

Tritax Symmetry (Hinckley) Limited

HINCKLEY NATIONAL RAIL FREIGHT INTERCHANGE

The Hinckley National Rail Freight Interchange Development Consent Order

Project reference TR050007

Environmental Statement Volume 2: Appendices

Appendix 9.8: Air Quality Air Dispersion Model Verification

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Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009
Regulation 5(2)(a)

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017
Regulation 14

This document forms a part of the Environmental Statement for the Hinckley National Rail Freight Interchange project.

Tritax Symmetry (Hinckley) Limited (TSH) has applied to the Secretary of State for Transport for a Development Consent Order (DCO) for the Hinckley National Rail Freight Interchange (HNRFI).

To help inform the determination of the DCO application, TSH has undertaken an environmental impact assessment (EIA) of its proposals. EIA is a process that aims to improve the environmental design of a development proposal, and to provide the decision maker with sufficient information about the environmental effects of the project to make a decision.

The findings of an EIA are described in a written report known as an Environmental Statement (ES). An ES provides environmental information about the scheme, including a description of the development, its predicted environmental effects and the measures proposed to ameliorate any adverse effects.

Further details about the proposed Hinckley National Rail Freight Interchange are available on the project website:

<http://www.hinckleynrfi.co.uk/>

The DCO application and documents relating to the examination of the proposed development can be viewed on the Planning Inspectorate's National Infrastructure Planning website:

<https://infrastructure.planninginspectorate.gov.uk/projects/east-midlands/hinckley-national-rail-freight-interchange/>

APPENDIX 6.2.9.8: AIR QUALITY AIR DISPERSION MODEL VERIFICATION

Whilst ADMS-Roads is widely validated for use in this type of assessment, model verification for the area around the study area will not have been included. To determine model performance at a local level, a comparison of modelled results with monitored results in the study area was done in accordance with the methodology provided by Defra. This process of verification aims to minimise modelling uncertainty by correcting modelled results by an adjustment factor to give greater confidence to the results.

A review of all monitoring sites within the study area was undertaken to establish those that were not suitable to take forward for use in the model adjustment process. The monitoring sites subsequently excluded from the model verification process are identified in Table 8.1.

Table 8.1: Monitoring locations excluded from model verification.

| Site ID | Site Type | Monitoring Type | Reason for Exclusion |
|-------------------------------|-----------|-----------------|---|
| Blaby District Council | | | |
| CM1 | Roadside | Automatic | Monitoring location too far removed from the affected road network to be adequately captured within the air quality model |
| DT17 | Roadside | Passive | Defra background concentrations are higher than the monitored concentrations |
| DT22 | Roadside | Passive | Within the Annual Status Report, the site is classified as being 1m from the kerb making it a kerbside site. |
| DT53 | Roadside | Passive | Defra background concentrations are higher than the monitored concentrations |
| DT73 | Roadside | Passive | Monitoring location is located adjacent to a car park |

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| Site ID | Site Type | Monitoring Type | Reason for Exclusion |
|--|--------------|-----------------|---|
| DT74 | Roadside | Passive | Site adjacent to a delivery bay |
| DT75 | Roadside | Passive | Site located by a bus stop |
| DT78 | Roadside | Passive | Data capture reported in Annual Status Report as below 75% |
| Hinckley and Bosworth Borough Council | | | |
| 1 | Urban Centre | Passive | Site classed as urban centre and not suitable for verification |
| 15 | Urban Centre | Passive | Site classed as urban centre and not suitable for verification |
| Charnwood Borough Council | | | |
| None | | | |
| Erewash Borough Council | | | |
| EBC18 | Other | Passive | Monitoring location too far removed from the affected road network to be adequately captured within the air quality model |
| EBC22 | Suburban | Passive | Monitoring location too far removed from the affected road network to be adequately captured within the air quality model |
| North Warwickshire District Council | | | |
| 2 | Roadside | Passive | Monitoring location too far removed from the affected road network to be |

