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London Plan Guidance

Air Quality Neutral

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London Plan Policy

[Policy SI1 Improving Air Quality Part B\(2\)\(a\) and Part E](#)

Planning application type and how the London Plan Guidance will be applied

All [development](#), unless specifically excluded (see Section 2.2), is required to submit an Air Quality Neutral assessment demonstrating how the Air Quality Neutral benchmarks in this guidance will be met.

There is a simplified assessment for [minor development](#) (see Section 2.3).

Who is this guidance for

Planning authorities, architects, transport planners and engineers, energy consultants and engineers, and applicants. For use in designing and specifying building and transport in design and in quantifying and assessing air quality performance against relevant Air Quality Neutral benchmarks.

1 About this document

1.1 What is Air Quality Neutral?

- 1.1.1 'Air Quality Neutral' is a term for developments that do not contribute to air pollution beyond allowable benchmarks. The benchmarks, set out in this guidance, are based on research and evidence carried out by building and transport consultants.

2 Applying Air Quality Neutral

2.1 Air Quality Neutral assessments for planning applications

- 2.1.1 There are two sets of benchmarks, which cover the two main sources of air pollution from new developments:

- Building Emissions Benchmark (BEB) - emissions from equipment used to supply heat and energy to the buildings
- Transport Emissions Benchmark (TEB) - emissions from private vehicles travelling to and from the development.

- 2.1.2 A development must meet both benchmarks separately in order to be Air Quality Neutral. If one or both benchmarks are not met, appropriate mitigation or offsetting will be required (see Section 4.2.4). As the benchmarks are based on evidence and are designed to be challenging but achievable, mitigation or offsetting provisions should be the exception.

- 2.1.3 Calculations against the benchmarks should inform the design process. However, the final Air Quality Neutral assessment itself can only be prepared once the energy and transport strategies for a development are suitably finalised or, where these strategies are not part of the application, development details are finalised for planning submission.

2.2 Excluded development

- 2.2.1 Developments, including major developments which do not include additional emissions sources are assumed to be Air Quality Neutral and do not need an Air Quality Neutral assessment. This would include, for example, developments that have no additional motor vehicle parking, do not lead to an increase in motor vehicle movements¹, and do not include new combustion plant such as gas-fired boilers. It is good practice to advise the local planning authority of this when submitting a planning application, for example in a cover letter or the planning statement.
- 2.2.2 Developments with emission sources that are not covered by the Air Quality Neutral benchmarks, such as [permitted installations](#) and industrial processes, are also excluded. In most cases these developments will be covered by a more detailed air quality impact assessment and/or other environmental regulations.

2.3 Minor developments

- 2.3.1 All developments in London are expected to meet the Air Quality Neutral benchmarks. However, most minor developments will not be required to provide a full air quality assessment. The simplified procedures for these developments are set out in Paragraphs 3.1.1 to 3.1.2 and 4.1.1 to 4.1.2.
- 2.3.2 Details of emission sources included in the development proposals should be set out in the planning application. These details may then be secured by planning condition, e.g. minimum emissions standards for combustion plant or maximum permitted car parking spaces.
- 2.3.3 In certain cases, such as developments in an Air Quality Focus Area, the local planning authority may require a full air quality assessment for a minor development due to the nature or location of the proposed scheme. In these cases, the air quality assessment Building Emissions Benchmarks (see Paragraphs 3.1.3 to 3.4.3) and Transport Emissions Benchmarks (see Paragraphs 4.1.4 to 4.2.4) should be used.

¹ Taxi, delivery and servicing vehicle trips, as well as heavy vehicle trips produced by the operation of an industrial or commercial premises are not covered by Air Quality Neutral. Please see Paragraph 4.1.5 for further information.

2.4 Phased developments

- 2.4.1 Where developments are phased, the entire development should be Air Quality Neutral and should be Air Quality Neutral at the completion of each phase. This will normally require assessment against the benchmarks at a number of separate points. Refer to Appendix 2 for further guidance.
- 2.4.2 If new car parking is brought forward in phases, the development should be tested against the TEB at the outline application stage, and again as detailed plans for each phase are brought forward.
- 2.4.3 If car parking is built as part of a single phase of the development, but intended to serve multiple phases, the applicant should either:
- show that parking spaces will only be released for use as the phase they are intended to serve is completed; or
 - show that the phase in which the parking is delivered meets the TEB when considered in isolation.

2.5 Material and non-material amendments

- 2.5.1 Changes to the design, energy or transport strategy after planning permission has been granted may affect whether a development is Air Quality Neutral. A reassessment of compliance with this guidance will normally be required for amendments that affect any of the following:
- Energy strategy
 - The proposed type or number of power and/or heating appliances
 - Transport strategy and/or travel plan
 - Number of parking spaces
 - Parking management plan
 - Number of residential units
 - Floorspace assigned to non-residential use classes
- 2.5.2 The reassessment should be proportionate and limited to the extent of the amendments. For example, a change to the number of car parking spaces would not need a reassessment of building emissions. A change that would unambiguously reduce emissions, such as replacing planned domestic boilers with heat pumps, or removing car parking could be allowed on that basis without reassessment at the discretion of the local planning authority.

