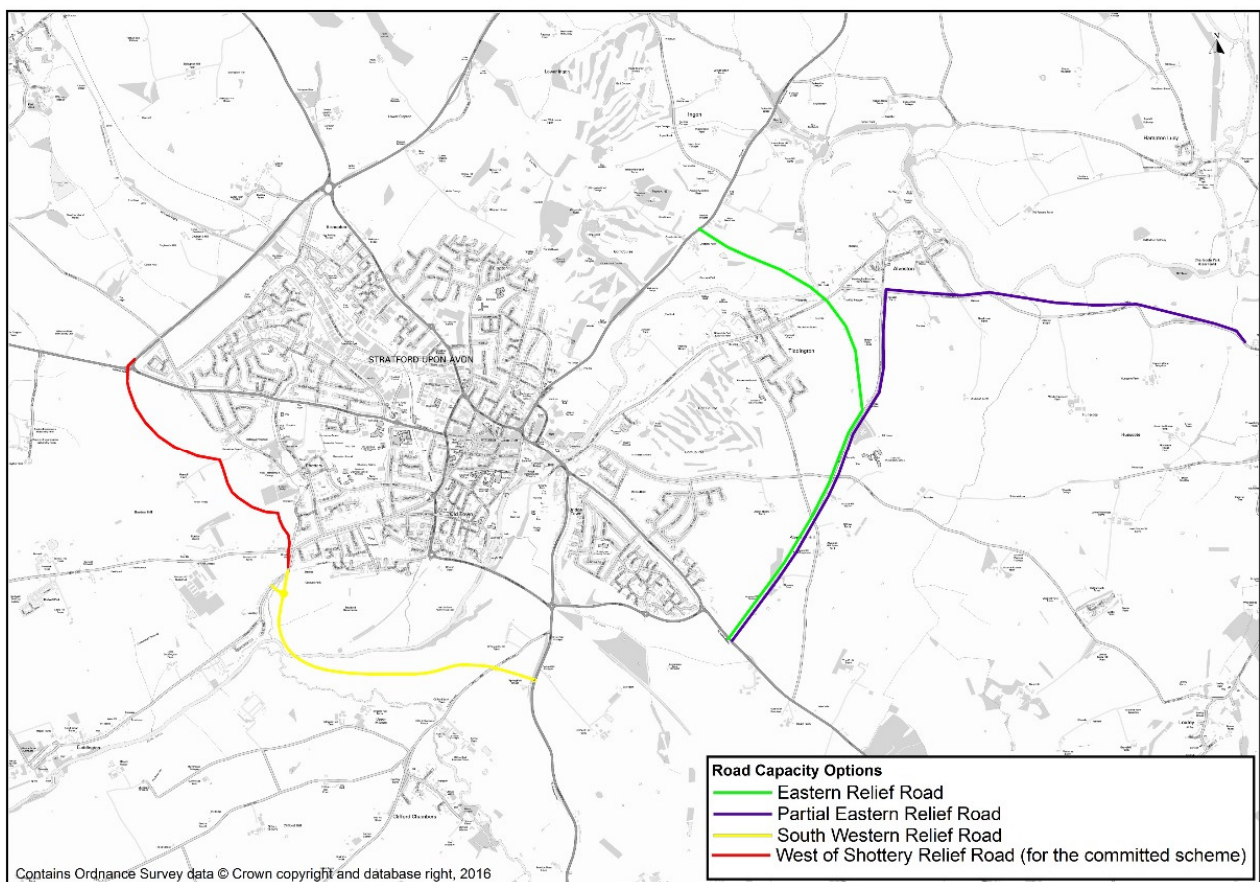
1.2. Study context

The Stratford-upon-Avon Core Strategy is a series of planning documents to guide development and change in the Stratford-upon-Avon District up to 2031. It determines where new homes are to be built, where new jobs will be created and how people can travel to get the things they need. The Core Strategy was adopted in July 2016 and a key element is the commitment to build at least 14,600 houses up to 2031. The main locations identified for the additional properties are as follows:

- Stratford-upon-Avon: 3,500 homes
- Main Rural Centres: 3,800 homes
- New settlement at Lighthorne Heath: approximately 2,300 homes
- New settlement at Long Marston Airfield: approximately 2,100 homes
- Local Service Villages: Approximately 2,000 homes
- Large Rural Brownfield Sites: approximately 1,245 homes
- Other Rural Locations: approximately 750 homes.

