



Contractor



Forth Crossing Bridge Constructors

HOCHTIEF Solutions
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Project

FORTH REPLACEMENT CROSSING

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**CONSTRUCTION NOISE MONITORING
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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 February 2014. 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 February 2014.
- 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 February 2014, 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 February 2014. 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 February 2014
M1	Whinny Hill	Network	<ul style="list-style-type: none"> • Surfacing, excavation, grouting and top soil batters • Crushing works <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 • Pier N1 de-stressing wells, cleaning of cofferdam
M4	North Leg	Crossing	<ul style="list-style-type: none"> • Central Tower rebar, formwork & concreting works • North Tower rebar, formwork & concreting works • Pier N1 de-stressing wells, cleaning of cofferdam
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 • Concreting and fixing rebar at S6 • Society Road TARMAC coring • Bearing installation at S7
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 • Concreting and fixing rebar at S6 • Society Road TARMAC coring • Bearing installation at S7
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 • Concreting and fixing rebar at S6 • Society Road TARMAC coring • Bearing installation at S7 • Launch – install plates to props, king post works and structural steel works
M11	Linn Mill	Network	<ul style="list-style-type: none"> • Launch – install plates to props, king post works

		(close proximity to Crossing)	<p>and structural steel works</p> <ul style="list-style-type: none"> • Pier S5 rebar, formwork & concreting works • Preparation of rebar prefabrication area at S5 causeway • Concreting and fixing rebar at S6 • Bearing installation at S7
M13	Clufflat Brae	Crossing	<ul style="list-style-type: none"> • Launch – install plates to props, king post works and structural steel works • Society Road TARMAC coring
M14	Springfield	Network	<ul style="list-style-type: none"> • Launch – install plates to props, king post works and structural steel works <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 – install plates to props, king post works and structural steel works • Gyrotory – cut batters/shaping rock • A904 tie in road works, including verge fill, kerbing and placing/trimming of type 1 sub-base for footpath <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 • Fill south bund/landscape <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 graphs 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 the meter at Linn Mill was found to stop running on two dates, 9 and 23 February. Some short periods of data are also missing due to power supply issues at Scotstoun; a total of 6 days of data is missing from this location. Additionally, due to house renovations at Springfield, a week of data is missing for this monitoring location. No results are available for February for Port Edgar as the meter was damaged during adverse weather conditions. Results are also not available for the North Leg for February due to an error with the device that was not detected due to the inaccessibility of this device.

3.3 Results demonstrate that the monthly average total construction noise results for daytime were within the threshold levels for all monitoring locations for February 2014, 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 all locations; Butlaw Fisheries, Clufflat Brae, Inchgarvie, Tigh-Na-Grian and Linn Mill. With regard to the Sunday averages (for applicable monitoring locations), there were an exceedances of both the day time and night time Sunday averages. Exceedances of the daytime Sunday average occurred at Butlaw Fisheries, Clufflat Brae, Inchgarvie and Linn Mill. Exceedances of the night time Sunday average occurred at Butlaw Fisheries, Linn Mill and Tigh-Na-Grian.

3.4 The exceedances noted are not thought to have been caused by increased noise levels due to construction. Each of the exceedances of the averages and Sunday averages, with the exception of the daytime averages at Springfield and Scotstoun, were found to be affected by increased noise levels due to periods of adverse weather. Audio demonstrates that the increased levels were caused by strong winds and with waves at Butlaw Fisheries and raindrops at Linn Mill also contributing to increased levels at these locations. 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 With regard to the exceedance of the threshold at Springfield, it was found that house renovations which began on the 18 February significantly influenced the noise levels at this location on 19, 20 and 21 of February, prior to the meter then being temporarily removed to enable the works to be undertaken. 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 February is consistent with levels for previous months.

- 3.6** During February 2014, 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 three exceedances occurred as a result of construction related noise. Each of these occurred at Linn Mill, with two occurring during the day time period and the other during the evening period (Table 2). However, the majority of exceedances at all locations 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 February the maximum noise threshold was exceeded on 36 occasions (daytime, 12; evening, 5; night time, 19). No exceedances were related to construction works. Exceedances were attributed to non-construction factors, including waves, adverse weather, planes and birds.
Clufflat Brae	During February the maximum noise threshold was exceeded on 38 occasions (daytime, 12; evening, 7; night time, 19). No exceedances were found to be due to construction works. Exceedances were found to be largely due to wind.
Inchgarvie Lodge	During February the maximum noise threshold was exceeded on 38 occasions (daytime, 14; evening, 4; night time, 20). No exceedances were attributed to construction works. Investigations found residents at the property, planes, birds and adverse weather to be the main contributing factors to the exceedances at this location.
Linn Mill	During February the maximum noise threshold was exceeded on 45 occasions (daytime, 12; evening, 7; night time, 26). Three construction related exceedances were recorded at this location during the day time, one due to a reversing vehicle and the other two due to plant movements. However, the exceedances at this location were largely due to adverse weather and birds.
Tigh-Na-Grian	During February the maximum noise threshold was exceeded on 26 occasions (daytime, 7; evening, 0; night time, 19). Exceedances were due to non-construction factors, notably wind, with some caused by birds, planes and FRB traffic.
Dundas Home Farm	During February the maximum noise threshold was exceeded on 5 occasions. These exceedances were not caused by the works. The exceedances were due to crow bangers, birds and local residents.
Echline	During February the maximum noise threshold was exceeded on 24 occasions. No exceedances at this location were due to construction activities. Exceedances were largely attributed to vehicles passing by on the adjacent roads, adverse weather conditions and air quality monitor collection.
Springfield	During February the maximum noise threshold was exceeded on 13 occasions. The exceedances were not considered to be caused by construction works at this location. Exceedances were found to be due to local residents.
Scotstoun	During February the maximum noise threshold was exceeded on 19 occasions. No exceedances were due to construction. Exceedances were largely attributed to vehicles passing by on the adjacent road.
Whinny Hill	During February the maximum noise threshold was exceeded on 7 occasions. Exceedances were not due to construction activities. Exceedances were due to a range of factors such as planes, birds and adverse weather conditions. .

Table 3: Summary of Construction Related Exceedances at Monitoring Locations

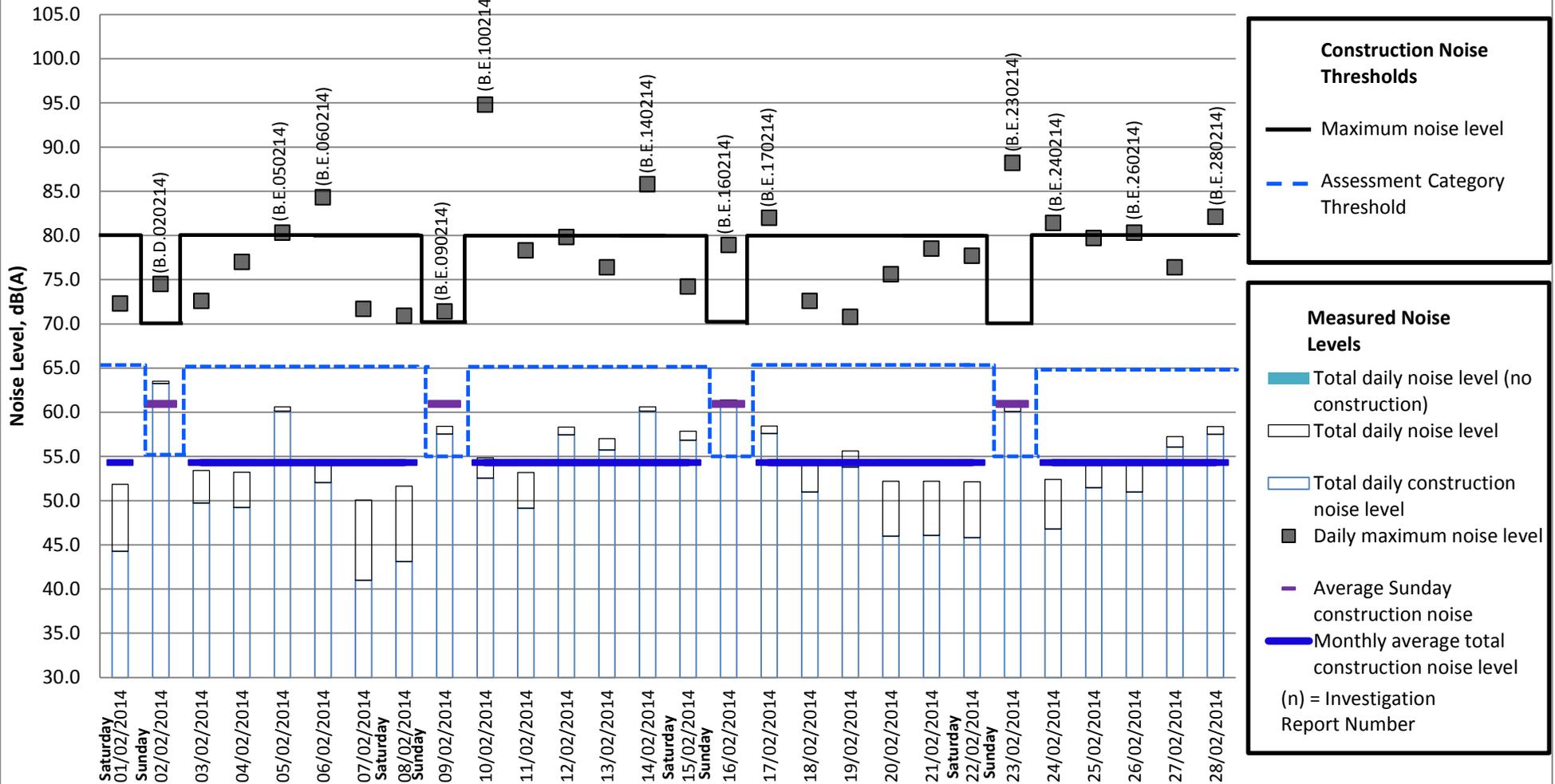
Construction Related Noise Exceedances - February 2014						
Date	Monitor	Period	Description	Lmax (dB(A))	Threshold (dB(A))	NVIR No.
05/02/2014	Linn Mill (Echline Field)	Evening	Plant moving in Echline	75.5	70.0	L.E.050214
14/02/2014		Day	Isolated reversing alarm	83.6	80.0	L.D.100214
28/02/2014		Day	Plant moving in Echline	80.7	80.0	L.D.280214



