Coast to Capital Local Transport Body
Application Supporting Document

West of Horsham Transport Package

Prepared for
West Sussex County Council

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CH2MHILL®

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Contents

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Acronyms and Abbreviations

BRES	Business Register Employment Survey
CBA	Cost Benefit Analysis
CBR	Cost Benefit Ratio
C2C LEP	Coast to Capital Local Enterprise Partnership
C2C LTB	Coast to Capital Local Transport Body
DfT	Department for Transport
EAST	Early Assessment and Sifting Tool
FUR	Functional Urban Regions
GIS	Geographic Information Systems
GVA	Gross Value Added
IMD	Index of Multiple Deprivation
LSOA	Lower Super Output Area
O&M	Operation and Maintenance
ONS	Office for National Statistics
PCU	Passenger Car Unit
PM10	Particulates
PT	Public Transport
PVB	Present Value Benefits
PVC	Present Value Costs
RFC	Ratio of Flow to Capacity
SDG	Steer Davies Gleave
SEP	Strategic Economic Plan
SNCI	Site of Nature Conservation Importance
TEMPro	Trip End Model Presentation Program
WebTAG	Web Transport Analysis Guidance
WSCC	West Sussex County Council

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1. Executive Summary of West of Horsham Package and Benefits

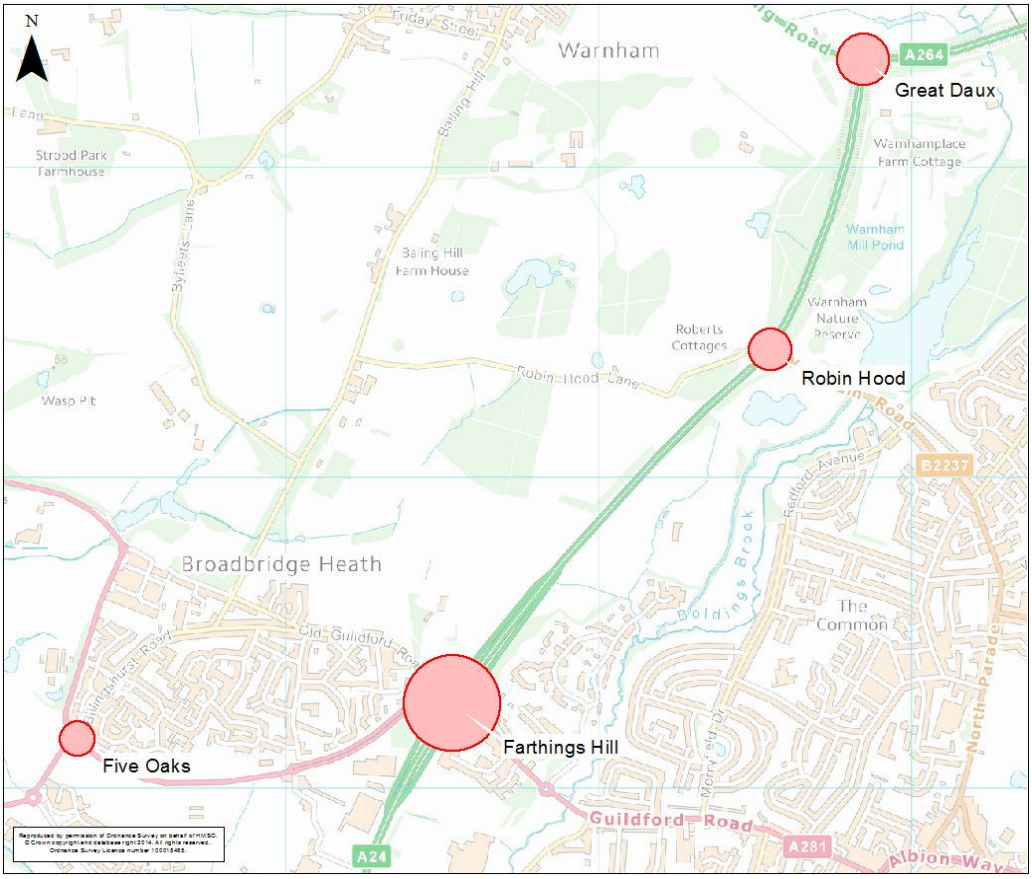
This report is a supporting technical annex for a funding application to the Coast to Capital Local Transport Body (C2C LTB) for the West of Horsham Transport Package. It sets out the policy context and the benefits and costs associated with the schemes that make up the package. The key points from the report are summarised below:

West of Horsham Transport Package

The West of Horsham Transport Package is identified in the Coast to Capital Local Enterprise Partnership (C2C LEP) Strategic Economic Plan (SEP) as a key package of schemes to support the housing and economic development. Funds have been secured for the Package in the SEP. There are four schemes that make up the package (see Figure 1):

- Farthings Hill Interchange
- Five Oaks Roundabout (including traffic management and speed reduction measures within Broadbridge Heath & to the north on the Warnham Lanes)
- Great Daux Roundabout
- Robin Hood Roundabout

Figure 1 - West of Horsham Transport Package



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The **Farthings Hill Interchange and Five Oaks** schemes are linked to the wider delivery of the 2,000 homes West of Horsham development. Construction of a new grade-separated junction on the A24, the Broadbridge Heath Relief Road and replacement footbridge is currently underway, due to be completed in late 2015. The new infrastructure provides an opportunity to address connectivity and severance issues between Broadbridge Heath and Horsham, especially for pedestrians and cyclists.

At Farthings Hill Interchange, this will be achieved by providing Toucan crossings and shared use paths which will improve connectivity of the existing footway/cycleway through the interchange.

At Five Oaks Roundabout, the existing A264 Broadbridge Heath Bypass will be declassified into a local distributor road and the northern arm C192 Billingshurst Road will be removed from the roundabout and relocated to a new junction off the declassified part of the A264. As an additional measure to discourage through traffic using Broadbridge Heath as a shortcut between the A281 Guildford Road and the A24. Traffic calming will be put in place on the junctions of C192 Warnham Road and Guildford Road with Billingshurst Road.

The **Great Daux Roundabout** and **Robin Hood Roundabout** schemes are linked to the delivery of the 2,500 home North of Horsham development. Both junctions are located on the strategic A24 and both currently experience congestion and delay. The Horsham District Transport Study[1] which assessed the impact of forecast strategic development and background traffic growth up to 2031 concluded that both junctions would require mitigation.

At Great Daux, additional entry lanes and signal control on all approaches are proposed whilst at Robin Hood, two additional entry lanes and signal control are on the A24 and Warnham Road approaches.

Table 1 provides a summary of the costs associated with each scheme. WSCC are seeking 75% funding from the C2C Local Transport Board with the remaining 25% match funded through S106 contributions.

Table 1 West of *Horsham Transport Package – Cost and Funding Summary*

Scheme	Cost Details	Costs	C2C LEP	S106
Farthings Hill	Base cost in 2014 prices (includes 15% optimism bias)	£ 1,416,765	£ 1,062,574	£ 354,191
Five Oaks	Base cost in 2014 prices (includes 15% optimism bias)	£ 842,062	£ 631,547	£ 210,515
Broadbridge Heath Traffic Calming	Base cost in 2014 prices (includes 35% optimism bias)	£ 270,000	£ 202,500	£ 67,500
Warnham Lanes Traffic Calming	Base cost in 2014 prices (includes 35% optimism bias)	£ 148,500	£ 111,375	£ 37,125
Great Daux	Base cost in 2014 prices (includes 20% optimism bias)	£ 870,800	£ 653,100	£ 217,700
Robin Hood	Base cost in 2014 prices (includes 20% optimism bias)	£ 640,376	£ 480,282	£ 160,094
	Package costs in 2014 prices	**£ 4,188,503**	**£3,141,378**	**£ 1,047,125**

[1] Horsham District Transport Study (WSCC, 2014)

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Transport benefits

Combined Transport Package Benefit Cost Ratio

Table 2 provides a summary of transport outputs from the transport benefits appraisal for the four schemes that make up the Horsham Transport Package. Please note that for appraisal purposes, the Present Value Costs (PVCs) presented have been discounted to 2010 prices.

Table 2 - West of Horsham *Benefit Cost Analysis summary*

Scheme	PVB	PVC	BCR
Farthings Hill	-£15,371,225	£1,029,559	-14.9
Five Oaks + Traffic Calming	-£3,570,116	£916,047	-3.9
Great Daux	£320,566,507	£632,808	506.6
Robin Hood	£322,653,586	£465,359	693.3
Package Total	**£624,278,752**	**£3,043,774**	**205.1**

Contribution to C2C SEP

Table 3 provides a summary of linkage between the five transport themes in the C2C LEP SEP and the proposed four schemes that make up the Horsham Transport Package:

Table 3 – Horsham Transport Package – Policy linkage summary

C2C LEP SEP Transport Themes	Farthings Hill Roundabout	Five Oaks Roundabout + Traffic Calming	Great Daux Roundabout	Robin Hood Roundabout
Connectivity	✓	✓		✓
Reliability	✓		✓	✓
Capacity			✓	✓
Quality	✓	✓	✓	✓
Resilience			✓	✓

Farthings Hill Interchange

The monetisation of the journey time benefits generates a PVB of **-£16,009,768** (over a 60 year period).

The proposed signalisation of Farthings Hill will reduce the average cost per accident by **£6,650**. Over the 60 year analysis period this equates to a PVB of **£635,544**.

The BCR for the Farthings Hill scheme has been calculated to be -**14.9:1**. The negative BCR is explained by the delay introduced to the junction through signalisation and the limitations of the modelling approach.

The proposed scheme will provide significant benefits to pedestrians and cyclists by increasing safety and reducing the considerable severance between Broadbridge Heath and Horsham caused by the current junction arrangement.

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The safety issues form a considerable barrier to residents of Broadbridge Heath walking and cycling to access Horsham and vice versa. A safer junction would encourage more trips using sustainable modes for commuting, school, retail, and leisure purposes.

Five Oaks Roundabout (including traffic management and speed reduction measures within Broadbridge Heath & to the north on the Warnham Lanes)

The monetisation of the journey time benefits generates a PVB of **-£2,339,182** (over a 60 year period).

Using the difference between the 'with' and 'without' scheme accident costs over a 60 year period equates to a PVB of **-£1,230,934**.

The BCR for the Five Oaks scheme has been calculated to be -**3.9:1**. The negative BCR is explained by the delay and accident dis-benefits associated with the new priority junction on the A264.

The proposed scheme will provide significant benefits to pedestrians and cyclists in Broadbridge Heath by reducing through traffic. The current busy nature of Old Guildford Road and Billingshurst Road discourages residents of Broadbridge Heath walking and cycling to Horsham and vice versa. Less through traffic will encourage more walking and cycling trips for commuting, school, retail, and leisure purposes.

The scheme will improve the public realm adjacent to the junction, particularly on the northern and eastern approaches, and the wider area. The northern arm of the existing roundabout will be replaced with a downgraded link road via the A264 that includes shared footway/cycleway paths and the existing A264 eastern approach will be narrowed to a local distributor road. These measures at the junction along with the traffic calming will reduce through traffic and vehicle speeds, making the general environment more attractive.

Great Daux Roundabout

The monetisation of the journey time benefits generates a PVB of **£320,566,507** (over a 60 year period).

The proposed signalisation of Great Daux will reduce the average cost per accident by **£6,650**. Over the 60 year analysis period this equates to a PVB of **£170,278**.

The BCR for the Great Daux scheme has been calculated to be **506.6:1**. The extremely high BCR is explained by the extremely high journey time benefits produced by the modelling approach used (which is discussed in more detail in the main body of the report) and the relatively low construction costs.

Robin Hood Roundabout

The monetisation of the journey time benefits generates a PVB of **£322,653,586** (over a 60 year period).

The proposed signalisation of Robin Hood will reduce the average cost per accident by **£6,650**. Over the 60 year analysis period this equates to a PVB of **£319,272**.

The inclusion of a signalised pedestrian crossing will improve connectivity for pedestrians and cyclists between Warnham and Horsham.

The BCR for the Robin Hood scheme has been calculated to be **693.3:1**. Similar to Great Daux, the extremely high BCR is explained by the limitations of the modelling approach and the relatively low construction costs.

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Economic benefits

The four schemes together will lead to significant economic benefits for the Horsham District area as well as for the wider region. The main economic benefits during the construction stage are temporary employment and Gross Value Added (GVA). It is estimated that approximately 29 temporary jobs will be created during the construction stage for all of the schemes combined. A total of £2.17 million in GVA is also forecast to be generated during the construction stage. The West of Horsham package of schemes will have a significant positive impact on accessibility and connectivity of the local area which is likely to attract businesses and visitors and increase local business turnover and rateable values. As a result, positive impacts on long term GVA and employment in the area are also expected.

