



Contractor



Forth Crossing Bridge Constructors

HOCHTIEF Solutions
American Bridge International
DRAGADOS
Morrison Construction

Project **FORTH REPLACEMENT CROSSING**

Document title

CONSTRUCTION NOISE MONITORING REPORT: DECEMBER 2013

Rev	Rev. Date	Purpose of revision	Made	Checked	Reviewed
00	16/12/13	First Revision	ESE	MWN	MWN

Document status

FOR REVIEW

Made by: Ellie Slee Checked By: Martin Wilson

Initials: ESE Initials: MWN

Document number

REP-00153

Rev
00

This document is intellectual property of FCBC Construction JV. Copying, distribution, usage, and information on contents of this are forbidden unless explicitly authorized.

Contents

- 1. Introduction**
- 2. Noise Monitoring Locations**
- 3. Noise Monitoring Results**

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 December 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 December 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 December 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 December 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 December 2013
M1	Whinny Hill	Network	<ul style="list-style-type: none"> • Drainage, kerbing and placing of Type 1 at Castlandhill Road <p>N.B. No evening, night time or Sunday daytime construction in vicinity.</p>
M3	Tigh-Na-Grian	Crossing	<ul style="list-style-type: none"> • Central Tower rebar, formwork & concreting works • North Tower rebar, formwork & concreting works • North Tower crane platform construction • Pier N1 de-stressing wells & trestle bridge foundation works
M4	North Leg	Crossing	<ul style="list-style-type: none"> • Central Tower rebar, formwork & concreting works • North Tower rebar, formwork & concreting works • North Tower crane platform construction • Pier N1 de-stressing wells & trestle bridge foundation works
M6	Port Edgar	Crossing	<ul style="list-style-type: none"> • Central Tower rebar, formwork & concreting works • South Tower rebar, formwork & concreting works • Pier S1 de-stressing wells works • Pier S3 cofferdam construction • Pier S5 rebar, formwork & concreting works • Preparation of rebar prefabrication area at S5 causeway • Fixing rebar at S6 • Society Road Planting
M7	Butlaw Fisheries	Crossing	<ul style="list-style-type: none"> • Central Tower rebar, formwork & concreting works • South Tower rebar, formwork & concreting works • Pier S1 de-stressing wells works • Pier S3 cofferdam construction • Pier S5 rebar, formwork & concreting works • Preparation of rebar prefabrication area at S5 causeway • Fixing rebar at S6 • Society Road Planting • Concreting, fixing rebar and installation of tie beam at S7/S8
M10	Inchgarvie Lodge	Crossing	<ul style="list-style-type: none"> • Central Tower rebar, formwork & concreting works • South Tower rebar, formwork & concreting works • Pier S1 de-stressing wells works • Pier S3 cofferdam construction • Pier S5 rebar, formwork & concreting works • Preparation of rebar prefabrication area at S5 causeway • Fixing rebar at S6 • Society Road Planting • Concreting, fixing rebar and installation of tie beam at S7/S8 • Launch – delivery and assembly of steel sections • South abutment – launch of west section

M11	Linn Mill	Network (close proximity to Crossing)	<ul style="list-style-type: none"> • Society Road Planting • Concreting, fixing rebar and installation of tie beam at S7/S8 • Launch – delivery and assembly of steel sections • South abutment –launch of west section
M13	Clufflat Brae	Crossing	<ul style="list-style-type: none"> • Society Road Planting • Concreting, fixing rebar and installation of tie beam at S7/S8 • Launch – delivery and assembly of steel sections • South abutment –launch of west section
M14	Springfield	Network	<ul style="list-style-type: none"> • Launch – delivery and assembly of steel sections • South abutment –launch of west section <p>N.B. No evening, night time or Sunday daytime construction in vicinity.</p>
M15	Echline Field	Network	<ul style="list-style-type: none"> • Launch – delivery and assembly of steel sections • South abutment –launch of west section • Echline cut – ripping rock and crushing • Gyratory – rebar works and concreting • A904 tie in road works, including drainage works and placing of Type 1 to west <p>N.B. No evening, night time or Sunday daytime construction in vicinity.</p>
M16	Scotstoun	Network	<ul style="list-style-type: none"> • Utilities works • Structure works <p>N.B. No evening, night time or Sunday daytime construction in vicinity.</p>
M17	Dundas Home Farm	Network	<ul style="list-style-type: none"> • Utility works <p>N.B. No evening, night time or Sunday daytime construction in vicinity.</p>
M18	Newton	Network	<ul style="list-style-type: none"> • 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 is considered as a network location, 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 this location 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. It should be noted that only limited daytime marine works were undertaken over the Christmas period (20 December 2013 to 6 January 2014); the graph reflect this as appropriate.
- 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. Due to adverse weather over the Christmas period, the meters at Tigh-Na-Grian, and Inchgarvie were found to stop running on 28 December, and the meter at Linn Mill stopped on 25 December. Some data is also missing due to device error, including 2 days at Dundas, Springfield and Tigh-Na-Grian with a longer period of 10 days missing from Whinny Hill due to device error and also an issue with access to the meter to enable resolution of the error.
- 3.3** Results demonstrate that the monthly average total construction noise results for daytime were within the threshold levels for all monitoring locations for December 2013, with the exception of Scotstoun. For the evening period, all monitoring locations were within the threshold levels. For the night time periods, there were exceedances at only five locations; Butlaw Fisheries, Clufflat Brae, Inchgarvie Lodge, Linn Mill and Tigh-Na-Grian. With regard to the Sunday averages (for applicable monitoring locations), exceedances of the daytime average were noted at Butlaw Fisheries and Linn Mill, with an exceedance of the night time average at Butlaw Fisheries only.
- 3.4** The exceedances noted are not thought to have been caused by increased noise levels due to construction. Each of the night time averages were found to be affected by increased noise levels due to periods of adverse weather, notably on the nights of 4 and 18 December. Audio demonstrates that the increased levels were caused by strong winds. Similarly, the results for the Sunday average were also found to be caused by adverse weather during this period. With regard to the averages reported for evening, night time and Sunday periods, it should be noted that these averages are based only on the highest L_{Aeq} levels for 1 hour periods which can affect the averages.
- 3.5** 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. The average for December is consistent with levels for previous months.
- 3.6** During December 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 and daily marine 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.

- 3.7** Investigations of the exceedances of the maximum noise level thresholds show that no exceedances occurred as a result of construction related noise. Rather exceedances were caused by factors including periods of adverse weather, localised noises at nearby properties and bird calls. At some locations, notably Scotstoun and Echline, existing traffic noise had an effect on maximum noise levels during the period covered in this report.
- 3.8** A summary of the findings for exceedances occurring at each of the locations can be found in Table 2.

Table 2: Summary of Exceedances at Monitoring Locations

Monitoring Location	Summary of Exceedance Details
Butlaw Fisheries	During December the maximum noise threshold was exceeded on 37 occasions (daytime, 16; evening, 4; night time, 17). No exceedances were related to construction works. Exceedances were attributed to non-construction factors, including waves, adverse weather and birds.
Clufflat Brae	During December the maximum noise threshold was exceeded on 28 occasions (daytime, 8; evening, 5; night time, 15). No exceedances were found to be due to construction works. Exceedances were found to be largely due to wind.
Inchgarvie Lodge	During December the maximum noise threshold was exceeded on 31 occasions (daytime, 12; evening, 6; night time, 13). No exceedances were attributed to construction works. Investigations found residents at the property and adverse weather to be the main contributing factors to the exceedances at this location.
Linn Mill	During December the maximum noise threshold was exceeded on 34 occasions (daytime, 11; evening, 6; night time, 17). No construction related exceedances were recorded at this location. The exceedances at this location were largely due to adverse weather.
Tigh-Na-Grian	During December the maximum noise threshold was exceeded on 29 occasions (daytime, 9; evening, 1; night time, 16). Exceedances were due to non-construction factors, notably wind, with some caused by birds.
Dundas Home Farm	During December the maximum noise threshold was exceeded on 3 occasions. These exceedances were not caused by the works. The exceedances were due to monitor maintenance and wind.
Echline	During December the maximum noise threshold was exceeded on 16 occasions. No exceedances at this location were due to construction activities. Exceedances were largely attributed to vehicles passing by on the adjacent roads, with wind and monitor maintenance also responsible for some exceedances.
Springfield	During December the maximum noise threshold was exceeded on 11 occasions. The exceedances were not considered to be caused by construction works at this location. Where audio is available, exceedances were found to be due to local residents. However, due to device error, some audio recordings are not available for exceedances.
Scotstoun	During December the maximum noise threshold was exceeded on 17 occasions. No exceedances were due to construction. Exceedances were largely attributed to vehicles passing by on the adjacent road, with some instances of wind causing exceedances.
Whinny Hill	During December the maximum noise threshold was exceeded on 13 occasions. Exceedances were not thought to be due to construction activities. However, due to device error, no audio is available for this monitoring location.

