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LYMINSTER BYPASS TRANSPORT BUSINESS CASE

Deliverable TN4 – Economic Assessment Report

09/11/2014

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Prepared by	Alan Cowan	Alan Cowan	Alan Cowan	
Signature				
Checked by	Alan Cowan	Alan Cowan	Alan Cowan	
Signature				
Authorised by	Craig Drennan	Craig Drennan	Craig Drennan	
Signature				
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LYMINSTER BYPASS TRANSPORT BUSINESS CASE

Deliverable TN4 – Economic Assessment Report

09/11/2014

Client

West Sussex County Council
County Hall
West Street
Chichester
PO19 1RH

Consultant

WSP UK Ltd
Mountbatten House
Basingstoke
RG21 4HJ
UK

Tel: +44 (0)1256 318800
Fax: +44 (0)1256 318700

www.wspgroup.co.uk

Registered Address

WSP UK Limited
01383511
WSP House, 70 Chancery Lane, London, WC2A 1AF

WSP Contacts

Alan Cowan, Associate
alan.cowan@wspgroup.com

Craig Drennan, Technical Director
craig.drennan@wspgroup.com

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1 Introduction

- 1.1.1 WSP has been commissioned by West Sussex County Council (WSCC) under the Improvement and Efficiency South East (IESE) framework to undertake model development and testing of the proposed Lyminster Bypass to provide the evidence base for the Transport Business Case (TBC) for the scheme.
- 1.1.2 The purpose of this technical note is to set out the methodology and results of the assessments that comprise the economic case, one of five elements in the TBC.
- 1.1.3 The TBC includes discussion of two options:
- **Option 1:** Completed Lyminster Bypass but assuming the developer will improve junctions on southern bypass over and above those consented for the North Littlehampton SDL. Wick level crossing will be closed to vehicular traffic. This is the preferred option
 - **Option 2:** Completed Lyminster Bypass with junctions on southern bypass consistent with consented designs. Wick level crossing to remain open to vehicular traffic
- 1.1.4 These are set out in figures 1.1 and 1.2 below.
- 1.1.5 Since the development of the model scenarios, circumstances have evolved such that neither option quite reflects the most likely scenario. Recent discussions with the North Littlehampton SDL developers have resulted in modified junction designs on the southern bypass which are based on, but not identical to, the proposed designs in Option 1. Network Rail have also indicated that it would not be economically viable at present to close the Wick level crossing, so this will remain open for the foreseeable future. Economic benefits of the scheme are therefore likely to be in excess of both options 1 and 2, but there is insufficient time to complete this assessment for submission of the Outline Transport Business Case. This will be updated as part of the Full Transport Business Case.
- 1.1.6 User benefits have been assessed for both options to provide an estimate of the robustness of core scheme benefits, but the wider impacts, accident appraisal and impacts of construction have been assessed for Option 1 core scenario only.
- 1.1.7 The report is structured as follows:
- **Section 2** – User benefits
 - **Section 3** – Wider impacts
 - **Section 4** – Accident appraisal
 - **Section 5** – Impact of construction
 - **Section 6** - Conclusions

