



Contractor



Forth Crossing Bridge Constructors

HOCHTIEF Solutions
American Bridge International
DRAGADOS
Morrison Construction

Project **FORTH REPLACEMENT CROSSING**

Document title

**CONSTRUCTION NOISE MONITORING REPORT:
JANUARY 2013**

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1 Introduction

- 1.1** Monitoring of construction noise is being undertaken by FCBC during the construction of the new Forth Crossing and the associated road network. This report covers the month of January 2013. The objective of this report is to detail the monitoring that has been undertaken across the site during this period and to present the construction noise monitoring results acquired for January 2013.
- 1.2** Monitoring of construction noise has been undertaken in accordance with the Code of Construction Practice (CoCP) and the Noise and Vibration Management Plan (NVMP).

2 Noise Monitoring Locations

- 2.1** During January 2013, construction noise was monitored using permanent, continuous noise monitoring devices at the locations listed in Table 1. The majority of the monitors were installed throughout November and December 2011, with additional monitors installed at Scotstoun Park (Arup's Office) and Newton during February 2012 and a further sound level meter installed at Whinny Hill during March 2012.
- 2.2** At some monitoring locations, the noise monitoring devices are accompanied by associated weather stations. Weather stations are present at Echline Field, Tigh-Na-Grian, Clufflat Brae, Dundas Home Farm, Butlaw Fisheries, Linn Mill and Whinny Hill.
- 2.3** Various construction works were undertaken across the site during January 2013. The main construction activities undertaken in the locality of each of the noise meters during the period have been listed in Table 1.

Table 1: Monitoring Locations

| Ref. | Monitoring Location | Crossing or Network | Main Construction Activities During January 2013 |
|------|---------------------|--|--|
| M1 | Whinny Hill | Network | Breaking of rock Loading of rock Drilling and blast 13 N.B. No evening, night time or Sunday daytime construction in vicinity. |
| M3 | Tigh-Na-Grian | Crossing | On-going works at Central Tower North Tower caisson excavation North Tower jet grouting Installation of Pier N1 cofferdam |
| M6 | Port Edgar | Crossing | On-going works at Central Tower South Tower jet grouting Pier S1 caisson excavation Pier S4 excavation Installation of Pier S5 cofferdam Pier S6 Piling and excavation works |
| M7 | Butlaw Fisheries | Crossing | On-going works at Central Tower South Tower jet grouting Pier S1 caisson excavation Pier S4 excavation Installation of Pier S5 cofferdam Pier S6 Piling and excavation works Installation of rebar & concrete pour at Pier S7 Grit blasting at Pier S8 |
| M10 | Inchgarvie Lodge | Crossing | On-going works at Central Tower South Tower jet grouting Pier S1 caisson excavation Pier S4 excavation Installation of Pier S5 cofferdam Pier S6 Piling and excavation works Grit blasting at Pier S8 Installation of rebar & concrete pour at Pier S7 Break out rock from launch Works at South Abutment including concrete pour |
| M11 | Linn Mill | Network (close proximity to Crossing) | Break out rock from launch Works at South Abutment including concrete pour |
| M13 | Clufflat Brae | Network (close proximity to Crossing) | Break out rock from launch Works at South Abutment including concrete pour |

| | | | |
|-----|------------------|---------|--|
| M14 | Springfield | Network | Break out rock from launch Generate rock at Queensferry gyratory N.B. No evening, night time or Sunday daytime construction in vicinity. |
| M15 | Echline Field | Network | Generate rock at Queensferry gyratory Backfill of A904 verges Hedge removal at U221 N.B. No evening, night time or Sunday daytime construction in vicinity. |
| M16 | Scotstoun | Network | Drainage works N.B. No evening, night time or Sunday daytime construction in vicinity. |
| M17 | Dundas Home Farm | Network | Utilities works Export of rock to Dundas Badger fence installation N.B. No evening, night time or Sunday daytime construction in vicinity. |
| M18 | Newton | Network | No works |

3 Noise Monitoring Results

3.1 All noise monitoring results for construction days have been presented in charts using the template provided in the Construction Noise Monitoring Information Note, as available on the project website (http://www.transportscotland.gov.uk/files/documents/projects/forth-replacement/FRC_Construction_Noise_Monitoring_Information_Note_2_.pdf). All charts can be found in the appendices of this report.

3.2 With regard to the noise monitoring results charts, the following should be noted:

- All locations are considered as either 'Main Crossing' or 'Network Connections', as set out in Table 1. Main Crossing works are undertaken during the day, evening and night time periods. Network connection works, however, are undertaken during the daytime only. The inclusion of data in the graphs reflects this. Although Linn Mill and Clufflat Brae are considered as network locations, the potential for marine works near the south shore to be heard has been recognised. As a result, evening and night time data has been included for these locations although no network connection construction activities have been undertaken during these periods.

- Noise data for days, evening and nights on which no construction works were conducted have been excluded from the monthly average results presented in the graph. Additionally, no investigations into the L_{AFmax} exceedances during these periods have been made as they would have been caused by non-construction related factors. However, noise results (L_{Aeq} and L_{AFmax}) for any days, evenings and nights on which no construction works have been conducted have been presented in the graphs in greyed out areas. At the start of January, no works were undertaken due to the Christmas break; marine works restarted on 4 January 2012, with networks works restarting on 7 January 2013.
 - An average for Sunday construction noise data has been included on the graphs where applicable; in locations where no Sunday works have been undertaken no average is shown.
 - As set out in the CoCP, the assessment time for evening, nights and Sunday daytime is 1 hour periods. To present the construction noise results for these periods, therefore, the maximum L_{AFmax} (fast time response) and maximum L_{Aeq} within the overall evening/night time period has been taken. It should be noted, therefore, that the average shown for these periods is an average of only the highest L_{Aeq} results.
 - Where noise data is missing for days, evening or nights during which construction works were conducted, this has been indicated. Some device errors were encountered in January resulting in loss of data for short periods at the following locations: Butlaw Fisheries, Clufflat Brae, and Tigh-Na-Grian at the beginning of the month during the Christmas period, and also at Linn Mill on a one of occurrence. Due to an error associated with the download of data from the Scotstoun meter, a single day of data is also missing from this location.
- 3.3** Results demonstrate that the monthly average total construction noise results for daytime were within the threshold limits for all monitoring locations for January 2013, with the exception of Scotstoun. For the evening period, the monthly average total construction noise results were within the threshold for all locations throughout January 2013. For night-time, results show exceedances of the threshold at Butlaw Fisheries, Clufflat Brae and Linn Mill, with all other monitoring locations within the threshold.
- 3.4** With regard to the Sunday averages (for applicable monitoring locations), exceedances of the threshold were noted for the Sunday daytime average at Butlaw Fisheries, and also for the Sunday night time average at the following locations: Butlaw Fisheries, Clufflat Brae, Inchgarvie, Linn Mill and Tigh-Na-Grian. All other locations were found to be within the Sunday average threshold for all periods.

- 3.5** The exceedances of the monthly average and the Sunday average thresholds at each of the monitoring locations, with the exception of Scotstoun, can be attributed to increased noise levels due to adverse weather conditions during January. For Butlaw, waves on the shore also exacerbated these noise levels. Furthermore, it should be noted that the averages for both night time and Sunday daytime periods are based only on the highest L_{Aeq} levels for 1 hour periods which can affect the averages.
- 3.6** The exceedance of the daytime average at Scotstoun is due to increased background noise levels due to the location of the meter directly adjacent to the road. Traffic noise at this location is further increased during periods of wet weather.
- 3.7** During January 2013, some exceedances of the maximum noise thresholds also occurred. Each exceedance of the threshold was investigated using triggered audio recordings, records of construction works (i.e. site programmes and diaries, daily marine reports and dredging reports) and analysis of weather station data, where required. A Noise and Vibration Investigative Report (NVIR) spread sheet has been produced detailing the results of the investigation for each exceedance. Where the exceedances are due to construction works, a detailed NVIR has been completed which details the results of the investigation in addition to any additional mitigation measures required.
- 3.8** Investigations of the exceedances of the maximum noise level thresholds show the majority to have occurred as a result of non-construction related noise. Spells of adverse weather conditions during January were found to result in a large number of exceedances, with increased exceedances at Butlaw Fisheries during such conditions due to the noise associated with waves on the shore. Additionally, birds and other animals, local noises at nearby properties and monitor maintenance were also found to be contributing factors to maximum noise level exceedances. At some locations, notably Scotstoun and Echline, existing traffic noise had an effect on maximum noise levels during the period covered in this report.
- 3.9** Where an exceedance due to construction works was identified, the works were investigated as soon as practicably reasonable and a detailed NVIR was completed, within which any additional mitigation measures were recognised.
- 3.10** The daytime L_{AFmax} threshold was exceeded on six occasions due to works related with the viaducts. All of the exceedances were found to be attributable to works associated with the Pier S6, with one related to the construction of the earthbund at Port Edgar Barracks, with the piling works found to have caused five of the exceedances.

- 3.11** Marine works were found to be attributable for a total of five exceedances. Three exceedances were recorded at Tigh-Na-Grian, with a single exceedance associated with the placement of the Pier N1 cofferdam unit and two exceedances found to be caused by works at the North Tower caisson. Works at the Pier S1 caisson were also found to be the cause of two night time exceedances at Butlaw Fisheries during January.
- 3.12** All construction related exceedances have been investigated and mitigation measures have been implemented where possible; the relevant NVIRs provide more detail with regard to these exceedances.
- 3.13** A summary of the findings for exceedances occurring at each of the locations can be found in Table 2. All construction related exceedances are detailed in Table 3; further information on related remedial actions is detailed in the relevant NVIR.

Table 2: Summary of Exceedances at Monitoring Locations

| Monitoring Location | Summary of Exceedance Details |
|---------------------|---|
| Butlaw Fisheries | During January the maximum noise threshold was exceeded on 41 occasions (daytime, 13; evening, 6; night time, 22). Six daytime exceedances were found to be due to works at Pier S6, with 2 night time exceedances due to works at Pier S1 caisson. However, a large number of exceedances were attributed to a range of non-construction factors, notably waves on the shore and wind. |
| Clufflat Brae | During January the maximum noise threshold was exceeded on 26 occasions (daytime, 8; evening, 5; night time, 13). No exceedances were attributable to construction works. Exceedances were found to be largely due to adverse weather conditions. |
| Inchgarvie Lodge | During January the maximum noise threshold was exceeded on 29 occasions (daytime, 12; evening, 3; night time, 13). No exceedances were found to be due to construction works. However, investigations found movements at the property, wind, planes and birds to be the main contributing factors to the exceedances at this location. |
| Linn Mill | During January the maximum noise threshold was exceeded on 29 occasions (daytime, 9; evening, 6; night time, 14). No exceedances were due to construction works; the majority of exceedances were caused by adverse weather conditions. |
| Tigh-Na-Grian | During January the maximum noise threshold was exceeded on 19 occasions (daytime, 5; evening, 1; night time, 13). Three night time exceedances was found to be due to construction works; one was caused by the placement of the Pier N1 cofferdam, with two caused by works at the North Tower caisson. However, other exceedances were also due to non-construction factors including birds, wind and planes. |
| Dundas Home Farm | During January the maximum noise threshold was exceeded on 7 occasions. Exceedances were not attributable to construction works. Exceedances were due to monitor maintenance, crow bangers and wind. |
| Echline | During January the maximum noise threshold was exceeded on 20 occasions. No exceedances at this location were due to construction activities. Exceedances were largely attributed to vehicles passing by on the adjacent roads. |
| Springfield | During January the maximum noise threshold was exceeded on 13 occasions. No exceedances at this location were due to construction activities. The majority of non-construction related exceedances were due to local residents, dogs and birds. |
| Scotstoun | During January the maximum noise threshold was exceeded on 21 occasions. Exceedances were attributed to vehicles passing by on the adjacent road. |

| | |
|-------------|--|
| Whinny Hill | During January the maximum noise threshold was exceeded on 10 occasions. Exceedances were not due to construction activities. A range of factors were found to cause exceedances at this location, including wind, quarry works and planes passing over. |
|-------------|--|