APPENDIX A

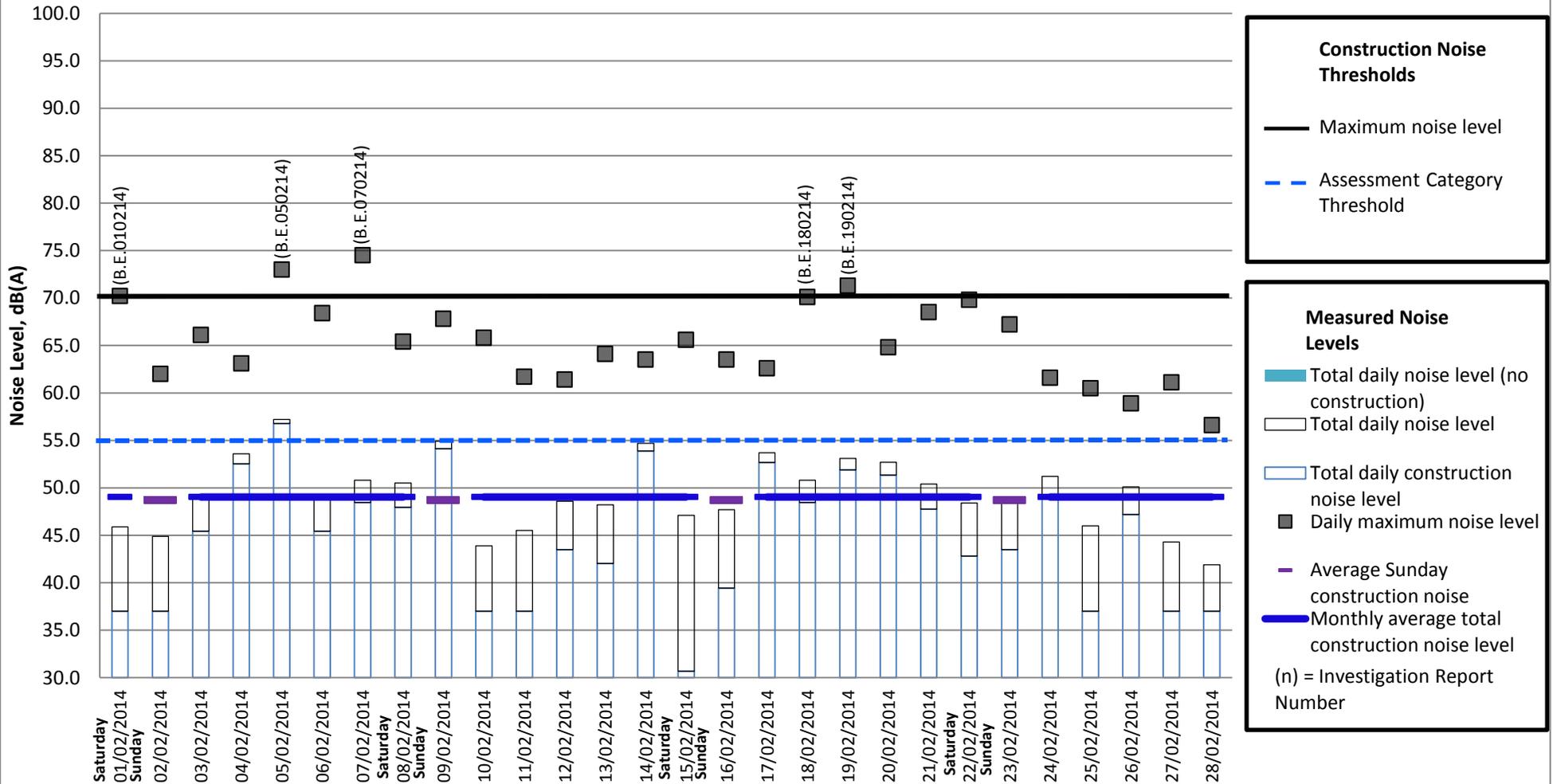
Measured Daytime Noise Levels at Butlaw Fisheries

Measurement period: February 2014



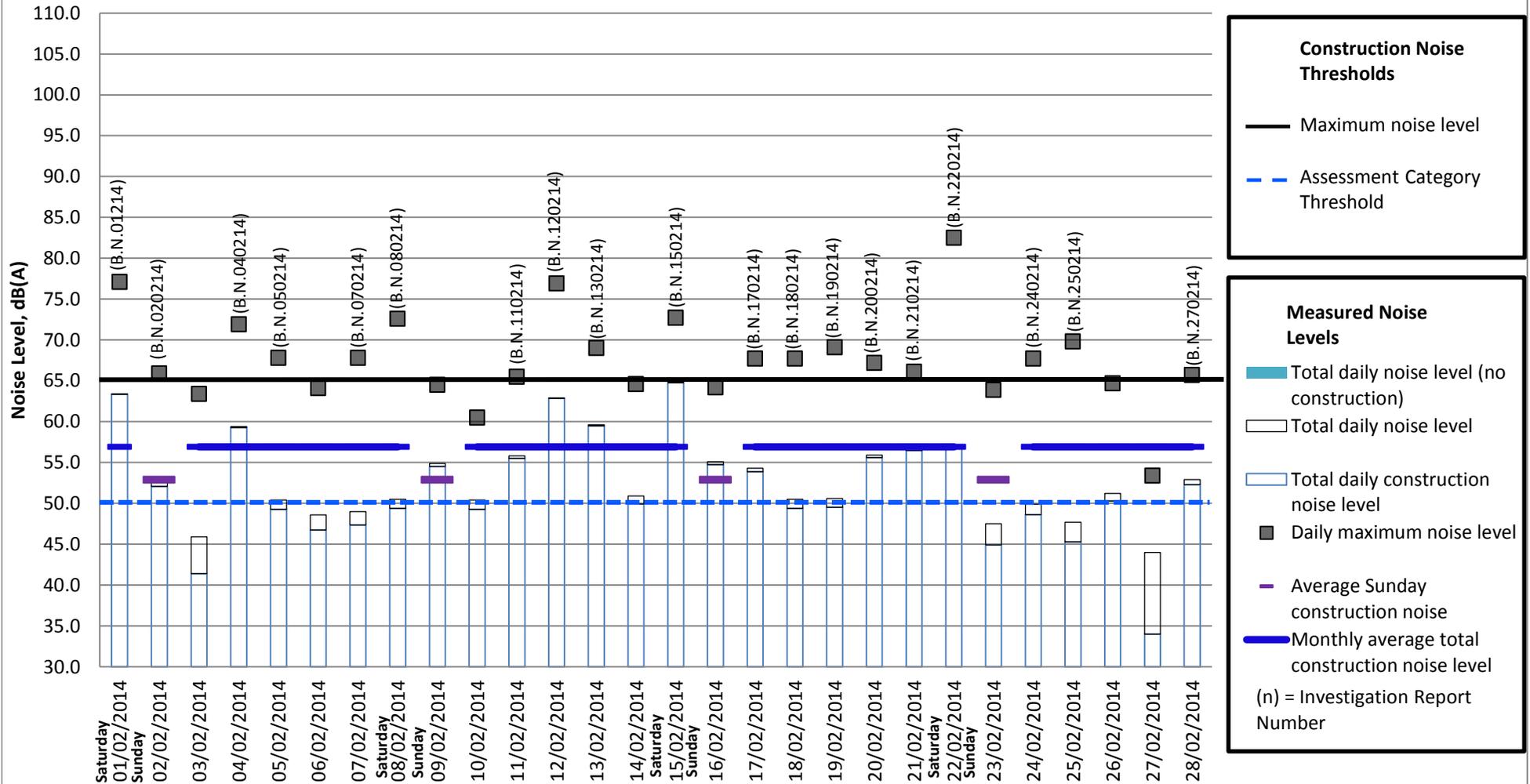
Measured Evening Noise Levels at Butlaw Fisheries

Measurement period: February 2014



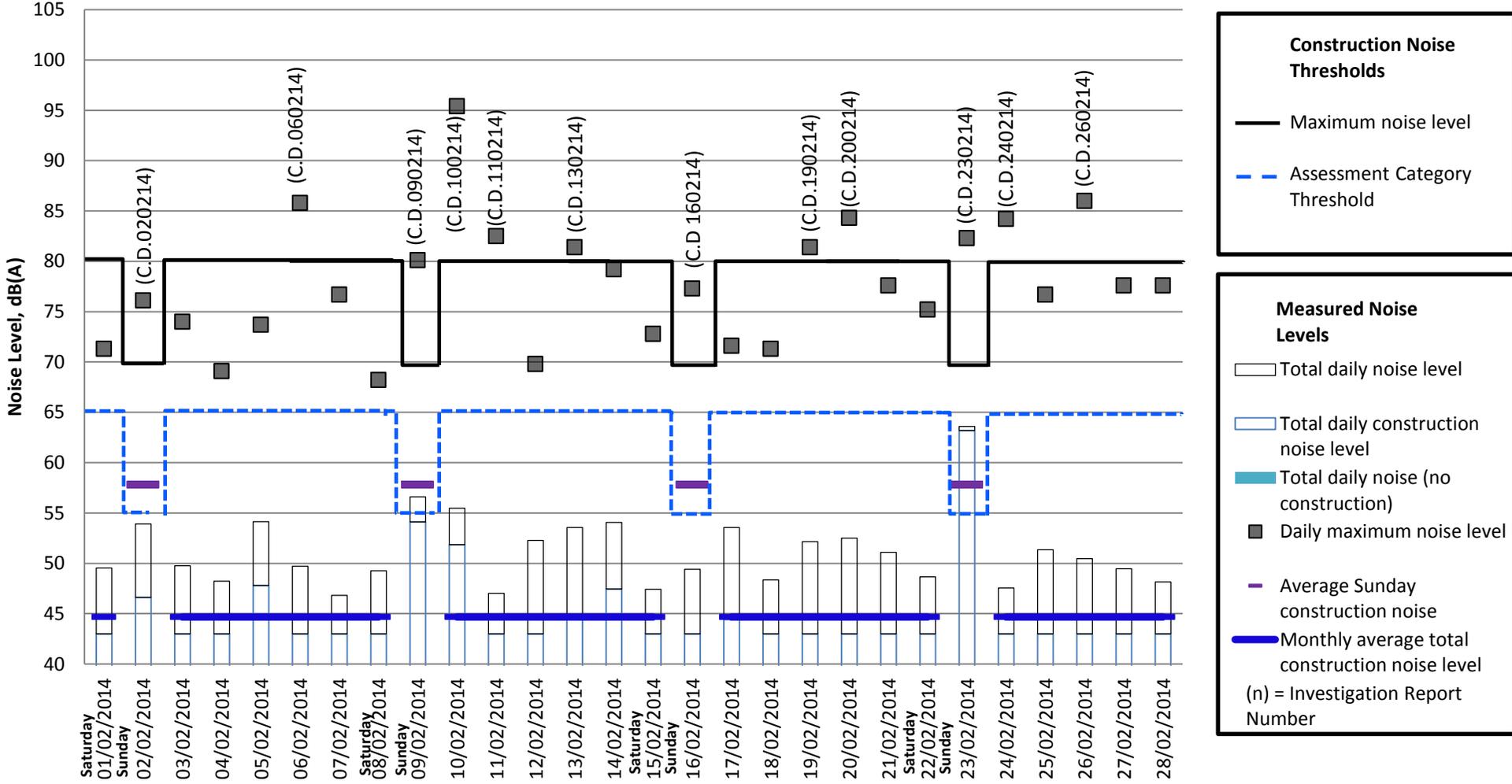
Measured Night time Noise Levels at Butlaw Fisheries