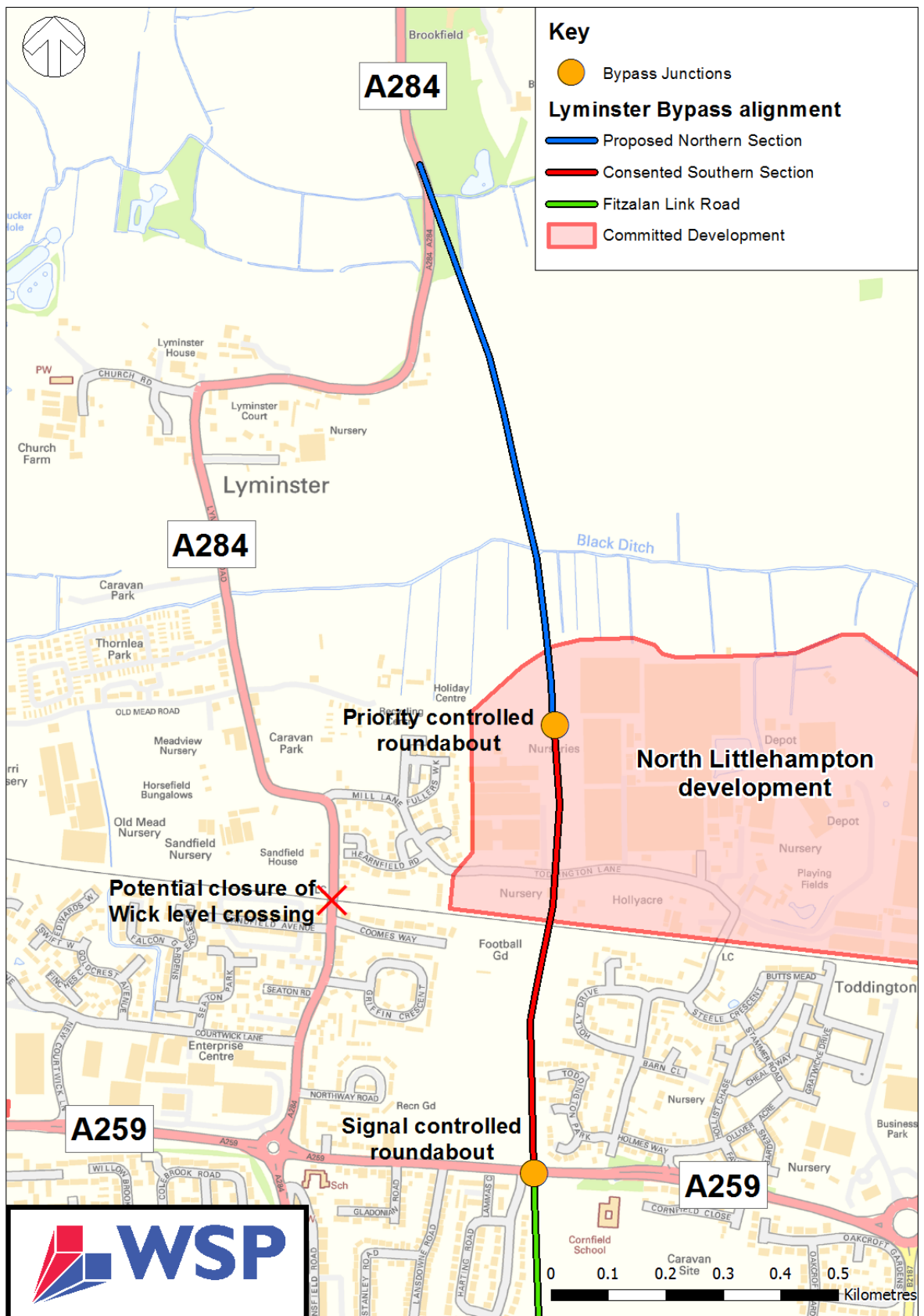


Figure 1.1: Option 1 assumptions

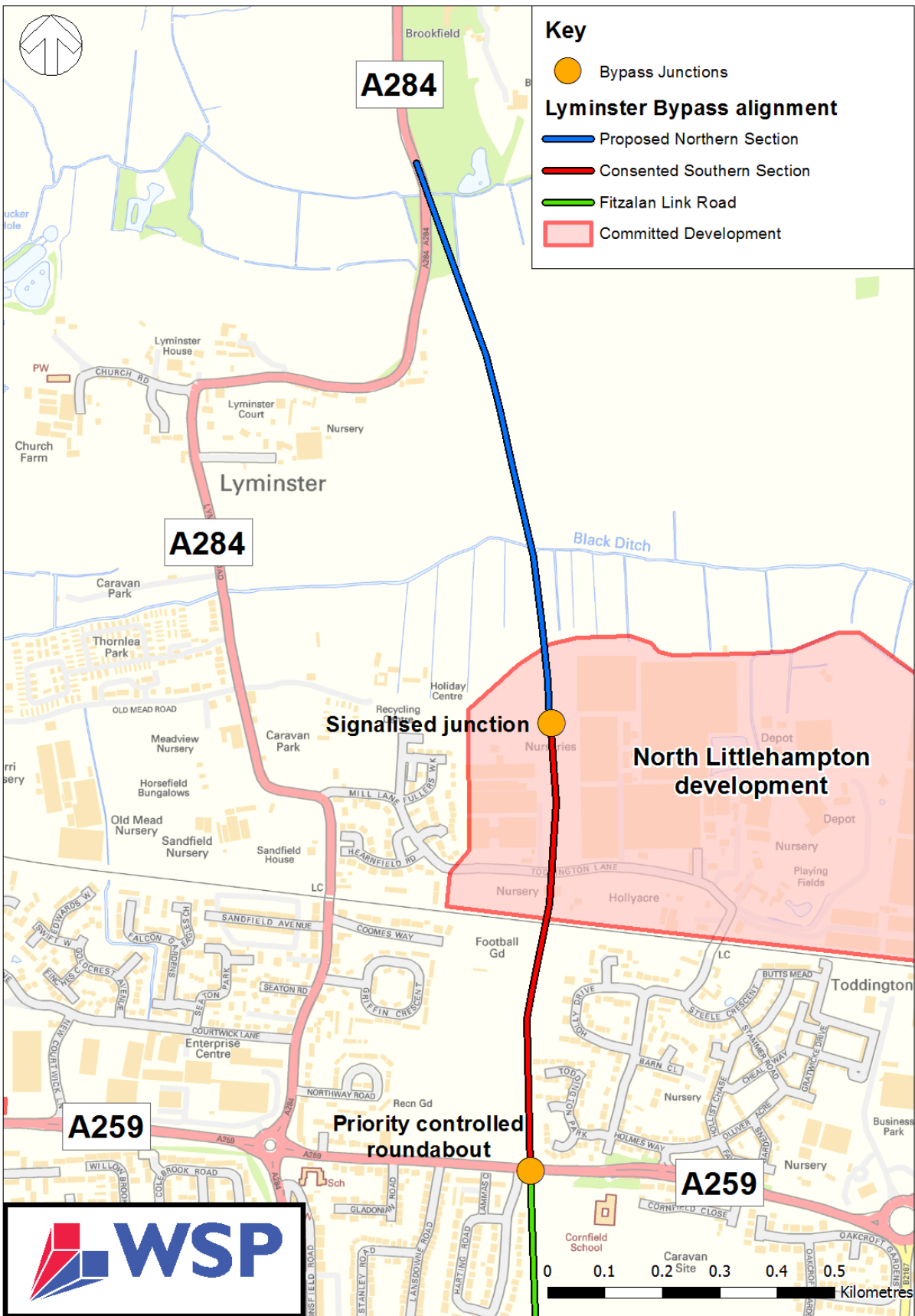


Figure 1.2: Option 2 assumptions

2 User benefits

2.1 Background

- 2.1.1 Scheme benefits have been assessed using the Department for Transport's TUBA (Transport Users Benefit Appraisal) software. This is an industry-standard tool for undertaking economic appraisal in accordance with guidelines published in WebTAG Unit A1 (May 2014). The full economic assessment methodology adopted including choice of parameters, definition of inputs, discounting and reporting is compliant with WebTAG Unit A1.

2.2 Input assumptions

- 2.2.1 The current version of the TUBA software is Version 1.9.4 which is consistent with parameters published in WebTAG Unit A1 (May 2014).
- 2.2.2 Lyminster Bypass, like most road projects, is considered to be an asset with an indefinite life, with maintenance and renewal taking place as required. Scheme appraisal has therefore been undertaken for a 60-year period in accordance with HM Treasury's Green Book, from the assumed scheme opening in 2017 to 2076.
- 2.2.3 Annualisation factors for the three modelled time periods have been derived based on values obtained from the traffic survey data, as set out in section 8.3 of the D3 Data Collection Report. The derived annualisation factors are given in table 2.1.

Table 2.1: Annualisation factors

Period	Peak hour to peak period factor	Number per year	Annualisation factor
AM (07:00-10:00)	2.329	253	589
IP (10:00-16:00)	6.075	253	1537
PM (16:00-19:00)	2.454	253	621
Off-peak (19:00-07:00 weekdays)	2.70	253	683
Weekend (Sat 07:00-Mon 07:00)	25.60	56	1444

- 2.2.4 Off-peak and weekend periods use the interpeak model as a proxy, with suitable factors applied based on observed traffic flows over these periods. Bank holidays are represented by weekend factors. There are 8 bank holidays per year, which can be amalgamated into four 2-day blocks equivalent to a weekend. Thus, there are 56 "weekend" periods in a year. The calculated benefits have therefore been derived for all 8,760 hours in the year.
