- Effect of roadworks during construction based on QUADRO indicative values. This is detailed more below.
- Notional major maintenance of £10million included.
- Optimism bias of 15% - 'conditional approval' level. The optimism bias has been assumed to be allocated to the public purse, with the developer contribution assumed fixed.
- GDP adjustment to 2010 prices (undiscounted) (for TUBA) taken from WebTAG data book.
- Stage of preparation (for TUBA) noted as Public Consultation.
- Sunk costs are excluded and deemed subsumed into normal council operations (as per WebTAG A1.2 Scheme costs).

Other

- Noise and air quality not monetised (see below).
- Simplified COBALT exercise undertaken (see below).
- Dependent housing. Detailed more below.

4.3.1 TUBA modelled periods

The AM and PM peak hour models have each been assumed to be representative of 120mins. Journey time data of current conditions was investigated to check that this is reasonable. Whilst there are elements of 'peakiness' in some movements, overall the assumption is sufficiently robust. In addition, as previously mentioned, the skims were created including part of the model pre-load to be more representative.

4.3.2 Dependent housing

Consideration has been given to how best address the appraisal of dependent housing. As the required basis the four steps in WebTAG A2.3 were investigated. It seemed appropriate to adopt a simpler approach.

The Sturry/ Broad Oak development being delivered in tandem with the scheme is regarded as dependent housing. The other sites have been assumed as non-dependent.

This is only an appraisal assumption and not a basis of any planning considerations.

4.3.3 Roadworks during construction

It is accepted that roadworks during construction, could be considered as part of appraisal. This could either be by use of QUADRO, more historically or for the SRN; or the 'active' congested assignment package, in this case VISSIM. However for this scheme the large proportion of the construction works will be offline to the existing network. Furthermore the ongoing maintenance will be absorbed into KCC's on-going asset management.

Consideration was given by reference to DMRB Volume 14 and TAG A1.3 (section10). It is worth noting that this process is neither a go/no-go nor a route sifting exercise.

KCC understand the importance of minimising the delay and need to consider the elements of the design particularly:

- On the western side of the area, there is a new roundabout on the A28 Mill Road (disruption to a link flow of 20,000vpd)
- On the eastern side, there is the signalising the A28/A291 junction; and adding the A291 links to the link road.
- Adding Broad Oak Link
- Minimising increased use of Shalloak Rd
- Working with Stagecoach to ensure smooth running of bus services.
- Working with Network Rail / proximity to level crossing.

A possible approach could be to complete the link road between A291 and Mill Rd, removing the A291 inbound traffic from the level crossing area, and then complete the A28 Island Rd connections to the link road.

It will also be important to coordinate any shuttle working with the level crossing down-time, and to a lesser extent the pedestrian crossing; and to ensure there is no blocking back caused by hampered right-turns due to queued traffic (e.g. the right turns for inbound traffic into the industrial estates on Mill Rd could be blocked by outbound queuing in the shuttled working).

For this scheme it has been deemed reasonable to apply an estimate using representative values from QUADRO. Six months of shuttle working has been assumed. Although there is potential for reassignment, via the alternative route, this has been dismissed as it assumed KCC would not encourage that approach. Whilst it may be better from a travel time perspective it could encourage more accidents.

4.3.4 On-going maintenance

It is generally assumed that the maintenance of the link road will be subsumed into KCC's ongoing network asset management. However, a major re-surfacing has been included in the TUBA run. This was assumed at £10 million.

4.3.5 Noise and air quality

There is a change in alignment of the transport corridor. However it is noted that this is alongside the existing rail corridor; and will not detrimentally affect many residential properties. Some impact is likely to Greenfields (Shooting school) and the Telephone Exchange on the A291, and the industrial area on the A28.

Environmental consultants will be involved with the design process for both the KCC scheme and the development site, but at this stage no further appraisal of noise and air quality is included. If deemed necessary an updated business case will include these aspects.

There is an expectation that the overall change will be broadly beneficial with the improvements through Broad Oak village.

4.4 Scheme Options Considered

Whilst the economic appraisal will be limited to the 'preferred' option this section gives an overview of the sifting of options.

