## CALCULATION PARAMETERS AND SETTINGS

Prediction calculations for turbine noise have been conducted in accordance with *ISO 9613: Acoustics – Attenuation of sound outdoors, Part 2: General method of calculation, 1996*. Guidance in terms of the calculation settings has been obtained from the Institute of Acoustics (IoA) Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise (IoA GPG) and its associated supplementary guidance notes. The following are the main aspects that have been considered in terms of the noise predictions presented in this instance.

*Directivity Factor*: The directivity factor (D) allows for an adjustment to be made where the sound radiated in the direction of interest is higher than that for which the sound power level is specified. In this case appropriate consideration is given to the issue of wind directivity as detailed in the relevant sections of this chapter.

*Ground Effect:* Ground effect is the result of sound reflected by the ground interfering with the sound propagating directly from source to receiver. The prediction of ground effects is inherently complex and depend on source height receiver height propagation height between the source and receiver and the ground conditions.

The ground conditions are described according to a variable defined as G, which varies between 0.0 for hard ground (including paving, ice concrete) and 1.0 for soft ground (includes ground covered by grass trees or other vegetation) Predictions have been carried out using a source height corresponding to the hub height of the proposed turbines, a receiver height of 4m and an assumed ground factor of G=0.5.

*Geometrical Divergence* This term relates to the spherical spreading in the free-field from a point sound source resulting in an attenuation depending on distance according to the following equation:

$$A_{geo} = 20 \times \log(d) + 11$$

where d = distance from the source

A wind turbine may be considered as a point source beyond a distance corresponding to one rotor diameter.

## CALCULATION PARAMETERS AND SETTINGS (Continued)

*Atmospheric Adsorption*

Sound propagation through the atmosphere is attenuated by the conversion of the sound energy into heat. This attenuation is dependent on the temperature and relative humidity of the air through which the sound is travelling and is frequency dependent with increasing attenuation towards higher frequencies.

In these predictions, a temperature of 10°C and a relative humidity of 70% have been used, which give relativity low levels of atmosphere attenuation and corresponding worst case noise predictions.

*Barrier Attenuation*

The effect of any barrier between the noise source and the receiver position is that noise will be reduced according to the relative heights of the source, receiver and barrier and the frequency spectrum of the noise. The barrier attenuations predicted by the ISO9613 model have been shown to be significantly greater than that measured in practice under down wind conditions. For this study, topographic screening effects of the terrain as predicted by the ISO 9613-2 model have been limited to no more than 2 dB in accordance with the IoA GPG Guidance.

Turbine coordinates (ING) for other wind farms included in the calculations are presented in the following Tables.

*Turbine coordinates assumed for Cloosh Wind Farm*

| Ref. | Co-ordinates | | Ref. | Co-ordinates | |
|---|---|---|---|---|---|
| | Easting | Northing | | Easting | Northing |
| TC32 | 109,070 | 234,151 | TC44 | 107,675 | 234,558 |
| TC33 | 109,506 | 234,047 | TC45 | 107,656 | 233,648 |
| TC34 | 109,991 | 233,840 | TC46 | 107,566 | 232,558 |
| TC35 | 109,465 | 233,512 | TC47 | 107,671 | 231,895 |
| TC37 | 109,337 | 233,048 | TC48 | 107,758 | 231,423 |
| TC38 | 109,199 | 232,578 | TC49 | 107,185 | 231,994 |
| TC39 | 109,357 | 232,259 | TC50 | 106,917 | 232,316 |
| TC41 | 108,371 | 233,661 | TC51 | 106,704 | 232,696 |
| TC42 | 108,476 | 234,058 | TC52 | 107,195 | 231,508 |
| TC43 | 107,892 | 234,237 | TC53 | 107,282 | 231,018 |

*Turbine coordinates assumed for Letterpeak Wind Farm*

| Ref. | Co-ordinates | | Ref. | Co-ordinates | |
|---|---|---|---|---|---|
| | Easting | Northing | | Easting | Northing |
| TLK1 | 114,585 | 227,849 | TLK5 | 114,511 | 226,428 |
| TLK2 | 114,679 | 227,522 | TLK6 | 114,874 | 226,360 |
| TLK3 | 114,556 | 227,118 | TLK7 | 114,759 | 225,985 |
| TLK4 | 114,750 | 226,789 | -- | -- | -- |

