A12 Chelmsford to A120 widening scheme

TR010060

6.3 ENVIRONMENTAL STATEMENT

APPENDIX 6.6 PROJECT AIR QUALITY ACTION PLAN

APFP Regulation 5(2)(a)

Planning Act 2008

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A12 Chelmsford to A120 widening scheme

Development Consent Order 202[ ]

ENVIRONMENTAL STATEMENT
APPENDIX 6.6 PROJECT AIR QUALITY ACTION PLAN

Regulation Reference	Regulation 5(2)(a)
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1 Project air quality action plan

1.1 Introduction

1.1.1 Chapter 6: Air quality, of the Environmental Statement [TR010060/APP/6.1] describes the findings of an assessment of the likely significant effects of the proposed scheme on air quality, during both the construction and operational phases. The assessment considers the do-minimum (DM) without the proposed scheme and do-something (DS) with the proposed scheme scenarios. The assessment, which has been undertaken in line with the Design Manual for Roads and Bridges (DMRB) LA 105 Air Quality (Highways England, 2019), considers the following matters:

- Baseline conditions: a review of existing air quality conditions within the study area.
- Construction dust: a qualitative assessment of the potential impacts of construction dust on relevant sensitive receptors.
- Local air quality: a detailed assessment of the potential air quality impacts of the proposed scheme, during both its construction and operation, on representative sensitive human health receptors within the study area.
- Designated habitats: an assessment of the potential for changes in air quality as a result of the proposed scheme to impact relevant designated habitats (as defined in LA105) within the study area.
- Compliance risk: an assessment of the potential risk of the proposed scheme to affect compliance with the annual mean nitrogen dioxide (NO_2) EU Limit Value in the ‘shortest possible time’.

1.1.2 The potential for impacts during construction and operation of the proposed scheme are discussed in detail within Section 6.9 of Chapter 6: Air quality, of the Environmental Statement [TR010060/APP/6.1].

1.1.3 The following bullets summarise the findings of the air quality assessment:

- The assessment identified **no likely significant** effects on air quality in the construction phase for the proposed scheme.
- The assessment identified **no likely significant** effects on air quality at human health and pollution climate mapping (PCM) receptors in the operational phase.
- The assessment identified **likely significant** effects at ecological receptors owing to an increase in nitrogen (N) deposition, as outlined in Chapter 9: Biodiversity, of the Environmental Statement [TR010060/APP/6.1].

- The proposed scheme meets the requirements of the National Networks National Planning Statement (NNNPS - Department for Transport, 2014), as set out in paragraph 5.13 of the NNNPS. However, as a likely significant effect has been concluded, the decision-maker will need to consider the weight of judgement in relation to consenting the proposed scheme as outlined in paragraph 5.12 of the NNNPS.

1.1.4 The assessment identified likely significant effects at ecological receptors owing to an increase in nitrogen deposition[1] at Perry's Wood, as outlined in Chapter 9: Biodiversity, of the Environmental Statement [TR010060/APP/6.1]. The following sections of this appendix describe the various mitigation options considered to try and remove the significant effects described in Chapter 9.

1.1.5 In accordance with the DMRB LA 105, confirmations of significant air quality effects on human health or ecological receptors trigger the development of a Project Air Quality Action Plan (PAQAP) where options to reduce the impact are to be considered.

1.1.6 Table 1.1 presents the confirmed significant effects associated with Perry's Wood. As a transect of receptors had been used to assess the site, the data are provided in ranges. Significant effects from nitrogen deposition were predicted for receptors up to 50m from the road source (see Table 1.5 of Appendix 6.5 of the Environmental Statement [TR010060/APP/6.3]).

Table 1.1 Summary of significant effects for Perry's Wood owing to operational impacts

Designated site	Distance to nearest modelled road (m)	Lower critical load (CL) (kg N/ha/yr)	Average baseline N deposition (kg N/ha/yr) from APIS	DM to DS change in estimated nutrient N deposition (kg N/ha/yr)	Change/LCL (%)
Perry's Wood Local Wildlife Site (LWS) and ancient woodland	4.9 - 44	10	32.5	0.45 - 2.82	4.45 - 28.15

1.2 Perry's Wood

1.2.1 Perry's Wood is bound by commercial premises to the north and south and farmed land to the west. Inworth Road (B1023) runs parallel to the site along its eastern boundary. The B1023 is a direct route between Tiptree and London Road (with access onto the A12 via the existing junctions 23 and 24). It is single carriageway with a 50mph (64kph) speed limit along the road section adjacent to Perry's Wood.