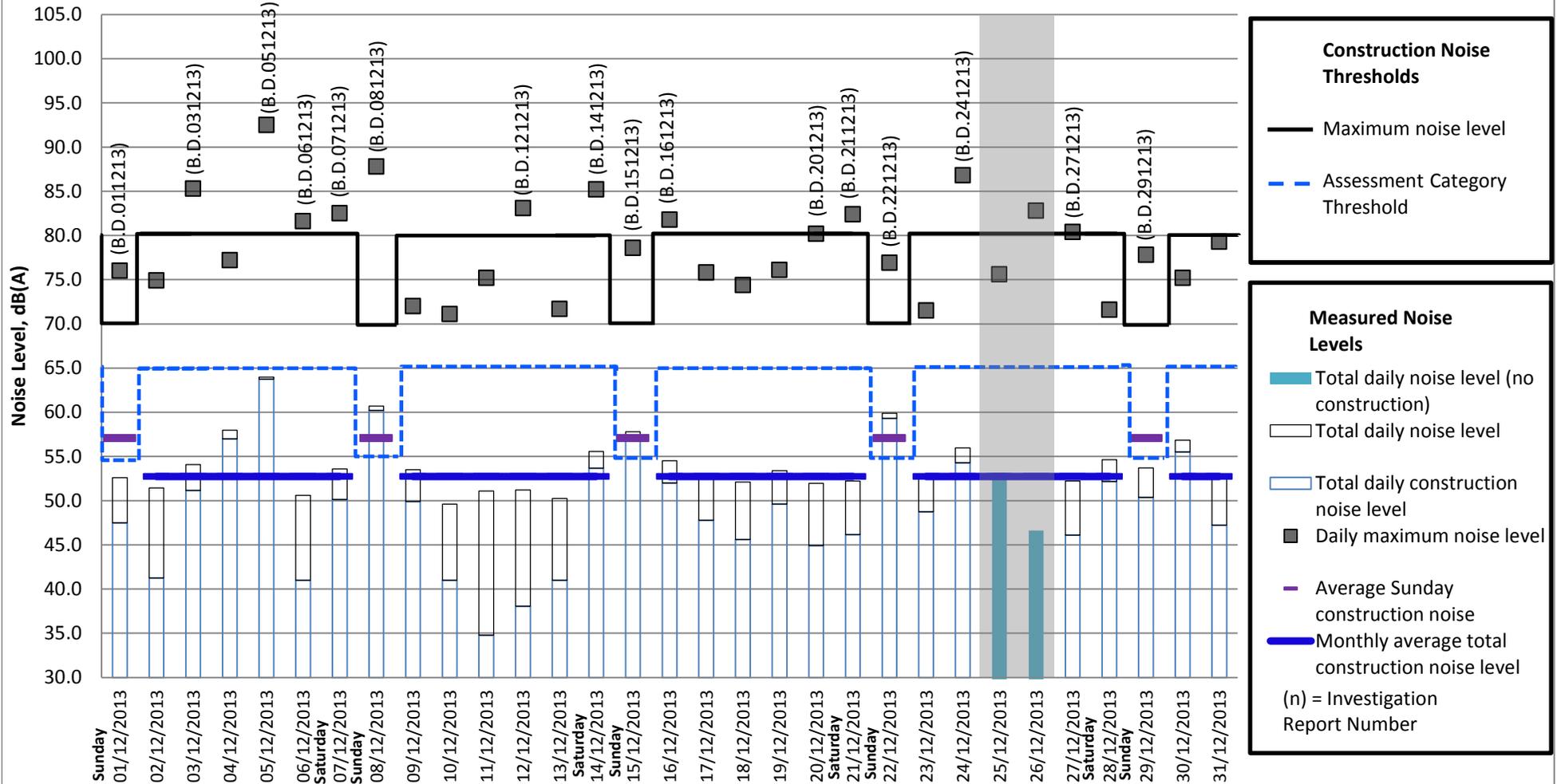


Forth Crossing Bridge Constructors

HOCHTIEF Solutions
American Bridge International
DRAGADOS
Morrison Construction

APPENDIX A

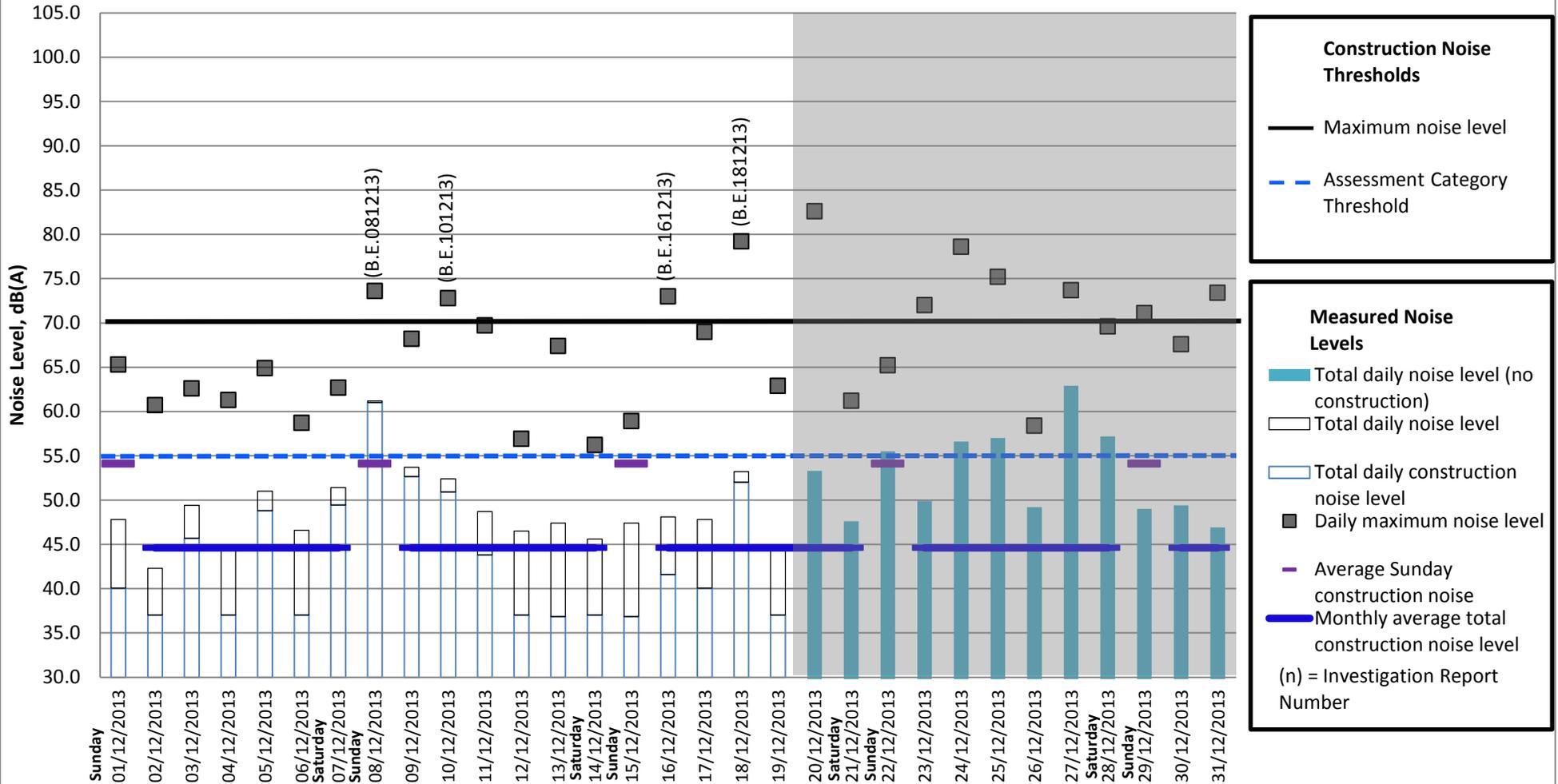
Measured Daytime Noise Levels at Butlaw Fisheries Measurement period: December 2013



Note: The grey areas of the chart represent days on which no construction works have been conducted; no daytime works were conducted on Christmas Day or Boxing Day.

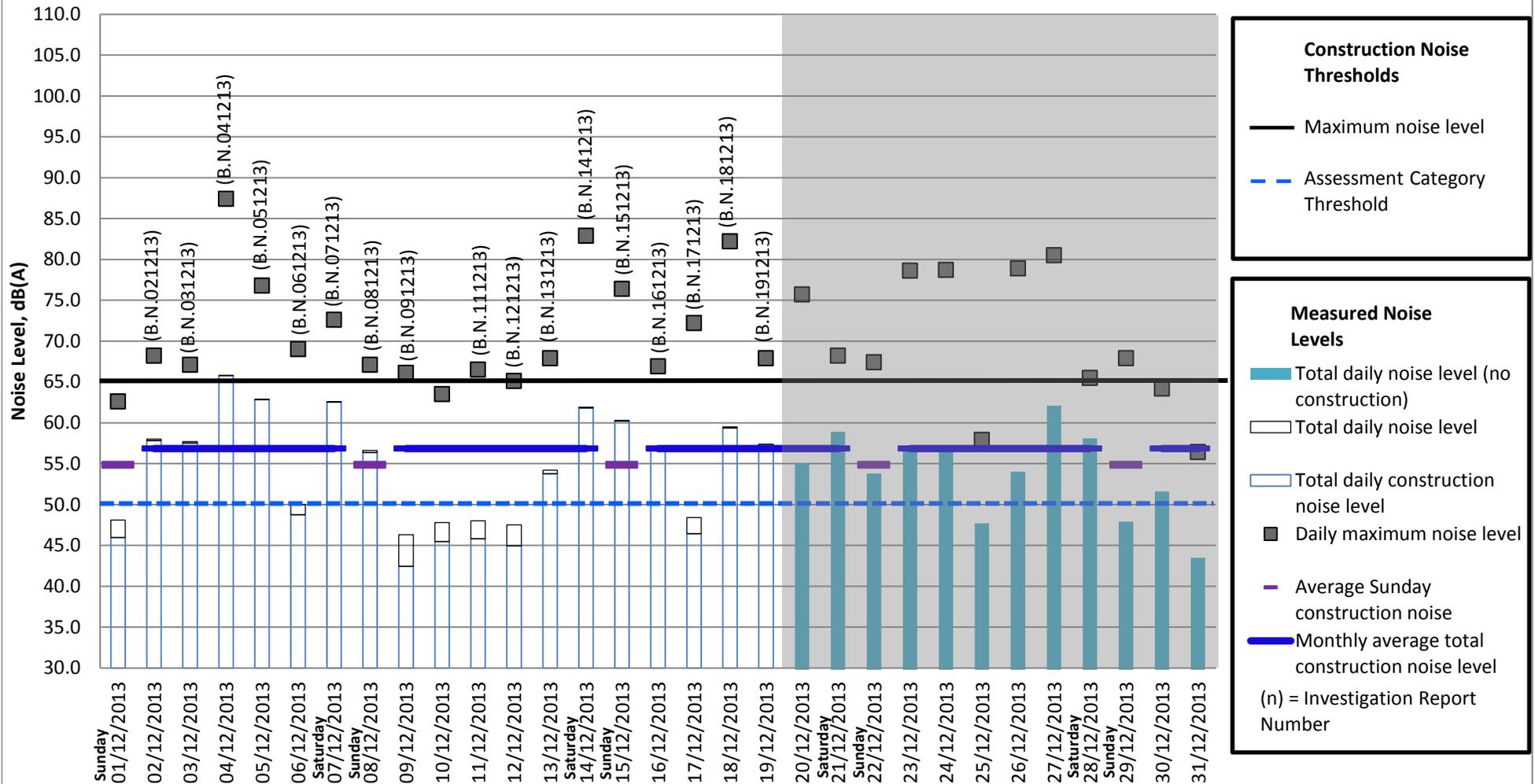
Measured Evening Noise Levels at Butlaw Fisheries

Measurement period: December 2013



Note: The grey areas of the chart represent days on which no construction works have been conducted; no evening works were conducted over the Christmas period (20/12/13 to 06/01/14).

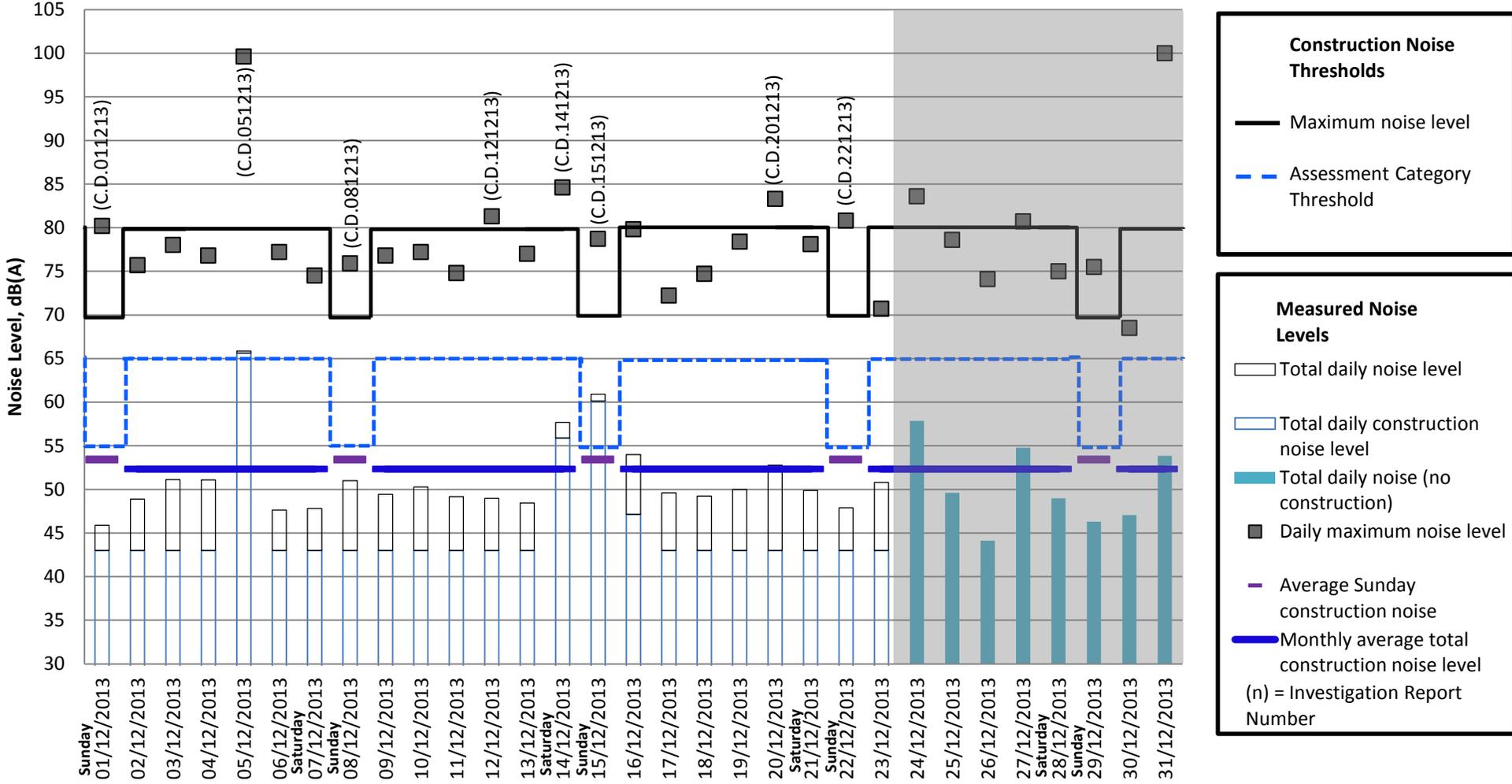
Measured Night time Noise Levels at Butlaw Fisheries Measurement period: December 2013



Note: The grey areas of the chart represent days on which no construction works have been conducted; no night works were conducted over the Christmas period (20/12/13 to 06/01/14).

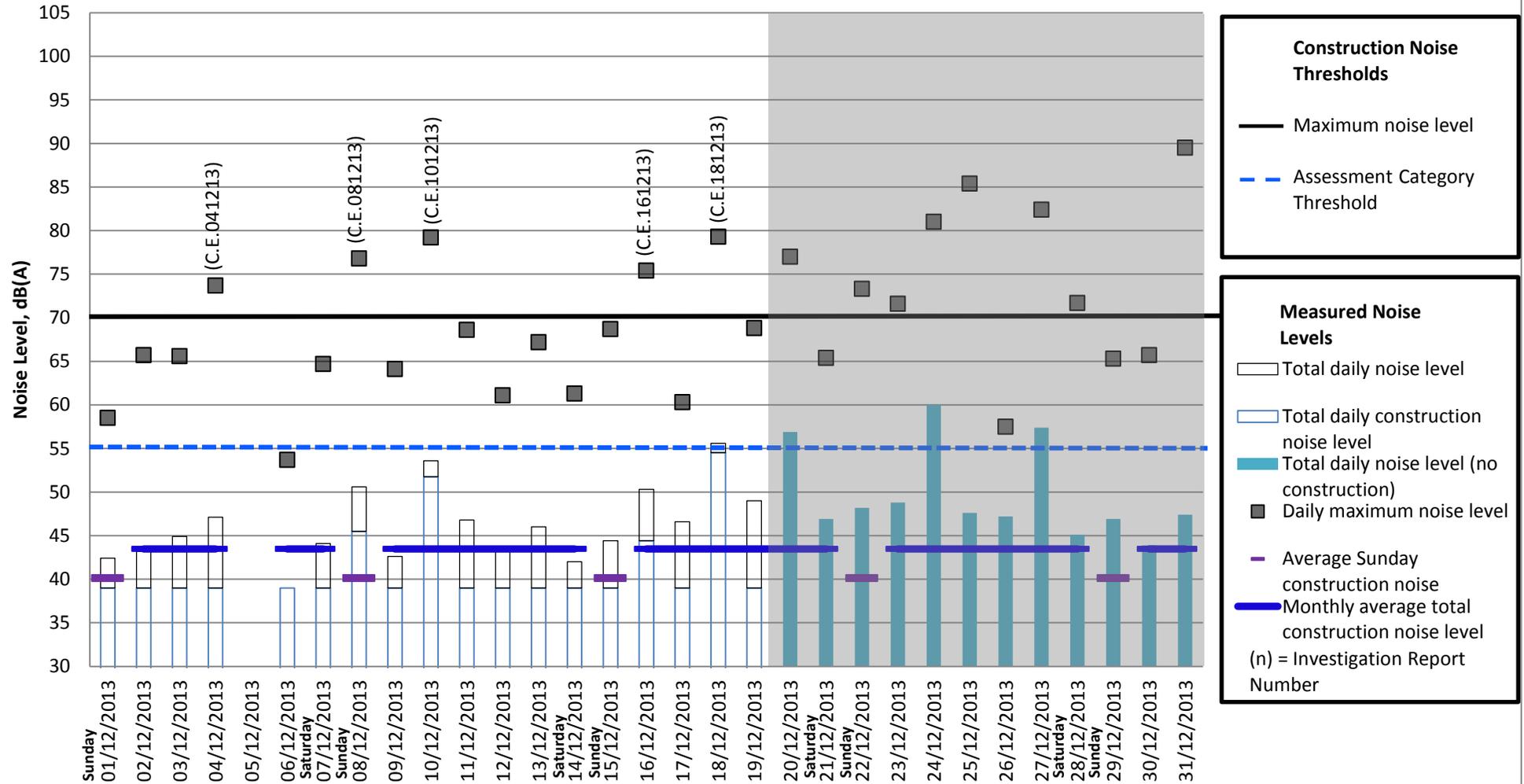
Measured Daytime Noise Levels at Clufflat Brae