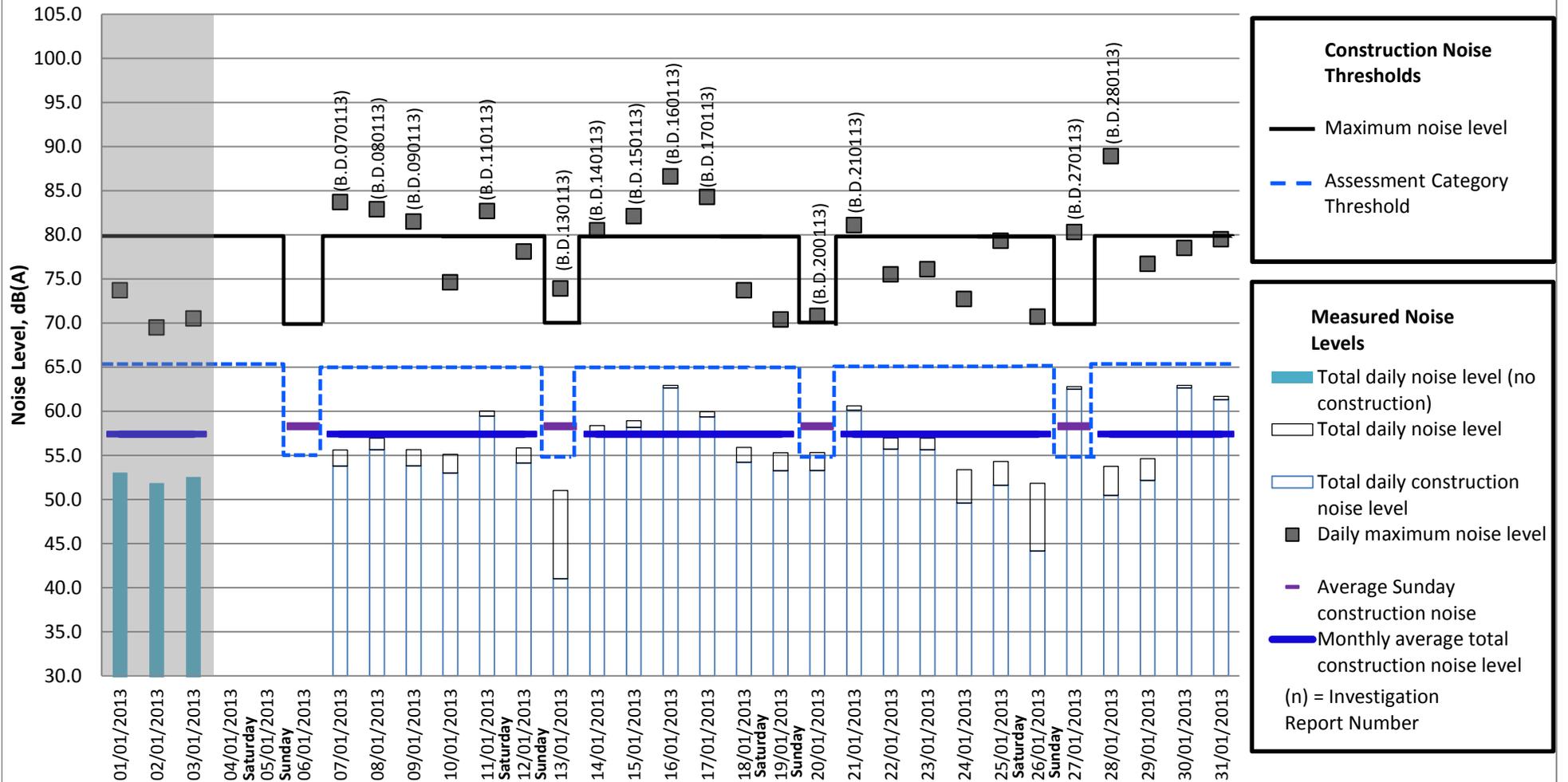
Table 3: Summary of Construction Exceedances at Monitoring Locations

| Monitor | Date | Period | Description | NVIR No. |
|------------------|----------|--------|--------------------------------|--------------------------|
| Butlaw Fisheries | 07/01/13 | Day | Pier S6 earthbund construction | B.D.070113 |
| | 11/01/13 | | Pier S6 Piling works | B.D.110113 |
| | 14/01/13 | | | B.D.140113 |
| | 15/01/13 | | | B.D.150113 |
| | 16/01/13 | | | B.D.160113 |
| | 17/01/13 | | | B.D.170113 |
| | 16/01/13 | Night | | Works at Pier S1 caisson |
| | 22/01/13 | | B.N.220113 | |
| Tigh-Na-Grian | 08/01/13 | Night | Works at North caisson | T.N.080113 |
| | 10/01/13 | | | T.N.100113 |
| | 13/01/13 | | Placement of Pier N1 cofferdam | T.N.130113 |

APPENDIX A

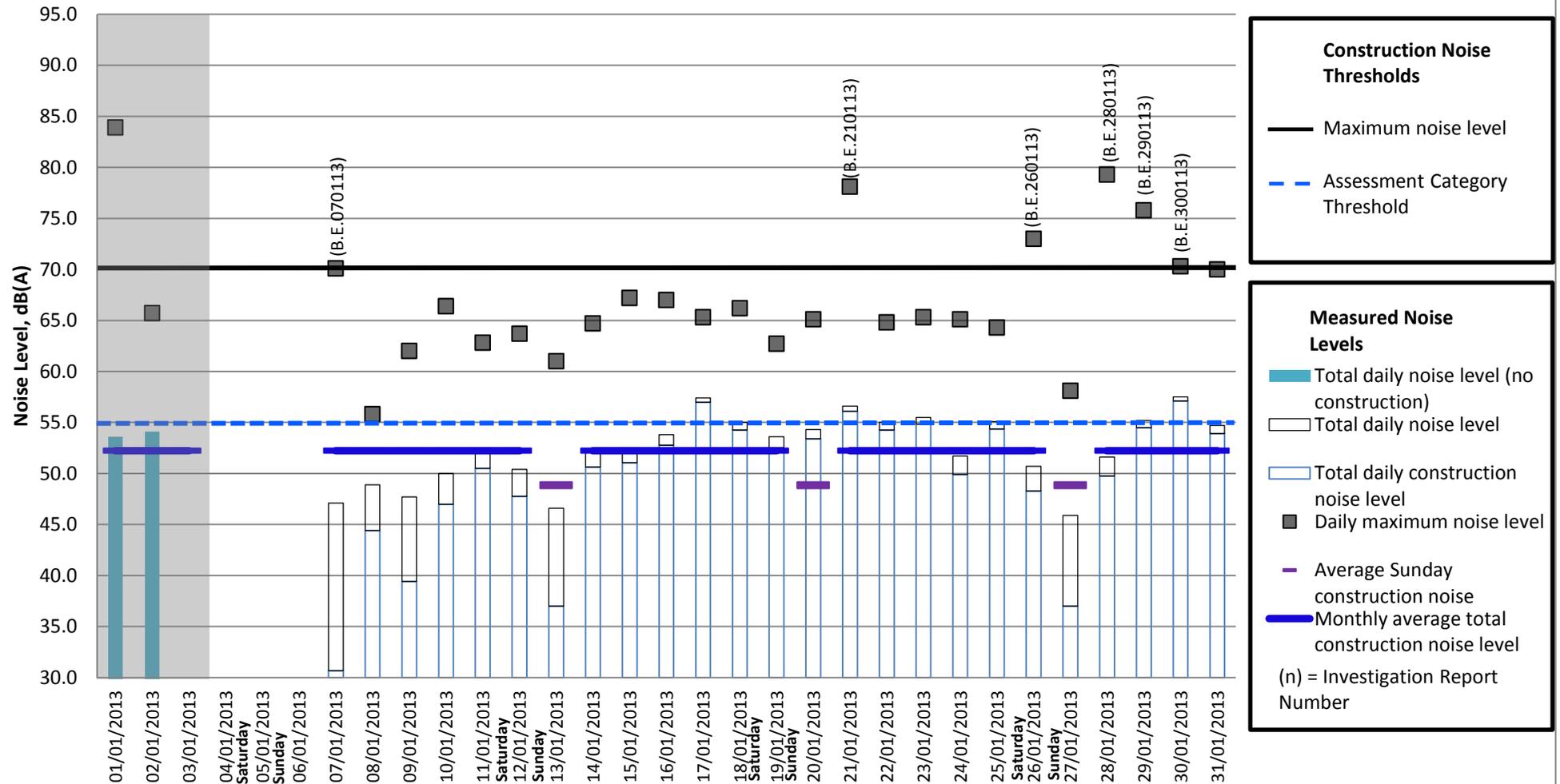
Measured Daytime Noise Levels at Butlaw Fisheries

Measurement period: January 2013



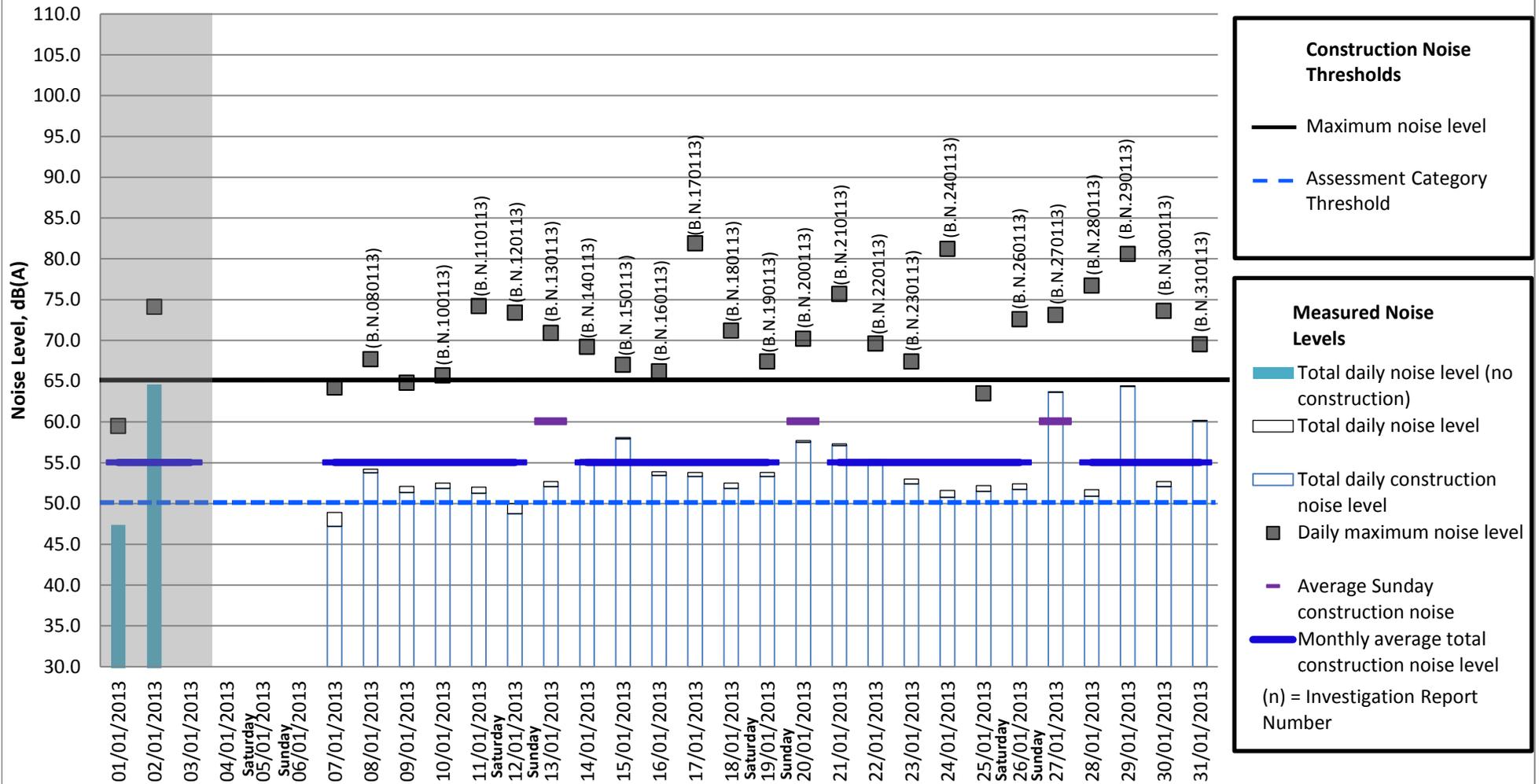
Note: The grey areas of the chart represent the days on which no construction works were undertaken; no works were conducted over the Christmas period - Marine: 21/12/12 to 03/01/13, Networks: 21/01/13 to 07/01/13. Data is missing for 04/01/13 to 06/01/13 due to device error.