[1] Total N deposition rate greater than the lower critical load for the relevant habitat; An increase in N deposition rate with the proposed scheme equivalent to more than 1% of the lower critical load; An increase in N deposition rate of more than 0.4 kg N/ha/yr. The threshold of 0.4 kg N/ha/yr is based on the Natural England dose response report, referenced in Figure 2.98 of the DMRB LA 105.

1.2.2 The site boundary is adjacent to the grass verges of the B1023 and extends back from the road approximately 190m.

1.2.3 Perry's Wood is a designated local wildlife site (LWS) and ancient woodland. Historic maps indicate that in 1895 it was the same size as currently and surrounded by agriculture. In 1799 it was smaller than it is now, suggesting that the southern one third of it is not ancient. The wood mainly comprises ash (*Fraxinus excelsior*) and pedunculate oak with an understorey of hornbeam coppice. Trees have been planted recently, probably in the last year. Tree guards were present and there were clear access routes to the planted areas. Trees were just single plantings scattered through the site. Species in the shrub layer include frequent midland hawthorn and occasional hazel, common ivy, crab apple and elm.

1.2.4 There did not appear to be any pattern in the vegetation in relation to distance from the road and no evidence of a gradient in vegetation change due to nitrogen deposition. The boundary along the road was well wooded with trees and shrubs.

1.3 Mitigation measures

1.3.1 Table 1.2 outlines measures considered to reduce the impact on Perry's Wood, the overseeing organisation responsible for implementing the measures or seeking agreement from, and a brief comment of measure feasibility.

Table 1.2 Mitigation measures considered

Option	Measure	Overseeing Organisation	Objective and feasibility
1.	Vertical barrier (minimum 9m cited p2.110.1, DMRB LA 105)	Colchester Borough Council	**Objective:** A vertical barrier formed from manmade materials to contain emissions close to the road source therefore limiting the dispersion of pollution into Perry's Wood. **Feasibility:** This would result in potential significant effects for other environmental disciplines such as landscape and visual. Significant air quality effects are experienced up to 50m from the site boundary, therefore, the barrier may not provide sufficient protection. On this basis, this measure has not been further examined in this PAQAP.

Option	Measure	Overseeing Organisation	Objective and feasibility
2.	Speed management	Colchester Borough Council	**Objective:** Reassignment of speed limits to promote better engine efficiencies, thus reducing exhaust emissions. In accordance with the DMRB LA 105 para.2.33 '*where speed management mitigation measures are included in the PAQAP, they shall only be applied to motorways and dual carriageways where they operate at high-speed driving conditions'*. **Feasibility:** The B1023 is a single carriageway with a speed limit of 50mph. Vehicles travelling at an average of 50 mph exhibit optimum performance in terms of emissions. Conversely, a reduction in speed may increase emissions compared to the current situation owing to lower engine performance and combustion efficiencies. A further analysis was undertaken and presented in Section 1.4 of this appendix, to appreciate the potential of speed management to effect emissions on Inworth Road
3.	Junction improvement	Colchester Borough Council	**Objective:** Altering junctions to improve the throughput of the traffic on Inworth Road thus promoting a reduction in the number and frequency of vehicle acceleration events (i.e. the event causing emissions). **Feasibility:** The B1023 is a direct route between Tiptree and the A12. There are no known causes for delays or areas requiring junction improvement in proximity to Perry's Wood. On this basis, this measure has not been further examined in this PAQAP.
4.	Traffic management	Colchester Borough Council	**Objective:** Management of the traffic on Inworth Road so that the traffic only uses the southbound carriageway thus moving traffic emissions further away from Perry's Wood. **Feasibility:** Introducing physical traffic calming measures such as a chicane would restrict the movement of traffic to one side of the road along the extent of Perry's Wood. This type of measure would increase vehicle journey times and potentially the diversion of vehicles onto other routes. It may not reduce NOx emissions due to a higher frequency of accelerations events. On this basis, this measure has not been further examined in this PAQAP.

Option	Measure	Overseeing Organisation	Objective and feasibility
5.	Road alignment	Colchester Borough Council / Land owner	**Objective:** Realigning a small section of Inworth Road northeast of Perry's wood would shift the source of emissions further away and lead to a reduction in nitrogen deposition. **Feasibility:** The cost of land take and loss of farmland would need to be balanced against the potential to maintain and improve the habitat. On this basis, this measure **has not** been further examined in this PAQAP.