Measurement period: December 2013



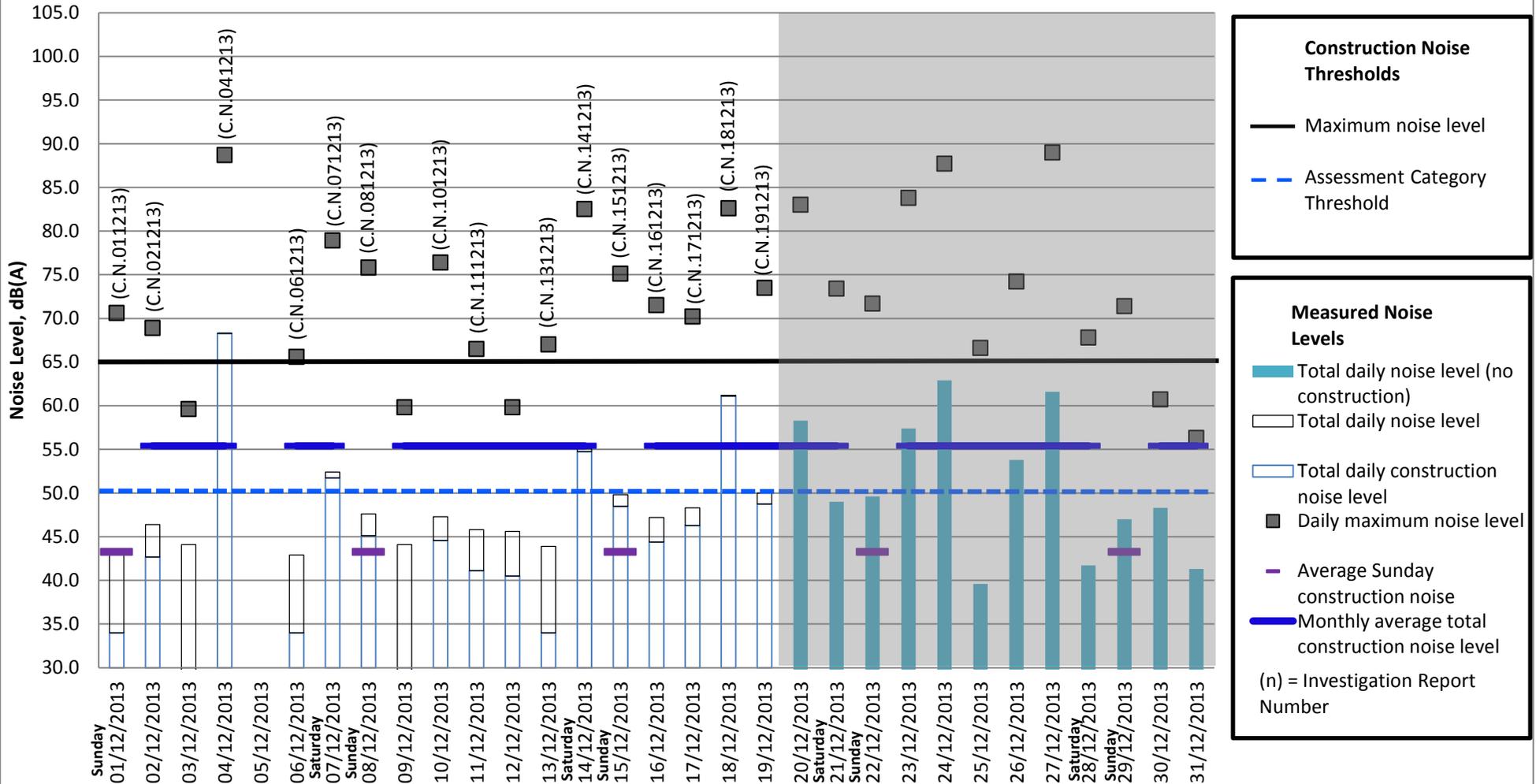
Note: The grey areas of the chart represent days on which no construction works have been conducted; no daytime works were undertaken in the vicinity of this location between 23/12/13 and 06/01/14.

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



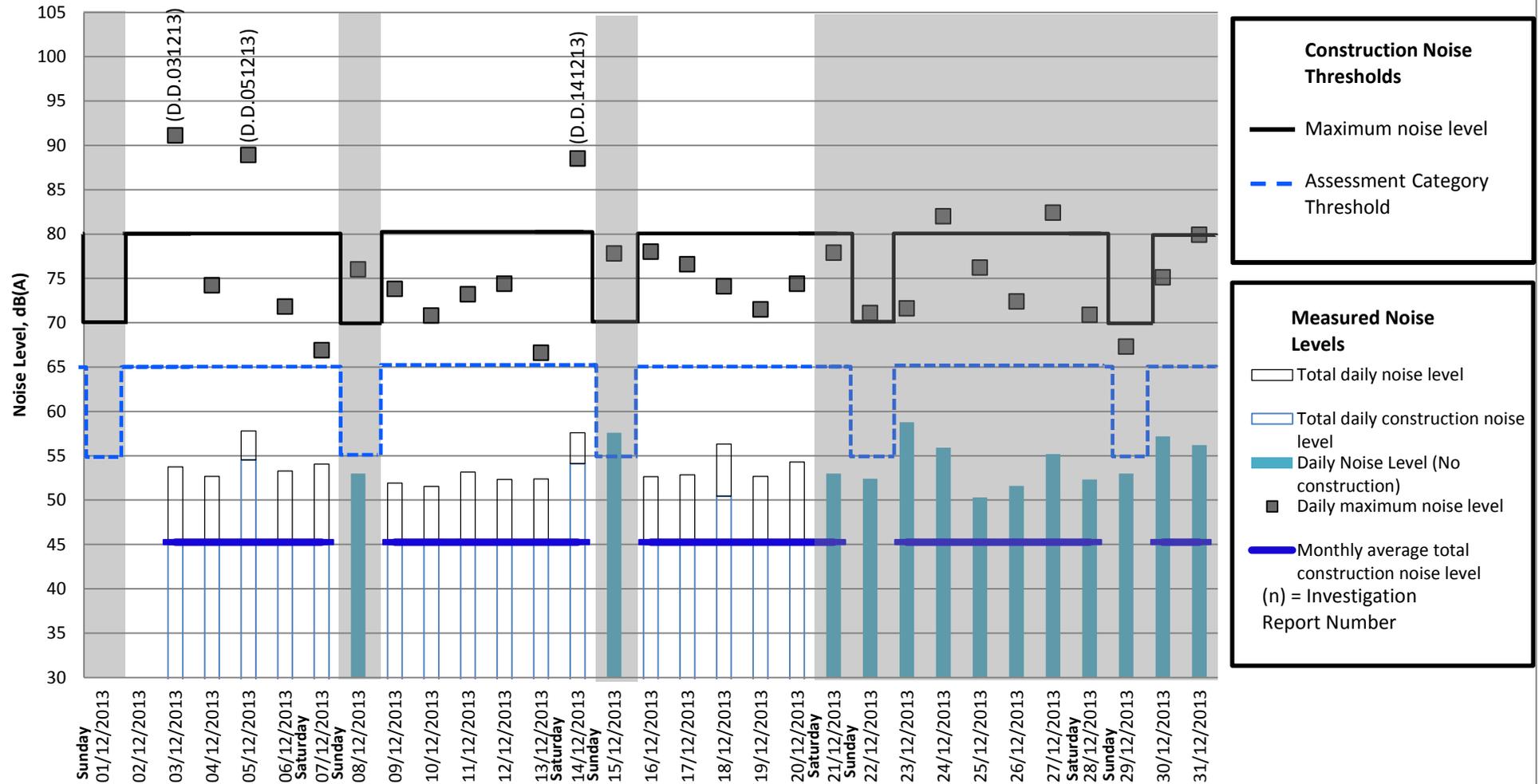
Note: The grey areas of the chart represent days on which no construction works have been conducted; no evening works were conducted over the Christmas period (20/12/13 to 06/01/14).

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



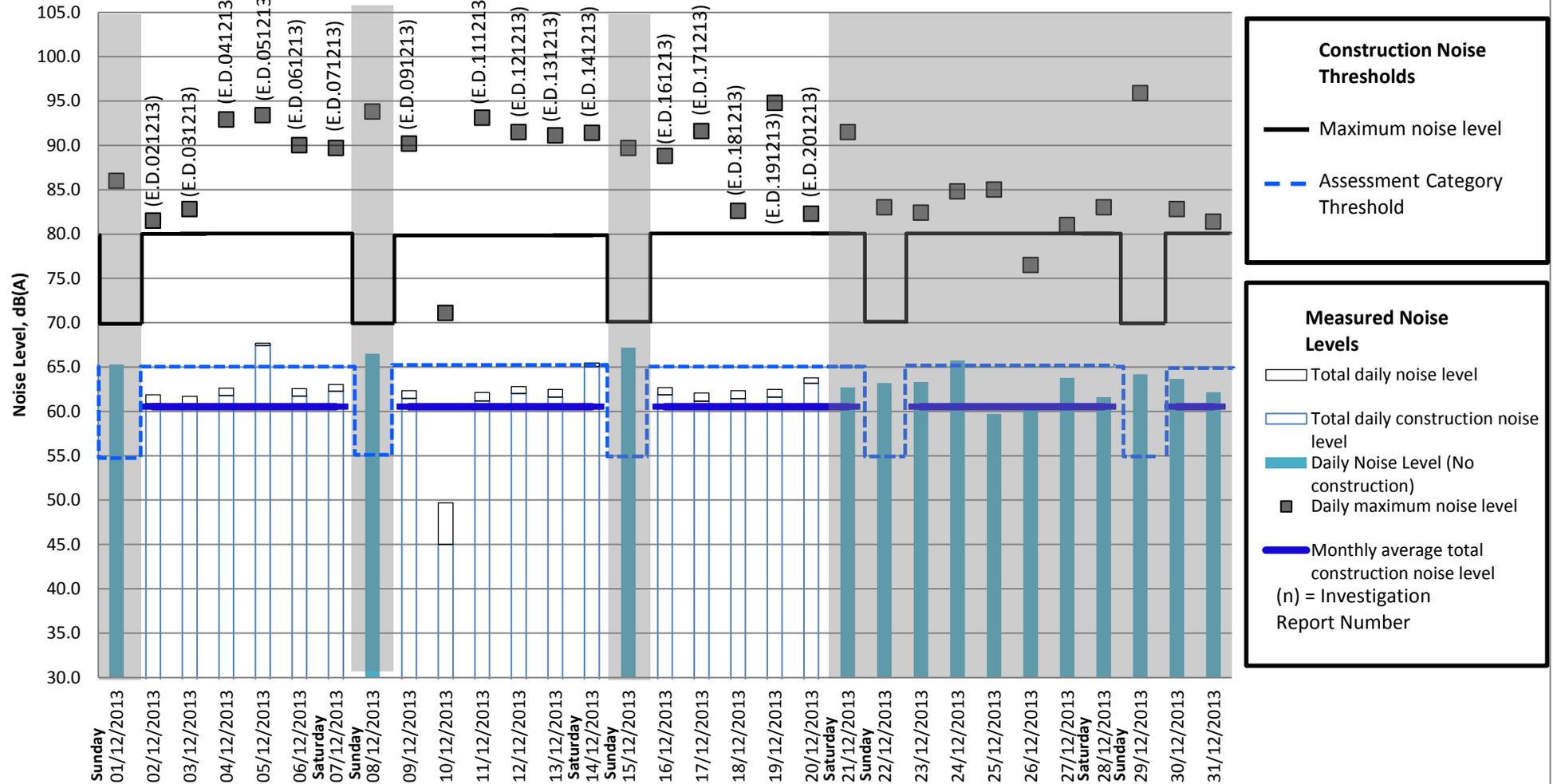
Note: The grey areas of the chart represent days on which no construction works have been conducted; no night works were conducted over the Christmas period (20/12/13 to 06/01/14).

