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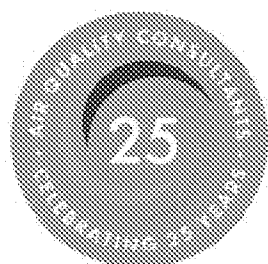


Air Quality Appendices: Land at Barnham, Eastergate & Westergate

January 2022



Experts in air quality
management & assessment



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Appendix G1 Construction Dust Assessment Procedure

G1.1 The criteria developed by IAQM (2016) divide the activities on construction sites into four types to reflect their different potential impacts. These are:

- demolition;
- earthworks;
- construction; and
- trackout.

G1.2 The assessment procedure includes the four steps summarised below:

STEP 1: Screen the Need for a Detailed Assessment

G1.3 An assessment is required where there is a human receptor within 350 m of the boundary of the site and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s), or where there is an ecological receptor within 50 m of the boundary of the site and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).

G1.4 Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is *negligible* and that any effects will be 'not significant'. No mitigation measures beyond those required by legislation will be required.

STEP 2: Assess the Risk of Dust Impacts

G1.5 A site is allocated to a risk category based on two factors:

- the scale and nature of the works, which determines the potential dust emission magnitude (Step 2A); and
- the sensitivity of the area to dust effects (Step 2B).

G1.6 These two factors are combined in Step 2C, which is to determine the risk of dust impacts with no mitigation applied. The risk categories assigned to the site may be different for each of the four potential sources of dust (demolition, earthworks, construction and trackout).

Step 2A – Define the Potential Dust Emission Magnitude

G1.7 Dust emission magnitude is defined as either 'Small', 'Medium', or 'Large'. The IAQM guidance explains that this classification should be based on professional judgement, but provides the examples in Table G1.1.

Table G1.1: Examples of How the Dust Emission Magnitude Class May be Defined

Class	Examples
Demolition	
Large	Total building volume >50,000 m ³ , potentially dusty construction material (e.g. concrete), on site crushing and screening, demolition activities >20 m above ground level
Medium	Total building volume 20,000 m ³ – 50,000 m ³ , potentially dusty construction material, demolition activities 10-20 m above ground level
Small	Total building volume <20,000 m ³ , construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10 m above ground, demolition during wetter months
Earthworks	
Large	Total site area >10,000 m ² , potentially dusty soil type (e.g. clay, which will be prone to suspension when dry to due small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes
Medium	Total site area 2,500 m ² – 10,000 m ² , moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m – 8 m in height, total material moved 20,000 tonnes – 100,000 tonnes
Small	Total site area <2,500 m ² , soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height, total material moved <10,000 tonnes, earthworks during wetter months
Construction	
Large	Total building volume >100,000 m ³ , piling, on site concrete batching; sandblasting
Medium	Total building volume 25,000 m ³ – 100,000 m ³ , potentially dusty construction material (e.g. concrete), piling, on site concrete batching
Small	Total building volume <25,000 m ³ , construction material with low potential for dust release (e.g. metal cladding or timber)
Trackout ^a	
Large	>50 HDV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m
Medium	10-50 HDV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 m – 100 m
Small	<10 HDV (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50 m

^a These numbers are for vehicles that leave the site after moving over unpaved ground.

Step 2B – Define the Sensitivity of the Area

G1.8 The sensitivity of the area is defined taking account of a number of factors:

- the specific sensitivities of receptors in the area;
- the proximity and number of those receptors;
- in the case of PM₁₀, the local background concentration; and
- site-specific factors, such as whether there are natural shelters to reduce the risk of wind-blown dust.

- G1.9 The first requirement is to determine the specific sensitivities of local receptors. The IAQM guidance recommends that this should be based on professional judgment, taking account of the principles in Table G1.2. These receptor sensitivities are then used in the matrices set out in Table G1.3, Table G1.4 and Table G1.5 to determine the sensitivity of the area. Finally, the sensitivity of the area is considered in relation to any other site-specific factors, such as the presence of natural shelters etc., and any required adjustments to the defined sensitivities are made.

Step 2C – Define the Risk of Impacts

- G1.10 The dust emission magnitude determined at Step 2A is combined with the sensitivity of the area determined at Step 2B to determine the *risk* of impacts with no mitigation applied. The IAQM guidance provides the matrix in Table G1.6 as a method of assigning the level of risk for each activity.

STEP 3: Determine Site-specific Mitigation Requirements

- G1.11 The IAQM guidance provides a suite of recommended and desirable mitigation measures which are organised according to whether the outcome of Step 2 indicates a low, medium, or high risk. The list provided in the IAQM guidance has been used as the basis for the requirements set out in Appendix G5.

STEP 4: Determine Significant Effects

- G1.12 The IAQM guidance does not provide a method for assessing the significance of effects before mitigation, and advises that pre-mitigation significance should not be determined. With appropriate mitigation in place, the IAQM guidance is clear that the residual effect will normally be 'not significant'.
- G1.13 The IAQM guidance recognises that, even with a rigorous dust management plan in place, it is not possible to guarantee that the dust mitigation measures will be effective all of the time, for instance under adverse weather conditions. The local community may therefore experience occasional, short-term dust annoyance. The scale of this would not normally be considered sufficient to change the conclusion that the effects will be 'not significant'.

Table G1.2: Principles to be Used When Defining Receptor Sensitivities

Class	Principles	Examples
Sensitivities of People to Dust Soiling Effects		
High	users can reasonably expect enjoyment of a high level of amenity; or the appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land	dwellings, museum and other culturally important collections, medium and long term car parks and car showrooms
Medium	users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or the appearance, aesthetics or value of their property could be diminished by soiling; or the people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land	parks and places of work
Low	the enjoyment of amenity would not reasonably be expected; or there is property that would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or there is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land	playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads
Sensitivities of People to the Health Effects of PM₁₀		
High	locations where members of the public may be exposed for eight hours or more in a day	residential properties, hospitals, schools and residential care homes
Medium	locations where the people exposed are workers, and where individuals may be exposed for eight hours or more in a day.	may include office and shop workers, but will generally not include workers occupationally exposed to PM ₁₀
Low	locations where human exposure is transient	public footpaths, playing fields, parks and shopping streets
Sensitivities of Receptors to Ecological Effects		
High	locations with an international or national designation and the designated features may be affected by dust soiling; or locations where there is a community of a particularly dust sensitive species	Special Areas of Conservation with dust sensitive features
Medium	locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or locations with a national designation where the features may be affected by dust deposition	Sites of Special Scientific Interest with dust sensitive features
Low	locations with a local designation where the features may be affected by dust deposition	Local Nature Reserves with dust sensitive features

Table G1.3: Sensitivity of the Area to Dust Soiling Effects on People and Property ¹

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

¹ For demolition, earthworks and construction, distances are taken either from the dust source or from the boundary of the site. For trackout, distances are measured from the sides of roads used by construction traffic. Without mitigation, trackout may occur from roads up to 500 m from sites with a *large* dust emission magnitude for trackout, 200 m from sites with a *medium* dust emission magnitude and 50 m from sites with a *small* dust emission magnitude, as measured from the site exit. The impact declines with distance from the site, and it is only necessary to consider trackout impacts up to 50 m from the edge of the road.

Table G1.4: Sensitivity of the Area to Human Health Effects ¹

Receptor Sensitivity	Annual Mean PM ₁₀	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32 µg/m ³	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg/m ³	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m ³	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m ³	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32 µg/m ³	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32 µg/m ³	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28 µg/m ³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24 µg/m ³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Table G1.5: Sensitivity of the Area to Ecological Effects ¹

Receptor Sensitivity	Distance from the Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Table G1.6: Defining the Risk of Dust Impacts

Sensitivity of the Area	Dust Emission Magnitude		
	Large	Medium	Small
Demolition			
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible
Earthworks			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Construction			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Trackout			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

Appendix G2 EPUK & IAQM Planning for Air Quality Guidance

G2.1 The guidance issued by EPUK and IAQM (Moorcroft and Barrowcliffe et al, 2017) is comprehensive in its explanation of the place of air quality in the planning regime. Key sections of the guidance not already mentioned above are set out below.

Air Quality as a Material Consideration

“Any air quality issue that relates to land use and its development is capable of being a material planning consideration. The weight, however, given to air quality in making a planning application decision, in addition to the policies in the local plan, will depend on such factors as:

- *the severity of the impacts on air quality;*
- *the air quality in the area surrounding the proposed development;*
- *the likely use of the development, i.e. the length of time people are likely to be exposed at that location; and*
- *the positive benefits provided through other material considerations”.*

Recommended Best Practice

G2.2 The guidance goes into detail on how all development proposals can and should adopt good design principles that reduce emissions and contribute to better air quality management. It states:

“The basic concept is that good practice to reduce emissions and exposure is incorporated into all developments at the outset, at a scale commensurate with the emissions”.

G2.3 The guidance sets out a number of good practice principles that should be applied to all developments that:

- include 10 or more dwellings;
- where the number of dwellings is not known, residential development is carried out on a site of more than 0.5 ha;
- provide more than 1,000 m² of commercial floorspace;
- are carried out on land of 1 ha or more.