1.4 Further discussion on road vehicle speed

1.4.1 While the sign posted speed limit on the section of the B1023 Inworth Road adjacent to Perry's Wood is 50mph, the traffic model has assigned a speed limit of 40mph. This is due to evidence from actual speed measurements indicating that the road vehicles are unlikely to be travelling at or near to the speed limit of 50mph.

1.4.2 The air pollution modelling approach applied for the proposed A12 scheme uses road traffic emissions factors classified into so called 'speed bands', which describe different air quality responses to different driving states.

1.4.3 Varying the speed to control emissions from vehicles would have little impact on the air quality modelling results given that a speed of both 30mph[2] and 50mph falls within the same 'Urban Free Flow' speed band i.e. the speed range applies the same emission factor. Therefore, adjusting the speed limit to either 30mph or 50mph within the traffic model would have no effect on the speed band selected and therefore emissions calculated for the nearest road link.

1.4.4 In terms of relative emissions, the most efficient speed bands for an urban road are 'Free Flow' and 'High Speed' for light duty vehicles (LDVs) and heavy-duty vehicles (HDVs) respectively. Most of the traffic on the B1023 is made up of LDVs, therefore in emissions terms, the model is performing most efficiently for the majority of the time. The various urban speed bands for LDVs and HDVs for 2027 are presented in Table 1.3 with their associated nitrogen oxide (NO_X) emission rates. Operational traffic data for the DM and DS scenarios in 2027 are presented in Table 1.4.

[2] 30 mph was selected as the hypothetical operational lower exemplar speed for the road section under examination.

Table 1.3 Urban speed banded emissions rates

Speed Band	NO_X (g/km)	
	LDV	HDV
Urban Heavy Congestion	0.217	2.283
Urban Light Congestion	0.160	0.610
Urban Free Flow	**0.132**	0.265
Urban High Speed	0.150	**0.157**

Table 1.4 Operational traffic data on the B1023 road section adjacent to Perry's Wood (2027)

Scenario		AM Peak			Interpeak			PM Peak			Off-Peak		
	Direction	Traffic Flow (hr)	% HDV	Speed band	Traffic Flow (hr)	% HDV	Speed band	Traffic Flow (hr)	% HDV	Speed band	Traffic Flow (hr)	% HDV	Speed band
Do-Minimum	SB	328	1.4	Free Flow	414	0.9	Free Flow	536	0.2	Free Flow	91	0.8	Free Flow
	NB	473	1.8	Light Congestion	428	1.9	Free Flow	355	0.8	Light Congestion	90	1.5	Free Flow
Do-Something	SB	464	3.6	Free Flow	549	2.1	Free Flow	693	0.5	Light Congestion	121	1.9	Free Flow
	NB	671	1.9	Light Congestion	527	2.3	Free Flow	465	1.2	Light Congestion	117	1.9	Free Flow
SB – Southbound: NB - Northbound													

1.4.5 It would not be viable to provide traffic management adjacent to Perry's Wood to enable all vehicles to travel at speeds to optimise their emissions due to the existing and forecasted levels of traffic. In addition, the 'optimum' speed for the majority LDVs on the B1023 is not necessarily the same 'optimum' speed for HDVs.

1.4.6 Table 1.4 presents the modelled traffic data for the B1023 adjacent to Perry's Wood. This shows that the northbound direction has a modelled speed band of 'Light Congestion' in the AM and PM peaks for the DM and DS scenarios, indicating that emissions are not as efficient per vehicle. In addition, a key difference between the DM and DS shows a change in speed band from 'Free Flow' to 'Light Congestion' in the southbound direction during the PM peak i.e. an increase in emissions per vehicle. This specific scenario is subject to sensitivity testing reported in Annex A of this appendix and summarised in Section 1.5.

1.5 Sensitivity testing

1.5.1 In order to quantify the impact of the potential changes to traffic data (as a result of the mitigation discussed above) on the significant effects at modelled ecological receptors at Perry's Wood, the following test scenarios have been made to the DS core assessment i.e. that reported in Chapter 6: Air quality, of the Environmental Statement [TR010060/APP/6.1]:

- Scenario 1 – change in PM peak speed band to match the DM i.e. light congestion to free flow for the nearest modelled road (reported in Annex A of this appendix and summarised in the paragraphs below)
- Scenario 2 – change the HDV% to match the DM in the AM peak for the nearest modelled road and adjoining links (reported in Annex A of this appendix)
- Scenario 3 – cumulative impact of scenario 1 and scenario 2 (reported in Annex A of this appendix)

1.5.2 The scenario 1 sensitivity test suggests that changing the PM peak DS speed band to 'Free Flow' from 'Light Congestion' is not sufficient to change the potential for significant effects at modelled receptors representing Perry's Wood. The results of the sensitivity test in terms of nutrient N-deposition are presented in Table 1.5. The results for the DS core assessment for comparison are presented in Table A.6 of Annex A. All N-deposition results are inclusive of the ammonia-based contribution emitted from road traffic.

