



Contractor



Forth Crossing Bridge Constructors

HOCHTIEF Solutions
American Bridge International
DRAGADOS
Morrison Construction

Project **FORTH REPLACEMENT CROSSING**

Document title

CONSTRUCTION NOISE MONITORING REPORT: OCTOBER 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 October 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 October 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 October 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 October 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 October 2013
M1	Whinny Hill	Network	<ul style="list-style-type: none"> • Drainage works at Castlandhill Road • King Malcolm Drive embankment landscaping fill <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 piling • Pier N1 airlifting & 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 piling • Pier N1 airlifting & 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 underwater concrete • Pier S3 piling for cofferdam • Pier S4 airlifting & underwater concrete • Pier S5 rebar & formwork • Society Road works
M7	Butlaw Fisheries	Crossing	<ul style="list-style-type: none"> • Central Tower rebar, formwork & concreting works • South Tower rebar, formwork & concreting works • Pier S1 underwater concrete • Pier S3 piling for cofferdam • Pier S4 airlifting & underwater concrete • Pier S5 rebar & formwork • Society Road works
M10	Inchgarvie Lodge	Crossing	<ul style="list-style-type: none"> • South Tower rebar, formwork & concreting works • Pier S1 underwater concrete • Pier S3 piling for cofferdam • Pier S4 airlifting & underwater concrete • Pier S5 rebar & formwork • Launch – assembly of steel sections and

			<p>placement of stillages</p> <ul style="list-style-type: none"> • South abutment – preparatory works for the launch of west section • Placing segments/rebar, concreting and waterproofing at S7/S8 • Society Road works
M11	Linn Mill	Network (close proximity to Crossing)	<ul style="list-style-type: none"> • Launch – assembly of steel sections and placement of stillages • South abutment – preparatory works for the launch of west section • Placing segments/rebar, concreting and waterproofing at S7/S8 • Society Road works
M13	Clufflat Brae	Crossing	<ul style="list-style-type: none"> • Launch – assembly of steel sections and placement of stillages • South abutment – preparatory works for the launch of west section • Placing segments/rebar, concreting and waterproofing at S7/S8 • Society Road works • Echline cut – ripping rock
M14	Springfield	Network	<ul style="list-style-type: none"> • Launch – assembly of steel sections and placement of stillages • South abutment – preparatory works for the launch of west section • Placing segments/rebar, concreting and waterproofing at S7/S8 • Society Road works • Echline cut – ripping rock <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 – assembly of steel sections and placement of stillages • South abutment – preparatory works for the launch of west section • Placing segments/rebar, concreting and waterproofing at S7/S8 • Society Road works • Echline cut – ripping rock • Gyrotory – structures including on-site fabrication of beams • A904 west tie in road works <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

			N.B. No evening, night time or Sunday daytime construction in vicinity.
M17	Dundas Home Farm	Network	<ul style="list-style-type: none"> • Utility works • Ditch drainage • Environmental bund <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.
- 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. Short periods of data are missing from the following locations: Dundas due to a loss of power caused by a third party; Echline and Port Edgar due to device error; and Inchgarvie due to issues with the power, both due to the device and also with the charging of the meter.
- 3.3** Results demonstrate that the monthly average total construction noise results for daytime were within the threshold levels for all monitoring locations for October 2013, with the exception of Scotstoun. For the evening period, all monitoring locations, with the exception of Butlaw Fisheries, were within the threshold levels. For the night time periods, there were exceedances at two locations (Butlaw and Linn Mill), with all other locations within the threshold levels. With regard to the Sunday averages (for applicable monitoring locations), exceedances of the threshold were noted for Sunday evening and night time at Butlaw Fisheries, with all other Sunday averages within the threshold levels.
- 3.4** The exceedances noted are not thought to have been caused by increased noise levels due to construction. The evening and night time averages at Butlaw were found to be affected by increased noise levels due to waves breaking on the shore. Where audio is available, it demonstrates that the increased levels were caused by waves. It should also be noted that screening and distance attenuation should be considered as these factors result in a lowering of the noise levels to within the threshold level at the nearest sensitive receptors; attended monitoring has illustrated a drop of at least 5 – 10 dB from Butlaw Fisheries to the nearest sensitive receptors with respect to noise generated around the south shore area of the estuary.
- 3.5** The night time average at Linn Mill was also affected by adverse weather conditions. Strong winds on 9 October and heavy rain on the 16 October in particular influenced the results at this location; where this data is removed the average is lowered to the threshold level (50 dB).
- 3.6** With regard to the exceedances of the Sunday averages, a review of the Sunday works undertaken indicates that, where the specific works undertaken are considered, alongside locations and associated distances; it is highly unlikely that the exceedances of the Sunday averages were related to construction works. Rather waves and adverse weather conditions are thought to have influence the levels.
- 3.7** Furthermore, it should be noted that all the averages reported for day time, evening, night time and Sunday periods, are based only on the highest L_{Aeq} levels for 1 hour periods which can affect the averages.

- 3.8** 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 October is consistent with levels for previous months.
- 3.9** During October 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.
- 3.10** Investigations of the exceedances of the maximum noise level thresholds show the majority to have occurred as a result of non-construction related noise, notably due to bird calls, some periods of adverse weather and localised noises at nearby properties. At some locations, notably Scotstoun and Echline, existing traffic noise had an effect on maximum noise levels during the period covered in this report.
- 3.11** 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 and subsequently implemented where practicable.
- 3.12** The daytime L_{AFmax} threshold was exceeded during October on nine occasions. Four exceedances, recorded at Butlaw Fisheries and Inchgarvie during the evening and night time periods, were found to be caused by the night works at Society Road. All other exceedances were recorded at Linn Mill. Two of these were caused by isolated bangs from plant, whilst three (two night time and one evening) were caused by concrete wagons moving along the haul track during the pour at pier S4. All construction related exceedances were investigated and mitigation measures implemented where possible; the relevant NVIRs provide more detail with regard to each exceedance.
- 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 October the maximum noise threshold was exceeded on 45 occasions (daytime, 10; evening, 9; night time, 26). One evening and two night time exceedances were caused by works at Society Road. All other exceedances were attributed to non-construction factors, notably birds, waves and adverse weather.
Clufflat Brae	During October the maximum noise threshold was exceeded on 49 occasions (daytime, 19; evening, 8; night time, 22). No exceedances were found to be due to construction works. Exceedances were found to be largely due to birds, weather conditions and dogs barking.
Inchgarvie Lodge	During October the maximum noise threshold was exceeded on 27 occasions (daytime, 13; evening, 4; night time, 10). One exceedance at this location was found to be due to construction works at Society Road. However, investigations found residents at the property and birds to be the main contributing factors to the exceedances at this location.
Linn Mill	During October the maximum noise threshold was exceeded on 50 occasions (daytime, 10; evening, 11 night time, 29). Two daytime exceedances were caused by plant, with a further one evening and two night time exceedances caused by concrete trucks. However, the exceedances at this location were largely caused by birds and adverse weather.
Tigh-Na-Grian	During October the maximum noise threshold was exceeded on 49 occasions (daytime, 20; evening, 0; night time, 29). Exceedances were due to non-construction factors, notably birds.
Dundas Home Farm	During October the maximum noise threshold was exceeded on 12 occasions. No exceedances were caused by the works. Exceedances were due to a range of factors, including gardening and birds.
Echline	During October the maximum noise threshold was exceeded on 25 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 October the maximum noise threshold was exceeded on 12 occasions. The exceedances were not caused by construction works at this location. The majority of exceedances were due to local residents.
Scotstoun	During October the maximum noise threshold was exceeded on 26 occasions. Exceedances were largely attributed to vehicles passing by on the adjacent road.
Whinny Hill	During October the maximum noise threshold was exceeded on 14 occasions. Exceedances were not due to construction activities. A range of factors were found to cause exceedances at this location, including birds, dogs barking, and wind.

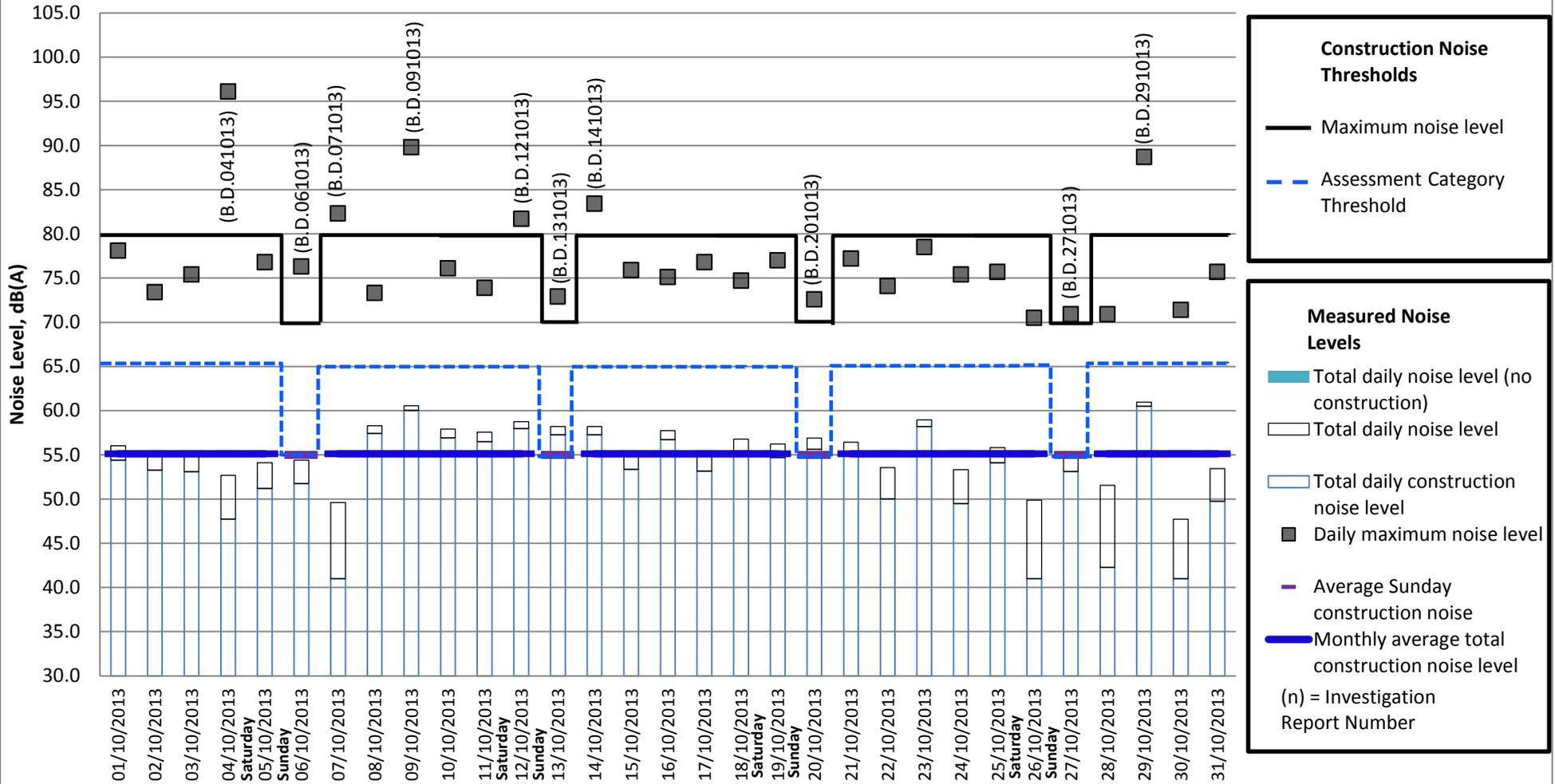
Table 3: Summary of Construction Exceedances at Monitoring Locations

Construction Related Noise Exceedances - October 2013						
Date	Monitor	Period	Description	Lmax (dB(A))	Threshold (dB(A))	NVIR No.
01/10/2013	Butlaw Fisheries (South Shore)	Evening	Society Rd Nightworks - Excavation	74.5	70.0	B.E.011013
02/10/2013		Night		73.8	65.0	B.N.011013
03/10/2013		Night	Society Rd Nightworks - Vibratory Roller	76.3	65.0	B.N.021013
02/10/2013	Inchgarvie Lodge (Society Road)	Night	Society Rd Nightworks - Engine Noise & Vibratory Roller	68.6	65.0	I.N.011013
07/10/2013	Linn Mill (Echline Field)	Day	Isolated bang from plant	81.5	80.0	L.D.071013
08/10/2013		Day		82.4	80.0	L.D.081013
19/10/2013		Night	S4 Concrete Pour - Clanging from concrete wagon moving along haul route	77.6	65.0	L.N.181013
19/10/2013		Evening		74.1	70.0	L.E.191013
20/10/2013		Night		75.2	65.0	L.N.191013