G2.4 The good practice principles are that:

- New developments should not contravene the Council’s Air Quality Action Plan, or render any of the measures unworkable;

- Wherever possible, new developments should not create a new “street canyon”, as this inhibits pollution dispersion;
- Delivering sustainable development should be the key theme of any application;
- New development should be designed to minimise public exposure to pollution sources, e.g. by locating habitable rooms away from busy roads;
- The provision of at least 1 Electric Vehicle (EV) “rapid charge” point per 10 residential dwellings and/or 1000 m² of commercial floorspace. Where on-site parking is provided for residential dwellings, EV charging points for each parking space should be made available;
- Where development generates significant additional traffic, provision of a detailed travel plan (with provision to measure its implementation and effect) which sets out measures to encourage sustainable means of transport (public, cycling and walking) via subsidised or free-ticketing, improved links to bus stops, improved infrastructure and layouts to improve accessibility and safety;
- All gas-fired boilers to meet a minimum standard of <40 mgNO_x/kWh;
- Where emissions are likely to impact on an AQMA, all gas-fired CHP plant to meet a minimum emissions standard of:
 - Spark ignition engine: 250 mgNO_x/Nm³;
 - Compression ignition engine: 400 mgNO_x/Nm³;
 - Gas turbine: 50 mgNO_x/Nm³.
- A presumption should be to use natural gas-fired installations. Where biomass is proposed within an urban area it is to meet minimum emissions standards of 275 mgNO_x/Nm³ and 25 mgPM/Nm³.

G2.5 The guidance also outlines that offsetting emissions might be used as a mitigation measure for a proposed development. However, it states that:

“It is important that obligations to include offsetting are proportional to the nature and scale of development proposed and the level of concern about air quality; such offsetting can be based on a quantification of the emissions associated with the development. These emissions can be assigned a value, based on the “damage cost approach” used by Defra, and then applied as an indicator of the level of offsetting required, or as a financial obligation on the developer. Unless some form of benchmarking is applied, it is impractical to include building emissions in this approach, but if the boiler and CHP emissions are consistent with the standards as described above then this is not essential”.

G2.6 The guidance offers a widely used approach for quantifying costs associated with pollutant emissions from transport. It also outlines the following typical measures that may be considered to offset

emissions, stating that measures to offset emissions may also be applied as post assessment mitigation:

- Support and promotion of car clubs;
- Contributions to low emission vehicle refuelling infrastructure;
- Provision of incentives for the uptake of low emission vehicles;
- Financial support to low emission public transport options; and
- Improvements to cycling and walking infrastructures.

Screening

Impacts of the Local Area on the Development

“There may be a requirement to carry out an air quality assessment for the impacts of the local area’s emissions on the proposed development itself, to assess the exposure that residents or users might experience. This will need to be a matter of judgement and should take into account:

- the background and future baseline air quality and whether this will be likely to approach or exceed the values set by air quality objectives;*
- the presence and location of Air Quality Management Areas as an indicator of local hotspots where the air quality objectives may be exceeded;*
- the presence of a heavily trafficked road, with emissions that could give rise to sufficiently high concentrations of pollutants (in particular nitrogen dioxide), that would cause unacceptably high exposure for users of the new development; and*
- the presence of a source of odour and/or dust that may affect amenity for future occupants of the development”.*

Impacts of the Development on the Local Area

G2.7 The guidance sets out two stages of screening criteria that can be used to identify whether a detailed air quality assessment is required, in terms of the impact of the development on the local area. The first stage is that you should proceed to the second stage if any of the following apply:

- 10 or more residential units or a site area of more than 0.5 ha residential use; and/or
- more than 1,000 m² of floor space for all other uses or a site area greater than 1 ha.

G2.8 Coupled with any of the following:

- the development has more than 10 parking spaces; and/or

- the development will have a centralised energy facility or other centralised combustion process.

G2.9 If the above do not apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area. If they do apply then you proceed to stage 2, which sets out indicative criteria for requiring an air quality assessment. The stage 2 criteria relating to vehicle emissions are set out below:

- the development will lead to a change in LDV flows of more than 100 AADT within or adjacent to an AQMA or more than 500 AADT elsewhere;
- the development will lead to a change in HDV flows of more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere;
- the development will lead to a realigning of roads (i.e. changing the proximity of receptors to traffic lanes) where the change is 5m or more and the road is within an AQMA;
- the development will introduce a new junction or remove an existing junction near to relevant receptors, and the junction will cause traffic to significantly change vehicle acceleration/deceleration, e.g. traffic lights or roundabouts;
- the development will introduce or change a bus station where bus flows will change by more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere; and
- the development will have an underground car park with more than 100 movements per day (total in and out) with an extraction system that exhausts within 20 m of a relevant receptor.

G2.10 The criteria are more stringent where the traffic impacts may arise on roads where concentrations are close to the objective. The presence of an AQMA is taken to indicate the possibility of being close to the objective, but where whole authority AQMAs are present and it is known that the affected roads have concentrations below 90% of the objective, the less stringent criteria are likely to be more appropriate.

G2.11 On combustion processes (including standby emergency generators and shipping) where there is a risk of impacts at relevant receptors, the guidance states that:

“Typically, any combustion plant where the single or combined NO_x emission rate is less than 5 mg/sec is unlikely to give rise to impacts, provided that the emissions are released from a vent or stack in a location and at a height that provides adequate dispersion. As a guide, the 5 mg/s criterion equates to a 450 kW ultra-low NO_x gas boiler or a 30kW CHP unit operating at <95mg/Nm³.

In situations where the emissions are released close to buildings with relevant receptors, or where the dispersion of the plume may be adversely affected by the size and/or height of adjacent buildings

(including situations where the stack height is lower than the receptor) then consideration will need to be given to potential impacts at much lower emission rates.

Conversely, where existing nitrogen dioxide concentrations are low, and where the dispersion conditions are favourable, a much higher emission rate may be acceptable”.

- G2.12 Should none of the above apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area, provided that professional judgement is applied; the guidance importantly states the following:

“The criteria provided are precautionary and should be treated as indicative. They are intended to function as a sensitive ‘trigger’ for initiating an assessment in cases where there is a possibility of significant effects arising on local air quality. This possibility will, self-evidently, not be realised in many cases. The criteria should not be applied rigidly; in some instances, it may be appropriate to amend them on the basis of professional judgement, bearing in mind that the objective is to identify situations where there is a possibility of a significant effect on local air quality”.

- G2.13 Even if a development cannot be screened out, the guidance is clear that a detailed assessment is not necessarily required:

“The use of a Simple Assessment may be appropriate, where it will clearly suffice for the purposes of reaching a conclusion on the significance of effects on local air quality. The principle underlying this guidance is that any assessment should provide enough evidence that will lead to a sound conclusion on the presence, or otherwise, of a significant effect on local air quality. A Simple Assessment will be appropriate, if it can provide this evidence. Similarly, it may be possible to conduct a quantitative assessment that does not require the use of a dispersion model run on a computer”.

- G2.14 The guidance also outlines what the content of the air quality assessment should include, and this has been adhered to in the production of this chapter.

Assessment of Significance

- G2.15 There is no official guidance in the UK in relation to development control on how to describe the nature of air quality impacts, nor how to assess their significance. The approach within the EPUK/IAQM guidance has, therefore, been used in this assessment. This approach involves a two stage process:

- a qualitative or quantitative description of the impacts on local air quality arising from the development; and
- a judgement on the overall significance of the effects of any impacts.

G2.16 The guidance recommends that the assessment of significance should be based on professional judgement, with the overall air quality impact of the development described as either 'significant' or 'not significant'. In drawing this conclusion, the following factors should be taken into account:

- the existing and future air quality in the absence of the development;
- the extent of current and future population exposure to the impacts;
- the influence and validity of any assumptions adopted when undertaking the prediction of impacts;
- the potential for cumulative impacts and, in such circumstances, several impacts that are described as '*slight*' individually could, taken together, be regarded as having a significant effect for the purposes of air quality management in an area, especially where it is proving difficult to reduce concentrations of a pollutant. Conversely, a '*moderate*' or '*substantial*' impact may not have a significant effect if it is confined to a very small area and where it is not obviously the cause of harm to human health; and
- the judgement on significance relates to the consequences of the impacts; will they have an effect on human health that could be considered as significant? In the majority of cases, the impacts from an individual development will be insufficiently large to result in measurable changes in health outcomes that could be regarded as significant by health care professionals.

G2.17 The guidance is clear that other factors may be relevant in individual cases. It also states that the effect on the residents of any new development where the air quality is such that an air quality objective is not met will be judged as significant. For people working at new developments in this situation, the same will not be true as occupational exposure standards are different, although any assessment may wish to draw attention to the undesirability of the exposure.

G2.18 A judgement of the significance should be made by a competent professional who is suitably qualified. A summary of the professional experience of the staff contributing to this assessment is provided in Appendix G3.

Appendix G3 Professional Experience

Penny Wilson, BSc (Hons) CSci MEnvSc MIAQM

Ms Wilson is an Associate Director with AQC, with more than 20 years' relevant experience in the field of air quality. She has been responsible for numerous assessments for a range of infrastructure developments including power stations, road schemes, ports, airports and residential/commercial developments. The assessments have covered operational and construction impacts, including odours. She also provides services to local authorities in support of their LAQM duties, including the preparation of Review and Assessment and Action Plan reports, as well as audits of Air Quality Assessments submitted with planning applications. She has provided expert evidence to a number of Public Inquiries, and is a Member of the Institute of Air Quality Management and a Chartered Scientist.

Ricky Gellatly, BSc (Hons) CSci MEnvSc MIAQM

Mr Gellatly is a Principal Consultant with AQC with over nine years' relevant experience. He has undertaken air quality assessments for a wide range of projects, assessing many different pollution sources using both qualitative and quantitative methodologies, with most assessments having included dispersion modelling (using a variety of models). He has assessed road schemes, airports, energy from waste facilities, anaerobic digesters, poultry farms, urban extensions, rail freight interchanges, energy centres, waste handling sites, sewage works and shopping and sports centres, amongst others. He also has experience in ambient air quality monitoring, the analysis and interpretation of air quality monitoring data, the monitoring and assessment of nuisance dust and odours and the monitoring and assessment of construction dust. He is a Member of the Institute of Air Quality Management and is a Chartered Scientist.