4.4.1 Option 1: Do Nothing

Description

Current situation

Conclusion

Option 1: Not relevant for appraisal, as excludes committed interventions and growth. Confirms 'the case for change'.

4.4.2 Option 2: Do Minimum

Description

Background growth, excluding dependent development, is applied to current network and other committed interventions.

This could include converting A291 / Sweechgate junction to a roundabout.

Advantages

- No need for scheme funding.
- Addresses accident cluster at A291/Sweechgate.

Disadvantages

- Existing situation likely to worsen and dependent housing not delivered.

Conclusion

Option 2: Not carried forward, but used as 'baseline' for appraisal.

4.4.3 Option 3a: Do Something (Low-cost options 1)

Description

Public transport and active modes interventions. Includes Demand Management/Smarter choices.

Advantages

- Possibility of lower cost and promotes the sustainability agenda.

Disadvantages

- This would be insufficient for the highway network in this area. Such options would be part of 'locking-in' the benefits of a highway scheme. There is a focus on enhancing the use of park and ride in conjunction with a highway scheme.

Conclusion

Option 3a: Rejected

4.4.4 Option 3b: Do Something (Low-cost options 2)

Description

Modifications to current network

Advantages

- Possibility of a lower cost option.

Disadvantages

- This would be insufficient for the highway network in this area and would be detrimental to the growth aspirations.

Conclusion

Option 3b: Rejected

4.4.5 Option 4: Do Something (Sturry Link Road without Broad Oak Link)

Description

Bridge over railway to bypass mainline traffic using Sturry Level Crossing. This would be in the viaduct from as identified in 3.7

Advantages

- Provides a highway network which can deliver local plan sites.
- Reduces vehicle flow over level crossing and through village; improving journey quality for cyclists, pedestrians, and local traffic.
- Reduces delay to vehicles through Sturry.
- Improved air quality in village.
- Reduced rat-running through Broad Oak.

Disadvantages

- Some landscape and environmental impact.
- Risk of funnelling too much traffic into a downstream capacity point at Vauxhall Rd.

Conclusion

Option 4: Extended to Option 5, after modelling exercise

4.4.6 Option 5: Do Something (Sturry Link Road with Broad Oak Link)

Description

As Option 4 but with additional link.

Advantages

- Provides a connection from the link road to a secondary parallel route into Canterbury. This allows traffic to cross Vauxhall Rd at the northern roundabout and use a parallel route through the urban area, rather than funnelling all A28 traffic through the southern roundabout. This should also reduce 'rat-running' through Broad Oak even further; as the alignment becomes the best route for more destinations in the urban area.

Disadvantages

- Cost due to increased new highway infrastructure and engineering requirements.

Conclusion

Option 5: Preferred

4.4.7 Option 6: Do Something (Broad Oak Link south of railway)

Description

As Option 5 but with additional link south of railway.

Advantages

- Possibilities of closure of level crossing.

Disadvantages

- Excessive cost due to either second railway crossing, or additional link being built as a viaduct over flood plain.

Conclusion

Option 6: Rejected

Options 4 and 5 also have variations including a wider bridge structure to accommodate potential road space for a bus lane, and potentially a dedicated approach to the park-and-ride. The design is proceeding assuming this extra width, and the costs have included the additional items (circa £2m).

Table 4-1 gives a summary of the above review of scheme options, in terms of the objectives and critical success factors for the scheme:

Table 4-1 - Summary of Scheme Option Assessment and Sifting

Reference to:	Option 1/2	Option 2	Option 3	Option 4	Option 5	Option 6
Description of Option:	**Do Nothing**	**Do Minimum**	**Low-cost options**	**Sturry Link Road**	**Sturry Link Road with Broad Oak Link**	**Broad Oak Link south of railway**
Improve operation of transport system	×	×	×	✓	✓✓	✓✓✓
Remove poor elements of existing layout	×	✓ **(partial)**	×	✓	✓	✓
Provide transport system which can deliver local plan	×	×	×	✓	✓	✓
Affordable finance	✓	✓	✓	✓	✓	×
Summary	**Reference**		**Discounted**	**See Option 5**	**Preferred**	**Discounted**

4.5 Economic Case Content and Method

The appraisal criteria for the scheme and the overall approach used to assess these are as shown in **Table 4-2**.