Table 4 West of Horsham Transport Package - Economic Benefits Summary

Economic Benefits	Farthings Hill	Five Oaks Roundabout + traffic calming	Great Daux	Robin Hood
Temporary Employment from Construction	✓	✓	✓	✓
Temporary GVA from Construction	✓	✓	✓	✓
Business Turnover and Rateable values	Marginal	Marginal	✓	✓
Long Term Employment and GVA	✓	✓	✓	✓

Social benefits

The social impacts have been assessed in terms of journey quality, accessibility and connectivity, severance, agglomeration, regeneration, improved perception of the area and improved wellbeing.

The Horsham package of schemes will have a significant positive impact on accessibility and connectivity of the local area. The Farthings Hill and the Five Oaks schemes will help reduce severance, increase accessibility for pedestrians and cyclists and encourage greater use of sustainable transport modes. Accessibility for motorised transport users will be increased as a result of capacity improvements at Great Daux and Robin Hood junctions.

The package will have a significant impact on journey quality for all mode users. The construction and realignment of a footways and cycleways at Farthings Hill and Five Oaks will provide a better environment for walking and cycling and will reduce travellers' stress and fear of accidents. The journey quality of vehicle users will be improved as a result of the journey time savings and reduced congestion at Great Daux and Robin Hood interchanges.

As a result of the schemes there will be an increase in physical activity and associated improvement in health and wellbeing benefits. The package will also contribute towards creating a more positive perception of the local area attracting businesses and inward investment which could have a positive agglomeration impact.

The Horsham District performs well economically and has low unemployment and low deprivation. Therefore, we expect that the package will only have a marginal impact on regeneration in the area.

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Table 5 West of Horsham Transport Package - Social Benefits Summary

Social Benefits	Farthings Hill	Five Oaks Roundabout + traffic calming	Great Daux	Robin Hood
Improved Journey Quality	✓	✓	✓	✓
Improved Accessibility and Connectivity	✓	✓	✓	✓
Severance	✓	✓		
Agglomeration	Marginal	Marginal	✓	✓
Regeneration	Marginal	Marginal	Marginal	Marginal
Increase in Physical Activity	✓	✓		
Improved Perception of the Area	✓	✓	✓	✓
Improved Wellbeing	✓	✓		

Environmental benefits

Taken as a whole, these projects have the potential to result in significant beneficial impacts on vehicle travellers, pedestrians, cyclists and the local community through improved road layouts, increased road capacities, signalisation, crossing facilities and widened footways and cycleways.

The Farthings Hill and Five Oaks schemes will improve safety for pedestrians and cyclists and encourage sustainable modes of travel. The Great Daux Interchange and Robin Hood Roundabout proposals will reduce journey times and slow moving traffic, resulting in reduced vehicle emissions and improved air quality.

Whilst some temporary impacts such as noise and vibration, dust and visual intrusion are inevitable during construction, no long term adverse impacts are envisaged provided that appropriate mitigation is put in place.

Further assessment work is required to ensure no adverse impact on bats, great crested newts, breeding birds and reptiles. Robin Hood roundabout in particular is located within 500m of several ponds which may support GCNs. The requirement for replacement planting also needs further consideration.

The Great Daux and Robin Hood roundabouts are located in minor aquifer intermediate Groundwater Vulnerability Zones and Secondary Aquifers. Groundwater impacts are likely to arise from the proposed works and so mitigation should be put in place to avoid any risk of pollution or contamination to groundwater.

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2.Introduction

This report is a technical document supporting the funding application to the C2C LTB for the West of Horsham Transport Package. It should be read in conjunction with the completed C2C LTB Funding Application Form.

The report presents the policy context for the funding application with particular focus on the C2C LEP SEP which commits to funding the schemes that make up the West of Horsham Transport Package.

It sets out the methodology used to assess each of the benefits and costs of the schemes, drawing on the Department for Transport's (DfT) Early Assessment and Sifting Tool (EAST), and Web Transport Analysis Guidance (WebTAG).

It then presents the transport, economic, social and environmental benefits and costs of each of the four schemes that are included in the package, in line with the requirements of the C2C LTB Funding Application Form. The report is structured into the following sections:

Section 3: **Policy Background**

Section 4: **Method**

Section 5: **Connectivity Schemes**

Farthings Hill Roundabout

Five Oaks Roundabout (including traffic management and speed reduction measures within Broadbridge Heath & to the north on the Warnham Lanes)

Section 6: **Capacity Schemes**

Great Daux Roundabout

Robin Hood Roundabout

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3.Policy Background

This section presents an overview of the policy context for the West of Horsham Transport Package. In line with the C2C LTB Funding Application Form this section focuses on the C2C LEP SEP[2] and justifies how the package will support its key transport themes.

The C2C LEP Strategic Economic Plan

The C2C LEP's vision is "that Coast to Capital will deliver exceptional growth and productivity gains to deliver economic performance to rival the best in Europe and the rest of the World". Six strategic priorities are outlined in the Plan:

- Successful Growth Locations, including transport investment;
- Successful Businesses;
- Building Competitive Advantage;
- Skills and Workforce;
- Growth is Digital; and
- Housing and infrastructure.

Successful Growth Locations

The SEP identified nine areas where growth will be delivered, comprising a mix of strategic corridors or areas, cities/towns, strategic sites/locations and Enterprise Zones:

- Burgess Hill
- Croydon
- Heart of the Gatwick Diamond
- East Surrey M25 Strategic Corridor
- Brighton and Hove
- Coastal Corridor
- Enterprise Bognor Regis Enterprise Zone
- Newhaven Enterprise Zone
- Shoreham Harbour and Airport

Heart of the Gatwick Diamond

Right at the heart of the Gatwick Diamond are the towns of Crawley and Horsham. Both are important business locations performing unique economic functions. The SEP wants to focus on enhancing and protecting them, while also taking steps to ensure there is supply of housing for a growing workforce.

Transport is identified in the SEP as a key priority underpinning the success of the sub-region as an enabler and driver of growth. It is the largest element of the C2C LEP Growth Deal.

[2] Coast to Capital Local Enterprise Partnership (2014) Strategic Economic Plan

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Transport Objectives

There are five key over-arching themes that aim to tackle the area's transport issues. The themes have been informed by business needs across the area:

- Connectivity: "Can I get where I want to go?"
- Reliability: "Will I arrive when I expect?"
- Capacity: "Will I get a seat, a parking space, a clear road?"
- Quality: "Will my journey be healthy, safe, clean, sustainable and enjoyable?"
- Resilience: "Will transport be there when I need it – 24/7?"

These C2C LEP SEP transport objectives are being delivered through two programmes:

1. Improvements to national networks
2. The Coast to Capital Transport Programme

The Coast to Capital Transport Programme comprises of Local Transport Body schemes and those related to connectivity and capacity, sustainable transport packages, and resilience. Schemes will be implemented across the LEP geography with particular focus on the Successful Growth Locations.

Connectivity and Capacity schemes

The SEP identifies 20 schemes (including the LTB schemes) aimed directly at unlocking new housing, jobs and/or employment floor space. These schemes provide the transport capacity or connectivity needed for one or more new developments to be viable. In many cases, these schemes would tackle problems that cause severance and delay.

In West Sussex, the C2C SEP states a Local Growth Fund contribution of **£4.763 million** for West of Horsham and A24 junction improvements, to unlock 2,000 new homes and 1,600 new jobs.

The connectivity and capacity schemes included in the West of Horsham funding application together comprise of proposals at Farthings Hill Roundabout, Five Oaks Roundabout (and associated traffic calming), Great Daux Roundabout, and Robin Hood Roundabout.

The C2C SEP states that the West of Horsham schemes will commence in 2016/17 with estimated phased delivery in 2018/19.

Local Indicators

Key performance indicators set by the C2C LEP in the C2C SEP are as follows:

- Increase net private sector jobs;
- Increase GVA total (£billion) to reduce the gap with the South East; and
- Increase the percentage of companies that are regularly exporting.

The targets are summarised in Table 6. The West of Horsham Transport Package will contribute to both increasing private sector employment and GVA.

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Table 6 Key Performance Indicators and Targets for the C2C LEP

Top line Priorities	2010 Baseline Coast to Capital	2010 Baseline South East Region	2020 Target
Net Private Jobs	652,200	Not applicable	140,000 net additional jobs
Private Jobs Share	81%	81%	Continue to match SE level
Public Jobs Share	19%	19%	Continue to match SE level
GVA Total £billion	£38.9bn	Not applicable	£55bn
GVA Per Head Working Age Population	£31,800	£35,100	Reduce gap with SE
Percentage of Companies Regularly Exporting	16%	Not available	1% increase year on year – double by 2035

Source: CC LEP (2014) C2C SEP

Land West of Horsham Masterplan

The Land West of Horsham Masterplan SPD was adopted by the Council on 31 October 2008 and forms part of the Local Development Framework.

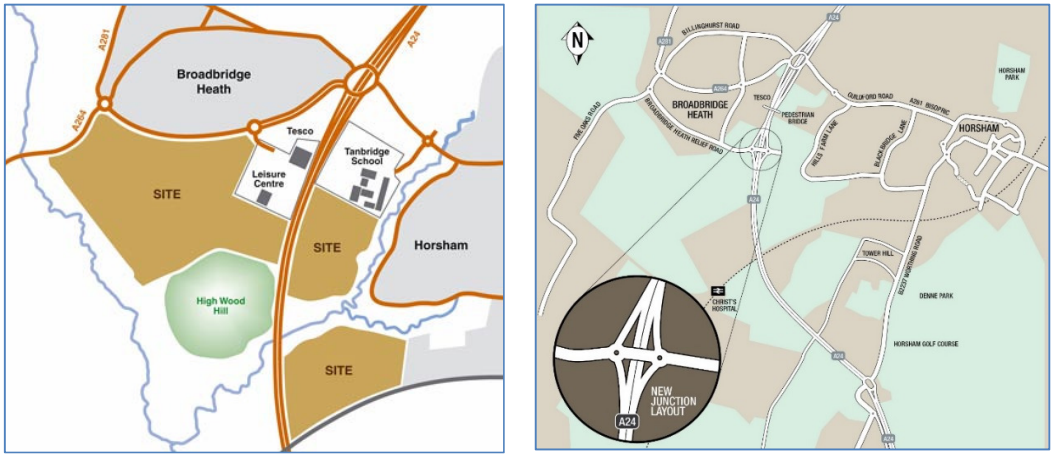
The Council identified land west of Horsham and south of Broadbridge Heath as a location suitable for a mixed-use development of 2,000 homes plus the necessary infrastructure, facilities and services under Policy CP7 of the Core Strategy (see Figure 2).

The Core Strategy was considered by independent Inspectors who approved the identification of this land for development subject to it meeting the criteria set out in the policy.

The construction of key highway infrastructure associated with the West of Horsham developments is currently underway, due to be completed in late 2015. The works involve the creation of new grade-separated junction on the A24, the Broadbridge Heath Relief Road and a replacement footbridge (see Figure 2).

Once complete, the Broadbridge Heath Relief Road will connect to the recently constructed roundabout on Five Oaks Road (A264), taking traffic pressure away from Broadbridge Heath and the Farthings Hill Interchange.