Jamie Dennis, MSci (Hons) AMEnvSc AMIAQM

Mr Dennis is an Assistant Consultant with AQC, having joined the company in December 2019. Prior to joining, he completed an MSci degree in Chemistry at the University of Bristol. He specialised in the regional modelling of trace gases and is a published author in the area. He has undertaken numerous air quality assessments, including road traffic and plant emissions modelling, as well as odour and construction dust risk assessments. He is an Associate Member of both the Institute of Air Quality Management and Institution of Environmental Sciences.

Appendix G4 Modelling Methodology

Model Inputs

G4.1 Predictions have been carried out using the ADMS-Roads dispersion model (v5). The model requires the user to provide various input data, including emissions from each section of road and the road characteristics (including road width, where applicable). Vehicle emissions have been calculated based on vehicle flow, composition and speed data using the EFT (Version 10.1) published by Defra (2021d). Model input parameters are summarised in Table G4.1 and, where considered necessary, discussed further below.

Table G4.1: Summary of Model Inputs

Model Parameter	Value Used
Meteorological Monitoring Site	Shoreham
Meteorological Data Year	2019
Dispersion Site Surface Roughness Length (m)	0.5
Dispersion Site Minimum MO Length (m)	30
Met Site Surface Roughness Length (m)	0.2
Met Site Minimum MO Length (m)	10

G4.2 AADT flows, speeds, and vehicle fleet composition data have been derived from the County traffic model by Pell Frischmann, who have undertaken the transport assessment work for the Proposed Development. Traffic speeds have been adjusted based on professional judgement, taking account of the road layout, speed limits and the proximity to a junction. The traffic data used in this assessment are summarised in ; the 'road link' reflects the ID in the SATURN traffic model, while the 'Label' aligns with Figure G4.1 to Figure G4.8, which show the road network included within the model, along with the speed at which each link was modelled. Diurnal and monthly flow profiles for the traffic have been derived from the national profiles published by DfT (2020).

Table G4.2: Summary of Traffic Data used in the Assessment

Road Link	Label	2019		2024 Base		2024 with Scheme		2030 Base		2030 with Scheme	
		AADT	%HDV	AADT	%HDV	AADT	%HDV	AADT	%HDV	AADT	%HDV
10006_30007	0	1,691	10	1,987	8	1,981	8	2,142	8	2,158	8
10006_50152	1	21,463	7	23,471	7	23,821	6	24,437	6	25,263	6
10006_50223	2	25,632	7	26,933	6	27,352	6	27,296	6	28,838	5
11001_9001	3	21,969	8	21,763	7	21,826	7	22,092	7	22,169	7
11003_11002	4	38,100	9	37,753	8	37,862	8	38,317	8	38,703	8

Road Link	Label	2019		2024 Base		2024 with Scheme		2030 Base		2030 with Scheme	
		AADT	%HDV	AADT	%HDV	AADT	%HDV	AADT	%HDV	AADT	%HDV
50009_50008	5	226	1	336	-	333	-	392	-	375	-
50018_50063	6	14,016	8	15,667	7	15,908	7	16,577	7	17,134	7
50018_50136	7	845	12	866	11	859	11	876	11	820	12
50018_50168	8	14,337	9	15,879	8	16,191	8	16,653	7	17,443	7
50018_50019	9	2,009	6	2,130	5	2,559	5	2,359	5	3,168	5
50019_70016	10	2,655	6	2,717	5	3,201	4	2,948	5	4,027	4
50027_50026	11	268	9	210	43	252	36	228	41	536	19
50028_70029	12	7,458	3	8,731	2	9,432	2	8,731	2	9,313	2
50029_50063	13	14,518	8	15,512	7	15,829	7	16,523	7	16,949	7
50029_50136	14	16,860	7	16,030	7	16,477	7	16,231	7	17,640	6
50029_75012	15	41,281	8	44,130	7	44,245	7	45,681	7	47,083	7
50033_75014	16	1,487	6	1,508	6	2,330	4	1,778	5	3,116	3
50034_50064	17	2,889	8	2,728	7	3,612	6	2,889	7	4,456	5
50035_75020	18	6,909	7	8,319	3	8,904	3	8,230	3	8,230	3
50036_70065	19	12,720	4	13,813	3	14,361	3	13,825	3	13,774	3
50040_50039	20	1,125	2	1,208	3	1,277	2	1,225	3	1,406	2
50041_50009	21	6,798	2	8,892	2	9,037	2	9,293	2	9,884	2
50041_50039	22	1,413	2	1,708	2	1,785	2	1,748	2	1,950	2
50043_50041	23	5,243	2	6,795	2	6,863	2	7,157	2	7,550	2
50045_50044	24	17,129	4	21,708	4	22,352	4	23,367	4	25,349	3
50047_50046	25	13,875	4	17,883	3	18,648	3	19,517	3	20,787	3
50048_50047	26	15,672	4	19,739	4	20,555	4	21,427	3	22,804	3
50057_50056	27	2,594	9	5,930	4	6,033	4	6,208	4	6,573	5
80032_80058	28	-	-	-	-	-	-	-	-	15,899	2
50064_50063	29	1,597	12	1,145	14	1,875	8	1,425	11	2,524	6
50069_50009	30	3,791	1	4,797	1	4,856	1	5,021	-	5,346	-
50070_50009	31	3,208	3	4,358	3	4,442	3	4,591	3	4,840	3
50083_50057	32	5,235	7	8,607	5	8,774	5	8,993	5	9,502	5
50083_50060	33	1,223	-	1,180	-	1,236	-	1,410	-	2,486	-
50084_50060	34	1,509	1	1,362	3	1,416	3	1,578	3	2,663	2
50085_50084	35	24,638	4	26,877	3	26,733	3	26,492	3	24,759	3
50086_50057	36	3,145	5	3,100	6	3,164	6	3,207	6	3,349	6
50088_50086	37	7,624	5	10,175	4	10,329	4	10,747	4	11,165	4

Road Link	Label	2019		2024 Base		2024 with Scheme		2030 Base		2030 with Scheme	
		AADT	%HDV	AADT	%HDV	AADT	%HDV	AADT	%HDV	AADT	%HDV
50089_50049	38	4,501	7	5,210	7	5,319	7	5,457	7	5,728	6
50089_50086	39	10,625	5	13,178	5	13,376	5	13,851	5	14,553	4
50090_50245	40	12,492	4	14,887	4	16,125	3	16,171	3	8,255	4
50091_75015	41	1,134	5	2,548	4	2,659	4	2,906	4	4,673	2
50091_75015	42	1,134	5	2,548	4	2,659	4	2,906	4	4,673	2
50092_50091	43	2,843	3	5,095	3	5,349	3	5,699	3	6,522	3
50093_50103	44	18,047	4	19,548	3	20,956	3	20,091	3	11,967	4
50094_50091	45	2,337	3	4,030	2	4,245	2	4,734	3	5,786	2
50096_50051	46	2,732	3	3,270	3	3,378	2	3,335	3	3,644	2
50096_50089	47	10,996	6	14,165	5	14,436	5	14,916	5	15,638	4
50098_50059	48	6,123	5	6,500	5	6,774	5	7,058	5	8,487	4
50098_50097	49	6,388	5	6,770	5	7,045	5	7,334	5	8,754	4
50099_50098	50	269	5	274	5	274	5	279	5	271	5
50099_50120	51	713	5	724	5	725	5	750	5	723	5
50100_50059	52	7,019	5	7,527	5	7,870	5	8,161	5	9,740	4
50100_50083	53	3,383	6	6,334	4	6,559	4	6,817	4	8,378	3
50100_50096	54	5,645	4	5,783	4	5,788	4	5,770	4	6,328	4
50102_50033	55	11,583	3	15,404	3	17,968	2	17,212	2	21,418	2
50102_50104	56	861	2	1,222	2	1,237	2	1,247	2	229	1
50103_70043	57	12,386	3	9,857	3	11,333	3	9,447	3	8,018	2
50104_50034	58	1,133	9	862	10	936	9	737	12	1,020	9
50104_70026	59	2,724	6	3,157	4	3,495	4	3,214	5	4,321	4
50107_50035	60	5,963	4	6,369	3	6,565	3	6,815	3	7,066	3
50108_50188	61	504	9	510	8	517	8	521	8	616	7
50108_50234	62	3,219	5	3,073	5	3,138	5	3,078	5	3,038	5
50111_50048	63	5,035	5	4,097	5	4,675	5	4,974	5	5,512	4
50112_50048	64	11,118	4	16,346	3	17,098	3	17,667	3	18,848	3
50112_50165	65	1,655	3	6,660	4	6,593	4	6,605	4	7,005	3
50113_50046	66	2,238	5	2,338	5	2,379	5	2,421	5	2,532	5
50114_50047	67	312	19	295	22	261	15	270	24	206	11
50117_50044	68	6,369	3	8,053	2	8,110	2	8,386	2	8,671	2
50120_50044	69	14,259	5	17,604	5	18,269	5	19,064	5	20,989	4
50120_50097	70	13,638	5	16,959	5	17,623	5	18,392	5	20,341	4

