



Contractor



Forth Crossing Bridge Constructors

HOCHTIEF Solutions
American Bridge International
DRAGADOS
Morrison Construction

Project **FORTH REPLACEMENT CROSSING**

Document title

CONSTRUCTION NOISE MONITORING REPORT: AUGUST 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 August 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 August 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 August 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 August 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 August 2013
M1	Whinny Hill	Network	Band drain works at King Malcolm Drive Excavation and breaking rock at Castlandhill Road and haulage to Ferrytoll N.B. No evening, night time or Sunday daytime construction in vicinity.
M3	Tigh-Na-Grian	Crossing	Works within Central Tower cofferdam North Tower dewatering works North Tower crane platform piling
M4	North Leg	Crossing	Works within Central Tower cofferdam North Tower dewatering works North Tower crane platform piling South Tower excavation & airlifting South Tower underwater concrete pour Pier S1 final caisson excavation Pier S4 airlifting & underwater concrete Pier S6 backfilling Pier S5 blinding, rebar & formwork
M6	Port Edgar	Crossing	Works within Central Tower cofferdam South Tower excavation & airlifting Pier S1 jet grouting works Pier S4 airlifting Pier S5 airlifting & concrete works Society Road works
M7	Butlaw Fisheries	Crossing	Works within Central Tower cofferdam South Tower excavation & airlifting Pier S1 jet grouting works Pier S4 airlifting Pier S5 airlifting & concrete works Pier S6 backfilling Society Road works
M10	Inchgarvie Lodge	Crossing	South Tower excavation & airlifting Pier S1 jet grouting works Pier S4 airlifting Pier S5 airlifting & concrete works Launch –fixing steel and erecting formwork, concrete pours, backfilling and assembly of stillages Scaffolding works, rebar, formwork and concrete pours at S7/S8 Society road works
M11	Linn Mill	Network (close proximity to Crossing)	Launch –fixing steel and erecting formwork, concrete pours, backfilling and assembly of stillages Scaffolding works, rebar, formwork and concrete pours at S7/S8 Pier trials area works

			Society road works
M13	Clufflat Brae	Crossing	Launch –fixing steel and erecting formwork, concrete pours, backfilling and assembly of stillages Scaffolding works, rebar, formwork and concrete pours at S7/S8 Pier trials area works Society road works
M14	Springfield	Network	Launch –fixing steel and erecting formwork, concrete pours, backfilling and assembly of stillages Loading tippers with clay for transport to Dundas Pier trials area works Gyratory – structures N.B. No evening, night time or Sunday daytime construction in vicinity.
M15	Echline Field	Network	Launch –fixing steel and erecting formwork, concrete pours, backfilling and assembly of stillages Loading tippers with clay for transport to Dundas Bulk excavation for mainline Structures works at gyratory N.B. No evening, night time or Sunday daytime construction in vicinity.
M16	Scotstoun	Network	Bus link works N.B. No evening, night time or Sunday daytime construction in vicinity.
M17	Dundas Home Farm	Network	Utilities works Environmental bund works Excavation works for mainline 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 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. Data is missing for the North Leg from the night period on 10 August to 21 August due to device error; the error was resolved as soon as reasonably practicable, though the timescale was restricted due to the limited accessibility to this device. A short period (2 days) is also missing from Scotstoun due to device error.
- 3.3** Results demonstrate that the monthly average total construction noise results for daytime were within the threshold limits for all monitoring locations for August 2013, with the exception of Scotstoun. For the evening and night time periods, all monitoring locations, with the exception of night time at Butlaw Fisheries, were within the threshold limits. With regard to the Sunday averages (for applicable monitoring locations), exceedances of the threshold were noted for the Sunday daytime, evening and night time average at Butlaw Fisheries. All other locations not listed were found to be within the Sunday average threshold for all periods.
- 3.4** The exceedances at Butlaw are not thought to have been caused by increased noise levels due to construction. The night time average was found to be affected by increased noise levels due to waves breaking on the shore, as well as bird calls at dawn. The exceedances of the Sunday averages are also not thought to be due to construction works. Though audio is not available for all the Sunday periods, no construction works were on-going at the time which would have caused the elevated noise levels observed. Where audio is available, it demonstrates that the increased levels were caused by birds and 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. 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.
- 3.5** 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 August is consistent with that recorded in previous months.

- 3.6** During August 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 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.
- 3.8** 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.
- 3.9** The daytime L_{AFmax} threshold was exceeded during August on six occasions. Four exceedances were recorded at Dundas and were found to be caused by a tipper tipping material for the construction of the environmental bund in close proximity to this monitoring station. A daytime construction related exceedance was also recorded at Linn Mill which was caused by plant movements in Echline field. A daytime exceedance was also recorded at Scotstoun, where the construction of a fence in close proximity to the meter caused an exceedance of the threshold. In addition to the daytime exceedance, three night time exceedances were caused by the night works at Society Road; these were recorded at Butlaw on one occasion and at Inchgarvie on two occasions. All construction related exceedances were investigated and mitigation measures implemented where possible; the relevant NVIRs provide more detail with regard to each exceedance.
- 3.10** 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 August the maximum noise threshold was exceeded on 53 occasions (daytime, 12; evening, 15; night time, 26). One night time exceedance was caused by construction works at Society Road. All other exceedances were attributed to a range of non-construction factors, but notably birds, waves and planes.
Clufflat Brae	During August the maximum noise threshold was exceeded on 41 occasions (daytime, 10; evening, 12; night time, 19). No exceedances were attributable to construction works. Exceedances were found to be largely due to birds, wind and residents at nearby properties.
Inchgarvie Lodge	During August the maximum noise threshold was exceeded on 45 occasions (daytime, 12; evening, 14; night time, 19). Two night time exceedances were 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 August the maximum noise threshold was exceeded on 42 occasions (daytime, 10; evening, 14; night time, 18). One exceedance was found to be due to plant movements in Echline filed. However, the majority of exceedances were caused by birds and residents at nearby properties.
Tigh-Na-Grian	During August the maximum noise threshold was exceeded on 57 occasions (daytime, 28; evening, 10; night time, 19). Exceedances were due to non-construction factors, notably birds.
Dundas Home Farm	During August the maximum noise threshold was exceeded on 10 occasions. Four exceedances were attributable to construction works (embankment works in close proximity to meter). Other exceedances were largely due to a gardening works at the property.
Echline	During August the maximum noise threshold was exceeded on 27 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 August the maximum noise threshold was exceeded on 10 occasions. The exceedances were not caused by construction works at this location. The majority of exceedances were due to local residents.
Scotstoun	During August the maximum noise threshold was exceeded on 25 occasions. Exceedances were largely attributed to vehicles passing by on the adjacent road. However, one exceedance was found to be due to the construction of a fence in close proximity to the meter.
Whinny Hill	During August the maximum noise threshold was exceeded on 8 occasions. Exceedances were not due to construction activities. A range of factors were found to cause exceedances at this location, including birds, dogs barking, wind and planes.