Measurement period: February 2014



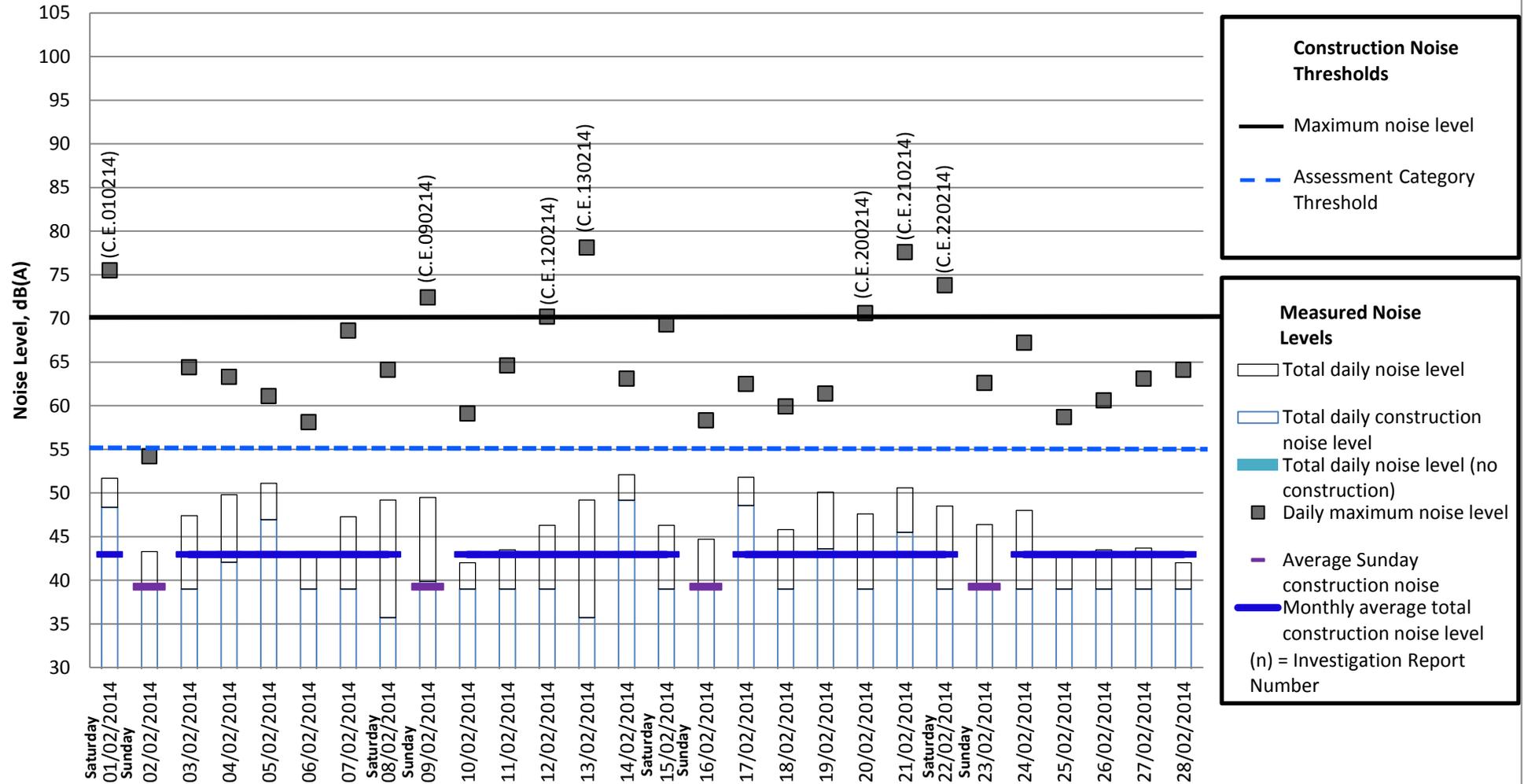
Measured Daytime Noise Levels at Clufflat Brae

Measurement period: February 2014



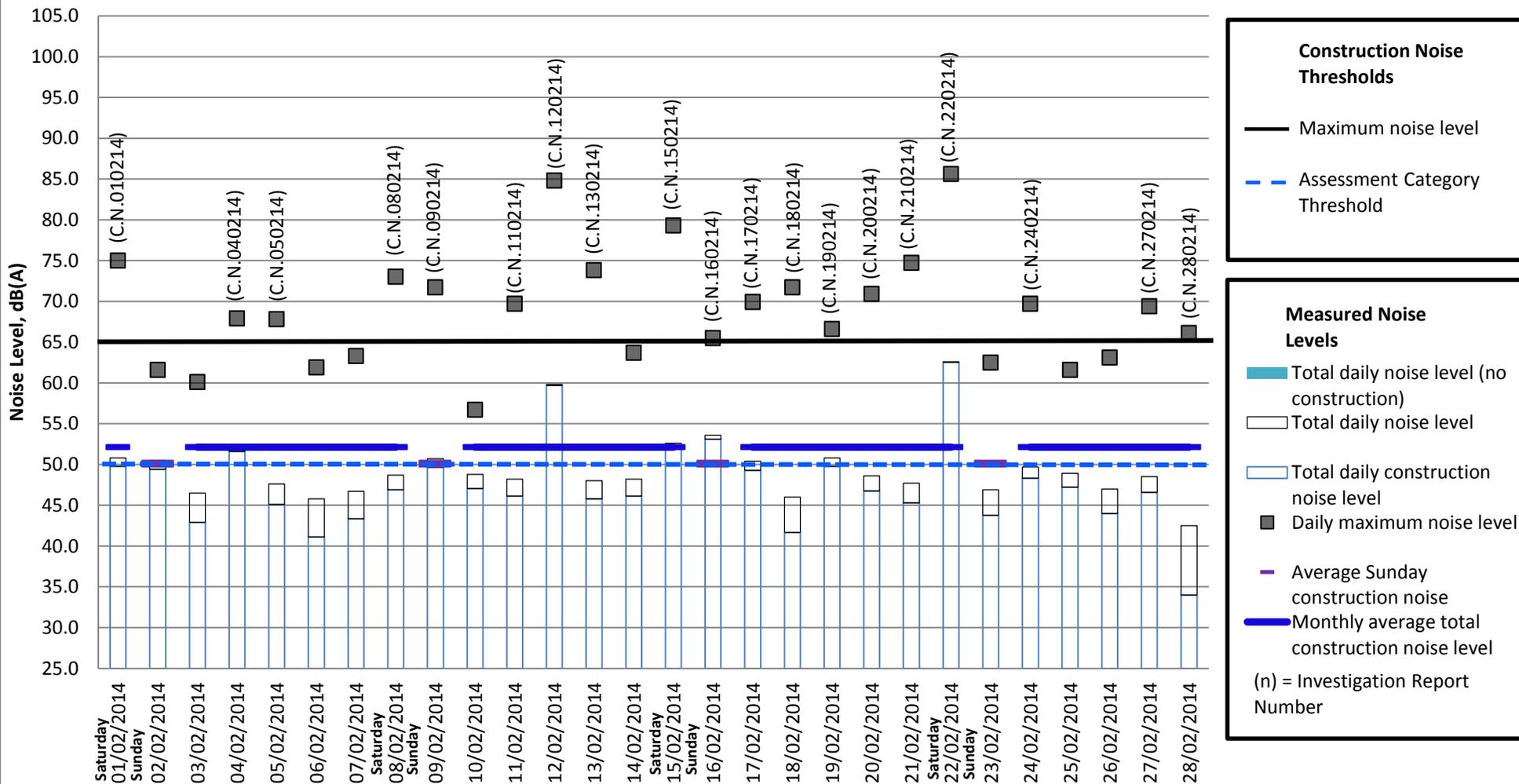
Measured Evening Noise Levels at Clufflat Brae