- 2.2.5 User classes have been defined as shown in table 2.2 so that the definitions used in model development have been applied to the TUBA assessment.

Table 2.2: User class definitions

UC	Model Definition	TUBA Parameter		
		Vehicle Type	Purpose	Person Type
1	Car: Commuting	Car	Commuting	All
2	Car: Employer's Business	Car	Business	All
3	Car: Other	Car	Other	All
4	LGV	LGV Freight	Business	All
5	OGV1	OGV1	Business	Driver
6	OGV2	OGV2	Business	Driver

2.2.6 TUBA requires that trip matrices are entered as total trips, but SATURN defines trips in Passenger Car Units (PCU), as set out in Deliverable D4 – Local Model Validation Report (February 2014). It is therefore necessary to apply adjustment factors to convert the PCU matrices into total trips. These are set out in table 2.3

Table 2.3: PCU to vehicle adjustment factors

UC	Model Definition	PCU Factor	TUBA Factor
1	Car: Commuting	1.0	1.00000
2	Car: Employer's Business	1.0	1.00000
3	Car: Other	1.0	1.00000
4	LGV	1.0	1.00000
5	OGV1	1.9	0.52632
6	OGV2	2.9	0.34483

2.2.7 The derivation of the PCU factors is set out in section 2.7 of Deliverable D7 - Forecasting Report (August 2014).

2.2.8 Model skims were extracted for 2017 and 2032. The TUBA default assumption on growth has been applied, with no additional growth assumed beyond the final modelled year of 2032. The default assumptions on growth in the values of impacts have also been applied, meaning that the per unit benefits of the scheme decline over time.

2.2.9 The model forecasts have been completed in accordance with WebTAG principals, as set out in the Lyminster Bypass Forecasting Report. WebTAG requires that forecasts for fixed trip models should include increase to account for fuel and income growth, resulting in relatively large growth forecasts. While this is sufficient to generate a robust assessment, it is reasonable to assume that such growth forecasts will not continue indefinitely. There is no further evidence to indicate the likely direction of traffic growth beyond this point, to the default assumption of zero growth beyond the final modelled year has been adopted.