Table 3: Summary of Construction Exceedances at Monitoring Locations

Construction Related Noise Exceedances - August 2013						
Date	Monitor	Period	Description	Lmax (dB(A))	Threshold (dB(A))	NVIR No.
09/08/2013	Butlaw Fisheries (South Shore)	Night	Society Rd Nightworks - Metal Clang	71.8	65.0	B.N.090813
09/08/2013	Inchgarvie Lodge (Echline Field)	Night	Society Rd Nightworks - Metal Clang	68.8	65.0	I.N.080813
10/08/2013				65.8		I.N.090813
12/08/2013	Dundas Home Farm (South Network)	Day	Tipper Tipping for Earthbund	81.9	80.0	D.D.120813
13/08/2013				81.1		D.D.130813
14/08/2013				81.7		D.D.140813
23/08/2013				82.5		D.D.230813
17/08/2013	Scotstoun (Arup Office)	Day	Fence works adjacent to monitor	91.5	80.0	Sc.D.170813
20/08/2013	Linn Mill (Echline Field)	Day	Plant Moving Down Echline	88.6	80.0	L.D.200813



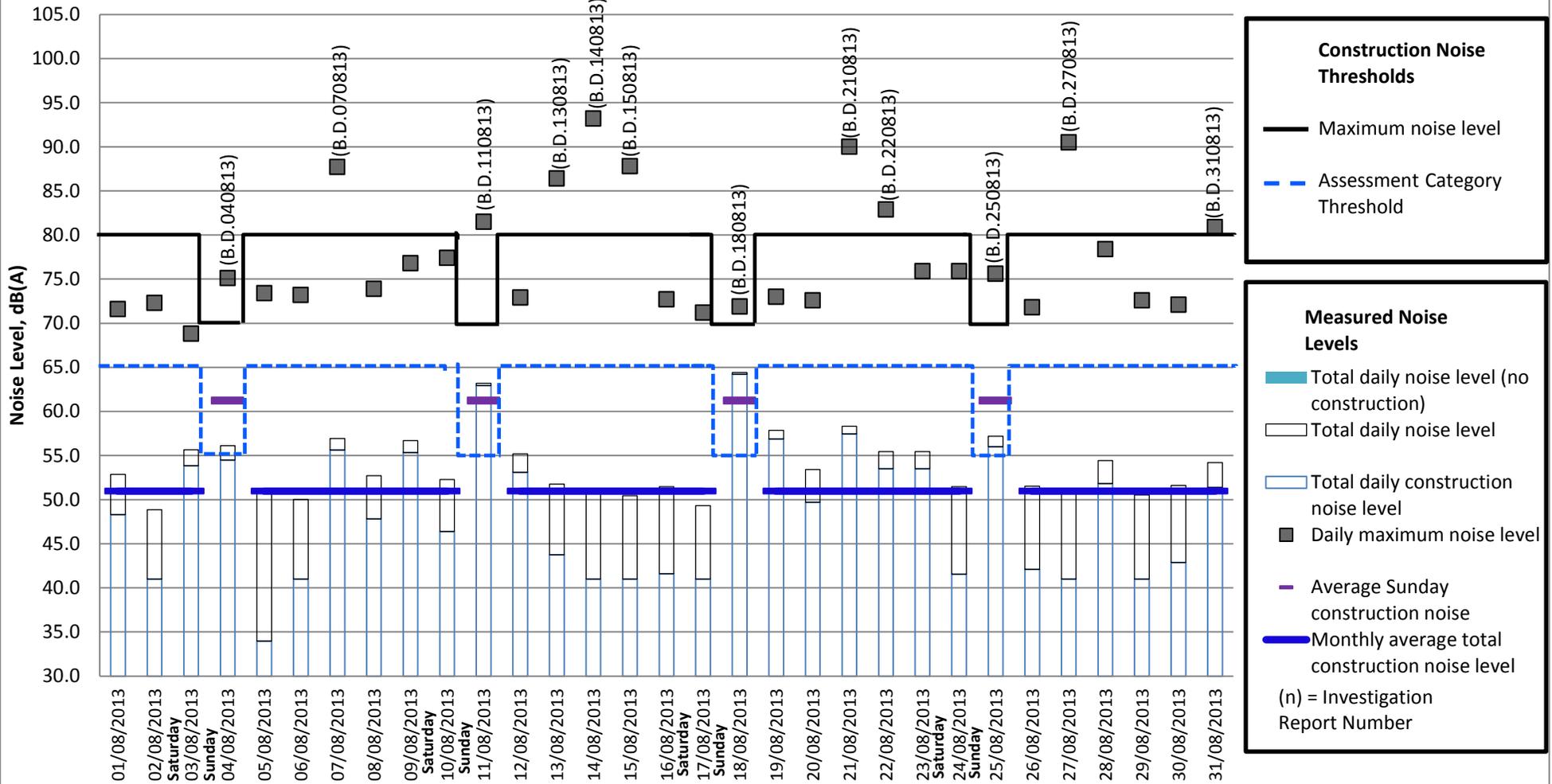
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APPENDIX A

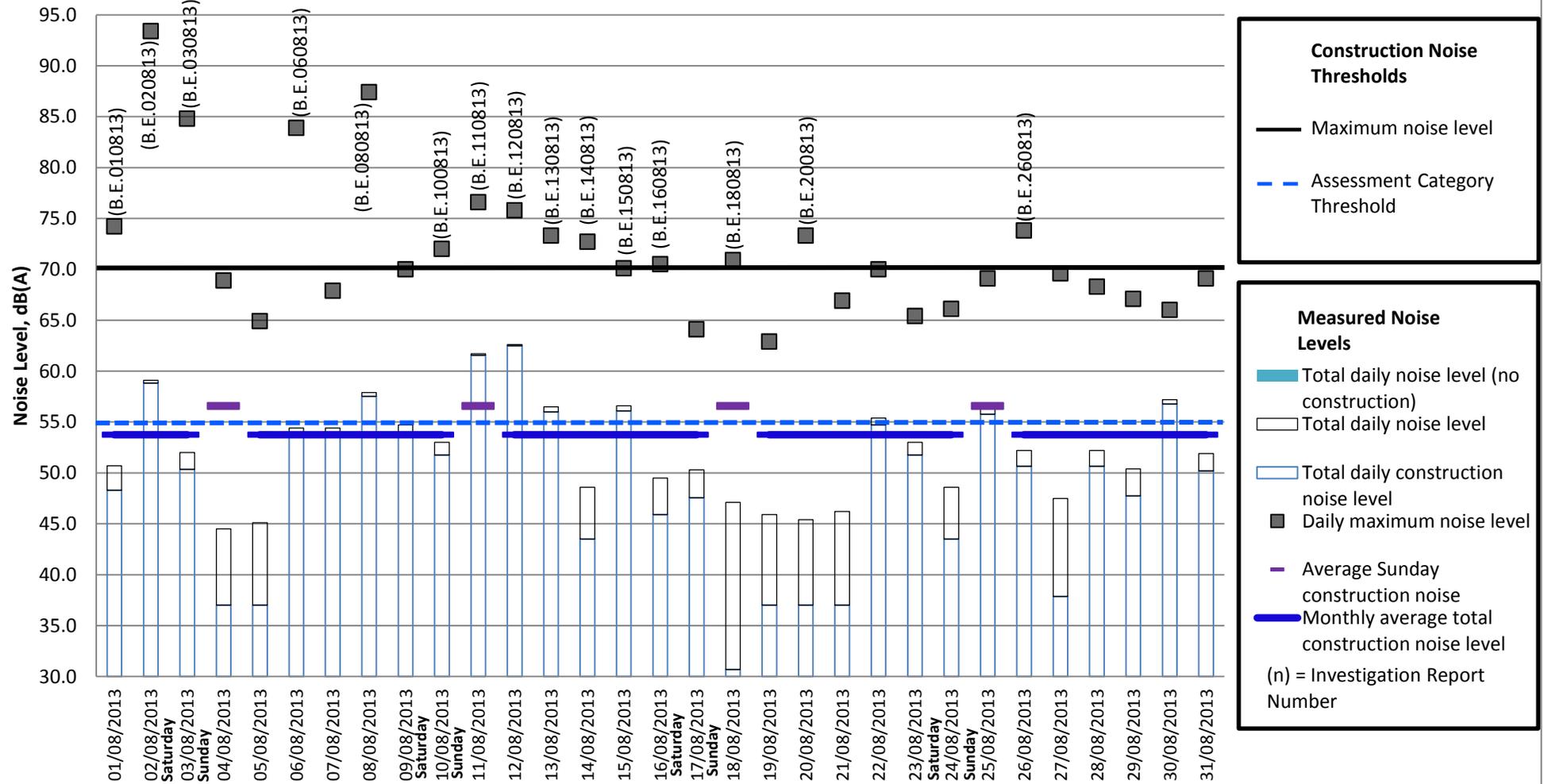
Measured Daytime Noise Levels at Butlaw Fisheries