Evidence from Stage 1 of this study shows that Stratford-upon-Avon frequently suffers from severe congestion and delays, both during peak commuting periods and during holidays due to the volume of visitors. The issue is compounded because there are only two road crossings over the River Avon in the town centre, one which is the Grade 1 listed Clopton Bridge. Without appropriate mitigation, the transport issues in the area and especially in Stratford-upon-Avon town centre are likely to become more acute. Figure 1 below shows the route capacity options which have been considered and Table 1 provides a brief description of the options.

Figure 1 - Relief road options



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Table 1. Summary of traffic impacts of Core Strategy Scenario

Relief Road Option (including route colour on Figure 1)	Brief Description
West of Shottery Relief Road	This is a committed scheme and will be delivered as part of housing development in the area.
South Western Relief Road	This would be formed by extending the West of Shottery Relief Road across the River Avon to form a complete western relief road of the town.
Eastern Relief Road	This would run from the A422 Banbury Road, crossing the River Avon at Tiddington and joining the A439 Warwick Road.
Partial Eastern Relief Road	This would run from the A422 Banbury Road to the B4086 Wellesbourne Road. The B4086 would be improved between this point and the A429 at Wellesbourne.

The three options that are the focus of this evaluation have broadly the same objectives in terms of purpose and functionality. Both the western and eastern routes will act as a bypass for Stratford-upon-Avon, have suitable pedestrian and cyclist routes, and will be designed to the same standard as the A3400. It is envisaged that a reduction to town centre through trips provided by an additional river crossing would potentially provide an opportunity to undertake traffic demand management and public realm improvements in the town centre.

1.3. Purpose of this Technical Note

The purpose of this Technical Note is to undertake an overall assessment of all of the route capacity options examined in this study. This high level assessment will draw upon the following evidence:

- Traffic modelling outputs (From Stage 3 and 7).
- An assessment of how each scheme aligns with the proposed local transport objectives shown below (from Stage 1).
- Economic Assessment outputs (from Stage 5).
- High level environmental assessment (from Stage 6).

The challenges and evidence presented in the Evidence Review (Stage 1) have been used to develop six local transport objectives that are specific for Stratford-upon-Avon:

- Reduce high car dependency for travel to work trips and school trips.
- Reduce Stratford-upon-Avon Town Centre through trips.
- Reduce the negative environmental impacts of transport, particularly on the Stratford-upon-Avon Air Quality Management Area (AQMA).
- Protect the historic urban core of Stratford-upon-Avon and support the visitor economy.
- Provide increased resilience to the transport network with regard to unplanned network incidents including flooding.

The purpose of this assessment is to determine which option performs best against the following metrics:

- Reduction in town centre through trips
- Average network speeds
- Average network delays
- Average distance travelled
- Environmental impacts
- Investment costs
- Economic benefits
- Alignment with local transport objectives.

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Based on the results of this simple analysis it will be possible to recommend a best performing option which WCC could potentially develop into a future scheme.

2. Recommended Approach

Where possible throughout this section, a red, amber, green (RAG) assessment has been used to show the option which is best performing (green) and worst performing (red) in terms of the indicator being assessed. This assessment has primarily been confined to the indicators that can be measured quantitatively, therefore only some of the impacts have not been assessed in this way. The remainder of this section is structured as follows:

- Section 2.1 – Traffic impacts of the relief road options.
- Section 2.2 – Environmental impacts of the relief road options.
- Section 2.3 – Comparison of investment costs.
- Section 2.4 – Cost benefit analysis results.
- Section 2.5 – Alignment with proposed local transport objectives.

