Appendix 6.1

Factors defining the sensitivity of a receptor to dust impacts are presented in Table 6.1A.

Table 6.1A: Receptor Sensitivity

Pollutant	Human Health	Dust Soiling	Ecological
High	- Locations where members of the public are exposed over a time period relevant to the air quality objectives for PM_{10}. (a) - Examples include residential dwellings, hospitals, schools and residential care homes.	- Regular exposure - High level of amenity expected. - Appearance, aesthetics or value of the property would be affected by dust soiling. - Examples include residential dwellings, museums, medium and long-term car parks and car showrooms.	- Nationally or Internationally designated site with dust sensitive features. (b) - Locations with vascular species. (c)
Medium	- Locations where workers are exposed over a time period relevant to the air quality objectives for PM_{10}. (a) - Examples include office and shop workers. (d)	- Short-term exposure - Moderate level of amenity expected. - Possible diminished. appearance or aesthetics of property due to dust soiling. - Examples include parks and places of work.	- Nationally designated site with dust sensitive features. (b) - Nationally designated site with a particularly important plant species where dust sensitivity is unknown.
Low	- Transient human exposure. - Examples include public footpaths, playing fields, parks and shopping streets.	- Transient exposure - Enjoyment of amenity not expected. - Appearance and aesthetics of property unaffected. - Examples include playing fields, farmland (e), footpaths, short-term car parks and roads.	- Locally designated site with dust sensitive features. (b)

(a)	In the case of the 24-hour objective, a relevant location would be one where individuals may be exposed for eight hours or more in a day.
(b)	Ecosystems that are particularly sensitive to dust deposition include lichens and acid heathland (for alkaline dust, such as concrete).
(c)	Cheffing C. M. & Farrell L. (Editors) (2005), The Vascular Plant. Red Data List for Great Britain, Joint Nature Conservation Committee.
(d)	Does not include workers' exposure to PM10 as protection is covered by Health and Safety at Work legislation.
(e)	Except commercially sensitive horticulture.

The sensitivity of the area as a whole is dependent on the number of receptors within each sensitivity class and their distance from the source. Human health impacts are also dependent on the existing PM_{10} concentrations in the area.

Table 6.1B, 6.1C and 6.1D summarise the criteria for determining the overall sensitivity of the area to dust soiling, health impacts and ecological impacts respectively.

Table 6.1B: Sensitivity of the Area to Dust Soiling Effects on People and Property

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

Table 6.1C: Sensitivity of the Area to Health Impacts from Dust (H = High, M = Medium, L = Low)

Receptor Sensitivity	Annual Mean PM_{10} Concentration ($\mu g/m^3$)	Number of Receptors	Distance from the Source (m)				
			< 20	< 50	< 100	< 200	< 350
High	<32	>100	H	H	H	M	L
		10-100	H	H	M	L	L
		1-10	H	M	L	L	L
	28 – 32	>100	H	H	M	L	L
		10-100	H	M	L	L	L
		1-10	H	M	L	L	L
	24 - 28	>100	H	M	L	L	L
		10-100	H	M	L	L	L
		1-10	M	L	L	L	L
	<24	>100	M	L	L	L	L
		10-100	L	L	L	L	L

		1-10	L	L	L	L	L
Medium	<32	>10	H	M	L	L	L
		1-10	M	L	L	L	L
	28 – 32	>10	M	L	L	L	L
		1-10	L	L	L	L	L
	24 - 28	>10	L	L	L	L	L
		1-10	L	L	L	L	L
	<24	>10	L	L	L	L	L
		1-10	L	L	L	L	L
Low	-	>1	L	L	L	L	L

Table 6.1D: Sensitivity of the Area to Ecological Impacts from Dust

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

The magnitude of the dust impacts for demolition, earthworks, construction and trackout is classified as small, medium or large depending on the scale of the proposed works as detailed in Table 6.1E.

Table 6.1E: Dust Emission Magnitude

Receptor Sensitivity	**Large**	**Medium**	**Small**
Demolition	- Total building volume >50,000m^3. - Potentially dusty material (e.g., concrete). - Onsite crushing and screening - Demolition activities >20m above ground level.	- Total building volume 20,000 - 50,000m^3. - Potentially dusty material - Demolition activities 10 - 20m above ground level.	- Total building volume <20,000m^3. - Construction material with low potential for dust release. - Demolition activities <10m above ground level. - Demolition during wetter months.
Earthworks	- Total site area >10,000m^2	- Total site area 2,500 -10,000m^2.	- Total site area <2,500m^2.