Table 4-2 – Appraisal Criteria for Assessing Core Scheme Performance

Appraisal Criteria	Direct/ Indirect Impact Appraisal	Approach Used to Assess Core Scheme Performance Items
Journey time savings	Direct	VISSIM modelling to feed TUBA
Improved layout and journey perception	Indirect	Qualitative
Wider Economic Impacts	Indirect	Ensuring viable transport strategy for emerging local plan

The Economic Case for this scheme is focused on:

- Assessing the direct, localised, economic efficiency and prosperity benefits of the scheme.
- Qualitatively appraising the wider scheme benefits, in terms of enabling planned developments and other major transport schemes in the area and complementary sustainable transport schemes.
- Offsetting the scheme benefits against the direct scheme capital costs, (i.e. construction costs, not accounting for the costs of any complementary investments).

As set out in the Strategic Case, this scheme will be important for supporting the development of jobs and housing in the local area. For the purposes of this scheme, the direct employment benefits (i.e. people employed in constructing the scheme) have not been calculated, although these may be assessed as part of the direct jobs generated by the LGF programme as a whole.

As previously highlighted, the economic appraisal has been undertaken against only two options:

- Do Minimum - reference case with the scheme not delivered; and
- Do Something - with delivery of the proposed scheme option.

4.6 Preferred Scheme Option

The link road with an additional link to Broad Oak, north of railway, has been selected as the preferred option, and a brief commentary highlights the reasons.

Operational – This option maintains the use of two corridors of traffic towards the City Centre. This is understood to be the basis of successful network operation. This routing is illustrated in Figure 4-2.

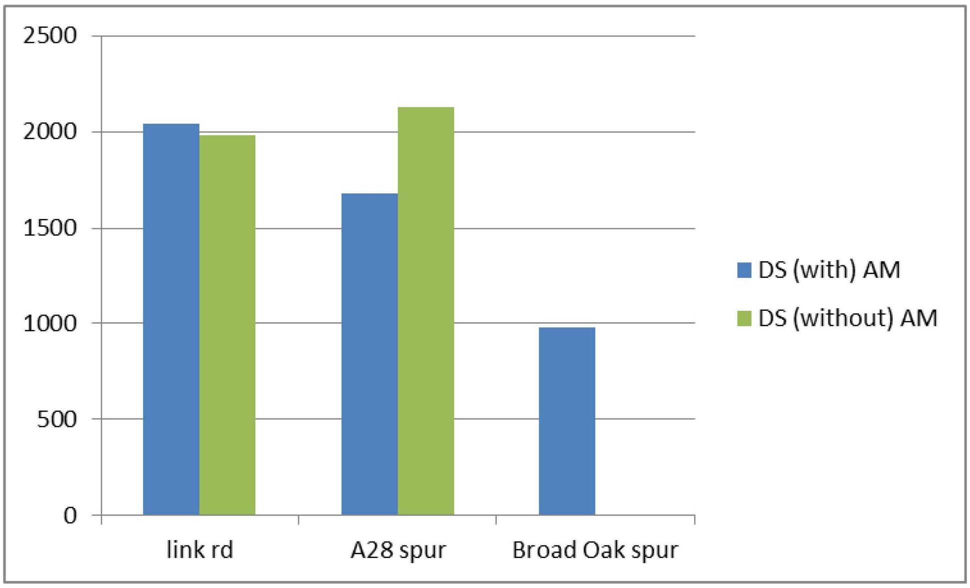

Figure 4-2 Flow comparison with/without additional link

Cost – Avoids excessive costs of a link to the south of a railway that would incur from either a second bridge or viaduct structure.

Objectives – In conjunction with other measures, can help deliver necessary infrastructure for delivering local plan. The scheme is also complementary to sustainable transport objectives.

4.7 Scheme Option Localised Performance

This section summarises the predicted performance of scheme options to understand the scheme layout's fitness for purpose.