Measured Evening Noise Levels at Butlaw Fisheries Measurement period: January 2013



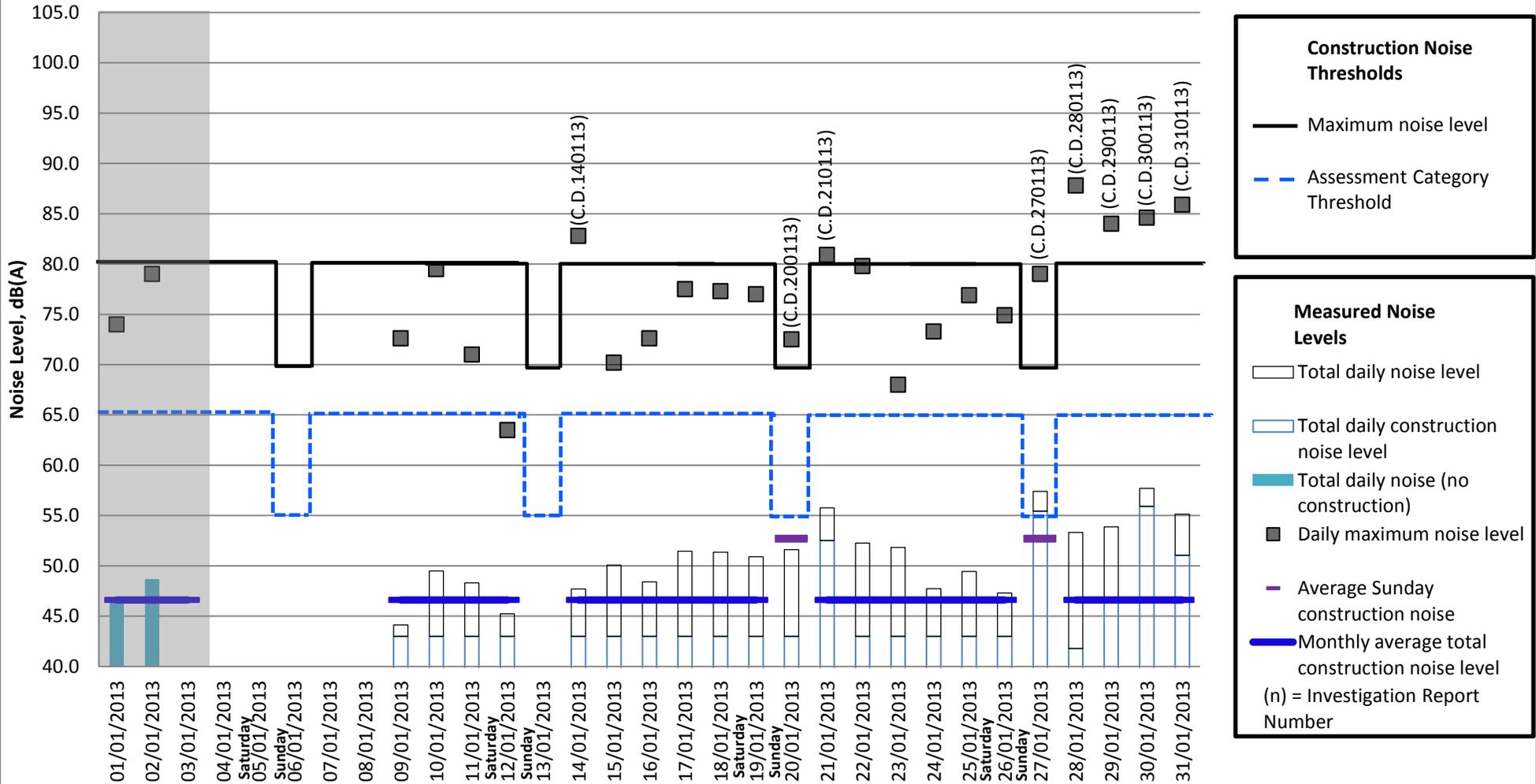
Note: The grey areas of the chart represent the evenings on which no construction works were undertaken; no works were conducted over the Christmas period - Marine: 21/12/12 to 03/01/13, Networks: 21/01/13 to 07/01/13. Data is missing for 03/01/13 to 06/01/13 due to device error.

Measured Night time Noise Levels at Butlaw Fisheries Measurement period: January 2013



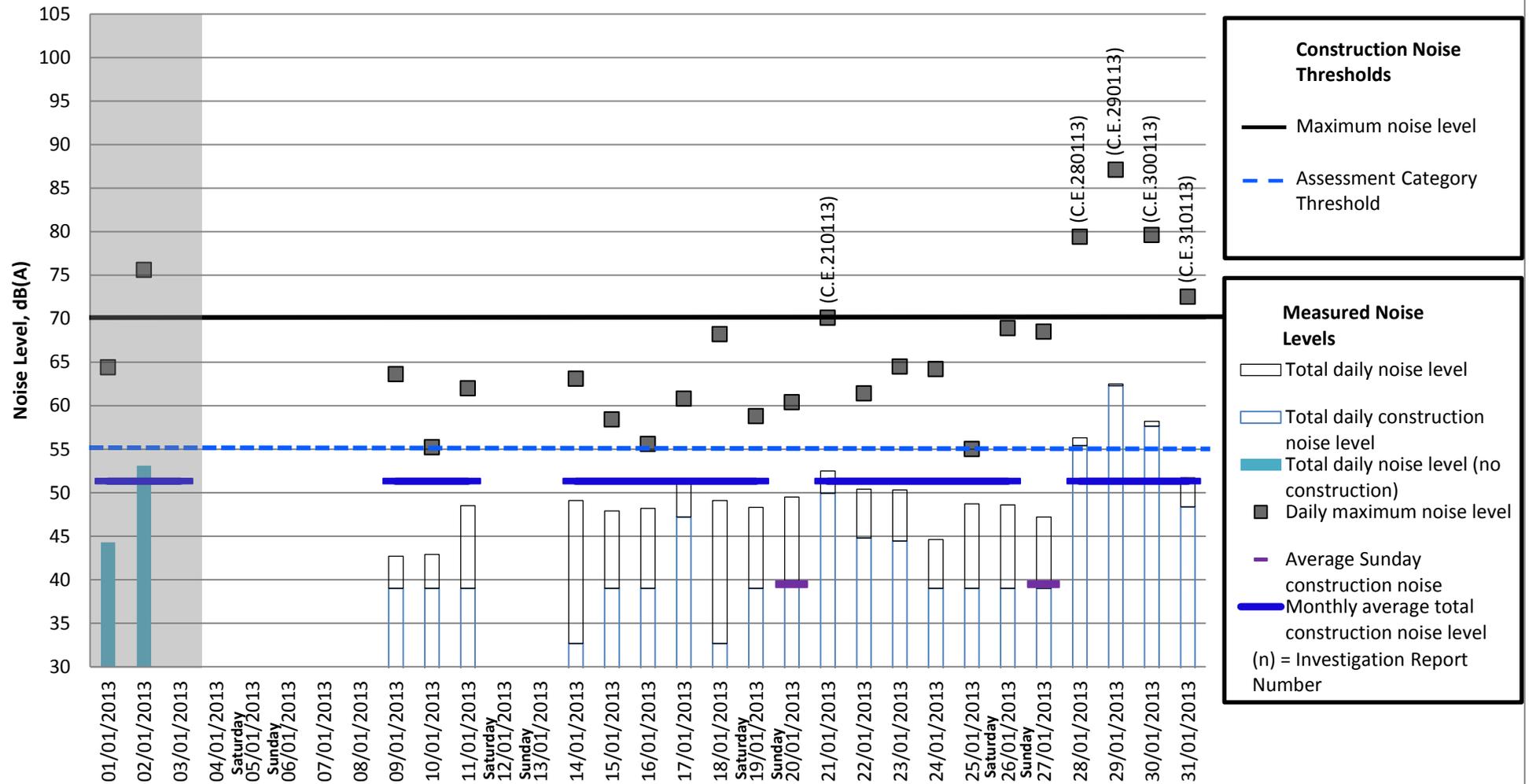
Note: The grey areas of the chart represent the nights on which no construction works were undertaken; no works were conducted over the Christmas period - Marine: 21/12/12 to 03/01/13, Networks: 21/01/13 to 07/01/13. Data is missing for 03/01/13 to 06/01/13 due to device error.

Measured Daytime Noise Levels at Clufflat Brae Measurement period: January 2013



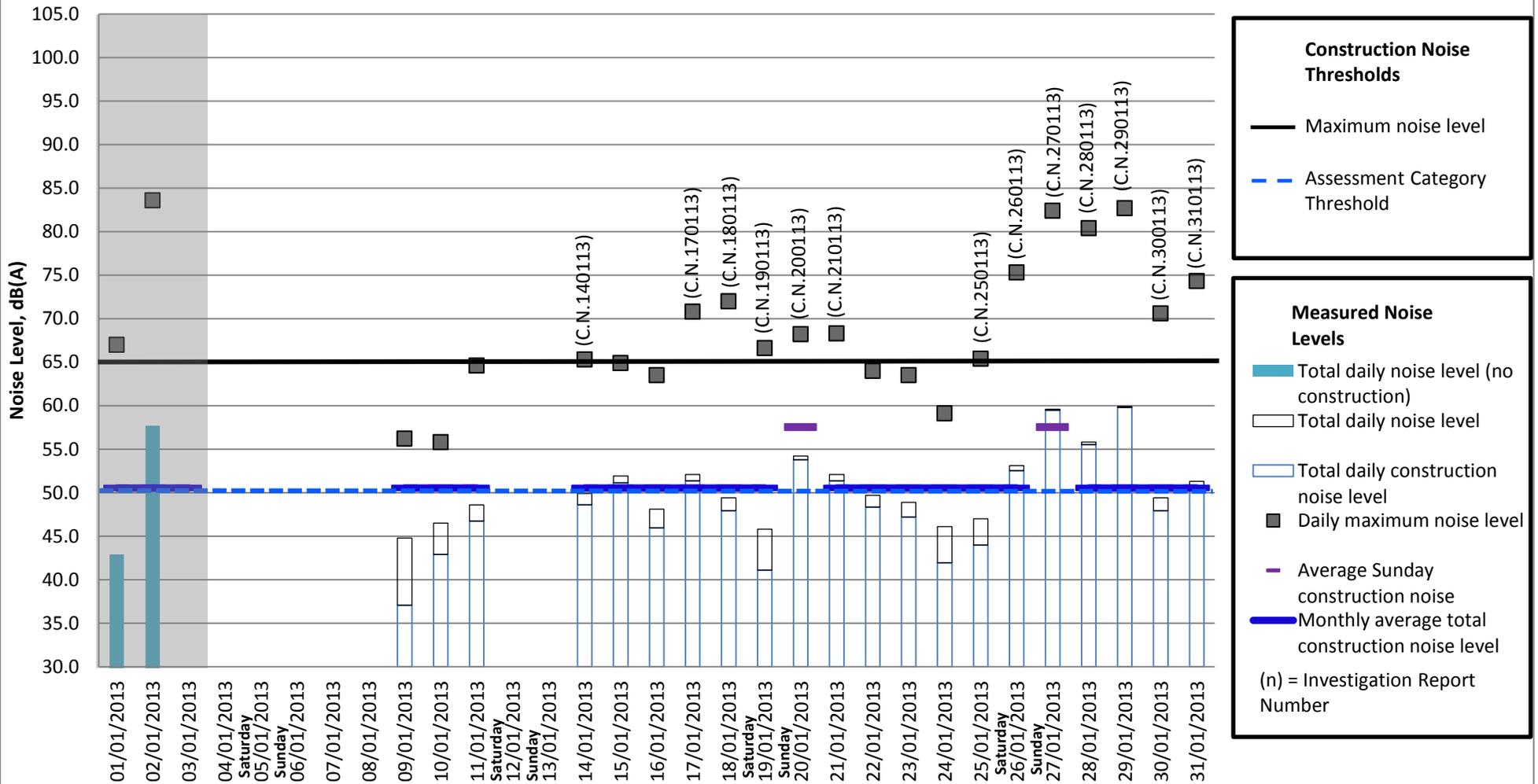
Note: The grey areas of the chart represent days on which no construction works were undertaken; no works were conducted over the Christmas period - Marine: 21/12/12 to 03/01/13, Networks: 21/12/12 to 07/01/13. Data is missing for 03/01/13 to 08/01/13 and on 13/01/13 due to device error.