2.6 Securing compliance for building emissions

2.6.1 Details of the specific appliance that will be installed in the completed development are not always known at planning application stage. Even when a specific appliance is assumed at planning application stage, for many reasons this may be different to the appliance that is installed in the completed development. It is therefore strongly advised that a condition requiring approval of the appliance details is used to ensure that the installed system is as good as, or better than, that used in the Air Quality Neutral assessment. For larger and more complex systems, abatement equipment may be needed to minimise emissions. Where abatement is required, the installation, use and maintenance of the abatement equipment should similarly be required by condition.

2.7 Securing compliance for transport emissions

2.7.1 For most developments, the key driver of transport emissions is the provision of car parking spaces. Therefore, a condition or legal agreement restricting car parking spaces to a specified maximum (not exceeding the amount assumed for the Air Quality Neutral calculation) should be required.

2.7.2 Where the development proposal requires specific local measures to reduce trip generation or trip length, these should be secured by condition or through a suitable legal agreement.

3 Building Emissions Benchmark (BEB)

3.1 Calculating the BEB

Simplified procedure for the Building Emissions Benchmark (BEB)

3.1.1 Where minor developments include new heating systems, they can be assumed to meet the BEB if:

- the new heating system is a heat pump or other zero emission heat source;
- the new heating system is a gas boiler with NO_x emissions rated at less than 40 mg/kWh; or
- the development is connecting to an existing heat network.

3.1.2 Where the simplified procedures for minor developments in 3.1.1 and 4.1.1 both apply, the rest of Section 3 does not apply. If either of these do not apply, and the development is not excluded (see Paragraphs 2.2.1 and 2.2.2), a full Air Quality Neutral assessment against both BEB and TEB is required, as per the procedure below.

Full procedure for the Building Emissions Benchmark (BEB)

3.1.3 The BEB is defined in grams (g) of nitrogen oxides (NO_x) emitted per square metre (m²) of floorspace over a year (gNO_x/m²/annum). The floorspace is defined as the gross internal area (GIA). The benchmark NO_x emission rates are defined for different land uses and are dependent on the characteristics of the energy strategy adopted for the development. These are based on achievable emission rates for the type of technology used. The benchmark NO_x emission rates are defined in Table 3.1.

3.1.4 Most non-combustion heat sources such as electric panel heaters and heat pumps (including air source and ground source heat pumps) are assumed to have zero heat-related NO_x emissions. However, for the avoidance of doubt, checks should be made with the manufacturer or an air quality consultant when non-standard or innovative technologies are used.

3.1.5 Solid and liquid biomass appliances also emit fine particulate matter in addition to NO_x. The benchmark emission rate for particulate matter is zero. Any development that uses solid or liquid fuels for primary or secondary heating will therefore not be Air Quality Neutral and will require mitigation or offsetting (see Section 5).

Table 3.1 Building Emissions Benchmark NO_x Emission Rates (gNO_x/m²/annum)

| Land Use* | Individual Gas Boilers | Gas Boiler Network | CHP + Gas Boiler Network | Heat Pumps + Gas Boiler Network |
|---|------------------------|--------------------|--------------------------|---------------------------------|
| Residential (including student accommodation and large-scale purpose-built shared living development) | 3.5 | 5.7 | 7.8 | 5.7 |
| Retail | 0.53 | 0.97 | 4.31 | 0.97 |
| Restaurants and bars | 1.76 | 3.23 | 14.34 | 3.23 |
| Offices | 1.43 | 2.62 | 11.68 | 2.62 |
| Industrial | 1.07 | 1.95 | 8.73 | 1.95 |
| Storage and distribution | 0.55 | 1.01 | 4.50 | 1.01 |
| Hotel | 9.47 | 15.42 | 38.16 | 15.42 |
| Care homes and hospitals | 9.15 | 14.90 | 36.86 | 14.90 |
| Schools, nurseries, doctors' surgeries, other non-residential institutions | 0.90 | 1.66 | 7.39 | 1.66 |
| Assembly and leisure | 2.62 | 4.84 | 21.53 | 4.84 |

* Separate use classes for commercial uses, including retail and offices, have now been replaced by use class E. If these separate uses are specified in the development proposal, they should be used for this assessment. Where the intended use is not specified, or where use class E has been specified, the benchmark for retail should be used.

3.1.6 The GIA for each land use is multiplied by the corresponding benchmark NO_x emission rate in Table 3.1 to calculate the benchmark NO_x emissions for each land use in the development proposal. These are then added together to calculate the **Building Emissions Benchmark** for the development, as shown in Table 3.2. Further example calculations are provided in Appendix 1.