Table 4-3 compares localised scheme performance against the do minimum. This is reported as vehicle hours which work as a proxy for journey time savings through the study area.

Table 4-3 – Localised Scheme Performance Compared with Do Minimum Reference Case

Scenario	Key Performance Indicators	Unit	AM	PM
Do-Minimum (opening year)	Performance indicators for Congestion Relief road schemes (VISSIM total hours)	Veh-hrs	858	975
Do-Something (opening year)			778	982
Do-Minimum (forecast year)			1314	1652
Do-Something (forecast year)			1099	1411

The scheme has a more beneficial effect in the opening year on the AM situation, noting the PM is broadly neutral at this point. This is in-line with expectations due to the nature of the pinch-point at the A28/A291 junction. The inbound traffic, higher with the AM tidality, has a give-way requirement from the A291 that is not extant for the outbound.

In the forecast year, with the additional growth, both time peaks show benefits.

4.8 Scheme Performance Risk and Outcome Sensitivity

It should be noted that the current scheme design has a limitation with regard to a new signalised junction to replace the current A28/A291 junction. With the current proposal there is potential blocking back on the old A28 over the level crossing to the extent that traffic is hindered reaching the new link road when the level crossing is in operation (illustrated as Figure 4-3). This blocking back prevents use of green time at the new signals at the A28/A291 junction. Due to the tidality this is more pertinent in the AM, and leads to an underestimate of benefits.

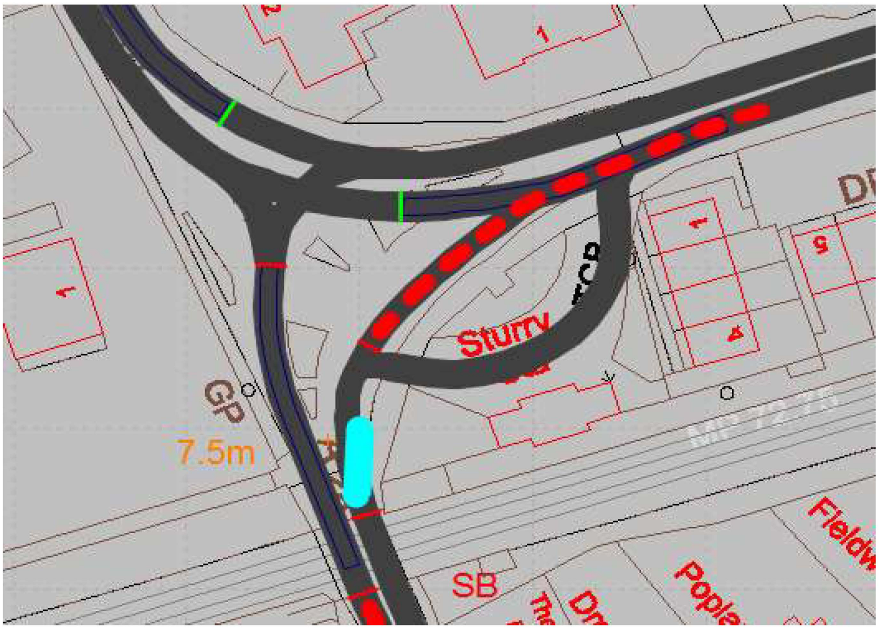

Figure 4-3 Design limitation

This limitation manifests in both the modelling and the design.

In the modelling the driver behaviour does not update, in terms of routing, if the driver is trying to use the old A28 instead of the new link road.

In the current design the stacking capacity is only about five vehicles. If either the stop line can be moved closer to the railway, albeit at some detriment to buses, or a longer flare can be introduced then greater benefits will ensue.

Further investigation is currently being undertaken by KCC and Amey to identify an optimal solution at this junction to eliminate/reduce this limitation.

4.9 Accident Appraisal

A small COBALT exercise was undertaken to ascertain potential accident benefits. This was kept to a simple spreadsheet exercise to determine the inputs, with link flows approximated to AADT. This was based on Option 4 which can be reasonably used as a simplification of the preferred option. This network has also kept distance neutral between origin-destinations; and assumed that the Vauxhall Rd roundabouts would be unchanged in combined accident terms.