APPENDIX A

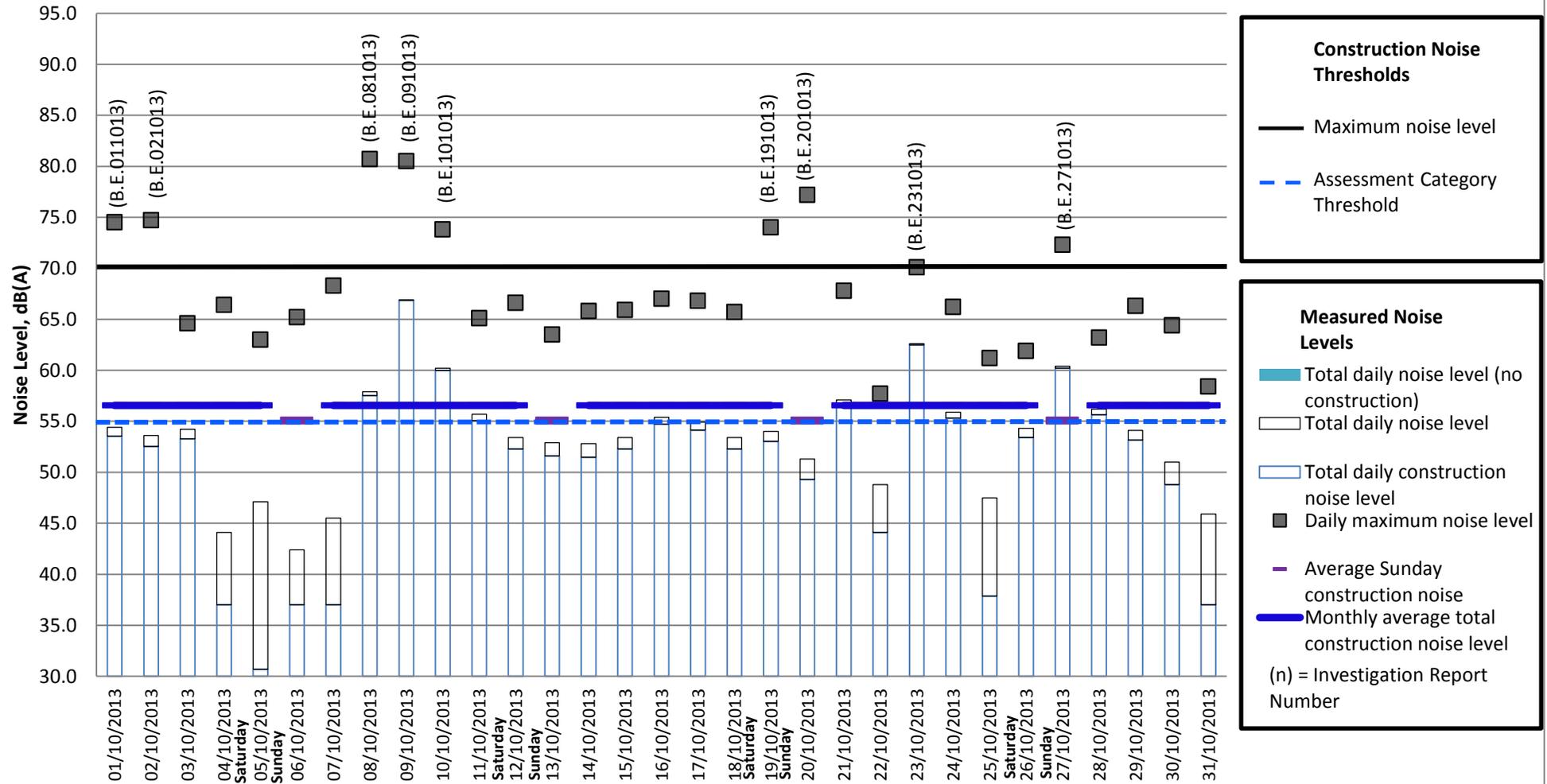
Measured Daytime Noise Levels at Butlaw Fisheries

Measurement period: October 2013



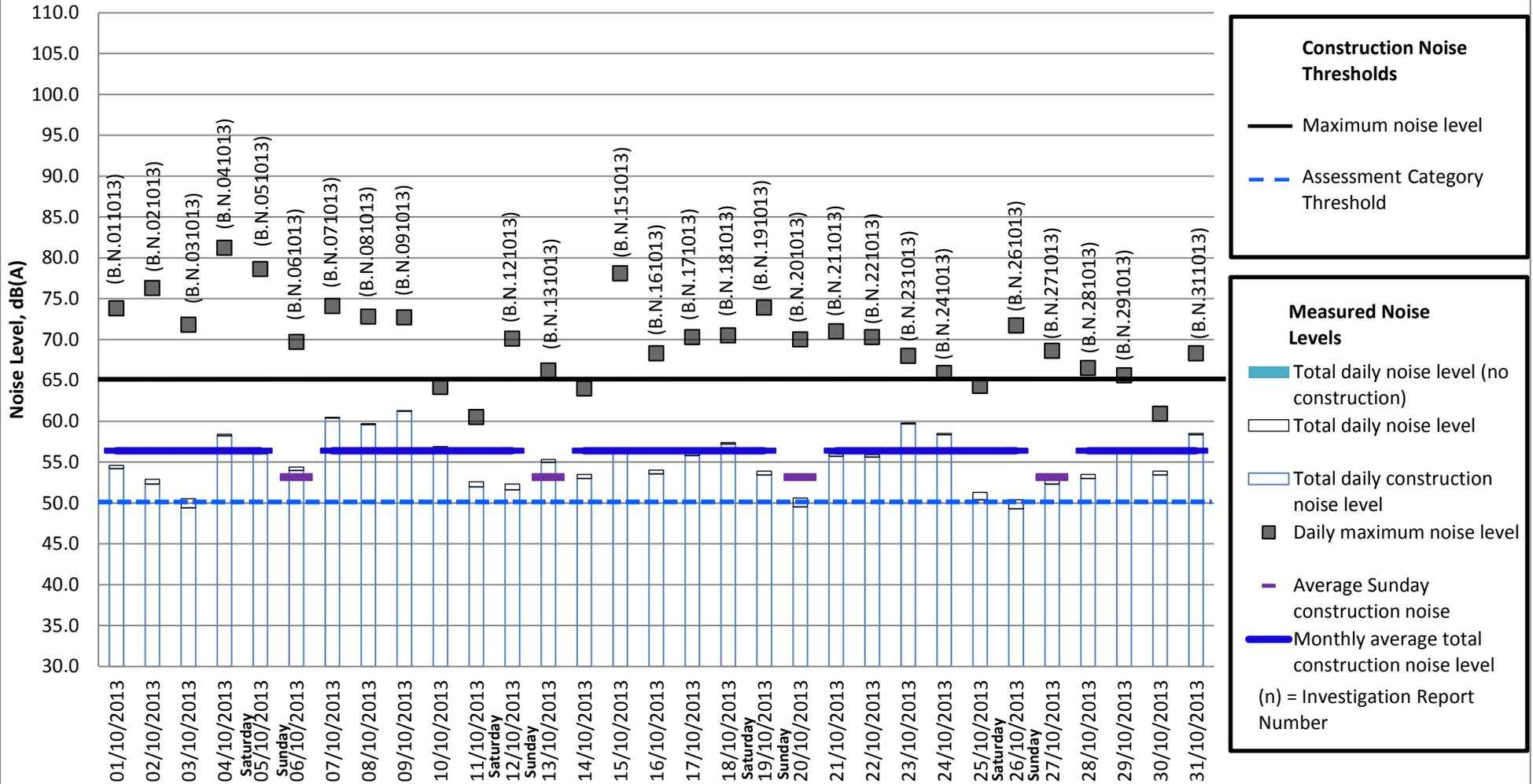
Measured Evening Noise Levels at Butlaw Fisheries

Measurement period: October 2013



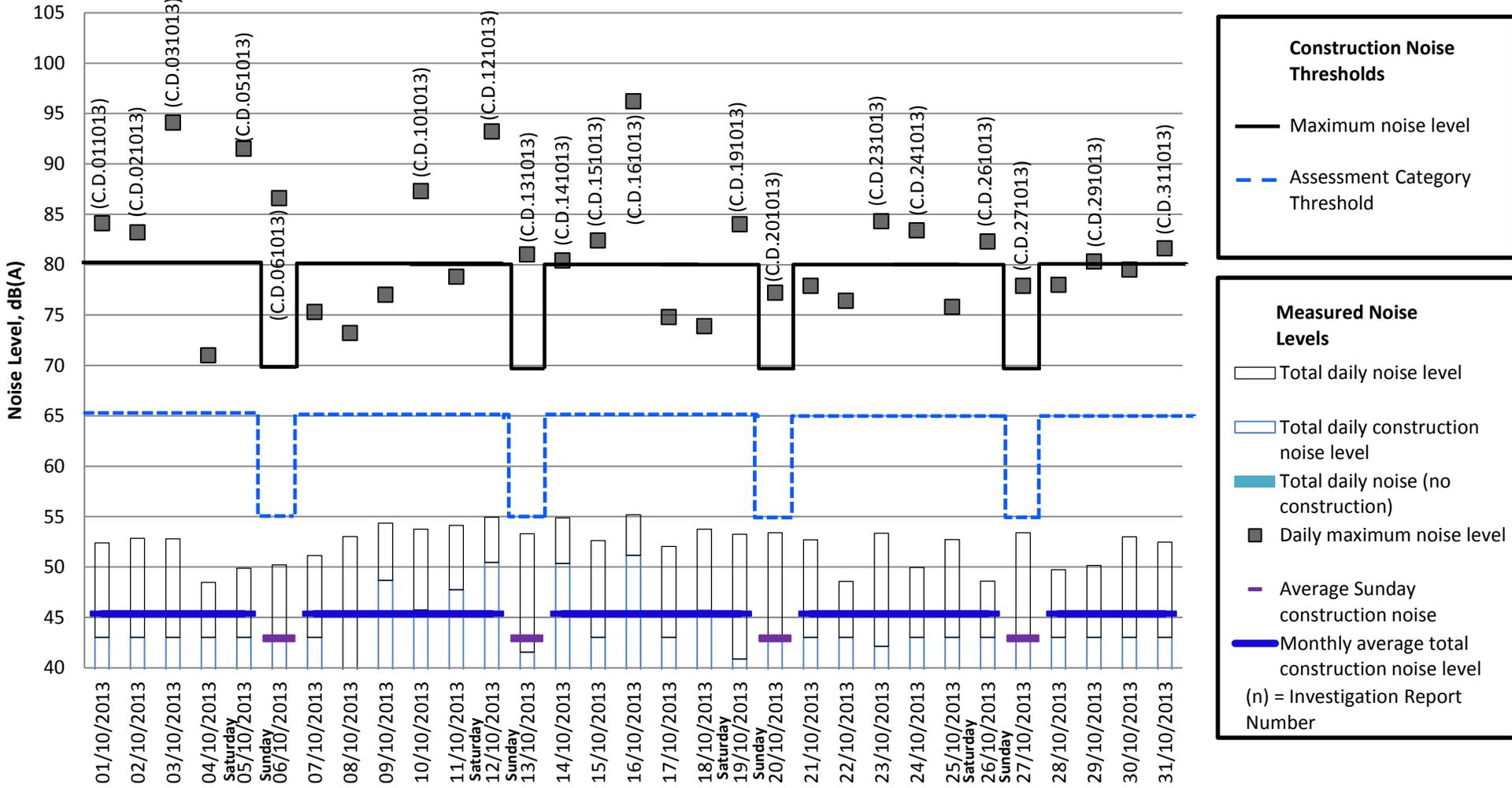
Measured Night time Noise Levels at Butlaw Fisheries

Measurement period: October 2013



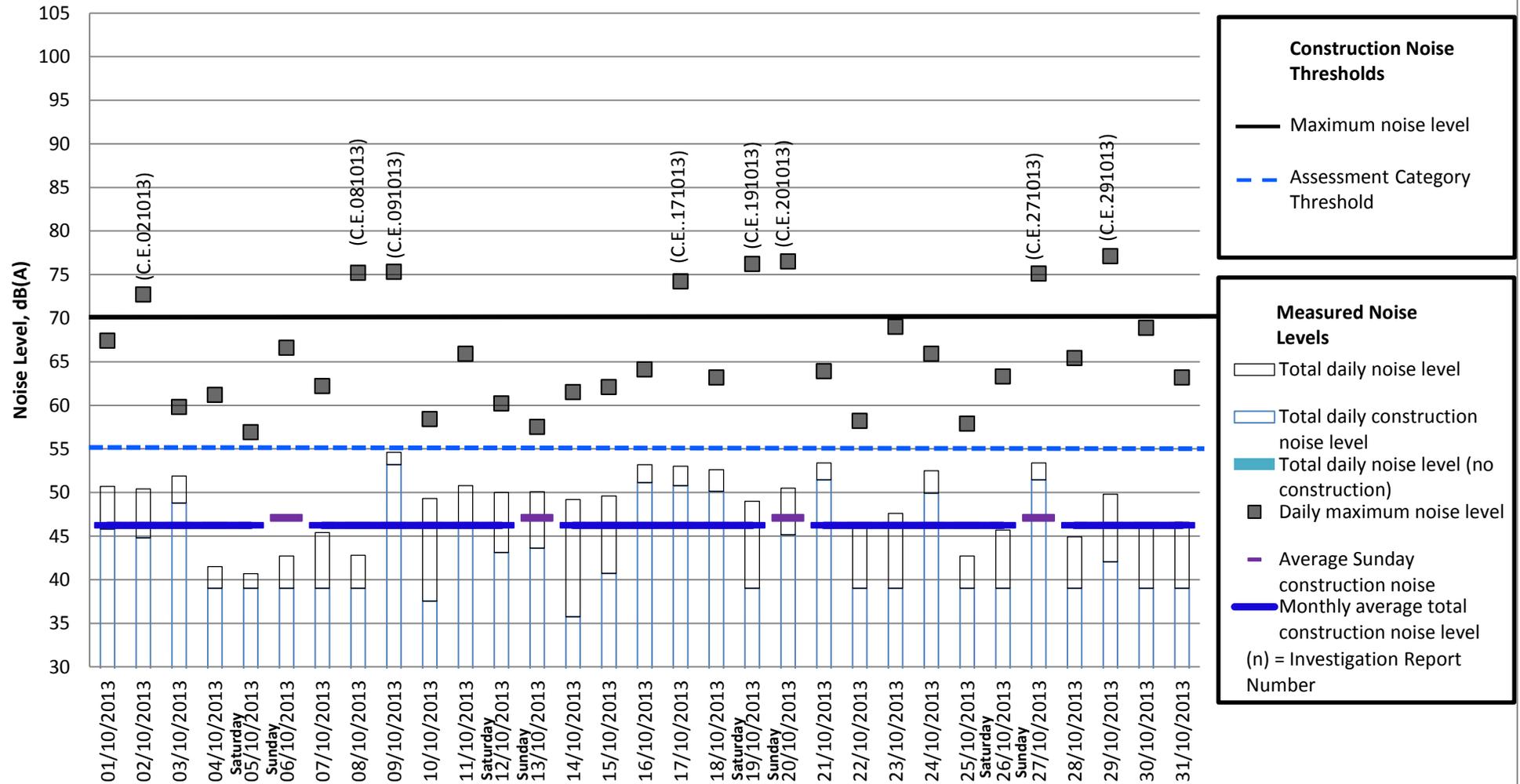
Measured Daytime Noise Levels at Clufflat Brae