Table 3.2 Example BEB Benchmark Calculation

| Land Use | GIA (m ²) | Benchmark NO _x Emission Rate (gNO _x /m ² /year) | Total Benchmark Emissions (gNO _x /year) |
|---|-----------------------|--|--|
| Example land use 1 | A | B | A x B = C |
| Example land use 2 | D | E | D x E = F |
| Building Emissions Benchmark for the development | | | C + F |

3.1.7 The GIA for each land use in the calculation should match the submitted planning documents, including the planning application form. Any deviation should be clearly indicated and justified.

3.2 Calculating the predicted building emissions

3.2.1 To calculate the total predicted building emissions, the typical energy use for each different combustion source proposed within the development, and an emission rate for each combustion source, will need to be known. Where there is no energy assessment for the application, information about the proposed emission sources, their predicted annual energy use and their emission rates should be provided elsewhere in the planning application documents.

3.2.2 The predicted annual **energy use** for each emission source can be found in the energy assessment for the development proposal (in a table similar to Table 3.3 below). Where there is no energy assessment for the application, information about the proposed emission sources and their predicted annual energy use should be provided elsewhere in the planning application documents or appended to the Air Quality Neutral assessment.

Table 3.3 Energy use reporting template for predicted building emissions

| Energy source | Total predicted residential energy use (MWh/year) | Total predicted non-residential energy use (MWh/year) |
|--|---|---|
| Grid electricity | | |
| Gas boilers (communal/individual) | | |
| Gas CHP | | |
| Connection to existing district heat network | | |
| Other gas use (e.g. cookers) | | |

3.2.3 The **emission rate** for each emission source will be included in the manufacturer's specification for the specific appliance. Where CHP is used, this may include selective catalytic reduction (SCR) technology to manage emissions. The size (output) of the CHP is the main factor which determines whether SCR is used, but there is no absolute cut-off point.

3.2.4 The predicted emissions for each source are:

Energy use for each source x emission rate of each source

3.2.5 These are then added together to give total predicted building emissions for the development (see Table 3.4). The development is considered Air Quality Neutral in terms of building emissions if the total predicted building emissions are less than the BEB.

Table 3.4 Example Total Predicted Building Emissions Calculation

| | Energy use (MWh/year) | NO _x emission rate (mg/kWh) | Total Predicted NO _x Building Emissions (mg/annum) |
|---|-----------------------|--|---|
| Emission source 1 | A | B | $A \times B = C$ |
| Emission source 2 | D | E | $D \times E = F$ |
| Total predicted building emissions for the development | | | C + F |

3.2.6 Where it has not been possible to identify a specific unit that will be installed, the generic emission rates in Table 3.5 can be used.

Table 3.5 Generic emission rates for combustion technologies

| Technology type | NO _x emission rate |
|---------------------|-------------------------------|
| Gas boiler | 40 mg/kWh |
| Gas engine with SCR | 25 mg/Nm ³ |
| Heat pump | 0 |

3.3 Generators

3.3.1 Backup plant installed for emergency and life safety power supply, such as diesel generators, may be excluded from the calculation of predicted building emissions. Normally, it would be expected that the use of these generators for anything other than an emergency and operational testing (less than 50 hours per year) would be prevented by planning condition. The NO_x and particulate matter emissions of generators used for purposes other than an emergency, such as selling power into the national grid, must be included in Air Quality Neutral calculations.

Generators for temporary applications

3.3.2 Emissions from generators which form part of planning applications for temporary structures should be included in the calculation of building emissions, as per the provisions in Paragraphs 3.3.1 and 3.3.1. Emissions from generators which form part of planning applications for temporary events, where generators are required for the event operation, do not need to be included.

3.4 Connecting to existing heat networks

3.4.1 New developments in Heat Network Priority Areas are expected to prioritise connection to existing district heat networks or be future-proofed for connection to a proposed network. Connection to a district heat network does not mean the development is automatically considered to be Air Quality Neutral, and an assessment will still need to be carried out. The assessment needed will depend on the type of heat network. Where the heat is from an existing source that would otherwise be wasted, the emission rate is zero. However, any additional emissions from top-up boilers or other combustion sources will still need to be calculated in the normal way.

3.4.2 Where the heat is from a purpose-built communal heat network, the situation is more complex. In the following scenarios, any additional emissions from the heat network should be accounted for in the assessment:

- The development proposal results in the heat network operating at higher loads or longer hours; or
- New plant is installed in the energy centre(s) to meet the increased demand of the development proposal.

3.4.3 The emission rate and energy use used should be based on the actual equipment installed in the energy centre. Technical details should be obtained from the energy and sustainability consultant, energy centre operator or other relevant specialist. Where a new energy centre is being built to supply a communal heat network, the full emissions from the energy centre attributable to the development should be included in the building emissions calculation.