The exercise has only been done as an approximation due to the limitation of assessing the benefits of reducing traffic crossing the level crossings, which in the coding were assumed to be junctions. Some of the smaller conflict points, local access points and Fordwich Rd, have been ignored. In addition user-inputs were used to reflect the accident cluster at Sweechgate and on the alternative route.

The breakdown and the simple network representation is given in Appendix D.

The results give evidence for a small uplift in the PVB/BCR, but not a greatly meaningful difference. A working value of circa £0.75m as an uplift to the PVB is stated. However, due to the possible variability of this small number it is not being included in the initial BCR.

This result being only slightly beneficial is logical, as there are benefits from traffic being on better highway infrastructure offset against the traffic using more junctions.

4.10 Other Social / Distributional Impacts

Social and distributional impacts have been given an appropriate consideration. It is noted that the scheme is assumed to have minimal impacts. As a predominantly highway scheme certain impacts are largely ignored, such as personal security and personal affordability.

Social impacts are summarised in the Appraisal Summary Table (AST) as per usual. It was felt unwieldy to add an extra Appendix for a distributional impacts pro-forma, keeping relevant comments in the narrative and in the AST.

Two points are worth highlighting. Firstly, there is the potential benefit from a more reliable bus service; noting bus users are often in the low income groups. This would be further enhanced by improvements to Sturry station and the surrounding bus stops; becoming more in keeping with a public transport hub/interchange. Secondly, traffic flow will be moved away from the local pedestrian / cycling movements in Sturry. This should provide a safer, more pleasant environment.

4.11 Appraisal Summary Table

A qualitative / quantitative assessment of predicted scheme performance against WebTAG appraisal criteria has been completed using an Appraisal Summary Table (AST) which is attached as Appendix B.

For this highway scheme a quantitative measure has been calculated for travel time savings (TUBA). In addition a small potential uplift for accident savings (COBALT) is noted. There are also qualitative statements for other key items.

4.12 Present Value Outcomes from Economic Appraisal

Table 4-4 shows summary of AMCB based on the TUBA results. As recommended in WebTAG (A2.3) benefits of dependent housing are not included in the AMCB.

Table 4-4 – Summary of Analysis of Monetised Costs and Benefits

Scheme Summary Analysis of Monetised Costs and Benefits (Present values and prices)	
Net Outcome for: **Do-Something Preferred Scheme minus Do Minimum**	**Present Values (£ 000s)**
User Present Value Benefit (PVB)	57,415
Capital Present Value Cost (PVC)	25,077
Scheme Net Present Value (NPV) = PVB - PVC	32,338
Scheme Initial Benefit to Cost Ratio (BCR) = PVB/PVC	2.3

4.13 TUBA output (results and warnings)

As the benefits of the scheme are derived from the TUBA run, some additional comments are given.

The TUBA warnings have been investigated. Although this is not necessarily required, as 'rule of a half' violations do not apply for fixed matrices, they were useful to check modelling results were credible.

It is noted that for this exercise we are looking at a 'large scheme in a small network' so it is likely to be less sensitive to model convergence. Modelling results can be supplied.

As indicated from the vehicle-hours quoted earlier, the AM peak is initially deriving the higher benefits. The time periods become comparable in the later year, although it has been noted that the AM is likely to be underestimated. The pattern of the benefits is shown in Figure 4-4.

The disaggregation of the benefits has been inspected for anomalies and credibility. The number of zones was small enough to use the zones as sectors in TUBA.