Measurement period: August 2013



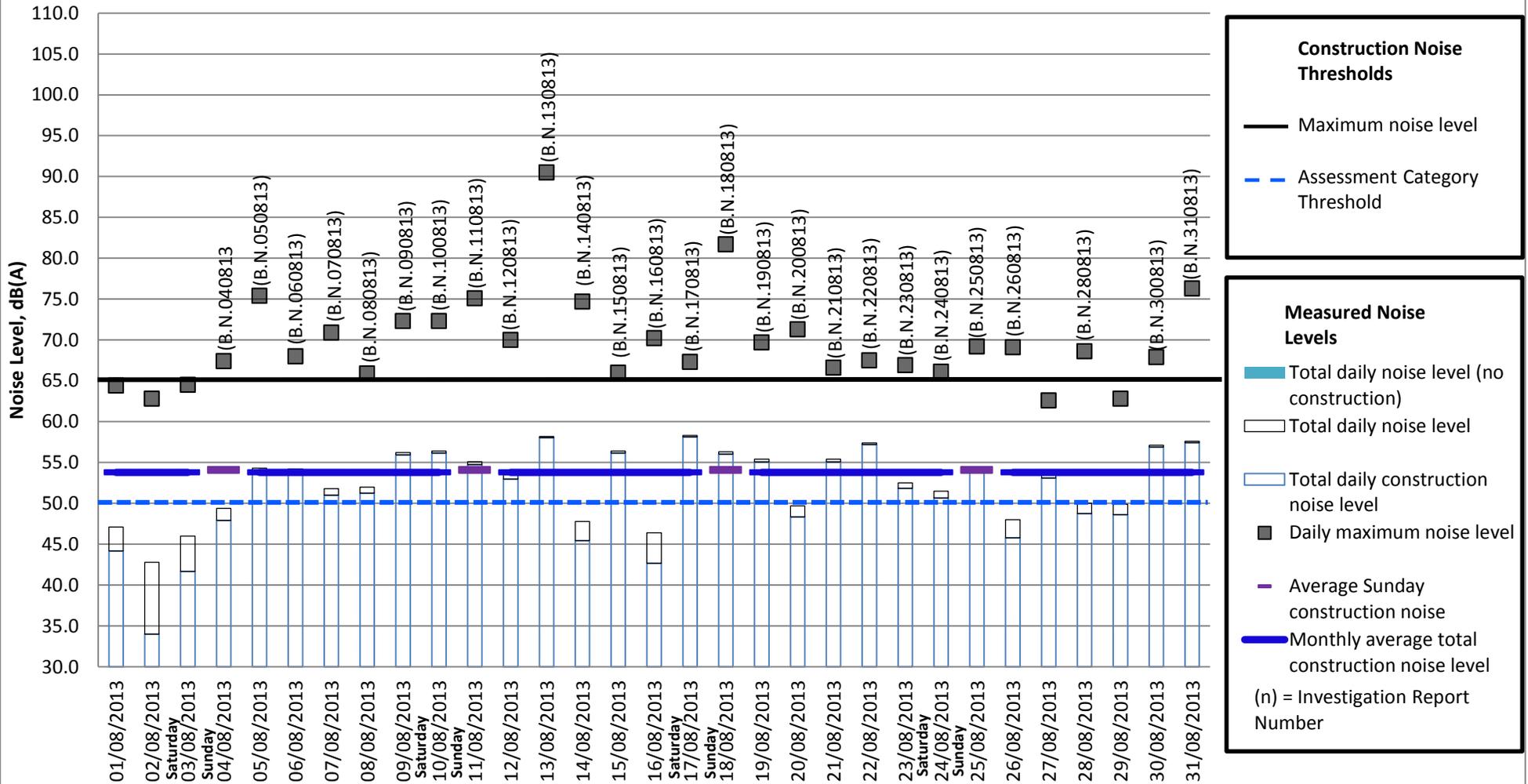
Measured Evening Noise Levels at Butlaw Fisheries

Measurement period: August 2013



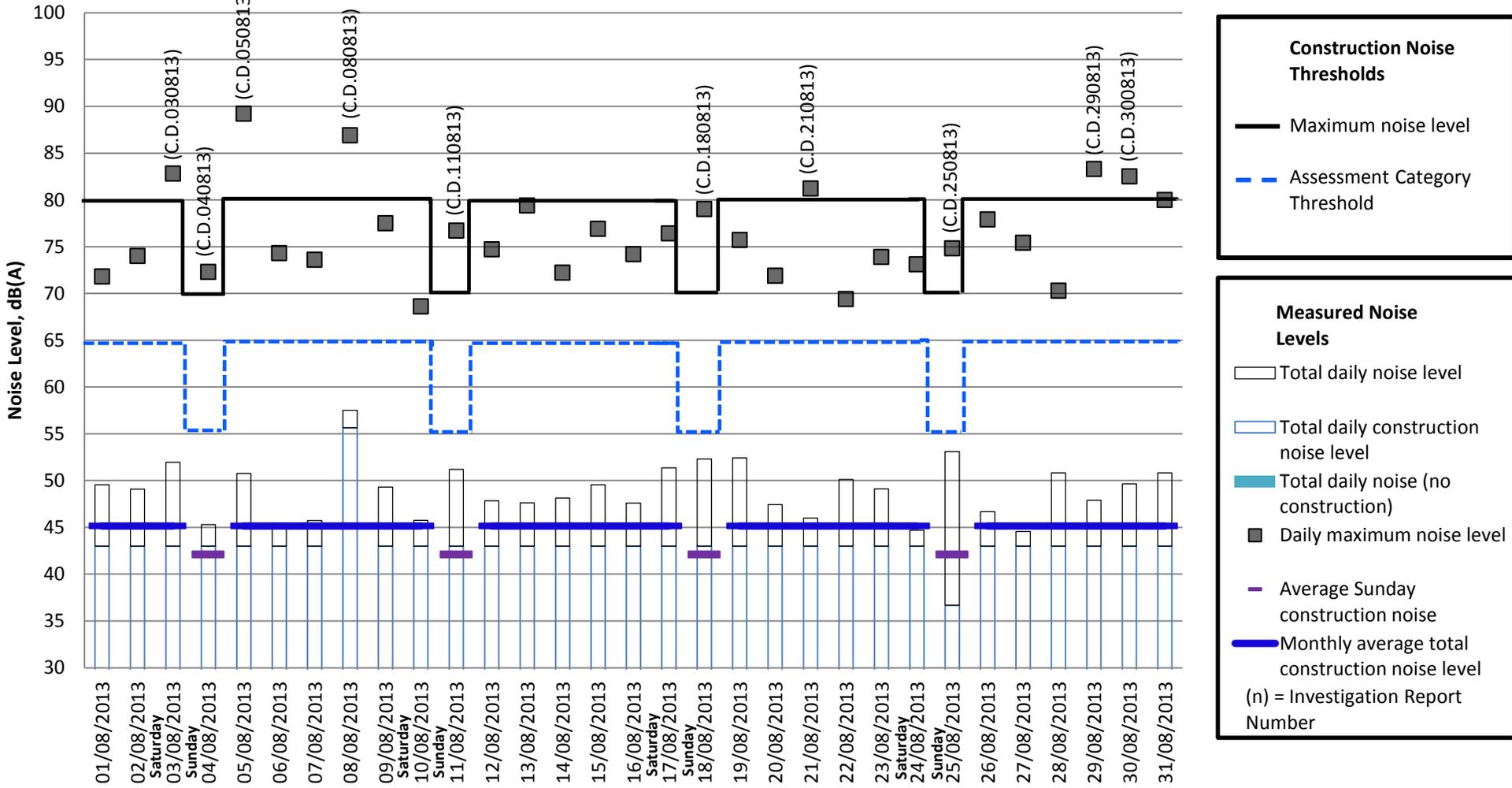
Measured Night time Noise Levels at Butlaw Fisheries