4 Transport Emissions Benchmark (TEB)

4.1 Calculating the TEB

Simplified procedure for the Transport Emissions Benchmark (TEB)

- 4.1.1 Where minor developments include new parking, they can be assumed to meet the TEB if the maximum parking standards set out in policies T6 and T6.1 to T6.5 of the London Plan are not exceeded. For land uses where maximum parking standards are not defined, a full calculation against the benchmarks should be carried out.
- 4.1.2 Where the simplified procedures for minor developments in 3.1.1 and 4.1.1 both apply, the rest of Section 4 does not apply. If either of these do not apply, and the development is not excluded (see Paragraphs 2.2.1 and 2.2.2), a full Air Quality Neutral assessment is required.
- 4.1.3 Where major developments meet the definition of 'car-free'², they can be assumed to meet the TEB and the rest of Section 4 does not apply. This assumption does not exempt a development from considering building emissions (see Section 3).

Full procedure for the Transport Emissions Benchmark (TEB)

- 4.1.4 The TEB is defined as the predicted number of trips per m² of floorspace (GIA) over a year (trips/m²/year) for non-residential use, or the anticipated number of trips per dwelling (trips/dwelling/year) for residential use. Benchmark Trip Rates are based on data from TRAVL (Trip Rate Assessment Valid for London)³ and are defined for different land uses and different areas of London. These are set out in Table 4.1.
- 4.1.5 The TEB only estimates car or light van trips generated by the development occupiers. These trips are likely to be generated by residents, customers or employees. The TEB does not include trips generated by deliveries and servicing, taxis or heavy vehicle movements from non-occupiers. Assessment of these trips should be captured in the wider air quality impact assessment where one is required.

² Developments that are defined as 'car-free' may include provision for disabled persons parking. The standards for disabled persons parking are outlined in the London Plan parking policies (T6 and T6.1 to T6.5) and supporting text.

³ The TRAVL system and TRICS provide information based on observed trip rates from developments, and these will be monitored and updated where necessary.

Table 4.1 Benchmark Trip Rates

| Land Use | Annual trips per | Benchmark Trip Rates | | |
|---|----------------------|-------------------------------|------------------------------|--------------|
| | | Central Activities Zone (CAZ) | Inner London (excluding CAZ) | Outer London |
| Residential (including student accommodation and large-scale purpose-built shared living development) | dwelling | 68 | 114 | 447 |
| Office / Light Industrial | m ² (GIA) | 2 | 1 | 16 |
| Retail (Superstore) | m ² (GIA) | 39 | 73 | 216 |
| Retail (Convenience) | m ² (GIA) | 18 | 139 | 274 |
| Restaurant / Café | m ² (GIA) | 64 | 137 | 170 |
| Drinking establishments | m ² (GIA) | 0.8 | 8 | N/A |
| Hot food takeaway | m ² (GIA) | N/A | 32.4 | 590 |
| Industrial | m ² (GIA) | N/A | 3.9 | 16.3 |
| Storage and distribution | m ² (GIA) | N/A | 1.4 | 5.8 |
| Hotels | m ² (GIA) | 1.0 | 1.4 | 6.9 |
| Care homes and hospitals | m ² (GIA) | N/A | 1.1 | 19.5 |
| Schools, nurseries, doctors' surgeries, other non-residential institutions | m ² (GIA) | 0.1 | 30.3 | 44.4 |

| Land Use | Annual trips per | Benchmark Trip Rates | | |
|----------------------|----------------------|-------------------------------|------------------------------|--------------|
| | | Central Activities Zone (CAZ) | Inner London (excluding CAZ) | Outer London |
| Assembly and leisure | m ² (GIA) | 3.6 | 10.5 | 47.2 |

* Separate use classes for commercial uses including retail and offices have now been replaced by use class E. If these separate uses are specified in the development proposal, they should be used for this assessment. Where the separate use is not specified, or where use class E has been specified, the benchmark for office/light industrial should be used.

4.1.6 Where a trip rate has not been set for a land use, this is because there is not enough data on trip rates for the type of development in this location. In these cases, the local planning authority should be consulted. It should be ensured that the maximum parking standards set out in policies T6 and T6.1 to T6.5 of the London Plan are not exceeded.

4.1.7 Where parts of the development will have no dedicated parking, for example a residents' gym that is not accessible to the public, these should be excluded from the calculation of the TEB.

4.1.8 The number of dwellings (residential) or GIA (non-residential) for each land use is multiplied by the benchmark trip rate to calculate the benchmark trip rates for each land use. These are then added together to calculate the Transport Emissions Benchmark for the development as shown in Table 4.2. Further example calculations are provided in Appendix 1.