Measurement period: October 2013



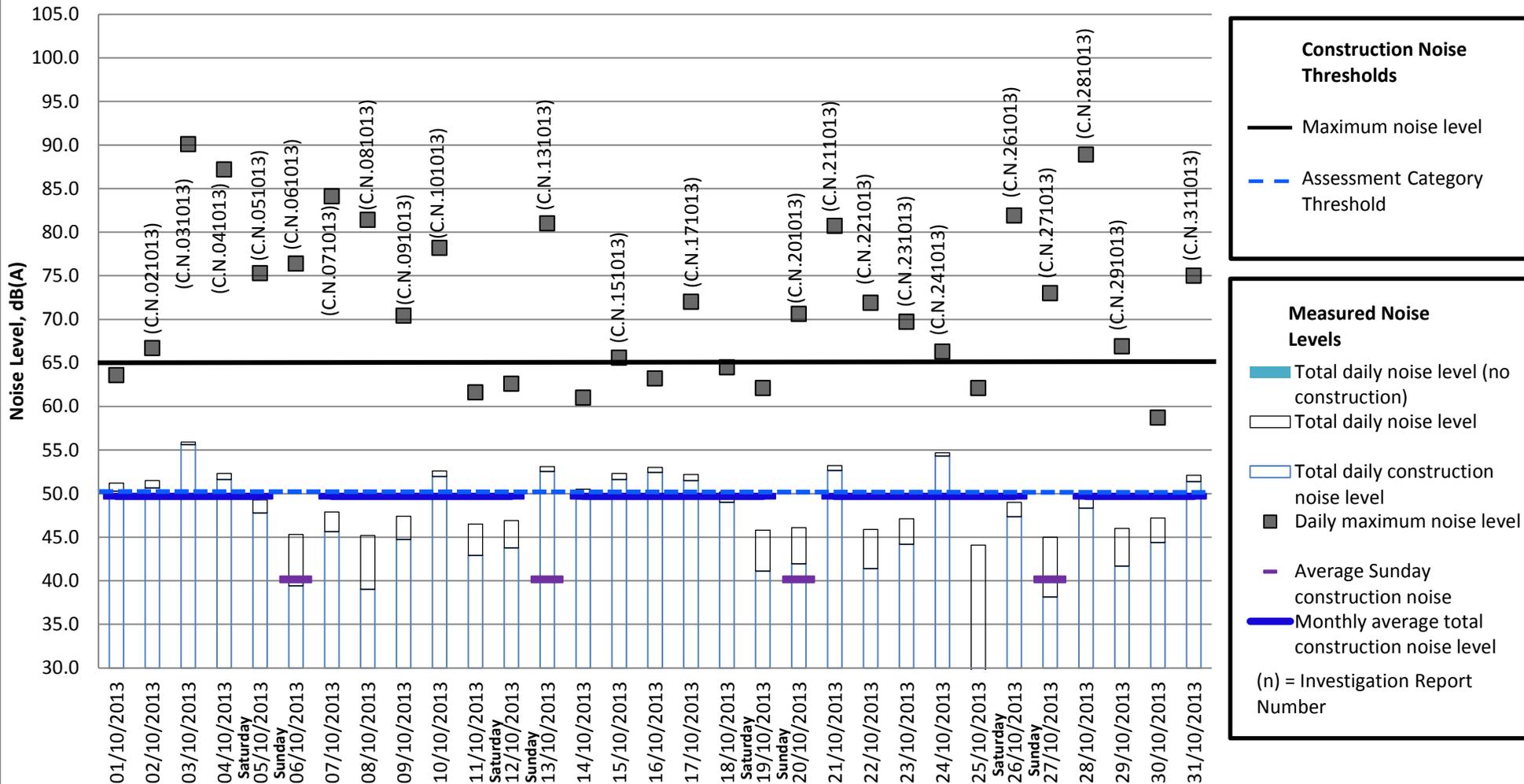
Measured Evening Noise Levels at Clufflat Brae

Measurement period: October 2013



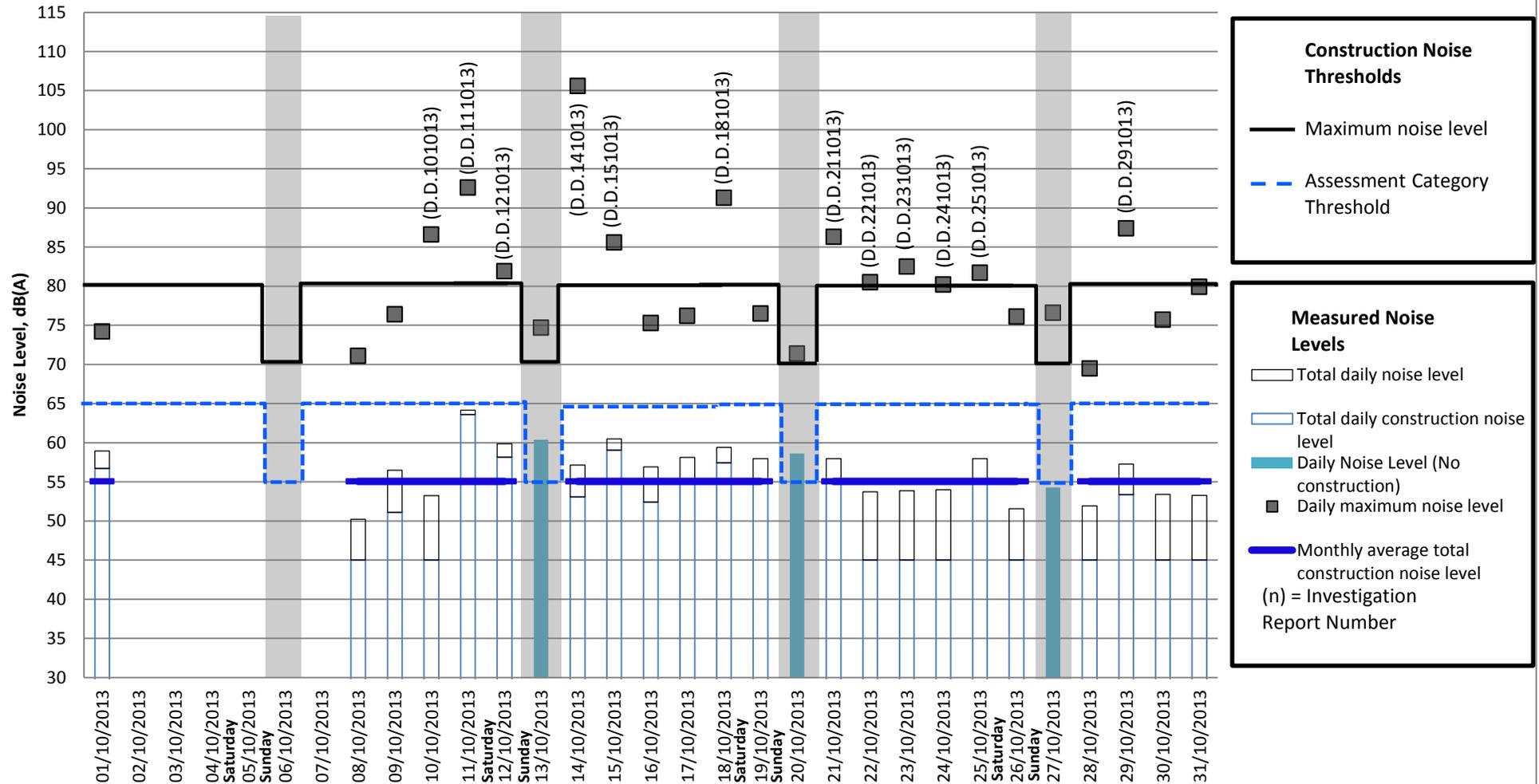
Measured Night-time Noise Levels at Clufflat Brae

Measurement period: October 2013



Measured Daytime Noise Levels at Dundas Home Farm

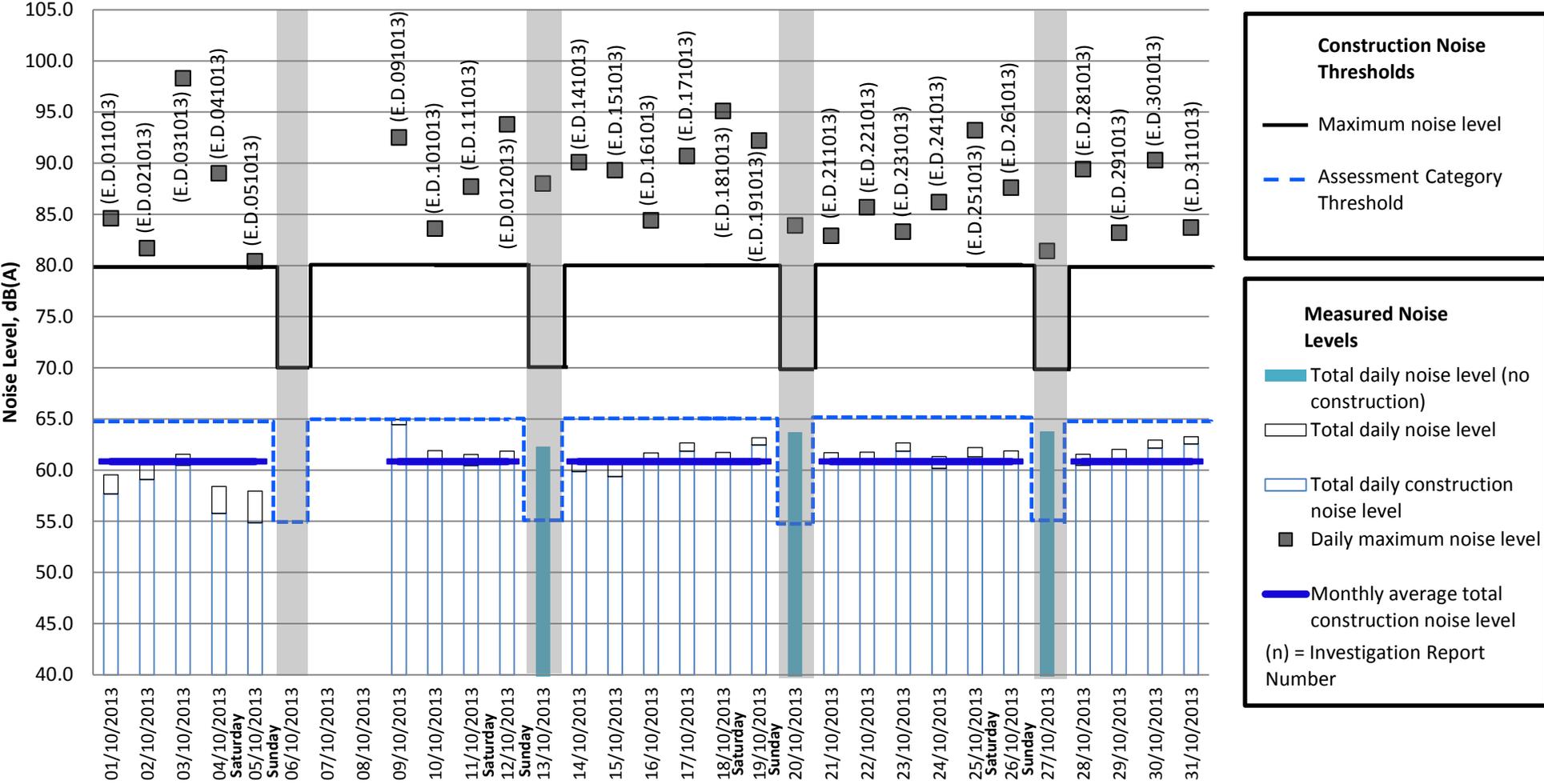
Measurement period: October 2013



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. Data is missing for 02/10/13 to 07/10/13 due to loss of power to the device caused by a third party.

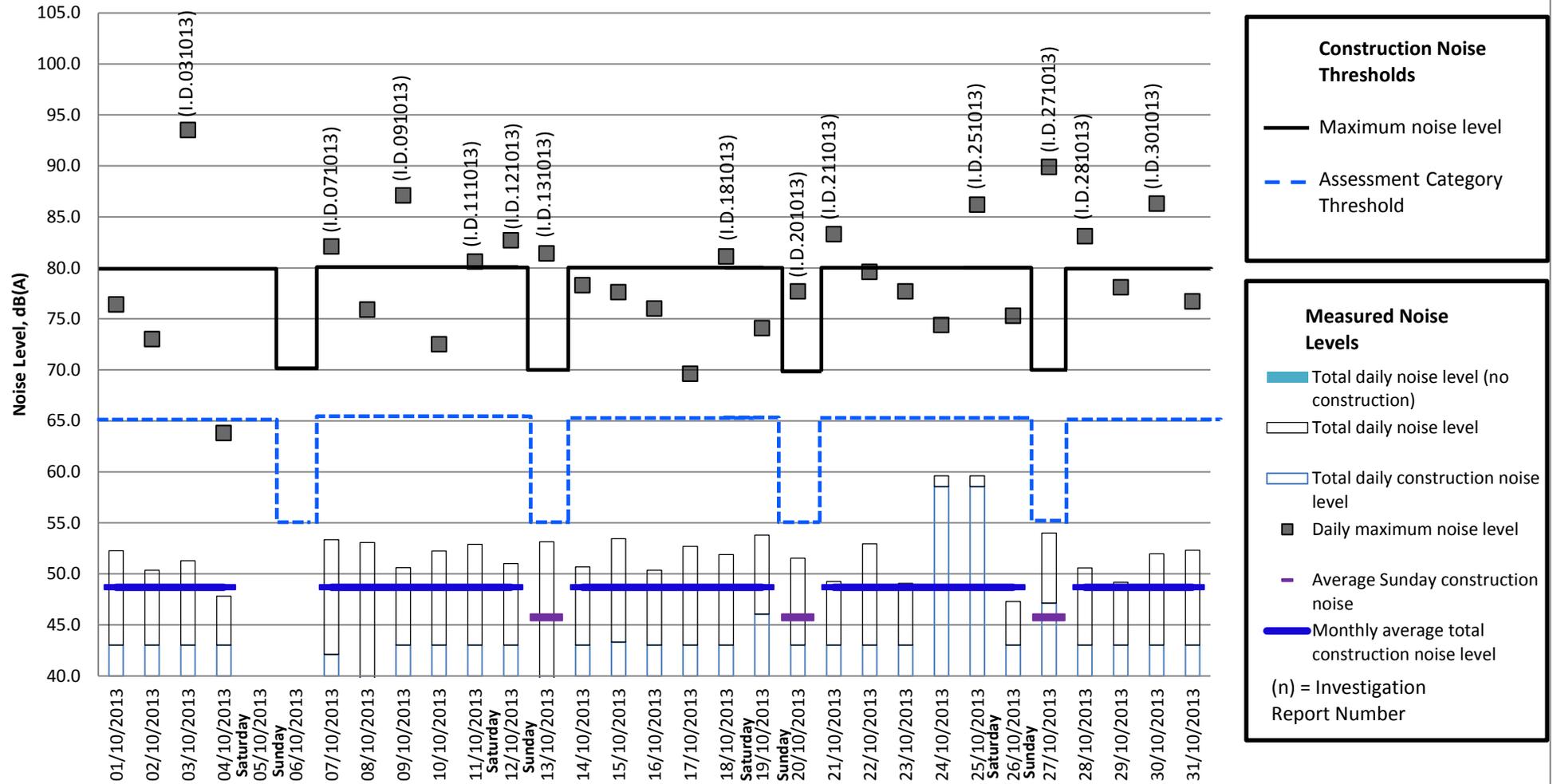
Measured Daytime Noise Levels at Echline Field