Road Link	Label	2019		2024 Base		2024 with Scheme		2030 Base		2030 with Scheme	
		AADT	%HDV	AADT	%HDV	AADT	%HDV	AADT	%HDV	AADT	%HDV
50132_50045	71	10,037	4	10,751	5	10,816	4	11,110	4	11,787	4
50133_50045	72	10,278	4	14,053	3	14,627	3	15,440	3	16,662	3
50133_50046	73	10,278	4	14,053	3	14,627	3	15,440	3	16,662	3
50136_50018	74	845	12	866	11	859	11	876	11	820	12
50136_50029	75	16,860	7	16,030	7	16,477	7	16,231	7	17,640	6
50136_50172	76	12,835	8	12,315	8	12,497	8	12,353	7	13,081	7
50136_7866	77	4,870	5	4,581	5	4,838	5	4,754	5	5,379	5
50142_50017	78	13,436	1	12,307	1	12,380	1	12,478	1	12,275	1
50142_50084	79	25,606	3	27,941	3	27,856	3	27,796	3	27,135	3
50101_50144	80	133	2	2,202	2	2,199	2	2,199	2	2,189	2
50145_50096	81	8,817	6	11,838	5	12,270	5	12,802	4	13,498	4
50146_50100	82	16,387	4	20,464	4	21,033	4	21,231	4	24,786	3
50157_75009	83	18,208	8	21,234	7	21,805	7	22,514	6	23,573	6
50169_50101	84	13,457	4	17,073	3	18,195	3	18,359	3	24,437	3
50170_50112	85	16,148	4	21,024	3	21,990	3	22,530	3	24,036	3
50170_50134	86	25,158	4	28,286	3	28,518	3	29,136	3	28,484	3
50177_70044	87	1,526	3	1,577	3	1,576	3	1,572	3	1,571	3
50180_50145	88	90	11	97	9	99	9	93	10	103	9
50185_50108	89	5,216	3	4,925	2	4,794	2	4,999	2	4,440	2
50192_50108	90	27,337	7	29,001	7	29,492	7	30,014	7	30,892	7
50222_10006	91	3,455	12	5,390	7	5,534	7	7,175	5	7,265	5
50231_50097	92	8,418	6	11,187	5	11,621	5	12,152	5	12,838	4
50231_50145	93	8,418	6	11,187	5	11,621	5	12,152	5	12,838	4
50241_10006	94	22,201	8	23,641	7	23,917	7	24,547	6	25,406	6
50242_10006	95	24,310	7	27,314	6	27,855	6	28,897	5	30,572	5
50245_70054	96	12,492	4	14,887	4	16,125	3	16,171	3	8,255	4
50257_5739	97	21,490	4	20,638	4	20,510	4	20,610	4	20,355	4
50272_50101	98	13,347	4	15,533	3	16,656	3	16,844	3	22,970	3
50272_50273	99	370	4	376	3	378	3	384	3	387	3
50273_50272	100	741	4	753	3	756	3	767	3	774	3
50274_70072	101	12,867	4	15,097	4	16,225	3	16,406	3	7,934	4
50275_50274	102	528	3	1,357	1	1,754	1	1,363	1	2,145	1
50278_50108	103	12,253	8	13,367	8	13,568	8	13,947	8	14,698	7

Road Link	Label	2019		2024 Base		2024 with Scheme		2030 Base		2030 with Scheme	
		AADT	%HDV	AADT	%HDV	AADT	%HDV	AADT	%HDV	AADT	%HDV
50278_50108	104	12,253	8	13,367	8	13,568	8	13,947	8	14,698	7
50286_50046	105	3,671	3	3,893	3	4,033	3	4,061	3	3,911	4
50286_50115	106	8,491	5	9,099	5	9,131	4	9,443	5	10,001	4
50288_50170	107	17,417	3	17,525	3	17,159	3	17,589	3	17,371	3
5839_5740	108	10,514	4	10,449	4	10,557	4	10,716	4	10,700	4
70005_50142	109	13,501	5	17,094	4	16,967	4	17,305	4	16,944	4
70010_50026	110	3,586	6	3,123	7	3,236	7	3,437	6	3,981	6
70010_50104	111	1,940	7	1,674	6	2,224	5	1,756	6	4,087	4
70012_70020	112	3,109	4	2,876	5	3,173	4	3,116	5	5,420	4
70013_50033	113	10,097	3	13,896	2	15,638	2	15,434	2	18,303	2
70013_70007	114	243	1	-	-	4	10	-	-	311	-
70014_70024	115	1,001	5	1,022	5	1,031	5	1,058	5	1,081	5
70016_70026	116	2,616	6	2,782	5	3,275	4	3,013	5	4,125	4
70017_70026	117	871	6	883	6	890	6	904	6	921	6
70018_50019	118	1,196	7	1,703	5	1,765	5	1,727	5	1,946	5
70020_50177	119	10,726	3	11,889	3	12,795	3	12,064	3	15,071	3
70020_70029	120	7,265	2	8,685	2	9,314	2	8,615	2	9,285	2
70022_70010	121	2,508	7	2,239	8	2,515	8	2,432	8	4,621	5
70024_50034	122	1,897	7	2,157	6	2,970	4	2,481	5	3,830	3
70025_50064	123	1,800	6	2,067	5	2,198	5	2,086	5	2,451	5
70025_70015	124	1,835	5	1,571	5	1,570	5	1,571	5	1,569	5
70032_50026	125	2,757	7	2,571	5	2,654	5	2,702	5	2,904	5
70032_50028	126	2,528	7	2,349	5	2,422	5	2,458	5	2,600	5
70032_70031	127	776	5	797	6	806	6	819	6	842	5
70033_50028	128	8,574	3	9,922	2	10,613	2	9,905	2	10,608	2
70033_75023	129	6,909	7	8,510	3	9,073	3	8,404	3	8,525	3
70034_70033	130	3,806	3	3,976	3	4,058	3	4,128	3	4,337	3
70035_70020	131	1,577	3	1,325	4	1,324	4	1,321	4	1,320	4
70042_50177	132	11,294	3	-	-	-	-	-	-	-	-
70042_80006	133	-	-	8,538	3	10,286	3	8,123	4	7,648	2
70043_70041	134	796	3	809	3	812	3	845	3	856	3
70043_70042	135	11,835	3	9,300	3	10,783	3	8,907	3	7,797	2
70047_50093	136	15,045	4	16,281	3	17,290	3	17,486	3	7,944	4

Road Link	Label	2019		2024 Base		2024 with Scheme		2030 Base		2030 with Scheme	
		AADT	%HDV	AADT	%HDV	AADT	%HDV	AADT	%HDV	AADT	%HDV
70047_70046	137	1,046	3	1,057	3	1,066	3	1,107	3	1,131	3
70048_70045	138	1,270	4	1,265	4	1,271	4	1,307	4	1,326	4
70048_70047	139	14,396	4	15,626	3	16,634	3	16,797	3	7,272	4
70049_70050	140	1,601	3	1,611	4	1,622	3	1,677	3	1,710	3
70050_70048	141	13,574	4	14,840	3	15,840	3	15,979	3	6,532	4
70050_70058	142	12,748	4	14,079	4	15,216	3	15,353	3	6,131	5
70053_50090	143	1,440	4	2,972	3	3,090	3	3,343	3	5,151	2
70054_50274	144	12,699	4	15,121	4	16,373	3	16,420	3	8,586	4
70054_70051	145	648	3	670	3	675	3	680	3	693	3
70057_70058	146	897	4	897	4	1,196	3	926	4	938	4
70059_80002	147	12,581	4	-	-	-	-	-	-	-	-
70060_50092	148	9,283	2	9,608	2	9,657	2	9,460	2	11,496	1
70060_50093	149	9,444	3	9,779	3	9,850	3	9,526	3	11,720	2
70060_70039	150	3,506	4	3,565	4	3,609	4	3,706	4	3,821	4
70061_50092	151	9,365	2	10,083	2	10,168	2	9,948	2	12,326	2
70061_50124	152	8,422	2	8,770	3	8,745	3	8,429	2	10,819	2
70065_50035	153	12,479	4	13,688	3	14,238	3	13,710	3	13,661	3
70070_70061	154	1,678	3	2,015	3	2,129	3	2,226	3	2,194	3
70072_80070	155	12,867	4	15,097	4	16,225	3	16,405	3	7,934	4
70073_50090	156	12,592	4	14,108	3	15,260	3	15,521	3	6,125	5
70073_70058	157	12,317	4	13,834	4	14,988	3	15,235	3	5,873	5
70074_70073	158	426	3	434	3	435	3	454	3	458	3
75002_70025	159	1,800	6	2,370	4	2,384	4	2,269	4	2,265	4
75004_70013	160	10,097	3	13,895	2	15,633	2	15,433	2	17,992	2
75004_75006	161	10,097	3	13,895	2	15,633	2	14,616	2	17,115	2
75007_75002	162	1,800	6	2,370	4	2,384	4	2,943	3	3,066	3
75010_70023	163	21,005	7	23,792	7	24,628	6	25,672	6	25,391	6
75015_70053	164	1,440	4	2,620	4	2,734	4	2,978	4	4,763	2
75020_75021	165	-	-	277	-	277	-	277	-	276	-
75024_50103	166	12,581	4	13,007	3	12,798	3	14,039	3	7,307	5
75024_70059	167	12,581	4	12,457	3	12,248	3	13,540	3	6,873	5
80001_70059	168	12,581	4	12,458	3	12,247	3	13,689	3	6,850	4
80002_50102	169	12,867	4	16,626	3	19,204	2	18,459	2	21,647	2

Road Link	Label	2019		2024 Base		2024 with Scheme		2030 Base		2030 with Scheme	
		AADT	% HDV	AADT	% HDV	AADT	% HDV	AADT	% HDV	AADT	% HDV
80004_80003	170	-	-	5,819	1	8,590	1	6,414	1	15,218	1
80004_80005	171	-	-	4,018	2	6,791	1	4,621	2	14,677	1
80007_80177	172	-	-	12,547	3	13,461	3	12,734	3	15,860	3
80010_80011	173	-	-	-	-	2,870	1	-	-	2,861	1
80013_70050	174	-	-	-	-	-	-	1,715	-	2,426	1
80013_70050	175	-	-	-	-	-	-	1,715	-	2,426	1
80015_80016	176	-	-	-	-	-	-	-	-	3,262	-
80017_80057	177	-	-	-	-	-	-	-	-	16,419	2
80019_80012	178	-	-	-	-	-	-	-	-	17,484	1
80020_80014	179	-	-	-	-	5,605	-	-	-	19,572	1
80021_80008	180	-	-	-	-	6,689	-	-	-	20,001	1
80025_80027	181	-	-	-	-	-	-	-	-	22,554	3
80033_80032	182	-	-	-	-	-	-	-	-	1,034	-
80072_80033	183	-	-	-	-	-	-	-	-	921	-
80058_80057	184	-	-	-	-	-	-	-	-	15,919	2
80023_80059	185	-	-	-	-	-	-	-	-	16,424	2
80032_80059	186	-	-	-	-	-	-	-	-	16,052	2
80064_80010	187	-	-	-	-	2,735	-	-	-	2,748	1
80070_80071	188	-	-	-	-	-	-	-	-	392	-
80072_80028	189	13,347	4	15,533	3	16,656	3	16,844	3	6,898	5
80072_80028	190	12,867	4	15,533	3	16,225	3	16,405	3	-	-