2.2.10 Although sensitivity testing around alternative growth profiles has not been carried out, the analysis undertaken on the high and low growth scenarios provides a sufficiently robust evidence base to assess the scheme benefits under alternative growth scenarios.

2.3 Results

- 2.3.1 Results from the TUBA assessment are presented for both Option 1 and Option 2. For each option, results are presented for the Core Scenario, as well as low and high growth scenarios as discussed in the Deliverable D7 - Forecasting Report (August 2014).
- 2.3.2 At this stage, scheme costs are not yet known, so they have not been included in the analysis. These will be included in the TBC, allowing the Benefit to Cost Ratio (BCR) to be calculated. The Transport Economic Efficiency (TEE) benefits for Option 1 are shown in table 2.4. All values are in thousands of pounds (£000s), in 2010 prices, discounted to 2010.

Table 2.4: Option 1 Transport Economic Efficiency benefits (£000s, 2010 prices discounted to 2010)

Benefit		Low Growth	Core Scenario	High Growth
Consumer - commuting user benefits	Travel time	£7,902	£12,659	£10,380
	Vehicle operating costs	£1,007	£1,231	£863
	Subtotal	£8,909	£13,890	£11,243
Consumer - other user benefits	Travel time	£42,815	£52,123	£50,917
	Vehicle operating costs	£4,708	£4,095	£4,685
	Subtotal	£47,523	£56,218	£55,601
Business benefits	Travel time	£20,370	£26,608	£28,016
	Vehicle operating costs	£1,750	£1,844	£1,595
	Subtotal	£21,120	£28,452	£29,610
Greenhouse gases		£898	£941	£901
Indirect tax revenues		-£2,409	-£2,522	-£2,467
Present Value of Benefits (PVB)		£77,042	£96,979	£94,888

- 2.3.3 The Core Scenario generates the highest benefits of £96.98m. As might be expected, the low growth scenario generates lower benefits of £77.04m, but the high growth scenario also generates slightly lower benefits than the Core Scenario of £94.89m. This is because the high growth scenario generates high user costs in both the Do Minimum and Do Something scenarios, but additional delay in the Do Something scenario is such that the difference between the two is lower than it is in the less congested Core Scenario.
- 2.3.4 User benefits for Option 2 are given in table 2.5.

Table 2.5: Option 2 Transport Economic Efficiency benefits (£000s, 2010 prices discounted to 2010)

Benefit		Low Growth	Core Scenario	High Growth
Consumer - commuting user benefits	Travel time	£10,845	£5,397	£14,458
	Vehicle operating costs	£1,598	£1,114	£1,412
	Subtotal	£12,443	£6,512	£15,870
Consumer - other user benefits	Travel time	£46,723	£30,037	£61,123
	Vehicle operating costs	£5,853	£4,648	£6,249
	Subtotal	£52,576	£34,685	£67,373
Business benefits	Travel time	£30,014	£18,697	£43,509
	Vehicle operating costs	£4,105	£2,996	£4,495
	Subtotal	£34,119	£21,692	£48,004
Greenhouse gases		£1,329	£950	£1,467
Indirect tax revenues		-£3,526	-£2,607	-£3,903
Present Value of Benefits (PVB)		£96,941	£61,232	£128,811

- 2.3.5 The Core Scenario benefits for Option 2 are substantially lower than those for Option 1 at £61.23m. The proposed junction designs on the southern bypass do not provide as much capacity as the improvements included in Option 1, causing some trips to seek alternative routes rather than experience delay on the southern bypass. This includes the existing A284, which is a viable alternative in Option 2 as Wick level crossing is not closed. Local residents do not, therefore, experience the same level of traffic reduction in the village as they do in Option 1.
- 2.3.6 The different assumptions underpinning the low and high growth scenarios have a fundamental impact in Option 2. With low growth, the junctions on the southern bypass do not operate at capacity, so substantial benefits are achieved. In the high growth scenario, improvements at Crossbush and along the A259 corridor encourage a switch in assignment onto the bypass, generating additional benefits.

3 Wider impacts

3.1 Background

- 3.1.1 The wider economic impacts of the proposed scheme have been assessed in accordance with guidance set out in WebTAG Unit A2-1. The guidance considers the following impacts:
- **WI1: Agglomeration:** changes in economic production as a result of changes in connectedness and accessibility
 - **WI2: Output change in imperfectly competitive markets:** a reduction in transport costs to businesses allows for an increase in output of goods and services that use transport
 - **WI3: Tax revenues arising from labour market impacts:** changes in labour supply or a move to more or less productive jobs due to a change in commuting cost
- 3.1.2 WebTAG indicates that the output change in imperfectly competitive markets and tax revenues from changes in the labour supply will be relevant to most schemes, but the other two elements may not be relevant. Critical to this determination is whether the scheme is in close proximity to an economic centre or large employment centre. WebTAG defines such locations as Functional Urban Regions (FUR), and the plan included in Appendix A of the guidance indicates that the Lyminster Bypass does not lie within a FUR. Consequently, only the output change in imperfectly competitive markets and change in tax revenues from changes in the labour supply have been assessed.