Measurement period: October 2013



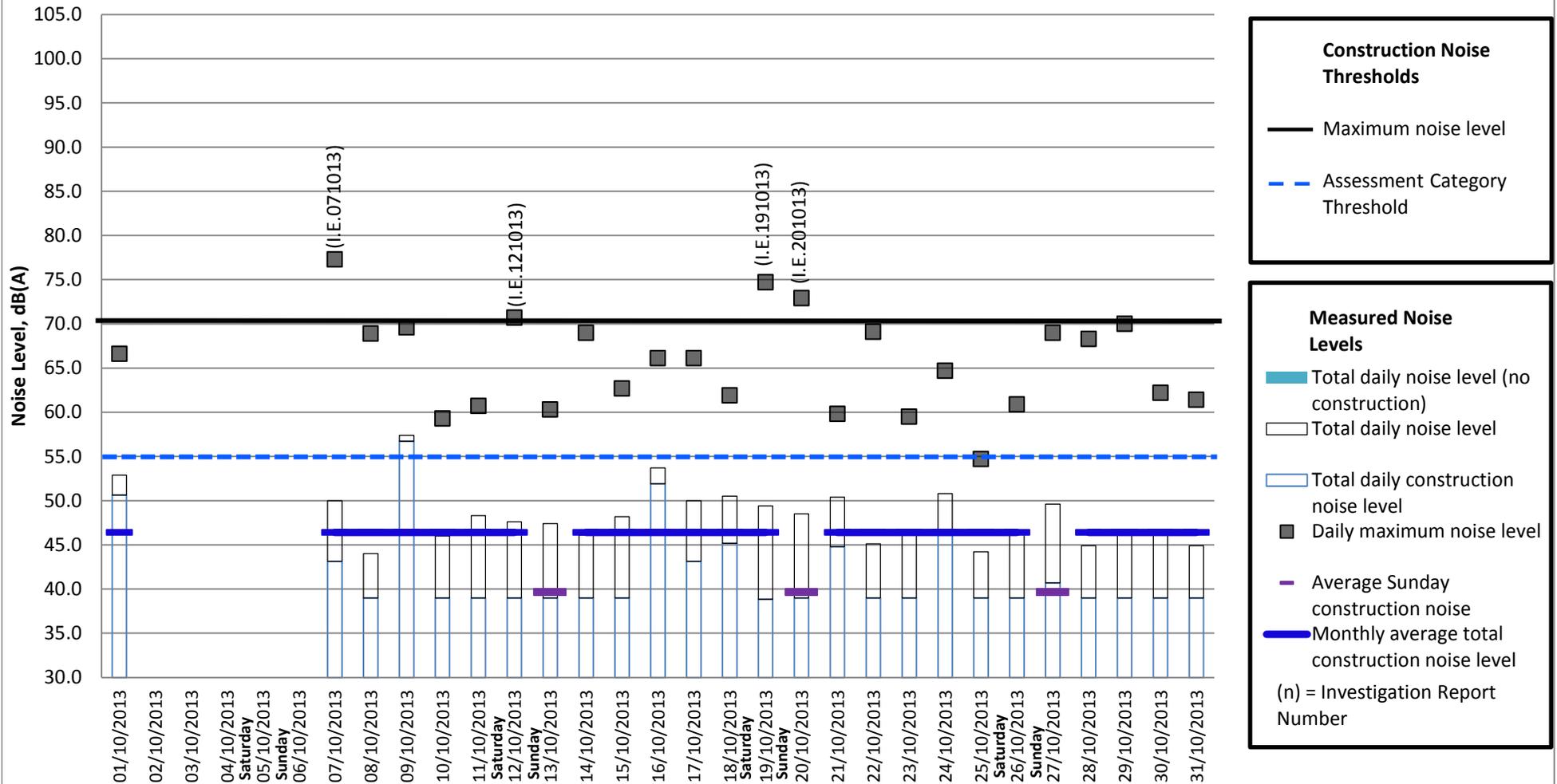
Note: The grey areas of the chart represent days on which no construction works have been conducted. A Sunday average has not been included on the graph as no Sunday works have been undertaken at this location. Data is missing for 06/10/13 to 08/10/13 due to a device error.

Measured Daytime Noise Levels at Inchgarvie Measurement period: October 2013



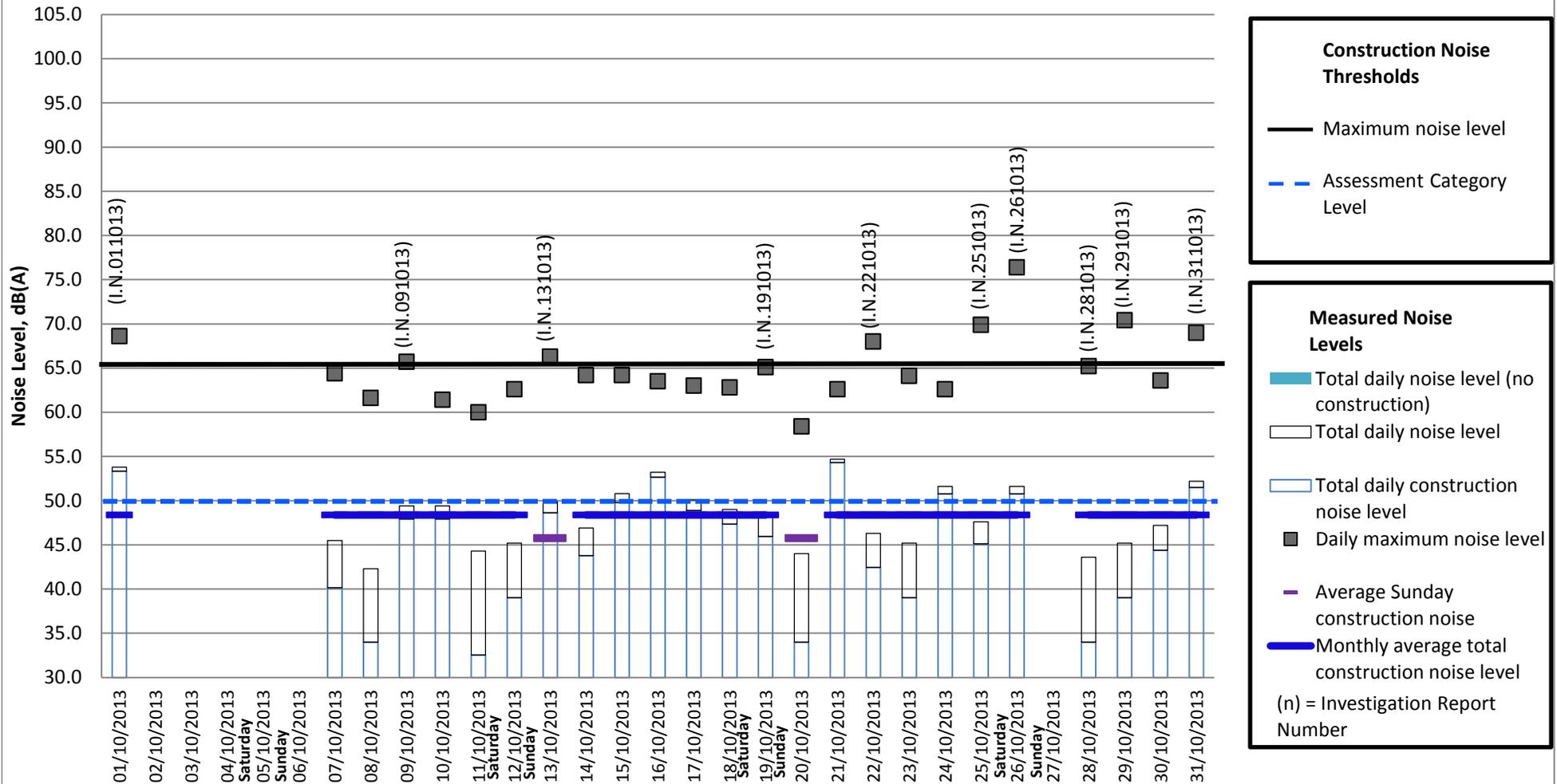
Note: Data is missing for this location for the daytime on 05/10/13 and 06/10/13 due to an issue with the power supply to this device.

Measured Evening Noise Levels at Inchgarvie Measurement period: October 2013



Note: Evening data is missing for 02/10/13 to 06/10/13 due to an issue with the power supply to the device.

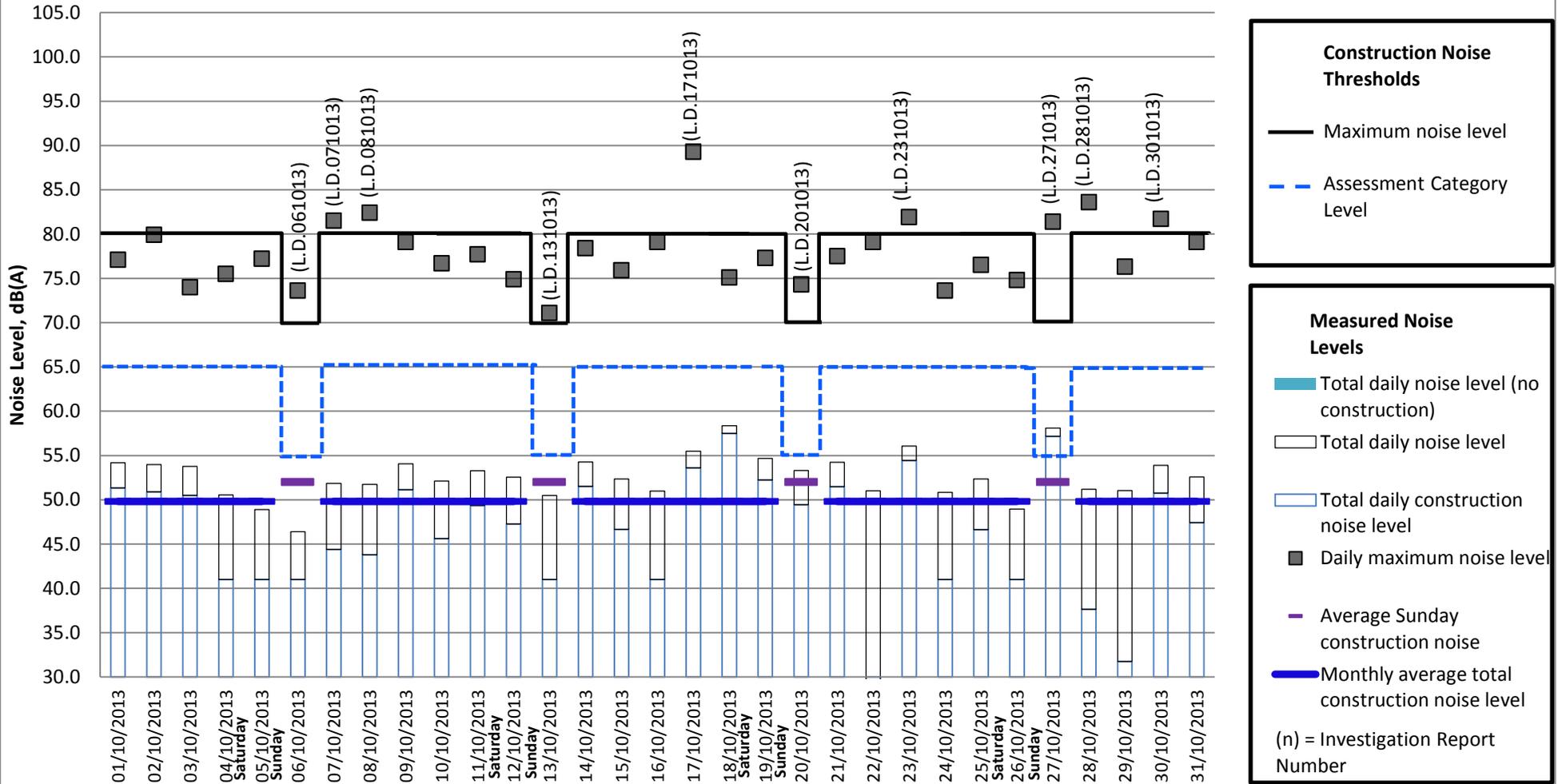
Measured Night-time Noise Levels at Inchgarvie Measurement period: October 2013



Note: Evening data is missing for 03/10/13 to 07/10/13 due to an issue with the power supply to the device and on 27/10/13 due to a device error.

