APPENDIX 8
Air Quality Impact Assessment

1. INTRODUCTION

1.1.1. The potential air quality impacts associated with the Hereford City Centre Transport Package have been assessed using the WebTAG Guidance (Unit A3.3 Air Quality Impacts, DfT, November 2014). The calculation of roadside pollutant concentrations followed the methodology set out in the Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 1, Air Quality (DMRB 11.3.1, HA207/07) for a detailed assessment. The distributional impacts were assessed using WebTAG Guidance (Unit A4.2 Distributional Impact Appraisal, Distributional Impacts of Air Quality, DfT, January 2014).

2. TRAFFIC DATA

2.1.1. Traffic data for the scheme was extracted from the HCCTP Saturn Model and factored accordingly for the following scenarios:

- Baseline year (2012);
- Do-minimum (DM)/without scheme 2017;
- Do-something (DS)/with scheme 2017;
- Do-minimum (DM)/without scheme 2032; and
- Do-something (DS)/with scheme 2032.

2.1.2. The DS scenario is representative of HCCTP scheme implementation and includes 800 additional residential units in the ESG area. It should be noted that this DS scenario represents a worst case scenario.

2.1.3. The traffic data was provided as Annual Average Daily Traffic (AADT), with the percentage HGVs and average speed for each road link.

2.1.4. Details of residential properties were extracted from the Ordnance Survey AddressBase® dataset for the Hereford area.

3. ASSESSMENT METHODOLOGY

3.1.1. The WebTAG assessment included the following steps;

- Screening Assessment;
- Quantification of air quality impacts;
- The appraisal of local air quality impacts;
- The appraisal of regional air impacts;
- Monetary valuation of air quality impacts; and
- Consideration of the distributional impacts in air changes in air quality.

3.1.2. In line with the WebTAG methodology, a screening assessment was first undertaken to identify if there were likely to be any significant impacts across the network as a result of the proposed transport package. This was done by comparing both the 'with' and 'without scheme' scenarios in both the opening year (2017) and future year (2032) in relation to the DMRB criteria for determining 'affected links', namely:

- A road alignment change by more than 5m; or
- A change in daily traffic flows of more than 1,000 AADT; or

- A change in heavy duty vehicles of more than 200 AADT; or a
- A change in the daily average speed of more than 10km/h.

3.1.3. A number of routes were identified as meeting the criteria:

Route	ID	Start Point	End Point
A49 (Victoria Street)	1	Barton Road	Newmarket Street
A49 (Edgar Street)	2	Newmarket Street	Newmarket Road
A438 (Newmarket Street/Bath Street)	3	Edgar Street	St Owen Street
A465 (Commercial Road/Aylestone Hill)	4	Bath Street	Barrs Court Road
Link Road plus feeder roads	5	Edgar Street	Commercial Road
Eign Street	6	A49	Friars Street
Bodenham Road/ Southbank Road	7	A438	A465
Barrs Court Road	8	A465	Burcott Road
Burcott Road/ Farriers Way	9	Barrs Court Road	A49
Newtown Road	10	A49	Link Road
New Road	11	Blackfriars St	Link Road
Coningsby Street	12	B4359	Canal Road
West Street / East Street	13	A40	Owen's Street
Hafod Road	14	A438	Old Eign Hill
A438 (Ledbury Road)	15	Eign Road	Bodenham Road
Blackfriars Street	16	Edgar Street	Widemarsh Street
B4359 (Widemarsh Street)	17	A438	A49
A4103	18	Atwood Lane	College Road
Priory Place / Grandstand Road	19	Newtown Road	Yazor Road
Yazor Road	20	Grandstand Road	A438
A438 (Whitecross Road)	21	Wordsworth Road	Holmer Street
Millbrook Street	22	Newtown Road	Prior Street

3.1.4. In summary, the routes cover the principal routes through and from Hereford (A49, A438, and A465), the new City Link Road and the principal east-west links between these roads.

4. STUDY AREA

4.1.1. The study area was determined by identifying affected links within the network in accordance with the DMRB criteria (Section 11.3.1, HA207/07). Separate study areas were defined for the regional and local air quality assessments.

4.1.2. For the local assessment, roadside pollutant concentrations were calculated at residential properties within a 200m buffer of the 15 principal routes identified as having significant changes in traffic/alignment due to the transport package (listed above). The locations of residential properties within the buffer were extracted from the AddressBase® dataset. To avoid issues of double counting properties, pollutant concentrations (NO2/PM10) were calculated at each residential property within the buffer (4142 in total) using a detailed dispersion model (ADMS Roads). The model was verified against monitoring undertaken by Herefordshire Council in 2012.

4.1.3. For the regional assessment, the whole traffic network for the centre of Hereford was used to calculate total pollutant emissions.

5. ASSESSMENT

5.1.1. The quantification and appraisal of air quality impacts was undertaken on the 4142 residential receptors within the 200m buffer of affected routes, for both particulate matter and nitrogen dioxide. The summary of the appraisal is shown in Table 1 for PM10 and Table 2 for NO2. .