Table 4.2 Example TEB Calculation

| Land Use | Annual trips per | Benchmark Trip Rates | Total Benchmark Trip Rate (trips/year) |
|--|--------------------|----------------------|--|
| Example residential land use 1 | 'A' dwellings | B | $A \times B = C$ |
| Example non-residential land use 2 | 'D' m ² | E | $D \times E = F$ |
| Transport Emissions Benchmark for the development | | | C + F |

4.2 Calculating the predicted trip rate

4.2.1 A trip rate is usually calculated as part of the transport assessment for the development. This figure should be used in the Air Quality Neutral assessment. Trip rates from TRICS (Trip Rate Information Computer System) can be used if they are also used in the transport assessment and multiplied to give an annual, rather than daily, number of predicted generated trips.

4.2.2 In some cases, the transport assessment will only include peak hour trips. In these cases, either:

- Include additional data setting out the full number of predicted trips based on the same modelling as the transport assessment (as an appendix to the air quality assessment or transport assessment); or
- Show how daily and annual trip rates have been calculated from the peak hour trips in the transport assessment. This should be done in accordance with [best transport assessment practice](#), as set out by Transport for London.

4.2.3 The breakdown of the predicted trip rate between different land uses is not required, but it may be helpful to do this if the TEB is exceeded.

4.2.4 If the total trip rate is less than or equal to the TEB, the development is Air Quality Neutral in terms of transport emissions.

5 Mitigation and offsetting

5.1 Mitigation measures

- 5.1.1 The Air Quality Neutral benchmarks have been calculated to be achievable and designed to be consistent with the energy and transport policies of the London Plan.
- 5.1.2 If the assessment shows that the development fails to meet one or both benchmarks, the first step is to amend the details of the development to meet the benchmarks. This could include changes to the energy or transport strategies, or changes to the overall design of the development.
- 5.1.3 If development is still not be able to meet the benchmarks, the next step is to seek agreement with the local planning authority to secure on or off-site mitigation measures (with on-site measures preferred in accordance with Part E of Policy SI 1). Mitigation measures should exceed the minimum requirements in the London Plan policies. An example might be exceeding minimum requirements for cycle parking or phased removal of car parking.
- 5.1.4 Mitigation measures should be agreed following these principles:
- Measures should be demonstrably effective and show how they will reduce local emissions or concentrations by at least the equivalent of the excess emissions.
 - Measures should relate to the type of excess emissions, for example measures to reduce building emissions should not be used to compensate for excess transport emissions. Similarly, local NO_x reductions should not be used to compensate for excess particulate matter emissions.
 - The measures should be genuinely additional to all the measures already accounted for in the air quality assessment.
 - The measures should be in place by the time the development is occupied.
 - Implementation of the measures must be robustly secured via planning condition or legal agreement.
- 5.1.5 Measures may be suggested by the local planning authority or by the applicant, but the local planning authority must determine whether proposed measures are appropriate and adequate to meet London Plan policy.

5.2 Offsetting payments

- 5.2.1 If it is not possible to identify or agree appropriate and adequate mitigation measures, it may be possible, at the discretion of the local planning authority, to agree an offsetting payment instead.
- 5.2.2 The offsetting payment is calculated by multiplying the excess emissions above the benchmarks (tonnes/annum) by the damage costs (£/tonne) over a 30-year period, with a 2 per cent annual uplift, as set out in 5.2.2. An example offsetting payment calculation is also provided in Section A1.1 in Appendix 1. The damage cost per tonne of excess emissions should use the most up to date version of the [Defra-published damage costs for air pollution](#). Most recently this sets both generic damage costs and specific damage costs for different emission sources. Where these differ, the higher amount should be used.

Table 5.1 Example offsetting payment calculation

| | Benchmark | Total predicted emissions | Excess emissions ⁴ | Damage cost | Annual offsetting amount |
|---------------------------------------|--|---------------------------|-------------------------------|-------------|--------------------------|
| | (tonnes/annum) | | | (£/tonne) | (£) |
| Building NO _x emissions | A | B | C = (B-A) | D | E = (C x D) |
| Building PM _{2.5} emissions | F | G | H = (G-F) | I | J = (H x I) |
| Transport NO _x emissions | K | L | M = (L-K) | N | O = (M x N) |
| Transport PM _{2.5} emissions | P | Q | R = (Q-P) | S | T = (R x S) |
| Total | {(E + J + O + T) x [(1+2% uplift)^{30 Years} -1]}/2% uplift | | | | |

⁴ If the figure is < 0, it should be entered as zero in the table. It is not permitted to use good performance against one benchmark to offset exceedances of another benchmark.

5.2.3 The details of an offsetting payment and when it should be made are subject to agreement between the local planning authority and the developer. However, it would normally be expected that payment would be made in full prior to the occupation of the development.

5.3 Calculation of transport emissions for offsetting purposes

5.3.1 For simplicity, the transport benchmarks only consider the trip rate generated by the development. However, for offsetting payments, an excess emissions rate will need to be calculated. To calculate the excess emissions rate above the benchmark, both the benchmark and the predicted trip rates will need to be multiplied by a trip length and an emission factor. These are provided in Table 5.2 and 0. The trip lengths are only provided for a limited number of uses. Local planning authorities will advise which to use for other uses but in general this should be the higher of the possible options.