2.1. Traffic impacts of the relief road options

The South Western Relief Road option has the most beneficial impact in terms of reducing town centre through trips, average speeds and average network delay. The Eastern Relief Road does not perform as well as the South Western Relief Road, but does perform better than the Partial Eastern Relief Road, which is the worst option against all indicators.

Modelling of a selection of town centre demand management measures shows that there is scope for discouraging traffic from using the town centre and encouraging vehicles to use a new relief road.

2.1.1. Modelling approach

A number of options were modelled to test the impact of a third river crossing in Stratford-upon-Avon. These options were tested against a 2031 Core Strategy scenario which contains the Core Strategy aspirations and commitments. These scenarios also include the Stratford Transport Package (STP) which are a series of schemes identified to mitigate the impact of the Core Strategy proposals. This modelled showed that:

The Core Strategy scenario was tested with the following route options:

- Scenario 1 – Reference Case: West of Shottery Relief Road only (committed scheme – included in all scenarios).
- Scenario 2 – South Western Relief Road.
- Scenario 3 – Eastern Relief Road.
- Scenario 4 – Partial Eastern Relief Road.
- Scenario 5 – South Western and Eastern Relief Roads.
- Scenario 6 - South Western and Partial Eastern Relief Roads.

The best performing options are generally Scenario 5 and Scenario 6, as both of these options provide new and/or improved highway to the east and the west of the town centre. However, it is unlikely that two relief roads and two additional river crossings would be promoted at the same time. It is therefore considered that it is most appropriate to compare the relative merits of Scenario 2, 3 and 4 only.

The performance of each of these Relief Road options has been established using a number of quantitative indicators extracted from the model outputs as follows:

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- Reduce town centre through trips – A comparison of the number of trips passing through a cordon consisting of Bridge Foot, Warwick Road, Birmingham Road, Alcester Road and Evesham Road.
- Average network speeds – The average speed travelled by all vehicles that completed a journey during the model simulation period.
- Average network delays – The average delay experienced by all vehicles that completed a journey during the model simulation period.
- Average distance – The average distance travelled by a vehicle that completed their journey during the model simulation period.

The results (and ranking) for the South Western, Eastern and Partial Eastern Relief Roads are shown in Table 2.

Table 2. Summary of Traffic Impacts of Core Strategy Scenario²

Highway Network Performance Indicator	Relief Road Option		
	South Western Relief Road	Eastern Relief Road	Partial Eastern Relief Road
Reduce town centre through trips	AM Peak: -881 trips PM Peak: -463 trips	AM Peak: -403 trips PM Peak: -88 trips	AM Peak: -98 trips PM Peak: +71 trips
Average network speeds	AM Peak: 59.3kph PM Peak: 56.6kph	AM Peak: 54.3kph PM Peak: 54.8kph	AM Peak: 51.4kph PM Peak: 47.4kph
Average network delays	AM Peak: 509secs PM Peak: 520secs	AM Peak: 555 secs PM Peak: 533 secs	AM Peak: 597 secs PM Peak: 631 secs
Average distance travelled	AM Peak: 8.4km PM Peak: 8.2km	AM Peak: 8.4km PM Peak: 8.1km	AM Peak: 8.5km PM Peak: 8.3km

Table 2 shows that the South Western Relief Road option has the most positive impact in terms of reducing town centre through trips, average speeds and average network delay. The Eastern Relief Road does not perform as well as the South Western Relief Road but does perform better than the Partial Eastern Relief Road, which is the worst option against all indicators. The reduction in town centre traffic associated with the South Western and Eastern Relief Roads provides an opportunity improve parts of the public realm in the sensitive town centre area.

2.2. Environmental impacts of the relief road options

All of the relief road options have negative environmental impacts as they introduce a new highway corridor into a previously open area and they impact upon a number of sensitive receptors. Due to the level of detail available at this stage, it is not possible recommend a best performing option in terms of environmental impacts.