Measured Evening Noise Levels at Clufflat Brae Measurement period: January 2013



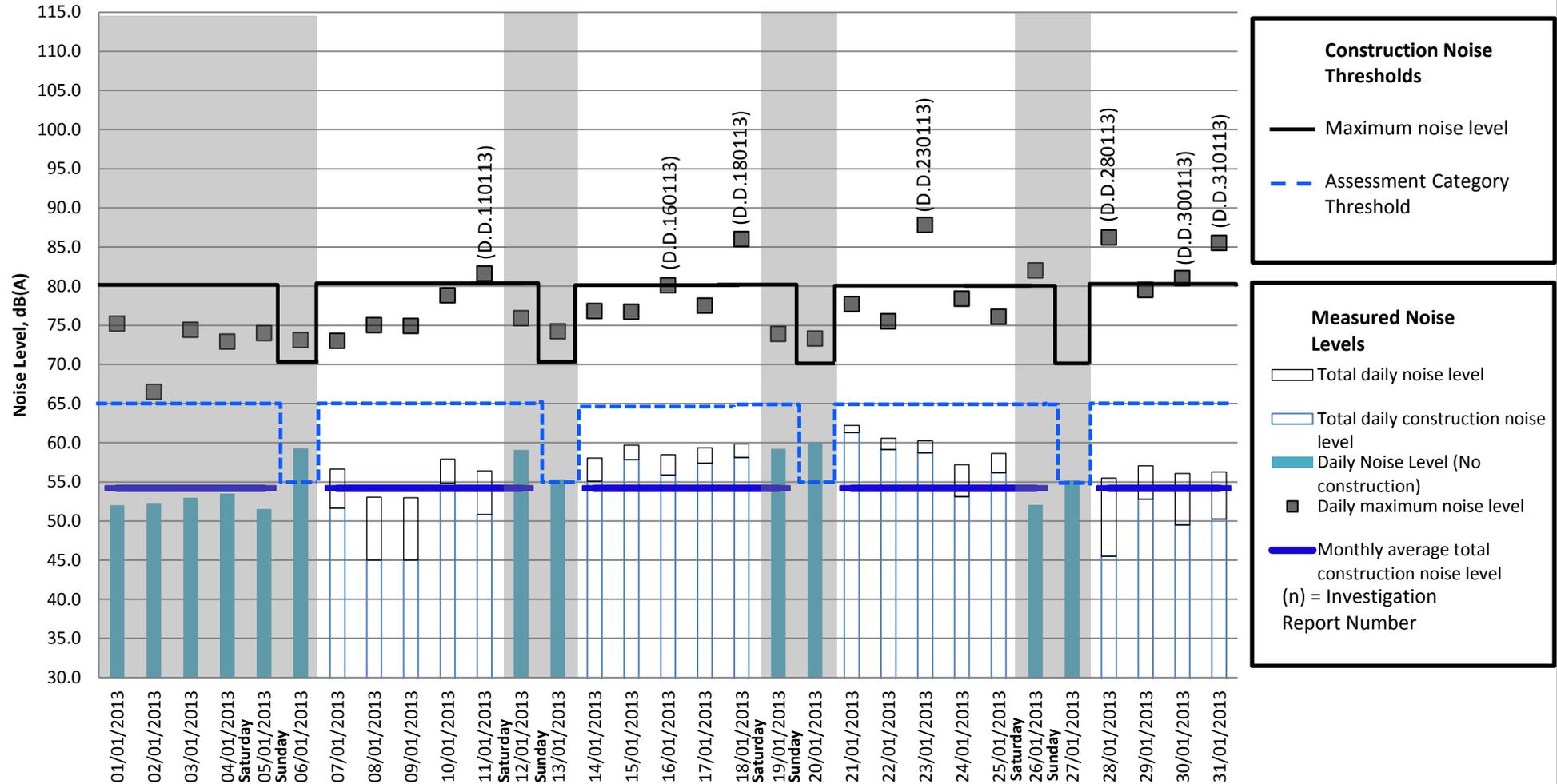
Note: The grey areas of the chart represent the evenings on which no works were undertaken; no works were conducted over the Christmas period - Marine: 21/12/12 to 03/01/13, Networks: 21/12/12 to 07/01/13. Data is missing for 03/01/13 to 08/01/13 and 12/01/13 to 13/01/13 due to device error.

Measured Night-time Noise Levels at Clufflat Brae Measurement period: January 2013



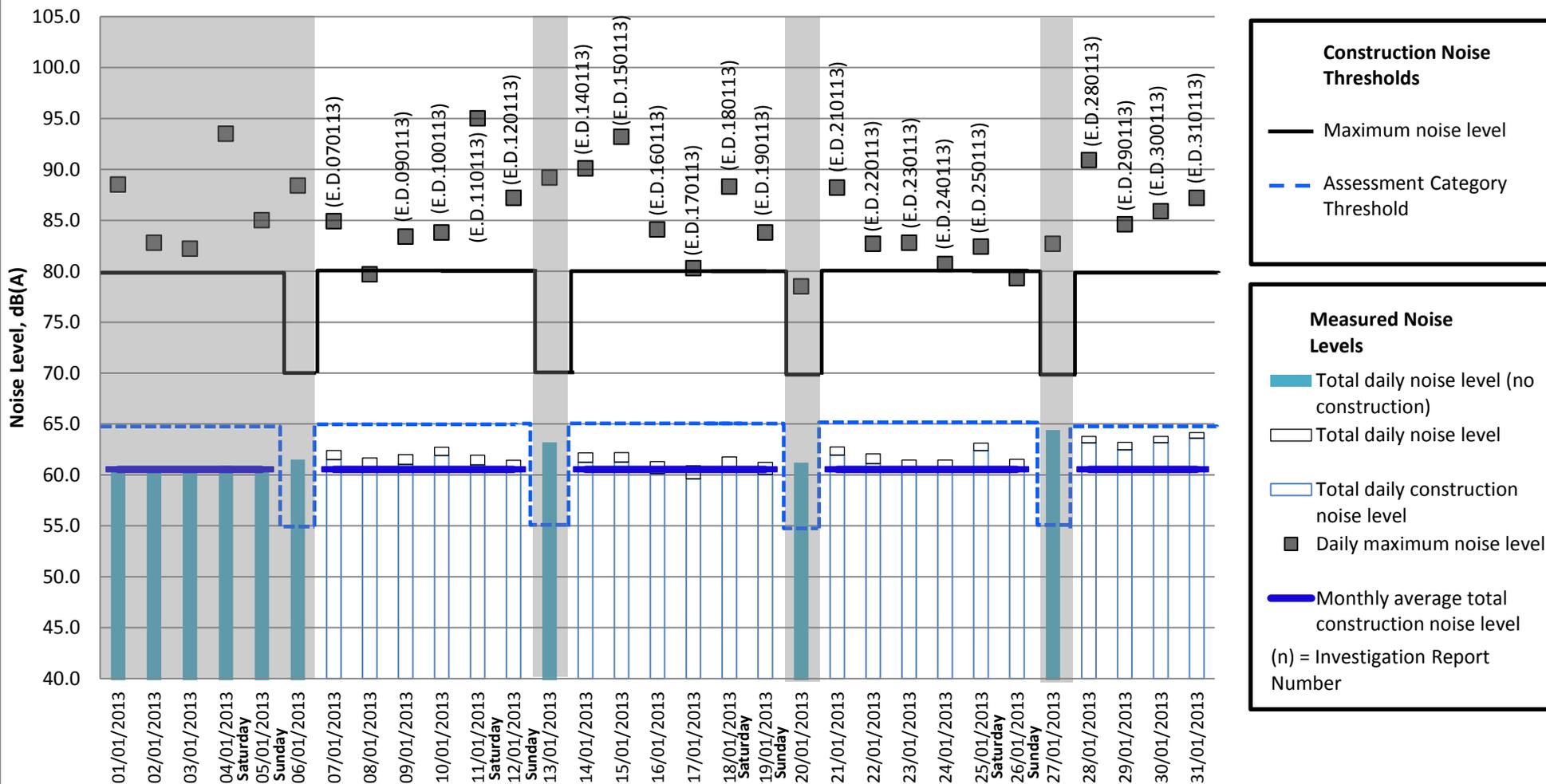
Note: The grey areas of the chart represent the nights on which no construction works were undertaken; no works were conducted over the Christmas period - Marine: 21/12/12 to 03/01/13, Networks: 21/01/13 to 07/01/13. Data is missing for 03/01/13 to 08/01/13 and 12/01/13 to 13/01/13 due to device error.

Measured Daytime Noise Levels at Dundas Home Farm Measurement period: January 2013



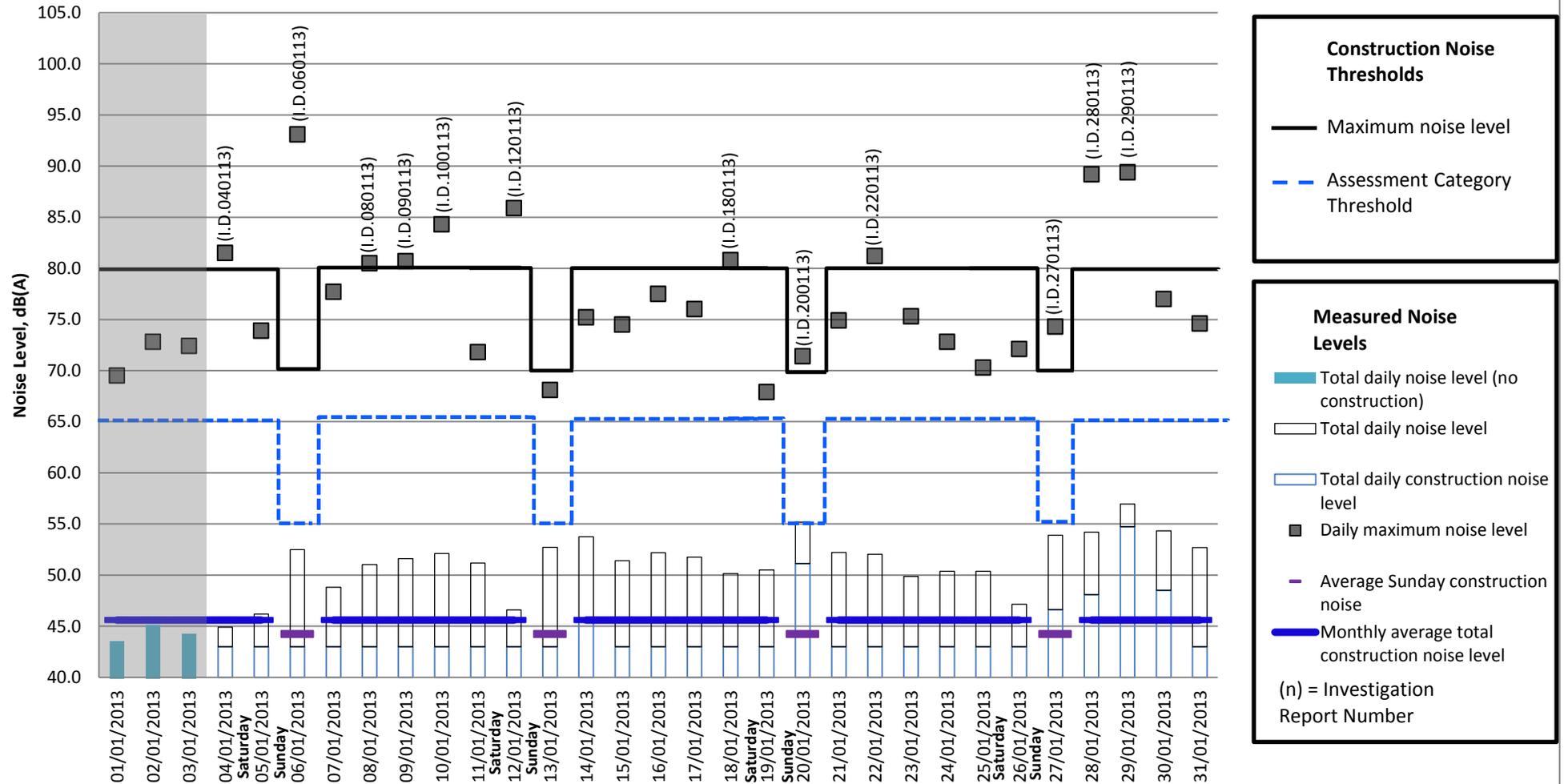
Note: The grey areas of the chart represent days on which no construction works have been conducted. The monthly average construction noise for Sunday has not been included as no Sunday works have been conducted at this location. Lmax data is missing on 27/01/13 due to device error.