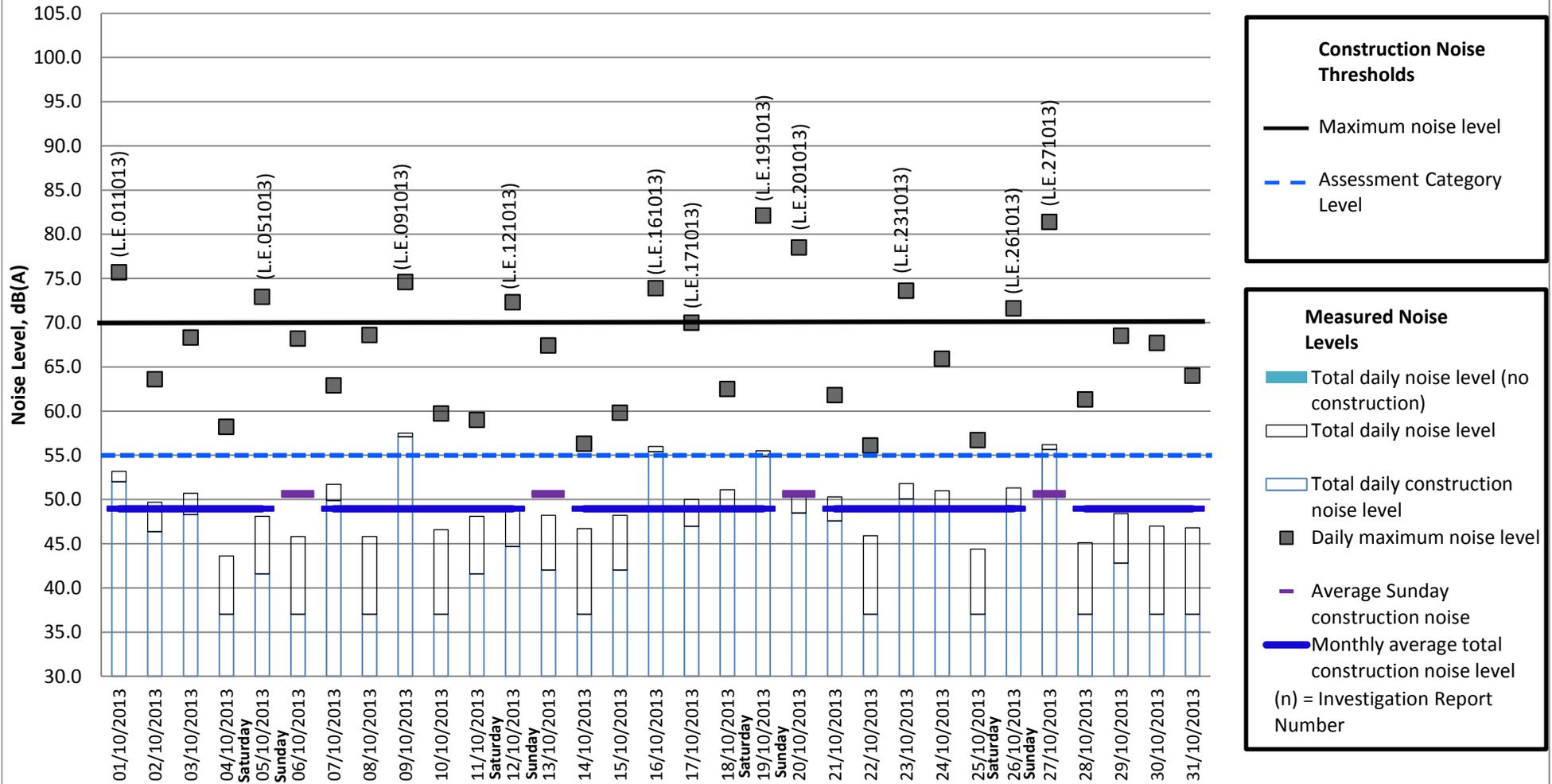
Measured Daytime Noise levels at Linn Mill

Measurement period: October 2013



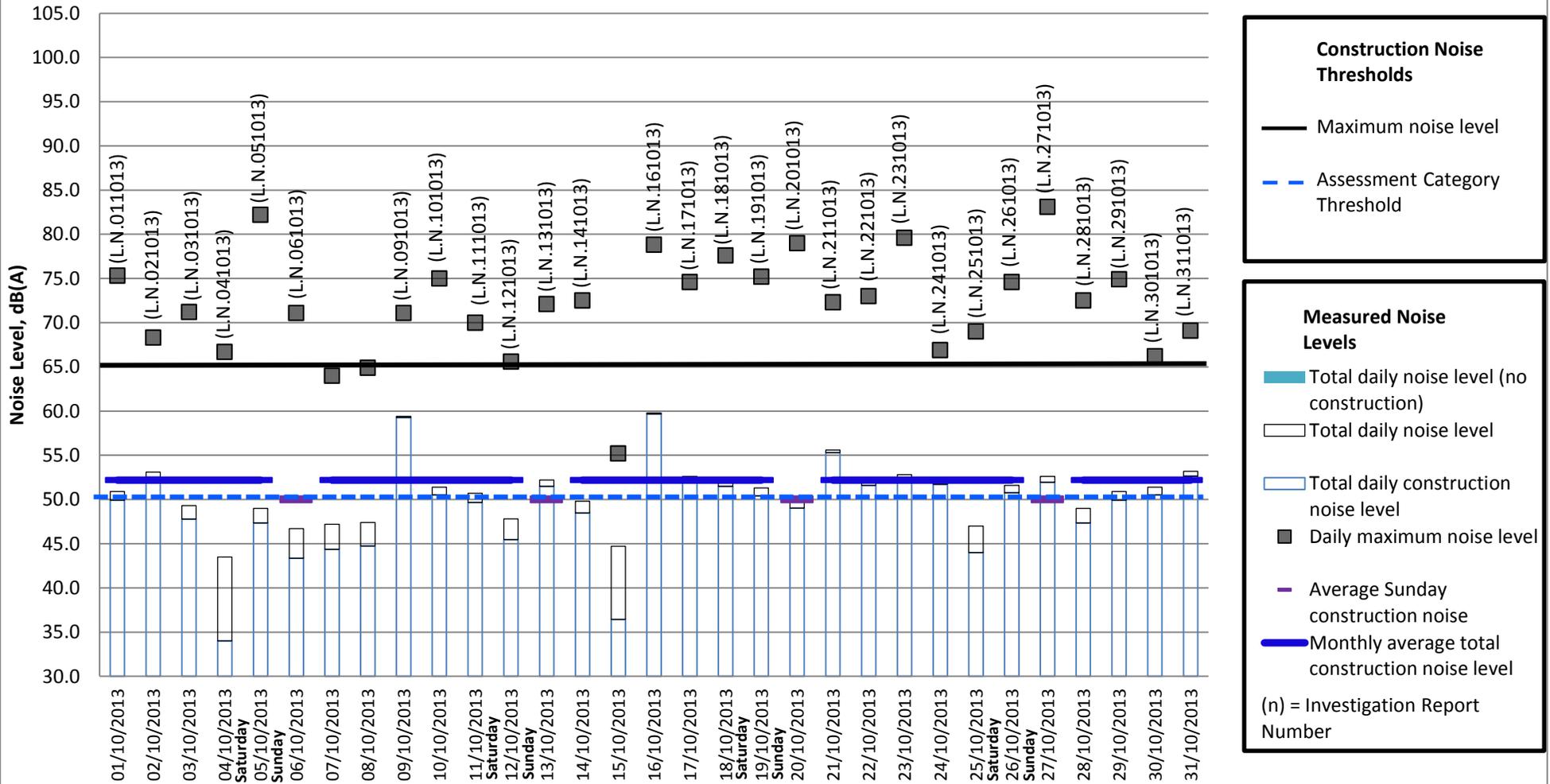
Measured Evening Noise Levels at Linn Mill