A high level qualitative environmental appraisal was undertaken as part of Stage 6 of the study. The purpose was to identify the potential environmental constraints associated with each of the route options. It should be noted that full scheme information is not yet available and a consideration of noise, local air quality and greenhouse gases has not been undertaken at this early stage of scheme development. This high level appraisal was solely base on the information available at the time and no site surveys were undertaken.

² Source: Stratford-upon-Avon – Third River Crossing High Level Option Appraisal, Vectos, January 2016.

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With these caveats in mind, it is not possible to attempt to rank the best performing options in terms of environmental impacts. Instead, Table 3 provides a brief summary of the main environmental constraints associated with each option.

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Table 3. Summary of environmental constraints³

Environment Sub-objective	Relief Road Option		
	South Western Relief Road	Eastern Relief Road	Partial Eastern Relief Road
Noise	Sensitive residential receptors are located within the study area.	Sensitive residential receptors are located within the study area.	Sensitive residential receptors are located within the study area.
Air Quality	Part of the proposed route is positioned within an AQMA (Air Quality Management Area). Sensitive receptors within the study area include residential properties and Stratford Racecourse SSSI. Sensitive residential receptors are located within the study area. There will be air quality benefits in the town centre as a result of reduced traffic.	Sensitive residential receptors are located within the study area. There will be air quality benefits in the town centre as a result of reduced traffic.	Sensitive residential receptors are located within the study area.
Landscape & Townscape	The proposed route would introduce a new linear transport corridor to an open landscape. Sensitive residential receptors are located within immediate vicinity of the route alignment.	The proposed route would introduce a new linear transport corridor to an open landscape. Sensitive residential receptors are located within immediate vicinity of the route alignment. A section of this route will utilize the existing Pimlico Lane.	The proposed route would introduce a new linear corridor to an open landscape. Sensitive residential receptors are located within the study area. A section of this route will utilize the existing Pimlico Lane, B4086 Wellesbourne Road and Stratford Road.
Historic Environment	One Grade II listed building is positioned approximately 60m from the proposed route.	Ten Grade II listed buildings are positioned within the study area, of which, the nearest listed building is Hemingford House located approx. 200 m west of the proposed route. The village of Alveston has been designated as a Conservation Area (located approx. 280m away).	Nine Grade II listed buildings are positioned within the study area, of which, the nearest listed buildings, Hemingford House and the west lodge and gate of Charlecote Park are positioned approx. 20m from the proposed route.
Biodiversity	Racecourse Meadow, a SSSI is positioned approx. 20m east of the proposed route. Two LWS (Local Wildlife Site) and one pLWS (Proposed Local Wildlife Site) are crossed by the proposed route alignment.	River Avon LWS is crossed by the proposed route alignment. One pLWS is positioned immediately adjacent to proposed route.	
Water Environment	The route option crosses the floodplains of Shottery Brook and the River Avon.	The route option crosses the floodplain of the River Avon. There are three groundwater source protection zones within the study area, all of which are designated as Inner zone.	The route option crosses the floodplain of the River Avon. There is one groundwater source protection zone within the study area, and it has been designated as Inner Zone.

³ Source: Stratford upon Avon Additional Road Capacity High Level Environment Assessment, Atkins, February 2016.

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In summary, all of the options have negative environmental impacts as they introduce a new highway corridor into a previously open area and they impact upon a number of sensitive receptors. Due to the level of detail available at present it is not appropriate to recommend a best performing option on environmental grounds.

2.3. Comparison of investment costs

The South Western Relief Road is the cheapest option to construct, followed by the Eastern Relief Road. This option is more costly because of higher land costs. The Partial Eastern Relief Road costs more than the South Western and Eastern Relief Roads. Although a river crossing is not included in this option, the route is longer than the other options so more highway works are required.

Indicative capital cost estimates have been prepared for the relief road options as part of Stage 4 of this study. It is important to note that due to the level of designs of these options, a number of assumptions were required. These assumptions are detailed in a separate document⁴ and a summary of the costs (including estimated land costs which were calculated separately by WCC) are shown in Table 4.