Measurement period: February 2014

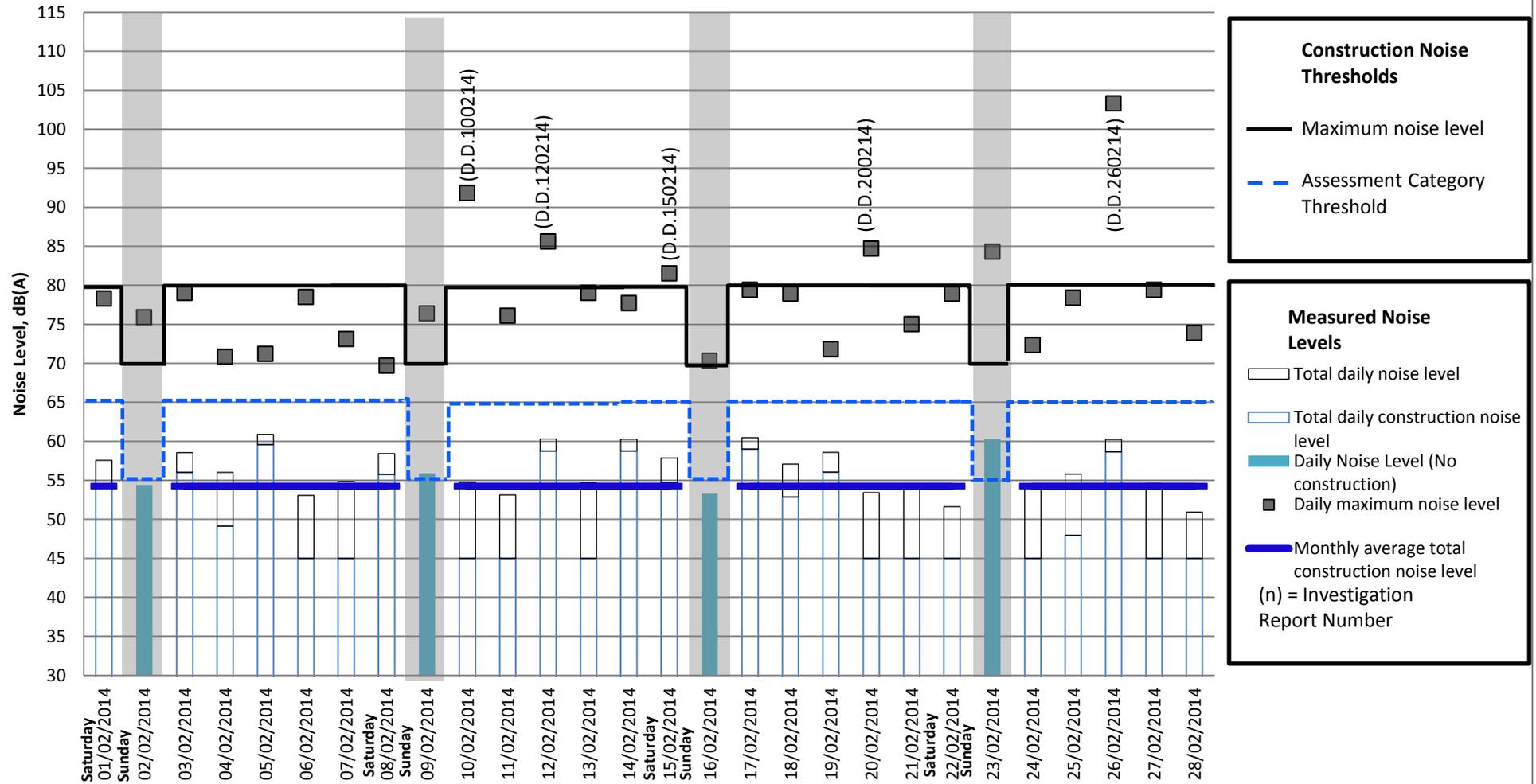


Measured Night-time Noise Levels at Clufflat Brae

Measurement period: February 2014

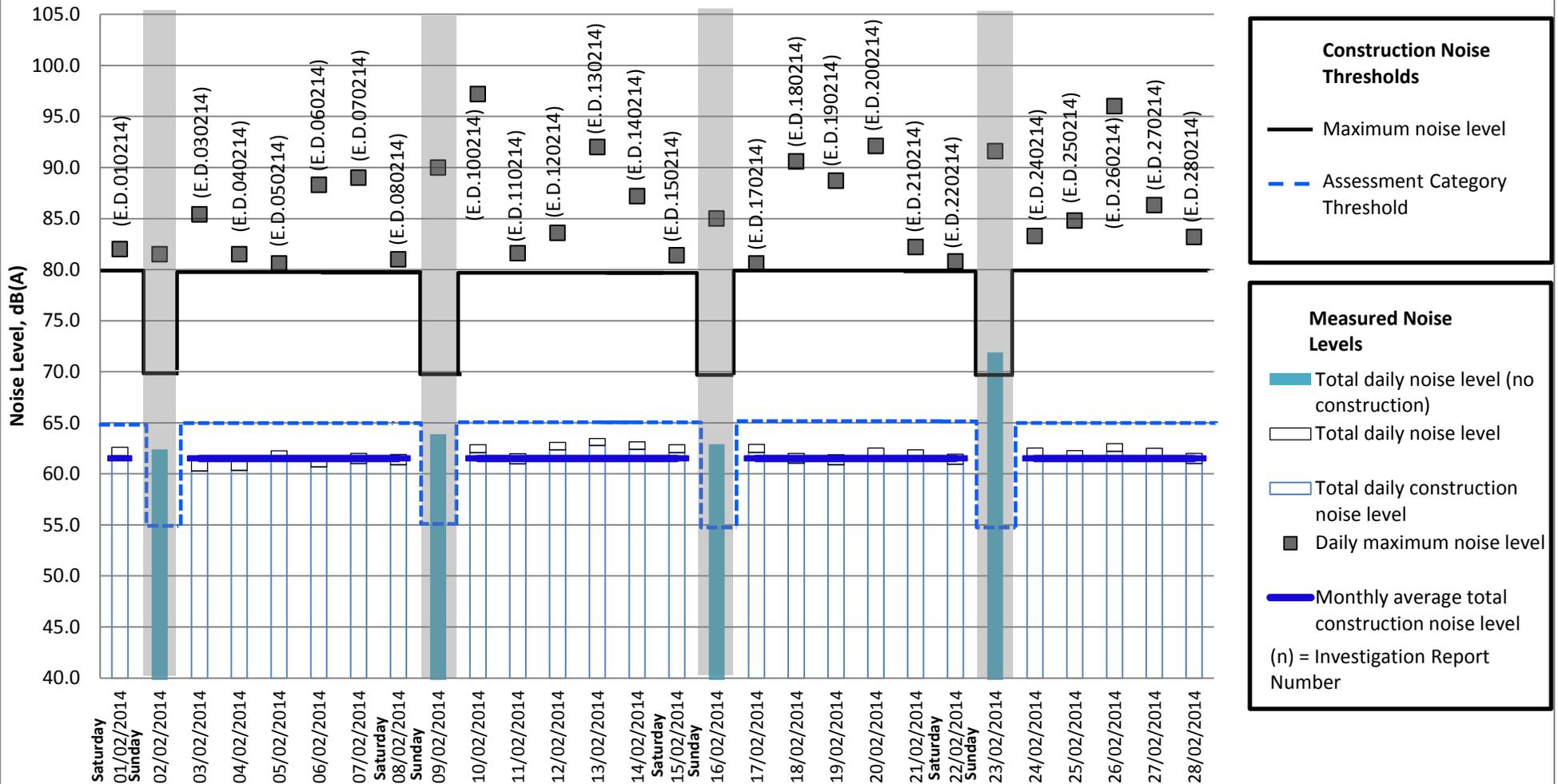


Measured Daytime Noise Levels at Dundas Home Farm Measurement period: February 2014



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

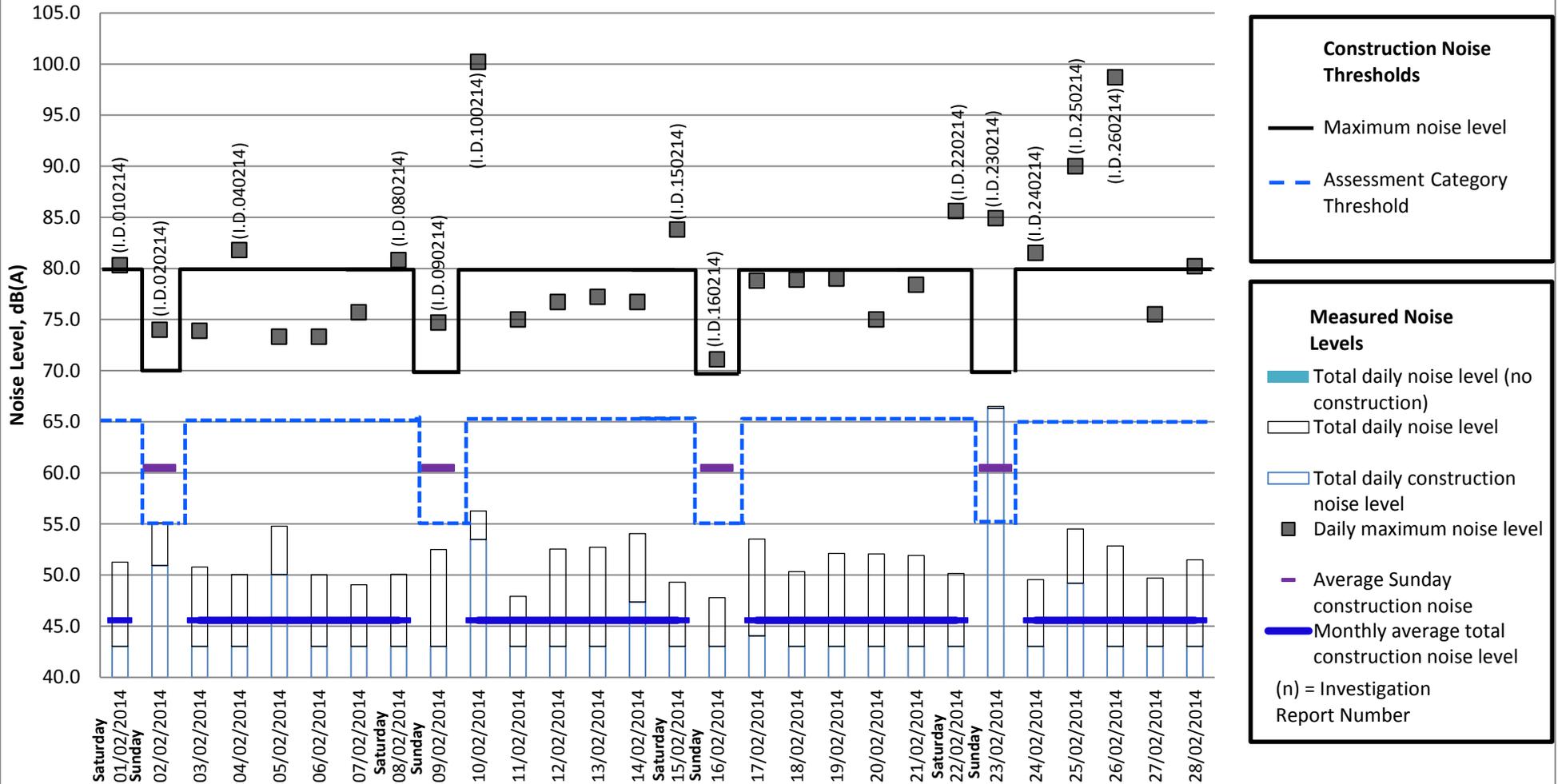
Measured Daytime Noise Levels at Echline Field Measurement period: February 2014



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. There were one off works on the nights commencing on the 24/02/14 and 25/02/14 on the A904 East (In the vicinity of the noise monitor at Echline corner). Throughout these works there were no construction exceedences.

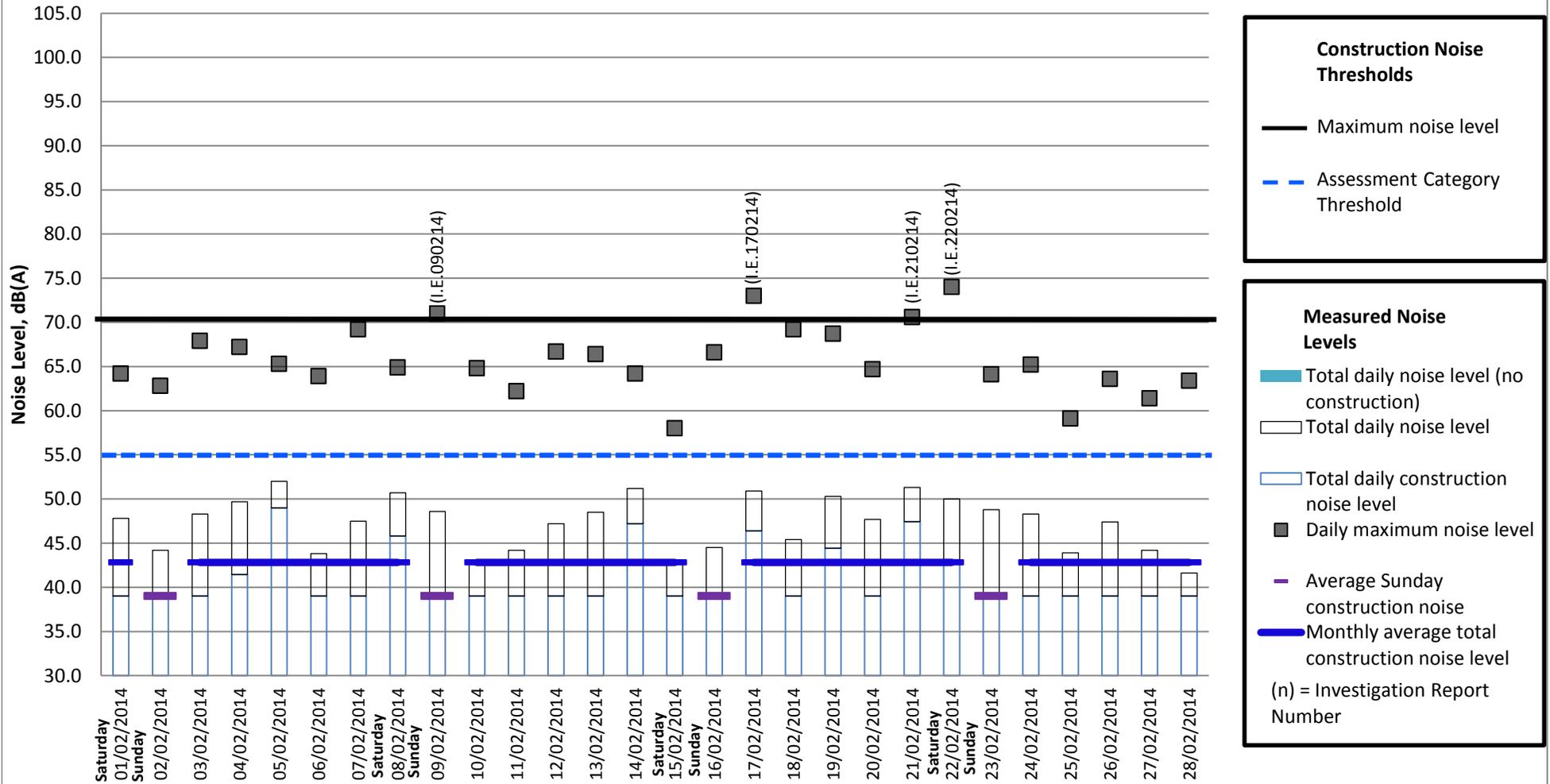
Measured Daytime Noise Levels at Inchgarvie