	- Potentially dusty soil. type (e.g., clay). - >10 heavy earth moving vehicles active at any one time. - Formation of bunds >8m in height. - Total material moved >100,000 tonnes.	- Moderately dusty soil type (e.g., silt). - 10 heavy earth moving vehicles active at any one time. - Formation of bunds 4 - 8m in height. - Total material moved 20,000 - 100,000 tonnes.	- Soil type with large grain size (e.g., sand). - <5 heavy earth moving vehicles active at any one time. - Formation of bunds <4m in height - Total material moved <20,000 tonnes. - Earthworks during wetter months.
Construction	- Total building volume >100,000m^3. - On site concrete batching. - Sandblasting.	- Total building volume 25,000 - 100,000m^3. - Potentially dusty construction material (e.g., concrete). - On site concrete batching.	- Total building volume <25,000m^3. - Material with low potential for dust release (e.g., metal cladding or timber).
Trackout	- >50 HGV movements in any one day (a). - Potentially dusty surface material (e.g., high clay content). - Unpaved road length >100m.	- 10 - 50 HGV movements in any one day (a). - Moderately dusty surface material (e.g., silt). - Unpaved road length 50 - 100m.	- <10 HGV movements in any one day (a). - Surface material with low potential for dust release. - Unpaved road length <50m.
(a) HGV movements refer to outward trips (leaving the site) by vehicles of over 3.5 tonnes.			

For each dust emission source, the worst-case area sensitivity is used in combination with the dust emission magnitude to determine the risk of dust impacts prior to mitigation as illustrated in Tables 6.1F, 6.1G and 6.1H.

Table 6.1F: Risk of Dust Impacts from Demolition

Receptor Sensitivity	Distance from the Source (m)		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible Risk

Table 6.1G: Risk of Dust Impacts from Earthworks and Construction

Receptor Sensitivity	Distance from the Source (m)		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible Risk

Table 6.1H: Risk of Dust Impacts from Trackout

Receptor Sensitivity	Distance from the Source (m)		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible Risk
Low	Low Risk	Low Risk	Negligible Risk

Appendix 6.2 – Model Input Parameters

Table 6.2A: Summary of ADMS-Roads Input Parameters

Parameter	Model Verification	Impact Assessment and Exposure
ADMS-Roads Model Version	5.0	5.0
Vehicle Emission Factors	EFT v11 for 2018	EFT v11 for 2030
Meteorological Data	Hourly sequential data from RAF Benson (2018)	Hourly sequential data from RAF Benson (2018)
Surface Roughness	0.5m	0.5m
Monin-Obukhov Length	30m	30m

Table 6.2B: Summary of 2018 Traffic Data for Model Verification

Road Link	AADT	HGV(%)	Average Speed (kph)
Lords Lane, W of Banbury Road (a)	13645 (a)	1.6%	80
Howes Lane, N of Middleton Stoney Rd	6538 (b)	5.8%	80
Howes Lane, E of Shakespeare Drive	8302 (b)	5.8%	64
Shakespeare Drive, S of Howes Lane	1527 (b)	5.8%	48
Kings End	12375 (b)	5.8%	48
(a) DfT count point 70010 for 2018 (b) Traffic flows for 2012 provided by Traffic Consultants, projected to 2018 using TEMPro v7.2 growth factor for Cherwell.			

Table 6.2C: Summary of 2031 Traffic Data for Operational Traffic Impact Assessment

Road Link	Do Nothing		Do Something		Average Speed (kph)
	AADT	HGV(%)	AADT	HGV(%)	

A41, N of Pingle Drive	22235	5.9%	21850	5.7%	48
Middleton Stoney Rd, W of Kings End	10602	6.1%	10452	5.9%	48
Middleton Stoney Rd, W of Howes Lane	5672	7.1%	9083	4.8%	78
Howes Lane, N of Middleton Stoney Rd	11481	6.0%	9889	6.4%	48
Howes Lane, E of Shakespeare Drive	11918	5.8%	11574	5.6%	64
Lords Lane, W of Banbury Road	15127	5.6%	13129	6.0%	80
Bucknell Road, N of Lords Lane	3443	5.7%	2453	7.1%	48
Bucknell Road, S of Howes Lane	7727	4.7%	7918	4.5%	50
Banbury Road, N of Lords Lane	18961	8.2%	18666	7.8%	75
Banbury Road, S of A4095	9035	3.8%	9871	3.5%	48
Buckingham Road, S of Skimmingdish Lane	12994	5.5%	13604	5.1%	64
Queens Avenue, S of Bucknell Road	20419	5.8%	20056	5.6%	48
A4421 Neunkirchen Way	18828	5.8%	18486	5.6%	80
A4421, E of Skimmingdish Lane	23912	5.8%	23499	5.6%	80
Shakespeare Drive, S of Howes Lane	1121	5.7%	1605	4.3%	48
Ardley Road (E of B430)	4455	5.8%	4487	5.5%	96