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



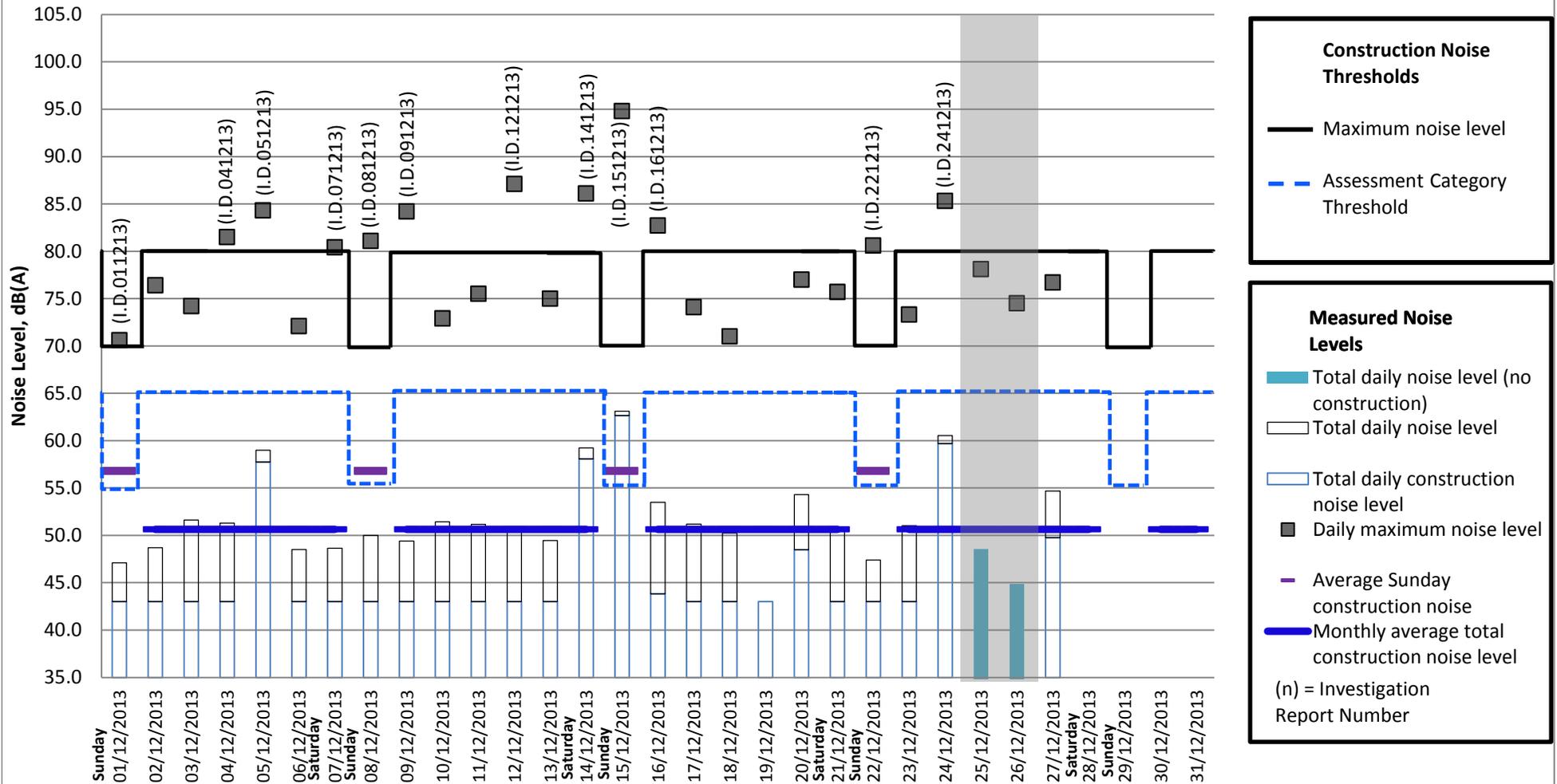
Note: The grey areas of the chart represent days on which no construction works have been conducted; no works were conducted over the Christmas period (20/12/13 to 06/01/14). The Sunday average has not been included as no Sunday works have been conducted at this location. Data is missing on 01/12/13 and 02/12/13 due to device error.

Measured Daytime Noise Levels at Echline Measurement period: December 2013



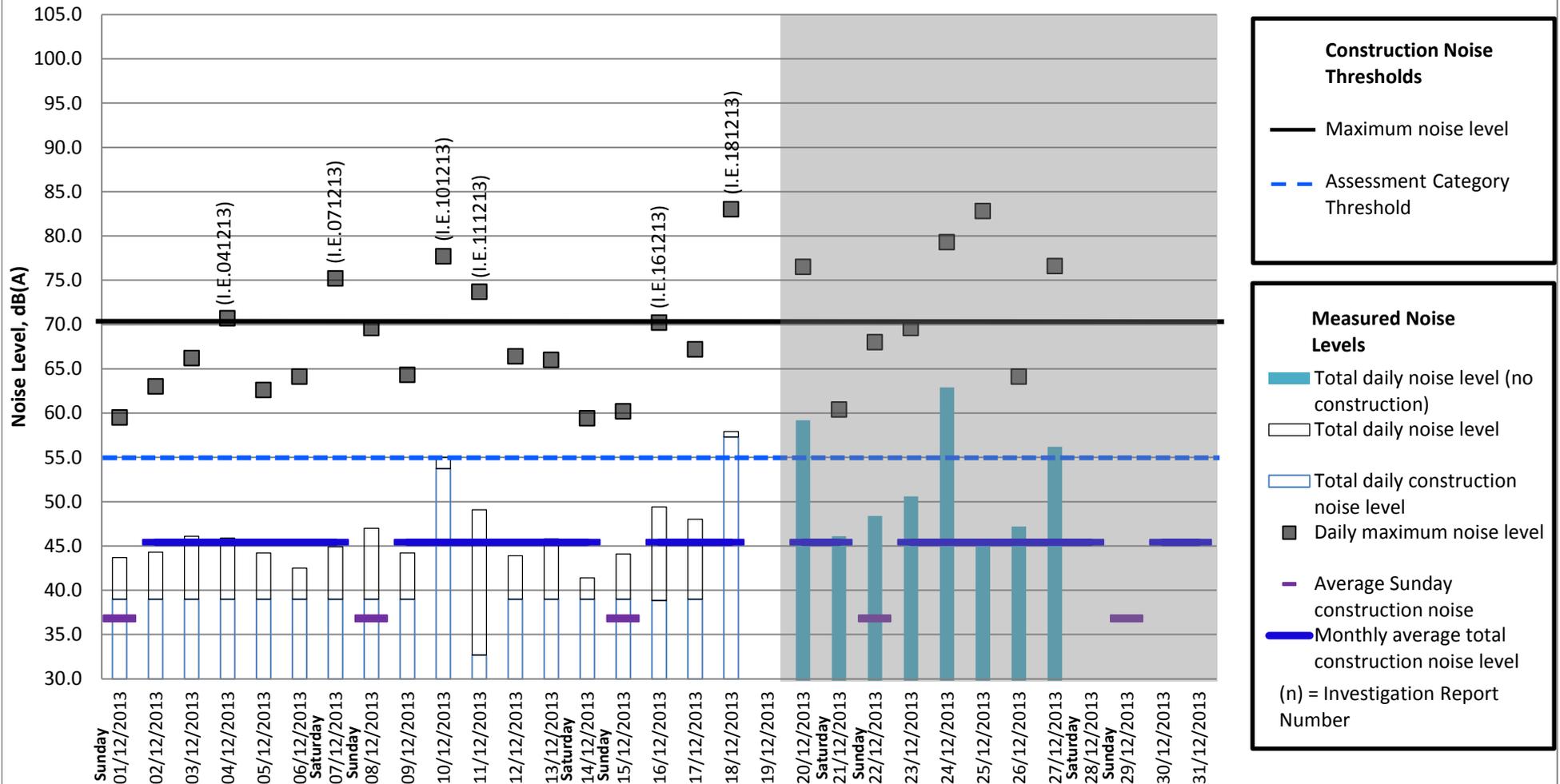
Note: The grey areas of the chart represent days on which no construction works have been conducted; no works were undertaken during the Christmas period (20/12/13 to 06/01/14). The Sunday average has not been included as no Sunday works have been conducted at this location.

Measured Daytime Noise Levels at Inchgarvie Measurement period: December 2013



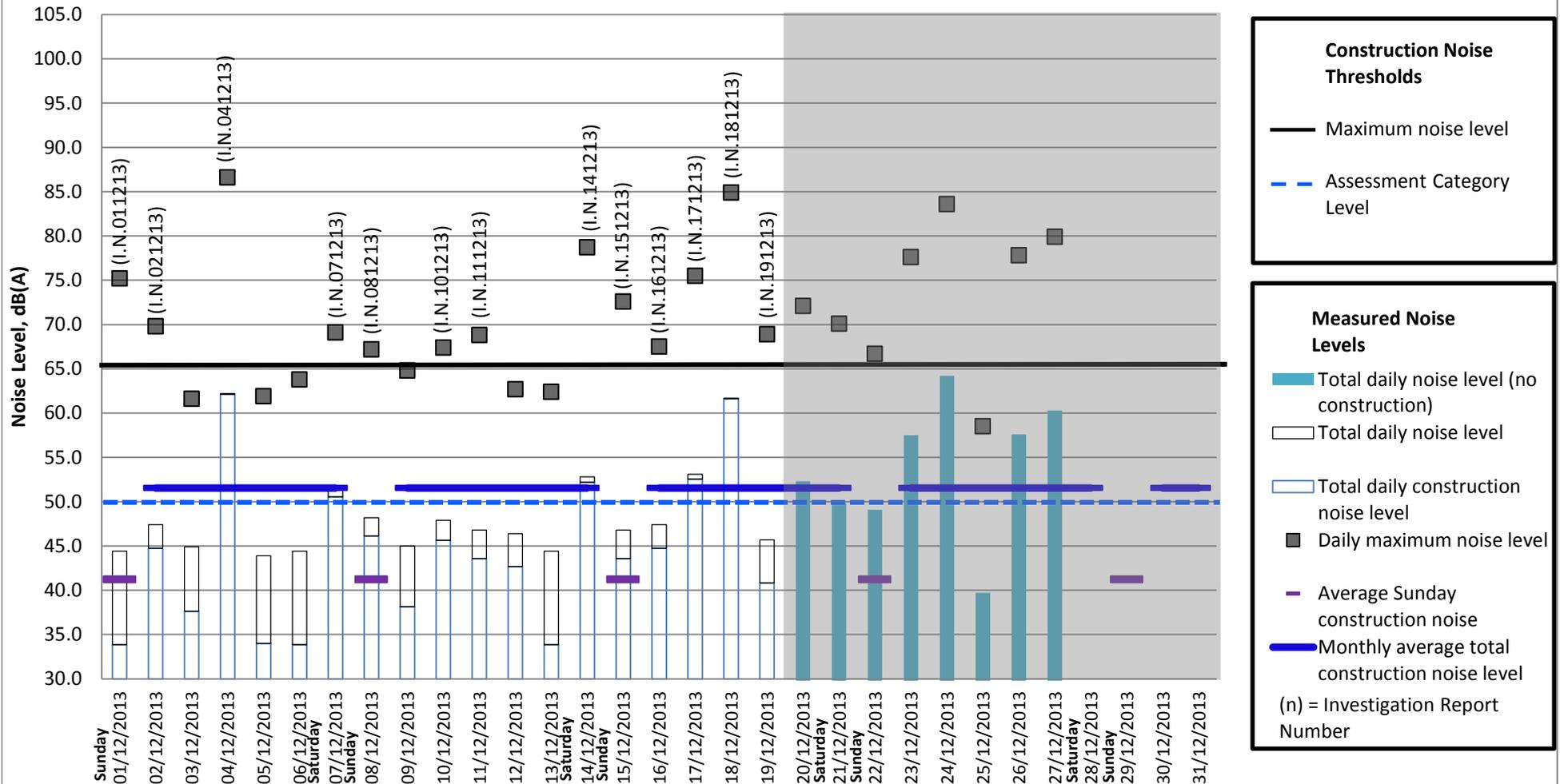
Note: The grey areas of the chart represent days on which no construction works have been conducted; no works were undertaken on Christmas Day or Boxing Day. Due to adverse weather over the Christmas period, the meter stopped running on 28/12/13.