Measurement period: February 2014

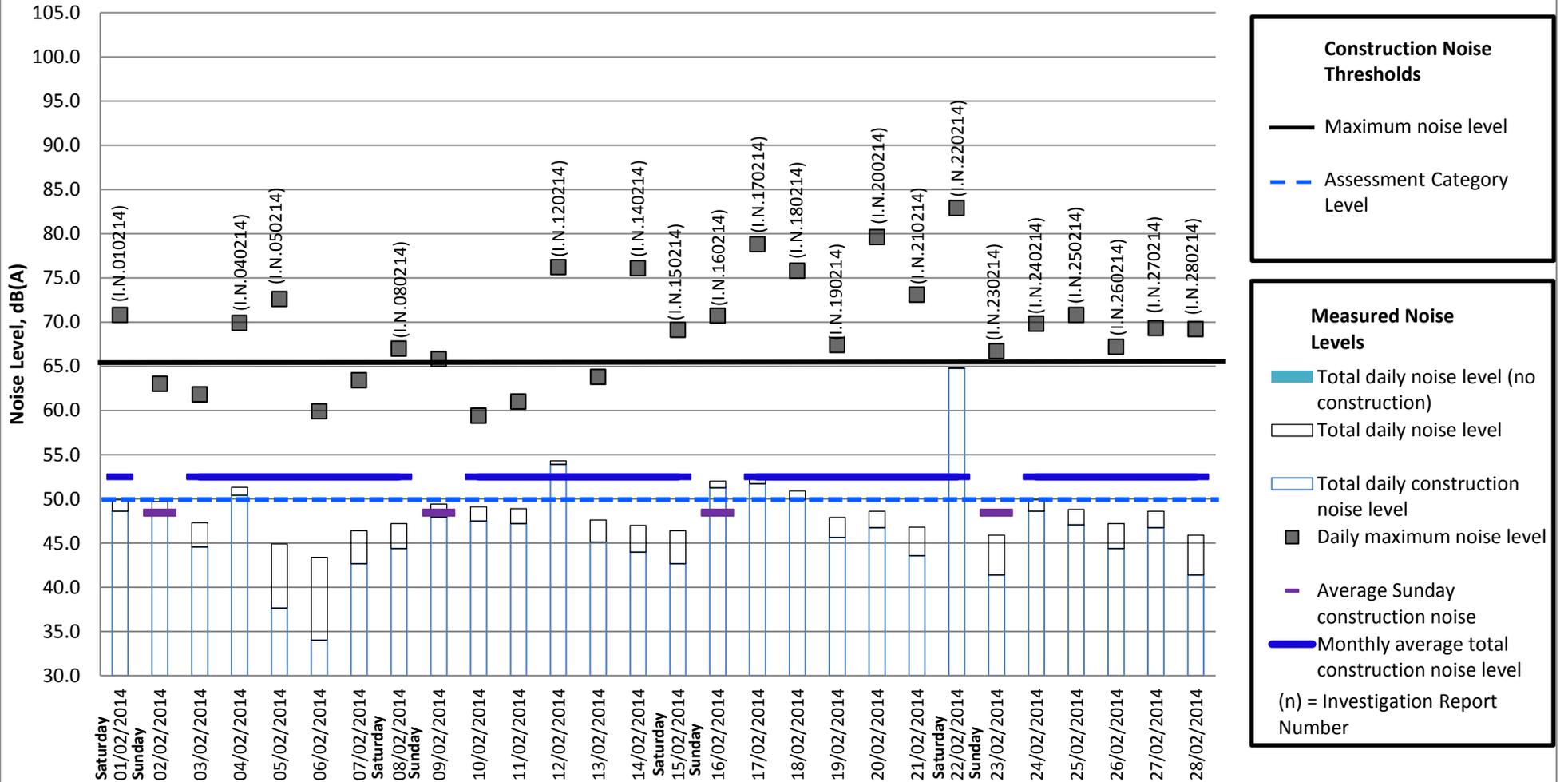


Measured Evening Noise Levels at Inchgarvie

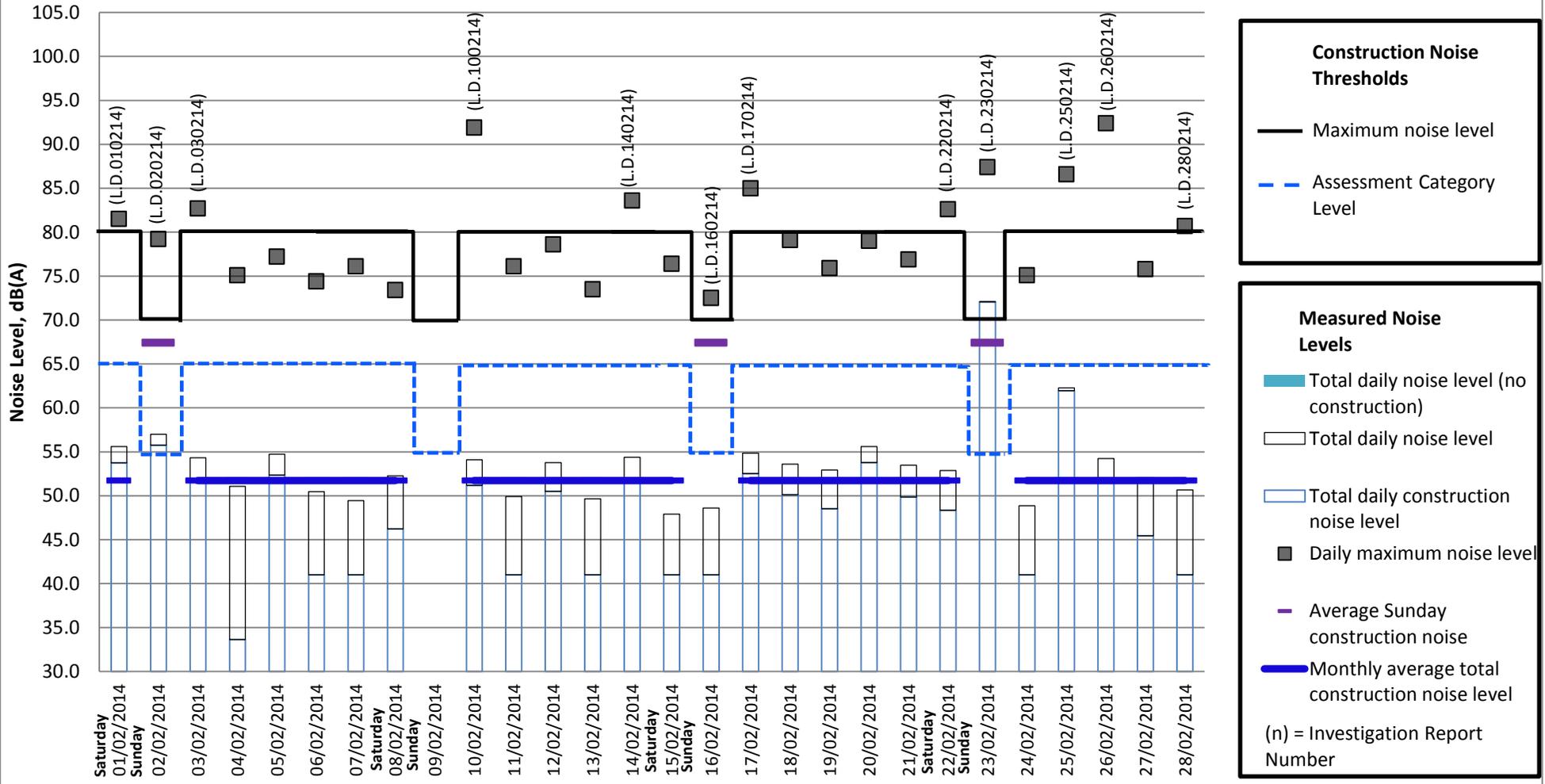
Measurement period: February 2014



Measured Night-time Noise Levels at Inchgarvie Measurement period: February 2014

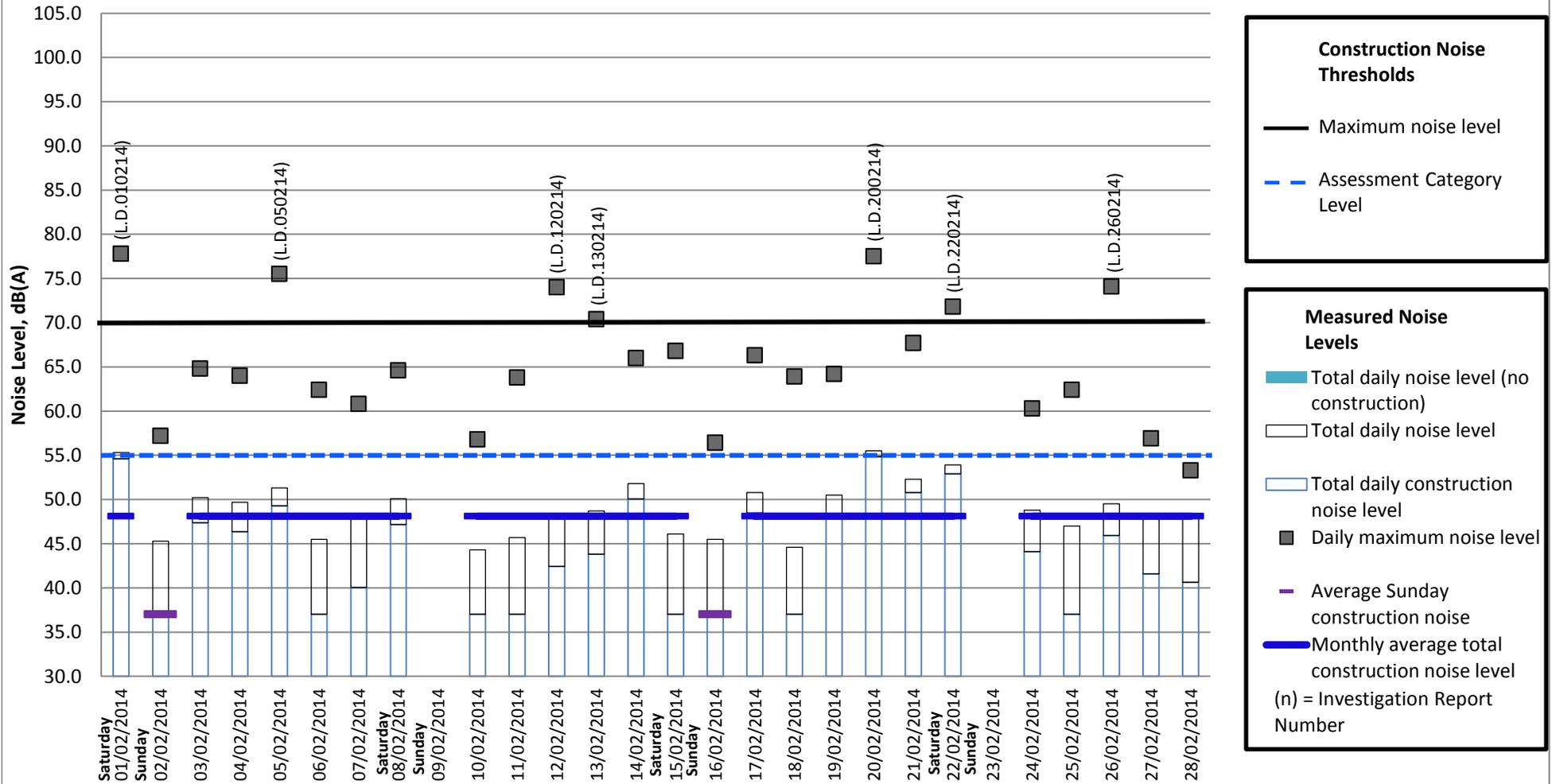


Measured Daytime Noise levels at Linn Mill Measurement period: February 2014



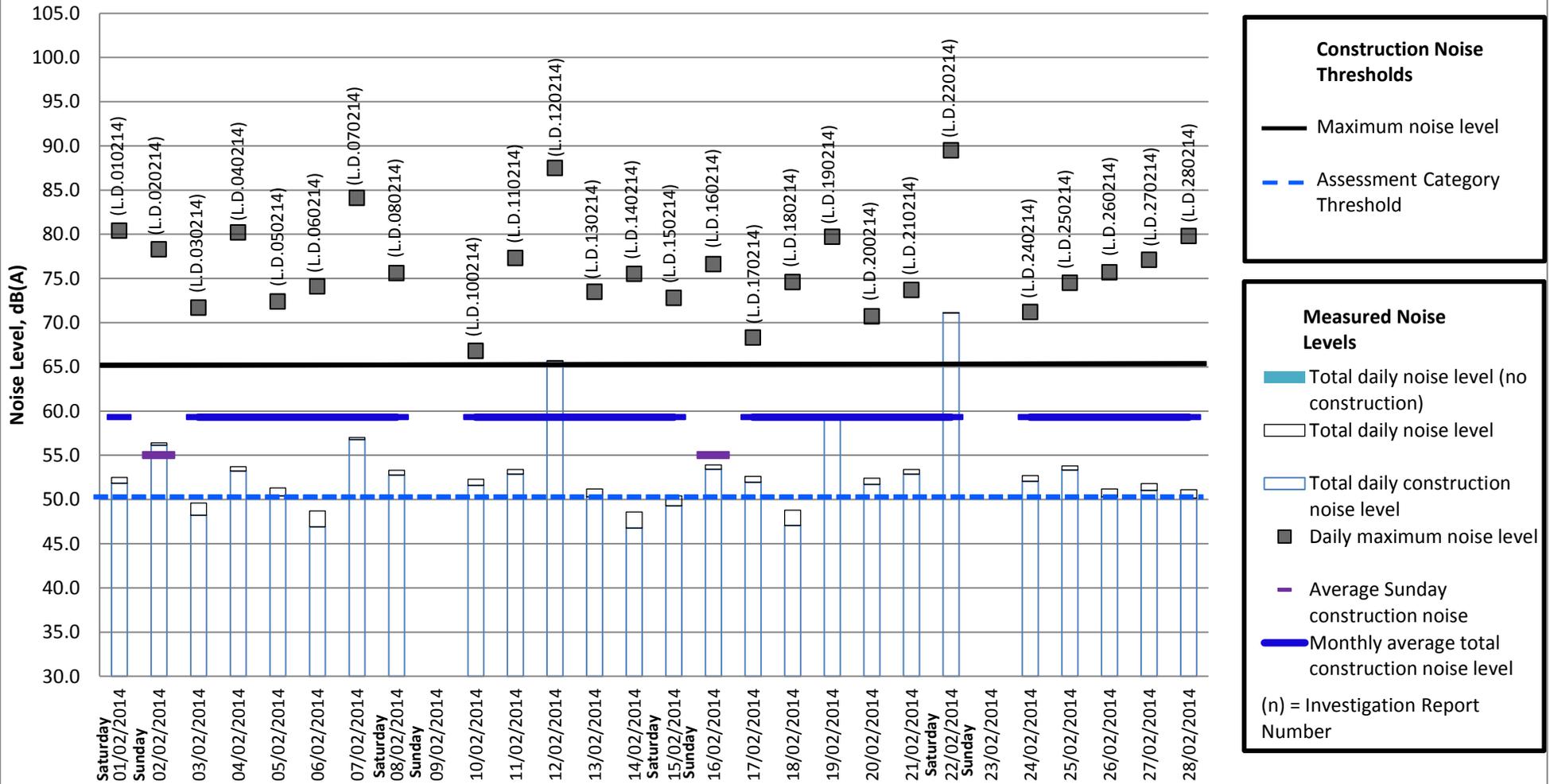