Shakespeare Drive, E of Middleton	9063	5.8%	9625	5.3%	48
The Approach, W of Bucknell Road	4514	5.8%	5459	4.8%	48
Ardley Road, N of Bucknell	4385	5.8%	4457	5.5%	96
Middleton Road, W of Bucknell	308	5.8%	1756	2.1%	48
B4030 Middleton Stoney Road, NW of NWB	5787	5.8%	6709	5.0%	96
M40 northbound (mainline only), S of J10 / N of J9	84416	14.3%	73224	14.2%	112

Table 6.2D: Summary of 2031 Traffic Data for Exposure Assessment

Road Link	AADT	HGV(%)	Average Speed (kph)
Howes Lane, E of Shakespeare Drive	12266	5.6%	64
Lords Lane, E of Bucknell Road	14705	4.5%	72
Lords Lane, W of Banbury Road	13966	6.0%	80
Bucknell Road, N of Lords Lane	2639	7.1%	48
Bucknell Road, S of Howes Lane	8288	4.5%	50
Banbury Road, N of Lords Lane	20236	7.8%	75
A4095 E of Banbury Road	23059	5.6%	80
Banbury Road, S of A4095	10234	3.5%	48
Howes Lane, E of Shakespeare Drive	12266	5.6%	64

Appendix 6.3 – Model Verification

Most nitrogen dioxide (NO_2) is produced in the atmosphere by the reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions. Verification of concentrations predicted by the ADMS-Roads model has followed the methodology presented in LAQM.TG16.

Modelled 2019 annual mean concentrations of NO_2 have been compared with the concentrations measured by the roadside diffusion tubes ST20, ST27 and ST30.

The measured NO_2 concentration has been converted into an equivalent measured Road-NOx (i.e., the component of total NOx coming from road traffic) concentrations using the Defra NOx from NO_2 calculator (v8.1). The conversion has assumed a background NO_2 concentration of 17.2 $\mu g/m^3$, the 2018 background concentration for the area. The measured Road-NOx concentrations are compared with the modelled Road-NOx concentrations in Figure 6.3A.