Measurement period: August 2013



Measured Daytime Noise Levels at Clufflat Brae

Measurement period: August 2013



Construction Noise Thresholds

- Maximum noise level
- Assessment Category Threshold

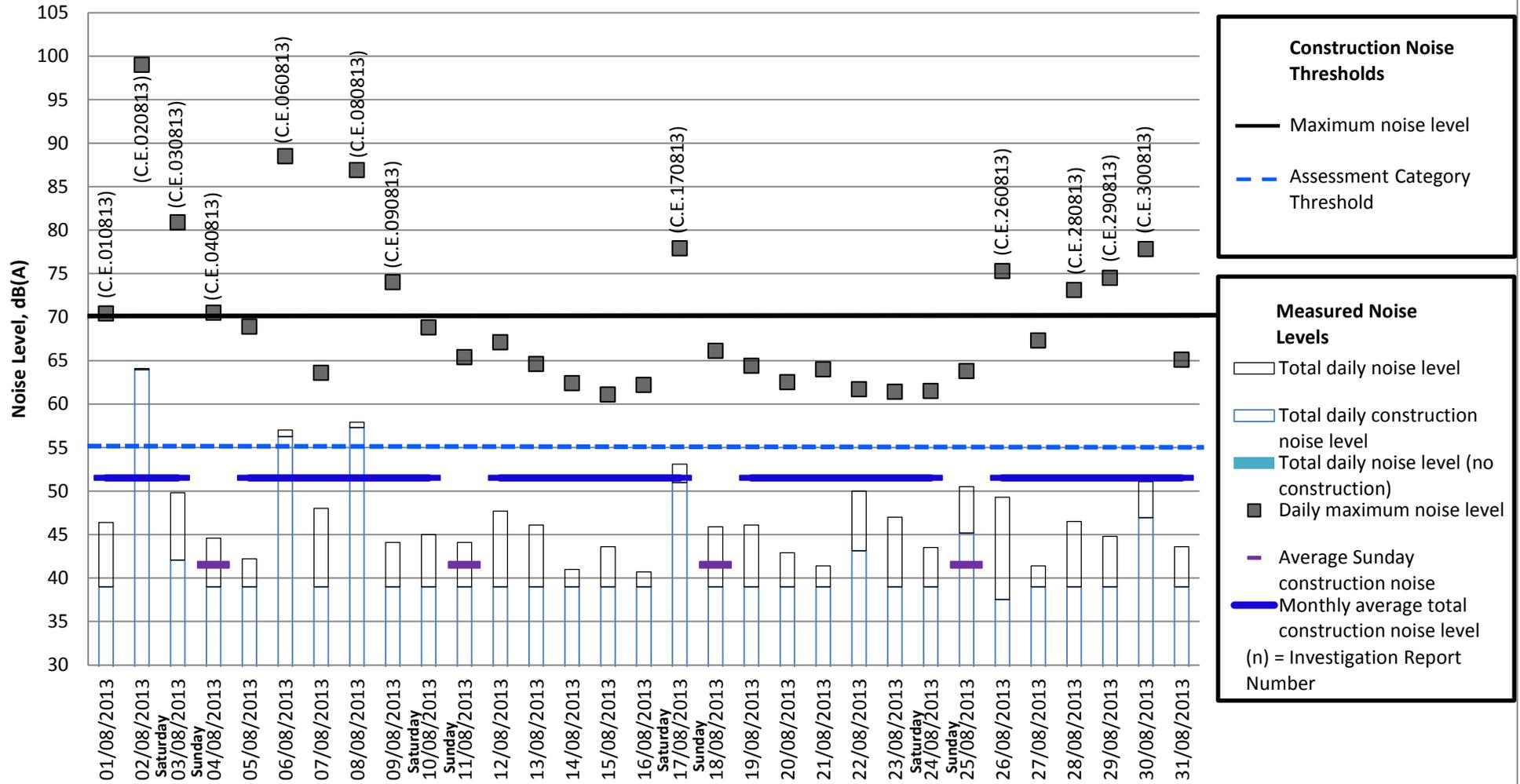
Measured Noise Levels