| Site ID | Site Type | Monitoring Type | Reason for Exclusion |
|---|-----------|-----------------|---|
| | | | adequately captured within the air quality model |
| 7 | Roadside | Passive | Site located adjacent to car parking bays which are not accurately captured within the air quality model |
| North West Leicestershire District Council | | | |
| None | | | |
| Nuneaton and Bedworth Borough Council | | | |
| None | | | |
| Coventry City Council | | | |
| None | | | |
| Rugby Borough Council | | | |
| 55 | Roadside | Passive | Monitoring location too far removed from the affected road network to be adequately captured within the air quality model |
| Tamworth Borough Council | | | |
| Q2 | Roadside | Passive | Monitoring location too far removed from the affected road network to be adequately captured within the air quality model |

Model verification was undertaken for Scenario 1: 2019 Base and Model Verification Year to predict the 2019 annual mean road contributions of NO_x at the monitoring

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locations in the study area. Verification and adjustment was then progressed with zoning by local authority within the study area.

No monitoring of PM₁₀ or PM_{2.5} is undertaken with the study area. Therefore the model verification factor calculated for the NO_x verification was utilised to adjust predicted concentrations of PM₁₀ and PM_{2.5}.

Blaby District Council

Table 8.1 details the monitoring locations which were excluded from model verification for Blaby District Council (BDC).

The model NO_x outputs were compared to the 2019 monitored concentrations to provide adjustment factors. Table 8.2 presents the verification process for NO_x.

Table 8.2: Blaby District Council model verification process.

| Model Verification Steps | Monitoring Site ID | | | | | | | |
|--|--------------------|------|------|------|------|------|------|------|
| | DT69 | DT39 | DT61 | DT48 | DT54 | DT18 | CM3 | DT16 |
| 2019 monitored total NO ₂ (µg.m ⁻³) | 16.7 | 15.8 | 20.9 | 25.0 | 26.6 | 24.9 | 24.8 | 27.9 |
| 2019 background NO ₂ concentration (µg.m ⁻³) | 15.3 | 10.5 | 16.5 | 17.2 | 23.1 | 23.1 | 23.1 | 20.0 |
| Monitored road contribution NO _x (µg.m ⁻³) | 2.6 | 9.7 | 8.2 | 14.8 | 6.7 | 3.4 | 3.3 | 15.2 |
| Modelled road contribution NO _x (µg.m ⁻³) | 2.4 | 3.9 | 7.4 | 16.6 | 8.8 | 10.8 | 9.3 | 27.2 |
| Ratio of monitored road NO _x to modelled road NO _x | 1.1 | 2.5 | 1.1 | 0.9 | 0.8 | 0.3 | 0.3 | 0.6 |

| | | | | | | | | |
|---|---|-------|------|------|------|------|------|------|
| Adjustment factor for modelled road contribution NO_x | 0.6848 therefore a factor of 1.0 was utilised to provide a more conservative assessment | | | | | | | |
| Adjusted modelled road contribution NO _x (µg.m ⁻³) | 2.4 | 3.9 | 7.4 | 16.6 | 8.8 | 10.8 | 9.3 | 27.2 |
| Modelled total NO ₂ concentration (µg.m ⁻³) | 16.6 | 12.7 | 20.5 | 25.9 | 27.7 | 28.7 | 27.9 | 33.8 |
| Monitored total NO ₂ concentration (µg.m ⁻³) | 16.7 | 15.8 | 20.9 | 25.0 | 26.6 | 24.9 | 24.8 | 27.9 |
| % difference between modelled and monitored total NO ₂ concentration | -0.8 | -24.7 | -2.0 | 3.6 | 3.8 | 13.2 | 11.2 | 17.3 |
| RMSE % (should be less than 25% and ideally less than 10%) | 26.1 | | | | | | | |

* Road-NO_x component, determined from NO_x to NO₂ calculator

To provide a conservative assessment a factor of 1.0 was applied to the modelled road-NO_x concentration at each receptor, before conversion to NO₂ concentrations using the NO_x to NO₂ calculator provided by Defra and the NO₂ background concentration.