Table 1.5 Results of scenario 1 sensitivity test: N deposition results for Perry's Wood (2027)

Receptor ID	Distance to nearest affected road (m)	Minimum critical load (CL) (kg N/ha/yr)	Average baseline N depositio n (kg N/ha/yr)	Estimated nutrient N deposition - with NH_3 contribution			
				Total N deposition (DS) (kg N/ha/yr)	DM to DS change (kg N/ha/yr)	Chan ge/CL (%)	Potentially significant?
ECO_Q_0	5	10	32.48	42.45	2.55	25.51	**Yes**
ECO_Q_10	15			36.95	1.01	10.15	**Yes**
ECO_Q_20	24			35.54	0.66	6.59	**Yes**
ECO_Q_30	34			34.88	0.50	4.97	**Yes**
ECO_Q_40	44			34.51	0.41	4.10	**Yes**

1.5.3 The change in magnitude of this sensitivity test is also small, showing that a measure with much greater impact is needed to remove the significant effect at Perry's Wood. The magnitude of change suggests that measures to address the 'Light Congestion' speed band in the AM and PM peaks in the northbound direction would not be sufficient to remove all of the significant effects at Perry's Wood. It should also be noted that sensitivity tests within Annex A of this appendix do not rely on a re-run of the traffic model, therefore it is a possibility improving modelled speed could result in increased flow on the link as it is more attractive to traffic, which could erode reductions in emissions gained by improving the journey times.

1.5.4 The AM and PM periods make up 25% of the time, therefore speed measures would be more effective in the interpeak and off peak periods, however, the speed bands in these periods in both directions are already optimum in terms of emissions for the majority of vehicles on the B1023.

1.5.5 As presented above, to remove the significant effect at all modelled receptors at Perry's Wood, a larger scale intervention such as physically moving the road source away from the receptor would be required. This would be a substantial undertaking requiring further land take and would need to be balanced against the cost of removing productive farmland and potential biodiversity losses elsewhere.

1.6 Summary

1.6.1 A number of mitigation options have been considered, some of which have been partially modelled and explored semi-quantitively. This has shown that the magnitude of change in the N deposition would need to be large to remove the significance of effect at all parts of Perry's Wood. The only measures with the potential to achieve such a reduction are physical alterations to the alignment of the road, which are not likely to be viable due to surrounding constraints.

1.6.2 Improvements could potentially be achieved by traffic management measures; however, these would not be large enough to remove the significant effects. The current speed band emissions for the majority of periods on the B1023 are already optimum in terms of emissions for the majority of vehicles using the road.

1.6.3 Further measures could be explored to reduce the amount of traffic using the B1023, however, this is counter to the benefits of putting in a new junction at the A12 to improve connectivity in the area.

1.6.4 It is improbable that significant effects at Perry’s Wood can be mitigated without disproportionate cost and potential loss of farmland.

1.7 Conclusion

1.7.1 The PAQAP has concluded that no mitigation options would be feasible in removing the identified significant effects. On this basis, recommendations made by the competent expert for biodiversity to offset the impact by planting additional trees within the Order Limits, as described in Chapter 9: Biodiversity of the Environmental Statement [TR010060/APP/6.1], have been proposed.

References

Department for Transport (2014). National Policy Statement for National Networks. Available at: https://www.gov.uk/government/publications/national-policy-statement-for-national-networks. Accessed March 2022.

Highways England (2019). Design Manual for Roads and Bridges LA 105 Air Quality, November 2019.

Annex A Sensitivity tests

A.1 Introduction

A.1.1 The receptors representing Perry's Wood were modelled to have significant effects up to a distance of 40m from the kerbside of the nearest modelled road link.

A.1.2 The traffic data on the nearest road likely to impact the ecological receptors was studied in detail to identify the changes between the DM and DS scenarios to ascertain what variables were causing the significant effect, and to assist in determining potential mitigation measures for these changes.

A.1.3 The comparison showed two potential changes in the traffic data (in addition to increased traffic flow) which could result in an increase in air pollutant concentrations and therefore contribute toward the potentially significant effect:

- AM peak HDV percentages increased in the southbound direction between the DM and DS scenarios
- Change in speed band in the PM peak from 'free flow' in the DM to 'light congestion' in the DS.