Table 4. Summary of Investment Costs

	Relief Road Option		
	South Western Relief Road	Eastern Relief Road	Partial Eastern Relief Road
Estimated investment cost (including indirects ⁵ and contingency ⁶)	£26.06m	£25.81m	£35.27m
Estimated land cost ⁷	£3.32m	£9.45m	£4.94m
Total estimated Investment Cost	£29.38m	£35.26m	£40.21m

The South Western Relief Road is the cheapest option to construct, followed by the Eastern Relief Road. This option is more costly because of higher land costs. The Partial Eastern Relief Road costs more than the South Western and Eastern Relief Roads. Although a river crossing is not included in this option, the route is longer than the other options so more highway works are required.

2.4. Cost benefit analysis results

The South Western Relief Road delivers the highest BCR (over 8) as it is the cheapest scheme to deliver and it delivers the most monetary benefits through improvements to journey times.

The Eastern Relief Road also demonstrates high value for money with a BCR of 5.

The Partial Eastern Relief Road has a BCR close to zero due to the lack of benefits delivered by this scheme which demonstrates that this option is poor value for money.

⁴ Stratford-upon-Avon Road Capacity Options, Feasibility Estimate, Faithful and Gould, February 2016.

⁵ Indirects include preliminaries (20%), design (10%) and client costs (10%).

⁶ An uplift factor of 30% has been applied for estimating uncertainty due to the level of design of the scheme options.

⁷ Land Costs provided by WCC.

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A cost benefit analysis was undertaken as part of Stage 5 of the study⁸ to determine the economic costs and benefits arising from the relief road options. The assessment has been undertaken using the Core Strategy scenario model outputs as this is now the most likely option following the adoption of the Core Strategy in July 2016.

The economic analysis results have been presented in Table 5 using the following indicators:

- Present Value of Costs (PVC) – Is a term used in cost benefit analysis that refers to the discounted sum, or present value of a stream of costs associated with a project or proposal. This explains why the present value of costs in Table 5 is different to the investment costs in Table 4.
- Present Value of Benefits (PVB) – As with the costs, but for a stream of benefits.
- Benefit to Cost Ratio (BCR) – This is the ratio of the benefits expressed in terms of present value (PVB) divided by the costs also expressed in terms of present value (PVC).

Table 5. Summary of economic assessment results⁹

Economic Indicator	Relief Road Option		
	South Western Relief Road	Eastern Relief Road	Partial Eastern Relief Road
Present Value of Costs (PVC)*	£21.51	£25.97	£29.68
Present Value of Benefits (PVB)*	£173.08m	£138.93m	£-2.13m
Benefit to Cost Ratio (BCR)	8.04	5.35	-0.007

* 2010 prices discounted to 2010.

Table 5 shows that the South Western Relief Road delivers the highest BCR (over 8) as it is the cheapest scheme to deliver and it delivers the most monetary benefits through improvements to journey times. The Eastern Relief Road also demonstrates high value for money with a BCR of 5. The analysis shows that the Partial Eastern Relief Road has a BCR close to zero due to the lack of benefits delivered by this scheme which demonstrates that this option is poor value for money.

2.5. Alignment with proposed local transport objectives

The South Western Relief Road and Eastern Relief Road align most with the transport objectives because they are predicted to reduce the amount of through traffic using the town centre. They also provide the additional capacity needed to provide network resilience. The Partial Eastern Relief Road is not predicted to reduce through trips and does not substantially increase the highway network capacity.

⁸ Third River Crossing High Level Option Testing, Economic Assessment, Vectos, 7th July 2016.

⁹ Key assumptions: Opening year assumed to be 2021. Traffic growth capped at 2036 since the National Trip End Model (NTEM) does not at this stage assume any growth beyond this period. Assessment period constrained to 30 years. Accident and maintenance costs have not been included within the assessment at this time.

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The local transport objectives developed specifically for Stratford-upon-Avon as part of Stage 1 of this study¹⁰ are contained in Table 6 below, together with a brief summary of how each scheme aligns to the objectives. Due to the amount of information available at present, it is not possible to undertake a RAG assessment to rank the performance of the schemes against all of the objectives listed.