Measurement period: October 2013

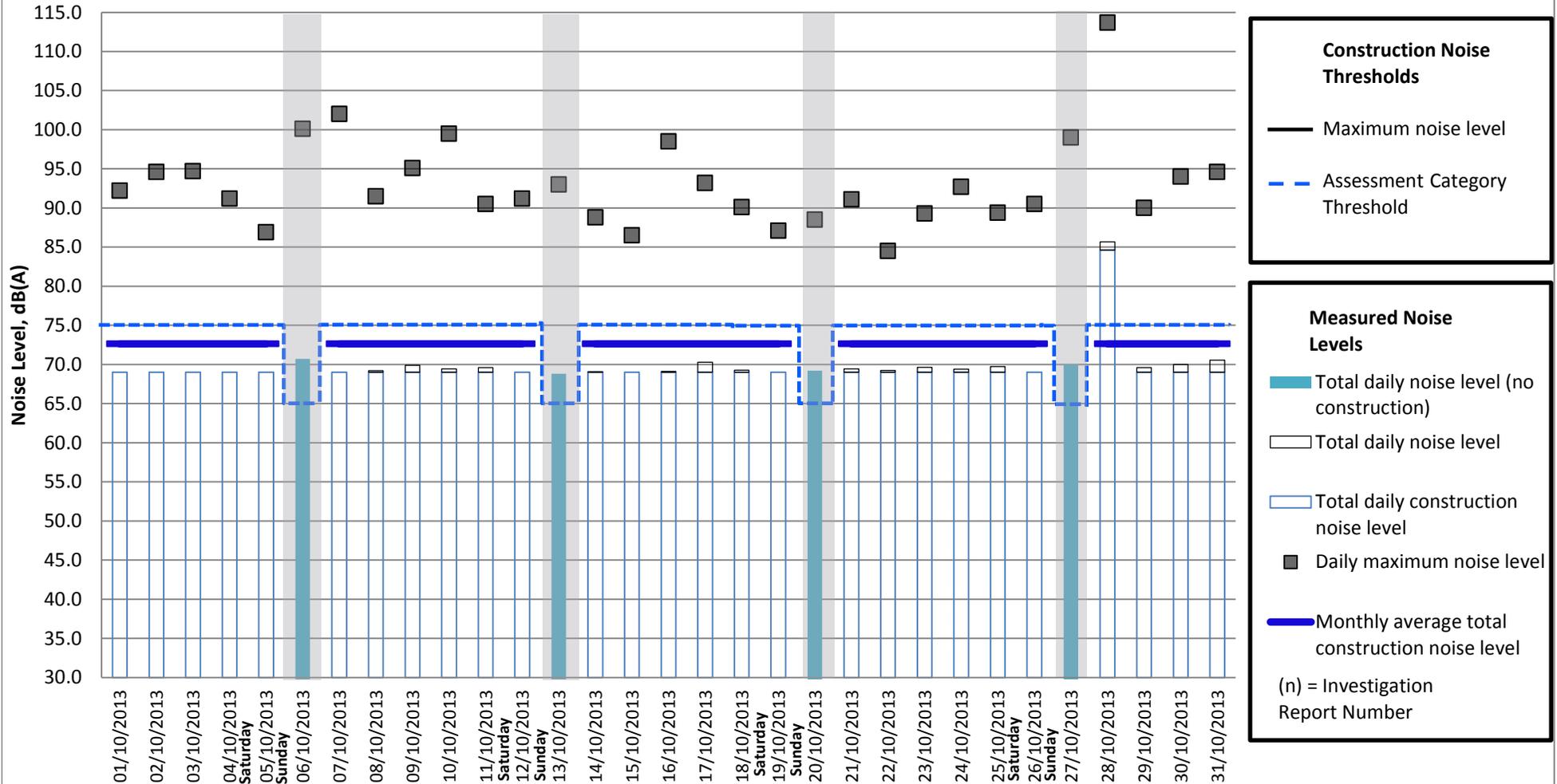


Measured Night-time Noise Levels at Linn Mill

Measurement period: October 2013

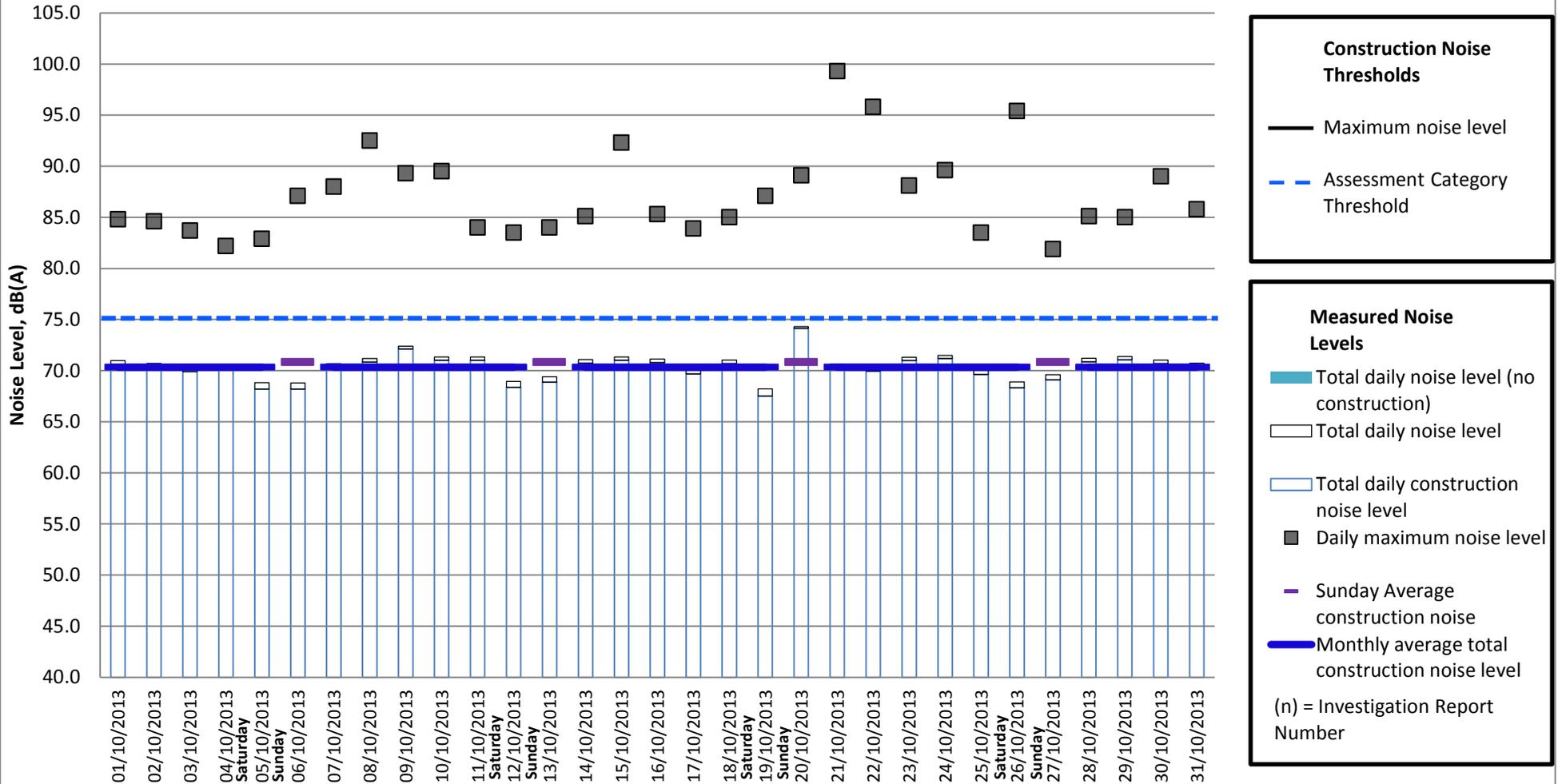


Measured Daytime Noise Levels at Newton Measurement period: October 2013

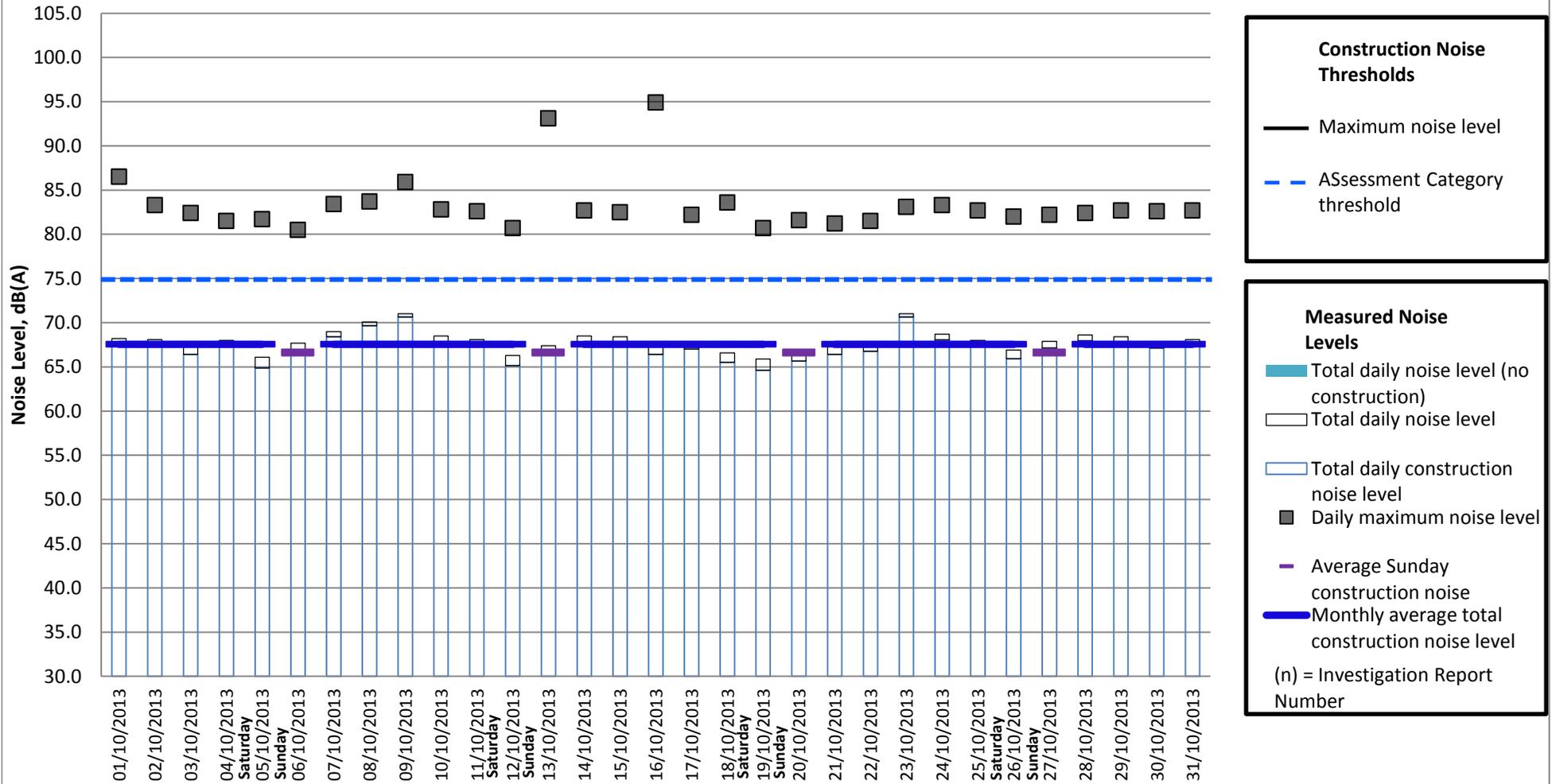


Note: The grey areas of the chart represent days on which no construction works have been conducted. It should be noted that the measured noise levels Mon - Fri can not be attributed to construction works due to the considerable distance (1.75 kilometers) between this monitoring location and the closest construction works.