A.1.4 This technical note reports the results of sensitivity testing around these variables to identify the change in significance of effect at Perry's Wood (if any) should mitigation be implemented that would result in these traffic changes or deemed likely due to model noise. The test scenarios undertaken for the sensitivity testing are described in Section A.2 (Methodology) of this Annex.

A.2 Methodology

Assessment scenarios

A.2.1 In order to quantify the impact of the proposed changes to traffic data on the potentially significant effects at modelled ecological receptors at Perry's Wood, the following test scenarios have been made to the DS core assessment i.e. the A12 scheme as proposed and presented within Chapter 6: Air quality, of the Environmental Statement [TR010060/APP/6.1]:

- Scenario 1 – change in PM peak speed band to match the DM i.e. light congestion to free flow for the nearest modelled road
- Scenario 2 – change the HDV% to match the DM in the AM peak for the nearest modelled road and adjoining links
- Scenario 3 – cumulative impact of scenario 1 and scenario 2.

A.2.2 Localised traffic activity data (i.e. for Perry's Wood) for the DS core assessment is shown in Table A.2 together with the DM in Table A.1.

Traffic data

A.2.3 Traffic data for scenarios 1 to 3 were taken from the core assessment where AM HDV% and PM speed bands were manually changed to match those in the DM for the sensitivity tests. All other variables remained the same as per the core DS assessment. The changes are presented in Table A.3 to Table A.5.

Air quality emissions and dispersion modelling

A.2.4 The sensitivity tests had regard to the processes outlined in the DMRB LA 105 Air Quality (Highway England, 2019). This is the same approach used in the core air quality assessment presented within Chapter 6: Air quality, of the Environmental Statement [TR010060/APP/6.1]. There have been no changes to methodologies for emissions calculations, dispersion modelling, verification, post processing and nitrogen deposition.

Assessing the significance of effects

A.2.5 The significance of environmental effects was determined following the DMRB LA 105 criteria which are outlined in Section 6.5 of Chapter 6: Air quality, of the Environmental Statement [TR010060/APP/6.1].

Table A.1 DM traffic data on closest modelled road and adjoining road links

	AM Peak			Interpeak			PM Peak			Off-Peak		
Link ID	Traffic Flow	% HDV	Speed band	Traffic Flow	% HDV	Speed band	Traffic Flow	% HDV	Speed band	Traffic Flow	% HDV	Speed band
14671_12002	328	1.4	Free Flow	414	0.9	Free Flow	536	0.2	Free Flow	91	0.8	Free Flow
12002_14671	473	1.8	Light Congestion	428	1.9	Free Flow	355	0.8	Light Congestion	90	1.5	Free Flow
12009_12833	422	1.9	Light Congestion	407	2.0	Light Congestion	394	0.8	Light Congestion	87	1.6	Free Flow
12833_12009	342	1.6	Light Congestion	400	1.1	Light Congestion	478	0.2	Light Congestion	87	0.9	Free Flow
12002_12833	351	1.5	Light Congestion	430	1.0	Light Congestion	523	0.2	Light Congestion	93	0.8	Free Flow
12833_12002	477	1.7	Light Congestion	438	1.8	Light Congestion	406	0.8	Light Congestion	94	1.5	Free Flow
14671_12003	455	1.8	Light Congestion	428	1.9	Light Congestion	355	0.8	Light Congestion	89	1.6	Free Flow
12003_14671	328	1.4	Light Congestion	414	0.9	Light Congestion	492	0.2	Light Congestion	88	0.8	Free Flow

Table A.2 DS core traffic data on closest modelled road and adjoining road links

	AM Peak			Interpeak			PM Peak			Off-Peak		
Link ID	**Traffic Flow**	**% HDV**	**Speed band**	**Traffic Flow**	**% HDV**	**Speed band**	**Traffic Flow**	**% HDV**	**Speed band**	**Traffic Flow**	**% HDV**	**Speed band**
14671_12002	464	3.6	Free Flow	549	2.1	Free Flow	693	0.5	Light Congestion	121	1.9	Free Flow
12002_14671	671	1.9	Light Congestion	527	2.3	Free Flow	465	1.2	Light Congestion	117	1.9	Free Flow
12009_12833	528	1.9	Light Congestion	464	2.6	Light Congestion	450	1.2	Light Congestion	102	2.0	Free Flow
12833_12009	430	4.0	Light Congestion	496	2.3	Light Congestion	550	0.5	Light Congestion	106	2.1	Free Flow
12002_12833	449	3.8	Light Congestion	532	2.2	Light Congestion	609	0.4	Light Congestion	114	1.9	Free Flow
12833_12002	592	1.7	Light Congestion	499	2.4	Light Congestion	473	1.1	Light Congestion	111	1.8	Free Flow
14671_12003	661	1.9	Light Congestion	527	2.3	Light Congestion	465	1.2	Light Congestion	117	1.9	Free Flow
12003_14671	452	3.7	Light Congestion	549	2.1	Light Congestion	667	0.5	Light Congestion	119	1.9	Free Flow