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

(n) = Investigation Report Number

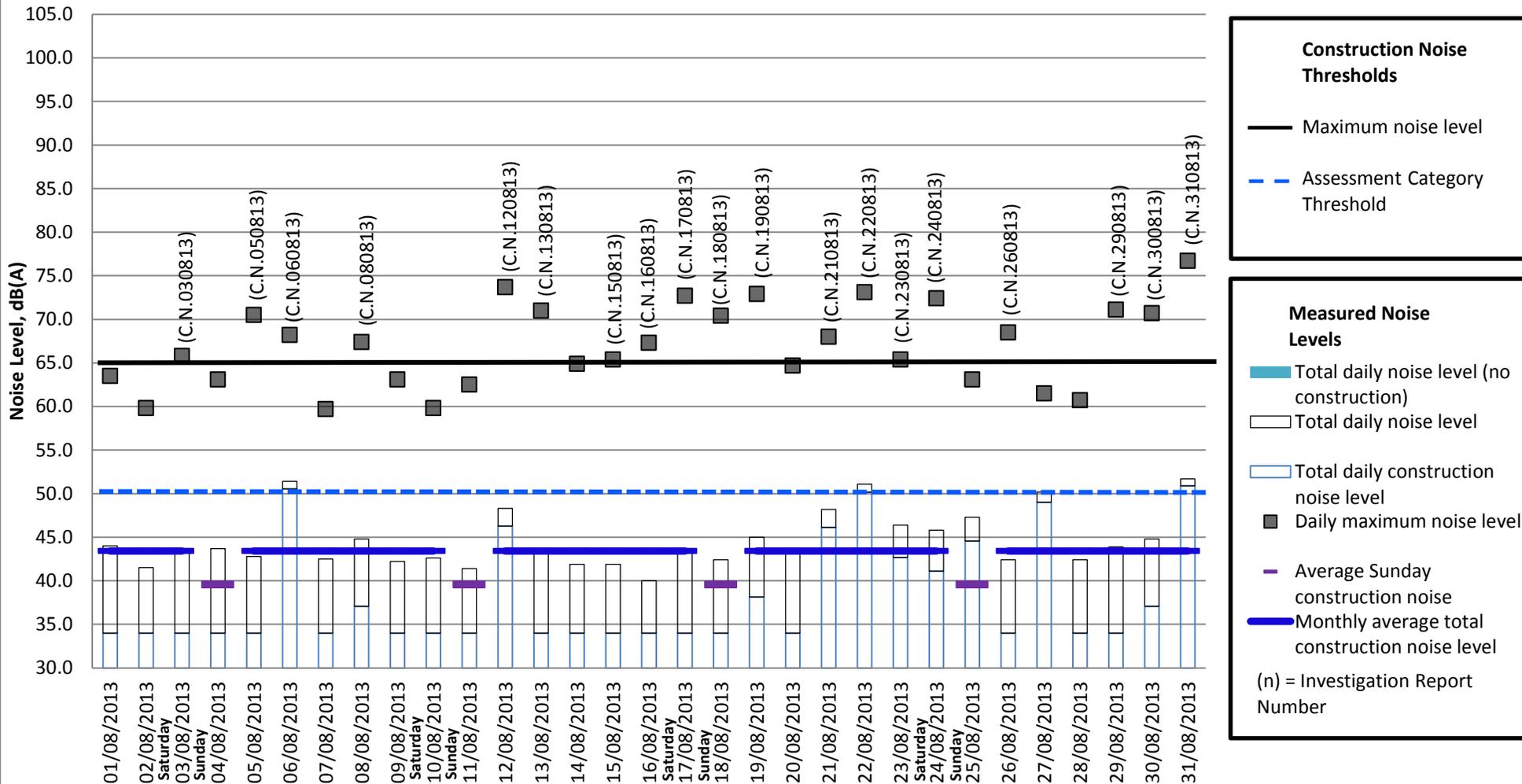
Measured Evening Noise Levels at Clufflat Brae

Measurement period: August 2013



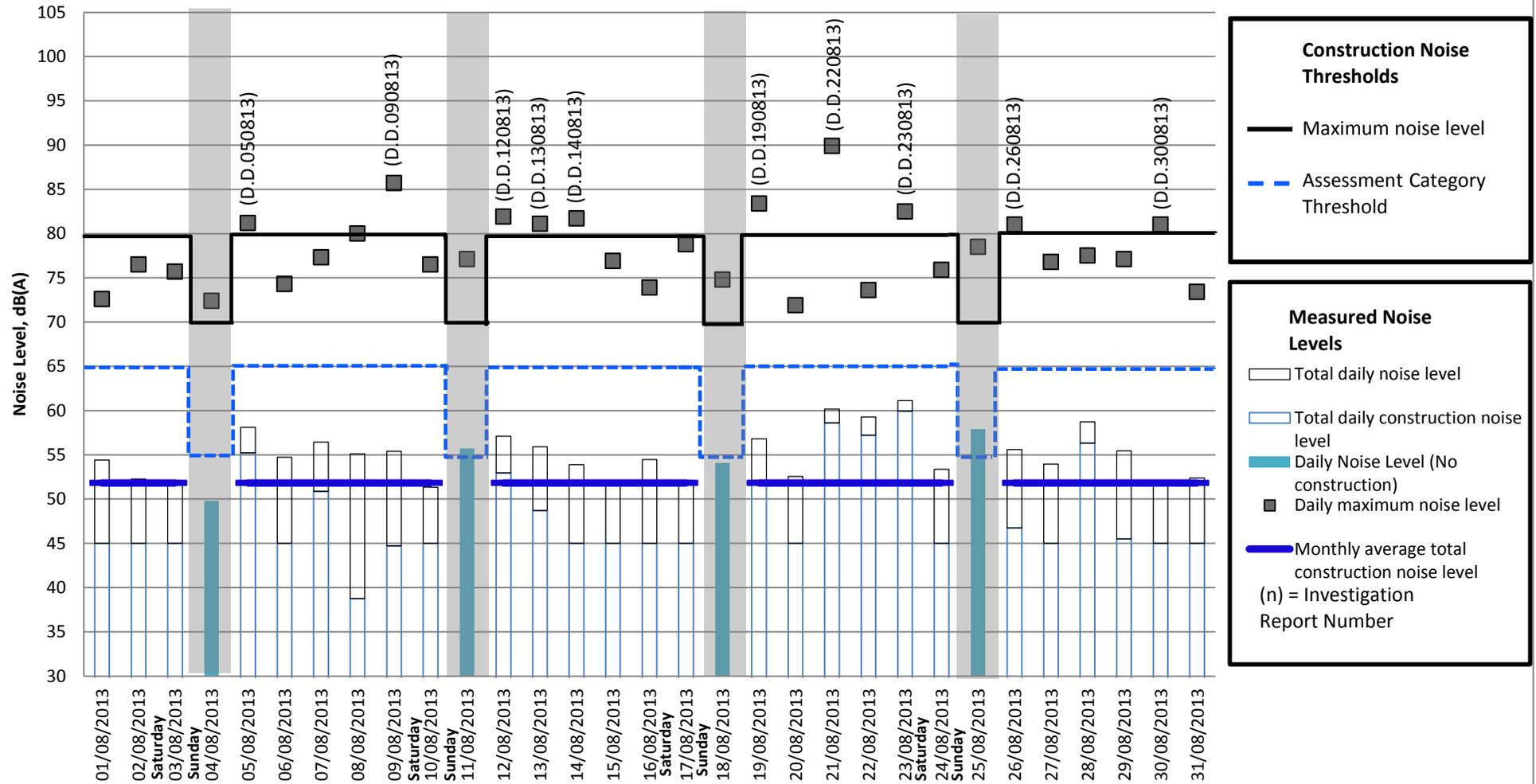
Measured Night-time Noise Levels at Clufflat Brae