Figure G4.1: Modelled Road Network & Speed – South Bognor Regis

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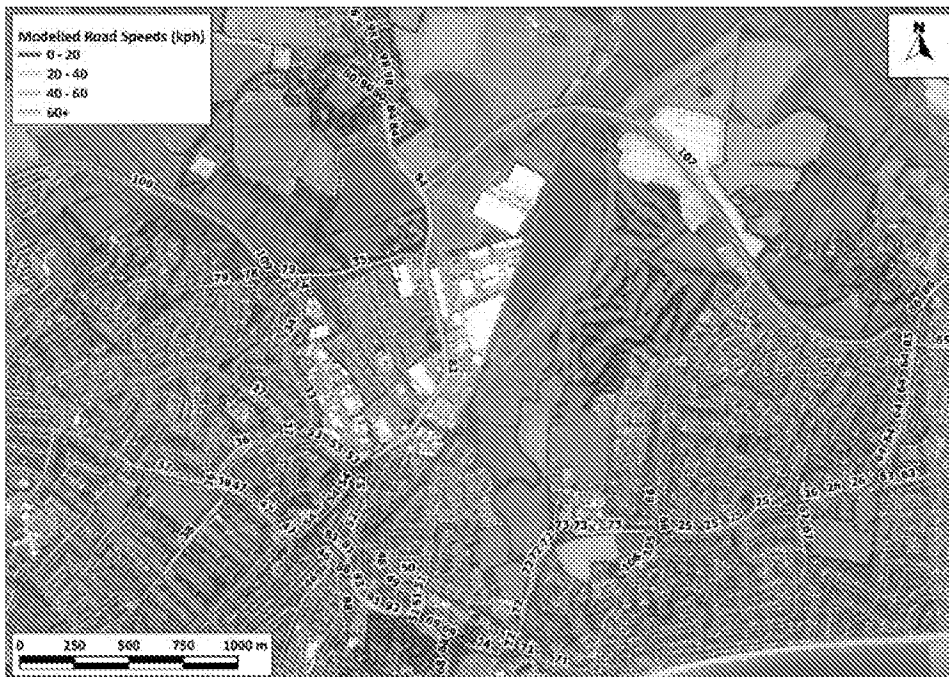


Figure G4.2: Modelled Road Network & Speed – North Bognor Regis

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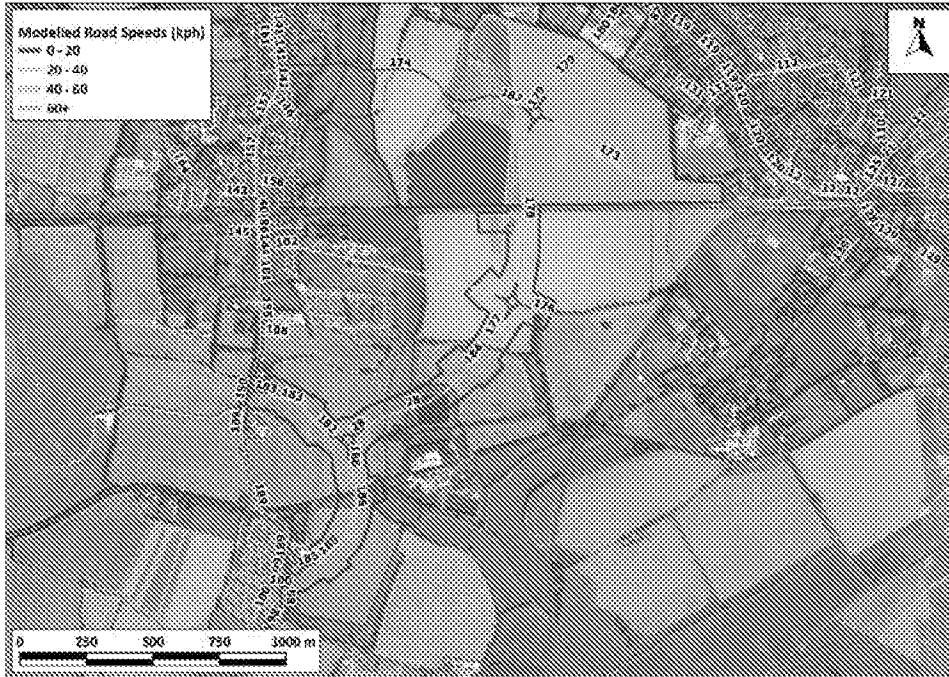


Figure G4.3: Modelled Road Network & Speed – South Barnham

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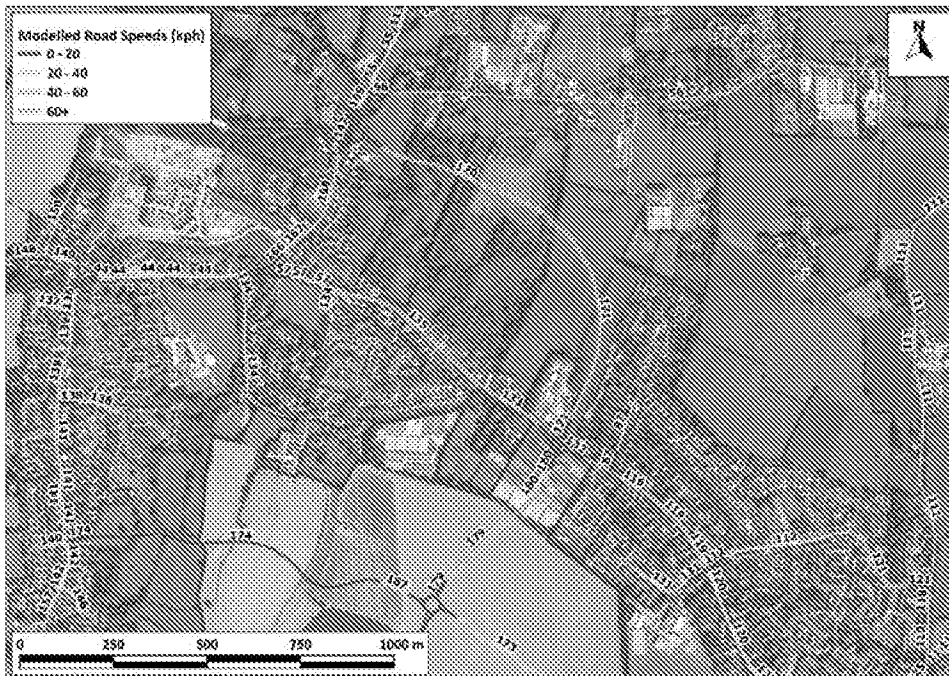


Figure G4.4: Modelled Road Network & Speed – North Bognor Regis

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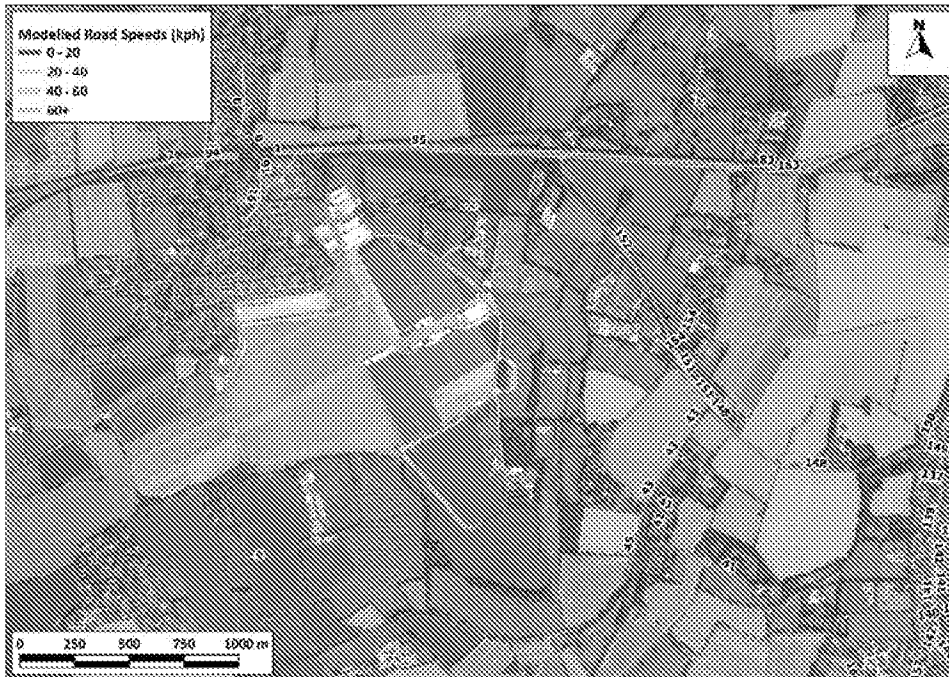


