ASSESSMENT OF OFFSITE TRAFFIC EMISSIONS

1. In order to quantify potential impacts of offsite vehicle emissions in the vicinity of the application site, a detailed dispersion modelling assessment has been undertaken using the ADMS Roads (version 3.4) software package. This model is routinely used in the UK for environmental assessment work. The assessment methodology and input data for the assessment of offsite vehicle emissions is provided below.

Model Inputs: Traffic Data

2. Access to the proposed quarry would be via Hatfield Road, close to the south-west corner of the application site.
3. The development traffic and traffic data for the A1057 section adjacent to the site entrance were derived through the transport assessment (refer to Chapter 7). Traffic data for the other road links included in the assessment were obtained from the Department for Transport[1].
4. The total number of HDV movements associated with the quarry is 174 movements per day. For the purposes of this assessment it has been assumed that all vehicles travel to and from the site from the A1(M) via A1057 Hatfield Road and A1001 Comet Way to represent a worst case approach.
5. The Air Quality Assessment has been carried out for three scenarios:
    - Baseline (verification): based on 2014 traffic counts with model results verified against 2014 WHDC diffusion tube monitoring data
    - 'Without development': 2017 predicted traffic flows for the existing traffic flows;
    - 'With development': 2017 predicted traffic flows with contribution from traffic generated by the Application Site.
6. Speeds entered into the dispersion modelling assessment were assumed to accord with the speed limit for each link. In accordance with the methodology outlined within LAQM.TG(09), an approximate 50m slow-down phase prior to each junction / roundabout was modelled at a speed of 20 km/h in order to reflect associated engine performance and increase in exhaust emission.
7. Traffic data utilised within the dispersion modelling assessment is presented in Table A9-1. Road locations included within the dispersion modelling assessment were digitised into ADMS Roads from Ordnance Survey data, and referenced to UK NGR co-ordinates. Emission factors for NO_X and PM_{10} were determined for each scenario using the Emission Factor Toolkit (EFT) (v.6.0.1) as produced by DEFRA and embedded within ADMS Road 3.4. It is noted that a newer version of the EFT is available. However, the emission factors from version 6.0.1 are still valid, since they are unaffected by the changes made for the release of EFT version 6.0.2.

1 Department for Transport, traffic count website, http://www.dft.gov.uk/traffic-counts/, accessed October 2015.

Table A9-1
Traffic Data used within the Dispersion Modelling Assessment – AADT Flow Data

Road Link	2014 AADT	2017 AADT Without Development	2017 AADT With Development
A1057 west of Ellenbrook Lane	14,787	15,413	15,607
A1057 east of Ellenbrook Lane	17,246	17,976	18,170
Comet Way	22,155	23,092	23,286
A1(M)	96,700	100,790	100,984

Table A9-2
Traffic Data used within the Dispersion Modelling Assessment – HDV Flow and Speed

Road Link	2014 HDV	2017 HDV Without Development	2017 HDV With Development	Modelled Speed (km/h)
A1057 west of Ellenbrook Lane	629	656	830	64
A1057 east of Ellenbrook Lane	1,158	1,207	1,381	64
Comet Way	2,440	2,543	2,717	80
A1(M)	5,852	6,100	6,274	112

Model Inputs: Meteorological Data

8. To calculate pollutant concentrations at identified receptor locations the model uses sequential hourly meteorological data, including wind direction, wind speed, temperature, cloud cover and stability, which exert significant influence over atmospheric dispersion.
9. Dispersion modelling has been undertaken using meteorological dataset from Luton Airport for the year 2014. A wind rose of the meteorological dataset used within this assessment is presented within the Baseline section of Chapter 9.