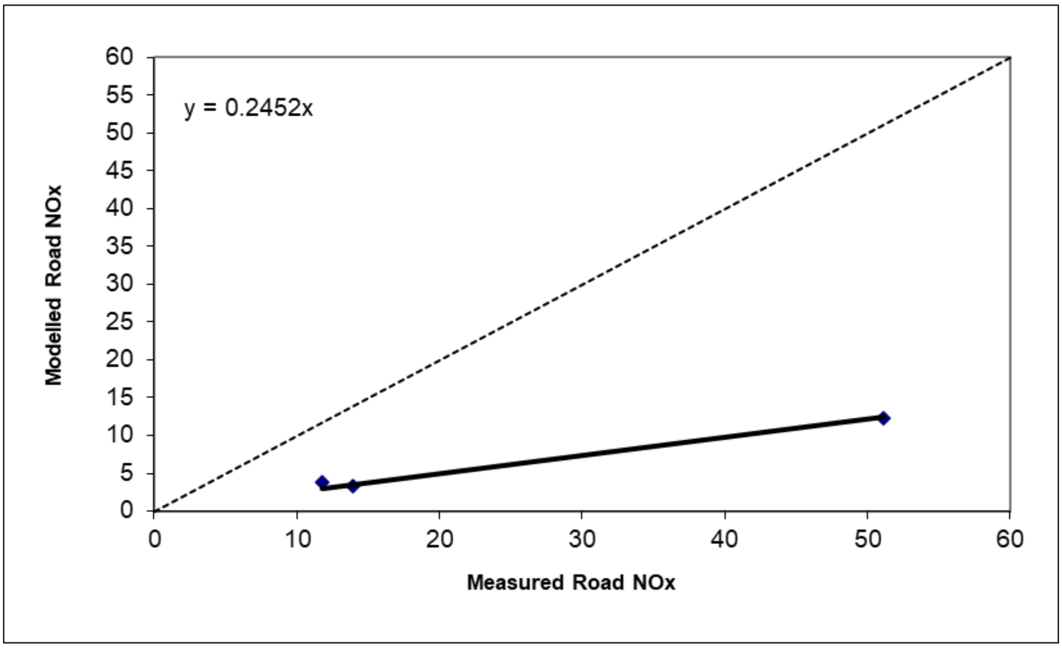

Figure 6.3A: Comparison of Measured Road-NOx Concentrations with Modelled Road-NOx Concentrations

A primary adjustment factor is determined as the ratio between the measured road-NOx contribution and the modelled Road-NOx contribution, forced through zero (1/0.2452 = 4.078). This factor was then applied to the modelled Road-NOx concentration for each monitoring location to provide an adjusted modelled Road-NOx concentration. The equivalent Road-NO_2 concentration is then determined using the Defra NOx from NO_2 calculator and added to the background NO_2 concentration, for comparison with the measured NO_2 concentration (see Figure 6.3B).

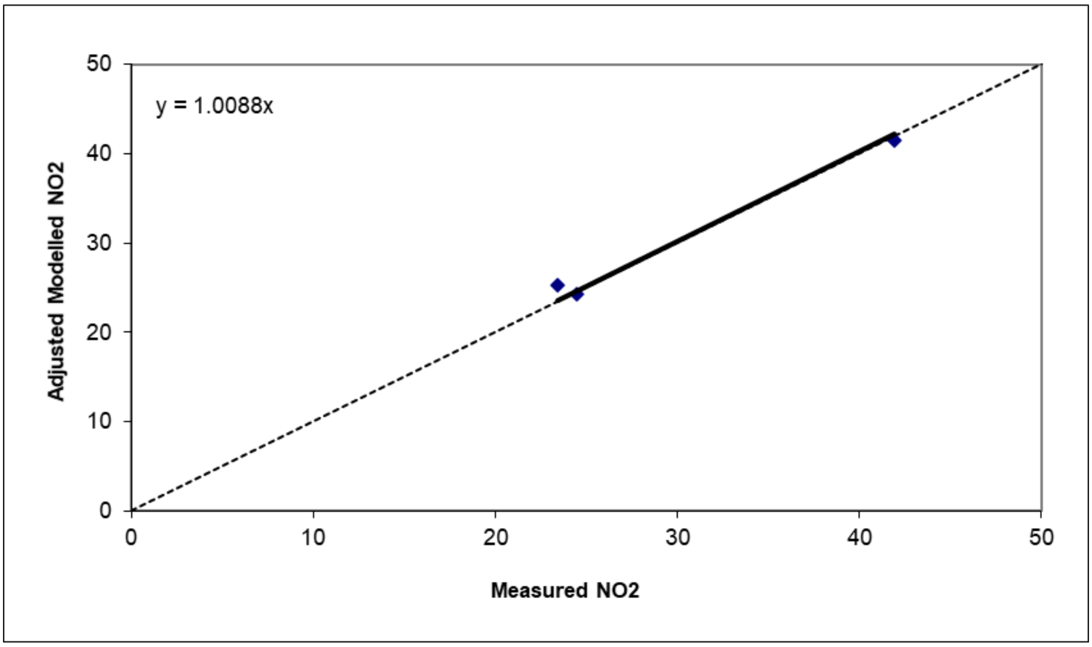

Figure 6.3B: Comparison of Measured NO_2 Concentrations with the Adjusted Modelled NO2 Concentrations

The average performance of the model can be expressed as the Root Mean Square Error (RMSE), which in accordance with LAQM.TG16 should ideally be less than 10% and not more than 25% of the relevant air quality standard (in this case, the annual mean NO2 objective of 40 µg/m3). The RMSE for the comparison of the adjusted modelled and measured NO2 concentrations is 1.1 $\mu g/m^3$, 2.8% of the air quality objective and therefore the modelled concentrations with primary adjustment are considered to provide an acceptable estimate of local air quality.

In the absence of a particulate monitoring site for verification purposes, the derived primary adjustment factor has also been applied to the modelled Road-PM_{10} and Road- $PM_{2.5}$ concentrations, in accordance with LAQM.TG16.