5.3.2 An example offsetting calculation is provided in Appendix 1.

Table 5.2 Average distance travelled by car per trip

| Land Use | Distance (km) | | |
|-------------|---------------|--------------|--------------|
| | CAZ | Inner London | Outer London |
| Residential | 4.2 | 3.4 | 11.4 |
| Office | 3.0 | 7.2 | 10.8 |
| Retail | 9.2 | 5.5 | 5.4 |

Table 5.3 Emission factors per vehicle-km

| Pollutant | Emission factors (g/veh-km) | | |
|-------------------|-----------------------------|--------------|--------------|
| | CAZ | Inner London | Outer London |
| NO _x | 0.48 | 0.39 | 0.35 |
| PM _{2.5} | 0.036 | 0.032 | 0.028 |

6 Reporting

- 6.1.1 For minor developments, use the simplified procedure at the start of Sections 3.1 and 4.1 and include relevant details in a cover letter or in other planning application documents.
- 6.1.2 For most major developments, the Air Quality Neutral assessment will form part of the wider air quality assessment. For clarity, the Air Quality Neutral assessment should be set out in its own chapter or section of the assessment. The minimum requirements for reporting are:
- tables showing the detailed calculation of the BEB and the TEB (sections 3.1 and 4.1);
 - tables showing the detailed calculation of the predicted building and transport emissions for the development (Sections 3.2 and 4.2);
 - a final calculation and statement to demonstrate whether the development as planned is or is not Air Quality Neutral;
 - if the development does not meet the Air Quality Neutral benchmarks, the mitigation measures to be secured to ensure the development can be considered Air Quality Neutral; and
 - supporting evidence or references to supporting evidence.
- 6.1.3 For phased developments, separate tables should be prepared for the development as a whole and for any phases where a full detailed design is included in the application.
- 6.1.4 Supporting evidence, such as GIAs for each land use, number of parking spaces and proposed heating technology, will be taken from other assessments and documents accompanying the application. Therefore, the source of any relevant information should be clearly referenced where appropriate.
- 6.1.5 The emission factor or trip rate used should be clearly stated. If a specific emission factor for building emissions is used, evidence should be included in or appended to the report. For instance, if a specific make and model of low NO_x boiler is assumed, then the manufacturer's data sheet should be included.

Appendix 1 Example Air Quality Neutral Calculations

A1.1 Example 1

A1.1.1 A mixed-use residential development in inner London for up to 29,022 m² of development, comprising:

- 324 residential dwellings up to 28,000 m²
- Retail, up to 120 m²
- Office, up to 110 m²
- A doctors' surgery, up to 660 m²
- A community hall, up to 130 m²
- An energy centre comprising 3 gas-fired boilers.

Building emissions

A1.1.2 Total NO_x emissions from the development were calculated from the generic emission rate for gas boilers of 40 mg/kWh, and a total annual energy usage of 2,100,000 kWh as provided by the energy and sustainability consultant.

$$40 \text{ mg/kWh} \times 2,100,000 \text{ kWh} = 84 \text{ kg}$$

A1.1.3 The total benchmarked building NO_x emission is calculated from the land use categories and the emissions benchmarks for a gas boiler network, as shown in Table A1.1.

Table A1.1 Calculation of BEB (Example 1)

| Land use | GIA (m ²) | Benchmark emission rate (g/m ² /annum) | Total benchmark emissions (kg) |
|------------------|-----------------------|---|--------------------------------|
| Residential | 28,000 | 5.7 | 159.6 |
| Retail | 120 | 0.97 | 0.12 |
| Office | 110 | 2.62 | 0.29 |
| Doctors' surgery | 660 | 1.66 | 1.10 |
| Community hall | 130 | 4.84 | 0.63 |

| Land use | GIA (m ²) | Benchmark emission rate (g/m ² /annum) | Total benchmark emissions (kg) |
|--------------|-----------------------|---|--------------------------------|
| Total | | | 161.7 |

A1.1.4 The total building emissions (84 kg) are thus less than the total BEB (161.7 kg). The development is thus Air Quality Neutral in terms of building emissions.

Transport emissions

A1.1.5 The transport assessment for the development predicted that the development will generate a total of 140,590 car trips per annum, comprising trips relating to each of the following land uses:

- Residential: 75,624
- Retail: 21,568
- Office: 1,250
- Doctors' surgery: 38,698
- Community hall: 3,450

A1.1.6 The total benchmark trip rates have been calculated as shown in Table A1.2.