Model Inputs: Assessment Area

10. Discrete receptors were identified in Table 9-11 of Chapter 9 and shown in Figure A9-1 below.

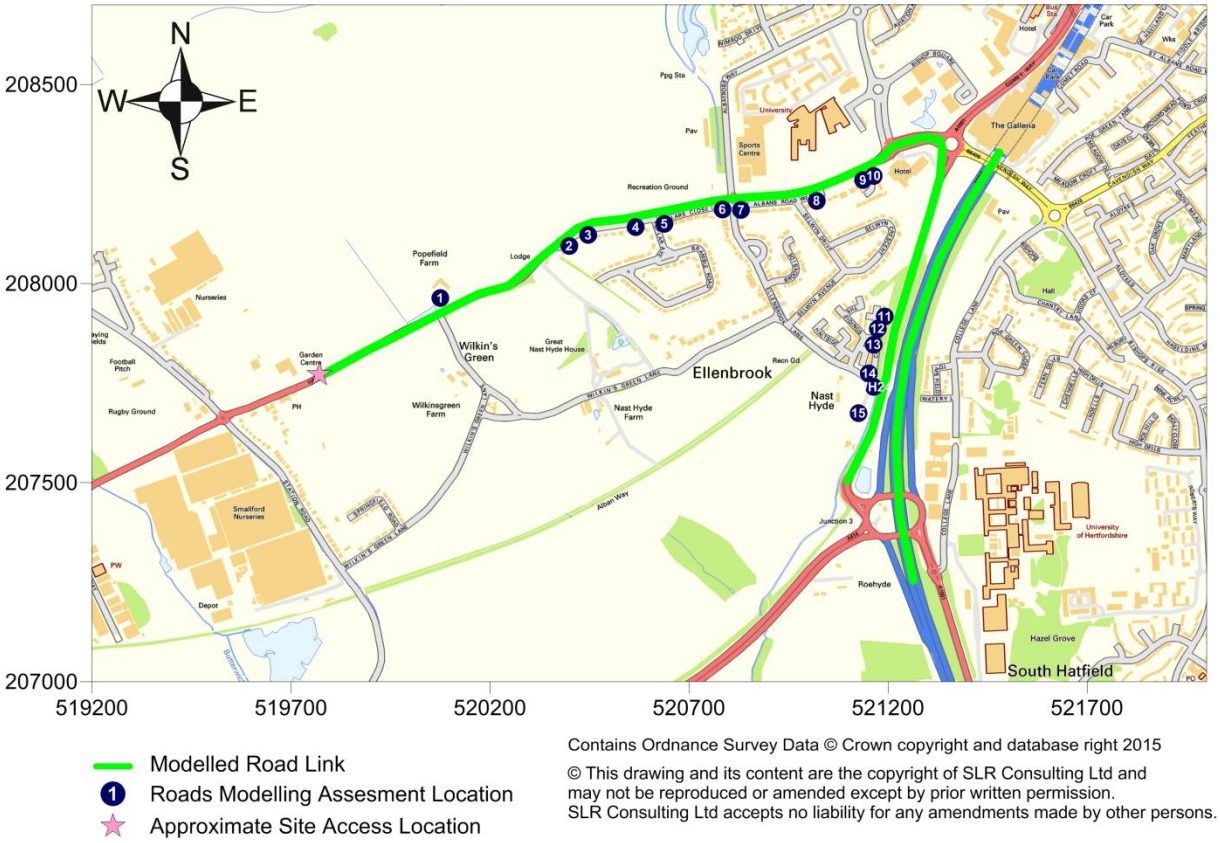

Figure A9-1 Model Input Data

Model Inputs: Surface Roughness Length

11. The roughness length (z_0) is an important variable for dispersion models.

12. In line with the advised roughness lengths in ADMS Roads a roughness length z_0 of 0.7m was used for this dispersion modelling study. This value of z_0 is considered appropriate for the morphology of the dispersion modelling assessment area.

Calculation of Concentrations

13. A calculated verification factor (see Appendix 9-2) was applied to the modelled NO_x concentrations. For nitrogen dioxide, the total concentrations were then determined using the methodology outlined in LAQM.TG(09) and the "NO_x to NO_2 conversion spreadsheet" tool[2].