Table 6. Summary of Relief Road Alignment with Objectives

Objective		Relief Road Option		
		South Western Relief Road	Eastern Relief Road	Partial Eastern Relief Road
1	Reduce Stratford-upon-Avon town centre through trips	Traffic modelling shows that this option reduces more town centre through trips than the other relief road options.	This option does reduce through trips, but has less of an impact than the South Western Relief Road option.	This option makes little difference to the number of town centre through trips.
2	Protect the historic core of Stratford-upon-Avon and support the visitor economy	This provides greater opportunities to protect and improve the historic core of the town centre, thereby improving the visitor experience.	It will still therefore provide future opportunities to improve the town centre.	The opportunities to protect and improve the historical core of the town centre are therefore more limited.
3	Provide increased resilience to the transport network with regard to unplanned network incidents including flooding	By providing an additional crossing over the River Avon, both of these options provide an alternative route for through traffic in the event of an incident in Stratford-upon-Avon town centre. This will increase the resilience of the highway network to deal with unplanned incidents.		The South Western and Eastern Relief Roads provide completely new routing options (together with additional cross river capacity). The Partial Eastern Relief Road only improves an existing route, so its ability to improve the resilience of the network is more limited.
4	Reduce high car dependency for travel to work trips and school trips	In isolation, none of the relief road options are likely to have an impact on reducing car dependency. Although any the reduction of traffic in Stratford town centre does present opportunities to introduce demand management measures which may reduce the attractiveness of the town centre for car users.		
5	Reduce the negative environmental impacts of transport, particularly on the Stratford-upon-Avon AQMA	The route is partially within the Stratford-upon-Avon AQMA However, it is also the most effective option for reducing trips within the town centre which contains the greatest concentration of sensitive environmental receptors.	The route runs outside the Stratford-upon-Avon AQMA and reduces trips within the town centre.	The route is outside of the Stratford-upon-Avon AQMA. However, it has little impact on the amount of traffic using the town centre.

¹⁰ Stratford-upon-Avon Additional Road Capacity – Evidence Review, Atkins, May 2016.

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The South Western Relief Road and Eastern Relief Road align most with the transport objectives because they are predicted to reduce the amount of through traffic using the town centre. They also provide the additional capacity needed to provide network resilience. The Partial Eastern Relief Road is not predicted to reduce through trips and does not substantially increase the highway network capacity. None of the schemes have a direct impact on reducing car dependency, but the South Western and Partial Eastern Relief Road do provide opportunities to undertake more substantial traffic management measures in the town centre. The schemes have not been ranked against the environmental objective due to the amount of information available at this time.

3. Summary

The findings from this study show that the **South Western Relief Road performs better than the Eastern Relief Road and Partial Eastern Relief Road** because:

- It provides the most benefits for Stratford-upon-Avon town centre in terms of traffic reduction. This increases the possibilities for potential demand management and associated public realm improvements in the town centre.
- It's the cheapest option to deliver (based on a high level cost estimate).
- It delivers the most economic benefits in terms of journey time / delay savings.
- It therefore has the most favourable BCR which means it will be easier to build a more compelling business case to secure funding.
- Compared to the Eastern Option, it requires the construction of less new carriageway.
- It integrates well with the West of Shottery Relief Road which is a committed scheme and completes a western bypass of the town centre.

It should be noted that **the Eastern Relief Road Option still performs well against the indicators measured in this study. However, it is clear from the work undertaken to date that the South Western Relief Road performs better with the forecast travel demand patterns expected from the Core Strategy housing and employment allocations.** The Eastern Relief Road could be considered at a later date to accommodate any future growth over and above that already committed as part of the Core Strategy.

The Partial Eastern Relief Road does not address the key issue in the Stratford District which is the lack of cross river capacity, thereby limiting its ability to reduce the amount of through trips in Stratford town centre. The length of the route means that it is also likely to be more expensive to construct than the other options.