Statistical analyses for the results in Table 8.2 demonstrates that the RMSE value marginally exceeds the 25% of the annual mean objective however, based on the number of monitoring locations utilised and the extent of the modelled road network, the RMSE value is considered to represent an acceptable level of average uncertainty within the air quality model.

Hinckley and Bosworth Borough Council

Table 8.1 details the monitoring locations which were excluded from model verification for Hinckley and Bosworth Borough Council (HBBC).

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The model NO_x outputs were compared to the 2019 monitored concentrations to provide adjustment factors. Table 8.3 presents the verification process for NO_x.

Table 8.3: Hinckley and Bosworth Borough Council model verification process.

| Model Verification Steps | Monitoring Site ID | | | | | | |
|---|--------------------|------|------|------|------|------|------|
| | 8 | 7 | 16 | 6 | 3 | 5 | 2 |
| 2019 monitored total NO ₂ (µg.m ⁻³) | 19.1 | 21.1 | 24.0 | 19.8 | 23.1 | 21.7 | 27.3 |
| 2019 background NO ₂ concentration (µg.m ⁻³) | 11.5 | 13.1 | 15.6 | 13.0 | 15.3 | 13.8 | 13.1 |
| Monitored road contribution NO _x (µg.m ⁻³) | 14.2 | 14.9 | 15.9 | 12.7 | 14.8 | 14.8 | 27.4 |
| Modelled road contribution NO _x (µg.m ⁻³) | 6.4 | 7.5 | 3.6 | 3.4 | 5.3 | 5.3 | 5.9 |
| Ratio of monitored road NO _x to modelled road NO _x | 2.2 | 2.0 | 4.4 | 3.7 | 2.8 | 2.8 | 4.6 |
| Adjustment factor for modelled road contribution NO_x | 2.928 | | | | | | |
| Adjusted modelled road contribution NO _x (µg.m ⁻³) | 18.6 | 21.8 | 10.5 | 10.0 | 15.5 | 15.6 | 17.3 |
| Modelled total NO ₂ concentration (µg.m ⁻³) | 21.4 | 24.6 | 21.2 | 18.4 | 23.5 | 22.1 | 22.3 |
| Monitored total NO ₂ concentration (µg.m ⁻³) | 19.1 | 21.1 | 24.0 | 19.8 | 23.1 | 21.7 | 27.3 |

| | | | | | | | |
|---|------|------|-------|------|-----|-----|-------|
| % difference between modelled and monitored total NO ₂ concentration | 10.7 | 14.3 | -13.0 | -7.8 | 1.7 | 1.9 | -22.6 |
| RMSE % (should be less than 25% and ideally less than 10%) | 14.0 | | | | | | |

* Road-NO_x component, determined from NO_x to NO₂ calculator

A road-NO_x factor of **2.928** was determined as the slope of the best fit line between the 'measured' road contribution and the model derived road contribution, forced through zero. This factor was then applied to the modelled road-NO_x concentration at each receptor, before conversion to NO₂ concentrations using the NO_x to NO₂ calculator provided by Defra and the NO₂ background concentration.

Statistical analyses for the results in Table 8.3 demonstrates that the RMSE value is within 25% of the annual mean objective. Given the number of monitoring sites considered in the study and the extent of the modelled road network, the RMSE value is considered to represent an acceptable level of average uncertainty within the air quality model.

Charnwood Borough Council

The model NO_x outputs were compared to the 2019 monitored concentrations to provide adjustment factors. Table 8.4 presents the verification process for NO_x.