Table A.3 DS scenario 1 traffic data on closest modelled road and adjoining road links

	AM Peak			Interpeak			PM Peak			Off-Peak		
Link ID	**Traffic Flow**	**% HDV**	**Speed band**	**Traffic Flow**	**% HDV**	**Speed band**	**Traffic Flow**	**% HDV**	**Speed band**	**Traffic Flow**	**% HDV**	**Speed band**
14671_12002	464	3.6	Free Flow	549	2.1	Free Flow	693	0.5	**Free Flow**	121	1.9	Free Flow
12002_14671	671	1.9	Light Congestion	527	2.3	Free Flow	465	1.2	Light Congestion	117	1.9	Free Flow
12009_12833	528	1.9	Light Congestion	464	2.6	Light Congestion	450	1.2	Light Congestion	102	2.0	Free Flow
12833_12009	430	4.0	Light Congestion	496	2.3	Light Congestion	550	0.5	Light Congestion	106	2.1	Free Flow
12002_12833	449	3.8	Light Congestion	532	2.2	Light Congestion	609	0.4	Light Congestion	114	1.9	Free Flow
12833_12002	592	1.7	Light Congestion	499	2.4	Light Congestion	473	1.1	Light Congestion	111	1.8	Free Flow
14671_12003	661	1.9	Light Congestion	527	2.3	Light Congestion	465	1.2	Light Congestion	117	1.9	Free Flow
12003_14671	452	3.7	Light Congestion	549	2.1	Light Congestion	667	0.5	Light Congestion	119	1.9	Free Flow
Variables in **bold** are different compared to the core DS assessment in Table A.2.												

Table A.4 DS scenario 2 traffic data on closest modelled road and adjoining road links

	AM Peak			Interpeak			PM Peak			Off-Peak		
Link ID	**Traffic Flow**	**% HDV**	**Speed band**	**Traffic Flow**	**% HDV**	**Speed band**	**Traffic Flow**	**% HDV**	**Speed band**	**Traffic Flow**	**% HDV**	**Speed band**
14671_12002	464	**1.4**	Free Flow	549	2.1	Free Flow	693	0.5	Light Congestion	121	1.9	Free Flow
12002_14671	671	1.9	Light Congestion	527	2.3	Free Flow	465	1.2	Light Congestion	117	1.9	Free Flow
12009_12833	528	1.9	Light Congestion	464	2.6	Light Congestion	450	1.2	Light Congestion	102	2.0	Free Flow
12833_12009	430	**1.6**	Light Congestion	496	2.3	Light Congestion	550	0.5	Light Congestion	106	2.1	Free Flow
12002_12833	449	**1.5**	Light Congestion	532	2.2	Light Congestion	609	0.4	Light Congestion	114	1.9	Free Flow
12833_12002	592	1.7	Light Congestion	499	2.4	Light Congestion	473	1.1	Light Congestion	111	1.8	Free Flow
14671_12003	661	1.9	Light Congestion	527	2.3	Light Congestion	465	1.2	Light Congestion	117	1.9	Free Flow
12003_14671	452	**1.4**	Light Congestion	549	2.1	Light Congestion	667	0.5	Light Congestion	119	1.9	Free Flow
Variables in **bold** are different compared to the core DS assessment in Table A.2.												

Table A.5 DS scenario 3 traffic data on closest modelled road and adjoining road links