Measured Daytime Noise Levels at Echline Field Measurement period: January 2013



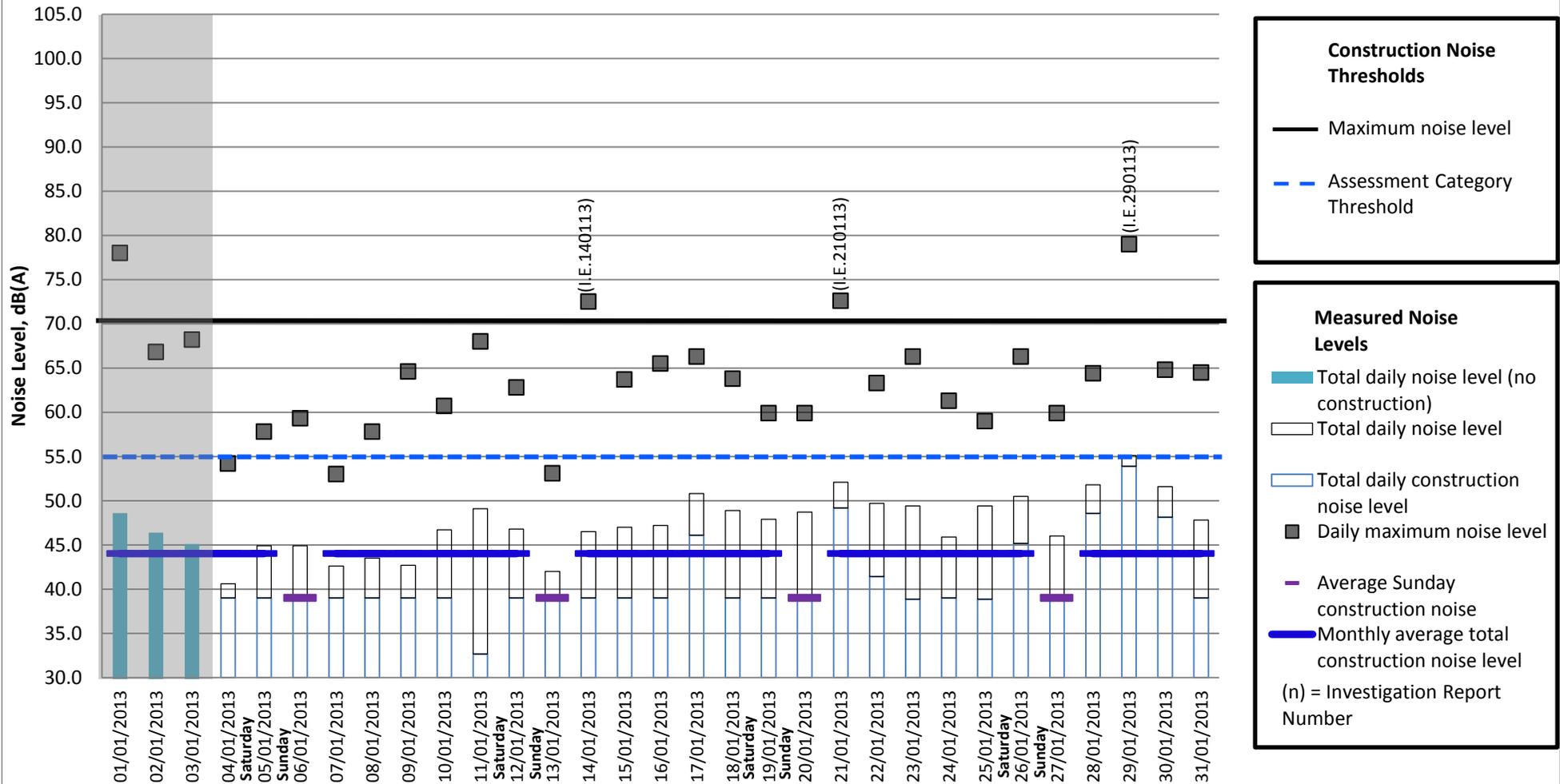
Note: The grey areas of the chart represent days on which no construction works have been conducted. A Sunday average has not been included on the graph as no Sunday works have been undertaken at this location.

Measured Daytime Noise Levels at Inchgarvie Measurement period: January 2013



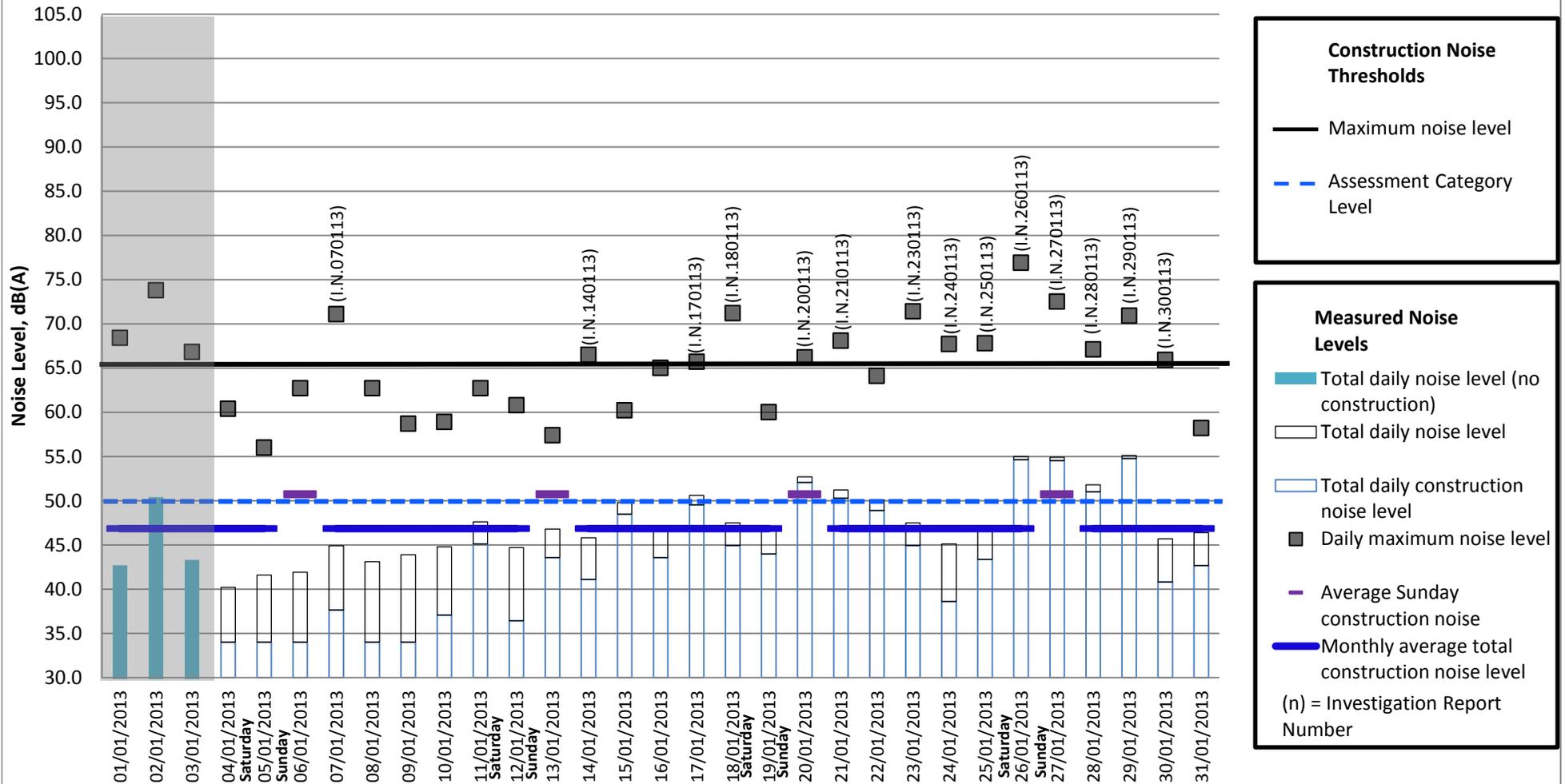
Note: The grey areas of the chart represent days on which no construction works have been conducted; no works were conducted over the Christmas period - Marine: 21/12/12 to 03/01/13, Networks: 21/01/13 to 07/01/13.

Measured Evening Noise Levels at Inchgarvie Measurement period: January 2013



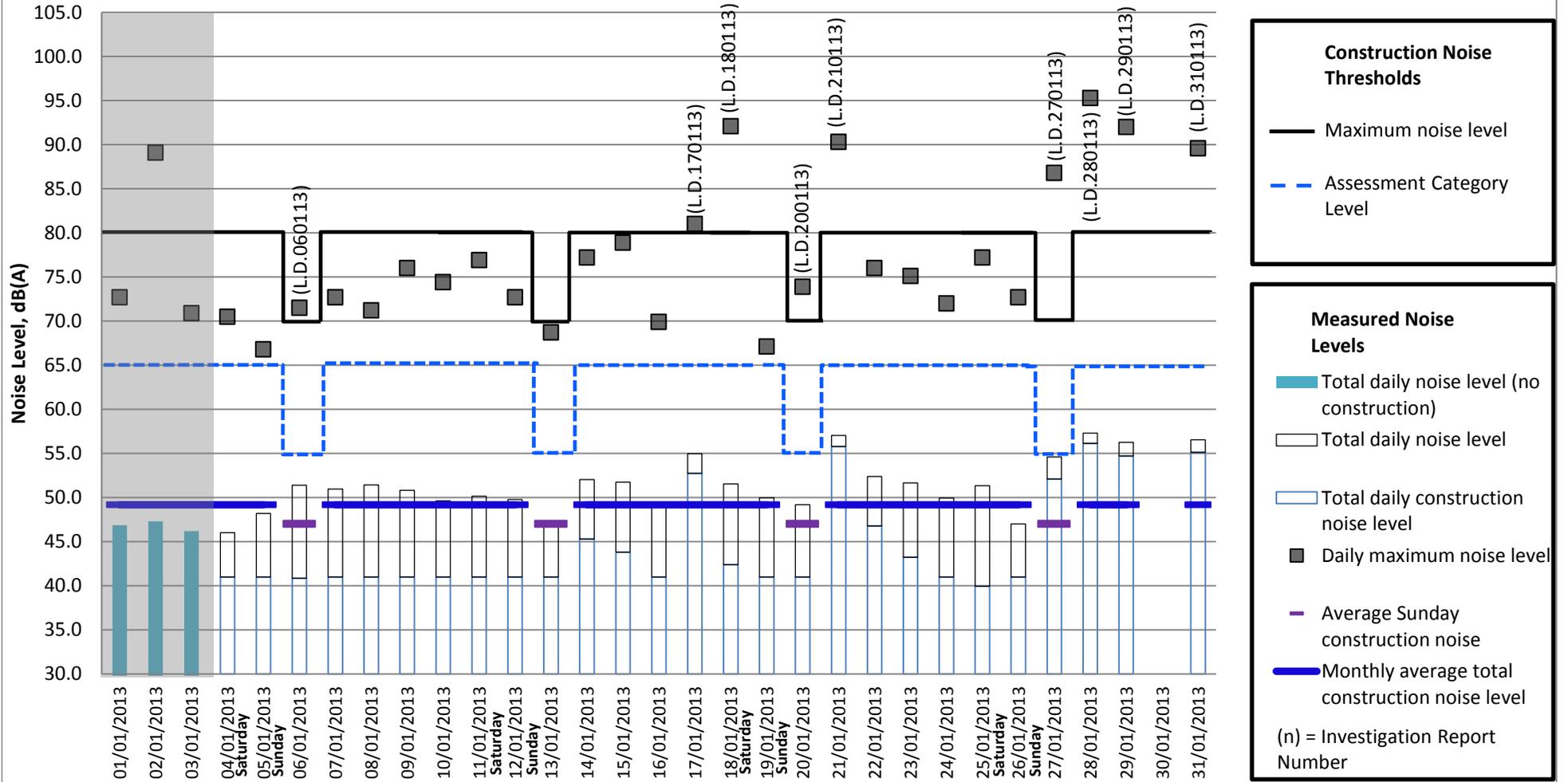
Note: The grey areas of the chart represent evenings on which no construction works have been conducted; no works were conducted over the Christmas period - Marine: 21/12/12 to 03/01/13, Networks: 21/01/13 to 07/01/13.