Measured Evening Noise Levels at Inchgarvie Measurement period: December 2013



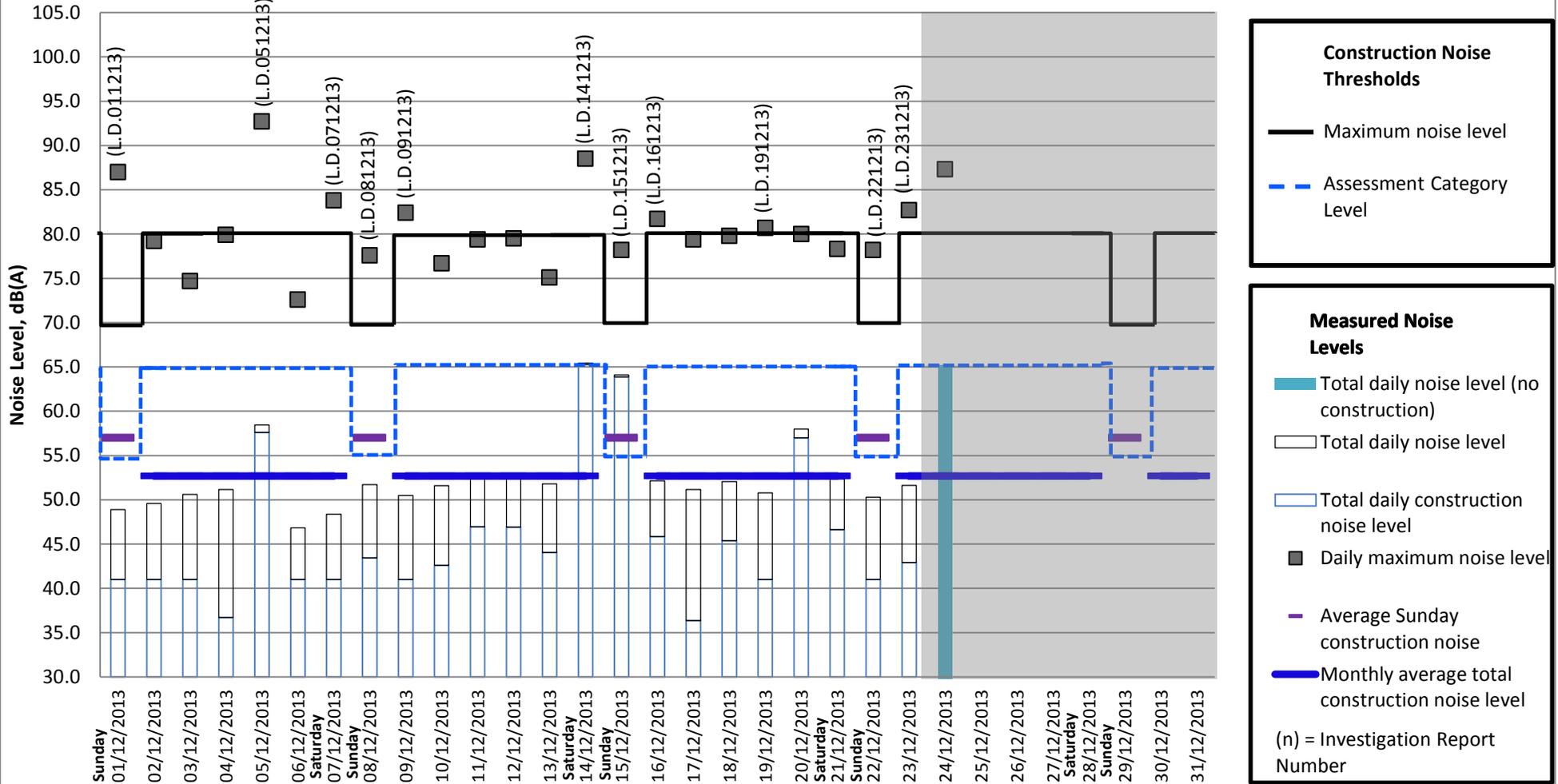
Note: The grey areas of the chart represent days on which no construction works have been conducted; no evening works were undertaken between 20/12/13 and 06/01/14. Due to adverse weather over the Christmas period, the meter stopped running on 28/12/13. Data is also missing for 19/12/13 due to adverse weather.

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



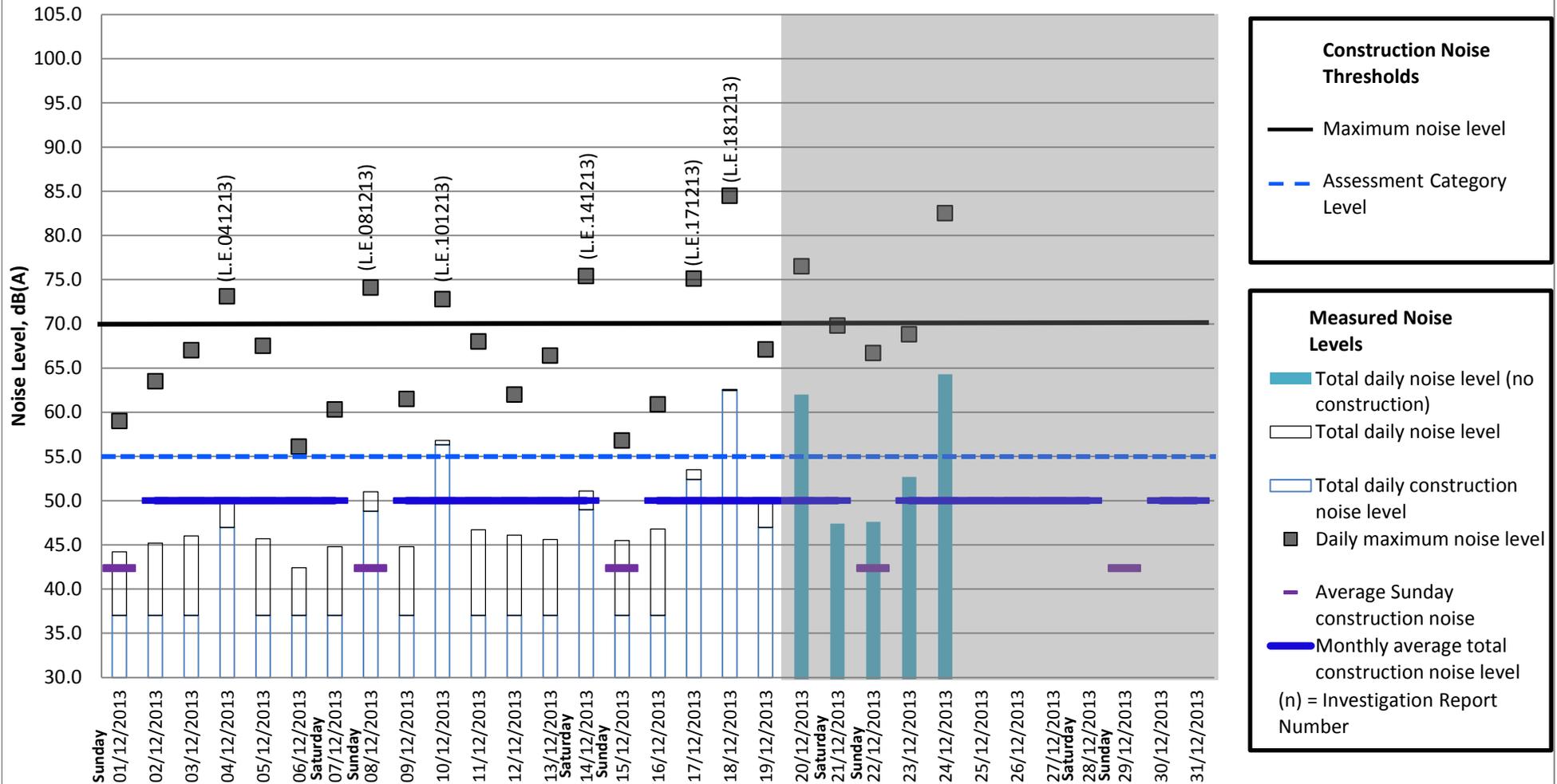
Note: The grey areas of the chart represent days on which no construction works have been conducted; no nighttime works were undertaken between 20/12/13 and 06/01/14. Due to adverse weather over the Christmas period, the meter stopped running on 28/12/13.

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



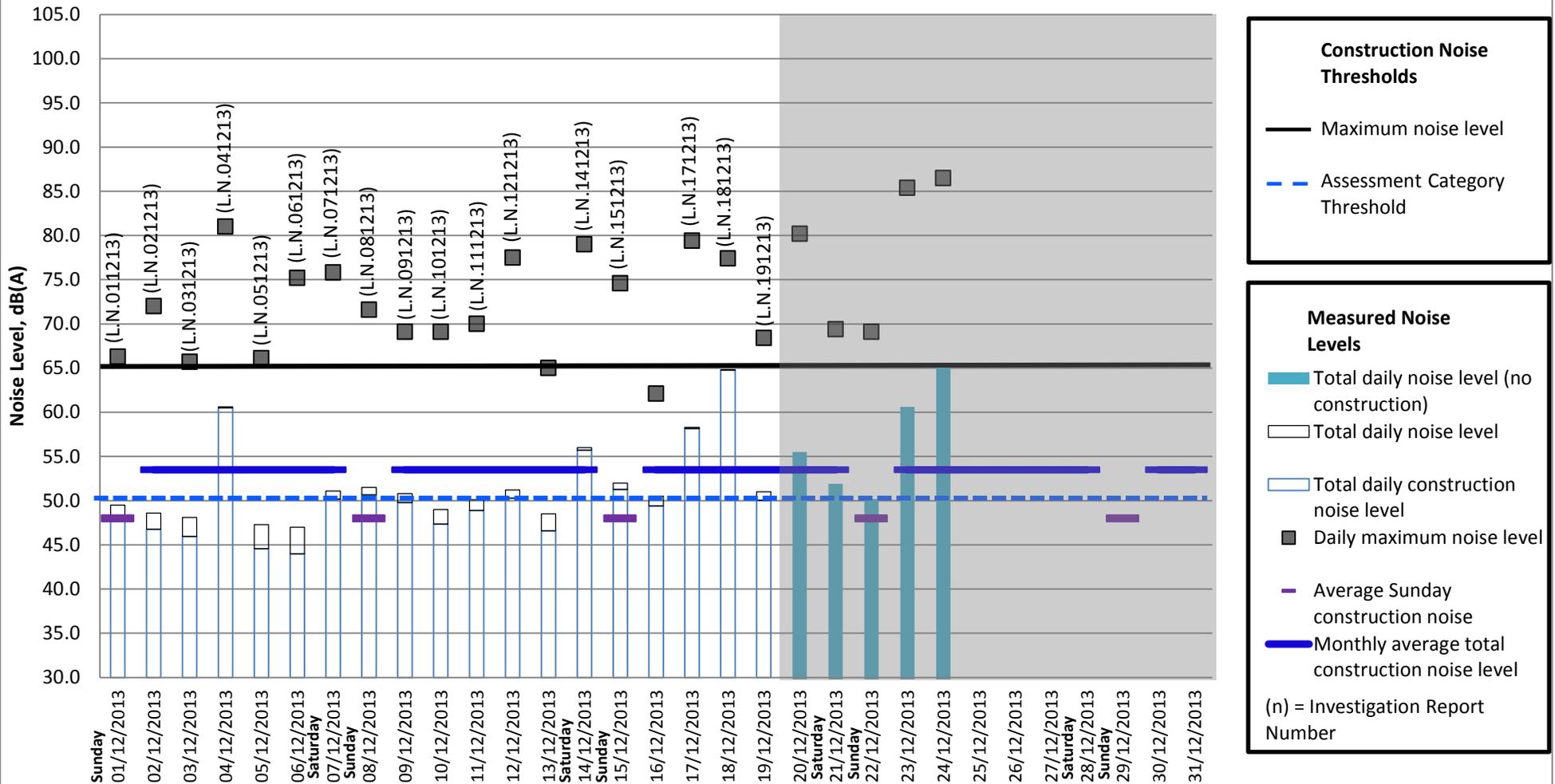
Note: The grey areas of the chart represent days on which no construction works have been conducted; no works were undertaken in the vicinity between 23/12/13 to 06/01/14. Due to adverse weather over the Christmas period, the meter stopped running on 25/12/13.