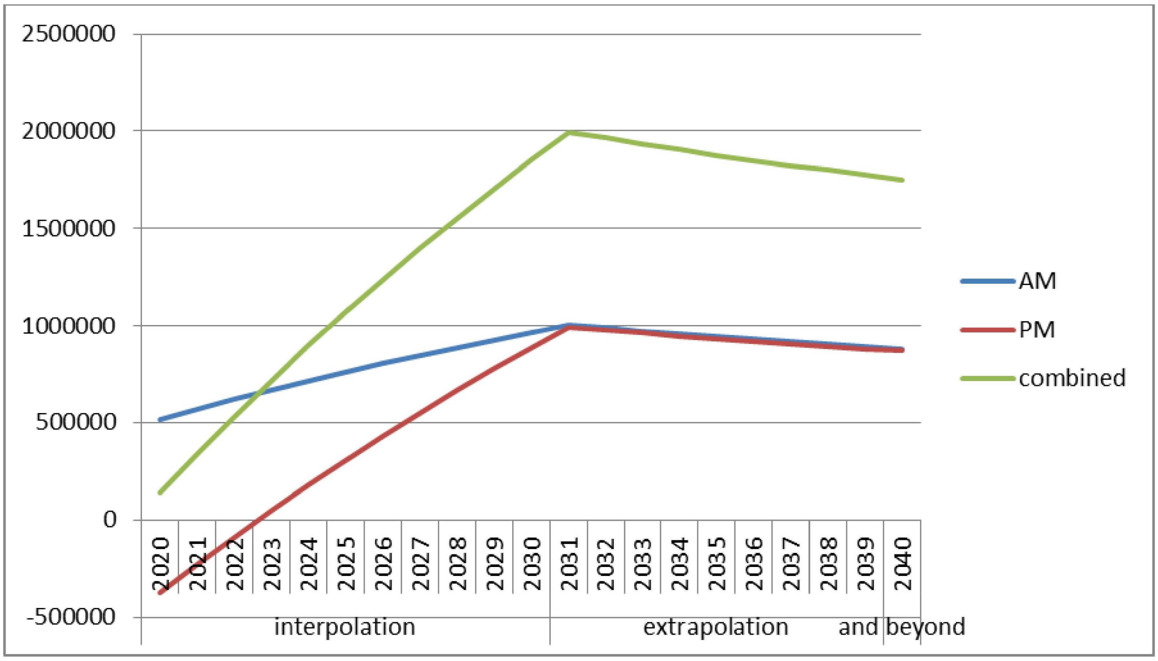

Figure 4-4 Benefits over years

4.14 Sensitivity testing

Sensitivity testing was undertaken with regards to the TUBA modelled hours, and the level of optimism bias.

TUBA modelled hours:

Whilst the use of each of the peak hours to represent two hours seems reasonable including reflecting off-peak and weekend, a sensitivity test was undertaken for both by decreasing to 1½ hours and increasing to 2½ hours. The BCR varies from 1.4 to 3.2. Even though the BCR would be only 1.4 if the benefits would only accrued for the lower modelled hours, this excludes other monetised benefits that would enhance the BCR, such as accident benefits. Furthermore no planning gain is included in the BCR at this stage.

Optimism bias:

The costs are relatively well developed, and still include a sizeable risk allocation (this is discussed in the Financial Case). Therefore the 15% optimism bias used is deemed robust. However a sensitivity test of 44% was undertaken reflecting a BCR of 1.5. Once again the aforementioned additional benefits, which would increase the BCR, should be considered. Therefore extreme cost escalation does not diminish the value for money of the scheme.

4.15 Planning Gain / TEC

As previously mentioned, planning gain can be quantified but should not be included in the AMCB. The assessment can, however, be drawn into the 'value for money' statement. This is step 4 in the WebTAGA2.3 – dependent housing assessment.

A simple approach has been used to quantify both the planning gain from the 1,000 dependent houses and to offset the Transport External Costs (TEC). The housing included is consistent with the dependent housing assumption.

The WebTAG worksheet for calculating impact of housing has calculated the planning gain, and TECs calculated using the Marginal External Cost Method. Rather than extracting from the model output, which would have constrained additional vehicle kilometres to the network, a first principle has been undertaken assuming the development trips have a measurable impact for 5 km.

The results are:-

- Planning gain : £23m (Slight beneficial)
- TEC : calculated as £11m.
- Net Panning Gain: circa £12 million.

As it is a relatively low number of houses, it is not surprising that both the planning gain and the TECs are of a low order of magnitude.

4.16 Adjusted BCR / Value for Money Statement

An initial BCR was calculated as 2.3 based on the TUBA results. As a highway scheme this is mainly journey-time savings based. It is noted that noise and air quality disbenefits have not been monetised and the COBA-LT results have not been included. The initial BCR suggests a high value-for-money.