Measured Night-time Noise Levels at Inchgarvie Measurement period: January 2013



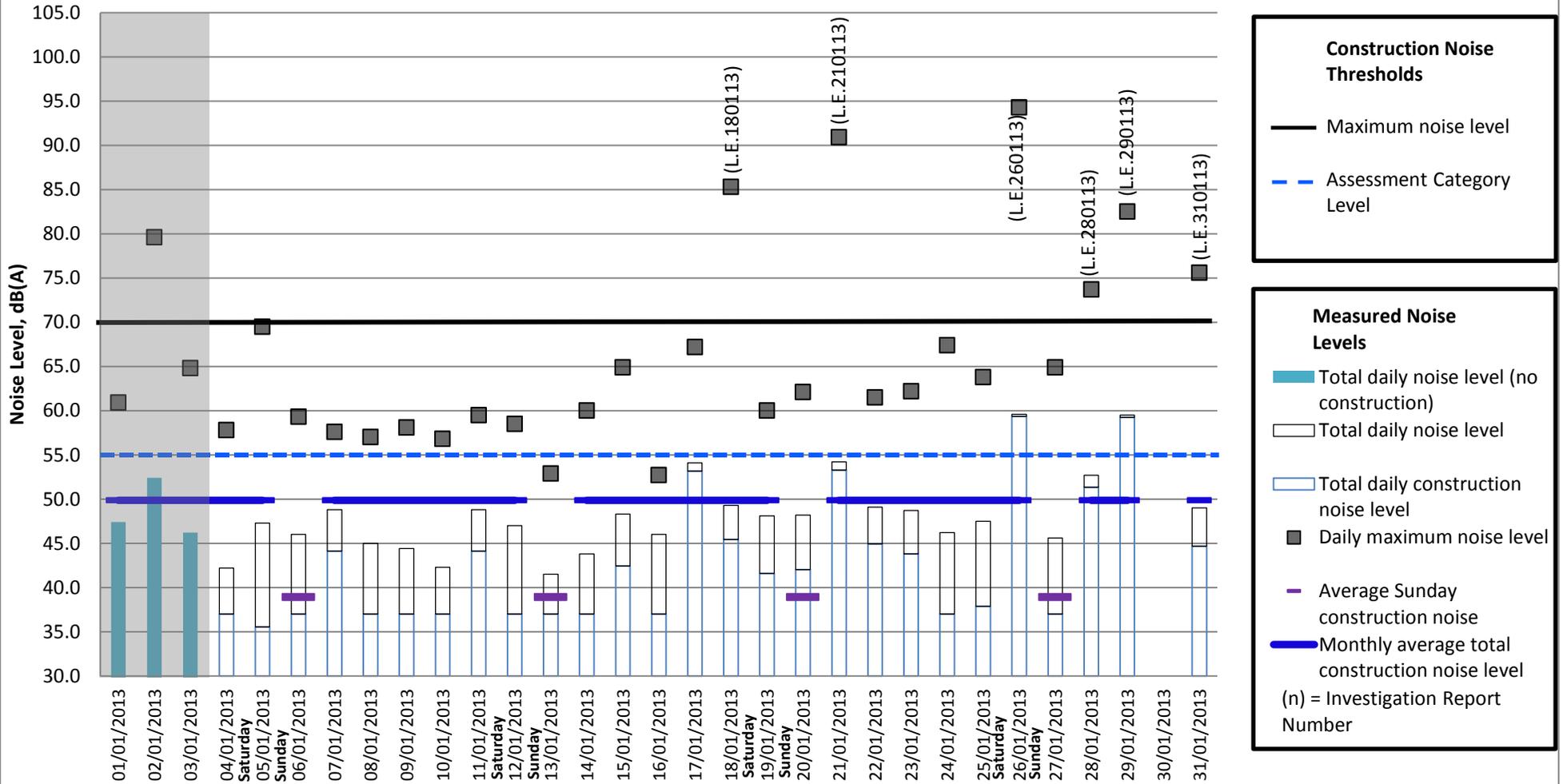
Note: The grey areas of the chart represent nights on which no construction works have been conducted; no works were conducted over the Christmas period - Marine: 21/12/12 to 03/01/13, Networks: 21/01/13 to 07/01/13.

Measured Daytime Noise levels at Linn Mill Measurement period: January 2013



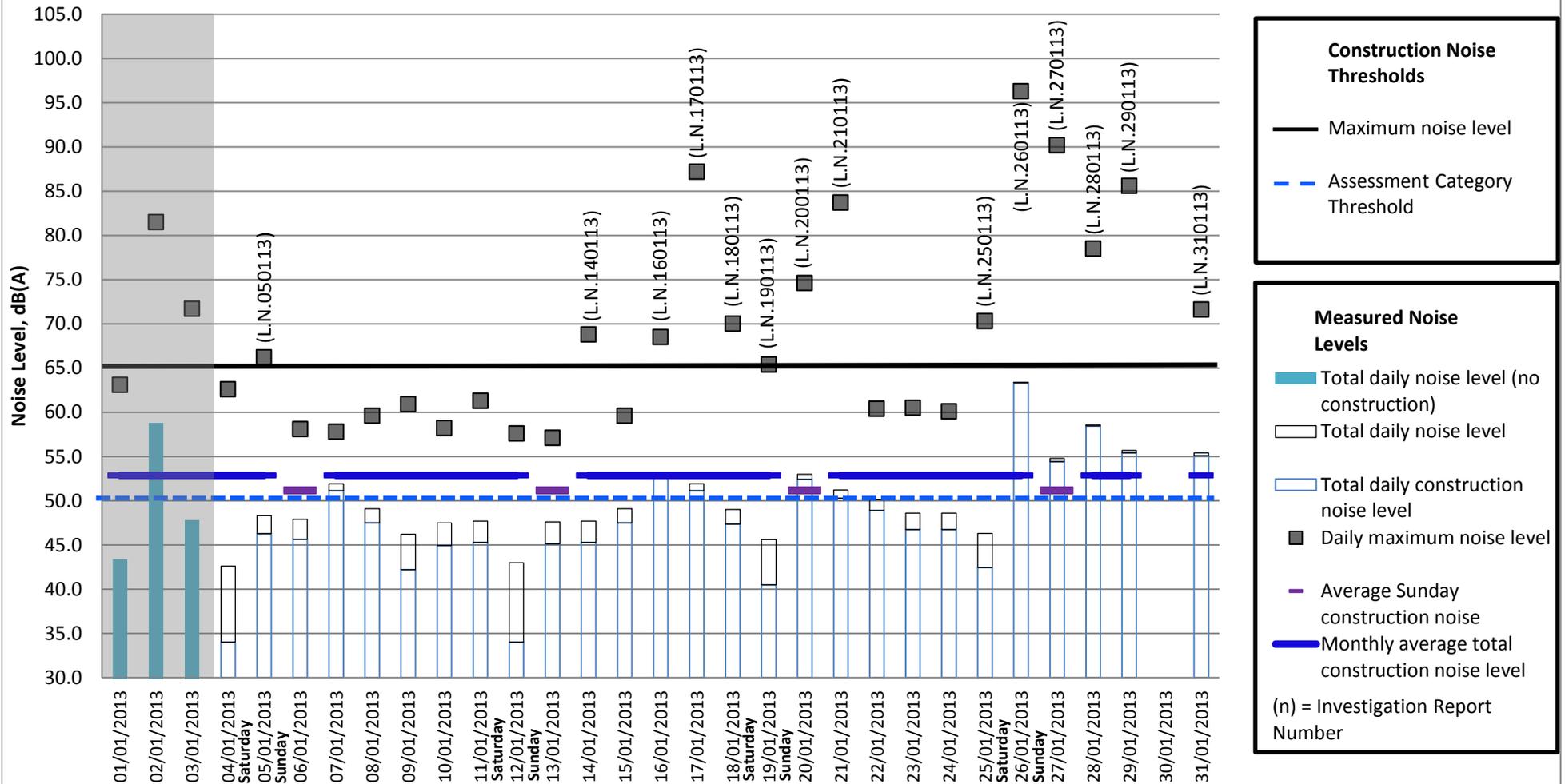
Note: The grey areas of the chart represent days on which no construction works have been conducted; no works were conducted over the Christmas period - Marine: 21/12/12 to 03/01/13, Networks: 21/01/13 to 07/01/13. Data is missing for 30/01/13 due to a device error.

Measured Evening Noise Levels at Linn Mill Measurement period: January 2013



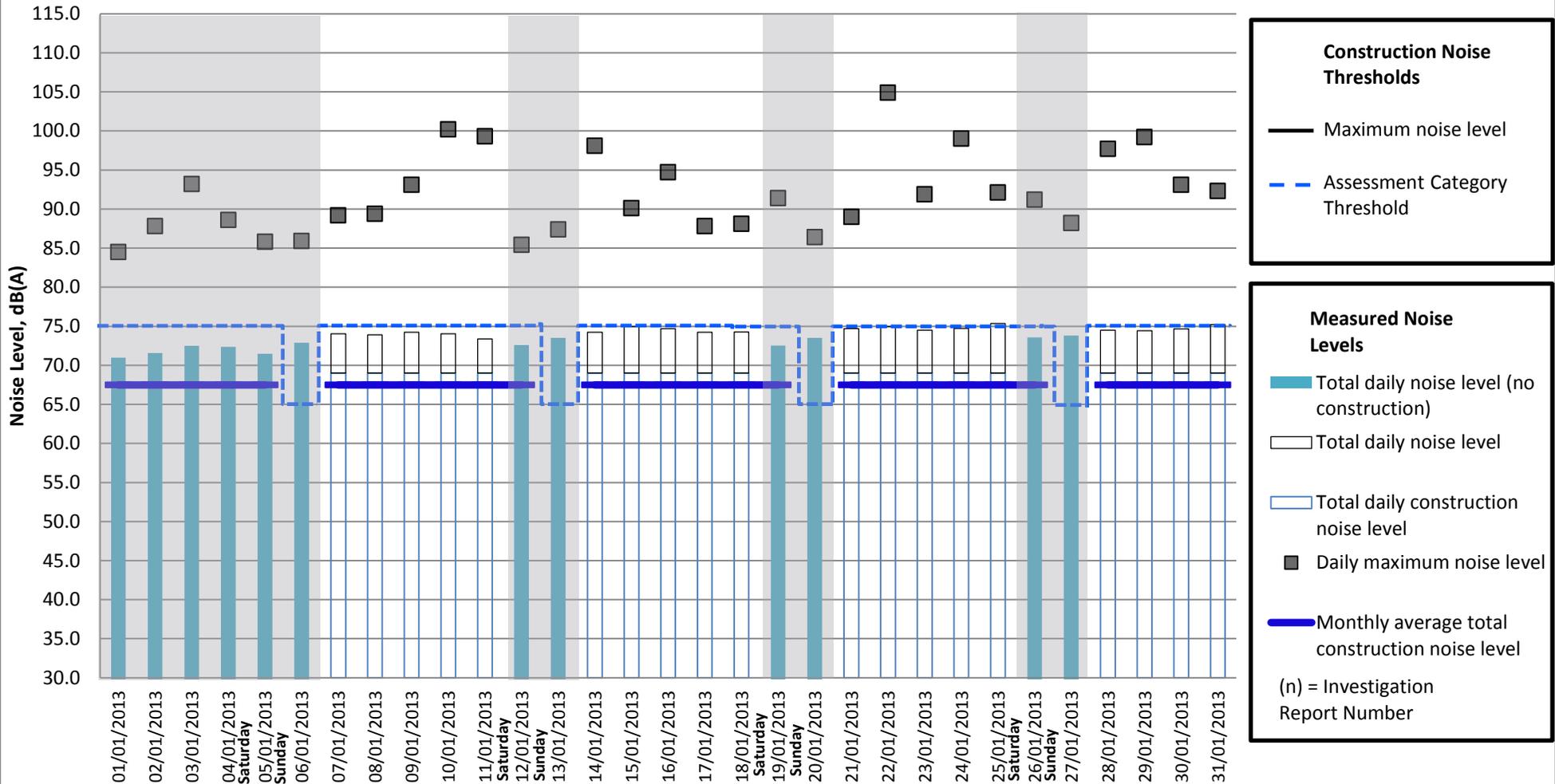
Note: The grey areas of the chart represent evenings on which no construction works have been conducted; no works were conducted over the Christmas period - Marine: 21/12/12 to 03/01/13, Networks: 21/01/13 to 07/01/13. Data is missing for 30/01/13 due to a device error.