Table 8.4: Charnwood Borough Council model verification process.

| Model Verification Steps | Monitoring Site ID 17 |
|---|-----------------------|
| 2019 monitored total NO ₂ (µg.m ⁻³) | 26.6 |
| 2019 background NO ₂ concentration (µg.m ⁻³) | 12.8 |
| Monitored road contribution NO _x (µg.m ⁻³) | 26.5 |
| Modelled road contribution NO _x (µg.m ⁻³) | 8.5 |

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| Model Verification Steps | Monitoring Site ID 17 |
|---|-----------------------|
| Ratio of monitored road NO _x to modelled road NO _x | 3.1 |
| Adjustment factor for modelled road contribution NO_x | 3.1162 |
| Adjusted modelled road contribution NO _x (µg.m ⁻³) | 26.5 |
| Modelled total NO ₂ concentration (µg.m ⁻³) | 26.6 |
| Monitored total NO ₂ concentration (µg.m ⁻³) | 26.6 |
| % difference between modelled and monitored total NO ₂ concentration | 0.0 |
| RMSE % (should be less than 25% and ideally less than 10%) | 0.0 |

* Road-NO_x component, determined from NO_x to NO₂ calculator

A road-NO_x factor of **3.1162** was determined as the slope of the best fit line between the 'measured' road contribution and the model derived road contribution, forced through zero. This factor was then applied to the modelled road-NO_x concentration at each receptor, before conversion to NO₂ concentrations using the NO_x to NO₂ calculator provided by Defra and the NO₂ background concentration.

The verification process utilised monitoring data at CBC monitoring location 17. Whilst this site resulted in a high adjustment factor being calculated, this provides a conservative assessment as the high adjustment factor was used to adjust predicted NO₂, PM₁₀ and PM_{2.5} across the Charnwood study area.

Erewash Borough Council

Table 8.1 details the monitoring locations which were excluded from model verification for Erewash Borough Council (EBC).

The model NO_x outputs were compared to the 2019 monitored concentrations to provide adjustment factors. Table 8.5 presents the verification process for NO_x.

Table 8.5: Erewash Borough Council model verification process.

| Model Verification Steps | Monitoring Site ID | | | | | | |
|---|---|--------|--------|--------|-------|-------|-------|
| | ECBC23 | ECBC22 | ECBC18 | ECBC11 | ECBC4 | ECBC2 | ECBC5 |
| 2019 monitored total NO ₂ (µg.m ⁻³) | 20.4 | 22.8 | 27.7 | 21.7 | 24.1 | 24.3 | 19.5 |
| 2019 background NO ₂ concentration (µg.m ⁻³) | 16.9 | 16.9 | 19.5 | 19.5 | 19.5 | 19.3 | 19.3 |
| Monitored road contribution NO _x (µg.m ⁻³) | 6.5 | 11.1 | 15.8 | 4.1 | 8.7 | 9.4 | 0.3 |
| Modelled road contribution NO _x (µg.m ⁻³) | 6.2 | 6.3 | 7.2 | 9.7 | 15.8 | 10.1 | 12.5 |
| Ratio of monitored road NO _x to modelled road NO _x | 1.0 | 1.8 | 2.2 | 0.4 | 0.6 | 0.9 | 0.0 |
| Adjustment factor for modelled road contribution NO_x | 0.6844 therefore a factor of 1.0 was utilised to provide a more conservative assessment | | | | | | |
| Adjusted modelled road contribution NO _x (µg.m ⁻³) | 6.2 | 6.3 | 7.2 | 9.7 | 15.8 | 10.1 | 12.5 |

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| | | | | | | | |
|---|------|-------|-------|------|------|------|------|
| Modelled total NO ₂ concentration (µg.m ⁻³) | 20.2 | 20.3 | 23.3 | 24.6 | 27.7 | 24.7 | 25.9 |
| Monitored total NO ₂ concentration (µg.m ⁻³) | 20.4 | 22.8 | 27.7 | 21.7 | 24.1 | 24.3 | 19.5 |
| % difference between modelled and monitored total NO ₂ concentration | -0.8 | -12.5 | -18.7 | 11.8 | 13.1 | 1.4 | 24.6 |
| RMSE % (should be less than 25% and ideally less than 10%) | 18.2 | | | | | | |

* Road-NO_x component, determined from NO_x to NO₂ calculator

To provide a conservative assessment a factor of 1.0 was applied to the modelled road-NO_x concentration at each receptor, before conversion to NO₂ concentrations using the NO_x to NO₂ calculator provided by Defra and the NO₂ background concentration.