*Turbine coordinates assumed for Uggool Wind Farm*

| Ref. | Co-ordinates | | Ref. | Co-ordinates | |
|---|---|---|---|---|---|
| | Easting | Northing | | Easting | Northing |
| TU54 | 110,785 | 235,652 | TU62 | 110,290 | 236,917 |
| TU55 | 110,934 | 236,015 | TU63 | 110,898 | 236,988 |
| TU56 | 110,310 | 235,551 | TU64 | 111,215 | 237,260 |
| TU57 | 110,306 | 235,993 | TU65 | 111,981 | 235,481 |
| TU58 | 110,601 | 236,283 | TU66 | 111,921 | 235,849 |
| TU59 | 110,343 | 236,583 | TU67 | 111,699 | 236,230 |
| TU60 | 110,005 | 236,235 | TU68 | 111,645 | 236,584 |
| TU61 | 110,857 | 236,647 | TU69 | 111,517 | 236,900 |

*Turbine coordinates assumed for Seecon Wind Farm*

| Ref. | Co-ordinates | | Ref. | Co-ordinates | |
|---|---|---|---|---|---|
| | Easting | Northing | | Easting | Northing |
| TS10 | 108,127 | 238,783 | TS18 | 108,666 | 236,789 |
| TS11 | 107,836 | 239,126 | TS21 | 107,805 | 236,865 |
| TS12 | 108,721 | 237,673 | TS22 | 107,406 | 237,093 |
| TS13 | 108,981 | 237,286 | TS23 | 107,935 | 237,321 |
| TS14 | 109,128 | 236,828 | TS24 | 108,354 | 237,051 |
| TS15 | 109,218 | 236,355 | TS25 | 106,775 | 236,532 |
| TS16 | 109,782 | 236,710 | TS26 | 106,454 | 236,813 |
| TS17 | 109,419 | 235,958 | TS29 | 105,927 | 235,701 |

*Turbine coordinates assumed for Lettercraffroe Wind Farm*

| Ref. | Co-ordinates | | Ref. | Co-ordinates | |
|---|---|---|---|---|---|
| | Easting | Northing | | Easting | Northing |
| TLE1 | 107,314 | 237,632 | TLE5 | 107,691 | 237,747 |
| TLE2 | 107,035 | 237,754 | TLE6 | 107,718 | 238,056 |
| TLE3 | 107,413 | 237,969 | TLE7 | 108,065 | 238,014 |
| TLE4 | 107,533 | 238,428 | TLE8 | 107,951 | 238,446 |

*Turbine coordinates assumed for Knockalough Wind Farm*

| Ref. | Co-ordinates | | Ref. | Co-ordinates | |
|---|---|---|---|---|---|
| | Easting | Northing | | Easting | Northing |
| TKL10 | 115,312 | 229,721 | TKL2 | 117,208 | 228,909 |
| TKL9 | 115,349 | 229,178 | TKL3 | 116,780 | 228,758 |
| TKL6 | 116,056 | 229,430 | TKL1 | 117,140 | 228,455 |
| TKL8 | 115,501 | 228,707 | TKL4 | 116,521 | 229,240 |
| TKL11 | 115,698 | 229,965 | TKL5 | 116,234 | 228,958 |
| TKL7 | 115,803 | 229,077 | -- | -- | -- |

*Turbine coordinates assumed for Knockranny Wind Farm*

| Ref. | Co-ordinates | | Ref. | Co-ordinates | |
|---|---|---|---|---|---|
| | Easting | Northing | | Easting | Northing |
| TK5 | 115,393 | 234,011 | TK1 | 116,169 | 233,639 |
| TK6 | 115,225 | 233,539 | TK2 | 116,087 | 233,951 |
| TK7 | 114,904 | 233,335 | TK3 | 115,669 | 233,651 |
| TK9 | 115,121 | 234,440 | TK8 | 116,137 | 234,503 |
| TK11 | 114,938 | 233,841 | TK13 | 115,896 | 234,259 |
| TK14 | 114,834 | 234,198 | -- | -- | -- |

*Turbine coordinates assumed for Cloosh Extension Wind Farm*

| Ref. | Co-ordinates | | Ref. | Co-ordinates | |
|---|---|---|---|---|---|
| | Easting | Northing | | Easting | Northing |
| TCE9 | 108,378 | 238,292 | TCE30 | 107,367 | 235,661 |
| TCE19 | 108,689 | 236,327 | TCE31 | 107,890 | 235,550 |
| TCE20 | 108,037 | 236,602 | TCE36 | 109,884 | 233,334 |
| TCE27 | 107,123 | 236,244 | TCE40 | 108,381 | 233,310 |
| TCE28 | 106,191 | 236,180 | -- | -- | -- |