Measured Night-time Noise Levels at Linn Mill Measurement period: January 2013



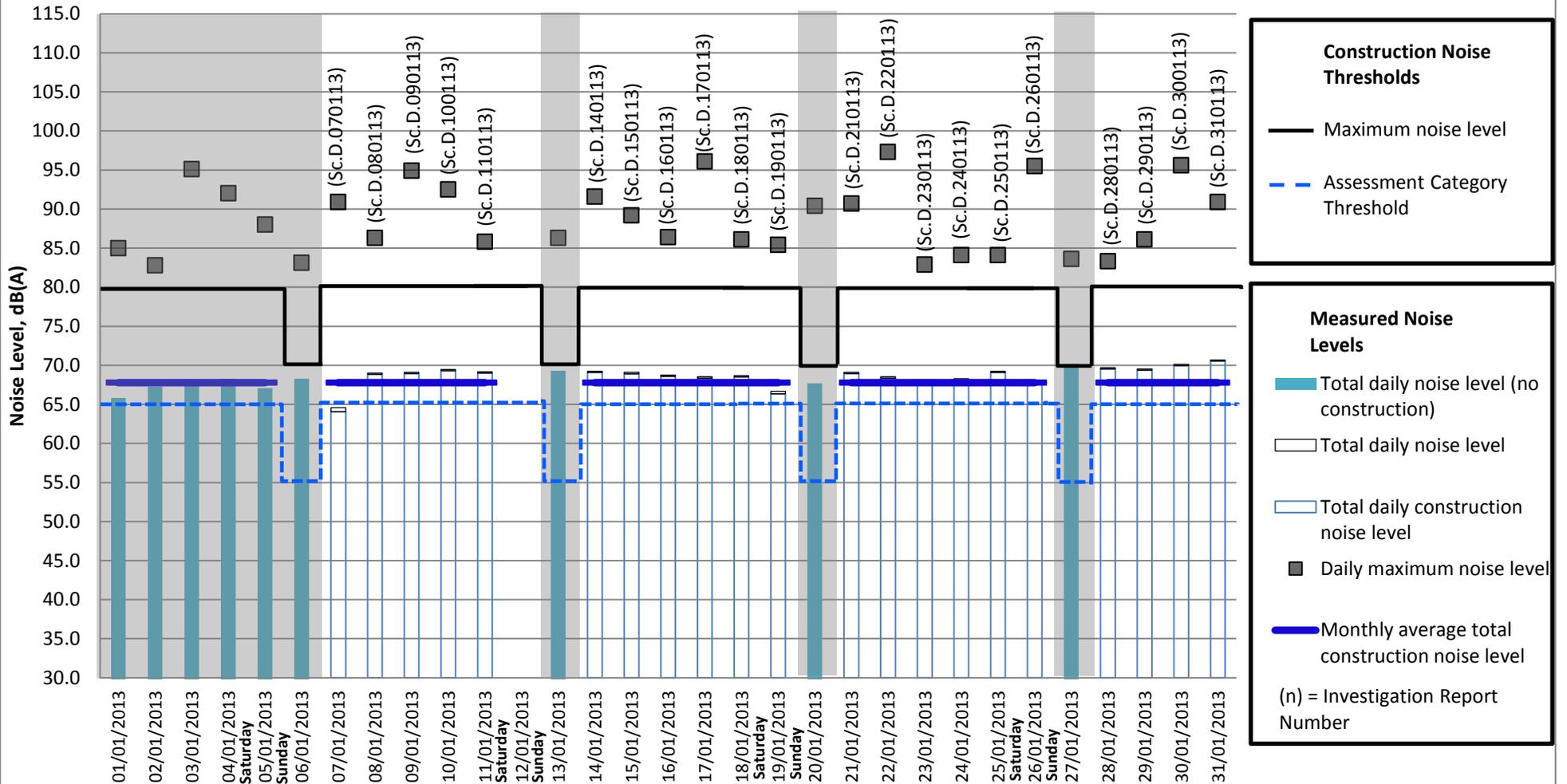
Note: The grey areas of the chart represent nights on which no construction works have been conducted; no works were conducted over the Christmas period - Marine: 21/12/12 to 03/01/13, Networks: 21/01/13 to 07/01/13. Data is missing for 30/01/13 due to a devicer error.

Measured Daytime Noise Levels at Newton Measurement period: January 2013



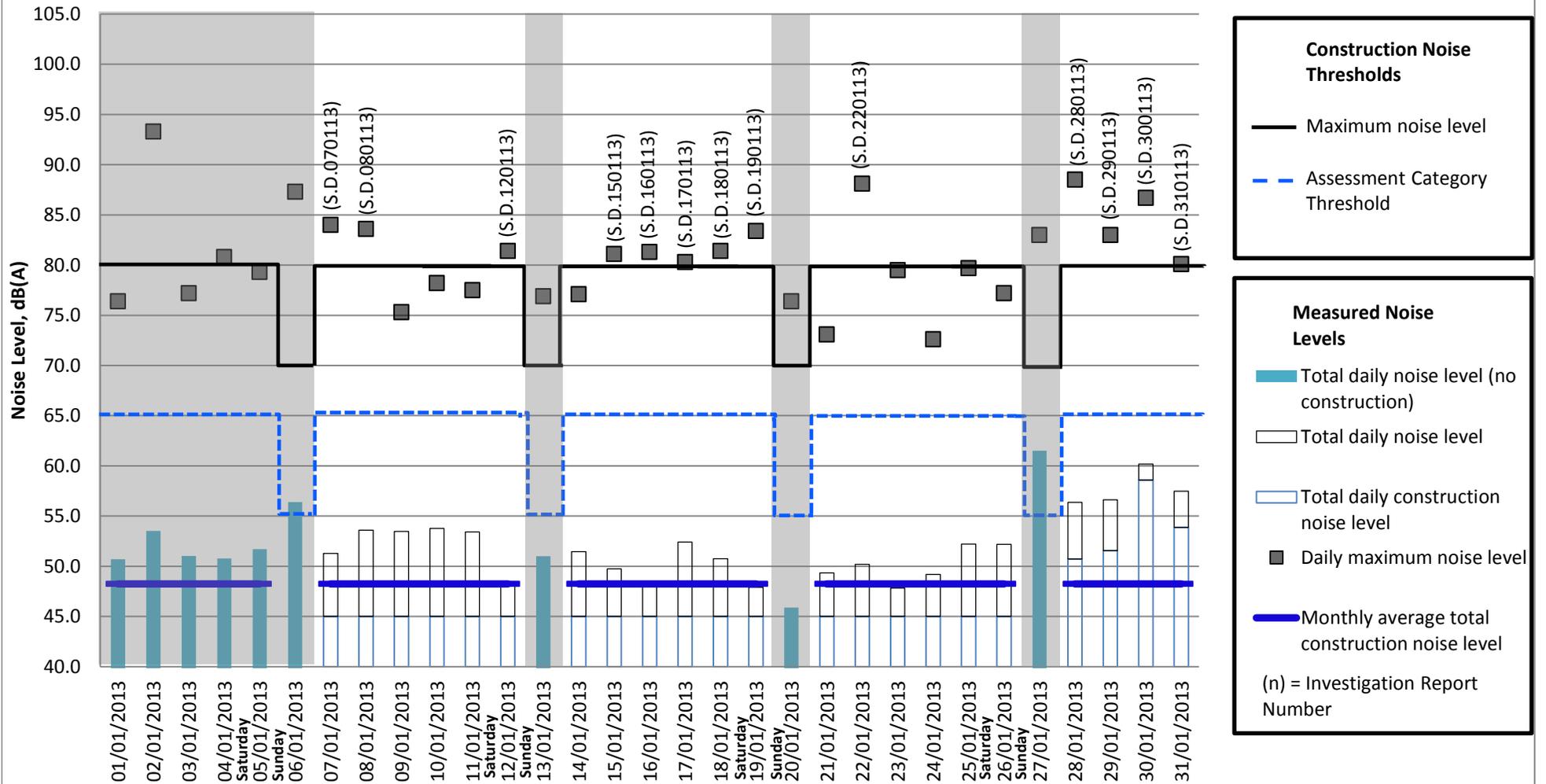
Note: The grey areas of the chart represent days on which no construction works have been conducted; no works have been conducted near this location on Saturday or Sunday. No works were conducted over the Christmas period (21/12/12 to 07/01/13). It should be noted that the measured noise levels Mon - Fri can not be attributed to construction works due to the considerable distance (1.75 kilometers) between this monitoring location and the closest construction works.

Measured Daytime Noise Levels at Scotstoun Measurement period: January 2013



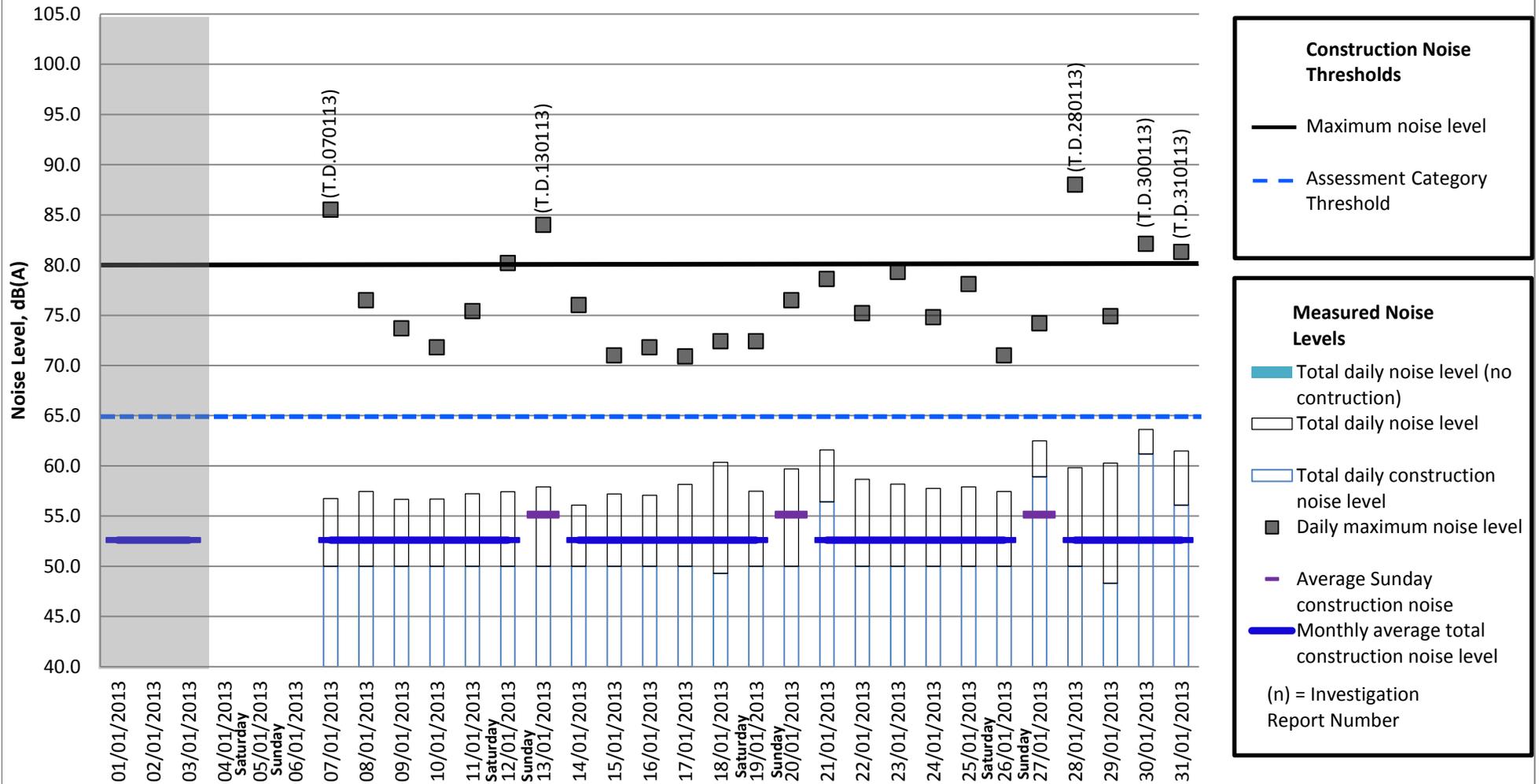
Note: The grey areas of the chart represent days on which no construction works have been conducted; no works were conducted over the Christmas period (21/12/12 to 07/01/13). The monthly average construction noise for Sunday has not been included as no Sunday works have been conducted at this location. Data is missing for 12/01/13 due to an error associated with the download of data.