Note: Due to adverse weather conditions, data is missing for 09/02/14.

Measured Evening Noise Levels at Linn Mill Measurement period: February 2014



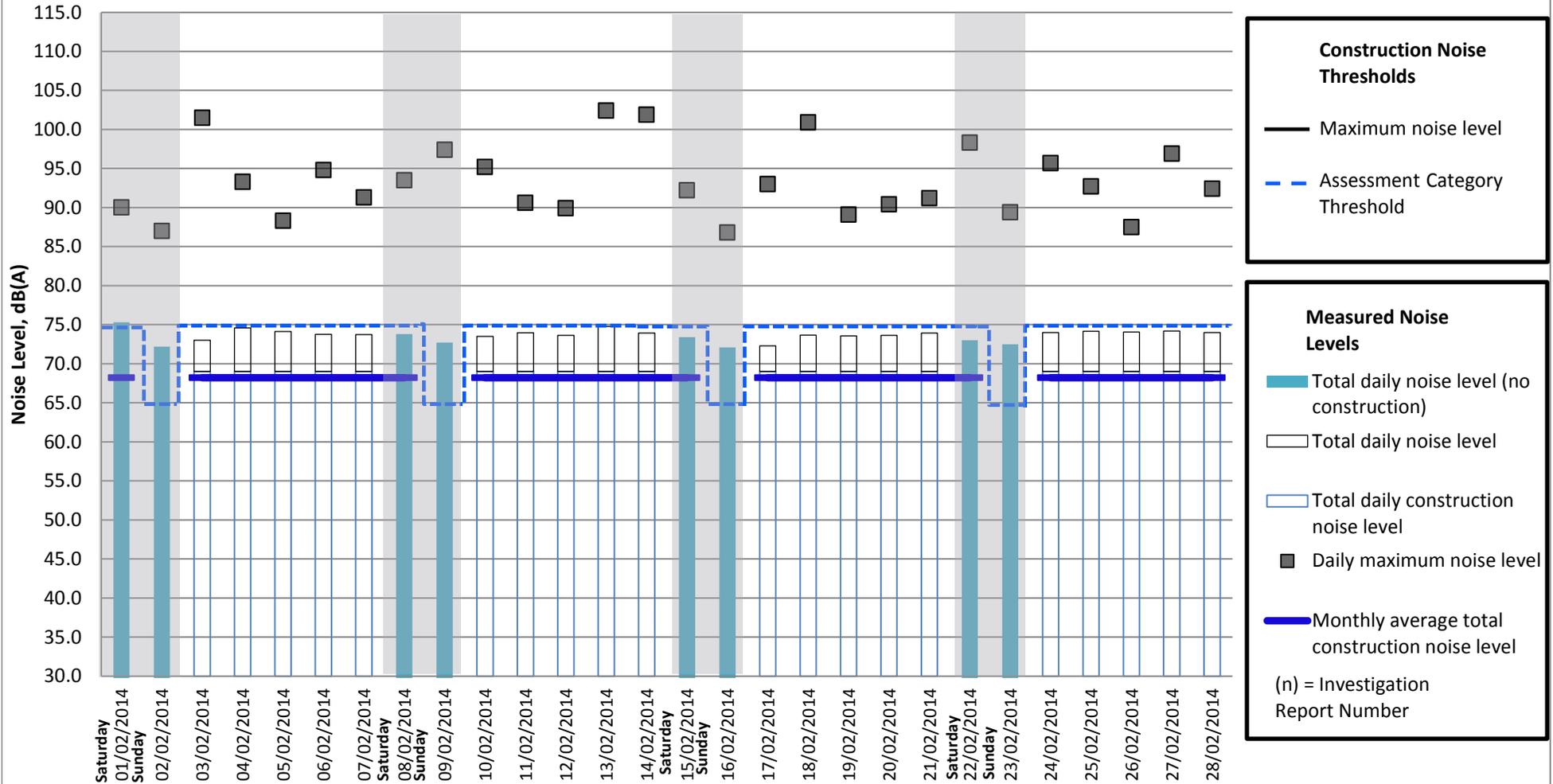
Note: Due to adverse weather conditions, data is missing for 09/02/14 and 23/02/14.

Measured Night-time Noise Levels at Linn Mill Measurement period: February 2014



Note: Due to adverse weather conditions, data is missing for 09/02/14 and 23/02/14.