Table A1.2 Calculation of TEB (Example 1)

| Land use | GIA (m ²) / No. dwellings | Benchmark trip rate | Total benchmark trip rate |
|--------------------|---------------------------------------|---------------------|---------------------------|
| Residential | 324 dwellings | 114 | 36,936 |
| Retail | 120 | 139 | 16,680 |
| Office | 110 | 1 | 110 |
| Doctors' surgery | 660 | 30.3 | 19,998 |
| Community hall | 130 | 10.5 | 1,365 |
| Total (TEB) | | | 75,098 |

A1.1.7 The total development trip rate is thus greater than the TEB. The development is thus not Air Quality Neutral in terms of transport emissions.

Entire development

A1.1.8 While the development was Air Quality Neutral in terms of building emissions, the total trip rate exceeded the TEB. Thus, mitigation of transport-related emissions would be required should no changes to the proposal be made.

Offsetting

A1.1.9 In the event that suitable mitigation cannot be agreed between the applicant and the local planning authority, an offsetting payment would need to be agreed to mitigate the excess transport emissions.

A1.1.10 In order to calculate the relevant offsetting payment, the TEB and total transport trip rates need to be converted into NO_x and PM_{2.5} emissions (see Table A1.3 and Table A1.4).

Table A1.3 Calculation of benchmark emissions (Example 1)

| Land use | Benchmark trip rate | Average distance per trip (km) | Emissions (g/veh-km) | | Total Emissions | |
|------------------|---------------------|--------------------------------|----------------------|-------------------|-----------------|-------------------|
| | | | NO _x | PM _{2.5} | NO _x | PM _{2.5} |
| Residential | 36,936 | 5.5 | 0.39 | 0.032 | 49.0 | 4.0 |
| Retail | 16,680 | 7.2 | | | 35.8 | 2.9 |
| Office | 110 | 3.4 | | | 0.31 | 0.03 |
| Doctors' surgery | 19,998 | 7.2 | | | 56.2 | 4.6 |
| Community hall | 1,365 | 5.5 | | | 2.9 | 0.24 |
| Total | | | | | 144.2 | 11.8 |

Table A1.4 Calculation of development emissions (Example 1)

| Land use | Development trip rate | Average distance per trip (km) | Emissions (g/veh-km) | | Total Emissions | |
|------------------|-----------------------|--------------------------------|----------------------|-------------------|-----------------|-------------------|
| | | | NO _x | PM _{2.5} | NO _x | PM _{2.5} |
| Residential | 75,624 | 5.5 | 0.39 | 0.032 | 100.3 | 8.3 |
| Retail | 21,568 | 7.2 | | | 46.3 | 3.8 |
| Office | 1,250 | 3.4 | | | 3.5 | 0.3 |
| Doctors' surgery | 38,698 | 7.2 | | | 108.7 | 8.9 |
| Community hall | 3,450 | 5.5 | | | 7.4 | 0.6 |
| Total | | | | | 266.2 | 21.9 |

A1.1.11 The excess emissions are then multiplied by the relevant damage costs and multiplied over 30 years, with a 2 per cent annual uplift, to give the total offsetting payment of £751,391 (see 0).

Table A1.5 Calculation of offsetting payment (Example 1)

| | Benchmark | Total predicted emissions | Excess emissions | Damage cost | Annual offsetting amount |
|---------------------------------------|---|---------------------------|------------------|-------------|--------------------------|
| | (tonnes/annum) | | | (£/tonne) | (£) |
| Building NO _x emissions | 0.162 | 0.084 | 0 | N/A | N/A |
| Building PM _{2.5} emissions | 0 | 0 | 0 | N/A | N/A |
| Transport NO _x emissions | 0.144 | 0.266 | 0.122 | 58,967 | 7,193.97 |
| Transport PM _{2.5} emissions | 0.012 | 0.022 | 0.010 | 1,132,776 | 11,327.76 |
| Total annual offsetting amount | £18,521.73 | | | | |
| Total offsetting amount | $\{(\pounds 18,521.73) \times [(1+0.02)^{30}-1]\}/0.02 = \pounds 751,391$ | | | | |

A1.2 Example 2

A1.2.1 A mixed-use residential development in outer London for up to 9,271 m² of development, comprising:

- 112 residential dwellings, up to 7,688 m²
- Office, up to 1,583 m²
- Heating and hot water to be provided by individual boilers and air source heat pumps (ASHPs).

Building emissions

A1.2.2 Total NO_x emissions from the development were calculated from the generic emission rate for boilers of 40 mg/kWh, and a total annual gas usage of 500,000 kWh as provided by the energy and sustainability consultant.

$$40 \text{ mg/kWh} \times 500,000 \text{ kWh} = 20 \text{ kg}$$

A1.2.3 The total benchmarked building NO_x emission is calculated from the land use categories and the BEB for individual gas boilers (as the gas boilers do not form a network with the ASHPs), as shown in Table A1.6.

Table A1.6 Calculation of BEB (Example 2)

| Land use | GIA (m ²) | Benchmark emission rate (g/m ² /annum) | Total benchmark emissions (kg) |
|--------------|-----------------------|---|--------------------------------|
| Residential | 7,688 | 1.43 | 26.9 |
| Office | 1,583 | 3.5 | 2.3 |
| Total | | | 29.2 |

A1.2.4 The total building emissions (20 kg) are thus less than the total BEB (29.2 kg). The development is thus Air Quality Neutral in terms of building emissions.