Measurement period: August 2013



Measured Daytime Noise Levels at Dundas Home Farm

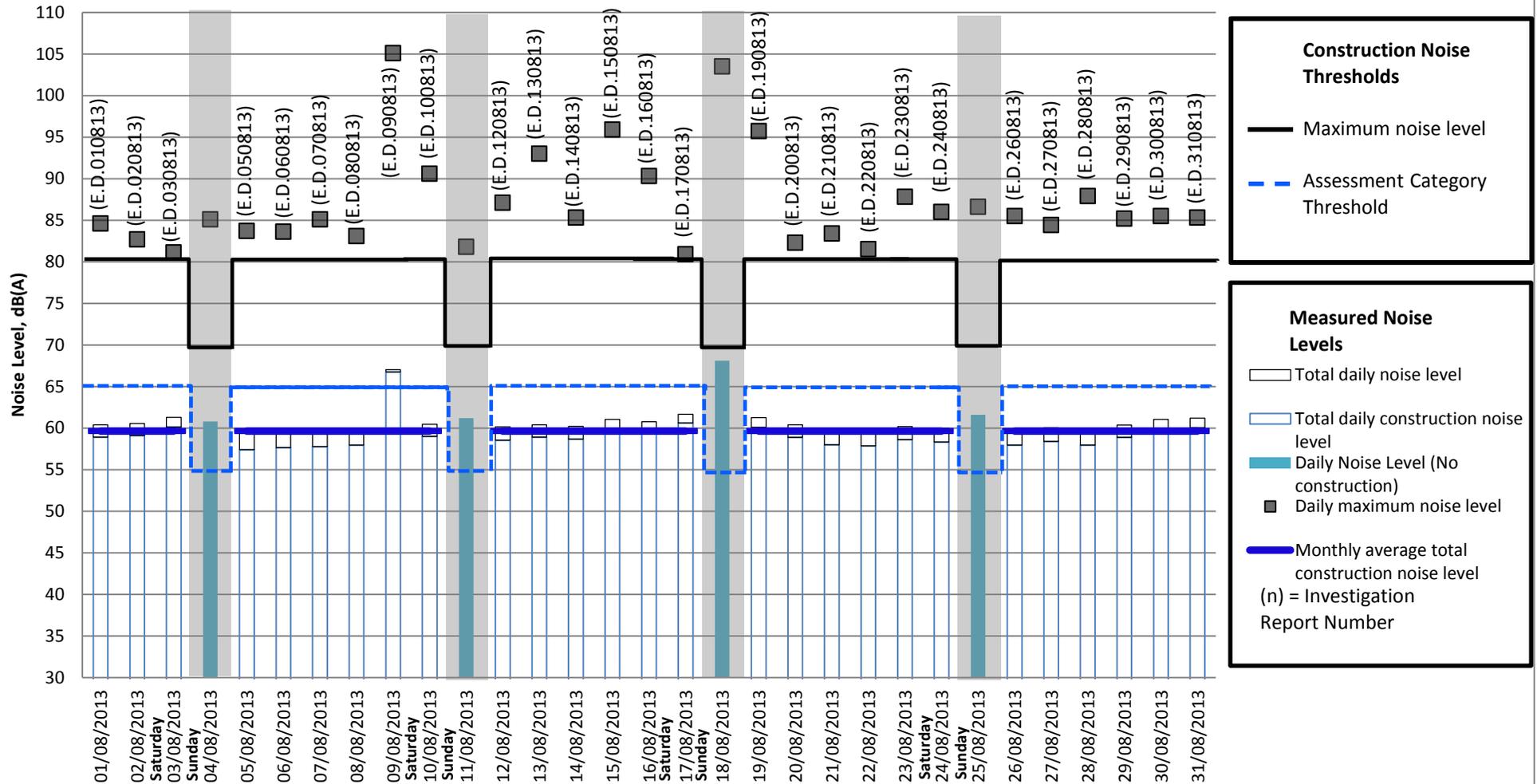
Measurement period: August 2013



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

Measured Daytime Noise Levels at Echline

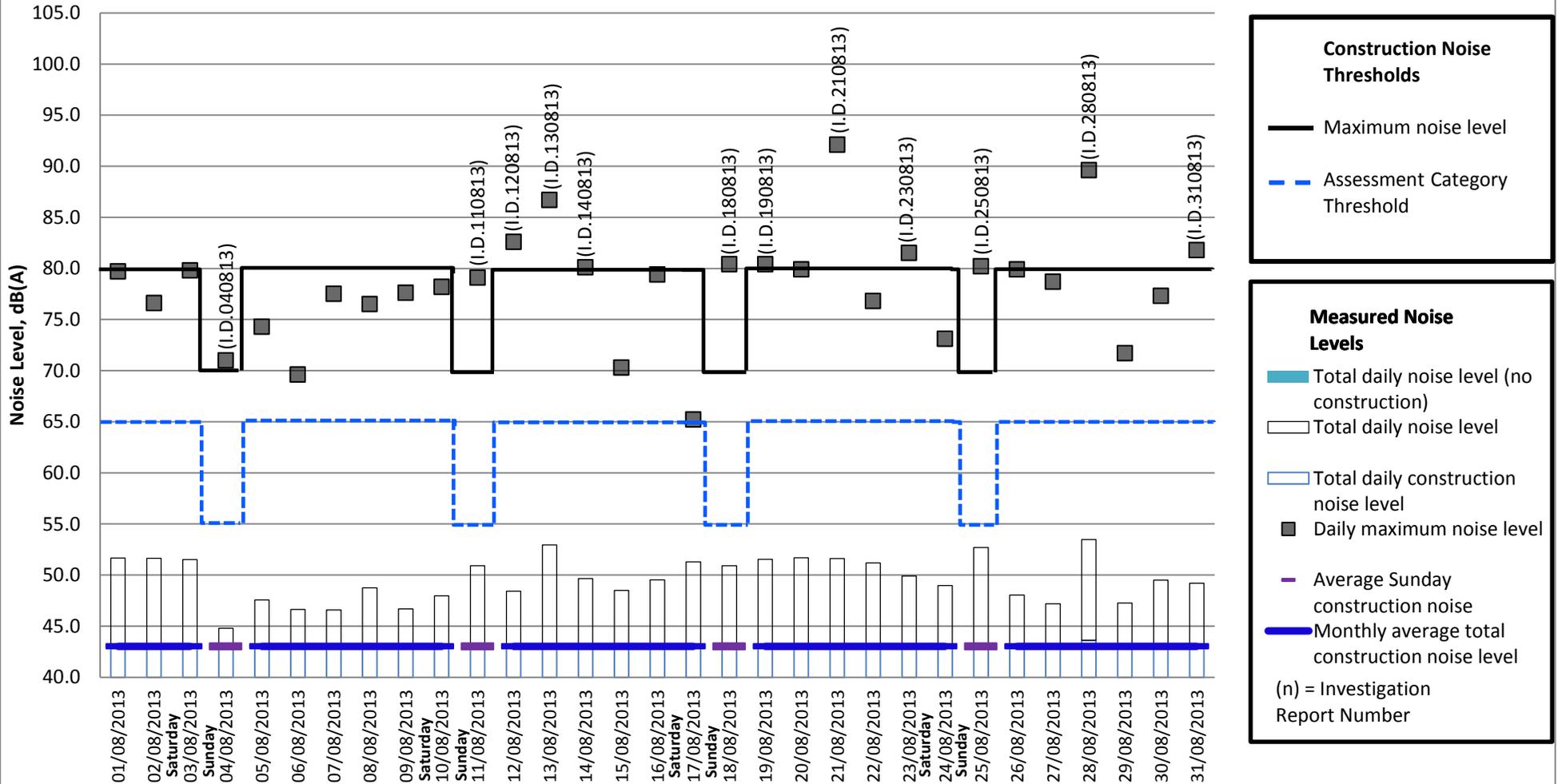