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



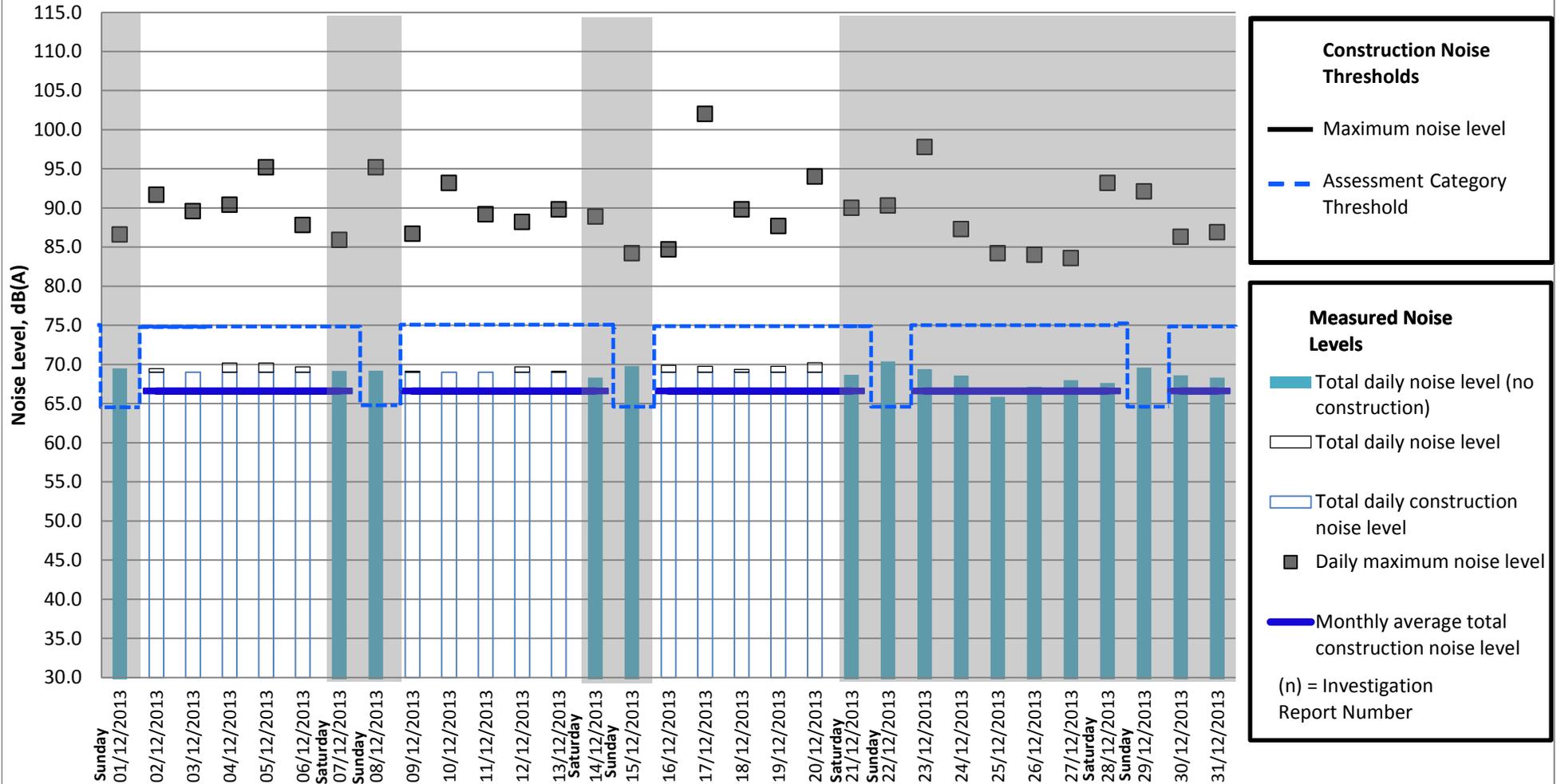
Note: The grey areas of the chart represent days on which no construction works have been conducted; no evening works were undertaken from 20/12/13 to 06/01/14. Due to adverse weather over the Christmas period, the meter stopped running on 25/12/13.

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



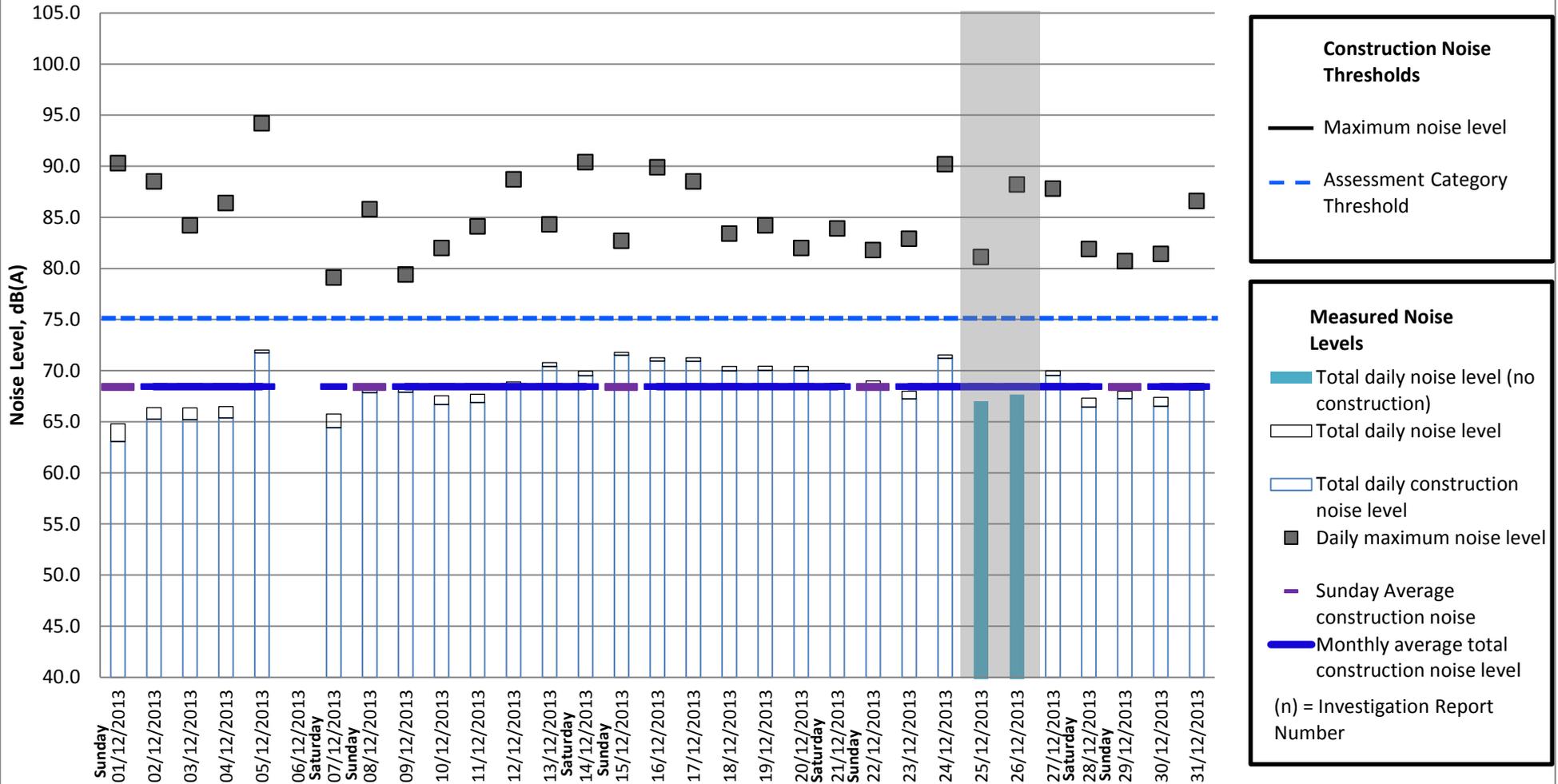
Note: The grey areas of the chart represent days on which no construction works have been conducted; no night time works were undertaken between 20/12/13 to 06/01/14. Due to adverse weather over the Christmas period, the meter stopped running on 25/12/13.

Measured Daytime Noise Levels at Newton Measurement period: December 2013



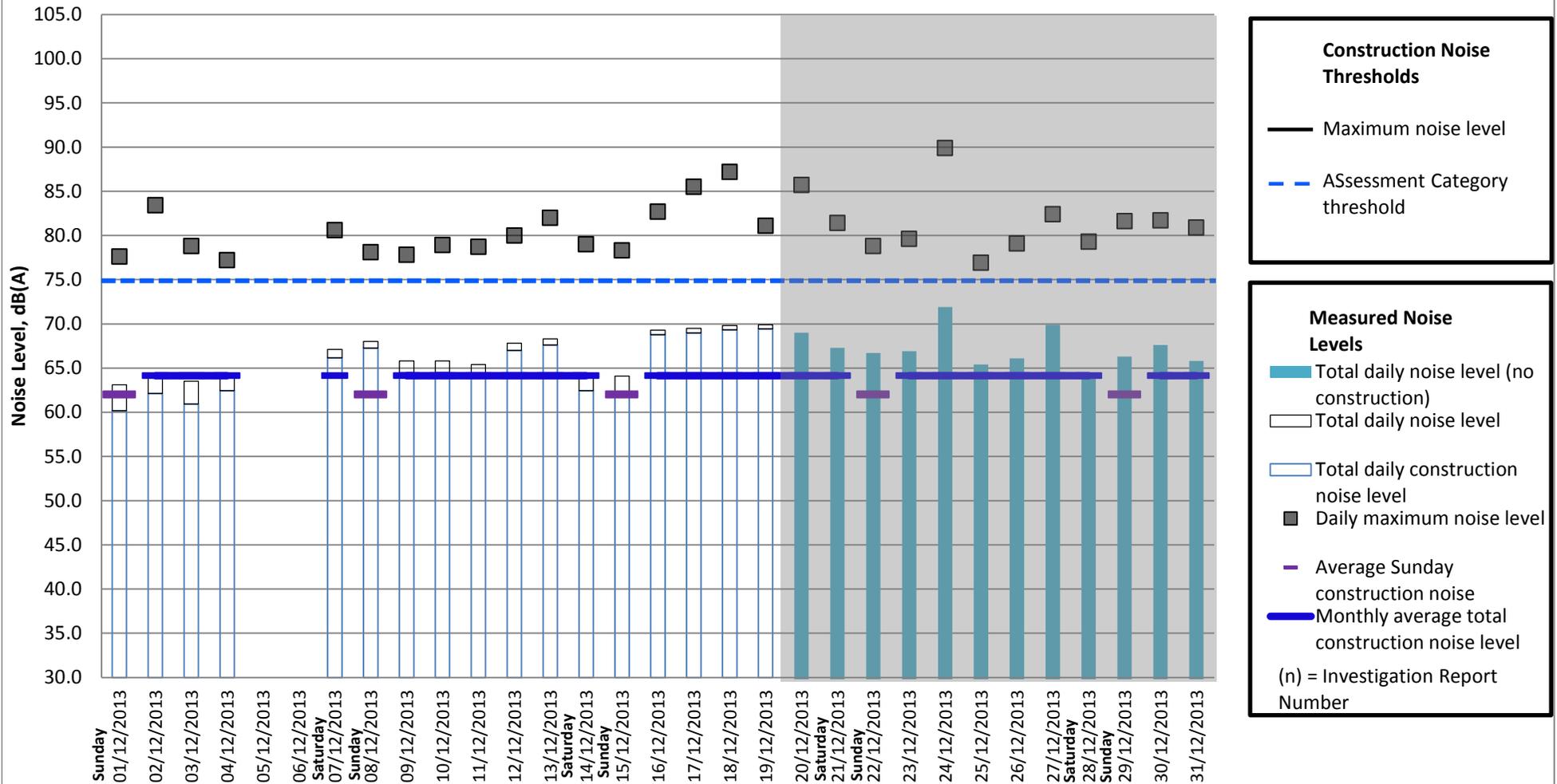
Note: The grey areas of the chart represent days on which no construction works have been conducted; no works were conducted over the Christmas period (20/12/13 to 06/01/14). It should be noted that the measured noise levels Mon - Fri can not be attributed to construction works due to the considerable distance (1.75 kilometers) between this monitoring location and the closest construction works.

Measured Daytime Noise Levels at North Leg Measurement period: December 2013



Note: The grey areas of the chart represent days on which no construction works have been conducted; no works were conducted on Christmas Day or Boxing Day. Data is missing on 06/12/13 due to adverse weather conditions.

Measured Evening Noise Levels at North Leg Measurement period: December 2013



Construction Noise Thresholds

- Maximum noise level
- - - Assessment Category threshold

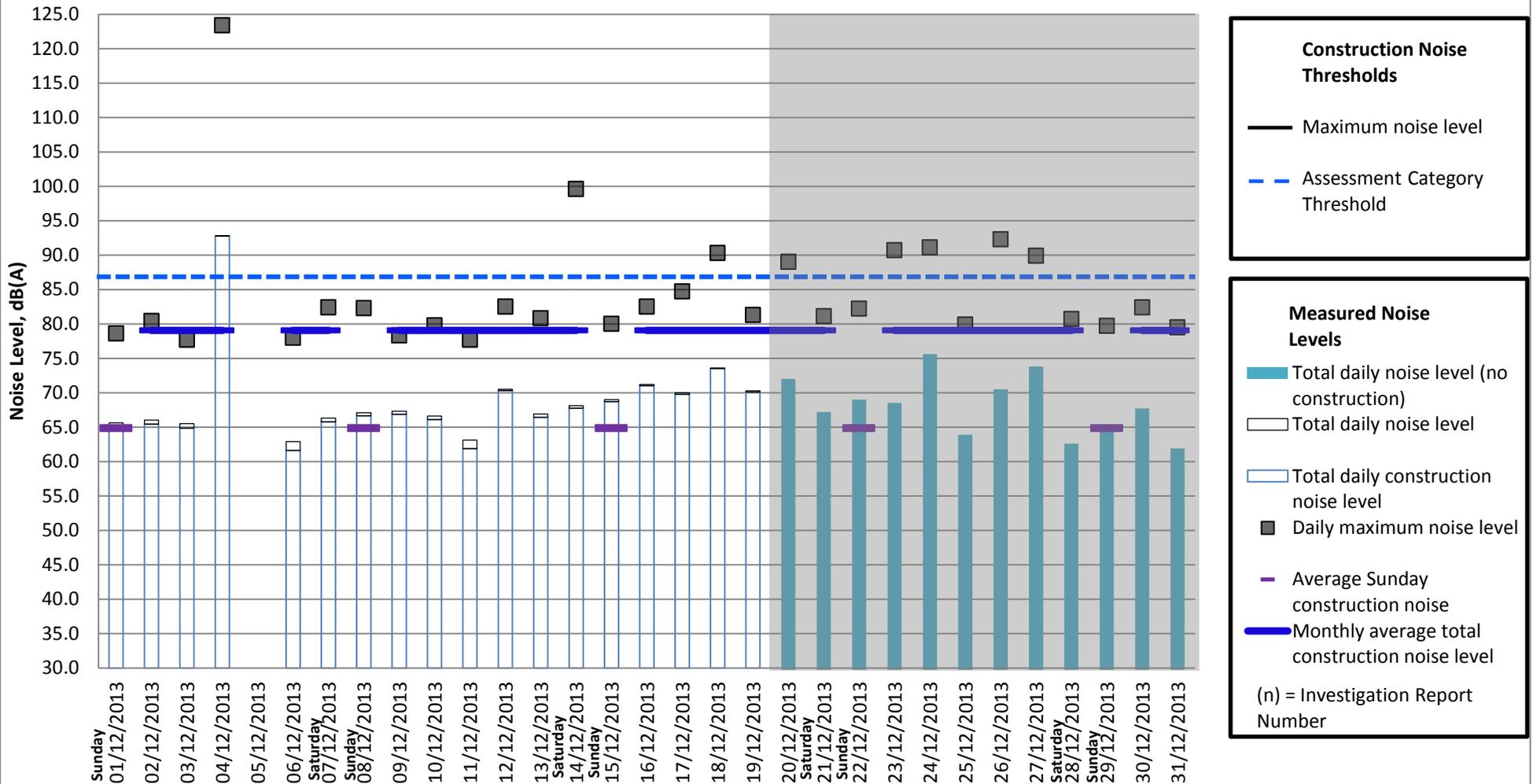
Measured Noise Levels

- Total daily noise level (no construction)
- Total daily noise level
- Total daily construction noise level
- Daily maximum noise level
- Average Sunday construction noise
- Monthly average total construction noise level