	AM Peak			Interpeak			PM Peak			Off-Peak		
Link ID	**Traffic Flow**	**% HDV**	**Speed band**	**Traffic Flow**	**% HDV**	**Speed band**	**Traffic Flow**	**% HDV**	**Speed band**	**Traffic Flow**	**% HDV**	**Speed band**
14671_12002	464	**1.4**	Free Flow	549	2.1	Free Flow	693	0.5	**Free Flow**	121	1.9	Free Flow
12002_14671	671	1.9	Light Congestion	527	2.3	Free Flow	465	1.2	Light Congestion	117	1.9	Free Flow
12009_12833	528	1.9	Light Congestion	464	2.6	Light Congestion	450	1.2	Light Congestion	102	2.0	Free Flow
12833_12009	430	**1.6**	Light Congestion	496	2.3	Light Congestion	550	0.5	Light Congestion	106	2.1	Free Flow
12002_12833	449	**1.5**	Light Congestion	532	2.2	Light Congestion	609	0.4	Light Congestion	114	1.9	Free Flow
12833_12002	592	1.7	Light Congestion	499	2.4	Light Congestion	473	1.1	Light Congestion	111	1.8	Free Flow
14671_12003	661	1.9	Light Congestion	527	2.3	Light Congestion	465	1.2	Light Congestion	117	1.9	Free Flow
12003_14671	452	**1.4**	Light Congestion	549	2.1	Light Congestion	667	0.5	Light Congestion	119	1.9	Free Flow
Variables in **bold** are different compared to the core DS assessment in Table A.2.												

A.3 Results and discussion

A.3.1 Nitrogen deposition calculations were undertaken, in line with DMRB LA 105, for the Perry's Wood transect locations as per the Environmental Statement. Within the core DS assessment, several receptors at Perry's Wood had a predicted total deposition rate above the minimum critical load, with both a predicted change in nitrogen deposition of more than 1% of the minimum critical load and of more than 0.4 kg N/ha/year. Therefore, there was the potential to be adversely affected by changes in nitrogen deposition. The results of nitrogen deposition for the core DS assessment are presented in Table A.6.

A.3.2 The results for scenario 1, scenario 2 and scenario 3 sensitivity tests are presented in Table A.7 to Table A.9.

A.3.3 Each of the modelled sensitivity scenarios result in lower nitrogen deposition both with and without the inclusion of ammonia (NH_3) relative to the core DS assessment presented in the Environmental Statement. However, the changes in nitrogen deposition without the inclusion of NH_3 are no different between the three sensitivity scenarios, indicating that changes in NO_X concentrations are not perceptible once converted to NO_2. There is some variation between the three sensitivity scenarios when nitrogen deposition with the inclusion of NH_3 is compared. The core results of this are compared in Table A.10.

A.3.4 The comparison of total N deposition (including NH_3) suggests the scenarios including the change in PM peak speed band are most effective in reducing total N deposition. The difference between scenario 1 and scenario 3 is negligible showing that the change in HDV% in the AM peak has very little impact on total N deposition (as shown by the scenario 2 results).

A.3.5 Relative to the core DS assessment, the changes modelled in the sensitivity scenarios are not sufficient to change the potentially significant effects at any modelled receptor at Perry's Wood. Table A.10 shows that modelled changes exceed:

- total deposition rate above the minimum critical load (10 kg N/ha/yr)
- change in nitrogen deposition of more than 1% of the minimum critical load
- change in nitrogen deposition of more than 0.4 kg N/ha/year

A.3.6 However, each of the modelled sensitivity scenarios show a reduction relative to the core DS assessment. Scenario 1 and scenario 3 show a modelled reduction in total N deposition (including NH_3) by 0.6%, and scenario 2 shows a modelled reduction in total N deposition (including NH_3) by 0.1%. When comparing the change in total N deposition (including NH_3) between the DM and DS across each of the modelled scenarios, there is a reduction between 8.0% and 9.7% for scenario 1 and scenario 3 compared to the core DS assessment. Whereas the reduction for scenario 2 is between 1.5% and 2.2%.

Table A.6 Summary nitrogen deposition for ecological receptors at Perry's Wood with potentially significant effects – DS core

Receptor ID	Distance to nearest affected road (m)	Minimum critical load (CL) (kg N/ha/yr)	Average baseline N deposition (kg N/ha/yr)	Estimated nutrient N deposition - without NH_3 contribution			Estimated nutrient N deposition - with NH_3 contribution			
				DM to DS change (kg N/ha/yr)	Change /CL (%)	Potentially significant?	Total N deposition (DS) (kg N/ha/yr)	DM to DS change (kg N/ha/yr)	Change /CL (%)	Potentially significant?
ECO_Q_0	5	10	32.48	0.55	5.54	Yes	42.71	2.82	28.15	Yes
ECO_Q_10	15			0.21	2.12	No	37.05	1.12	11.21	Yes
ECO_Q_20	24			0.14	1.35	No	35.60	0.73	7.25	Yes
ECO_Q_30	34			0.10	0.97	No	34.93	0.54	5.42	Yes
ECO_Q_40	44			0.08	0.83	No	34.54	0.45	4.45	Yes