Measurement period: August 2013



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

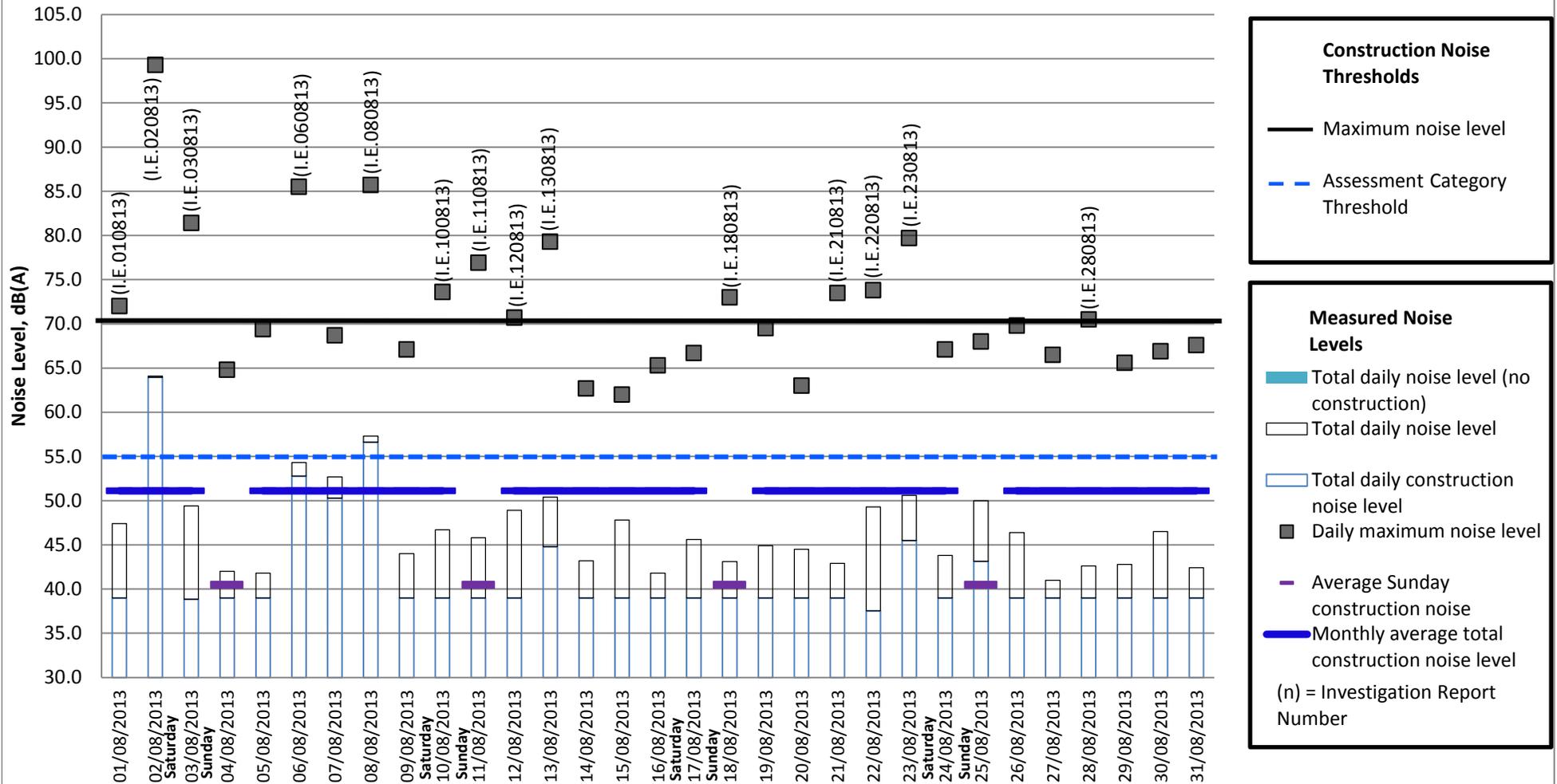
Measured Daytime Noise Levels at Inchgarvie

Measurement period: August 2013



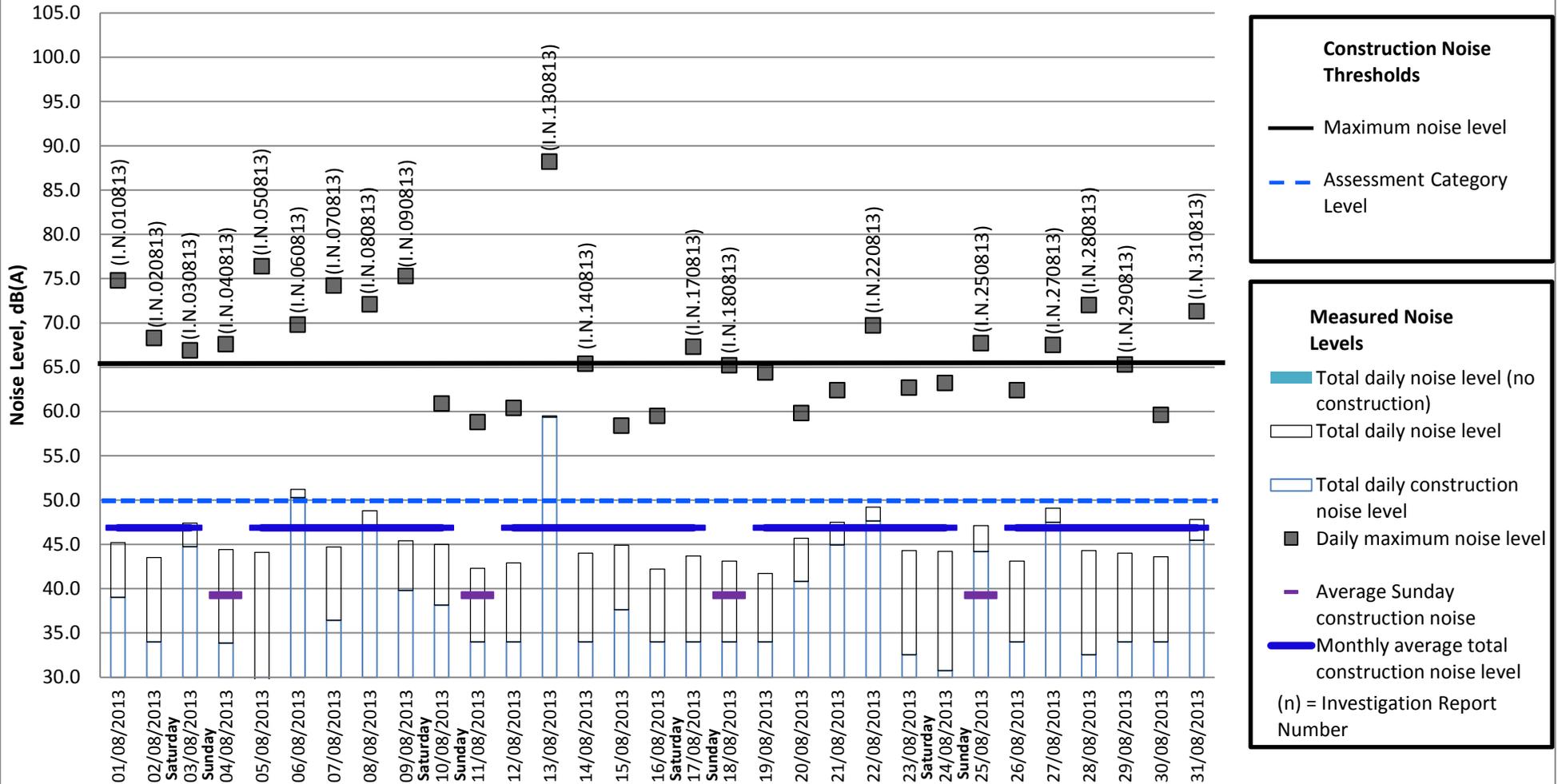
Measured Evening Noise Levels at Inchgarvie