Figure 2 - Land West of Horsham



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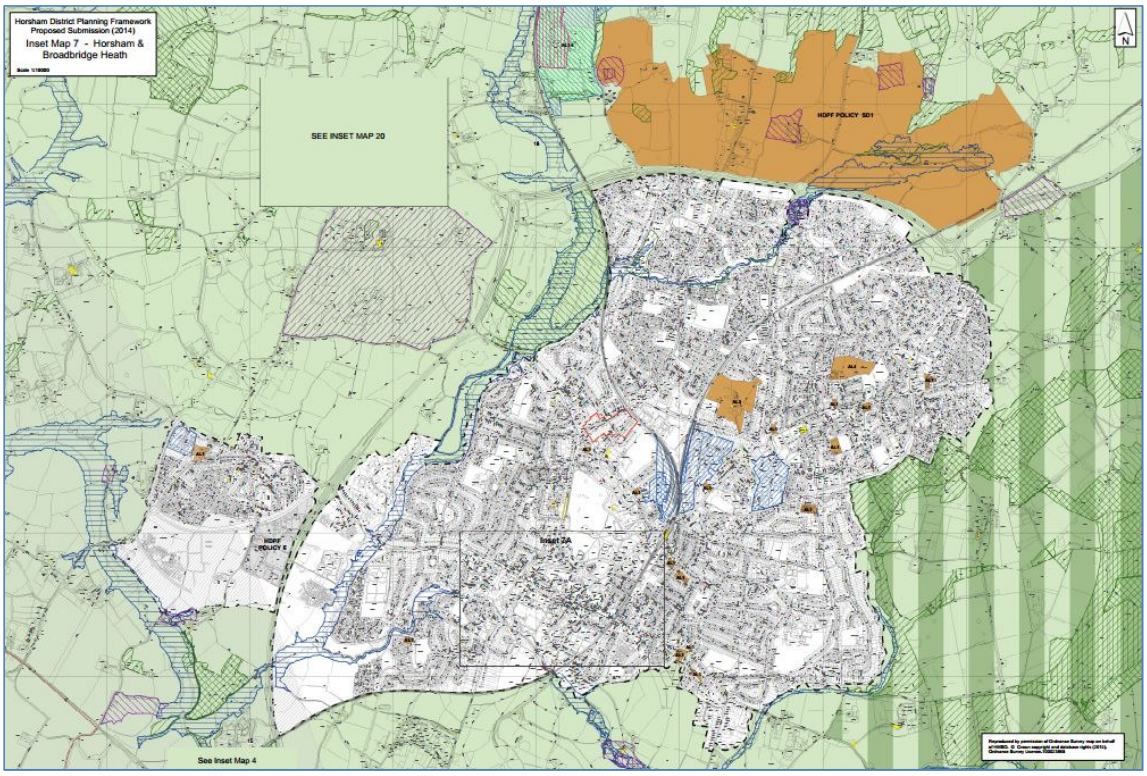
North of Horsham Strategic Development

The North of Horsham Strategic Development is proposed within Horsham District Council's Planning Framework 2014 (Policy SD1), which was submitted to the Secretary of State on Friday 8 August 2014 for independent examination. The Inspector is holding a series of public hearing sessions in November.

The development, that is expected to be completed by 2031, will provide 2,500 new homes, a new high quality business park and a parkway station that includes a park and ride facility and sustainable transport links to Horsham town and Horsham train station. The location of the development is shown by the orange shaded area in Figure 3.

Figure 3 - North of Horsham



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4.Method

The C2C LTB Funding Application covers four business case criteria; Transport, Economic, Social Distributional, and Environmental.

Where possible, the benefits have been quantified. Where this is not possible, a qualitative assessment has been undertaken. The approach has drawn on both the DfT's EAST sifting tool to help identify potential benefits, and WebTAG to formulate the method for each indicator. The following paragraphs describe the method used for assessing each indicator.

For the appraisal of benefits, the schemes have been split into two groups: Connectivity and Capacity.

Connectivity Schemes

The 'Connectivity' schemes form part of the wider delivery of the Land West of Horsham Masterplan and will support the Council's wider objectives to promote the use of sustainable transport and integration of the local communities.

Capacity Schemes

The 'Capacity' schemes are located on the strategic A24 and are primarily associated with the delivery of the North of Horsham development and the mitigation of development impact on existing travel patterns.

Table 7 – West of Horsham scheme classification

Transport appraisal group	Farthings Hill Interchange	Five Oaks Roundabout + Traffic Calming	Great Daux Roundabout	Robin Hood Roundabout
Connectivity	✓	✓		
Capacity			✓	✓

The transport benefits of each scheme have been assessed individually whereas the economic, social, and environmental impacts of the Connectivity and Capacity schemes have been considered collectively. The following text provides a summary of how the benefits were assessed:

Transport benefits

The appraisal considers their economic transport benefits and their contribution to the C2C SEP transport policy objectives.

Economic transport benefits

The economic transport benefits associated with each group have been assessed based on criteria set out in the C2C LTB Funding Application Form:

- Value for money (including Benefit Cost Ratio);
- Expected impact on journey times;
- Expected impact on road safety casualties;
- Encouraging sustainable travel;
- Valuing the public realm; and
- Other transport benefits.

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Value for Money / Benefit Cost Ratio

For each individual scheme and for the overall scheme package, Benefit to Cost Ratios (BCRs) have been calculated by combining monetised journey time and accident impacts with the predicted scheme costs.

Expected impact on journey times

In the absence of a strategic transport model, journey time benefits for the West of Horsham schemes have been assessed using outputs from junction models. Monetised time impacts have been generated (over a 60 year period) using the difference in total network delay between the 'base' and 'with scheme' models.

A number of key assumptions in this process are set out below:

- Annualisation has been factored in line with WebTAG guidance. Delay savings derived from modelling results for the peak hours were expanded to three hour periods (0700-1000 and 1600-1900). The factors used to achieve this are based on DfT car distribution by time of day data[3]. The period delay savings were then combined and multiplied by 253 to cover all time periods in a year;
- User benefits have been projected over a 60-year appraisal period from the opening year of the scheme. Savings beyond the opening year have been assumed to remain unchanged and therefore gradually reduce in real terms when discounted to the same price base year (2010);
- Values of Time are based on the average weekday car and other appraisal parameters follow the information in the standard DfT WebTAG Data Book[4];
- All benefit and cost streams were discounted to the same price base year 2010, with a 3.5% discount rate from year 0 to 30 and 3.0% discount rate from year 31 to 60 from the current year.

It should be noted that using outputs from a junction model, as opposed to a strategic model, will overestimate journey time impacts because it is unable to account for traffic reassignment. In reality, a change to a junction is likely to either induce extra traffic to use it or divert traffic away depending on the nature of the scheme, thus diluting the predicted journey time impact.

The dilution effect, however, will be offset by the economic, social, and environmental benefits that have not been included in the transport appraisal. On this basis, the proposed methodology is considered to be robust.

Expected impact on road safety casualties

The impact of the schemes on road casualties has been assessed using the Valuation of Accidents methodology set out in the DfT's COBA manual[5]. The approach uses the average number of accidents occurring in the last five years and determines whether or not the proposal would reduce the average cost per accident based on standard values for various junction types[6]. The average cost of accident at signalised roundabout, for example, is less than one that occurs at a non-signalised roundabout, due to average severity rates of accidents at the respective types of junctions.

Where no accident data is available, where a new junction is proposed for example, COBA's Cross Product Model has been used. The model uses AADT flows and junction type coefficients to predict the annual

[3] https://www.gov.uk/government/statistical-data-sets/tra03-motor-vehicle-flow - Table TRA0308

[4] https://www.gov.uk/government/publications/WebTAG-tag-data-book-may-2014

[5] Part 2: The valuation of costs and benefits in COBA (revised June 2006)

[6] https://www.gov.uk/government/publications/coba-11-user-manual - Table 5/3

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accident rate. AADTs on each link of a junction were generated by summing the peak hour flows and multiplying them by a factor generated using the DfT car distribution by time of day data[3].

The net monetised impact on accidents have then been incorporated into the BCR calculations.

Encouraging sustainable travel

For each scheme, the benefits associated with encouraging sustainable travel and modal shift (where appropriate) have been assessed qualitatively.

Valuing the public realm

If the scheme has any impact on the public realm, it has been assessed qualitatively.

Other transport benefits

Where relevant, any other transport benefits associated with the schemes have been noted.

Contribution to transport objectives

The funding application form also requires that a scheme or package of schemes is scored for its contribution to the C2C LEP SEP's transport objectives. A summary has therefore been provided for each scheme. Table 8 provides details of how each objective has been incorporated into the transport appraisal:

Table 8 – C2C LEP SEP transport objectives

C2C LEP SEP Transport Objectives	Approach to assessing SEP transport themes through WebTAG
Connectivity: "Can I get where I want to go?"	Factored into the appraisal of social benefits (accessibility)
Reliability: "Will I arrive when I expect?"	Factored into the transport appraisal through journey time savings. In a larger scale appraisal, reliability can be measured by assessing expected variances in journey times
Capacity: "Will I get a seat, a parking space, a clear road?"	Factored into the transport appraisal through journey time savings
Quality: "Will my journey be healthy, safe, clean, sustainable and enjoyable?"	Factored into the appraisal of social benefits (journey quality)
Resilience: "Will transport be there when I need it – 24/7?"	In a larger scale appraisal this would be assessed through cancelations and delays and fed into time savings. It has been assessed qualitatively in this study

Economic

Temporary Construction Employment

Temporary employment that will be generated during the construction of the schemes has been derived from the construction activities and cost estimates. A ratio of construction jobs per pound of investment has been estimated based on a review of existing civil works schemes, and then applied to the total estimated cost for each of the West of Horsham schemes. A ratio of one new job for every £143,750 in construction costs was identified.

The resulting number of jobs created has then been split between construction and professional and technical sector using a 2:1 ratio previously derived by CH2M HILL for similar studies, in order to provide an indication of the types of jobs that will be created. For schemes that cost under £1m, we have assumed that the 2:1 relationship between construction and professional will not provide an appropriate level of accuracy, therefore, we have only reported on the total temporary jobs that could be created. The figures should be treated with caution and are designed to provide a high level estimate of a possible scale of the impacts on employment. In reality, the impact will depend on a multitude of factors and may vary considerably between schemes.

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In addition to temporary direct construction jobs, it is expected that the West of Horsham package will also help generate some indirect jobs in the supply chain and induced jobs due to additional spending of employee wages. Given the scale of the schemes the indirect and induced impacts are likely to be limited and have not been quantified in this study.

Temporary Construction Gross Value Added

GVA will be generated during the construction phase. This has been calculated for each scheme using the construction employment and industry-specific GVA/employment ratios derived from the Office for National Statistics (ONS) regional GVA figures and the ONS Business Register Employment Survey (BRES) dataset. We estimated an appropriate ratio for construction GVA/employment. For every construction employee there is £81,760 generated in construction GVA in the South East. A second ratio was prepared for professional & technical GVA/employment for construction. For every professional and technical employee there is £49,925 generated in sector GVA regionally. Applying these ratios to the total expected number of construction and professional jobs generated during construction provides an approximation of the potential GVA impact at the construction stage. The ratio of construction GVA/employment has been applied to estimate the GVA impact for smaller schemes with values below £1m. In a similar vein to construction employment, the GVA figures are broad level estimates provided to inform the analysis of the potential scale of GVA impacts of schemes.

Rateable Values

It is expected that the West of Horsham schemes could have an impact on the overall attractiveness of the core impact areas as well as the surrounding area. Implementing these schemes is likely to have an impact on business and residential demand and consequently the rental values of commercial and residential properties. The impact on rateable values is expected to be marginal and has been assessed qualitatively.

Business Turnover

In addition to the potential growth in rateable values, improvements in the areas' attractiveness could also increase the number of visitors leading to higher retail footfall and local business turnover. In a similar vein to the rateble values, the impacts on business turnover are likely to be marginal and have been assessed qualitatively.

Long Term Employment and GVA In addition to temporary construction related employment and GVA, longer term growth in employment and GVA can be expected as a result of the schemes to varying degrees. The following types of jobs are typically created as a result of transport schemes:

- jobs associated with operating and maintenance of new assets;
- jobs arising as a result of the improved travel conditions delivered by the scheme; and
- new jobs that have become accessible to the residents of the impact area because of the scheme.

A qualitative assessment has been used to report on potential employment and GVA impacts for Horsham.

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Social Benefits

Journey Quality

According to WebTAG, journey quality is an import factor that influences the travel choices made by individuals. It is defined as a measure of the real and perceived physical and social environment experience while travelling and includes factors such as traveller care (cleanliness, facilities, information, and environment), travellers' views (presence of barriers that may obstruct view) and traveller stress (frustration, fear of potential accidents, route uncertainty).

Journey quality impacts of a transport scheme would normally be assessed using bespoke stated preference surveys and would be included in the appraisal and modelling work. In the absence of such research and the limited scope of this study, the journey quality assessment for this study was performed qualitatively following the framework set out in WebTAG.

Using professional judgement and experience with similar schemes, impacts on each of the key journey quality factors have been analysed and reported in TAG Journey Quality Assessment table, the full version of which can be found in Annex 1. For simplicity, journey quality factors that are likely to be unaffected or where the impacts were considered to be minimal have been excluded from this report.

Accessibility and Connectivity

The recommended method for assessing accessibility impacts of a transport scheme are presented in WebTAG Unit A4.2 on Distributional Impacts. It identifies two assessments, the strategic accessibility assessment and the accessibility audit. The former assesses the impact in changes to the transport network and is based on the production of contour maps in Geographic Information Systems (GIS) showing accessibility to sites. The latter is a more qualitative process where the analyst assesses the various ways in which the scheme affects accessibility for different users. Considering the scale of the schemes, the accessibility analysis has been scaled down to be proportionate and relevant to the schemes. A desk top qualitative analysis of the accessibility impacts has been carried out as part of this study.

Severance

WebTAG defines community severance as the separation of residents from facilities and services they use within their community caused by transport infrastructure or traffic flows. It is mostly concerned with non-motorised transport mode users such as pedestrians and cyclists.