Transport emissions

A1.2.5 The transport assessment for the development predicted that the development will generate a total of 113,100 car trips per annum, comprising trips relating to each of the following land use classes:

- Office: 18,200
- Residential: 94,900

A1.2.6 The TEB has been calculated as shown in Table A1.7.

Table A1.7 Calculation of TEB (Example 2)

| Land use | GIA (m ²) / No. dwellings | Benchmark trip rate | Total benchmark trip rate |
|--------------------|---------------------------------------|---------------------|---------------------------|
| Residential | 112 dwellings | 447 | 50,064 |
| Office | 1,583 | 16 | 25,328 |
| Total (TEB) | | | 75,392 |

A1.2.7 The total development trip rate is thus greater than the TEB. The development is thus not Air Quality Neutral in terms of transport emissions.

Entire development

A1.2.8 While the development was Air Quality Neutral in terms of building emissions, the total trip rate exceeded the TEB and thus mitigation of transport-related emissions would be required.

A1.3 Example 3

A1.3.1 A residential development in inner London for 38,753 m² of development, comprising:

- 428 residential dwellings, up to 38,478 m²
- Retail, up to 125 m²
- On-site gym, up to 150 m²
- Heating and hot water to be provided by air source heat pumps with an emergency diesel generator to be tested 12 hours per year.

Building emissions

A1.3.2 The development's heat demand will be met by ASHPs which have no heat-related NO_x emission, and no BEB is defined. The diesel generator will not be used for any purpose other than for routine testing and maintenance.

A1.3.3 The development is therefore Air Quality Neutral in terms of building emissions.

Transport emissions

A1.3.4 The transport assessment for the development predicted that the development will generate a total of 9,163 car trips per annum, comprising trips relating to each of the following land use classes:

- Retail: 4,015
- Residential: 5,148

A1.3.5 The on-site gym is not expected to generate any trips as it is for use by residents. The benchmark trip rate calculation should therefore not include trips relating to the gym floorspace.

A1.3.6 The TEB has been calculated as shown in Table A1.8.

Table A1.8 Calculation of TEB (Example 3)

| Land use | GIA (m ²) / No. dwellings | Benchmark trip rate | Total benchmark trip rate |
|--------------------|---------------------------------------|---------------------|---------------------------|
| Residential | 428 dwellings | 114 | 48,792 |
| Retail | 125 | 139 | 17,375 |
| Total (TEB) | | | 66,167 |

A1.3.7 The total development trip rate is thus less than the TEB. The development is therefore Air Quality Neutral in terms of transport emissions.

Entire development

A1.3.8 The predicted building and transport emissions are less than the BEB and the TEB. The development is therefore Air Quality Neutral and no further mitigation is required.

Appendix 2 Application to a Phased Energy Strategy

This appendix provides a worked example of how a large, phased development should be brought forward to ensure the development remains compliant with the Air Quality Neutral benchmarks.

- A2.1.1 An applicant is seeking permission for a 6-phase development, with Phases 1 and 2 set out as detailed proposals and Phases 3 – 6 in outline. A district heating network is proposed, with the energy centre to be built in Phase 3.
- A2.1.2 At the initial application stage, the Air Quality Neutral assessment should include:
- an assessment of all phases together (both detailed and indicative) to show that the whole scheme, once completed, is capable of meeting the Air Quality Neutral benchmarks; and
 - an assessment of the detailed proposals for Phases 1 and 2 based on the interim energy strategy (that is without the energy centre, as this is delivered in Phase 3).
- A2.1.3 If substantial changes are made to Phase 2 (after initial permission is granted) which are likely to change the building emissions, a revised assessment of the new detailed proposals should be made based on the new interim energy strategy.
- A2.1.4 When the detailed proposals for Phase 3 are brought forward, including the initial operational phase of the energy centre, the Air Quality Neutral assessment should include:
- an assessment of Phase 3, and Phases 1 and 2 if connected to the energy centre, as it will operate at the completion of Phase 3. This should show that Phases 1 – 3 are Air Quality Neutral upon connection to the energy centre.
- A2.1.5 If the design of the energy centre or the proposed quantum of development has changed since the outline application, the assessment of the full 6-phase development (including indicative plans for the remaining phases) should be reviewed to ensure the final development is still capable of meeting the benchmarks.
- A2.1.6 When the detailed proposals for Phases 4 – 6 are brought forward, each phase should be assessed following the principles set out in Section 3.4 on connecting to heat networks.
- A2.1.7 As well as ensuring that the aims of the policy are delivered, this approach should allow developers sufficient flexibility to evolve the energy strategy over time as technology changes or to address any significant changes in the development proposals.