3.2 Input assumptions

Output change in imperfectly competitive markets (WI2)

- 3.2.1 This element represents the welfare impact that results because increases in the output of goods and services are valued more highly by consumers than the cost of producing this output.
- 3.2.2 The guidance for the calculation of this impact is very simple – it is a straightforward uplift equivalent to 10% of the business user benefits, as reported in the Transport Economic Efficiency table from the TUBA analysis. The benefit for each modelled year has been extracted and used to create a 60-year profile.

Tax revenues arising from changes in labour supply (WI3)

- 3.2.3 Paragraph 4.1.13 in WebTAG Unit A2-1 sets out that the calculation of this impact is done in three stages:
- **Stage 1:** calculate how commuting costs for round trips change as a result of the scheme and how this will affect the benefit an individual obtains from working
 - **Stage 2:** calculate how the change in benefit from working will impact on the overall amount of labour supplied
 - **Stage 3:** calculate the additional national output produced by the new labour supplied
- 3.2.4 WebTAG Unit A2-1 Appendix D sets out in detail the derivation of the formula used to calculate this impact, combining all three elements above and simplifying the formula. The final formula actually used to calculate the impact (GP1) is given in Appendix D.1.15 to the WebTAG unit, as follows:

$$GP1^f = -\varepsilon^{LS} \frac{\eta}{1 - \tau_1} \sum_i \left(\sum_j W_{i,j}^{S,f} (G_{i,j}^{A,c,f} - G_{i,j}^{B,c,f}) \right)$$

3.2.5 The actual impact reported considered for the analysis is the additional tax generated from this, defined as:

$$W13^f = \tau_2 GP1^f$$

3.2.6 The definitions of terms and parameters are set out in table 3.1. Where specified, parameter values are provided in WebTAG Unit 2-1 Appendix B.

Table 3.1: Labour supply impact parameters

Term	Definition	Value
ε^{LS}	Elasticity of labour supply with respect to effective wages	0.1
η	Parameter that captures the lower productivity of workers on the margin of the labour force	0.69
τ_1	Average tax rate on earnings	0.3
τ_2	Tax take on labour supply	0.4
$W_{i,j}^{S,f}$	Number of workers living in model zone i and working in zone j , in forecast year f and scenario S .	Calculated from model
$G_{i,j}^{A,c,f}$	Round-trip commuting average generalised costs of travel between zone i and zone j in forecast year f in the alternative case A (i.e. Do Something scenario)	Calculated from model
$G_{i,j}^{B,c,f}$	Round-trip commuting average generalised costs of travel between zone i and zone j in forecast year f in the baseline case B (i.e. Do Minimum scenario)	Calculated from model

3.2.7 The commuting production-attraction matrices (W) were developed from the East of Arun Transport Model (EATM) AM peak commuting matrix (user class 1), which was assumed to be representative of commuting behaviour. To create a full commuting production-attraction matrix, totals for the number of workers and jobs per zone were extracted from the TEMPRO v6.2 dataset. The commuting matrix was then Furnessed, with rows set to match the number of workers, and columns set to match the number of jobs.

3.2.8 Round trip commuting generalised costs were calculated as follows:

$$G_{i,j}^{S,c,f} = \frac{(g_{i,j}^{S,c,f} + g_{j,i}^{S,c,f})T_{i,j}^{B,c,f}}{T_{i,j}^{B,c,f}}$$

3.2.9 The input parameters are described in table 3.2.

Table 3.2: Round trip commuting generalised cost parameters

Term	Definition	Value
$g_{i,j}^{S,c,f}$	Generalised cost of travel from zone i to zone j in scenario S for commuting purpose c in forecast year f . Cost specified in money terms	Calculated from model
$T_{i,j}^{B,c,f}$	Number of commuting trips from zone i to zone j in forecast year f in the baseline case B (i.e. Do Minimum scenario)	Calculated from model

3.2.10 WebTAG does not mention modelled time periods in the calculation of this impact. The AM peak hour generalised costs have been used, as these are likely to represent the largest commuting period.

- 3.2.11 For the calculation of benefits, it is important that intra-zonal costs are suitably represented. Since these are not reported when output from the EATM, they have been estimated as 0.5 times the minimum cost from a given origin to any other destination, in keeping with options available in SATURN.
- 3.2.12 Similarly, to avoid generalised costs being cancelled out by trips with zero movements, a minimum trip value of 0.01 was set.
- 3.2.13 Generalised costs were output from the EATM specified in units of time (seconds). These were monetised by applying the value of time for commuting purposes, derived from the WebTAG databook, and dividing by 3,600.