A positive impact on severance from a transport scheme may be observed if the scheme acts to remove the physical barrier or the heavy traffic flow that restricts pedestrian and cycle movements. Often the impacts of severance on pedestrians and cyclists are expected to be different and, therefore, should be assessed separately. The impact of a project on severance is normally assessed for the with-scheme and without-scheme scenarios at a number of locations across the network. The impacts for this study have been assessed qualitatively drawing on our assessment of the existing level of severance in the local area.

Agglomeration

Agglomeration provides a measure of the mass of economic activity across the impact area. It measures accessibility of firms and workers to each other and, therefore, is a function of generalised cost for business and commuting travel. A scheme that reduces cost of journeys could, therefore, have an agglomeration benefit provided that it helps businesses to access a larger pool of labour and workers to access a wider range of jobs. Although linked to regeneration, this is assessed separately in WebTAG.

A transport scheme that increases accessibility in an area in close proximity to an economic centre or large employment centre is likely to have an impact on agglomeration. There are specific areas in England where agglomeration impact of a transport scheme is expected to be significant. These are called Functional Urban Regions (FURs) and are listed in the WebTAG FURs database. The areas in the

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database are split between the core areas and hinterlands. FUR cores are defined as collections of contiguous 2001 Census Area Statistical (CAS) wards, with each ward having at least 7 jobs per hectare and a minimum total job count of 60,000 for the core as a whole. FUR hinterlands are adjacent to a core area, with each hinterland ward having that local core as it top commuting destination, and with at least 10% of the working population from each hinterland ward commuting to that core.[7]

As part of this assessment, agglomeration impacts of schemes have been assessed qualitatively. The impact areas have been compared against the FUR database to identify whether these contain core or hinterland FURs, thus, commenting on whether the expected agglomeration impact is likely to be significant.

Regeneration

Improvements to infrastructure including transport and urban realm schemes are likely to contribute to the regeneration of the local area. This can be assessed in terms of house prices, levels of deprivation, reduced unemployment and improved wellbeing. All of these impacts have been assessed qualitatively.

The analysis of the possible impacts on regeneration will involve assessing the baseline deprivation levels in the local area. This will involve using the Index of Multiple Deprivation (IMD) data to report on area's current level of deprivation compared to the country's average. The IMD provides a relative measure of deprivation in small areas across England and is constructed using a combination of seven domains and 38 separate indicators, each of which reflects a different aspect of deprivation. The seven domains are Income, Employment, Health and disability, Education skills and training, Barriers to housing and services, Crime, and Living environment.

In addition to the IMD levels, the rate of unemployment can be assessed to provide an indication of the socioeconomic situation of the area. The base line has been assessed using the ONS 2011 Census dataset and the ONS Labour Profile for the Horsham District.

Physical Activity

Cycling and walking schemes lead to an increase in physical activity which has significant health and wellbeing impacts on people. Studies have shown that physical activity is a primary contributor to a broad range of chronic diseases including heart disease, stroke and diabetes. Increase in physical activity is also known to play an important role in preventing obesity and improving mental health and wellbeing.[8]

The overall impacts of a scheme on physical activity will depend on the change in the number of pedestrians and cycle users, as well the change in average time travelled by active mode. Quantifying these impacts would require traffic model analysis to forecast the shift to active transport mode following the scheme completion. In the absence of the modal shift forecast, the impact of the West of Horsham transport package on physical activity has be assessed qualitatively as part of this study.

Improved Perception of the Area

The West of Horsham transport package of schemes is expected to contribute towards creating a more positive perception of the local area. This impact has been assessed qualitatively drawing on case study examples and the current baseline environment where appropriate.

Improved Wellbeing

[7] Functional Urban Region Look up sheet, WebTAG, DfT

[8] TAG Unit A4.1 – Social Impact appraisal, WebTAG, DfT

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Studies have shown that positive impacts on physical activity thorough greater use of active transport modes leads to better health and wellbeing for local communities. A qualitative assessment of West of Horsham schemes' impact on wellbeing has been provided in support of this application.

Environmental benefits

A high level appraisal of potential environmental effects associated with the West of Horsham works has been undertaken. The appraisal has been based on a desk study comprising a review of readily available data to identify and consider the environmental risks exist at each site. The following data sources were used to inform the environmental appraisal:

- http://www.natureonthemap.naturalengland.org.uk
- http://www.britishlistedbuildings.co.uk
- http://www.heritagegateway.org.uk
- http://maps.environment-agency.gov.uk/wiyby
- http://www.westsussex.gov.uk
- http://www.horsham.gov.uk

Each component project has been considered in turn, followed by an assessment of the cumulative effects of the package as a whole.

Environmental issues covered as part of the appraisal comprise archaeology and cultural heritage, air quality, ecology, water, landscape and townscape, geology and ground conditions, noise and vibration, and effects on vehicle travellers, pedestrians, cyclists and the local community.

A summary of the key conclusions is provided for each scheme. Detailed results of the appraisal are presented in a Technical Memorandum, presented in Annex 10.

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5.Connectivity Schemes

Farthings Hill Interchange

Farthings Hill Interchange, located to the west of Horsham on the A24, provides strategic links with the A264 Broadbridge Heath Bypass, A281 Guildford Road.

The Interchange is located immediately to the north of the new grade-separated junction on the A24, proposed as part of the West of Horsham housing developments, due to be completed in late 2015.

The new junction provides an opportunity, at Farthings Hill, to address existing severance issues between Broadbridge Heath and Horsham, especially for sustainable forms of transport.

Scheme description

The proposed scheme widens the A24 approaches, improves connectivity of the existing footway/cycleway through the interchange and enhances the safety of pedestrians and cyclists. A summary of the proposed works is provided below (see Annex 2 for scheme drawing):

- Widening of the A24 northbound off slip road;
- Widening of the A24 southbound off slip road;
- Partial widening of circulatory Lanes;
- Signalisation of the roundabout;
- Provision of Toucan crossings and footway widening; and
- Drainage improvement works.

Construction costs and funding

The estimated cost of the Farthings Hill Interchange scheme is **£1,416,765**. This includes construction and design costs, along with a 15% optimism bias.

£1,062,574 (75%) of the funds required for the scheme is being sort from the C2C LEP via the C2C LTB. The remaining £354,191 (25%) will be provided through Section 106 developer contributions.

Maintenance costs

Detailed maintenance and operational costs of the scheme have not been assessed. Due to the introduction of traffic signals, the costs associated with maintaining the proposed scheme will be greater than what is currently spent but is not considered to be significant.

Timeframe

The final time frame for scheme delivery has yet to be confirmed but detailed design is scheduled for 2014/2015 with works to be completed in 2017.

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Transport benefits

Modelling approach

Traffic modelling was undertaken using traffic flows and junction models provided by WSCC.

The traffic flows used to form the opening year results were obtained from the West of Horsham Traffic Model most recently developed by WSP. The proposed scheme at Farthings Hill will be in place after the completion of the committed infrastructure associated with the West of Horsham development (new A24 junction and Broadbridge Heath Relief Road). The traffic flows from the model that most closely replicated this situation was their 2023 Do Something scenario.

The traffic flows were applied to a base ARCADY model that was developed by WSCC to test the performance of Farthings Hill prior to the West of Horsham infrastructure being in place. The 'with scheme' LinSig model was used for the Preliminary Design Report for the Farthings HIll scheme.

The difference in highway network performance between the base model and the 'with scheme' models forms the basis of the Cost Benefit Analysis (CBA).

The LinSig model assumed the Toucan crossings would be called in every cycle, thus representing a very robust assessment of junction performance. It is fair to assume that the crossing facilities would not in reality be called in every cycle, so for the purposes of this assessment the average of the delay outputs with the Toucan's running in every cycle and not at all have been used.

Expected impact on journey times

The monetisation of the scheme benefits, using the difference in total network delay (pcuhrs) between the base and 'with scheme' models, generates a PVB of -£16,009,768 (over a 60 year period). Full details of the calculation steps used can be found in Annex 3.

The significant journey time dis-benefit is a result of traffic reassignment following the completion of the West of Horsham infrastructure and the introduction of the Toucan crossings. The new A24 junction and Broadbridge Heath Relief Road take a significant volume of traffic away from Farthings Hill so the delay in the base model is minimal. The 'with scheme' model outputs show that junction will operate within capacity but the introduction of four signalised crossing points generates delay.

The forecast dis-benefits to motorised vehicles may be significant but some of it will be offset by the unquantified benefits to pedestrians and cyclists (discussed in more detail below). It is also worth reiterating that the use of a junction model will overestimate journey time impacts because it is unable to account for traffic reassignment.

The scheme is in reality helping to deliver the environmental benefits that are offered by the introduction of a new link road and the modelling of a fixed trip matrix is a technical approach that does not reflect the desired outcome of the scheme.

Expected impact on road safety casualties

Based on COBA guidance, the proposed signalisation of Farthings Hill will reduce the average cost per accident by £6,650. Over the 60 year analysis period, which takes into account the current accident rate (5 per year) and the general reduction in accident rates over time, this equates to a PVB of £635,544. Full details of the calculation steps used can be found in Annex 3.

Encouraging sustainable travel

The proposed scheme will provide significant benefits to pedestrians and cyclists by increasing safety and reducing the considerable severance between Broadbridge Heath and Horsham caused by the current junction arrangement.

Seven of the thirty accidents at Farthings Hill involved pedestrians (1) or cyclists (6). Most accidents involved conflicts at either entries or exits to the roundabout. The introduction of signalised crossings

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will help to reduce these types of accidents and alleviate the perception of the junction as unsafe to cycle on.

The safety issues form a considerable barrier to residents of Broadbridge Heath using sustainable travel options to access Horsham and vice versa. A safer junction would encourage more trips using sustainable modes for commuting purposes (via the train stations) or for leisure trips.

It has not, however, been possible to quantify these benefits. Accordingly, they have not been considered as part of the BCR appraisal.

Valuing the public realm

The impact of the scheme will improve the public realm both in terms of environment and perceived safety. The introduction of signalised crossing points and widened footways will reduce the current conflict between vulnerable users and motorised vehicles, creating a more equitable use of space between transport modes.

Further assessment of the urban realm has been addressed in the Social impact section.

Other transport benefits

There are not considered to be any further transport benefits associated with the proposed scheme.

Benefit to Cost Ratio

The BCR for the Farthings Hill scheme has been calculated to be -**15.9:1**. The negative BCR is explained by the significant journey time dis-benefits and limitations of the modelling approach noted previously.

The BCR was calculated by combining the journey time PVB and dividing it by the PVC associated with the scheme. The steps taken to calculate the PVC of the scheme can be found in Annex 3.

Contribution to policy objectives

Table 9 below provides a summary of how the scheme contributes to the C2C LEP SEP's transport objectives:

Table 9 – Farthings Hill contribution to policy objectives

C2C LEP SEP Transport Themes	Contribution to policy objectives
Connectivity: "Can I get where I want to go?"	For pedestrians and cyclists, the scheme will significantly improve connectivity and reduce severance between Broadbridge Heath and Horsham. The existing junction forms a significant barrier to non-motorised users
Reliability: "Will I arrive when I expect?"	The scheme will provide journey time reliability benefits to sustainable travel modes by providing dedicated crossing facilities
Capacity: "Will I get a seat, a parking space, a clear road?"	The improved facilities for pedestrian and cyclist comes at the expense of increased journey times for motorised vehicles
Quality: "Will my journey be healthy, safe, clean, sustainable and enjoyable?"	The quality of the journey for sustainable modes will be greatly enhanced by the proposed scheme. The junction will be safer and more enjoyable to navigate. The increase of sustainable travel will also provide health benefits and improve air quality
Resilience: "Will transport be there when I need it – 24/7?"	The scheme will have limited impact on resilience

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Five Oaks Roundabout (including traffic management and speed reduction measures within Broadbridge Heath and to the north on the Warnham Lanes)

Five Oaks Roundabout is located on the south western boundary of Broadbridge Heath, approximately 1.3 km west of A24 Farthings Hill Interchange. The existing Five Oaks roundabout provides links with the A24 northbound and southbound through the A264 Broadbridge Heath Bypass and Old Guilford Road.

Scheme Description

The objective of the Five Oaks Roundabout and associated traffic calming is to improve awareness of Broadbridge Heath as a village, not a through road. This will be achieved by declassify the existing A264 Broadbridge Heath Bypass into a local distributor road, providing village gateway signage and implementing a variety of traffic calming measures. A summary of the proposed works is provided below. A drawing for the roundabout scheme is provided in Annex 4. Scheme drawings for the traffic calming schemes are not currently available.

Five Oaks Roundabout:

- A new connector road to Billinghurst Road (via a new priority junction);
- Removal of Billinghurst road direct link to the roundabout;
- Narrowing of the existing A 264 carriageway to local distributor road;
- Providing new shared footway/cycleway paths.