5.1.2. The air quality distributional impact appraisals are shown in Tables 3 and 4 for PM_{10} and Tables 5 and 6 for NO_2.

Table 1 Summary of routes, the aggregated table, particulate matter (PM_{10}).

	Comment
Quantitative Measures	**Opening Year (2017)** 1468 properties experience an improvement in air quality, 4957 properties experience deterioration in air quality, 0 properties experience no change in air quality **Future Year (2032)** 2657 properties experience an improvement in air quality, 3767 properties experience deterioration in air quality, 1 properties experience no change in air quality
Assessment Scores	Net Total assessment score over all properties: 94.04 (2017) 24.9 (2032)
Qualitative Comments	**Net increase in overall exposure to PM_{10}.** Improvements in air quality are modelled along Barrs Court Road and Burcott Road, Conningsby Street and part of Edgar Street, Newmarket Street and Widemarsh Street. The maximum decrease of 0.710µg/m^3 is seen at the junction of Barrs Court Road and Commercial Road. Deteriorations in air quality are modelled elsewhere, with a maximum increase of 4.25µg/m^3 at Ledbury Road. In 2032, improvements in air quality are also modelled on Whitecross Road and Grandstand Road on the north-western edge of Hereford
Reference Sources	Traffic data was supplied by PB Traffic engineers (2015); Exposure calculated using ADMS-Roads and EfT v6.

Table 2 Summary of routes, the aggregated table, nitrogen dioxide (NO_2).

	Comment
Quantitative Measures	**Opening Year (2017)** 1122 properties experience an improvement in air quality, 5234 properties experience deterioration in air quality, 69 properties experience no change in air quality **Future Year (2032)** 1735 properties experience an improvement in air quality, 4338 properties experience deterioration in air quality, 352 properties experience no change in air quality
Assessment Scores	Net total assessment score over all properties: 1165 (2017) 334.4 (2032)
Qualitative Comments	**Net increase in overall exposure to NO_2.** Improvements in air quality are modelled along Barrs Court Road and Burcott Road, Conningsby Street and part of Edgar Street, Newmarket Street and Widemarsh Street. The maximum decrease of 2.29µg/m^3 is seen at Barrs Court Road. Deteriorations in air quality are modelled elsewhere, with a maximum increase of 0.635µg/m^3 at Widemarsh Street. In 2032, improvements in air quality are also modelled on Whitecross Road on the north-western edge of Hereford
Reference Sources	Traffic data was supplied by PB Traffic engineers (2015); Exposure calculated using ADMS-Roads and EfT v6.

Table 3 Distributional Impacts: Air Quality for Particulate Matter 2017

	Indices of Deprivation - Income Domain					Total
	Most Deprived ←				→ Least Deprived	
	0-20%	20-40%	40-60%	60-80%	80-100%	
Population in each group with improved air quality [A]	0	826	510	132	0	1,468
Population in each group with no change in air quality [B]	0	0	0	0	0	0
Population in each group with deteriorating air quality [C]	0	1,276	2,248	1,076	357	4,957
Net no of Winners / Losers in each group [D] = [A] – [C]	0	-450	-1,738	-944	-357	
Total number of Winners / Losers across all groups [E] = ∑[D]						-3,489
Net winners/losers in each area as percentage of total [F] = [D] / [E]	0%	13%	50%	27%	10%	100%
Share of total population in the impact area	0%	33%	43%	19%	6%	100%
Assessment	Neutral	x	xx	xxx	xx	

Table 4 Distributional Impacts: Air Quality for Particulate Matter 2032

	Indices of Deprivation - Income Domain					Total
	Most Deprived ←				→ Least Deprived	
	0-20%	20-40%	40-60%	60-80%	80-100%	
Population in each group with improved air quality [A]	0	1,083	1,361	183	30	2,657
Population in each group with no change in air quality [B]	0	1	0	0	0	1
Population in each group with deteriorating air quality [C]	0	1,018	1,397	1,025	327	3,767
Net no of Winners / Losers in each group [D] = [A] – [C]	0	65	-36	-842	-297	
Total number of Winners / Losers across all groups [E] = ∑[D]						-1,110
Net winners/losers in each area as percentage of total [F] = [D] / [E]	0%	-6%	3%	76%	27%	100%
Share of total population in the impact area	0%	33%	43%	19%	6%	100%
Assessment	Neutral	✓	xx	xxx	xxx	

Table 5 Distributional Impacts: Air Quality for Nitrogen Dioxide 2017

	Indices of Deprivation - Income Domain					Total
	Most Deprived ←				→ Least Deprived	
	0-20%	20-40%	40-60%	60-80%	80-100%	
Population in each group with improved air quality [A]	0	709	378	35	0	1,122
Population in each group with no change in air quality [B]	0	36	29	4	0	69
Population in each group with deteriorating air quality [C]	0	1,357	2,351	1,169	357	5,234
Net no of Winners / Losers in each group [D] = [A] – [C]	0	-648	-1,973	-1,134	-357	
Total number of Winners / Losers across all groups [E] = ∑[D]						-4,112
Net winners/losers in each area as percentage of total [F] = [D] / [E]	0%	16%	48%	28%	9%	100%
Share of total population in the impact area	0%	33%	43%	19%	6%	100%
Assessment	Neutral	x	xx	xxx	xx	