Table 3.3: Commuting values of time

Year	£/hr
2017	£8.24
2032	£10.67

Profiling over 60 years

- 3.2.14 Initial calculations for WI2 and WI3 have been made for the two modelled years of 2017 and 2032. To be included in the appraisal, these must be profiled over 60 years to 2076 and discounted to 2010 using standard procedures used in the TUBA assessment.
- 3.2.15 Since values for WI2 have been derived from the TUBA assessment, they have already been discounted to 2010. The values for each modelled year were therefore divided by the relevant discount rate to generate the present year value for input into the 60-year profile.
- 3.2.16 Following WebTAG guidance, values for years between the two modelled years were interpolated. For years after the last modelled year, the imperfect competition impact WI2 was grown by the work value of time. The tax wedge on labour market impact WI3 was grown by the non-work value of time. Both growth rates are provided in the WebTAG databook, and after 2032 they are identical.

3.3 Results

- 3.3.1 The results of the analysis described above are summarised in table 3.4. The appraisal period is 2017-2076. All monetary values are in thousands of pounds, in 2010 prices, discounted to 2010.

Table 3.4: Wider economic impacts results (£000s, 2010 prices discounted to 2010)

Impact	2017	2032	Full Period	Net Present Value
WI2 – Output in Imperfectly Competitive Markets	£39.0	£125.3	£10,370.5	£2,788.9
WI3 – Tax revenue from changes in labour supply	-£16.3	£96.2	£7,587.4	£1,890.2
TOTAL	£22.7	£221.5	£17,957.9	£4,679.1

- 3.3.2 The wider impacts benefits represent 4.82% of the total user benefits calculated by TUBA. This is broadly consistent with advice presented in WebTAG, which estimates total wider impacts benefits to be around 10-30% of TUBA benefits when all four wider impacts measures are assessed.

4 Accident assessment

4.1 Background

4.1.1 Assessment of the costs and benefits associated with accidents has been undertaken using the DfT's CoBALT (**C**ost – **B**enefit-**A**nalysis **L**ight **T**ouch) software.

4.2 Input assumptions

4.2.1 CoBALT uses information derived from the SATURN model, so a network has been built that replicates the EATM network. Traffic flows have been obtained from the SATURN model, for the following years:

- Base Year (2013)
- Opening year (2017)
- Design year with Scheme (2032)

4.2.2 Accident data for a period of five years from 2009 to 2013 has been obtained from WSCC in order to provide accident rates for existing links in CoBALT. The accidents have been geocoded to correspond to the selected highway network. The observed accidents are shown by year in figure 4.1, and by severity in figure 4.2.