Broadbridge Heath traffic calming:

- 2 x enhanced gateways to the village (on declassified A264 Broadbridge Heath Bypass + Old Guildford Road)
- 20mph limit around the village triangle (TRO)
- Improvements to existing Zebra crossings (on Old Guildford Road + Billingshurst Road)
- Surface treatment changes outside village Post Office + speed reduction measures
- Potential vehicle activated signs at entrances to the village

Warnham Lanes traffic calming:

- To introduce 40mph speed limit on Broadbridge Heath Road
- Byfleet Lane passing bays and verge protection
- A281 Guildford Road/ Stroods Lane improvement

Construction costs and funding

The estimated cost of the Five Oaks scheme is **£1,260,562**. This includes construction and design costs and optimism bias (based on work undertaken on each element, 15% for roundabout and 35% for traffic calming).

£945,422 (75%) of the funds required for the scheme is being sort from the C2C LEP via the C2C LTB. The remaining £315,140 (25%) will be provided through Section 106 developer contributions.

Maintenance costs

Detailed maintenance and operational costs of the scheme have not been assessed. The difference between current maintenance expenditure and the costs associated with the proposed scheme are not expected to be significantly different.

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Timeframe

The final time frame for scheme delivery has yet to be confirmed but detailed design is scheduled for 2014/2015 with works to be completed in 2016.

Transport benefits

Modelling approach

The approach taken to the traffic modelling was very similar to that used for Farthings Hill. As before, the base ARCADY model was developed by WSCC to test the performance of Five Oaks prior to the West of Horsham infrastructure being in place.

However, in this case, the 'with scheme' models were created by CH2M Hill, an ARCADY model for the three-arm roundabout and a PICADY model for the local access to Billinghurst Road from the A264.

The traffic flows used to form the opening year results were also taken from the West of Horsham Traffic Model and, as before, the proposed scheme at Five Oaks will be in place after the completion of the committed infrastructure associated with the West of Horsham development so 2023 Do Something flows were used.

The outputs from the strategic model, which modelled the existing four-arm roundabout had to be manually re-assigned to take into account the removal of the northern arm and replacement priority junction access to the east, on the A264.

The difference in highway network performance between the base model and the 'with scheme' models forms the basis of the Cost Benefit Analysis (CBA).

Expected impact on journey times

The monetisation of the scheme benefits, using the difference in total network delay (pcuhrs) between the base and 'with scheme' models, generates a PVB of -£2,339,182 (over a 60 year period). Full details of the calculation steps used can be found in Annex 5.

The journey time dis-benefit is a result of the introduction of the new priority junction on the A264. Vehicles who would normally approach the northern arm of the existing roundabout (Billingshurst Road) and turn right or go straight on, now have to negotiate two junctions. It is also more difficult for vehicles to turn right out of the priority junction than it is to turn right or go straight from the existing roundabout.

This, however, is not unexpected and is the purpose of the new priority junction and traffic calming. The additional delay will discourage drivers from using Broadbridge Heath as a through route via Old Guildford Road and Billingshurst Road. Some (if not all) of the relatively small forecast dis-benefit to motorised vehicles will be offset by the unquantified benefits to the public realm, pedestrians, and cyclists in (discussed in more detail below).

Expected impact on road safety casualties

Based on the 5-year accident data from WSCC, the current accident rate at the existing four-arm roundabout is 1 per year. To cater for the conversion of the roundabout to three-arms, the COBA Cross Product Model methodology was used to generate an accident rate reduction factor. Based on the manually reassigned traffic flows, the accident rate at the three-arm roundabout was calculated to be 30% lower. The average cost per accident for a three-arm roundabout £54,470.

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For the new priority junction, the COBA Cross Product Model was and the manually assigned traffic flows generated an accident rate of 0.89 per year. The cost of the average accident at a priority junction is £101,550.

Using the difference between the 'with' and 'without' scheme accident costs over a 60 year period (taking into account the general reduction in accident rates over time) equates to a PVB of -£1,230,934. Full details of the calculation steps used can be found in Annex 5.

The accident dis-benefit is primary a result of the new priority junction and the limitations of the modelling approach. The average cost of an accident at a priority junction is almost twice that of a three or four arm roundabout. The accident rate, however, is likely to have been overestimated because traffic reassignment has not been taken into account. One of the main aims of the scheme is reduce through traffic via Old Guildford Road by introducing junction delay and traffic calming.

The traffic calming will also provide some additional unquantified benefits through the speed reduction measures and improvements to pedestrian crossings.

Encouraging sustainable travel

The proposed scheme will provide significant benefits to pedestrians and cyclists in Broadbridge Heath by reducing through traffic.

The current busy nature of Old Guildford Road and Billingshurst Road discourages residents of Broadbridge Heath using sustainable travel options to access Horsham and vice versa. Less through traffic would encourage more trips using sustainable modes for commuting, retail, and leisure purposes.

It has not, however, been possible to quantify these benefits. Accordingly, they have not been considered as part of the BCR appraisal.

Valuing the public realm

The scheme will improve the public realm adjacent to the junction and the wider area. The northern arm of the existing roundabout will be replaced with a downgraded link road via the A264 that includes shared footway/cycleway paths and the existing A264 eastern approach will be narrowed to a local distributor road. The traffic calming measures will include two new enhanced gateways to the village (on the declassified A264 Broadbridge Heath Bypass and Old Guildford Road) providing drivers with a strong message that they are now entering a village.

Further assessment of the urban realm has been addressed in the Social impact section.

Other transport benefits

There are not considered to be any further transport benefits associated with the proposed scheme.

Benefit to Cost Ratio

The BCR for the Five Oaks scheme has been calculated to be -3.9:1. The negative BCR is explained by the journey time dis-benefits and increase in accidents caused by the introduction of the new priority junction.

The BCR was calculated by combining the journey time PVB and dividing it by the PVC associated with the scheme. The steps taken to calculate the PVC of the scheme can be found in Annex 5.

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Contribution to policy objectives

Table 10 below provides a summary of how the scheme contributes to the C2C LEP SEP's transport objectives:

Table 10 – Five Oaks Roundabout contribution to policy objectives

C2C LEP SEP Transport Themes	Contribution to policy objectives
Connectivity: "Can I get where I want to go?"	Enhanced footways and crossing facilities will connect pedestrians and cyclists from the new development to Broadbridge Heath and Horsham whilst the traffic calming measures will enhance their journey
Reliability: "Will I arrive when I expect?"	The scheme will have limited impact on reliability
Capacity: "Will I get a seat, a parking space, a clear road?"	The improved facilities for pedestrian and cyclist comes at the expense of increased journey times for motorised vehicles
Quality: "Will my journey be healthy, safe, clean, sustainable and enjoyable?"	The quality of the journey for pedestrians and cyclist will be greatly enhanced by the proposed scheme. The junction will be safer and more enjoyable to navigate. The increase of sustainable travel will also provide health benefits and improve air quality
Resilience: "Will transport be there when I need it – 24/7?"	The scheme will have limited impact on resilience

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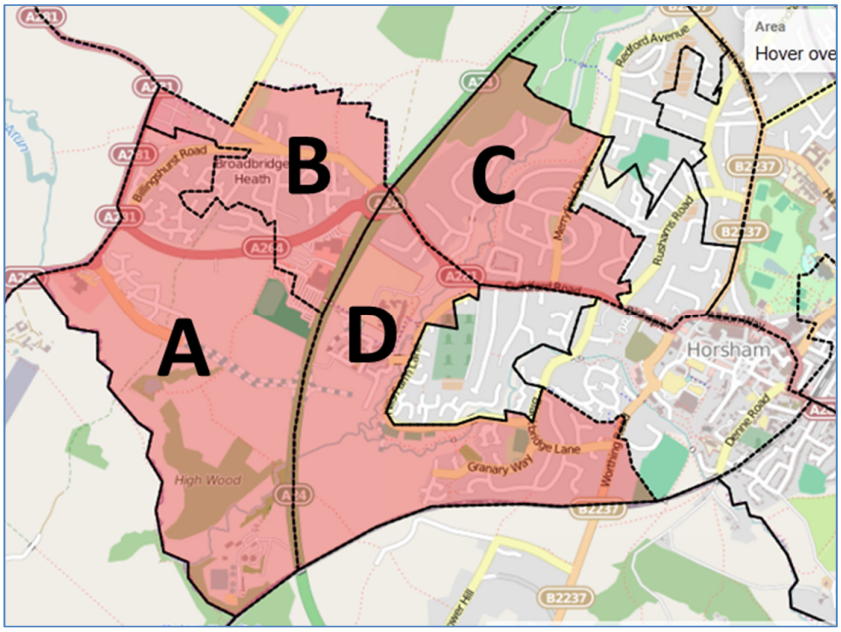
Combined Economic Social & Environment benefits

Economic benefits

Impact Area

The economic and social impacts from the scheme have been assessed within a core impact area. Provided that most ONS datasets collect and report data at the Lower Super Output Area (LSOA level), the impact area for the Farthings Hill and Five Oaks junction improvement schemes has been approximated by a combination of LSOAs as shown in *Figure 4*. The area covers physical location of the proposed junction improvements, as well as the surrounding areas of Broadbridge Heath and west of Denne Neighbourhood which are likely to accrue most of the benefits generated by the schemes.

Figure 4: Impact Area, Farthings Hill Roundabout



Source: Nomis/ONS (2014) Business Register Employment Survey, LSOA map

Baseline

Population & Unemployment

The total resident population of the impact area has been estimated at 6,500 in 2011[9]. The total working age population has been estimated at approximately 4,700, of which 76% are considered economically active. The LSOA that lies to the south east of the Farthings Hill roundabout (area D) has the highest number of residents and the highest unemployment rate of 4%. The average unemployment rate across the four LSOAs is equal to 3.4% which is below the 4.6 % in Horsham and 5.9% in the South East in the corresponding year.[10]

Local Business Sector

The more recent figures from BRES show that the total employment in the area in 2013 was estimated at approximately 2,000. The data shows that the majority of jobs in that year were generated by wholesale

[9] 2011 Census: Key Statistics; Usual Resident Population dataset, Nomis ONS

[10] 2011 Census: Key Statistics, Economic Activity by Sex dataset, Nomis/ONS

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and retail trade (48%) and education (10%) sectors.[11] The area has a range of large retailers including Homebase, Halfords and Tesco supermarket.

House Prices

We have used average house prices in Broadbridge Heath as an approximation for the average price in the impact area. This year's estimate of the average property price in Broadbridge Heath, as reported by Rightmove, was £347,502 which is higher than nearby Warnham (£295,850) and Horsham (£306,590). The prices grew by 16% on the year before and by 51% on 2010.[12]

Deprivation

The three out of four LSOAs (areas A-C) currently rank in the bottom 30% of the most deprived LSOAs suggesting lower than average level of deprivation in the impact area.[13] The LSOA that lies to the south east of Farthings Hill roundabout (area D) falls just above the median and is in the top 47% of the most deprived areas in the country. The IMD rankings for the four areas are summarised in Table 11.

Table 11 Farthings Hill Roundabout Improvement Scheme Impact Area - LSOAs and IMD Rank

LSOA	Rank of IMD Score (1=Most deprived; 32,382=least deprived)	National ranking
Area A	30290	Top 17% least deprived
Area B	23696	Top 27% least deprived
Area C	32171	Top 1% least deprived
Area D	15233	Top 53% least deprived

Construction Stage

During the construction stage temporary employment and GVA will be generated.

Temporary Construction Employment

The total required investment to deliver the Farthings Hill scheme has been estimated at £1.41 million at 2014 prices. Applying an estimated job ratio of one temporary construction job to every £143,750 in construction costs to the costs of the Farthings Hill roundabout scheme indicates that the scheme is likely to generate up to 10 temporary jobs. It has been assumed that approximately two thirds of these jobs (7 jobs) are likely to be construction jobs and one third (3 jobs) are likely to be professional and technical jobs.

In similar vein, it is expected that the total £1.26m investment to improve the Five Oaks interchange and introduce traffic calming at Broadbridge Heath and Warham Lanes is likely to generate up to 9 temporary jobs during construction of which 6 are likely to be construction jobs and 3 are likely to be professional and technical jobs.

[11] Business Register Employment Survey, Nomis/ONS

[12] Data provided by Rightmove.com

[13] The English Indices of Deprivation 2010, Oxford Consultants for Social Inclusion (OCSI) for the Department for Communities and Local Government

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Temporary Construction GVA

In order to estimate GVA at the construction stage, the total annual construction GVA in the South East (£13.5 billion) and total professional and technical industry GVA (£15.1 billion) were divided by the corresponding construction jobs (165,069) and professional & technical jobs (303,255) in the region to creating GVA/employment ratios for both industries. The ratios were then applied to the number of temporary jobs that will be created during the construction of Farthings Hill and Five Oaks interchange improvement schemes. The estimated GVA impacts of the schemes are £711,000 and £640,000 respectively.