Figure G4.5: Modelled Road Network & Speed – Crockerhill, Tangmere and Norton

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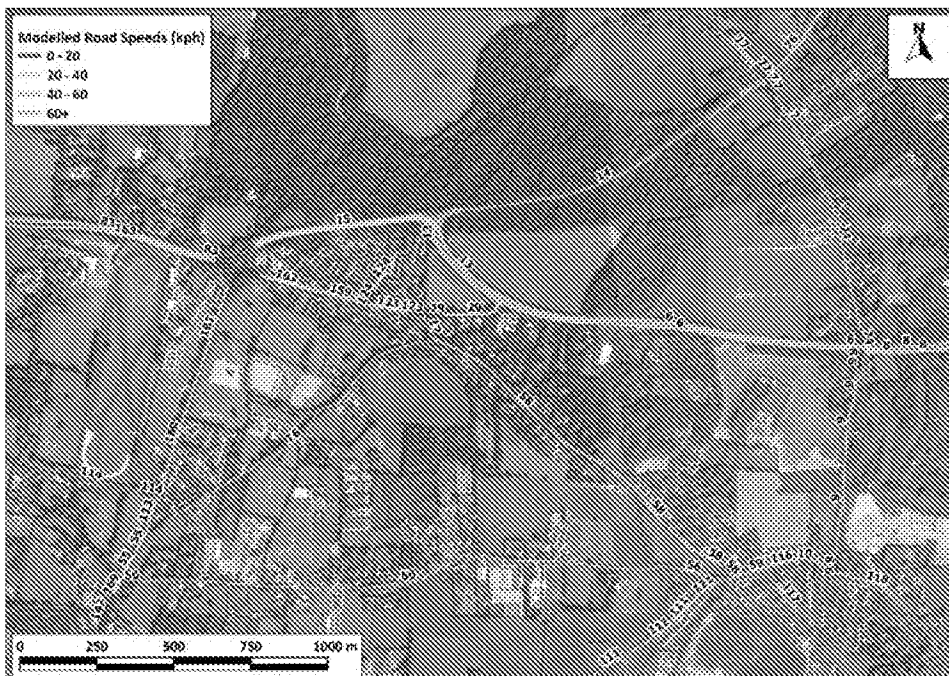


Figure G4.6: Modelled Road Network & Speed – Fontwell, Slindon Common and Walberton

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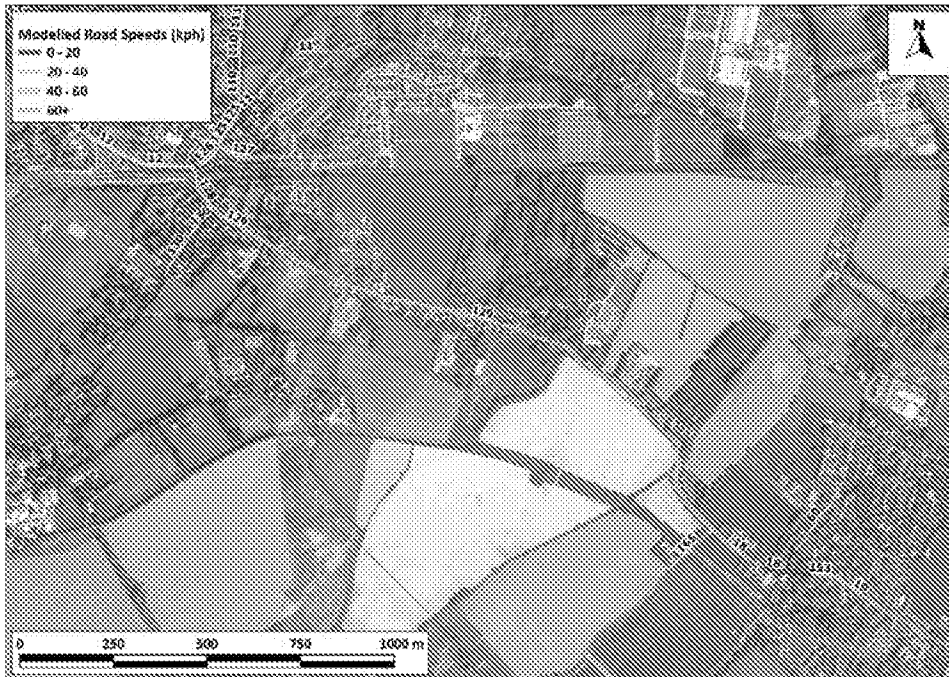


Figure G4.7: Modelled Road Network & Speed – Yapton

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Figure G4.8: Modelled Road Network & Speed – Arundel

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G4.3 Hourly sequential meteorological data in sectors of 10 degrees from Shoreham for 2019 have been used in the model. The Shoreham meteorological monitoring station is located at Shoreham Airport, approximately 30 km to the west of the proposed development. It is deemed to be the nearest monitoring station representative of meteorological conditions in the vicinity of the proposed development; both the application site and the Shoreham meteorological monitoring station are located at near-coastal locations on the south coast of England where they will be influenced by the effects of coastal meteorology. A wind rose for the site for the year 2019 is provided in Figure G4.9. The station is operated by the UK Met Office. Raw data were provided by the Met Office and processed by AQC for use in ADMS.

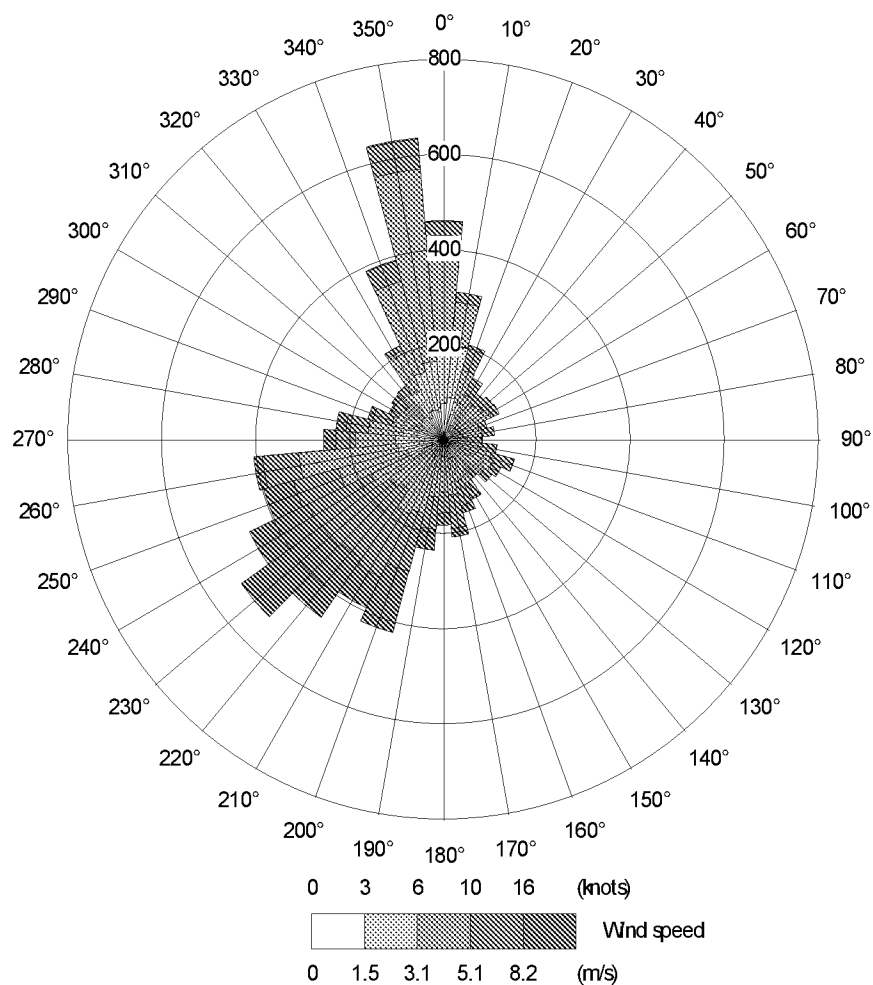


Figure G4.9: Wind Rose – Shoreham 2019

Model Verification

G4.4 Evidence collected over many years has shown that, in most urban areas, dispersion modelling relying upon Defra's EFT has tended to systematically under-predict roadside nitrogen dioxide concentrations. To account for this, it is necessary to adjust the model results against local measurements. The model has been run to predict annual mean nitrogen dioxide concentrations during 2019 at the Barn20, Bog10, Bog12, Bog13 and Yap19 diffusion tube monitoring sites. These sites have been selected because they are representative of receptor locations along the affected road network. Site Bog18 has been excluded from the model verification due to it being located outside of the study area along a road not included in the model.

Nitrogen Dioxide

- G4.5 Most nitrogen dioxide (NO_2) is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions of nitrogen oxides ($\text{NO}_x = \text{NO} + \text{NO}_2$).
- G4.6 The model output of road- NO_x (i.e. the component of total NO_x coming from road traffic) has been compared with the 'measured' road- NO_x . Measured road- NO_x has been calculated from the measured NO_2 concentrations and the predicted background NO_2 concentration using the NO_x from NO_2 calculator (Version 8.1) available on the Defra LAQM Support website (Defra, 2021d).
- G4.7 The unadjusted model has under predicted the road- NO_x contribution; this is a common experience with this and most other road traffic emissions dispersion models. An adjustment factor has been determined as the slope of the best-fit line between the 'measured' road contribution and the model derived road contribution, forced through zero (Figure G4.10). The calculated adjustment factor of 2.400 has been applied to the modelled road- NO_x concentration for each receptor to provide adjusted modelled road- NO_x concentrations.
- G4.8 The total nitrogen dioxide concentrations have then been determined by combining the adjusted modelled road- NO_x concentrations with the predicted background NO_2 concentration within the NO_x to NO_2 calculator. Figure G4.11 compares final adjusted modelled total NO_2 at each of the monitoring sites to measured total NO_2 .