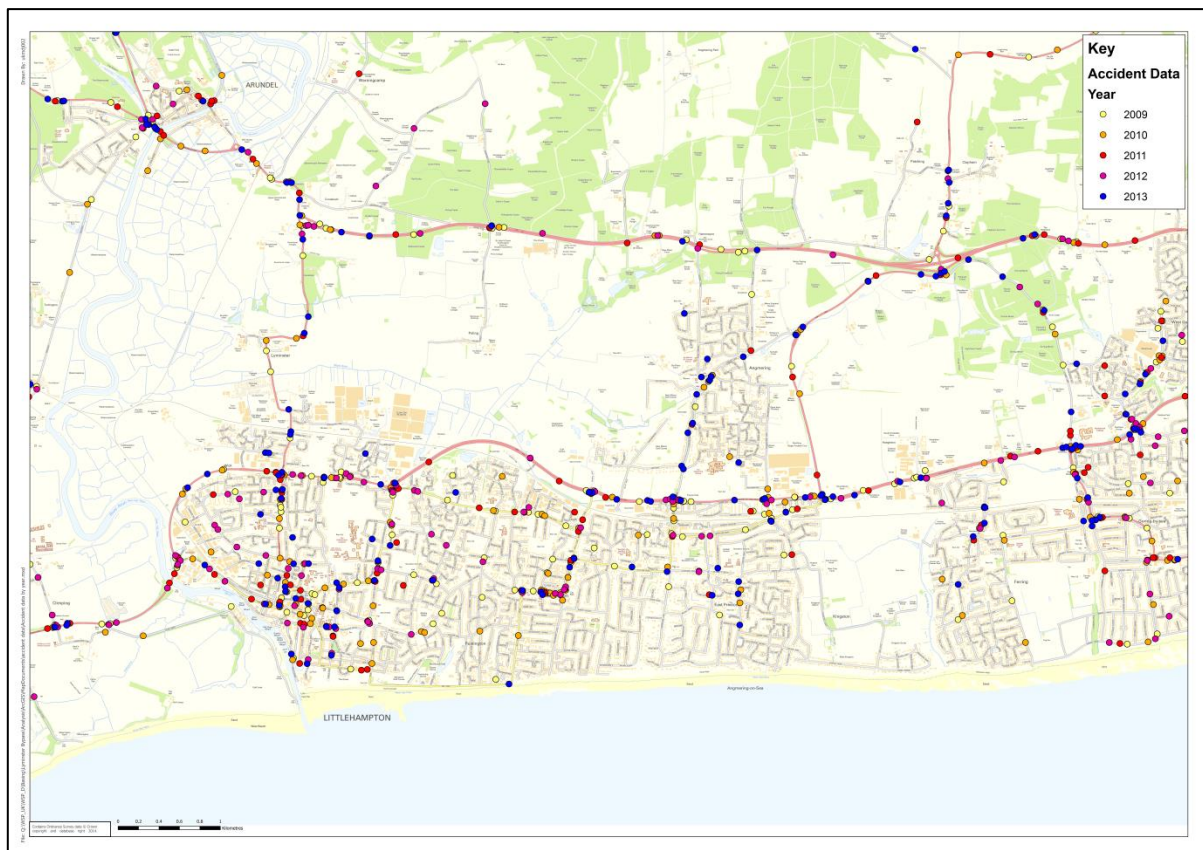


Figure 4.1: Observed accidents by year

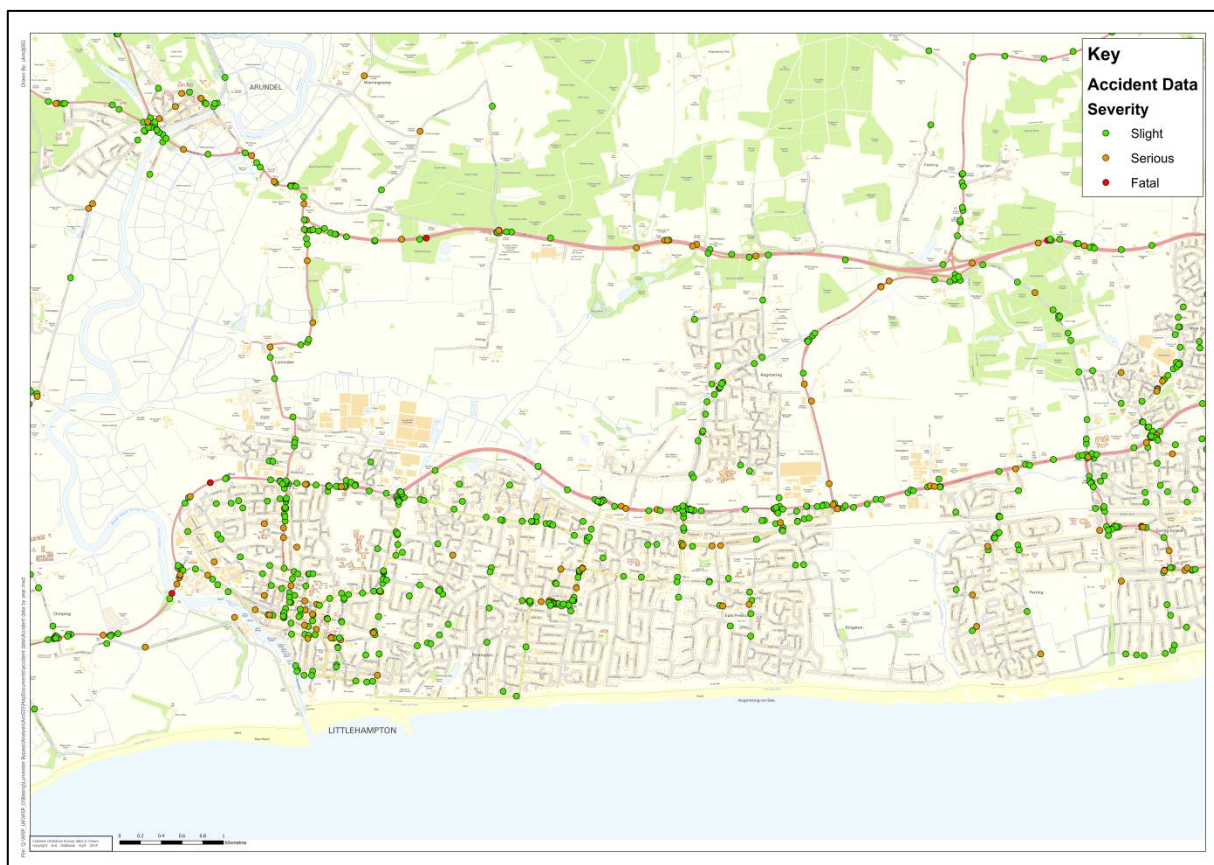


Figure 4.2: Observed accidents by severity

4.2.3 CoBALT provides three options for assessment:

- Link only
- Junction only
- Link and junction combined

4.2.4 The analysis for the Lyminster bypass has been carried out using the 'combined' method. This requires considerably less analysis than separate link and junction analysis, so is the appropriate proportional assessment for this scheme. WebTAG Unit A4-1 2.3.9 indicates that this is acceptable when local data is hard to distinguish between links and junctions.

4.3 Results

4.3.1 Costs per casualty and per accident are given in tables 4.1 and 4.2, and are taken from the WebTAG data book (May 2014). All monetary values are in pounds, in 2010 prices, discounted to 2010.