Operational Stage

Business Turnover and Rateable Values

The two schemes may have a marginal impact on local business turnover and rateable values.

The Farthings Hill and the Five Oaks schemes will help improve the overall perception and connectivity of the area which can create an attractive and welcoming environment for visitors and local residents leading to an increase in local footfall and local business turnover.

In addition, the expected growth in resident population resulting from new developments and improved accessibility of the local transport network could create attractive retail opportunities for new businesses serving the local communities. This will increase demand from retailers leading an increase in the rental values of properties. An increase in the total rental values for the area may occur to the existing properties and to new developments that could follow as a result of an improvement in the area's commercial vitality.

Both impacts, however, are expected to be marginal due to the potential dis-benefits in a form of negative journey time savings and congestion which are analysed in more detail in the Transport Benefits section of this report.

Longer term employment and GVA

The rise in local commercial activity may create some additional jobs and GVA in the local area generating tax revenue for local and national governments.

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Social Benefits

Improved Journey Quality

Both the Five Oaks and the Farthings Hill schemes have the potential to deliver significant improvements in journey quality to active mode users by providing better quality pedestrian and cycle facilities, improving journey environment and reducing travellers' stress. The impacts on journey quality for motorised transport users are likely to be negative due to the expected increase in journey times and congestion at the junctions. Some positive impacts on journey quality of vehicle users, however, may be derived from reduced fear of accidents resulting from wider carriageways and signalisation of junctions. The potential impacts of the schemes on the main journey quality factors are summarised in *Table 12* and *Table 13*

Table 12 WebTAG Journey Quality Impact Assessment, Farthings Hill Roundabout

FACTOR	SUB-FACTOR	IMPACT
TRAVELLER CARE	Facilities	The scheme will deliver better facilities for cyclists and pedestrians by providing new footpaths and new pedestrian crossing facilities, as well as realigning the existing footpaths to optimise pedestrian and cycle movements. The scheme will provide lay by facilities for service vehicles.
	Environment	The scheme will provide a better environment for pedestrians and cyclists resulting from new, more efficient and more accessible routes.
TRAVELLER STRESS	Frustration	The scheme is likely to have a positive impact on reducing frustrations for pedestrians and cyclists associated with inability/difficulty in completing the cross over due to heavy traffic.
	Fear of potential accidents	The scheme is expected to reduce the fear of potential accidents for all road users due to wider carriageways, signalisation of the junction arms and reconfiguration of pedestrian and cycle routes to improve safety.

CH2M HILL adaptation of DfT (2014) WebTAG Journey Quality Table

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Table 13 WebTAG Journey Quality Impact Assessment, Five Oaks Roundabout

FACTOR	SUB-FACTOR	IMPACT
TRAVELLER CARE	Facilities	Construction of a new connecting road; new screening facility, new footpaths and cycle paths
	Environment	Declassification of the road into a local distributer road may lead to a reduction in noise and local air quality for the local residents.
		An increase in the use if active modes for short distance journeys may have a positive impacts on the capacity of the existing parking facilities around key location such as the local supermarket and the local leisure centre.
TRAVELLER STRESS	Frustration	Reduced frustration for pedestrians, cyclists and local residents as a result of reduced severance and improved connectivity of the transport network.
	Fear of potential accidents	Declassification of the A264 bypass may reduce average speeds improving residents' perception of safety. It will also improve safety for the commuting pedestrians and cyclists.

CH2M HILL adaptation of DfT (2014) WebTAG Journey Quality Table

Improved Accessibility and Connectivity

Provision of attractive and safe pedestrian and cycle routes will improve accessibility to the local road network encouraging sustainable travel and reducing dependency on private car use.

One of the objectives of the Farthings Hill scheme is to construct, widen and realign footways and cycleways at the junction to improve safety and efficiency of existing network, thus, making it more accessible to the more vulnerable groups of the local community. Often it is the oldest and the youngest members of the community who might not have access to a vehicle and may rely on pedestrian and cycle networks to make short distance trips. Accessibility for wheelchair users will also be improved as a result of the scheme.

Improvements in accessibility for pedestrians and cyclists are also expected as a result of the Five Oaks scheme. The accessibility at Five Oaks will be improved through the provision of wider footways as well as the construction of additional pedestrian crossing improving connectivity between Broadbridge Heath and the new West of Horsham development. The reduction in traffic on the declassified A264 bypass and the Billinghurst Road and the improved accessibility and connectivity of the local pedestrian and cycle network are likely to encourage greater use of sustainable transport.

Severance

Both schemes are likely to have a positive impact on severance.

The current design of Farthings Hill junction favours motorised traffic which acts to create an obstacle for pedestrian and cycle movement. This is a major hindrance which may reduce the communities' interaction with each other and with the local businesses. Severance is also known to inhibit business development and restrain economic growth. An analysis of comparator schemes shows that similar interventions are likely to have a significant impact on reducing severance. For instance, the business case prepared for the Coppid Beech Junction Improvement scheme in West Wokingham, which involved provision of additional lanes, signalisation of junction arms and improving walk and cycle facilities, showed that the scheme's impacts on community severance were expected to be significant.[14]

[14] Wokingham: Coppid Beech Junction Improvement LPPF Submission, Supporting Business Case Information, http://www.wokingham.gov.uk/EasySiteWeb/GatewayLink.aspx?alId=233122

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The Five Oaks scheme is also expected to reduce severance by redirecting the through traffic from the A264 Broadbridge Heath Bypass to the new east-west link and providing additional pedestrian crossings to facilitate pedestrian movement between Broadbridge Heath and the new development. The reduction in severance will play an important role in creating an attractive community space and improving wellbeing of the local residents.

Agglomeration

It is expected that the schemes' overall impact on agglomeration is likely to be marginal. The schemes are expected to increase the cost of business travel which could have some negative impact on agglomeration by reducing competitiveness of the local area.

We do, however, expect some positive impacts on business creation and productivity on a small scale to be delivered as a result of the future growth of the local residential communities, which will be partially supported and facilitated through the improved connectivity of the local transport network.

The Impact Area is listed as one of the hinterland FURs. Improving accessibility of a hinterland area is likely to facilitate economic interaction between the core and the hinterlands, which suggests that the area is more likely to benefit from the agglomeration of business if transport improvements are made.[15]

Regeneration

The baseline assessment of the impact area shows that the local levels of deprivation and unemployment are significantly lower than the national average (see baseline), which shows that it is not necessarily in need of regeneration. It is expected that the schemes' direct impacts on jobs and house prices will be marginal, which also indicates limited regeneration potential.

However, the schemes are being implemented in conjunction with the new West of Horsham residential development, which has been forecast to create approximately 1,600 new jobs and is likely to deliver wider benefits to the local retail sector and the local economy. To deliver the full scale of benefits, the development will need to be complemented with the transport investment package that acts to improve area's overall attractiveness and attract residents and businesses. The Farthings Hill and the Five Oaks schemes are expected to deliver these benefits, and are, therefore, a good fit to support the development and the local transport strategy.

Increase in physical activity and associated health benefits

As a result of the improvements to the cycling and pedestrian networks at the junctions, we anticipate that there will be an increase in the number of pedestrian and cycle trips and/or an increase in the average time spent cycling or walking which is likely to have a positive impact in physical activity.

Physical activity has important health and wellbeing benefit to the community. Studies have shown that transport schemes that focus on providing convenient and save environment for walking and cycling are likely to facilitate an increase in the use of active transport modes and have a positive impact on physical activity. Greater level of physical activity leads better health, reduced absenteeism and as a result higher productivity which have a positive impact on economy and personal wellbeing.[16]

An analysis of literature physical activity and health has shown that the lack of physical activity is a significant problem in the UK costing the NHS approximately £8-10 billion a year. According to the NHS, only 40% of men and 28% of women are achieving minimum required levels of physical activity. Evidence

[15] Functional Urban Regions in England: Lookup Sheet, TAG Unit A2.1 – Wider Impacts, Department for Transport

[16] WebTAG: TAG Unit A4.1 – Social Impact Appraisal

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suggests that even low interventions to promote active travel can have significant impacts on physical and mental health, stress reduction and quality of life.[17]

Improved Perception of the Area and Improved Wellbeing

The schemes are likely to have a positive impact on community wellbeing as a result of the improved accessibility and reduced severance, as well as the increase in physical activity of the local population.

Both schemes will improve interaction within the community by improving access to local retail, leisure and other facilities, which should lead to better integration and wellbeing.

Traffic calming measures and the declassification of the A264 is likely to reduce the through traffic and rat-running on the local roads. This will reduce noise and emissions and improve safety. Studies have found that traffic calming schemes can have a positive impact on the local environment and the local communities. A study of 10 traffic-calming schemes in Scotland shows that a reduction in average speed had translated into improved perception of safety for cyclists and pedestrians and had led to children being allowed to play out and walk to school and adults making more walking and cycle trips.[18]

[17] Active Travel, Related Academic Evidence;Sustrains (2011) http://www.sustrans.org.uk/sites/default/files/images/files/Summary%20of%20active%20travel%20projects%282%29.pdf

[18] Community Impact of Traffic Calming Schemes – Research Findings Summary, The Scottish Government (1999); http://www.scotland.gov.uk/Publications/1999/10/38560fea-6e19-4098-95cd-37be45958aa8

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Environment benefits

The environmental appraisal of the Farthings Hill Roundabout and Five Oaks Roundabout schemes concluded that:

- The proposed schemes will result in no significant adverse impacts on known archaeology and cultural heritage, water quality and flood risk or geology;
- The proposed traffic calming measures and the declassification of the A264 will result in local improvements in air quality and noise;
- There is potential for temporary adverse impacts on air quality, noise and vibration during construction, but it is envisaged that these can be adequately mitigated by the adoption of appropriate construction methods and standards;
- The proposed works are likely to affect a small number of mature trees (either directly through removal or indirectly through impact on their roots) within the area of works and potentially within deciduous woodland BAP habitat areas. This may require further discussions with Horsham District Council. Appropriate protection measures should be adopted during construction to ensure other trees and their roots are not detrimentally affected by construction machinery. Further consideration will also need to be given to potential impacts on bats, great crested newts, breeding birds, reptiles;
- During construction, there will be a change to the local landscape due to construction plant, equipment and materials being stored on site. However, this will be a temporary impact, which will not be significantly out of character with the urban setting of the site and will not result in significant impacts on views;
- There is potential for significant temporary disruption to vehicle and footway users during construction. However, it is envisaged that appropriate traffic management measures will be implemented. The provision of a toucan crossing, widened footways and cycleways and signalisation of the roundabout will significantly improve safety for pedestrians and cyclists. Improved connectivity of footways and cycleways through the roundabout will also encourage sustainable transport use in the local community; and
- A PRoW through the northern extent of Five Oaks roundabout will be affected by the proposed works. Liaison with the Horsham District Council's PRoW Officer should therefore be undertaken to confirm whether a temporary closure or diversion of the adjacent PRoW will be required during the construction period. In the long term, the provision of widened footways and cycleways and traffic calming on the C192 Billingshurst Road will significantly improve safety for pedestrians and cyclists. Improved connectivity of footways and cycleways through the roundabout will also encourage sustainable transport use in the local community; and
- Increased sustainable transport use is envisaged to reduce reliance on the car, thus lower fuel consumption and reduce vehicle emissions. This will result in long term beneficial impacts on overall and local air quality, with associated reductions in carbon emissions.

Full details of the environmental assessment can be found in Annex 10.

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6.Capacity Schemes

Great Daux Roundabout

The three arm Great Daux roundabout is located to the north west of Horsham, approximately 1km north of the Robin Hood Roundabout. It forms the junction of the A24 and the A264.

The western A24 Dorking Road approach is a single carriageway, with a 50mph speed limit that flares to a two lane entry. Both the A24 (south) and A264 approaches are national speed limit dual carriageways with two lane entries.

Scheme description

The scheme proposes to provide additional entry lanes and signal control on all approaches (see Annex 6 for scheme drawing).

Construction costs and funding

The estimated cost of the Great Daux scheme is **£870,800**. This includes construction and design costs, along with a 20% optimism bias.

£653,100 (75%) of the funds required for the scheme is being sort from the C2C LEP via the C2C LTB. The remaining £217,700 (25%) will be provided through Section 106 developer contributions.

Maintenance costs

Detailed maintenance and operational costs of the scheme have not been assessed. Due to the introduction of traffic signals, the costs associated with maintaining the proposed scheme will be greater than current annual expenditure but is not considered to be significant.