MODELLING RESULTS

14. Paragraph 6.13 of LAQM states that: '*in all cases where model verification has been* carried *out, the approach should be fully documented and any adjustment factor applied should be explicitly stated*'.

15. The baseline scenario modelling for year 2014 has been used to verify the model by comparing levels against data from the monitoring carried out by WHDC. An

2 Defra, NO_x to NO_2 calculator, Version 4.1, June 2013.

adjustment factor of 2.51 has been calculated and applied to the modelling results for the assessment scenarios in line with this guidance. Modelled PM_{10} concentrations are presented as unverified results.

16. The verification process is detailed in Appendix 9-2.

NO_2 Concentrations - Predicted Annual Mean

17. Predicted annual mean ground level NO_2 concentrations to assess the impact of the proposed development are presented in Table A9-3.

Table A9-3
Assessment Results – NO_2 Annual Mean (µg/m^3)

Receptor Ref.	Background Concentration	Without Development [A]	With Development [A]	Magnitude of Change	Change as a Percentage of the AQO (%)
1	16.2	19.0	19.2	0.16	0.40
2	16.0	19.4	19.6	0.19	0.47
3	16.0	19.2	19.3	0.18	0.45
4	16.0	18.9	19.0	0.16	0.40
5	16.0	18.7	18.8	0.14	0.35
6	16.0	21.4	21.8	0.40	1.00
7	16.0	21.1	21.4	0.32	0.80
8	22.4	26.6	26.7	0.14	0.35
9	22.4	27.9	28.0	0.16	0.40
10	22.4	28.0	28.2	0.20	0.50
11	20.7	31.9	32.0	0.10	0.25
12	20.7	32.9	33.0	0.12	0.30
13	20.7	31.3	31.4	0.10	0.25
14	20.7	31.8	31.9	0.10	0.25
15	20.7	30.1	30.2	0.10	0.25

Note A: Scenario modelled as an assumed 2017 preparation year, with 2017 emission factors and 2014 mapped background pollutant concentrations.

18. As shown in Table A9-3, there are no predicted exceedences of the annual mean NO_2 AQO at the assessment locations in either the 'without development' and 'with-development' scenarios. In addition, the increase in the annual mean NO_2 concentration 1% of the AQO.

19. Predicted impacts on annual mean NO_2 concentrations are summarised in Table A9-4.

Table A9-4
Predicted Annual Mean NO_2 Impacts: Road Vehicle Exhaust Emissions

Receptor Ref.	Magnitude of Impact	Impact Significance
1	Imperceptible	Negligible
2	Imperceptible	Negligible
3	Imperceptible	Negligible
4	Imperceptible	Negligible
5	Imperceptible	Negligible
6	Small	Negligible
7	Imperceptible	Negligible
8	Imperceptible	Negligible
9	Imperceptible	Negligible
10	Imperceptible	Negligible
11	Imperceptible	Negligible
12	Imperceptible	Negligible
13	Imperceptible	Negligible
14	Imperceptible	Negligible
15	Imperceptible	Negligible

20. As indicated in Table A9-4, the predicted magnitude of impact on annual mean NO_2 concentrations is imperceptible (<1% change in the annual mean AQO) at all of the assessed locations apart from at Location 6, which has a small predicted impact. The unmitigated impact significance is predicted to be negligible at considered receptors in accordance with the stated assessment methodology.

NO_2 Concentrations - Predicted 1-hour Mean

21. The methodology presented within LAQM.TG(09) to determine compliance with the hourly mean NO_2 objective states:

> *"*Authorities *may assume that exceedences of the 1-hour mean objective for NO_2 are only likely to occur where annual mean concentrations are 60 µg/m^3 or above'*

22. All annual mean NO_2 concentrations are predicted to remain below 60 µg/m^3 therefore there is not considered a risk of the 1-hour mean Objective being exceeded.