Statistical analyses for the results in Table 8.5 demonstrates that the RMSE value is within 25% of the annual mean objective. Given the number of monitoring sites considered in the study and the extent of the modelled road network, the RMSE value is considered to represent an acceptable level of average uncertainty within the air quality model.

North Warwickshire District Council

No monitoring locations within the North Warwickshire District Council (NWDC) authority area were included in the verification process as detailed in Table 8.1.

The model verification factor was therefore utilised from neighbouring Nuneaton and Bedworth Borough Council (NBBC) as receptors within NWDC and NBBC authority areas and within the study area, are located close to the A5 and M6 and therefore the NBBC

verification factor is considered to be representative of conditions within the NWDC authority area.

North West Leicestershire District Council

The model NO_x outputs were compared to the 2019 monitored concentrations to provide adjustment factors. Table 8.6 presents the verification process for NO_x.

Table 8.6: North West Leicestershire District Council model verification process.

| Model Verification Steps | Monitoring Site ID |
|---|---------------------------|
| | 45 |
| 2019 monitored total NO ₂ (µg.m ⁻³) | 26.7 |
| 2019 background NO ₂ concentration (µg.m ⁻³) | 13.4 |
| Monitored road contribution NO _x (µg.m ⁻³) | 25.4 |
| Modelled road contribution NO _x (µg.m ⁻³) | 11.1 |
| Ratio of monitored road NO _x to modelled road NO _x | 2.3 |
| Adjustment factor for modelled road contribution NO_x | 2.2781 |
| Adjusted modelled road contribution NO _x (µg.m ⁻³) | 25.3 |
| Modelled total NO ₂ concentration (µg.m ⁻³) | 26.7 |
| Monitored total NO ₂ concentration (µg.m ⁻³) | 26.7 |
| % difference between modelled and monitored total NO ₂ concentration | 0.0 |

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| | |
|--|---------------------------|
| Model Verification Steps | Monitoring Site ID |
| | 45 |
| RMSE % (should be less than 25% and ideally less than 10%) | 0.0 |

* Road-NO_x component, determined from NO_x to NO₂ calculator

A road-NO_x factor of **2.2781** was determined as the slope of the best fit line between the 'measured' road contribution and the model derived road contribution, forced through zero. This factor was then applied to the modelled road-NO_x concentration at each receptor, before conversion to NO₂ concentrations using the NO_x to NO₂ calculator provided by Defra and the NO₂ background concentration.

Nuneaton and Bedworth Borough Council

Table 8.1 details the monitoring locations which were excluded from model verification for NBBC.

The model NO_x outputs were compared to the 2019 monitored concentrations to provide adjustment factors. Table 8.7 presents the verification process for NO_x.

Table 8.7: Nuneaton and Bedworth Borough Council model verification process.

| Model Verification Steps | Monitoring Site ID | | |
|---|--------------------|------|------|
| | NB06 | NB31 | NB35 |
| 2019 monitored total NO ₂ (µg.m ⁻³) | 31.4 | 29.4 | 23.2 |
| 2019 background NO ₂ concentration (µg.m ⁻³) | 20.6 | 24.0 | 15.0 |
| Monitored road contribution NO _x (µg.m ⁻³) | 21.2 | 10.4 | 15.5 |

| Model Verification Steps | Monitoring Site ID | | |
|---|--------------------|------|-------|
| | NB06 | NB31 | NB35 |
| Modelled road contribution NO _x (µg.m ⁻³) | 9.1 | 9.4 | 3.2 |
| Ratio of monitored road NO _x to modelled road NO _x | 2.3 | 1.1 | 4.8 |
| Adjustment factor for modelled road contribution NO_x | 1.872 | | |
| Adjusted modelled road contribution NO _x (µg.m ⁻³) | 17.1 | 17.6 | 6.1 |
| Modelled total NO ₂ concentration (µg.m ⁻³) | 29.4 | 33.0 | 18.3 |
| Monitored total NO ₂ concentration (µg.m ⁻³) | 31.4 | 29.4 | 23.2 |
| % difference between modelled and monitored total NO ₂ concentration | -6.8 | 10.8 | -26.7 |
| RMSE % (should be less than 25% and ideally less than 10%) | 12.4 | | |

A road-NO_x factor of **1.872** was determined as the slope of the best fit line between the 'measured' road contribution and the model derived road contribution, forced through zero. This factor was then applied to the modelled road-NO_x concentration at each receptor, before conversion to NO₂ concentrations using the NO_x to NO₂ calculator provided by Defra and the NO₂ background concentration.