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

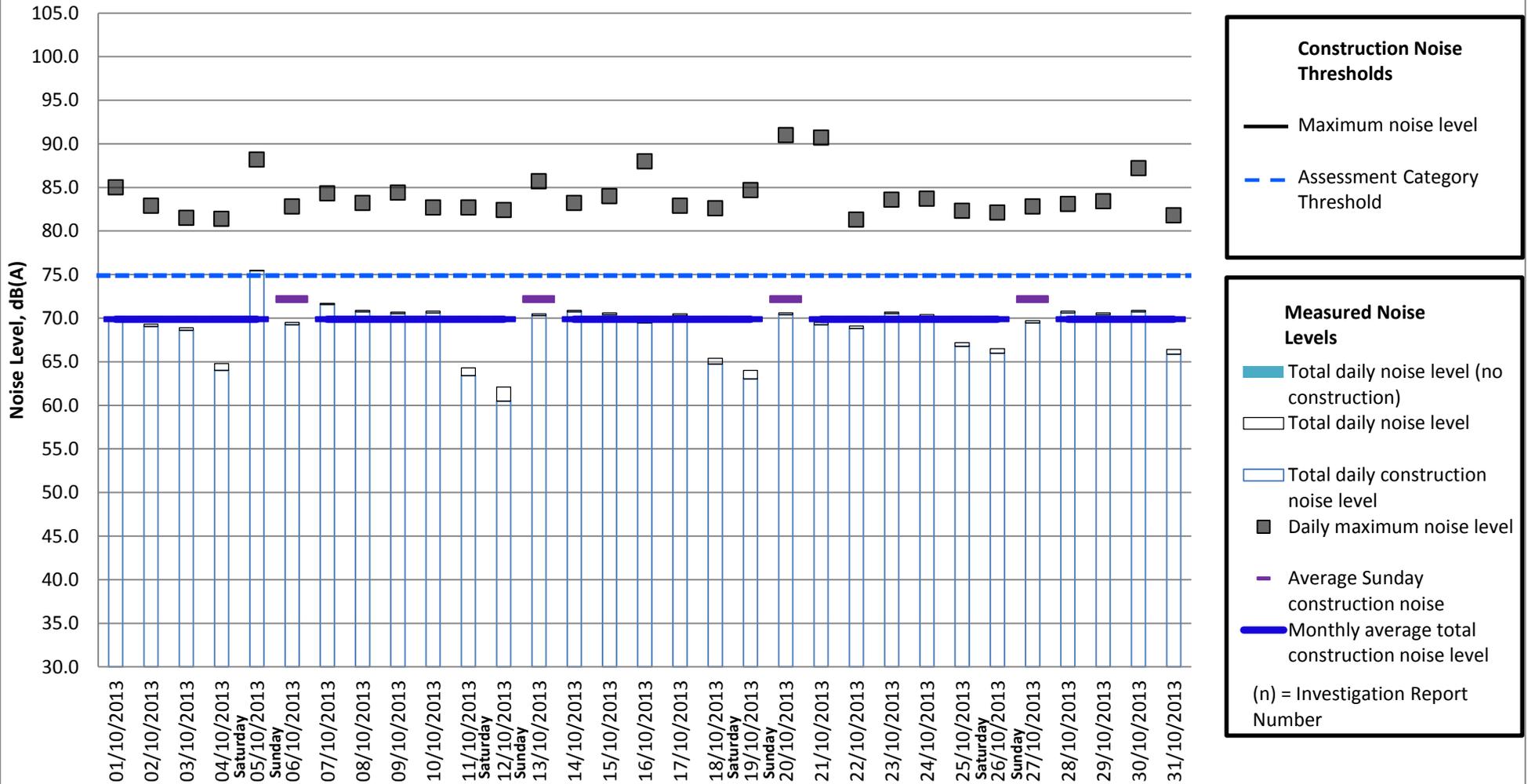


Measured Evening Noise Levels at North Leg Measurement period: October 2013

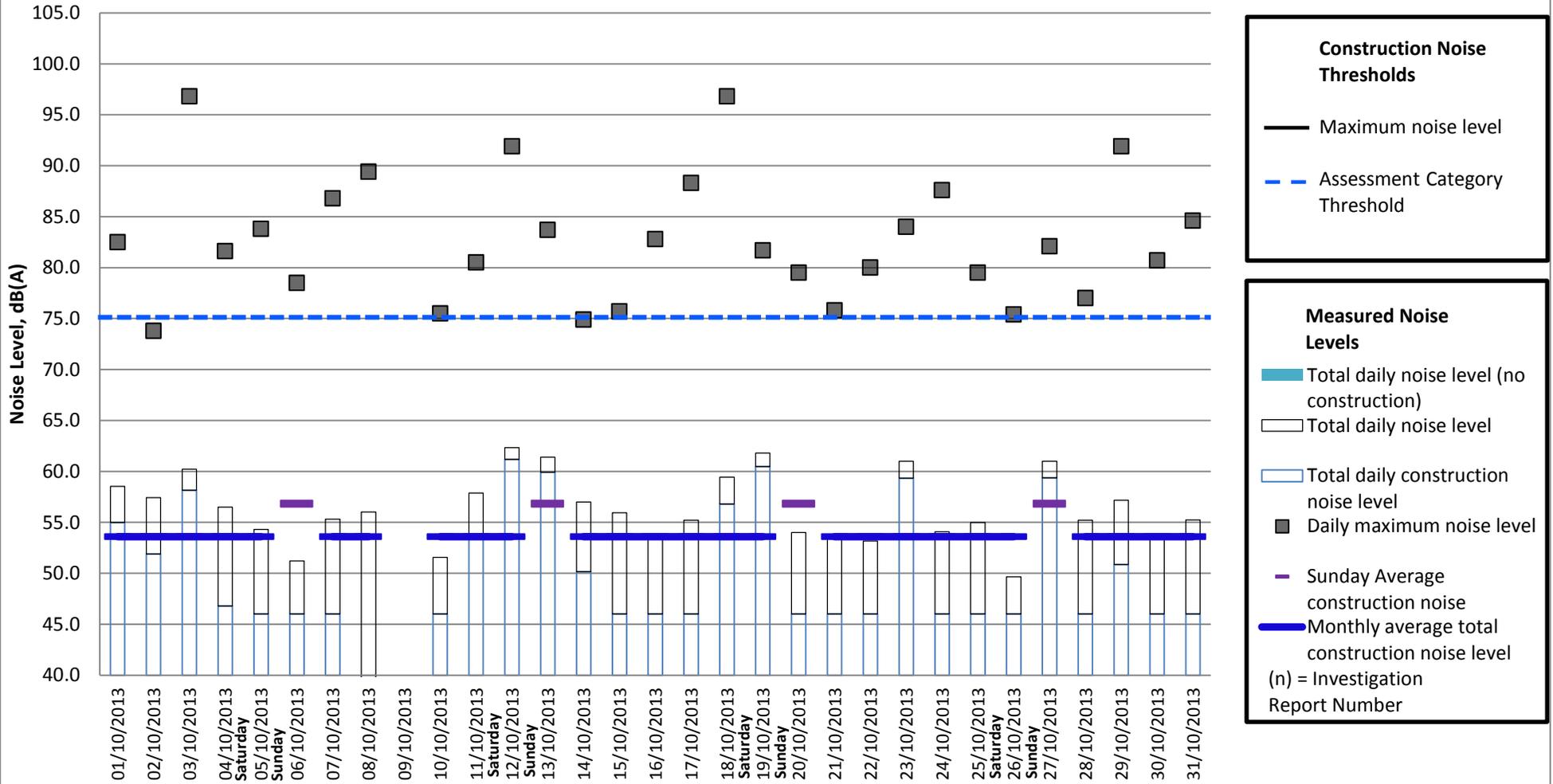


Measured Night-time Noise Levels at North Leg

Measurement period: October 2013

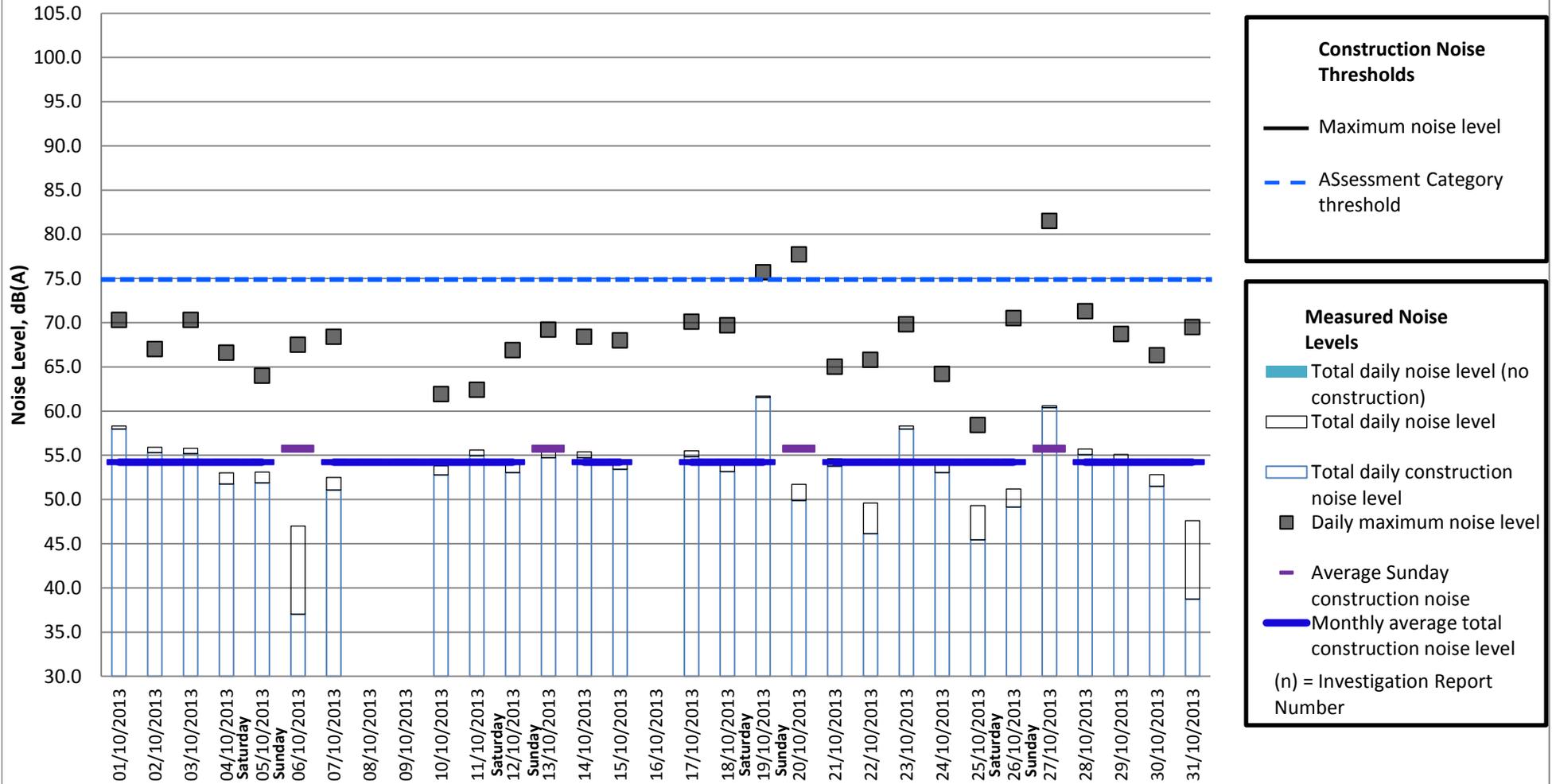


Measured Daytime Noise Levels at Port Edgar Measurement period: October 2013



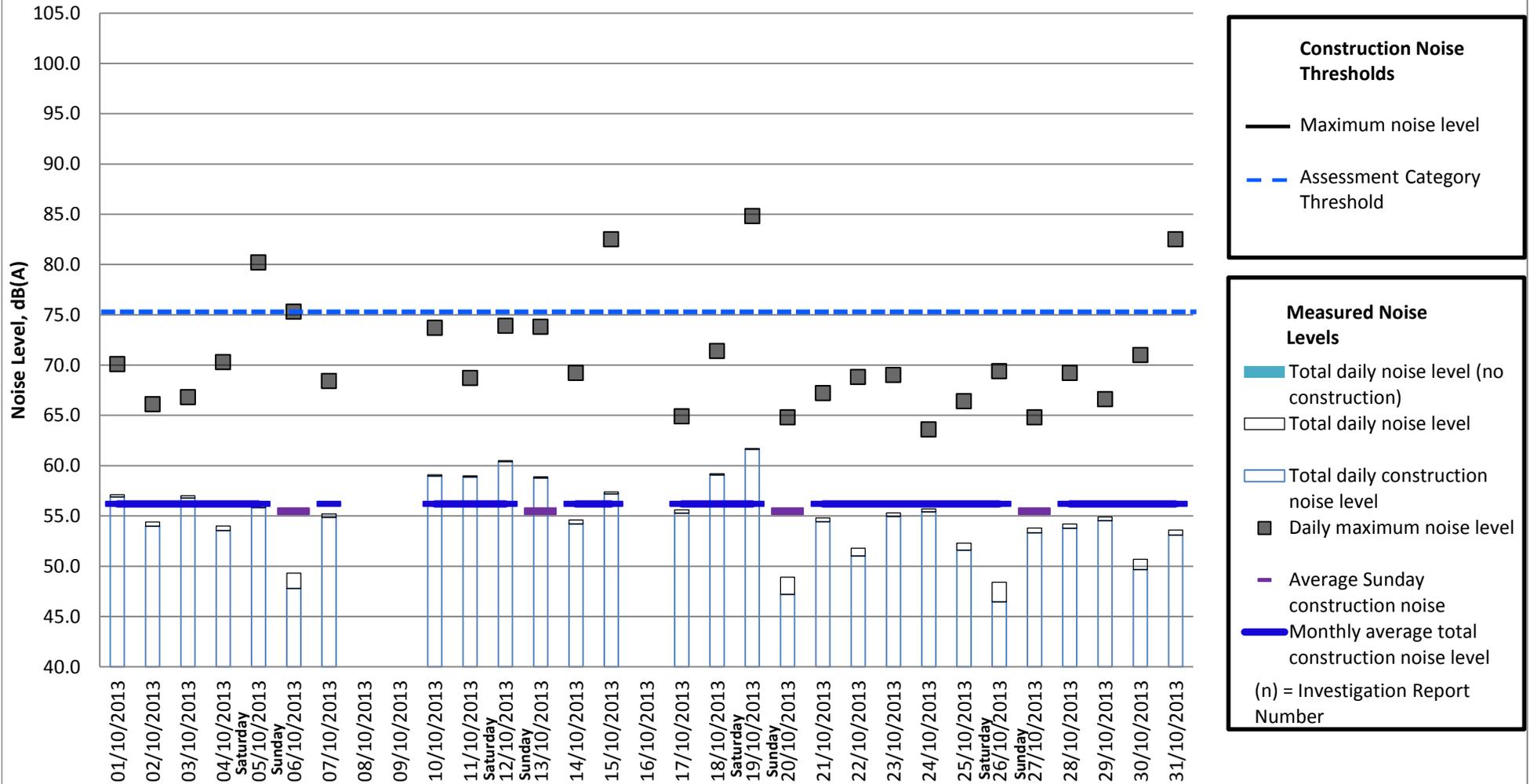
Note: Data is missing for 09/10/13 due to device error.

Measured Evening Noise Levels at Port Edgar Measurement period: October 2013



Note: The grey areas of the chart represent days on which no construction works have been conducted. Evening data is missing for 08/10/13, 09/10/13 and 16/10/13 due to device error.

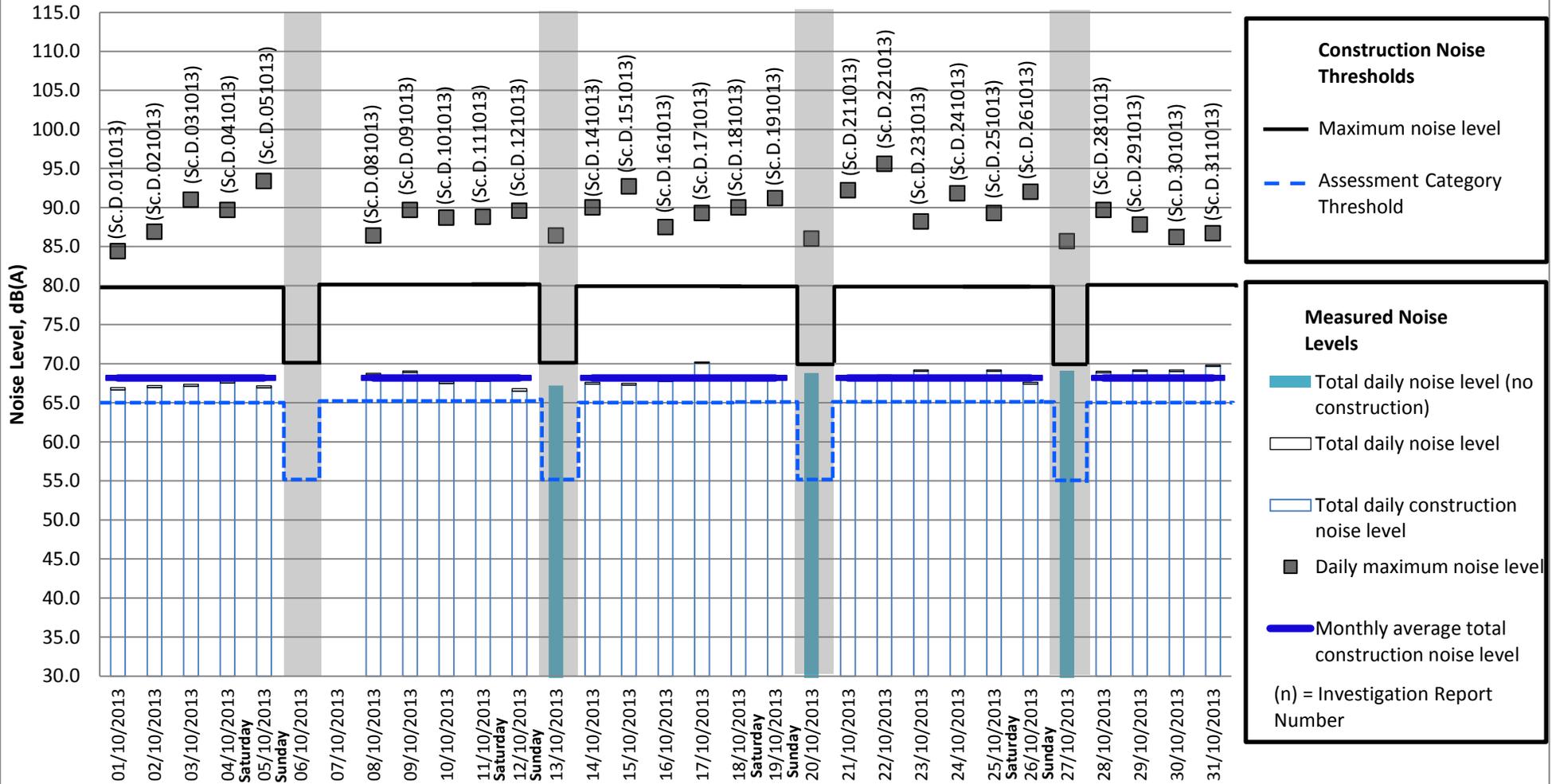
Measured Night-time Noise Levels at Port Edgar Measurement period: October 2013



Note: The grey areas of the chart represent days on which no construction works have been conducted. Data is missing for 08/10/13, 09/10/13 and 16/10/13 due to device error.

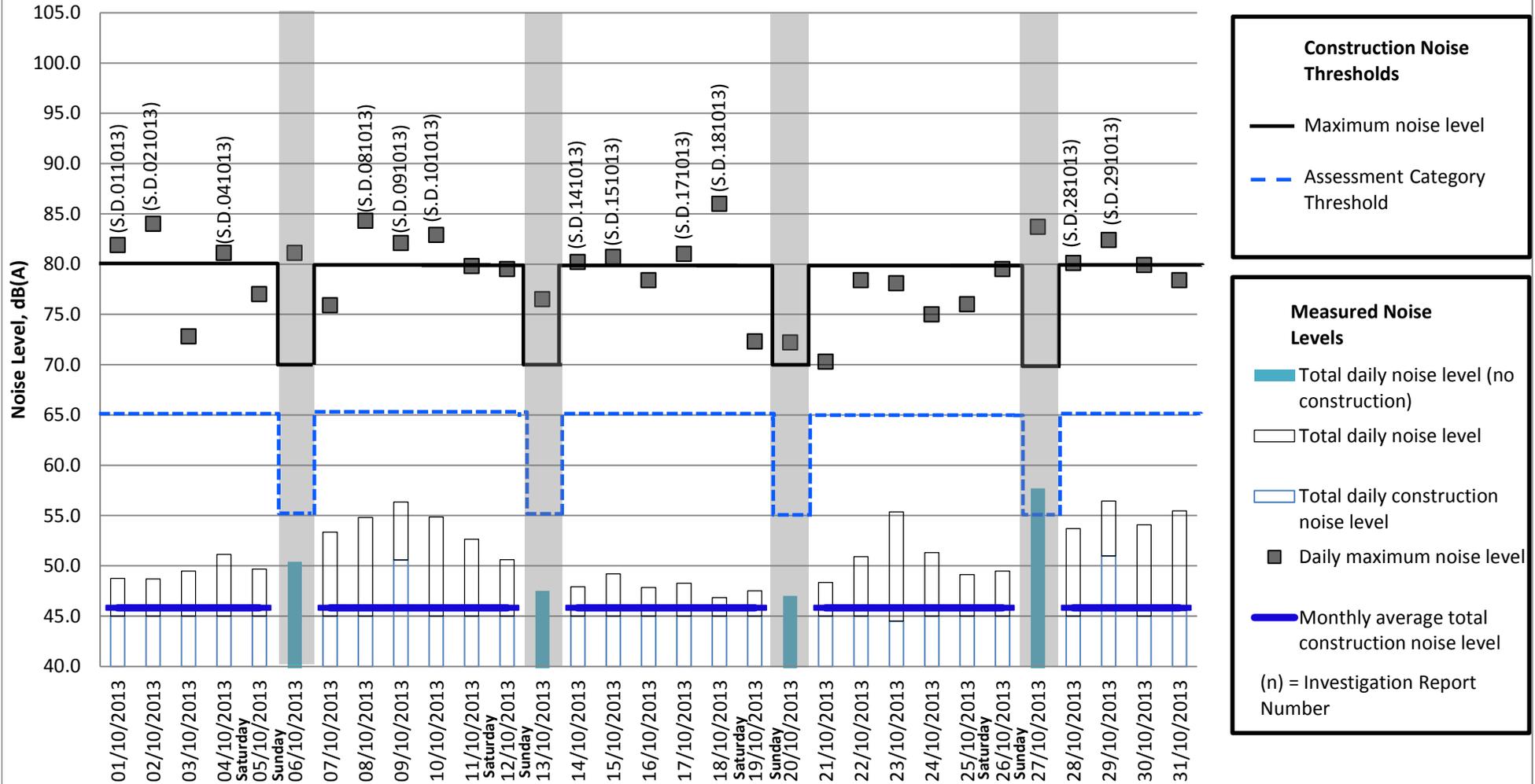
Measured Daytime Noise Levels at Scotstoun

Measurement period: October 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. Data is missing at