PM_{10} Concentrations - Predicted Annual Mean

23. Predicted annual mean ground level PM_{10} concentrations to assess the impact of the proposed development are presented in Table A9-5.

Table A9-5
Assessment Results – PM_{10} Annual Mean (µg/m^3)

Receptor Ref.	Background Concentration	Without Development[A]	With Development[A]	Magnitude of Change	Change as a Percentage of the AQO (%)
1	19.2	19.4	19.5	0.01	0.03
2	18.4	18.6	18.7	0.01	0.03
3	18.4	18.6	18.6	0.01	0.03
4	18.4	18.6	18.6	0.01	0.02
5	18.4	18.6	18.6	0.01	0.02
6	18.4	18.7	18.7	0.01	0.03
7	18.4	18.6	18.6	0.01	0.03
8	20.4	20.7	20.7	0.01	0.02
9	20.4	20.8	20.8	0.01	0.03
10	20.4	20.8	20.8	0.01	0.03
11	20.0	20.7	20.7	0.01	0.02
12	20.0	20.7	20.7	0.01	0.03
13	20.0	20.6	20.6	0.01	0.02
14	20.0	20.7	20.7	0.01	0.02
15	20.0	20.6	20.6	0.01	0.02

Note A: Scenario modelled as an assumed 2017 preparation year, with 2017 emission factors and 2014 mapped background pollutant concentrations.

24. As shown in Table A9-5, there are no predicted exceedences of the annual mean PM_{10} AQO at the assessment locations in either the 'without development' and 'with-development' scenarios. In addition, the increase in the annual mean NO_2 concentration is less than 1% of the AQO.

25. Predicted impacts on annual mean PM_{10} concentrations are summarised in Table A9-6.

Table A9-6
Predicted Annual Mean PM_{10} Impacts: Road Vehicle Exhaust Emissions

Receptor Ref.	Magnitude of Impact	Impact Significance
1	Imperceptible	Negligible
2	Imperceptible	Negligible
3	Imperceptible	Negligible
4	Imperceptible	Negligible
5	Imperceptible	Negligible
6	Imperceptible	Negligible
7	Imperceptible	Negligible
8	Imperceptible	Negligible
9	Imperceptible	Negligible
10	Imperceptible	Negligible
11	Imperceptible	Negligible
12	Imperceptible	Negligible
13	Imperceptible	Negligible
14	Imperceptible	Negligible
15	Imperceptible	Negligible

26. As indicated in Table A9-6, the predicted magnitude of impact on annual mean PM_{10} concentrations is imperceptible (<1% change in the annual mean AQO) at all of the assessed locations. The unmitigated impact significance is predicted to be negligible at considered receptors in accordance with the stated assessment methodology.

Predicted PM_{10} Concentrations - 24-hour Mean

27. The results of the assessment are shown in Table A9-7 for the number of days where PM_{10} concentrations are greater than 50 µg/m³ as a daily mean.

Table A9-7:
24-Hour Mean PM_{10} (No. Days >50µg/m³)

Receptor Ref.	Without Development	With Development
1	2.8	2.8
2	2.0	2.0
3	1.9	1.9
4	1.9	1.9
5	1.9	1.9
6	2.0	2.0
7	1.9	1.9
8	4.3	4.3
9	4.4	4.5
10	4.4	4.5
11	4.3	4.3
12	4.4	4.4
13	4.2	4.2
14	4.2	4.3
15	4.1	4.1

28. The proposed development would not increase the number of days of PM_{10} concentrations greater than 50 µg/m³ by more than 1 day at assessed receptors. The number of predicted 24-hour mean PM_{10} exceedences are within the number permitted (35-exeedences per year are allowed). Predicted impacts on 24-hour Mean PM_{10} concentrations are 'imperceptible' resulting in a 'negligible' significance of impact at all assessed receptors.