(n) = Investigation Report Number

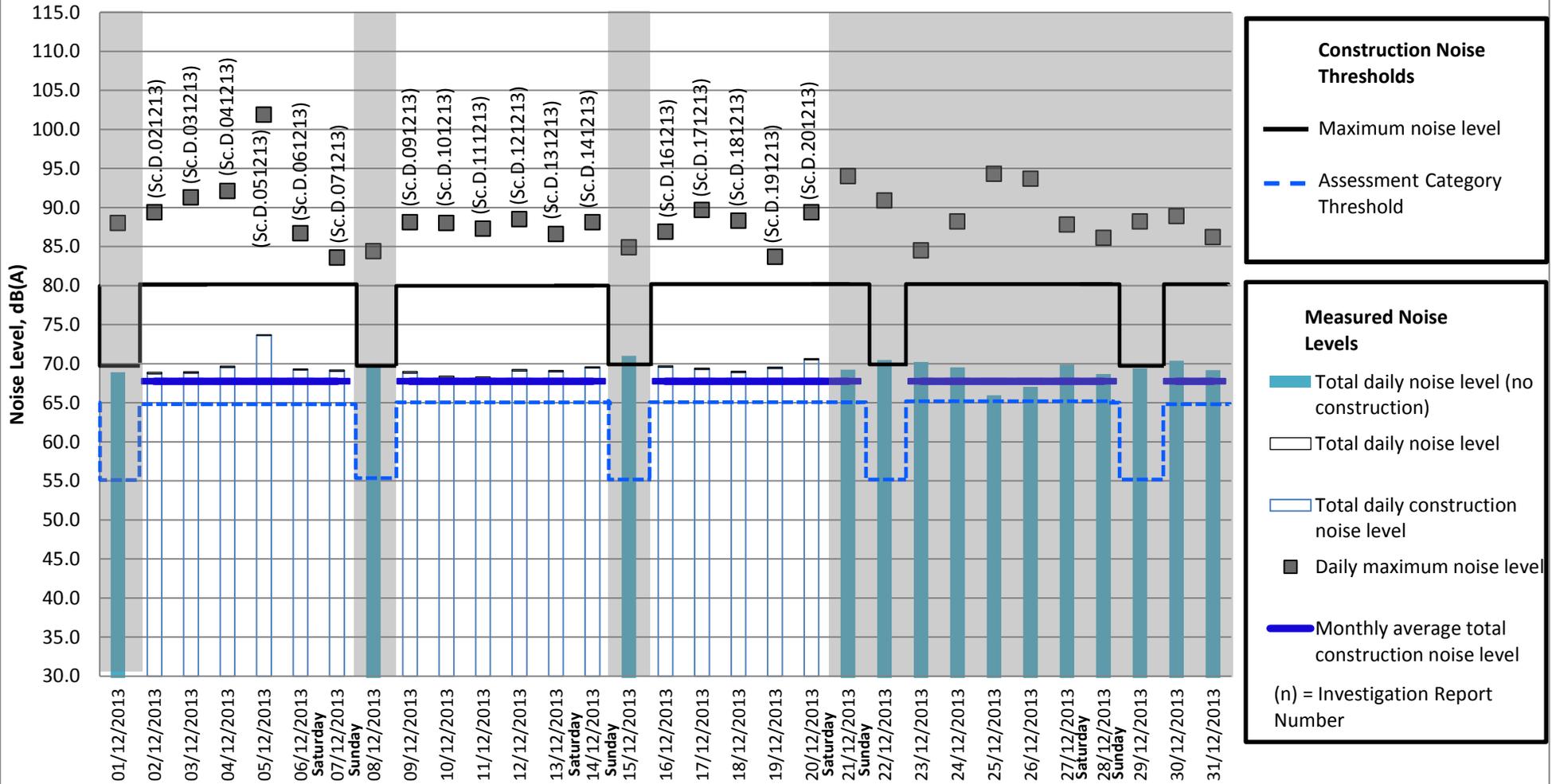
Note: The grey areas of the chart represent days on which no construction works have been conducted; no evening works were conducted between 20/12/13 and 06/01/14. Data is missing on 05/12/13 and 06/12/13 due to adverse weather conditions.

Measured Night-time Noise Levels at North Leg Measurement period: December 2013



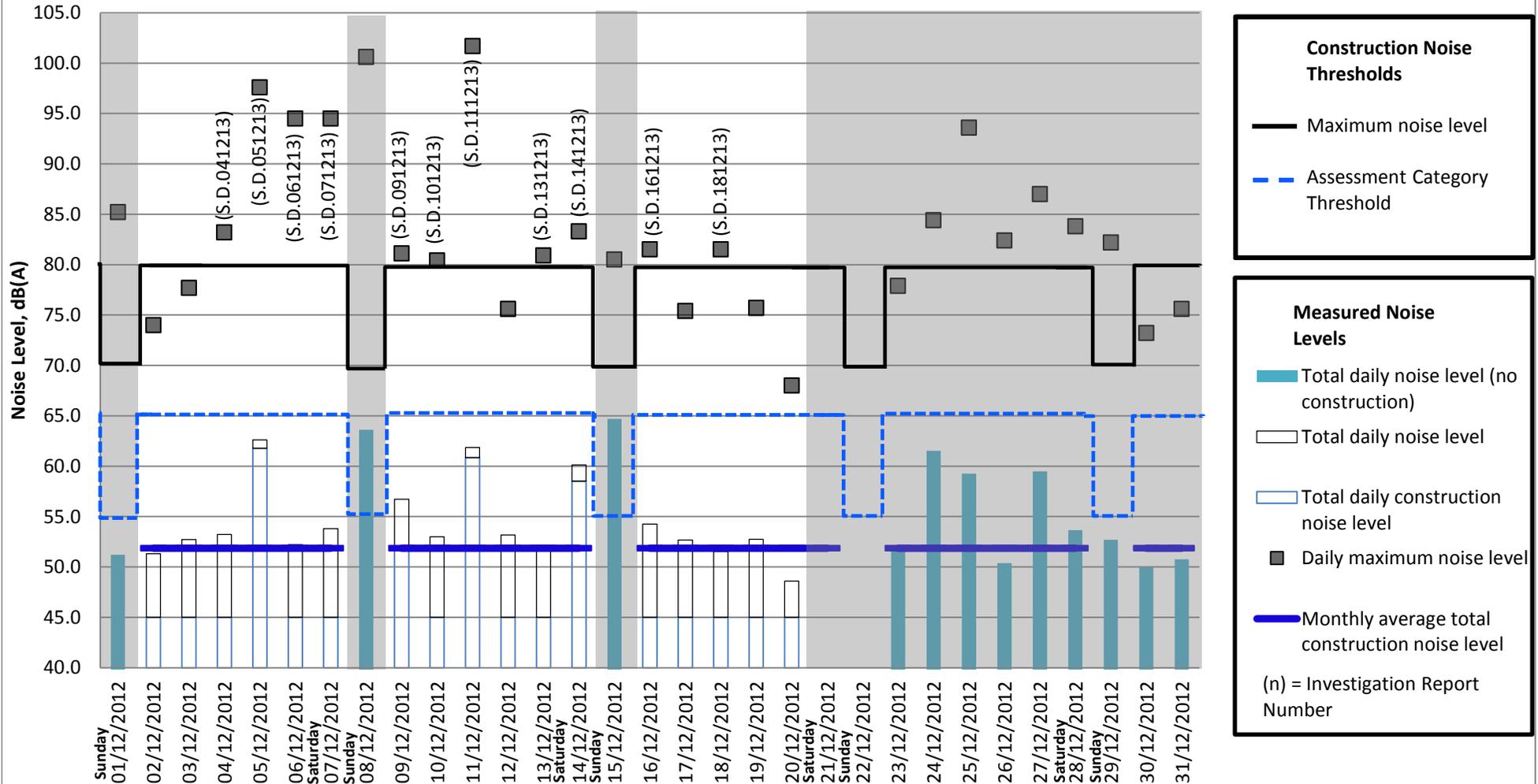
Note: The grey areas of the chart represent days on which no construction works have been conducted; no night time works were conducted between 20/12/13 and 06/01/14. Data is missing on 05/12/13 due to adverse weather conditions.

Measured Daytime Noise Levels at Scotstoun Measurement period: December 2013



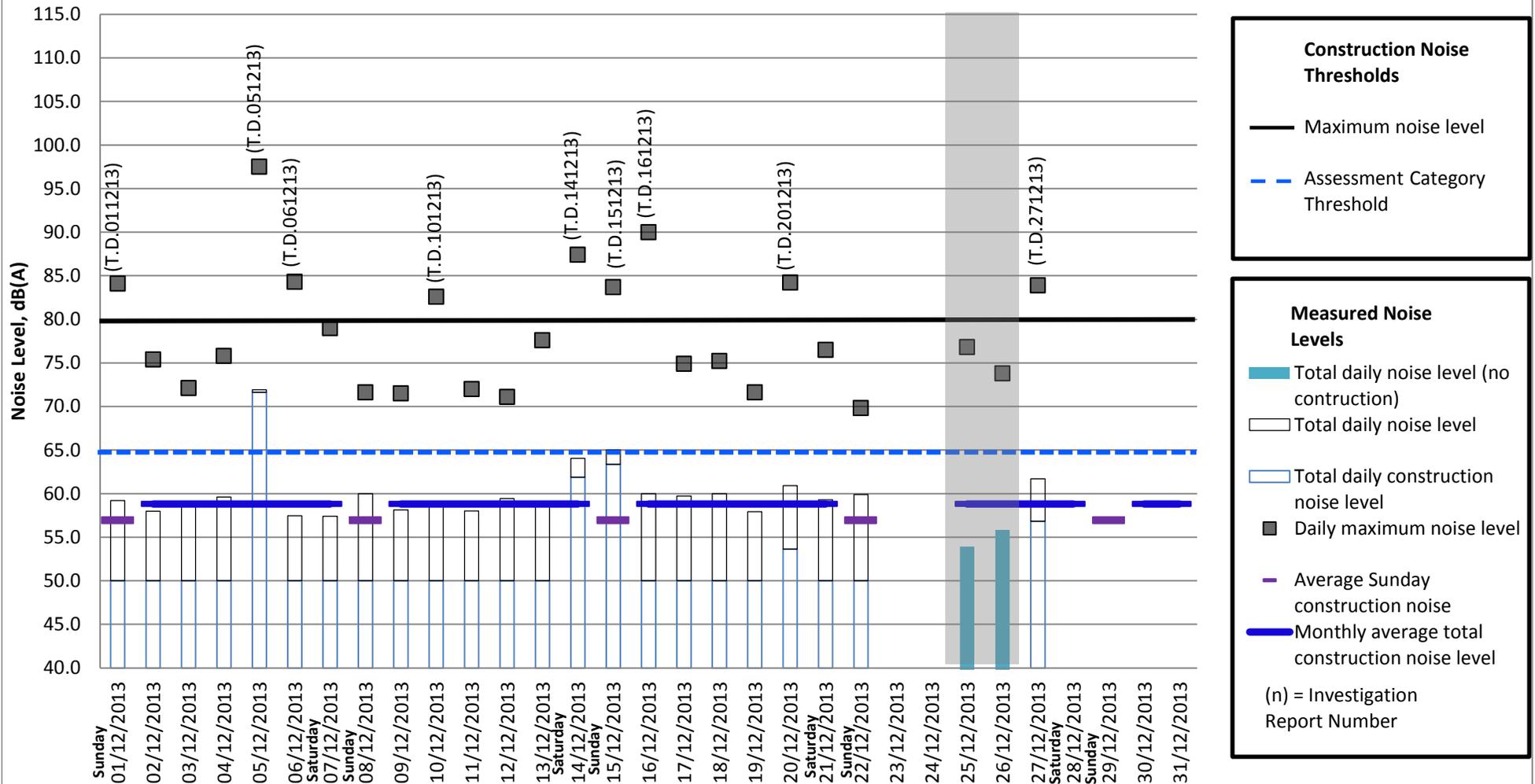
Note: The grey areas of the chart represent days on which no construction works have been conducted; no works were conducted over the Christmas period (20/12/13 to 06/01/14). The monthly average construction noise for Sunday has not been included as no Sunday works have been conducted at this location .