Timeframe

The final time frame for scheme delivery has yet to be confirmed but detailed design is scheduled for 2015/2016 with works to be completed in 2017.

Transport benefits

Modelling approach

Traffic modelling was undertaken using traffic flows and junction models provided by WSCC.

The traffic flows used to form the opening year results were, again, obtained from the West of Horsham Traffic Model. The proposed scheme at Great Daux is also scheduled to be in place after the completion of the committed infrastructure associated with the West of Horsham development so flows from their 2023 Do Something scenario were used.

In addition to the 2023 traffic flows, WSCC manually developed 2029 traffic flows for Great Daux and Robin Hood roundabouts that incorporated the North of Horsham development19.

The 2023 and 2029 traffic flows were applied to a base ARCADY and a 'with scheme' LinSig models which were both created for WSCC as part of a project to develop the proposed mitigation scheme.

Using the opening year 2023 and forecast year 2029 traffic flows, the difference in highway network performance between the base model and the 'with scheme' models forms the basis of the Cost Benefit Analysis (CBA).

[19] A24 Broadbridge Heath Junction Assessment (Paul Eagle, 2013)

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Expected impact on journey times

The monetisation of the scheme benefits using the difference in total network delay (pcuhrs) between the base and 'with scheme' models generates a PVB of £320,566,507 (over a 60 year period). Full details of the calculation steps used can be found in Annex 7.

The extremely high journey time benefit is a result of the significant delay predicted by the base model, especially in the 2029 forecast year when the manually assigned North of Horsham development flows are included. In the AM peak, the A264 and A24 south approaches are operating well above theoretical capacity, 138% and 155% Ratio of Flow to Capacity (RFC) respectively. In the PM peak, all three approaches are predicted to operate above capacity, the A264 at 134%, the A24 South at 112% and A24 West at 168%.

The 'with scheme' model predicts the junction will operate well within capacity when signals and additional entry lanes are added.

In reality, the delay predicted by the junction models would not occur due to traffic reassignment and peak spreading (people choosing to start their journeys earlier of later, outside of the peak hours). This, in addition to the manually assigned 2029 traffic flows means the journey time benefits of implementing the scheme would not be as high as predicted. It should also be noted that the junction modelling software will not be providing reliable analysis of journey delays once significantly over capacity.

Expected impact on road safety casualties

Based on COBA guidance, the proposed signalisation of Great Daux will reduce the average cost per accident by **£6,650**. Over the 60 year analysis period, which takes into account the current accident rate (1.3 per year) and the general reduction in accident rates over time, this equates to a PVB of **£170,278**. Full details of the calculation steps used can be found in Annex 7.

Encouraging sustainable travel

The proposed scheme is on the strategic road network and is primarily aimed at providing journey time benefits to motorised vehicles, there are no sustainable transport benefits. Accordingly, they have not been considered as part of the BCR appraisal.

Valuing the public realm

The proposed scheme does not offer any public realm benefits so it has not been considered as part of the BCR appraisal.

Further assessment of the urban realm has been addressed in the Social impact section.

Other transport benefits

There are not considered to be any further transport benefits associated with the proposed scheme.

Benefit to Cost Ratio

The BCR for the Great Daux scheme has been calculated to be **506.6:1**. The extremely high BCR is explained by the extremely high journey time benefits and relatively low construction costs.

The BCR was calculated by combining the journey time PVB and dividing it by the PVC associated with the scheme. The steps taken to calculate the PVC of the scheme can be found in Annex 7.

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Contribution to policy objectives

Table 14 below provides a summary of how the scheme contributes to the C2C LEP SEP's transport objectives:

Table 14 – Great Daux contribution to policy objectives

C2C LEP SEP Transport Themes	Contribution to policy objectives
Connectivity: "Can I get where I want to go?"	Connectivity on a strategic level will be improved by increased capacity offered by the scheme. Great Daux forms an important intersection between the A24 (a strategic north/south truck road and the A264 which provides access to and from Crawley and the M23.
Reliability: "Will I arrive when I expect?"	Reliability will be improved with reduced journey times and congestion. Users will be able plan their journeys with less chance of delays affecting their journey.
Capacity: "Will I get a seat, a parking space, a clear road?"	The capacity of the junction will be significantly enhanced by the proposed scheme, reducing congestion and delays. The existing junction is predicted to be unable to cope with forecast traffic flows, especially those associated with the North of Horsham development.
Quality: "Will my journey be healthy, safe, clean, sustainable and enjoyable?"	The quality of the journey will be improved with reduced delays, and the associated driver's stress and frustration. Reduced congestion will also lower CO^2 emissions, improving air quality, providing indirect health benefits.
Resilience: "Will transport be there when I need it – 24/7?"	The scheme will lead to 'round the clock' improvements to the junction.

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Robin Hood Roundabout

The junction is situated to the north west of Horsham, approximately 1.5km north of Farthings Hill Interchange and 1km south Great Daux Roundabout. It forms the junction between the A24 and B2237 Warnham Road.

The A24 approaches are dual carriageways operating at national speed limit. The B2237 is a single carriageway with a two lane entry to the junction.

Scheme description

The scheme proposes to provide to provide two additional entry lanes and signal control on the A24 and Warnham Road approaches (see Annex 8 for scheme drawing).

Construction costs and funding

The estimated cost of the Robin Hood scheme is **£640,376**. This includes construction and design costs, along with a 20% optimism bias.

£480,281 (75%) of the funds required for the scheme is being sort from the C2C LEP via the C2C LTB. The remaining £160,093 (25%) will be provided through Section 106 developer contributions.

Maintenance costs

Detailed maintenance and operational costs of the scheme have not been assessed. Due to the introduction of traffic signals, the costs associated with maintaining the proposed scheme will be greater than what is currently spent but is not considered to be significant.

Timeframe

The final time frame for scheme delivery has yet to be confirmed but detailed design is scheduled for 2015/2016 with works to be completed in 2017.

Transport benefits

Modelling approach

Traffic modelling was undertaken using the same broad approach as that outlined for Great Daux Roundabout.

The 2023 and 2029 traffic flows were applied to a base ARCADY and a 'with scheme' LinSig models which were both created for WSCC as part of a project to develop the proposed mitigation scheme.

Using the opening year 2023 and forecast year 2029 traffic flows, the difference in highway network performance between the base model and the 'with scheme' models forms the basis of the Cost Benefit Analysis (CBA).

Expected impact on journey times

The monetisation of the scheme benefits using the difference in total network delay (pcuhrs) between the base and 'with scheme' models generates a PVB of £322,653,586 (over a 60 year period). Full details of the calculation steps used can be found in Annex 9.

As with Great Daux, the extremely high journey time benefit is a result of the significant delay predicted by the base model in both forecast years. In 2029 the A24 North (115%), Warnham Road (104%), and A24 south (149%) are predicted to operate above theoretical capacity in the AM peak. In the PM peak capacity is further exceeded, the A24 North is at 165%, Warnham Road 140%, and A24 South 117%.

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The 'with scheme' model predicts the junction will operate within capacity when signals and additional entry lanes are added.

In reality, the delay predicted by the junction model would not occur due to the same level because of traffic reassignment and peak spreading. This, in addition to the manually assigned 2029 traffic flows means the journey time benefits of implementing the scheme would not be as high as predicted.

Expected impact on road safety casualties

Based on COBA guidance, the proposed signalisation of Robin Hood will reduce the average cost per accident by **£6,650**. Over the 60 year analysis period, which takes into account the current accident rate (2.5 per year) and the general reduction in accident rates over time, this equates to a PVB of **£319,272**. Full details of the calculation steps used can be found in Annex 9.

Encouraging sustainable travel

The proposed scheme is on the strategic road network and is primarily aimed at providing journey time benefits to motorised vehicles, however, the inclusion of a signalised pedestrian crossing will improve connectivity for pedestrians and cyclists between Warnham and Horsham. These benefits have not be quantified so have not been considered as part of the BCR appraisal.

Valuing the public realm

The proposed scheme does not offer any public realm benefits so it has not been considered as part of the BCR appraisal.

Further assessment of the urban realm has been addressed in the Social impact section.

Other transport benefits

There are not considered to be any further transport benefits associated with the proposed scheme.

Benefit to Cost Ratio

The BCR for the Robin Hood scheme has been calculated to be 693.3:1. Similar to Great Daux, the extremely high BCR is explained by the significant journey time benefits when compared to the 'without scheme' base model and the relatively low construction costs. The same limitations of the junction modelling outputs also apply.

The BCR was calculated by combining the journey time PVB and dividing it by the PVC associated with the scheme. The steps taken to calculate the PVC of the scheme can be found in Annex 9.

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Contribution to policy objectives

Table 15 below provides a summary of how the scheme contributes to the C2C LEP SEP's transport objectives:

Table 15 – Robin Hood contribution to policy objectives

C2C LEP SEP Transport Themes	Contribution to policy objectives
Connectivity: "Can I get where I want to go?"	The inclusion of a signalised pedestrian crossing will improve connectivity for pedestrians and cyclists between Warnham and Horsham.
Reliability: "Will I arrive when I expect?"	Reliability will be improved with reduced journey times and congestion. Users will be able plan their journeys with less chance of delays affecting their journey.
Capacity: "Will I get a seat, a parking space, a clear road?"	The capacity of the junction will be significantly enhanced by the proposed scheme, reducing congestion and delays. The existing junction is predicted to be unable to cope with forecast traffic flows, especially those associated with the North of Horsham development.
Quality: "Will my journey be healthy, safe, clean, sustainable and enjoyable?"	The quality of the journey will be improved with reduced delays, and the associated driver's stress and frustration. Reduced congestion will also lower CO^2 emissions, improving air quality, providing indirect health benefits.
Resilience: "Will transport be there when I need it – 24/7?"	The scheme will lead to 'round the clock' improvements to the junction.

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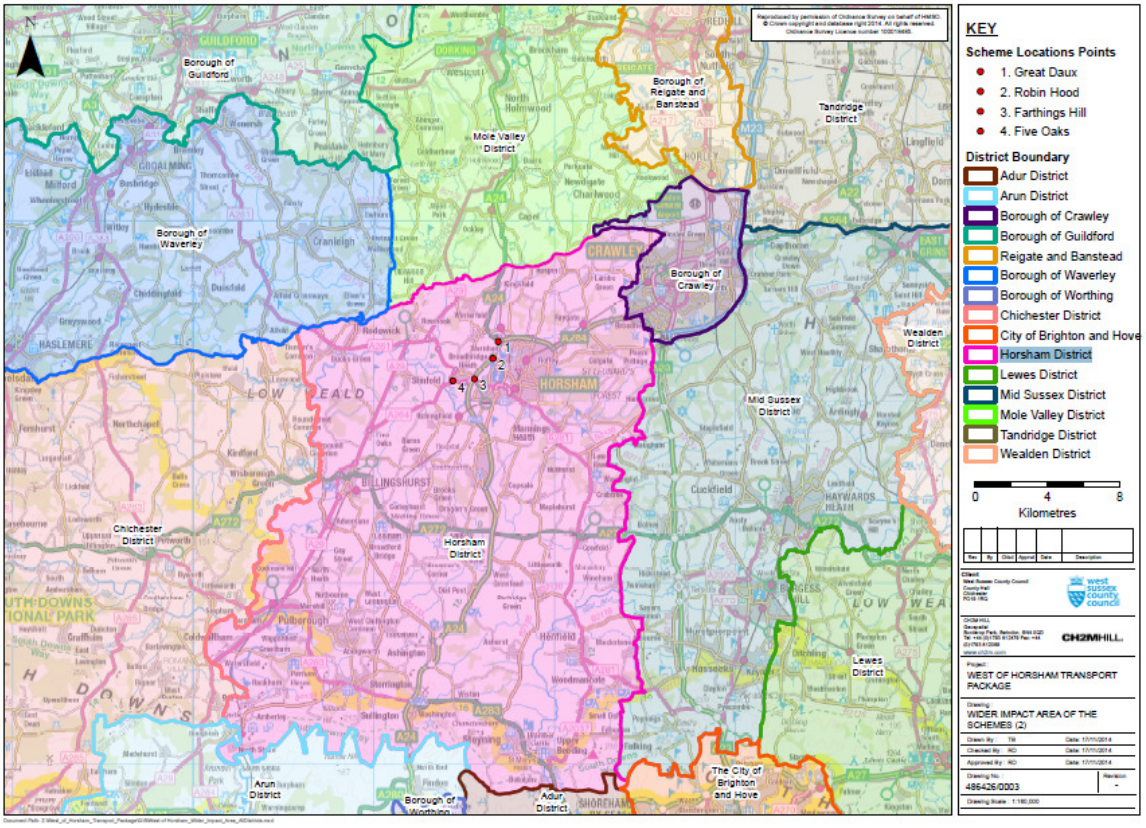
Combined Economic Social & Environment benefits

Economic benefits

The Great Daux and the Robin Hood roundabout schemes are expected to increase the overall capacity of the transport network and, therefore, have the potential to have significant economic and social impacts on the areas around the improved junctions, as well a slightly wider area that will also benefit from the improved accessibility and time savings resulting from the schemes. To account for the likely wider impacts, the impact area for these two schemes has been approximated using the geographical boundaries of the Horsham District Council. It is also possible that some residual benefits may be observed in the adjacent boroughs of Mole Valley and Crawley. An assessment of the potential scale of these impacts would require a detailed traffic study which lies outside of the scope of this assessment. The core impact area (the Horsham District) and the adjacent areas, where some benefits may be expected, are illustrated in Figure 5.