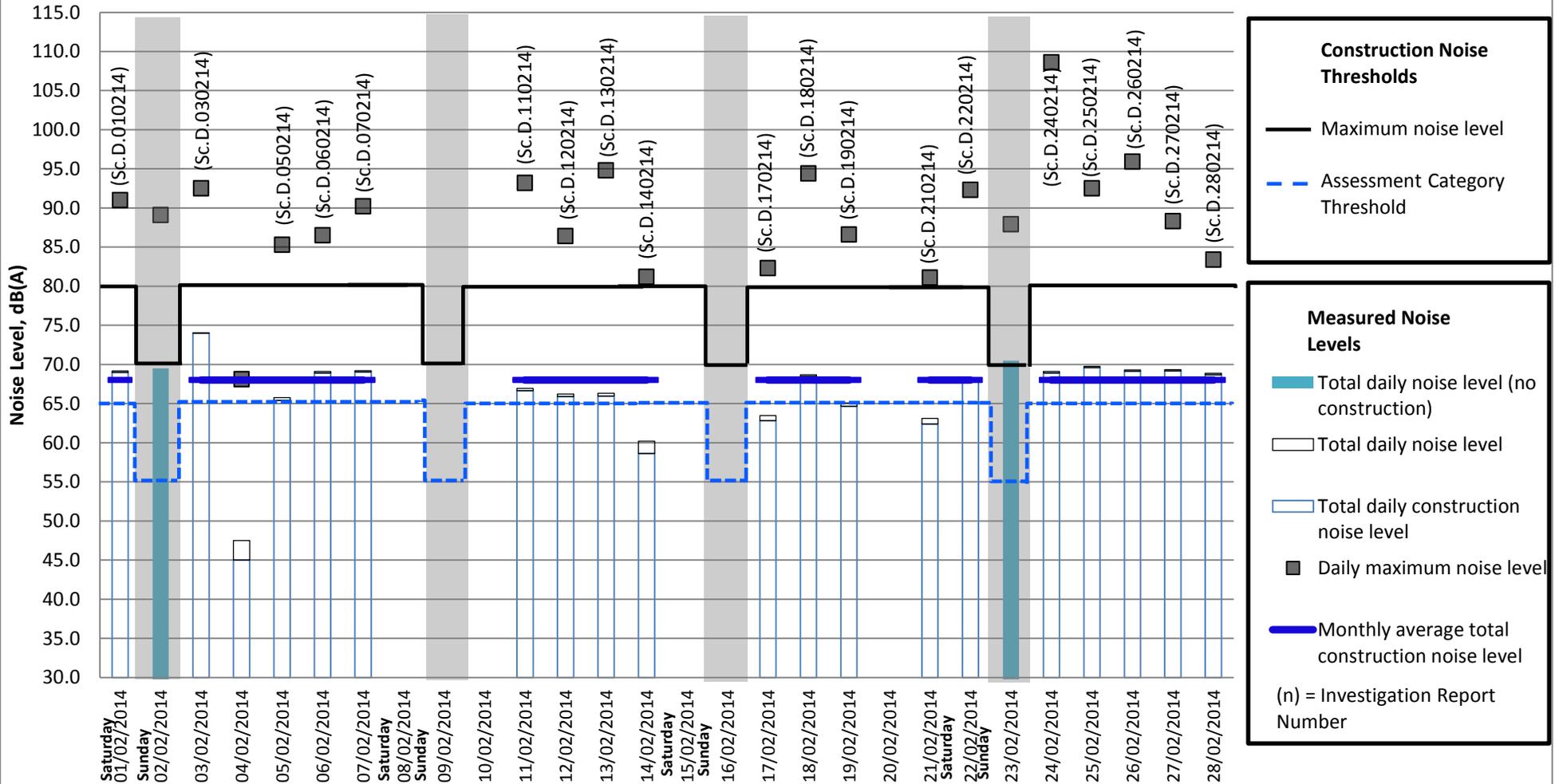
Measured Daytime Noise Levels at Newton Measurement period: February 2014



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. 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.

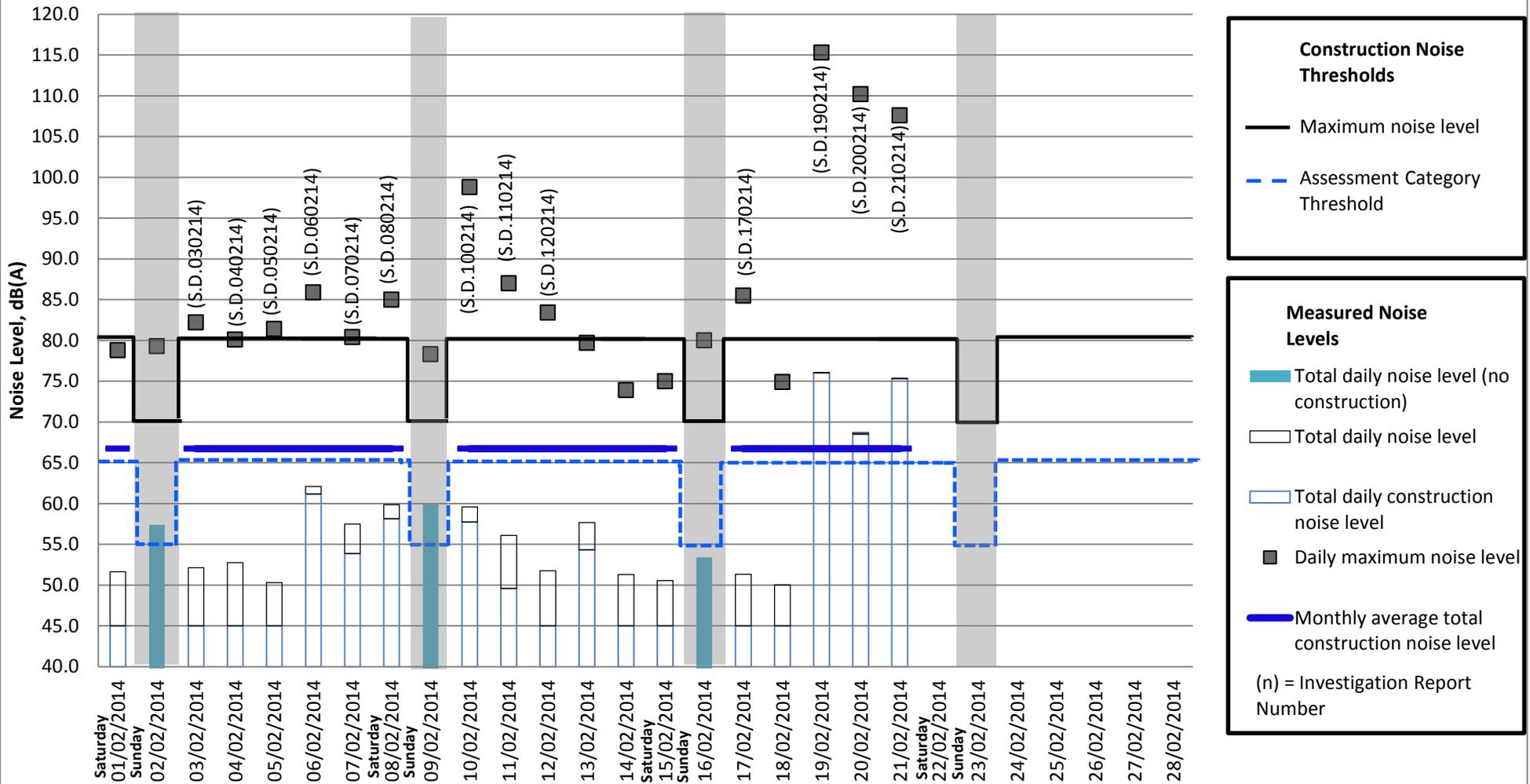
Measured Daytime Noise Levels at Scotstoun

Measurement period: February 2014



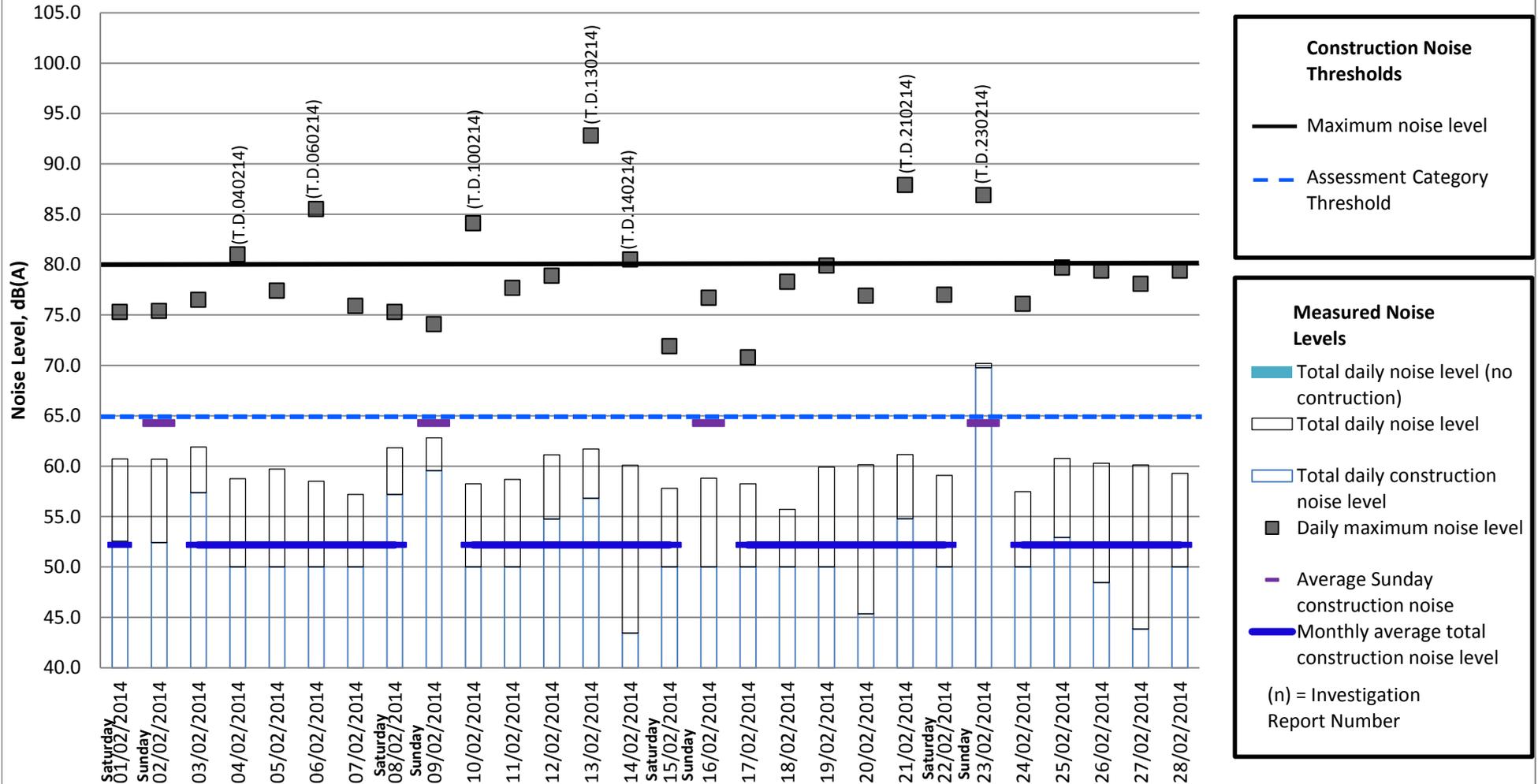
Note: The grey areas of the chart represent days on which no construction works have been conducted. The monthly average construction noise for Sunday has not been included as no Sunday works have been conducted at this location. The following dates have missing data due to a power issue (broken power cable): 08/02/14-10/02/14, 15/02/14, 16/02/14 & 20/2/14.