Measured Daytime Noise Levels at Springfield Measurement period: December 2013



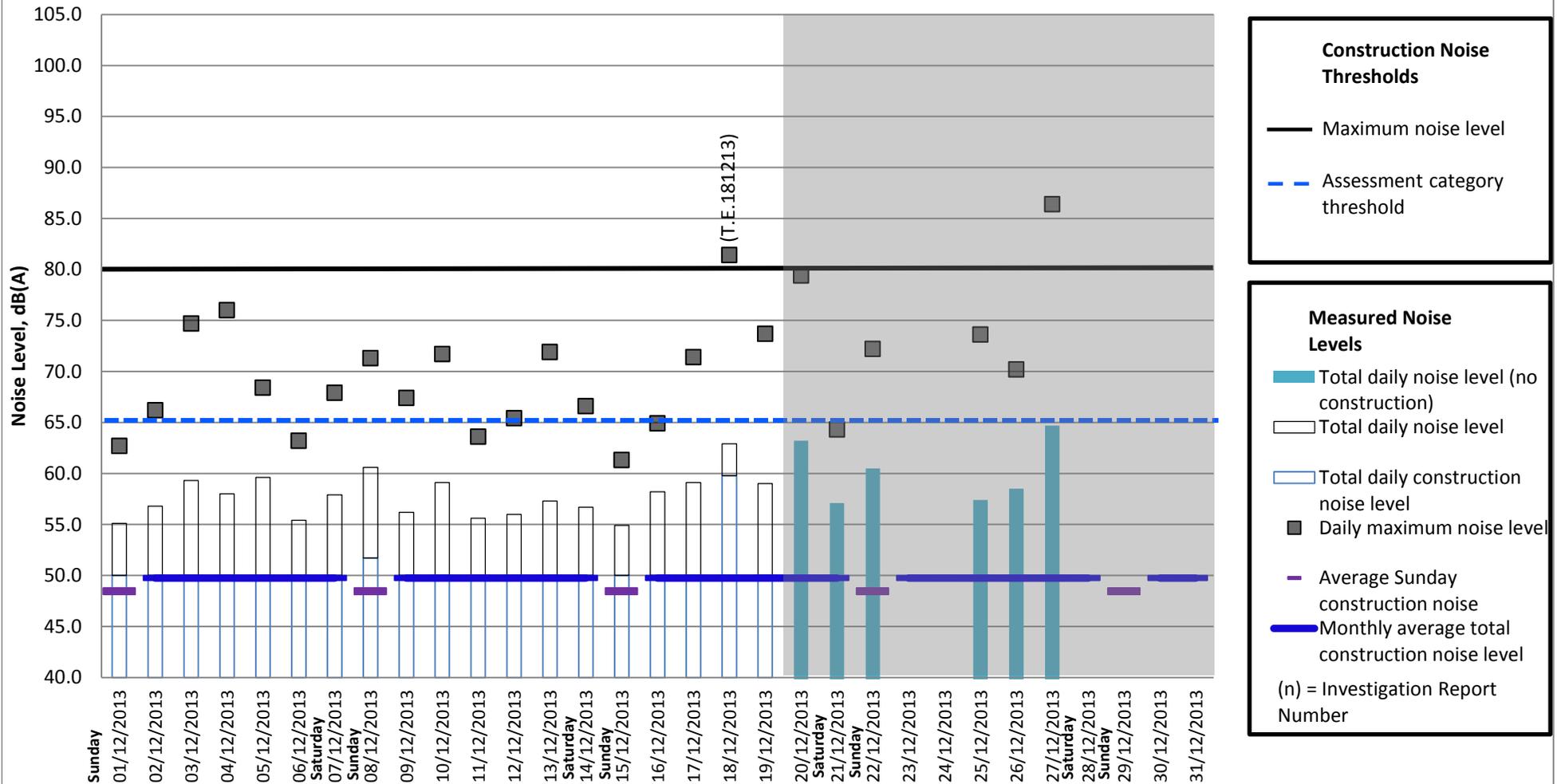
Note: The grey areas of the chart represent days on which no construction works have been conducted; no works were undertaken over the Christmas period (20/12/13 to 06/01/14). The monthly average construction noise for Sunday has not been included as no Sunday works have been conducted at this location. Data is missing on 21/12/13 and 22/12/13 due to device error.

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



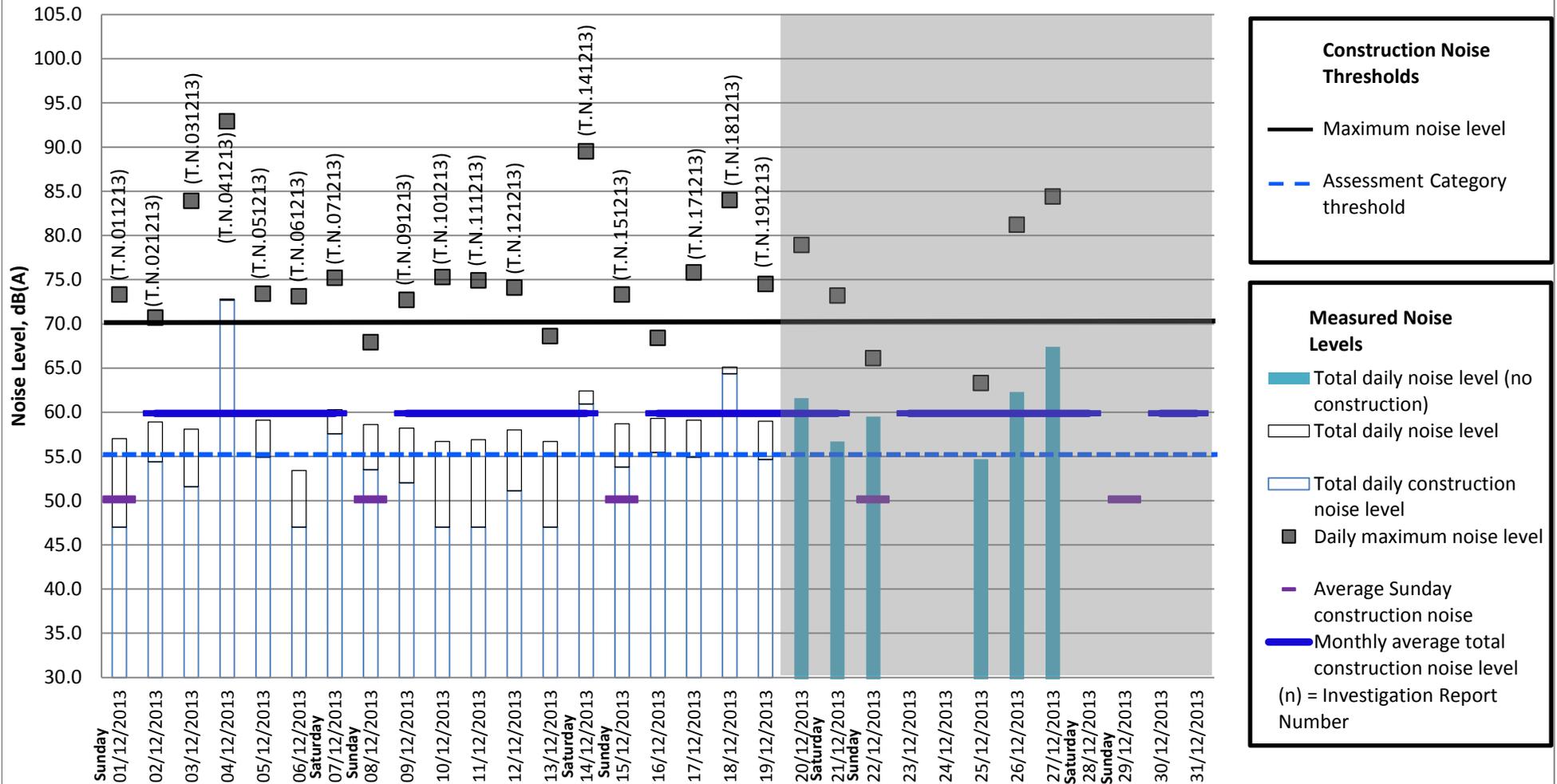
Note: The grey areas of the chart represent days on which no construction works have been conducted; no daytime works were conducted on Christmas Day or Boxing Day. Due to adverse weather over the Christmas period, the meter stopped running on 28/12/13. Due to device error, data is missing on 23/12/13 and 24/12/13.

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



Note: The grey areas of the chart represent days on which no construction works have been conducted; no evening works were conducted over the Christmas period (20/12/2013 to 06/01/2014). Due to adverse weather over the Christmas period, the meter stopped running on 28/12/2013. Due to device error, data is missing for 23/12/2013 and 24/12/2013.

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



Construction Noise Thresholds

- Maximum noise level
- - - Assessment Category threshold

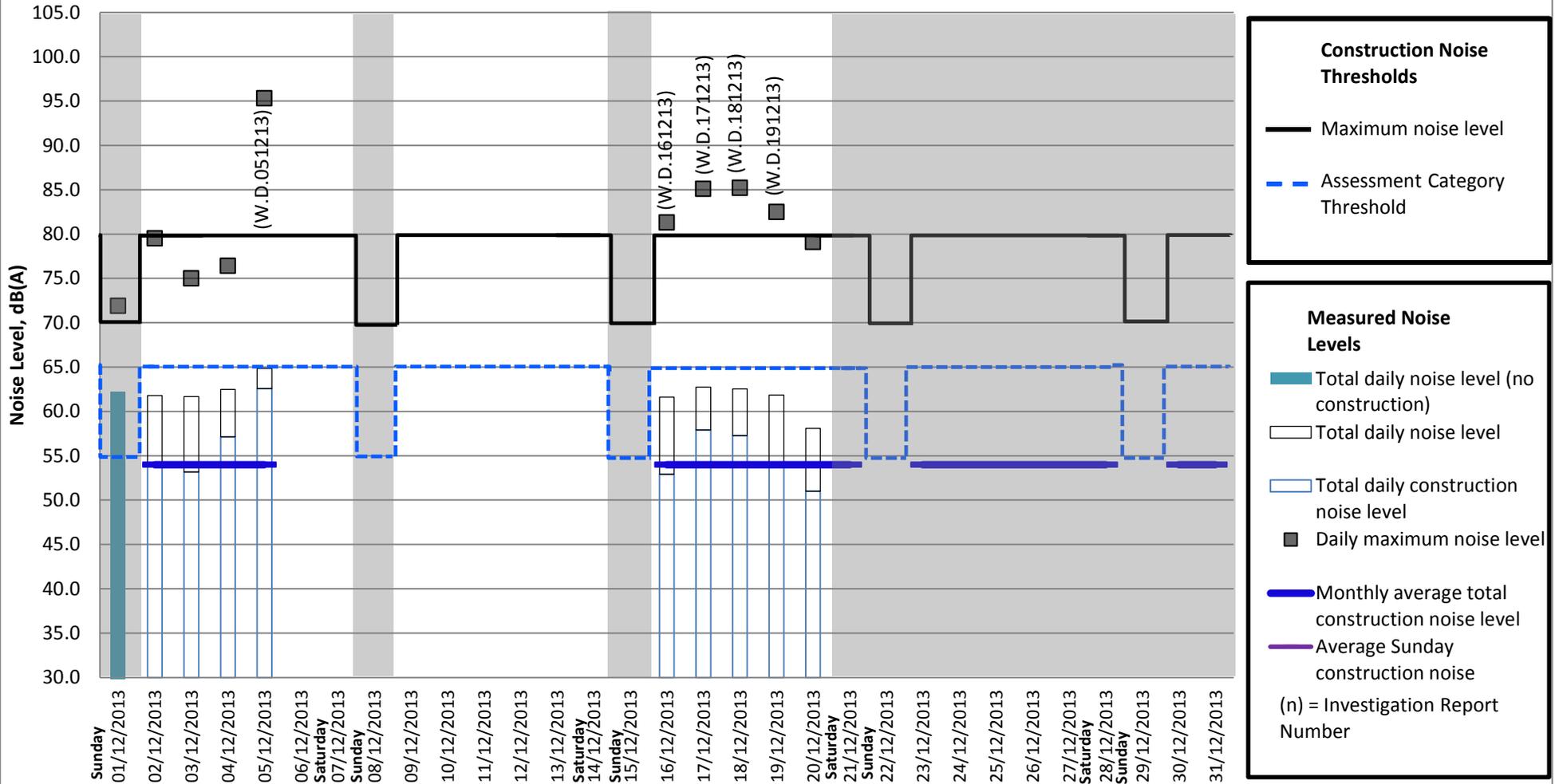
Measured Noise Levels

- Total daily noise level (no construction)
- Total daily noise level
- Total daily construction noise level
- Daily maximum noise level
- - - Average Sunday construction noise
- Monthly average total construction noise level

(n) = Investigation Report Number

Note: The grey areas of the chart represent days on which no construction works have been conducted; no night time works were conducted over the Christmas period (20/12/13 to 06/01/14). Due to adverse weather over the Christmas period, the meter stopped running on 28/12/13. Due to device error, data is missing for 23/12/13 and 24/12/13.

Measured Daytime Noise Levels at Whinny Hill Measurement period: December 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 (20/12/13 to 06/01/14). Data is missing for 06/12/13 to 15/12/13 and 21/12/13 to 31/12/13 due to device error and issues with access to the device.