DETAILED MODELLING: VERIFICATION METHODOLOGY

Introduction

29. The potential uncertainty in the raw model outputs from the ADMS Roads (version 3.4) dispersion modelling study has been assessed through a model verification study whereby model outputs were compared with NO_2 monitoring results from passive diffusion tube monitoring undertaken by WHDC. This is detailed in the following sections.

Potential Sources of Error

30. Sources of error in the dispersion modelling of road traffic emissions may include the following:

- omission of other local pollutant sources due to lack of appropriate data;
- uncertainties in traffic flow model input data (e.g. actual vehicle flow data; vehicle fleet composition and %HDV; average vehicle speed);
- simplifications in emission factors used and their suitability for the for actual vehicle fleet within the modelling area, particularly in regard to engine size, age and type and the overall maintenance of the vehicle;
- simplifications in building topography and the under-representation of the reduced ventilation effects in street canyons;
- uncertainties and suitability in meteorological data used in modelling study, including model input parameters, such as roughness length, for example; and
- general limitations and assumptions contained within the dispersion model algorithms.

Model Verification Study

31. A model verification study was undertaken for the year 2014. This corresponds to the 2014 pollutant monitoring results supplied by WHDC, the 2014 Luton airport meteorological dataset and traffic dataset obtained from the Department for Transport.

32. Extensive monitoring is undertaken within the City to monitor and assessment annual mean NO_2 concentrations against compliance with the AQO. However, only limited PM_{10} monitoring is undertaken, and none within the location of the proposed development site. The 2015 DEFRA mapped background PM_{10} concentration for the 1km grid square containing the proposed development is 19.2 µg/m^3, as presented within the Background section of Chapter 9. Therefore, it is considered that the immediate locale surrounding the proposed development site is less sensitive to increases of PM_{10} compared to NO_2. Therefore, modelled PM_{10} impacts are presented as unverified results.

33. Model inputs were as previously detailed above in this Appendix. The verification study included one discrete receptor locations, corresponding to the diffusion tube monitoring locations from the WHDC network. Traffic data for input into the verification study is presented in Table A9-1 and A9-2.

NO_2 Monitoring Results

34. Table A9-8 displays the diffusion tube monitoring result and the calculated NO_X concentration using the methodology contained within LAQM.TG(09). Diffusion data from January to July 2015 were available. The seven month average, 48 µg/m^3 was adjusted using the 2014 bias adjustment factor of 0.81. This has then been annualised using a factor obtain from 2014 continuous monitoring data for six monitoring stations within 50 km of the site following the guidance outlined in LAQM TG(09). For this calculation, the 2014 NO_2 mapped background concentration from the 1km x 1km grid square containing the diffusion tube was utilised.

Table A9-8
Monitored Annual Mean NO_2 for 2014 Converted to NOX

Monitoring Location	NGR (m)		Monitored NO_2 Concentration (µg/m^3)	Calculated Roadside NO_X Contribution (µg/m^3)
	X	Y		
WH24 - Ellenbrook Lane opposite the A1001	521164	207740	39.2	40.8

Table note: Calculated in accordance with LAQM.TG(09) and DEFRA NO_X to NO_2 calculator version 4.1, assuming a background NO_2 concentration of 20.7 µg/m^3

35. The calculated annual mean NO_X road contribution has been predicted at the above WHDC diffusion tube monitoring location, through the dispersion modelling study as presented in Table AQ3-9.

Table A9-9
Verification Data 2014

Monitoring Location	Modelled NO_X Road Contribution (µg/m^3)	Calculated Roadside NO_X Contribution (µg/m^3)	Ratio
WH24 - Ellenbrook Lane opposite the A1001	16.3	40.8	1:2.51

36. The ratio between modelled and calculated NO_X road contributions at the WHDC diffusion tube monitoring location considered within the dispersion modelling verification assessment was found to be **1:2.51**. All raw modelling results have subsequently been corrected by a factor of 2.51.