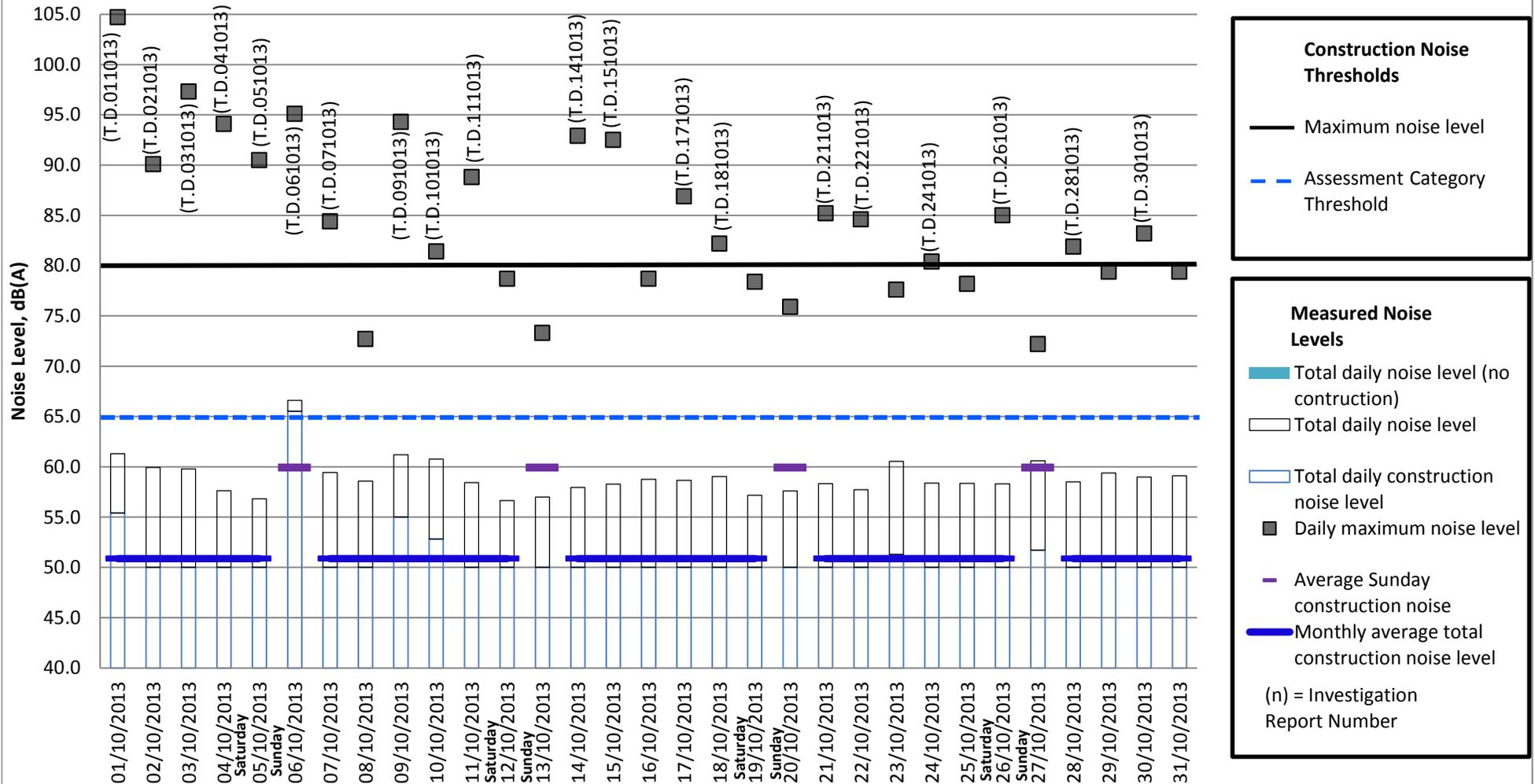
Measured Daytime Noise Levels at Springfield Measurement period: October 2013



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.

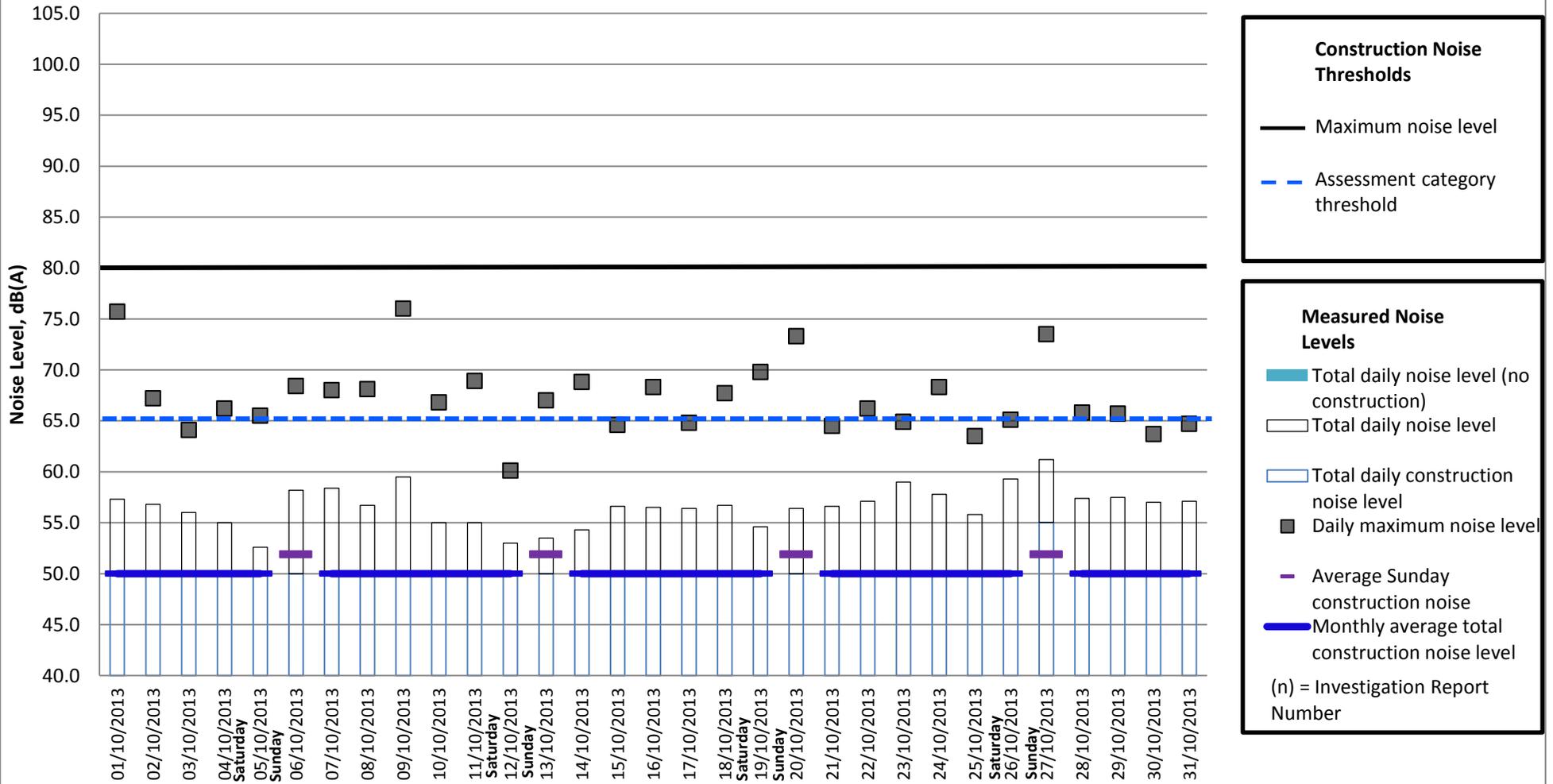
Measured Daytime Noise Levels at Tigh-Na-Grian

Measurement period: October 2013



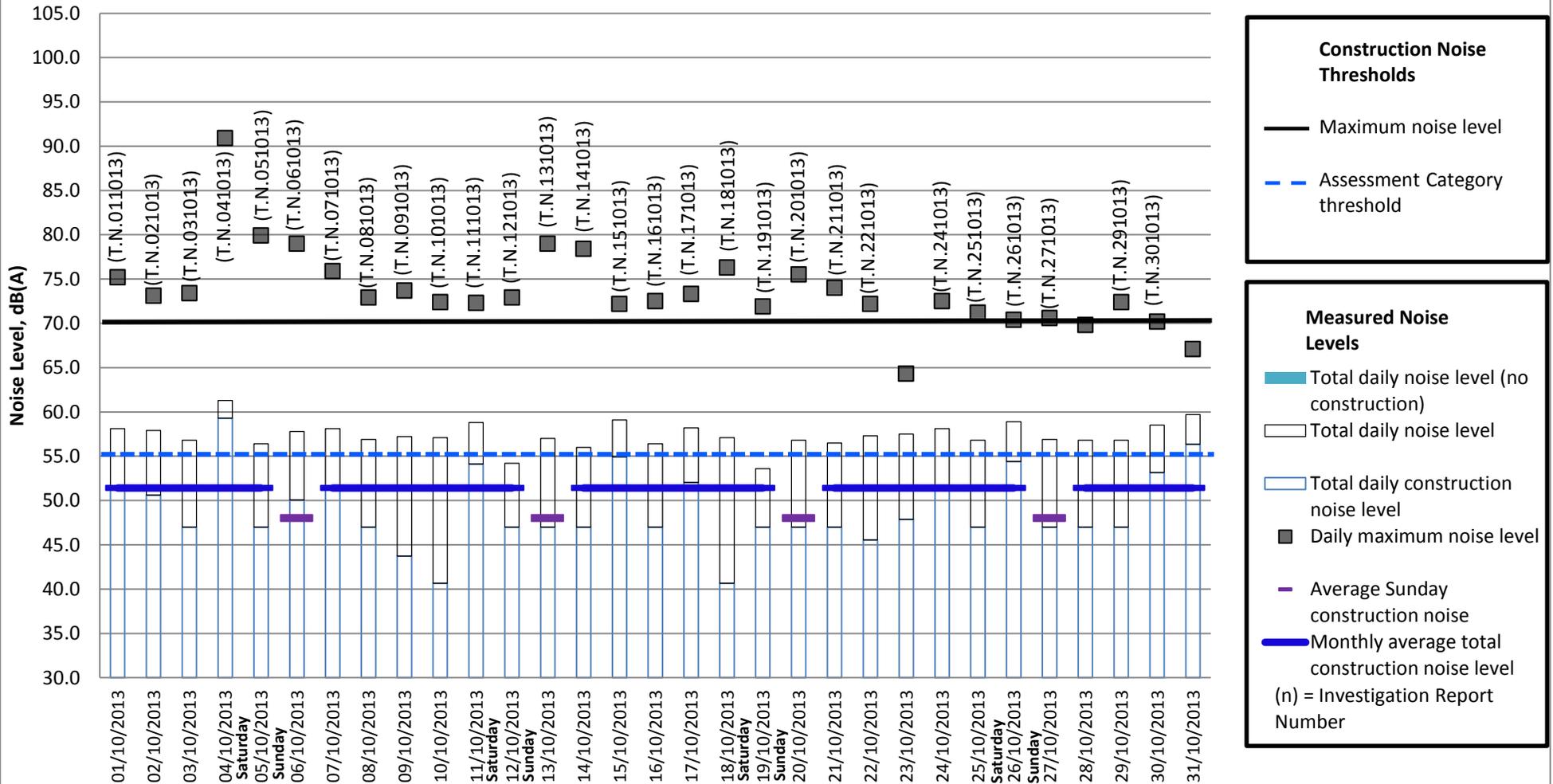
Measured Evening Noise Levels at Tigh-Na-Grian

Measurement period: October 2013



Measured Night-time Noise Levels at Tigh-Na-Grian

Measurement period: October 2013



Construction Noise Thresholds

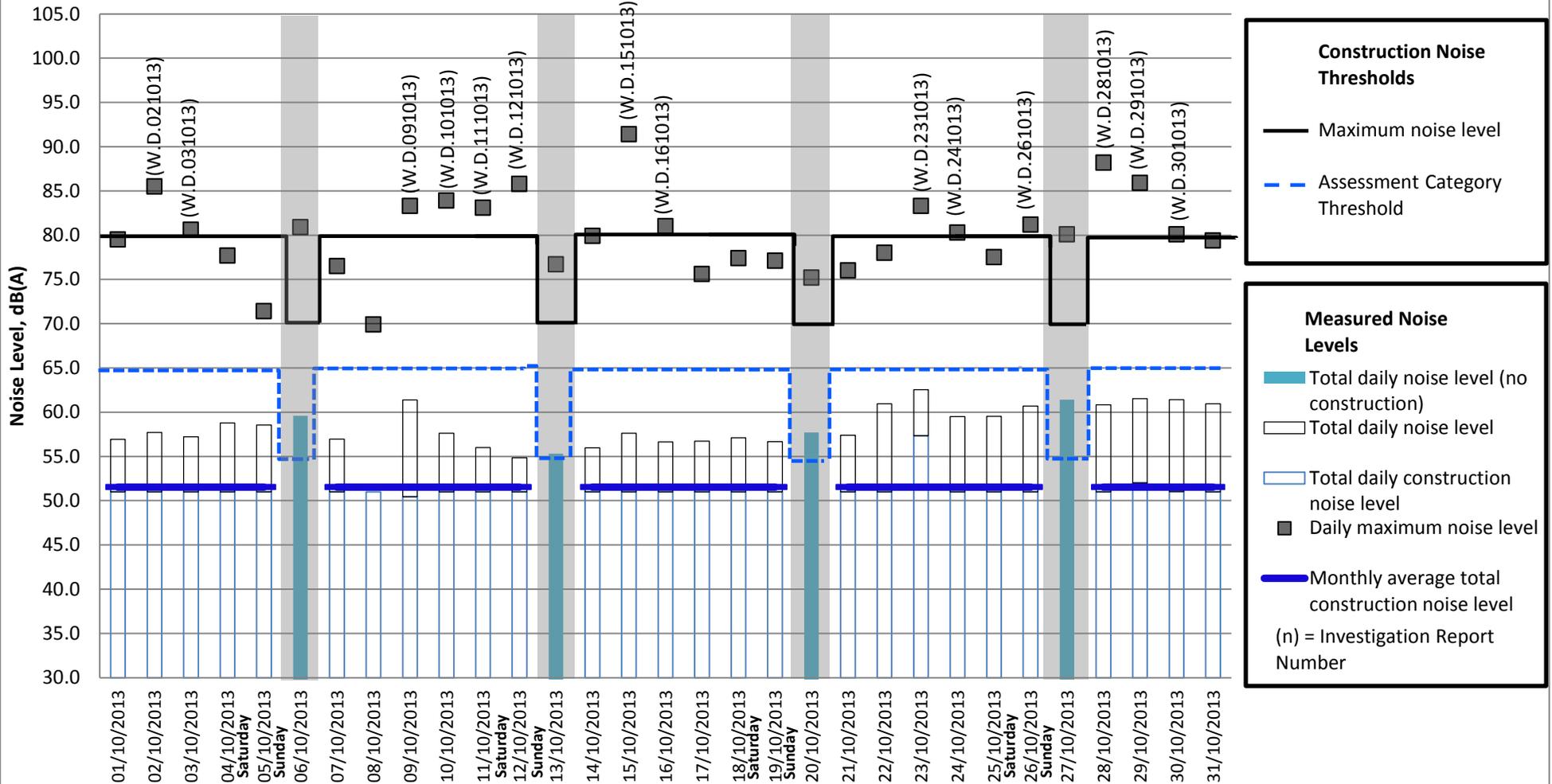
- Maximum noise level
- Assessment Category threshold

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

Measured Daytime Noise Levels at Whinny Hill Measurement period: October 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.