Statistical analyses for the results in Table 8.7 demonstrates that the RMSE value is within the ideal annual mean objective. Given the number of monitoring sites considered in the study and the extent of the modelled road network, the RMSE value is

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considered to represent an acceptable level of average uncertainty within the air quality model.

Coventry City Council

The model NO_x outputs were compared to the 2019 monitored concentrations to provide adjustment factors. Table 8.8 presents the verification process for NO_x.

Table 8.8: Coventry City Council Model Verification Process

| Model Verification Steps | Monitoring Site ID Grange3 |
|---|---------------------------------------|
| 2019 monitored total NO ₂ (µg.m ⁻³) | 36.4 |
| 2019 background NO ₂ concentration (µg.m ⁻³) | 24.0 |
| Monitored road contribution NO _x (µg.m ⁻³) | 24.7 |
| Modelled road contribution NO _x (µg.m ⁻³) | 6.7 |
| Ratio of monitored road NO _x to modelled road NO _x | 3.7 |
| Adjustment factor for modelled road contribution NO_x | 3.6794 |
| Adjusted modelled road contribution NO _x (µg.m ⁻³) | 24.7 |
| Modelled total NO ₂ concentration (µg.m ⁻³) | 36.4 |
| Monitored total NO ₂ concentration (µg.m ⁻³) | 36.4 |
| % difference between modelled and monitored total NO ₂ concentration | 0.0 |

| | |
|--|-----|
| RMSE % (should be less than 25% and ideally less than 10%) | 0.0 |
|--|-----|

** Road-NO_x component, determined from NO_x to NO₂ calculator*

A road-NO_x factor of **3.6794** was determined as the slope of the best fit line between the 'measured' road contribution and the model derived road contribution, forced through zero. This factor was then applied to the modelled road-NO_x concentration at each receptor, before conversion to NO₂ concentrations using the NO_x to NO₂ calculator provided by Defra and the NO₂ background concentration.

The verification process utilised monitoring data at CCC monitoring location Grange3. Whilst this site has resulted in a high adjustment factor being calculated, this provides a conservative assessment as the high adjustment factor was used to adjust predicted NO₂, PM₁₀ and PM_{2.5} across the Coventry study area.

Rugby Borough Council

No monitoring locations suitable for model verification were identified within the Rugby Borough Council (RBC) authority area.

The model verification factor was therefore utilised from neighbouring CCC, as receptors within CCC and RBC authority areas and within the study area, are located close to the M6 and therefore the CCC verification factor is considered to be representative of conditions within the RBC authority area.

Tamworth Borough Council

No monitoring locations suitable for model verification were identified within the Tamworth Borough Council (TBC) authority area.

The model verification factor was therefore utilised from neighbouring NBBC, as receptors within NBBC and TBC authority areas and within the study area, are located close to the A5 and therefore the NBBC verification factor is considered to be representative of conditions within the TBC authority area.

Summary

The RMSE values for each verified zone are within, 25% of the annual mean NO₂ air quality objective with the exception of Blaby DC. However, given the number of monitoring sites considered within the study area, the extent of the modelled road network and the limitations associated with the study as detailed within Chapter 6.1.9: *Air quality*, the RMSE values are considered to represent an acceptable level of average uncertainty within the air quality model.

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The statistical analysis of the adjusted model performance and uncertainty demonstrates that the atmospheric dispersion model is robust and representative for the prediction of annual mean NO_x , PM_{10} and $\text{PM}_{2.5}$ concentrations at identified receptor locations throughout the study area.