Measured Daytime Noise Levels at Springfield Measurement period: February 2014

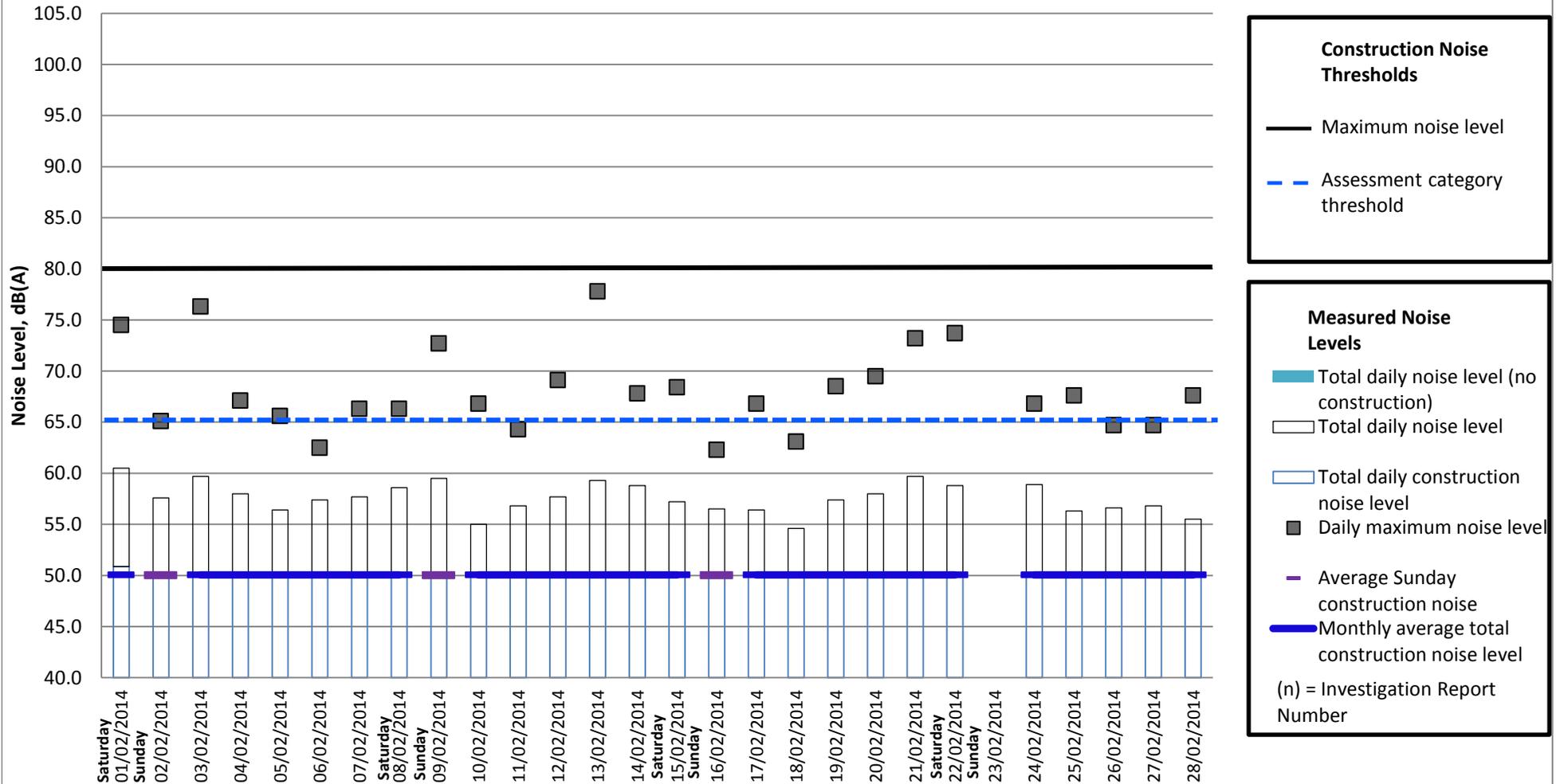


Note: The grey areas of the chart represent days on which no construction works have been conducted. There is no data at the following dates due to exterior house renovations at monitor location: 22/02/14 - 28/02/14 .

Measured Daytime Noise Levels at Tigh-Na-Grian Measurement period: February 2014

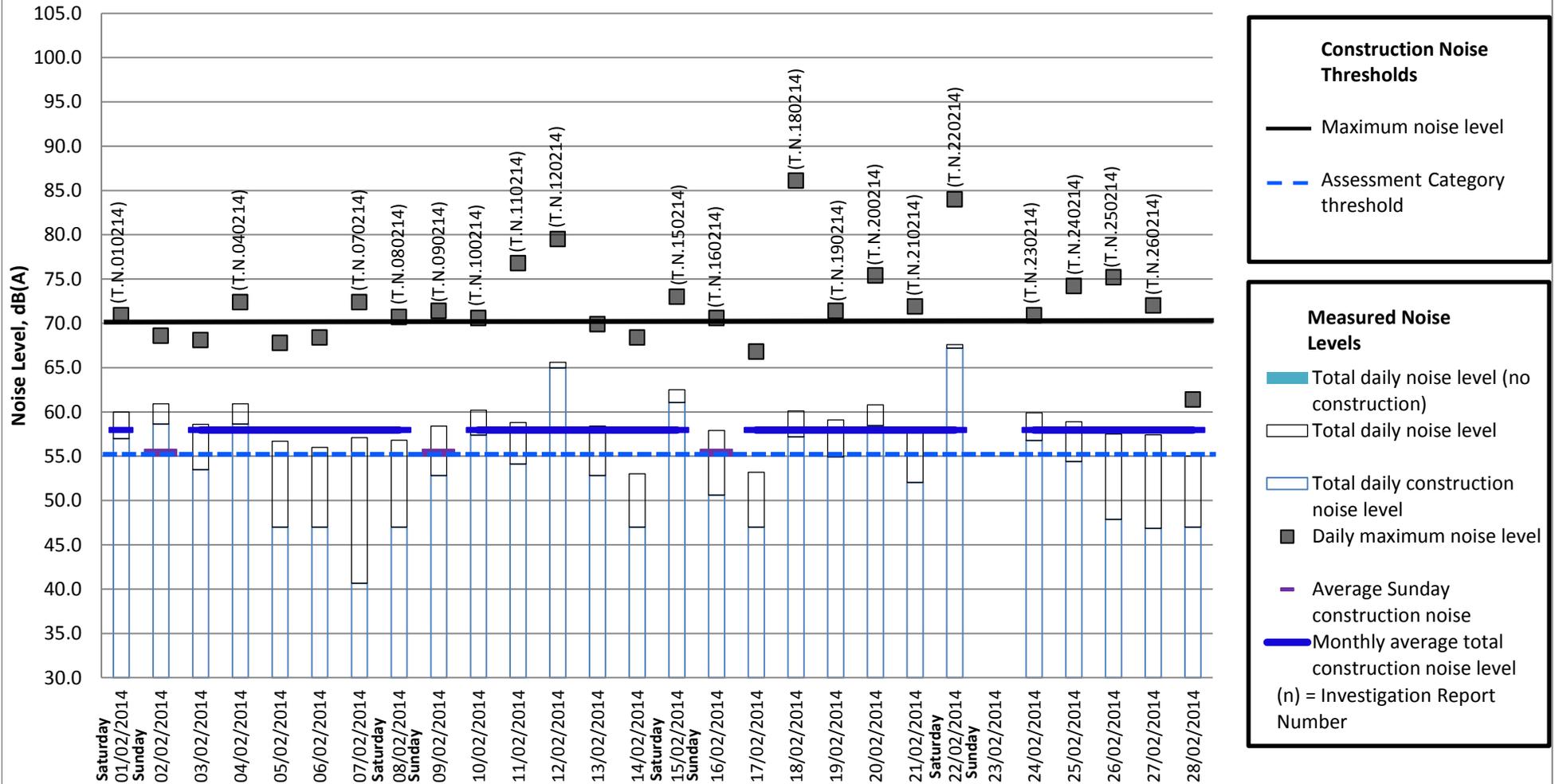


Measured Evening Noise Levels at Tigh-Na-Grian Measurement period: February 2014



Note: Due to adverse weather conditions, data is missing for 23/02/14.

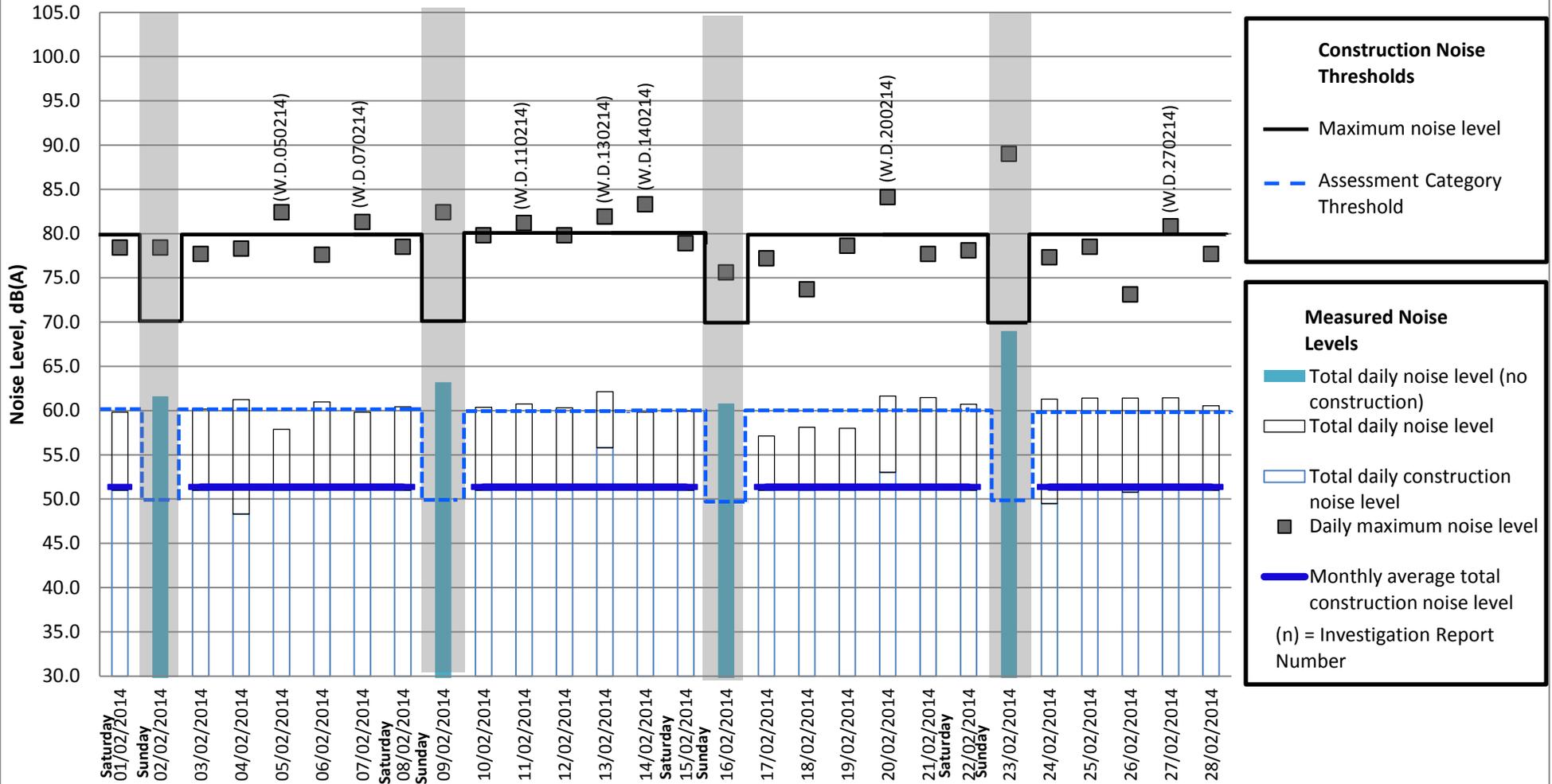
Measured Night-time Noise Levels at Tigh-Na-Grian Measurement period: February 2014



Note: Due to adverse weather conditions, data is missing for 23/02/14.

Measured Daytime Noise Levels at Whinny Hill

Measurement period: February 2014



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.