Measured Daytime Noise Levels at Springfield Measurement period: January 2013



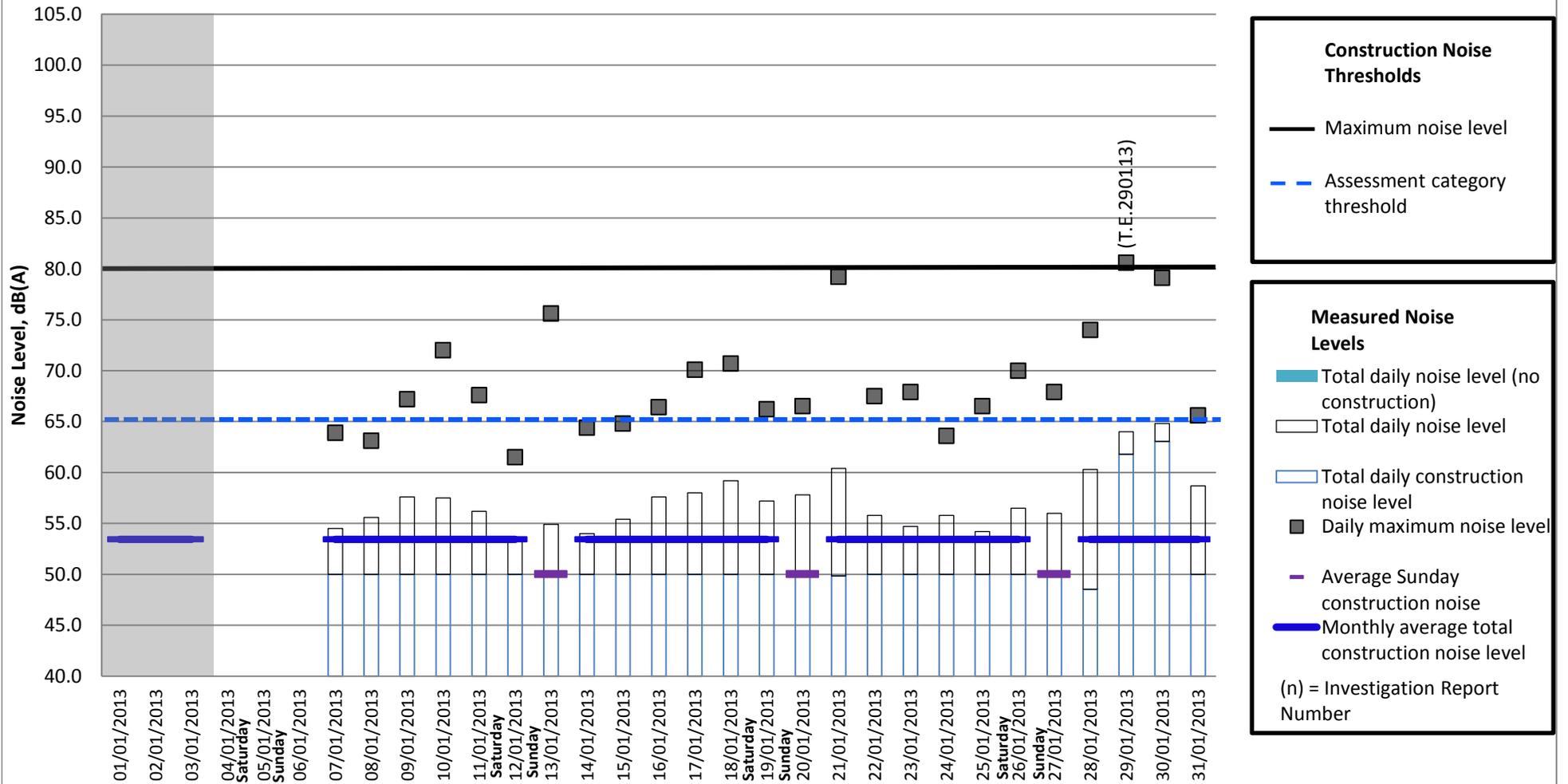
Note: The grey areas of the chart represent days on which no construction works have been conducted; no works were conducted over the Christmas period (21/12/12 to 07/01/13). The monthly average construction noise for Sunday has not been included as no Sunday works have been conducted at this location.

Measured Daytime Noise Levels at Tigh-Na-Grian Measurement period: January 2013



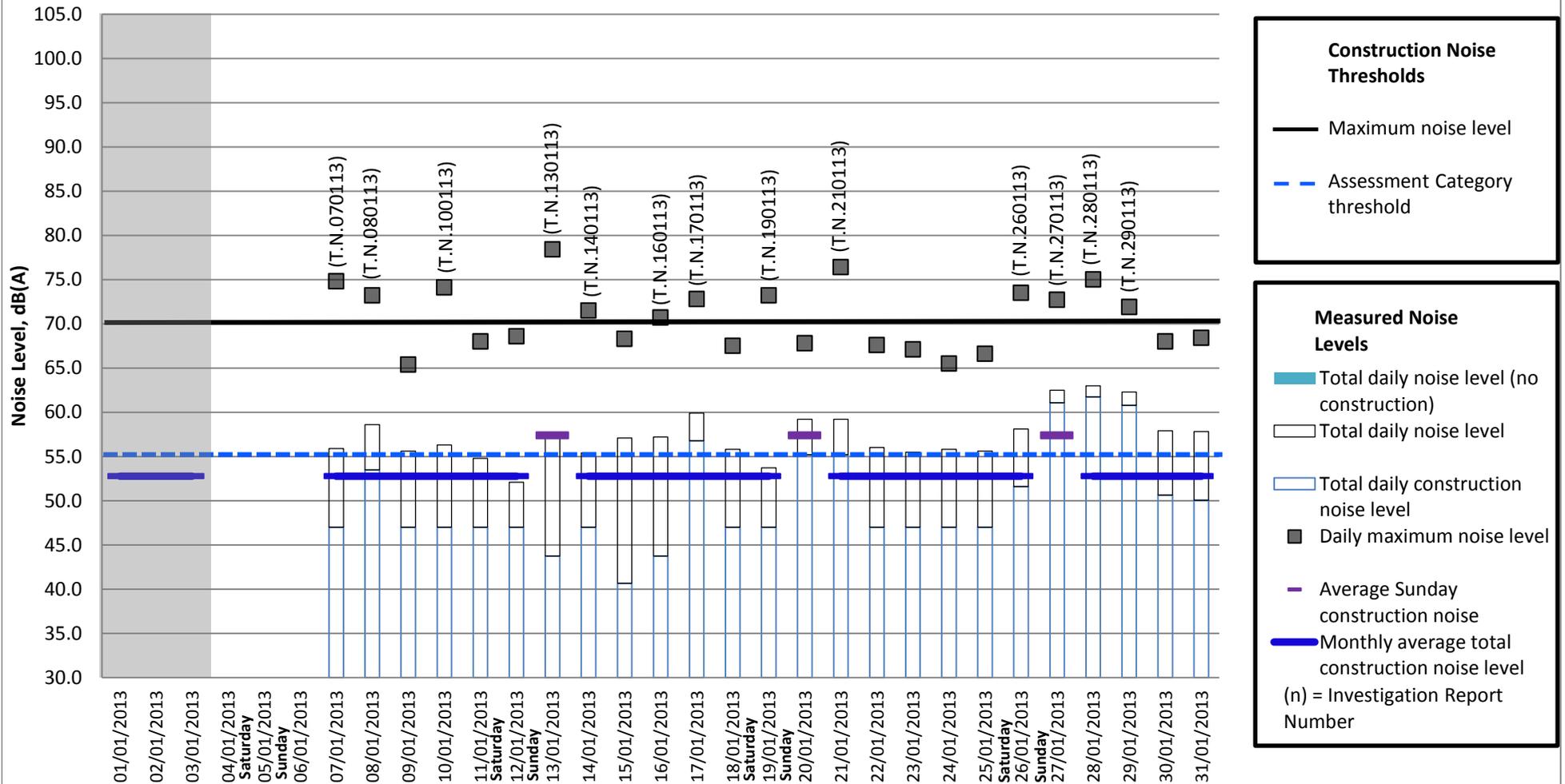
Note: The grey areas of the chart represent days on which no construction works have been conducted; no works were conducted over the Christmas period - Marine: 21/12/12 to 03/01/13, Networks: 21/01/13 to 07/01/13. Data is missing for 01/01/13 to 06/01/13 due to device error.

Measured Evening Noise Levels at Tigh-Na-Grian Measurement period: January 2013



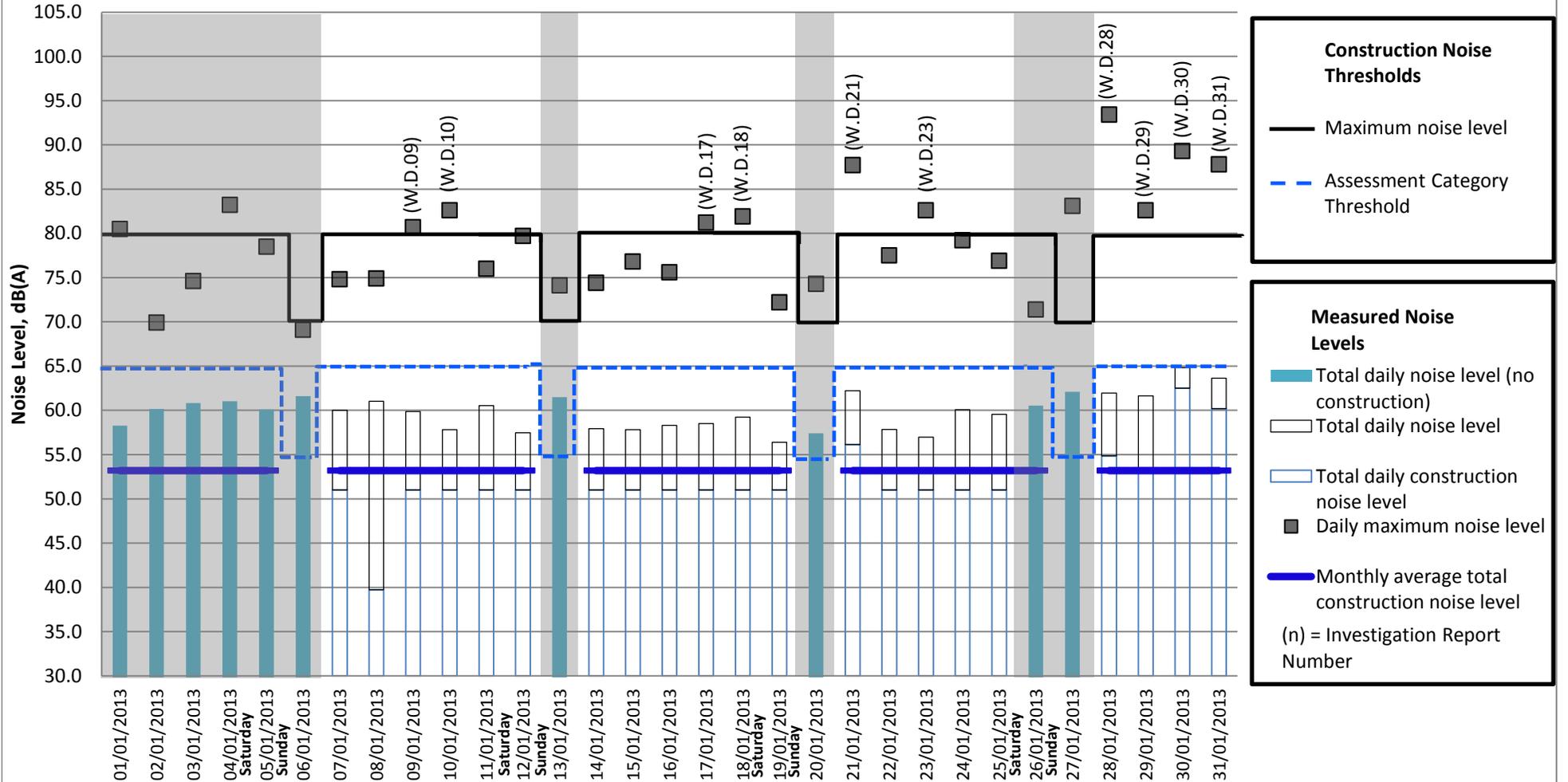
Note: The grey areas of the chart represent evenings on which no construction works have been conducted; no works were conducted over the Christmas period - Marine: 21/12/12 to 03/01/13, Networks: 21/01/13 to 07/01/13. Data is missing for 01/01/13 to 06/01/13 due to device error.

Measured Night-time Noise Levels at Tigh-Na-Grian Measurement period: January 2013



Note: The grey areas of the chart represent nights on which no construction works have been conducted; no works were conducted over the Christmas period - Marine: 21/12/12 to 03/01/13, Networks: 21/01/13 to 07/01/13. Data is missing for 01/01/13 to 06/01/13 due to device error.

Measured Daytime Noise Levels at Whinny Hill Measurement period: January 2013



Note: The grey areas of the chart represent days on which no construction works have been conducted. The monthly average construction noise for Sunday has not been included as no Sunday works have been conducted at this location during this period.