Table 6 Distributional Impacts: Air Quality for Nitrogen Dioxide 2032

	Indices of Deprivation - Income Domain					Total
	Most Deprived ←				→ Least Deprived	
	0-20%	20-40%	40-60%	60-80%	80-100%	
Population in each group with improved air quality [A]	0	881	756	68	30	1,735
Population in each group with no change in air quality [B]	0	91	253	8	0	352
Population in each group with deteriorating air quality [C]	0	1,130	1,749	1,132	327	4,338
Net no of Winners / Losers in each group [D] = [A] – [C]	0	-249	-993	-1,064	-297	
Total number of Winners / Losers across all groups [E] = ∑[D]						-2,603
Net winners/losers in each area as percentage of total [F] = [D] / [E]	0%	10%	38%	41%	11%	100%
Share of total population in the impact area	0%	33%	43%	19%	6%	100%
Assessment	**Neutral**	**x**	**xx**	**xxx**	**xxx**	

6. CONCLUSION

6.1.1. The results of the assessment are presented in the Appraisal Summary Table below (Table 7). There is a net worsening of exposure to both PM10 and NO2 as a result of the transport package. There is a small net increase in regional emissions for NOx and, moreover, increases in emissions occur along some routes identified in national modelling as being at risk of exceeding the EU limit value in the opening year. This risk is negligible by 2020.

6.1.2. The valuation of local air quality impacts shows a net dis-benefit of the scheme due primarily to the increase in exposure to PM10.

Table 7 Appraisal summary table of the air quality assessment.

Impact	Summary of Key Impacts	Quantitative	Qualitative	Monetary	Distributional
Air Quality	Overall there is a net deterioration in exposure to PM10 and NO2. The scheme does not result in any exceedences of air quality objectives Net increase in emissions in area at risk of exceedence of EU limit values	**Assessment Score:** **2017** PM_{10}: 94.04 NO_2: 1165 **2032** PM_{10}: 27.47 NO_2: 294 **Emissions NO_x (tonnes per year):** 2017: 2.3 (0.1 in area of risk of exceedence of limit value) 2032: 0.8 +61 tonnes over 60 year appraisal period	N/A	Value of Change in PM_{10} concentration: NPV:-£118,475 Value of Change in NO_x emissions: NPV: -£42,886 **Total value of change in air quality:** -£161,361	Air quality benefits are weighted towards areas with income deprivation – this is a beneficial impact. Disbenefits are weighted towards less deprived areas

APPENDIX 8A

Local Air Quality Valuation Workbook Summary

Air Quality Valuation Summary Worksheet

CCTP
Air Quality appraisal

Summary Assessment

	Central estimate	Lower estimate	Upper estimate
Present Value of change in PM_{10} concentrations:	-£118,475	-£62,087	-£134,626
Present Value of change in NO_X emissions:	-£42,886	-£34,259	-£56,434
Total value of change in air quality: £NPV	-£161,361	-£96,346	-£191,060

Note: All Monetary Values are in 2010 Prices and Values. Positive values reflect a net benefit (ie air quality improvement)

Quantitative Assessment

"Net Total Route Assessment" (opening year) for PM_{10} :	94
Change in NO_X emissions over 60 year appraisal period:	61

Qualitative Comments:

Net disbenefit in relation to exposure to PM10, increasing over time

Net disbenefit in relation to total emissions of NO2, including an increase in emissions in areas at risk of exceeding the objective in opening year

Valuation shows a net disbenefit of £161,361

APPENDIX 8B

Local Air Quality Valuation Emissions/Concentration Data

Emissions

Enter the with and without scheme NOx and PM10 emissions/concentrations for the opening and forecast year.

CCTP

		Year	Without scheme total emissions	With scheme total emissions	Change in emissions
Total NOx emissions in tonnes per year	Opening year	2017	42.1	44.4	2.3
	Forecast year	2032	21.2	22.0	0.8
			Without scheme aggregated net total assessment	With scheme aggregated net total assessment	Change in score
PM10 concentrations	Opening year	2017	98,137	98,231	94.0
	Forecast year	2032	96,064	96,089	24.9

APPENDIX 8C

Local Air Quality Valuation Regional Emissions Data

Worksheet 2 - Regional Air Quality

Option name CCTP Opening year 2017 Forecast year 2032

		Without scheme		With scheme		Change in emissions	
		Opening year	Forecast year	Opening year	Forecast year	Opening year	Forecast year
NOx emissions in tonnes per year	Areas not exceeding limit values	31.4	21.2	33.6	22.0	2.2	0.8
	Areas exceeding limit values	10.7	0.0	10.8	0.0	0.1	0.0

Qualitative comments: Emissions calculated using EfT v6.02; Areas exceeding limit values taken from PCM model for 2010 (exceedence risk in 2015, no exceedence in 2020)

Data Sources: Traffic data from PB Engineers (2015)