Table 4.1: Costs per casualty (2010 prices)

Severity	Cost
Fatal	£1,632,892
Serious	£183,491
Slight	£14,145

Table 4.2: Costs per accident (2010 prices)

Severity	Insurance Admin	Damage to property			Police cost		
		Urban	Rural	M'way	Urban	Rural	M'way
Fatal	£300	£7,808	£13,242	£16,845	£16,970	£17,426	£17,629
Serious	£186	£4,185	£6,037	£14,373	£1,874	£2,340	£2,471
Slight	£113	£2,468	£4,002	£7,272	£485	£664	£554
Damage only	£54	£1,765	£2,639	£2,536	£36	£20	£17

4.3.2 The results of the accident analysis are shown in table 4.3. The appraisal period is 2017-2076.

Table 4.3: Accident analysis results (2010 prices, discounted to 2010)

Benefit		Value
Total accidents saved by scheme		85
Casualties saved by scheme	Fatal	1
	Serious	10
	Slight	108
	TOTAL	119
Total value of accident savings		£4,721,700

4.3.3 The scheme generates just under £5m worth of safety benefits arising from a reduction in accidents and casualties. Therefore there are significant safety benefits associated with the scheme.

5 Impact of construction

5.1 Background

5.1.1 WebTAG Unit A1-3 Section 10 recommends that the impact of delays during construction should be assessed through the use of the traffic model and monetised using TUBA.

5.2 Input assumptions

5.2.1 The nature of the scheme is that it will largely be constructed off-line, with no impact on existing road users. The proposed bypass will be constructed from the southern tie-in working northwards, so the only impact on existing traffic is at the northern end tie-in with the existing A284. The proposed link to the A284 must be constructed prior to the northern tie-in so that a connection can be provided.

5.2.2 Overnight closures will be required to allow the construction levels between the existing road and the proposed bypass to be tied together. Due to the restrictive width of the existing A284 it may not be possible or practical to provide the surfacing to the required standards during overnight closures, so weekend closures may be required to complete the final surfacing.

5.2.3 The following impacts have therefore been assumed as periods during construction that are likely to have an impact on existing traffic. Both involve closures of the A284 between Crossbush and the new link.

- 15 overnight closures (22:00 – 06:00)
- 2 weekend closures (22:00 Friday – 06:00 Monday)

5.2.4 The 2017 Do Something interpeak model has been modified to include this closure. TUBA has been run for a period of 1 year, from 2016 to 2017. Because they cover different time periods, different factors have been derived to the full assessment. The following annualisation parameters are shown below:

Table 5.1: Annualisation factors

Period	Peak hour to peak period factor	Number	Annualisation factor
Off-peak	0.80	15	12
Weekend	26.17	2	52

5.2.5 The Do Minimum scenario is unchanged. All other assumptions are the same as the TUBA appraisal, as set out above.

5.3 Results

5.3.1 Results from the TUBA assessment are presented in table 5.1. All values are in thousands of pounds, in 2010 prices, discounted to 2010.

Table 5.2: Costs of delays during construction (£000s, 2010 prices discounted to 2010)

Benefit		Total
Consumer - commuting user benefits	Travel time	-£9
	Vehicle operating costs	-£4
	Subtotal	-£13
Consumer - other user benefits	Travel time	-£116
	Vehicle operating costs	-£38
	Subtotal	-£154
Business benefits	Travel time	-£57
	Vehicle operating costs	-£17
	Subtotal	-£74
Greenhouse gases		-£4
Indirect tax revenues		£17
Present Value of Benefits (PVB)		-£228

5.3.2 The overall cost of delays during construction is therefore £228,000.

6 Conclusions

6.1 Summary

- 6.1.1 This report presents the results of the economic appraisal of the scheme's benefits. All calculations have been undertaken in line with the guidance set out in the DfT's WebTAG and HM Treasury's Green Book.
- 6.1.2 Total scheme benefits are substantial, ranging from £61m to £129m, depending on the option assessed and the input assumptions.
- 6.1.3 The scheme also generates wider benefits of £4.7m arising from changes to imperfectly competitive markets and increased tax revenue as a result of changes in the labour supply.
- 6.1.4 The scheme has a positive impact on safety, with a reduced volume of accidents and casualties that save the economy £4.7m.
- 6.1.5 The impacts of construction on traffic are minimal, with delays during construction amounting to £228,000.
- 6.1.6 The total benefits for the Option 1 core scenario are set out in table 6.1. All values are in thousands of pounds, in 2010 prices, discount to 2010.

Table 6.1: Summary of benefits for Option 1 core scenario (£000s, 2010 prices discounted to 2010)

Benefit	Total
User benefits	£98,560
Greenhouse gases	£941
Indirect taxes	-£2,522
Wider impacts	£4,679
Accident benefits	£4,722
Delays during construction	-£228
Present Value of Benefits (PVB)	£106,152

Appendices

Klicka här för att ange text.

Mountbatten House

Basingstoke

RG21 4HJ

UK

Tel: +44 (0)1256 318800

Fax: +44 (0)1256 318700

www.wspgroup.co.uk