Figure 5: Impact Area, Horsham District



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Baseline

Population and Employment

The total resident population estimate for the Horsham District was 132,900 in 2013. The total number of economically active residents was estimated at 69,000 of which approximately 4.2% were registered as unemployed. This figure is below the 5% unemployment rate in the South East and the 6.8% rate for the UK average.[20]

Local Businesses and Local Economy

The area shows signs of good economic performance and a. According to BRES dataset, the total employment in the area in 2013 was estimated at approximately 52,000. The data shows that the majority of jobs in that year were generated by retail trade (12%), education (10%) and health (9%) sectors.[21]

The number of active enterprises in 2012 stood at 6,860, which is one of the highest in the West Sussex County. The number of enterprise births and deaths in the same year was approximately 670 and 625 respectively which shows an increase in the total number of businesses in the area.[22]

According to the latest UK Business Counts data, approximately 90% of the local enterprises are micro businesses with the average number of employees between 0 and 9. The proportion of medium and large enterprises with the number of employees equal to 50 and above is only 2.2% of the total enterprises in the area. These figures are in line with what is observed at regional and national level.[23]

The impact area has good availability of high level skills which is also reflected in higher than average earnings. The Horsham district has a higher proportion of working age population educated at the level of NVQ4 and above (41.8%) compared to 38% in the South East and 35% the UK as a whole. The average residents' hourly pay in the area is also 9.5% higher than the regional average and approximately 20% higher than the national average. [24]

House Prices

We have used average house prices in Horsham as an approximation for the average price in the impact area. The average price in Horsham this year, as reported by Rightmove, was £306,590 which is somewhat higher than in nearby Warnham (£295,850) but significantly lower than in Broadbridge Heath (£347,502) and in Mannings Heath (£470,743). The prices grew by 5% on the year before and by 10% on 2010.[25]

[20] Horsham, Labour Market Profile, Nomis/ONS

[21] Busines Register Employment Survey, Nomis/ONS

[22] Business Demography 2012, ONS

[23] Horsham, Labour Market Profile, Nomis/ONS

[24] Ibid.

[25] Data provided by Rightmove.com (2014)

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Deprivation

The local authority on average scored extremely low on deprivation. According to the IMD data, only 1 out of 81 LSOAs in Horsham fall within the top 40% most deprived areas in England. All LSOAs in the Horsham district are below the 20% most deprived mark.[26]

Construction Stage

During the construction stage temporary employment and GVA will be generated.

Temporary Construction Employment

Applying the estimated average investment per job ratio of £143,750 (see Section 4 for method) shows that the Great Daux Roundabout improvement scheme is likely to generate up to 6 temporary jobs during construction. The Robin Hood Roundabout scheme is expected to generate up to 4 temporary jobs during construction.

Due to the size of the schemes we assume that the 1:2 relationship between construction and professional jobs is not appropriate, therefore, we have only reported on the total temporary jobs that could be created.

Temporary Construction GVA

The total GVA that could be generated during the construction stage of the Great Daux Roundabout scheme has been estimated at approximately **£490,500**.

The Robin Hood Roundabout scheme is expected to generate **£327,000** of GVA during the construction period.

Operational Stage

Business Turnover and Rateable Values

The schemes are likely to have a positive impact on business turnover and rateable values in the impact area.

Removing congestion at the junctions and optimising traffic flow is likely to reduce journey times and fuel consumption, lowering travel costs for residents, businesses and visitors. This may encourage users to make more journeys and repeat journeys to the area, which may lead to an increase in footfall and growth in business turnover.

Following the successful completion of the North of Horsham Strategic Development, the area is likely to see an increase in the number of new business entrants. The proposed improvements of the Great Daux and the Robin Hood interchanges will play a significant role in facilitating the development of the new business cluster by offering lower cost of journeys and helping to create an attractive and vibrant commercial district. Increased demand from businesses will have a positive impact on rateable values of the business units with a gradual increase in rents and associated business rates generating GVA and government revenues.

Longer term employment and GVA

Through improving the transport infrastructure in the area making it more attractive for business and inward investment, there is potential for the creation of longer term employment opportunities and GVA.

[26] The English Indices of Deprivation 2010, Oxford Consultants for Social Inclusion (OCSI) for the Department for Communities and Local Government

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Social benefits

Improved Journey Quality

An improvement in core junction performance is likely to positively affect journey quality by improving the highway environment and reducing travellers' stress and frustration associated with road congestion and journey time uncertainty. The key impacts of the scheme on journey quality are summarised in *Table 16*.

Table 16: TAG Journey Quality Impact Assessment, Great Daux and Robin Hood Junctions

FACTOR	SUB-FACTOR	IMPACT
TRAVELLER CARE	Facilities	The schemes will improve the capacity of the highway facilities specifically for the motorised transport users by providing additional lanes and wider entry points to the roundabouts.
	Environment	The schemes will reduce congestion, which is expected to have a positive impact on highway environment.
TRAVELLER STRESS	Frustration	Improvement in journey time savings and journey time reliability will reduce drivers' frustration and stress and will help to deliver more pleasant journeys.
	Fear of potential accidents	An improvement in the capacity of the roundabout and reduced congestion is likely to reduce fear of potential accidents and improve journey quality.

CH2M HILL adaptation of DfT (2014) WebTAG Journey Quality Table

Improved Accessibility and Connectivity

The combined effect of the A24 junction improvement schemes will be to reduce congestion and, therefore, it will improve the accessibility within the core impact area. The schemes could potentially also improve connectivity between the impact area and other destination in the surrounding areas connected via the A24.

Severance

Severance is not expected to occur as a result of these schemes.

Agglomeration

The schemes are likely to positively affect agglomeration in the impact area. Studies have shown that improvements in road transport generally bring firms closer to each other and firms closer to workers in terms of travel times and costs.[27] The schemes will help deliver better accessibility and connectivity of the local area facilitating closer economic integration. This is likely to result in more competition and improvements in productivity and knowledge sharing which establishes an attractive environment for business creation and improves the basis for agglomeration.

The WebTAG FUR lookup table suggests that 16 out of 22 CASs that form the local authority of Horsham were identified as hinterland FURs, which means these are commuting areas to a core region. Improving

[27] Productivity and employment impacts of agglomeration: evidence from transport improvements, Gibbons et al, London School of Economics & Spatial Economics Research Centre,http://personal.lse.ac.uk/gibbons/Papers/Draft_nov10_UEAM.pdf

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accessibility of the hinterland area is likely to facilitate economic interaction between the core and the hinterlands, which suggests greater potential for agglomeration impacts.

Regeneration

The schemes will have small positive impact on area regeneration.

Congested road networks discourage investment and new employment and cause retention difficulties for existing employment and businesses moving out of area. A reduction in travel costs can help to improve commercial vitality of the area by attracting more businesses and employment to the local area. The increase in commercial activity is likely to attract inward investment and facilitate new developments leading to increased demand and prices of residential and commercial properties and economic growth and regeneration of the local area.

The impacts of the proposed schemes on regeneration, however, are expected to be marginal. The impact area performs well economically and has higher than average hourly earnings and low unemployment (see Baseline). In addition, the area's deprivation score was found to be low, which suggests that regeneration impacts of the schemes is likely to be limited.

The proposed junction improvements, however, are likely to be necessary in order to maintain the high level of economic performance and area's attractiveness given the anticipated future housing developments. Without further improvements the congestion currently observed at peak hours may become exacerbated by future traffic growth serving to discourage new investment and hinder business growth.

Improved Perception of the Area

Improvements in journey times and connectivity and reduced congestion on the A24 may lead to an improvement in the overall perception of the area by the local residents, visitors and the local business community.

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Environmental benefits

The environmental appraisal of the Great Daux and Robin Hood roundabout schemes concluded that:

- The proposed project will result in no significant adverse impacts on known archaeology, flood risk or geology;
- Given the proximity of the Great Daux Grade II Listed Building to the area of works, care should be taken to minimise any adverse impacts during construction that may affect the building directly or indirectly such as noise and vibration, dust, air pollution and visual impacts. These effects are, however, likely to be temporary and localised, and can be mitigated by the application of suitable controls during construction;
- Given the proximity of the South East Lodges of Warnham Court School Grade II* Listed Building to the area of works, care should be taken to minimise any adverse impacts during construction that may affect the building directly or indirectly such as noise and vibration, dust, air pollution and visual impacts. These effects are, however, likely to be temporary and localised, and can be mitigated by the application of suitable controls during construction;
- There is potential for temporary adverse impacts on air quality, noise and vibration during construction, but it is envisaged that these can be adequately mitigated by the adoption of appropriate construction methods and standards;
- The proposed works are likely to require the removal of trees (including trimming of branches to facilitate access, or works within the root protection zone) within the area of works and potentially within deciduous woodland BAP habitat areas. This may require further discussions with Horsham District Council. Appropriate protection measures should be adopted during construction to ensure other trees and their roots are not detrimentally affected by construction machinery. Further consideration will also need to be given to potential impacts on bats, great crested newts, breeding birds, reptiles. Given that there are several ponds within 500m of the Five Oaks site, there is likely to be potential for GCNs. Further protected species surveys are therefore recommended;
- The site is located in a minor aquifer intermediate Groundwater Vulnerability Zone and Secondary A aquifer. Mitigation should be put in place to avoid any risk of pollution or contamination to groundwater;
- During construction, there will be a change to the local landscape due to construction plant, equipment and materials being stored on site. However, this will be a temporary impact, which will not be significantly out of character with the setting of the site and will not result in significant impacts on views; and
- There is potential for significant temporary disruption to vehicle users during construction. However, it is envisaged that appropriate traffic management measures will be implemented. In the long term, the works to increase junction capacity. This will reduce journey times, slow moving traffic, driver stress, frustration and accidents, and will result in a significant improvement for vehicle users. These improvements will also result in reduced vehicle emissions, which will result in beneficial impacts on overall and local air quality, with associated reductions in carbon emissions. At Robin Hood Roundabout, the new crossing facilities will improve safety for pedestrians and cyclists.

Full details of the environmental assessment can be found in Annex 10.

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Annex 1: WebTAG Journey Quality Factors

FACTOR	SUB-FACTOR	DEFINITION
TRAVELLER CARE	Cleanliness	Internal and external cleanliness and graffiti; the condition of the seats; tables; brightness of internal lighting.
	Facilities	Types of seats, handles, luggage racks and storage, toilets, buffet/restaurant facilities and level of staff customer service, presence of service stations and facilities for motorists.
	Information	Audibility, frequency and usefulness of on-board PA announcements; the provision of general travel information and customer magazines; and the condition of advertising posters.
	Environment	Extent of overcrowding, ventilation; temperature; noise; overall condition and smoothness of ride, motor vehicle condition and driver capability.
TRAVELLERS' VIEWS	-	Depth of cuttings or natural/ artificial barriers, the presence of which may block views of the surrounding countryside or townscape.
TRAVELLER STRESS	Frustration	Road layout and geometry; condition of the road network; ability to make good progress along a route.
	Fear of potential accidents	Presence of other vehicles, inadequate sight distances, possibility of pedestrians stepping into the road, presence of central reservation or safety barriers (or not); inadequate lighting; the width of the road/ carriageway/lane; presence of roadworks; the absence of lane markings, cats eyes, and hard shoulders.
	Route Uncertainty	Timetables and network maps (e.g. available in public places, or on the Internet), provision of in-vehicle route signs. (NB actual time savings through better information should be assessed as a TEE benefit).

Annex 2: Farthings Hill Interchange Scheme

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Annex 3: Farthings Hill Interchange BCR analysis

Annex 4: Five Oaks Roundabout Scheme

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Annex 5: Five Oaks Roundabout and Traffic Calming BCR analysis

Annex 6: Great Daux Roundabout Scheme

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Annex 7: Great Daux Roundabout BCR analysis

Annex 8: Robin Hood Roundabout Scheme

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Annex 9: Robin Hood Roundabout BCR analysis

Annex 10: Environment Technical Memorandum

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