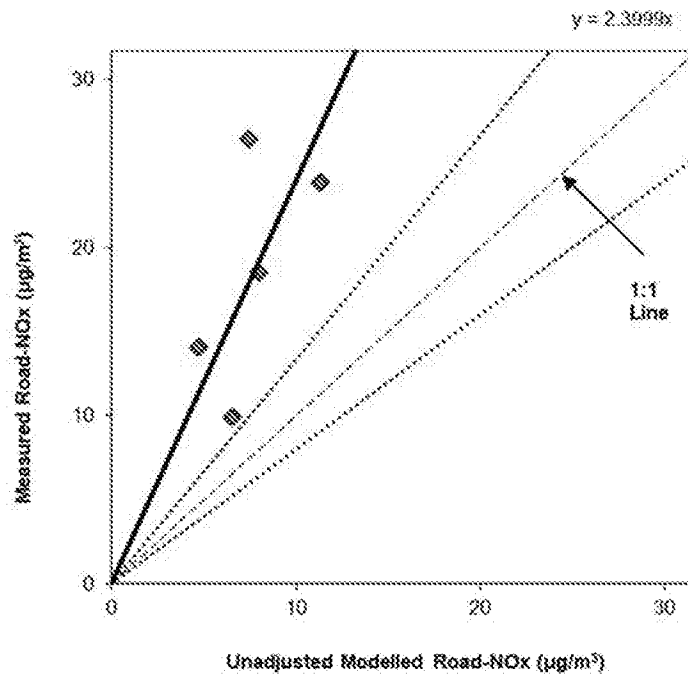


Figure G4.10: Comparison of Measured Road NO_x to Unadjusted Modelled Road NO_x Concentrations. The dashed lines show ± 25%.

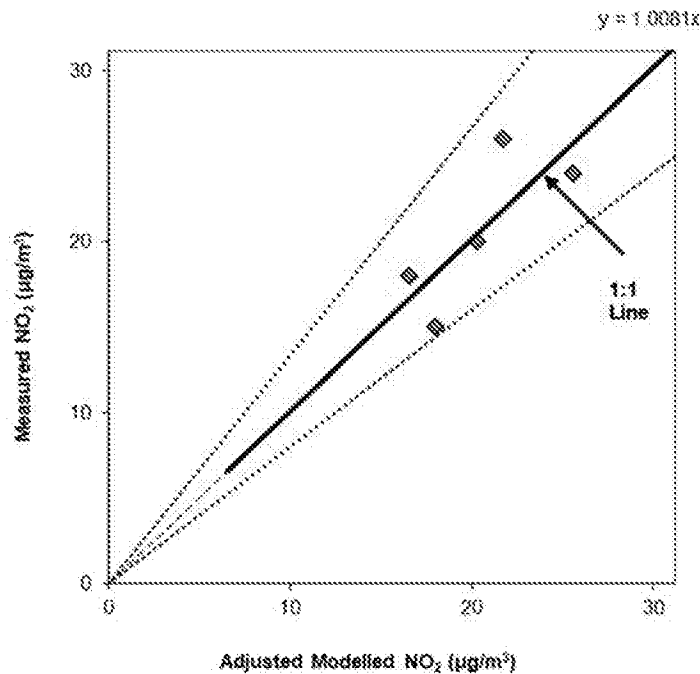


Figure G4.11: Comparison of Measured Total NO₂ to Final Adjusted Modelled Total NO₂ Concentrations. The dashed lines show ± 25%.

- 4.8.1 Table G4.3 shows the statistical parameters relating to the performance of the model, as well as the 'ideal' values (Defra, 2021b). The values calculated for the model demonstrate that it is performing well.

Table G4.3: Statistical Model Performance

Statistical Parameter	Model-Specific Value	'Ideal' Value
Correlation Coefficient ^a	0.77	1
Root Mean Square Error (RMSE) ^b	2.53	0
Fractional Bias ^c	0.00	0

- ^a Used to measure the linear relationship between predicted and observed data. A value of zero means no relationship and a value of 1 means absolute relationship.
- ^b Used to define the average error or uncertainty of the model. The units of RMSE are the same as the quantities compared (i.e. $\mu\text{g}/\text{m}^3$). TG16 (Defra, 2021b) outlines that, ideally, a RMSE value within 10% of the air quality objective ($4\mu\text{g}/\text{m}^3$) would be derived. If RMSE values are higher than 25% of the objective ($10\mu\text{g}/\text{m}^3$) it is recommended that the model is revisited.
- ^c Used to identify if the model shows a systematic tendency to over or under predict. Negative values suggest a model over-prediction and positive values suggest a model under-prediction.

PM₁₀ and PM_{2.5}

- G4.9 The approach described above for NO_x and nitrogen dioxide determines the road increment of concentrations by subtracting the predicted local background from the roadside measurements. This works well for NO_x because the differences between roadside and background concentrations typically represent a large proportion of the total measured value. The same is not true for PM₁₀ and PM_{2.5} concentrations, which are dominated by non-road emissions, even at the roadside. In practice, the influence of a local road on concentrations can often be smaller than the uncertainty in the mapped background concentration. As an example of this, 31% of all roadside and kerbside sites in London which measured PM_{2.5} in 2019 with >75% data capture, recorded an annual mean concentration lower than the equivalent Defra mapped background value. Using measured background concentrations does not provide any significant benefit, owing largely to the spatial resolution of available measurements, but also because of measurement uncertainty. For example, hourly-mean PM_{2.5} concentrations measured at roadside sites are often lower than those measured at nearby urban background sites, while concentrations at urban background sites are often lower than those measured at rural sites.
- G4.10 For these reasons, it is not appropriate to calculate the annual mean road-increment to PM₁₀ and PM_{2.5} concentrations by subtracting either the mapped background or a local measured background concentration. This, in turn, means that the approach to model adjustment which is described for NO_x and NO₂ is not appropriate for PM₁₀ and PM_{2.5}. Historically, many studies have derived a model adjustment factor for NO_x and applied this to PM₁₀ and PM_{2.5}. This is also not appropriate, since there is no reason to expect the same bias in emissions of NO_x, PM₁₀ and PM_{2.5}.

- G4.11 While there is very strong evidence that EFT-based models have consistently under-predicted road-NO_x concentrations in urban areas, there is no equivalent evidence for PM₁₀ and PM_{2.5}. There is currently no strong basis for applying any adjustment to the model outputs. Predicted concentrations of PM₁₀ and PM_{2.5} have thus not been adjusted.

Post-processing

- G4.12 The model predicts road-NO_x concentrations at each receptor location. These concentrations have been adjusted using the adjustment factor set out above, which, along with the background NO₂, has been processed through the NO_x to NO₂ calculator available on the Defra LAQM Support website (Defra, 2021d). The traffic mix within the calculator has been set to “All other urban UK traffic”, which is considered suitable for the study area. The calculator predicts the component of NO₂ based on the adjusted road-NO_x and the background NO₂.

Appendix G5 Receptor Locations

Table G5.1: Description of Receptor Locations

Receptor	Type	X coordinate	Y coordinate	Heights Modelled (m) *
Existing properties				
1	Residential (Carehome)	493710	99888	1.5
2	Residential	493569	100038	1.5
3	Residential	493699	99800	1.5
4	Residential	493746	99777	1.5
5	Residential	494340	99516	1.5
6	Residential	494596	99941	1.5
7	Residential	495347	100067	1.5
8	Residential	495758	100191	1.5
9	Residential	496208	100478	1.5
10	Residential	496191	100484	1.5
11	Residential	493387	101213	1.5
12	Residential	493326	101209	1.5
13	Residential	493403	100519	1.5
14	Residential	493366	100527	1.5
15	Residential	493426	100488	1.5
16	Residential	493327	100636	1.5
17	Residential	493759	102490	1.5
18	Residential	493838	102065	1.5
19	Residential	492831	98777	0.1
20	Residential	492854	98797	1.5
21	Residential	492838	98779	1.5
22	Residential	493230	98764	1.5
23	Residential	493888	99703	1.5
24	Residential	493782	100337	1.5
25	Residential	493781	100362	1.5
26	Residential	493688	100353	1.5
27	Residential	493461	99987	1.5
28	Residential	493137	100262	1.5
29	Residential	495138	100054	1.5
30	Residential	496147	100298	1.5
31	Residential	496308	100954	1.5
32	Residential	496314	100974	1.5

Receptor	Type	X coordinate	Y coordinate	Heights Modelled (m) *
33	Residential	493901	102867	1.5
34	Residential	493889	102996	1.5
35	Residential	493905	103092	1.5
36	Residential	493747	103500	1.5
37	Residential	493791	103735	1.5
38	Residential	493811	104191	1.5
39	Residential	493781	104363	1.5
40	Residential	493835	104694	1.5
41	Residential	493884	104868	1.5
42	Residential	493878	104842	1.5
43	Residential	493844	105033	1.5
44	Residential	493857	105305	1.5
45	Residential	493890	105570	1.5
46	Residential	493933	105596	1.5
47	Residential	494279	105571	1.5
48	Residential	494425	105590	1.5
49	Residential	494385	105605	1.5
50	Residential	495234	105134	1.5
51	Residential	495589	104814	1.5
52	Residential	495579	104773	1.5
53	Residential	495768	104461	1.5
54	Residential	496035	104398	2
55	Residential	496169	104734	1.5
56	Residential	492840	105849	1.5
57	Residential	492725	105994	1.5
58	Residential	490710	107007	1.5
59	Residential	491028	106989	1.5
60	Residential	497543	103327	1.5
61	Residential	497613	103315	1.5
62	Residential	496686	106076	1.5
63	Residential	496995	106117	1.5
64	Residential	497079	106775	1.5
65	Residential	497101	106783	1.5
66	Residential	496751	107702	1.5
67	Residential	496744	107693	1.5
68	Residential	501299	106907	1.5
69	Residential	501423	106858	1.5

Receptor	Type	X coordinate	Y coordinate	Heights Modelled (m) ^a
70	Residential	501420	106886	1.5
71	Residential	495231	105141	1.5
72	Residential	494610	106002	1.5
73	Residential	494688	106080	1.5
74	Residential	496549	106095	1.5
75	Residential	494782	106283	1.5
76	Residential	494811	106268	1.5
77	Residential	493759	104372	1.5
78	Residential	492591	105373	1.5
79	Residential	495338	105065	1.5
80	Residential	496148	105372	1.5
81	Residential	496397	105871	1.5
82	Residential	496463	105940	1.5
83	Residential	494907	107148	1.5
84	Residential	495662	106873	1.5
85	Residential	495685	106847	1.5
86	Residential	495695	106886	1.5
87	Residential	495615	106948	1.5
88	Residential	496233	106461	1.5
89	Residential	495245	105124	1.5
90	Residential	494594	105944	1.5
91	Residential	494577	105922	1.5
New properties				
92	Worst-Case Location	494870	104726	1.5
93	Worst-Case Location	494872	104710	1.5
94	Worst-Case Location	494873	104718	1.5
95	Worst-Case Location	494806	104360	1.5
96	Worst-Case Location	494811	104361	1.5

^a Receptors have been modelled at 1.5 m from ground level to represent human exposure, except for at basement windows or receptors with elevated windows.