In terms of an adjusted BCR there are three key components, wider impacts and dependent development, journey reliability and environmental (landscape and ecology).

It has not been seen necessary to adjust the BCR but the three items are reaffirmed as part of the VfM statement.

A planning gain would be generated from the 1,000 houses of around £23m which would enhance the BCR. A simple, and relatively pessimistic, approximation of TECs suggests only accruing 50% of the planning gain. This gives further surety of the BCR translating, with other considerations, to a high value for money.

For this scheme, there are two elements to journey time reliability. Firstly there is the general variability caused by congested conditions. Secondly there is the specific pattern of the level crossing. In terms of the adjusted BCR, the first point can be addressed by a small uplift in the travel time savings, with the 5% suggested in 'Value for Money Assessment: Advice Note for Local Transport Decision Makers' seeming reasonable (a ready-reckoner calculation, based on WebTAG A1.3, is also in this order of magnitude, if not higher). The second point, about the level crossing, is noted as an additional unquantified benefit, with fewer users being impeded by the level crossing.

In terms of environmental impacts, the scheme does require some land-take but this is generally alongside the existing railway. There will also be some visual intrusion due to the bridge structures. However this is near an industrial area and will not be a severe negative impact. In addition, there are no significant ecological impacts noted. The wider impact of the development side is not part of this report; being commensurate with the site's planning application and the Canterbury local plan.

There are some other beneficial factors which should be mentioned. The scheme could facilitate a greater number of trains as more level crossing 'downtime' might be achievable. Also, as mentioned, in the SDI there are possible bus user benefits both in terms of access and journey time.

4.16.1 Overall VfM Category

Overall Final VfM Category (considering risk and sensitivities): High

This category considers the points covered in this report, including the initial and adjusted BCRs. It is a balanced view which considers both disbenefits, such as non-monetised environmental factors, and positive points such as the possibility of additional benefits from improved design.

5 Financial Case

5.1 Overview

The Financial Case for the *Sturry Link Rd* gives an itemised breakdown of the expected project cost components and the time profile for the transport investment. It considers if these capital costs are affordable from public accounts at the times when the costs will arise. It also identifies where contributions of anticipated funding will be obtained, to meet the scheme costs and it assesses the breakdown of funds between available sources and by year and considers how secure these funds are likely to be. Finally, it reviews the risks associated with the scheme investment and examines possible mitigation.

5.2 Project Costs

This section considers the capital costs associated with the proposed scheme investment. This is for the viaduct option as identified in 3.7.

5.2.1 Scheme Elements

The 'combined' scheme is in four notable parts :

1) The bridge over the railway (the LEP scheme) £28.5 million.
2) The new network through the developer controlled site. This is developer funded, comprised of three links of £8.5m, £3.5m and £2m.
3) The new signalised junction £1.1 million.
4) The additional link (as described in Option 5) £4.1 million. This is an extension to the network the developer is providing.

For consistency with the modelling and appraisal, all four elements have been included in the costing of the 'scheme' in the *Economic case*.

It is noted that part 2 (and the additional link - part 4) is, to a large extent, a scheme by itself. This is being delivered by the developer of the 1,000 houses, previously described as the dependent housing, as the access road for the site. This will then be adopted by the county council to complete the link road with the other elements. This wider planning implication is not considered further here. It is considered further in the *Management case*.

Developer contribution consists of both delivering portion 2 and a contribution towards 1, 3 and 4. As will be clarified the developer is expected to pay for the balance of the costs excluding the LGF contribution.

5.2.2 Breakdown of Project Costs

Table 5-1 shows the itemised breakdown of scheme capital costs, including both construction costs and other costs for the KCC elements. These were provided by KCC's cost consultants and are in correct for 2016. The construction costs are further itemised in Appendix E. The key divisions of the cost are shown in Figure 5-1. The costs for the developer's network are not included here.

The itemised elements (Appendix E) consider the implications of both working with Network Rail and construction in a floodplain/riparian environment. This reflects the acknowledged engineering challenges and the liaison with Network Rail and Environment Agency as highlighted in 3.7.