Table A.7 Summary nitrogen deposition for ecological receptors at Perry's Wood with potentially significant effects – DS scenario 1

Receptor ID	Distance to nearest affected road (m)	Minimum critical load (CL) (kg N/ha/yr)	Average baseline N deposition (kg N/ha/yr)	Estimated nutrient N deposition - without NH_3 contribution			Estimated nutrient N deposition - with NH_3 contribution			
				DM to DS change (kg N/ha/yr)	Change /CL (%)	Potentially significant?	Total N deposition (DS) (kg N/ha/yr)	DM to DS change (kg N/ha/yr)	Change /CL (%)	Potentially significant?
ECO_Q_0	5	10	32.48	0.50	5.01	Yes	42.45	2.55	25.51	Yes
ECO_Q_10	15			0.19	1.91	No	36.95	1.01	10.15	Yes
ECO_Q_20	24			0.12	1.22	No	35.54	0.66	6.59	Yes
ECO_Q_30	34			0.09	0.90	No	34.88	0.50	4.97	Yes
ECO_Q_40	44			0.08	0.76	No	34.51	0.41	4.10	Yes

Table A.8 Summary nitrogen deposition for ecological receptors at Perry's Wood with potentially significant effects – DS scenario 2

Receptor ID	Distance to nearest affected road (m)	Minimum critical load (CL) (kg N/ha/yr)	Average baseline N deposition (kg N/ha/yr)	Estimated nutrient N deposition - without NH_3 contribution			Estimated nutrient N deposition - with NH_3 contribution			
				DM to DS change (kg N/ha/yr)	Change /CL (%)	Potentially significant?	Total N deposition (DS) (kg N/ha/yr)	DM to DS change (kg N/ha/yr)	Change /CL (%)	Potentially significant?
ECO_Q_0	5	10	32.48	0.50	5.01	Yes	42.65	2.75	27.54	Yes
ECO_Q_10	15			0.19	1.91	No	37.03	1.10	10.96	Yes
ECO_Q_20	24			0.12	1.22	No	35.59	0.71	7.09	Yes
ECO_Q_30	34			0.09	0.90	No	34.92	0.53	5.33	Yes
ECO_Q_40	44			0.08	0.76	No	34.53	0.44	4.38	Yes

Table A.9 Summary nitrogen deposition for ecological receptors at Perry's Wood with potentially significant effects – DS scenario 3

Receptor ID	Distance to nearest affected road (m)	Minimum critical load (CL) (kg N/ha/yr)	Average baseline N deposition (kg N/ha/yr)	Estimated nutrient N deposition - without NH_3 contribution			Estimated nutrient N deposition - with NH_3 contribution			
				DM to DS change (kg N/ha/yr)	Change /CL (%)	Potentially significant?	Total N deposition (DS) (kg N/ha/yr)	DM to DS change (kg N/ha/yr)	Change /CL (%)	Potentially significant?
ECO_Q_0	5	10	32.48	0.50	5.01	Yes	42.44	2.54	25.42	Yes
ECO_Q_10	15			0.19	1.91	No	36.94	1.01	10.11	Yes
ECO_Q_20	24			0.12	1.22	No	35.54	0.66	6.57	Yes
ECO_Q_30	34			0.09	0.90	No	34.88	0.50	4.96	Yes
ECO_Q_40	44			0.08	0.76	No	34.51	0.41	4.09	Yes

Table A.10 Comparison of total N deposition (including NH_3) for the four modelled scenarios

Receptor ID	Total N deposition (DS) (kg N/ha/yr)				DM to DS change (kg N/ha/yr)				Change/CL (%)			
	Core	Scenario 1	Scenario 2	Scenario 3	Core	Scenario 1	Scenario 2	Scenario 3	Core	Scenario 1	Scenario 2	Scenario 3
ECO_Q_0	42.71	42.45	42.65	42.44	2.82	2.55	2.75	2.54	28.15	25.51	27.54	25.42
ECO_Q_10	37.05	36.95	37.03	36.94	1.12	1.01	1.10	1.01	11.21	10.15	10.96	10.11
ECO_Q_20	35.60	35.54	35.59	35.54	0.73	0.66	0.71	0.66	7.25	6.59	7.09	6.57
ECO_Q_30	34.93	34.88	34.92	34.88	0.54	0.50	0.53	0.50	5.42	4.97	5.33	4.96
ECO_Q_40	34.54	34.51	34.53	34.51	0.45	0.41	0.44	0.41	4.45	4.10	4.38	4.09