Appendix G6 Emissions Mitigation Statement

Introduction

- G6.1 This Appendix presents the calculated air quality damage costs associated with the proposed residential development of Barnham, Eastergate and Westergate.
- G6.2 Defra developed the damage cost approach to enable proportionate analysis when assessing relatively small impacts on air quality. The damage costs are a set of impact values which were derived using the more detailed Impact Pathway Approach. These values estimate the societal costs associated with small changes in pollutant emissions. Combined with emission change estimates, they provide an approximate valuation of the aggregate societal impacts of a policy. Such impacts can then be set against the direct monetary costs of a scheme to provide a cost-benefit calculation. Thus, damage costs do not provide a figure for the abatement of emissions to a given level.
- G6.3 Abatement costs are usually derived from a marginal abatement cost curve (MACC) which gives the incremental cost of measures to achieve a certain outcome, such as the removal of an exceedance of the air quality objectives. However, the measures available and their associated costs are quite time-specific which means that they need to be updated on a regular basis. Defra's last MACC for NO₂ exceedances was produced several years ago and has now been withdrawn. There are therefore no Defra approved abatement costs for air quality currently available. Thus, while damage costs are not the same as abatement costs, they provide a current and available resource for assigning value to air pollution emissions.

Air Quality and Emissions Mitigation Guidance for Sussex Authorities

- G6.4 The Air Quality and Emissions Mitigation Guidance for Sussex (Sussex-air Air Quality Partnership, 2020) has been developed with local authorities across Sussex to provide a consistent approach for assessing the potential air quality impacts of development- and transport-related emissions, and a common framework for mitigating those impacts. The guidance provides a checklist to determine whether a detailed air quality assessment and/or an emissions mitigation assessment is required.
- G6.5 Should an emissions mitigation assessment be required, the guidance provides a framework for calculating the appropriate costs associated with the development's emissions, using the Defra IGCB Air Quality Damage Costs (Defra, 2021c) for specific pollutants, and appropriate mitigation options.

Damage Cost Calculations

- G6.6 The calculation of damage costs has utilised the most recent EFT (Defra, 2021a), used to determine the development's transport emissions, alongside Defra's damage cost toolkit (Defra, 2021c), used to determine the associated damage costs for those emissions.
- G6.7 The calculation process includes:

- identifying the additional trips or vehicle numbers generated by the proposed development;
- calculating the emissions from these trips for the pollutants of concern (NO_x and PM_{2.5}) using the EFT, for each of the five years assessed, starting with the year of opening. This calculation has assumed a 10 km trip length and a 50 kph average speed;
- calculating the damage costs for the specific pollutant emissions using the damage cost toolkit, based on the costs for road transport in a medium urban area. The toolkit allows for reductions in emissions over time, applies a discount in line with HM Treasury's Green Book and also adjusts for inflation; and
- extracting the 'Central' total value for each pollutant and summing these for use as the damage cost total for the scheme.

G6.8 Due to the phasing of the proposed development, a worst-case approach has been adopted in calculating the damage costs, that the Barnham, Eastergate and Westergate development, north of the railway line, will be fully operational in 2024, as opposed to its expected year of completion, in 2031.

Damage Cost Calculations

Calculations

G6.9 The traffic data used in the EIA are derived from the County model, rather than from specific development-generated trips, and it is not possible to extract from this model the annual trips associated only with the proposed development in isolation. Pell Frischmann, who have undertaken the Transport Assessment for the proposed development, have instead derived indicative Annual Average Daily Traffic (AADT) trips from the residential and school uses, equating to a total of 6,577 trips AADT. This figure is for light vehicles only, and thus does not include any heavy duty vehicle (HDV) trips that the Proposed Development might generate (although it is likely to generate very few). The annual emissions from the light vehicle trips in the five years from the year of first occupation (2024) have been calculated using the EFT and entered into Defra's damage cost toolkit. The calculations and results are presented in Table G6.1.

Table G6.1: Damage Cost Calculation

Year	2024	2025	2026	2027	2028
NOx					
Total Emissions (tonnes)	4.49	4.05	3.65	3.27	2.93
Central Damage Cost (£/tonne) ^a	9,445	9,634	9,826	10,023	10,223
Discounted Central Cost (£)	42,427	37,722	33,457	29,534	26,093
Total Central Present Value (£)	169,232				
PM _{2.5}					
Total Emissions (tonnes)	0.42	0.42	0.42	0.42	0.41
Central Damage Cost (£/tonne) ^a	82,857	84,514	86,204	87,928	89,687
Discounted Central Cost (£)	34,935	34,201	33,537	32,924	32,348
Total Central Present Value (£)	167,944				

^a Road transport urban medium

G6.10 Summing the values for NO_x and PM_{2.5} gives an estimated total damage cost of **£337,176**.

Conclusions

- G6.11 Damage cost calculations for NO_x and PM_{2.5} give a total damage cost of **£337,176**, although it should be noted that the damage cost approach was not developed to provide a figure for the abatement of emissions to a given level (see Paragraphs G6.2 and G6.3).
- G6.12 It is anticipated that the approximate implementation costs of mitigation measures proposed (beyond those required by policy) will far exceed this damage cost.

Appendix G7 Email Consultation with Arun District Council

G7.1 In response to the EIA Scoping Opinion document prepared in relation to Barnham, Eastergate & Westergate, following consultation with Jamie Dennis and Ricky Gellatly (AQC), Nancy Stuart (BEW planning team) sent the below paragraphs to James Cross (Arun District Council) on 11th January 2021. In relation to a site-specific monitoring survey:

"Paragraph 4.32, bullet point 1, references the proposed air quality monitoring strategy for the ES. It states that the Environmental Health department is: 'disappointed to see that no real monitoring of air quality is planned as part of the EIA. The Council's two closest air quality monitoring sites are in Barnham and at the level crossing in Westergate. However, these are new sites which have only been in existence since January 2020 and have been disrupted by Covid 19 so there is very little real data from the area. I would therefore recommend that baseline data is gathered from the area through real monitoring rather than relying ARUN DISTRICT COUNCIL BN/112/20/EIS SD5 Barnham, Eastergate & Westergate (BEW), Arun, West Sussex October 2020 7 on predictions and modelling. Monitoring locations should be approved by the Council's Environmental Health Team prior to commencement.'

We believe that a site-specific monitoring survey would not assist in our assessment for the following reasons:

- Any new monitoring will be conducted in a 'post-Covid19' scenario, and thus be subject to the same uncertainties as Arun's own monitoring data for 2020 – this would therefore make the monitoring no better than the three diffusion tubes deployed by the council in Barnham, "which have only been in existence since January 2020 and have been disrupted by Covid19".*
- From the perspective of our assessment, the only reason that monitoring data is required is to calibrate our model. It is anticipated that 2019 traffic data will be used in the baseline air quality model, which means that using 2019 air quality data would allow for consistency within our assessment and avoid issues related to Covid19.*
- The most sensitive areas for modelling will be those with existing air quality issues and traffic congestion i.e. Barnham, the A259 to the north of Bognor and the AQMAs in Chichester. There is already 2019 monitoring data available for these locations (Barn20, Yap19, Bog13, Bog18, extensive Chichester sites) which will be used to verify the air quality model. Differences in air quality between the monitoring sites in Bognor and Chichester and locations closer to the site, i.e. traffic flows/speeds, road type and background concentrations, will be accounted for in the model inputs."*

G7.2 In relation to an assessment of odours from the Lidsey Sewage Treatment Works:

"Paragraph 4.32, bullet point 2 requests clarity on assessment of odour from the sewage treatment works close to the southern site boundary.

To clarify, an odour constraints assessment has been conducted by AQC, covering the whole strategic allocation. Results will be discussed briefly within the chapter for this application, which is for development of the northern section of the allocation, and we have been passed results on to the project team for the southern section of the allocation, which will be subject to a separate application"

G7.3 On 29th January 2021, the below response was received from James Cross and Joanne Lewis (Arun District Council). In relation to a site-specific monitoring survey:

"Since my comments made in October 2020 we obviously haven't seen a return to more normal working and travel patterns yet which I had been hoping for. I am therefore inclined to agree that new monitoring at this time wont add anything to an assessment. Providing 2019 air quality monitoring and traffic data is used this should give a sensible baseline on which to base the assessment and avoid Covid 19 issues. I am therefore happy with this explanation assuming that 2019 data is used to verify the air quality model and as stated "differences in air quality between the monitoring sites in Bognor and Chichester and locations closer to the site, i.e. traffic flows/speeds, road type and background concentrations, will be accounted for in the model inputs."

G7.4 In relation to an assessment of odours from the Lidsey Sewage Treatment Works:

"Clarification noted. A detailed odour assessment is likely to be required for the Southern section of the allocation but more general assessment of the whole allocation should be sufficient for the northern allocation unless this raises particular concerns which would warrant further investigation."