Measurement period: August 2013



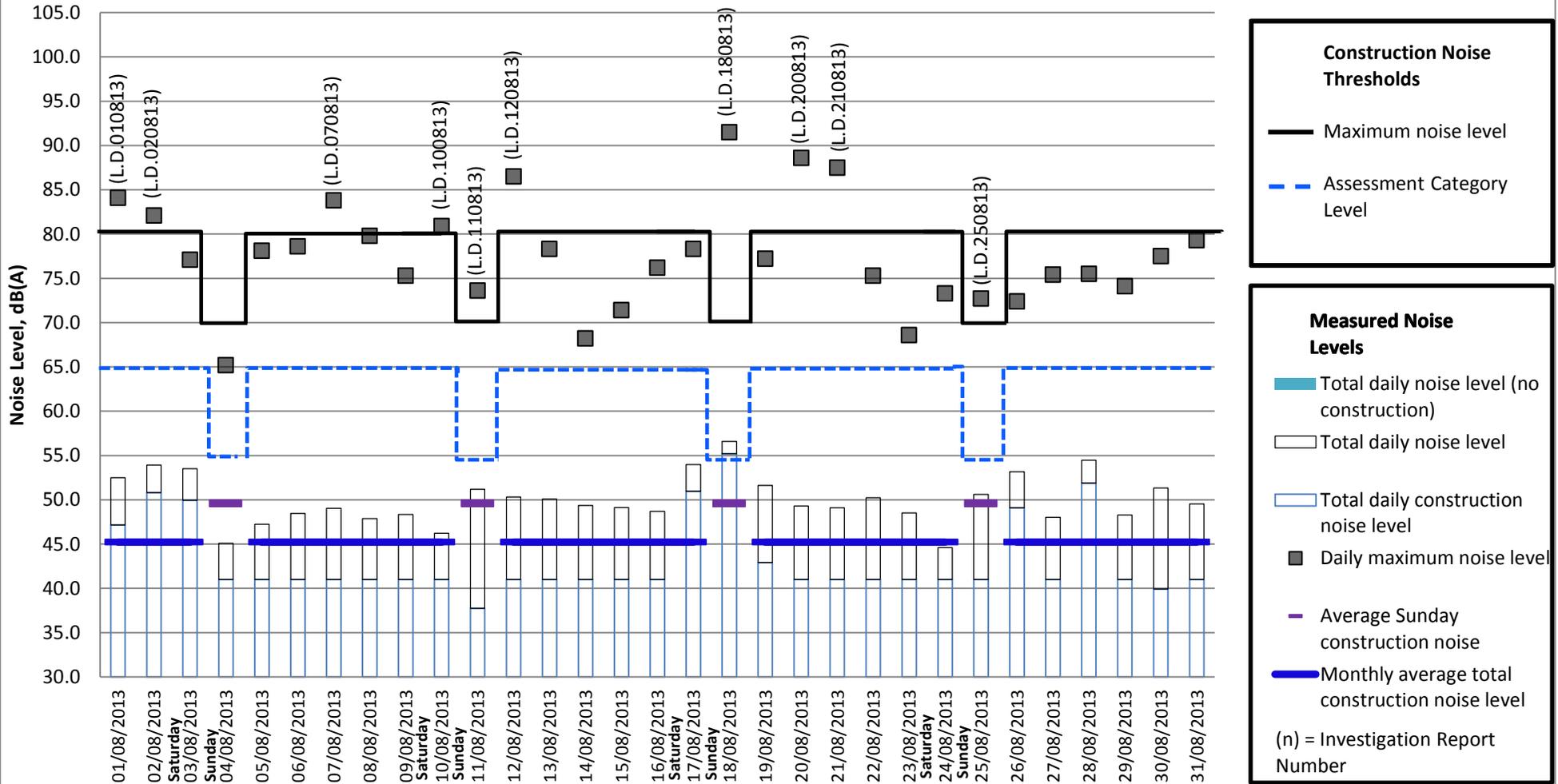
Measured Night-time Noise Levels at Inchgarvie

Measurement period: August 2013



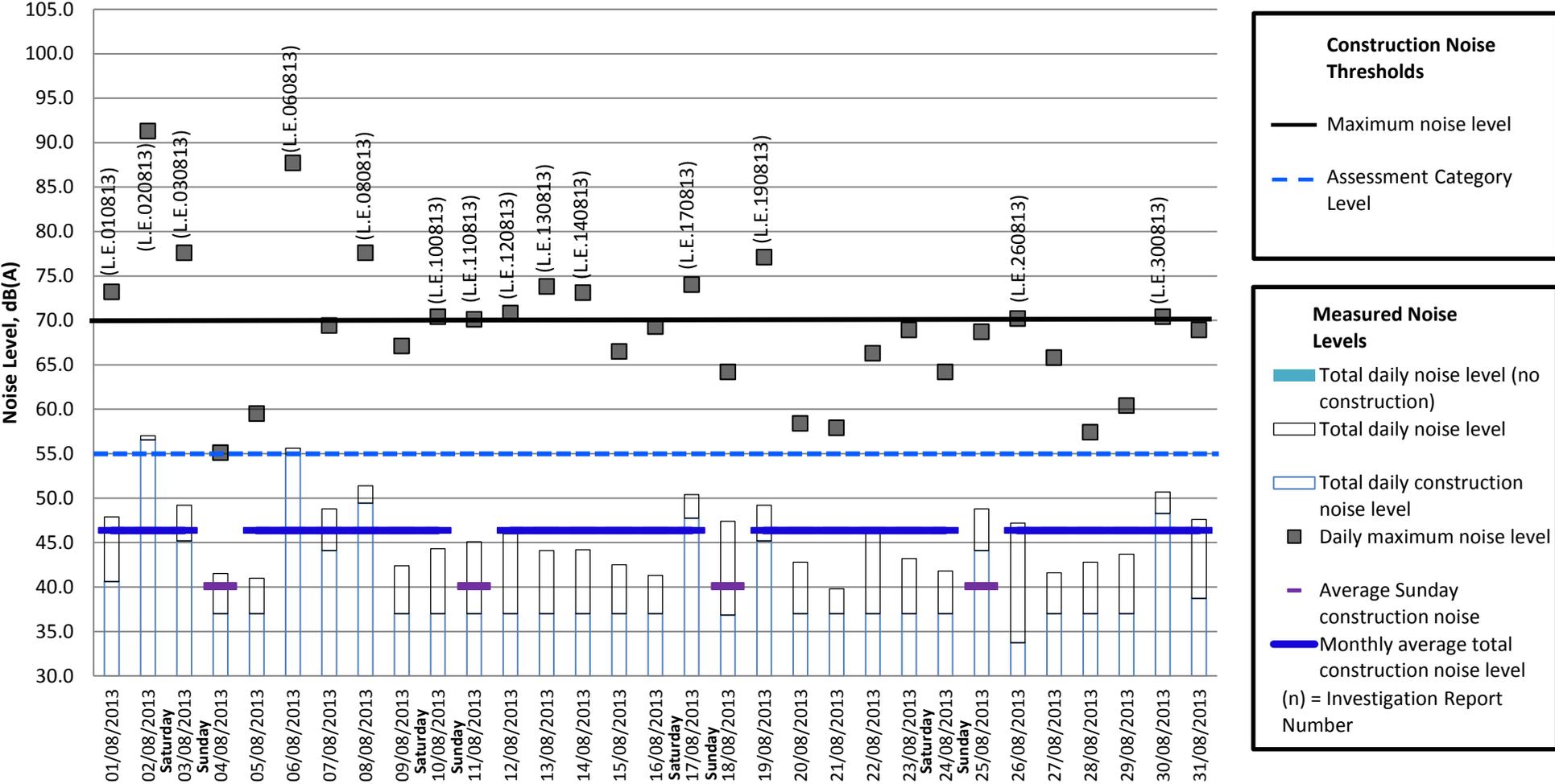
Measured Daytime Noise levels at Linn Mill

Measurement period: August 2013



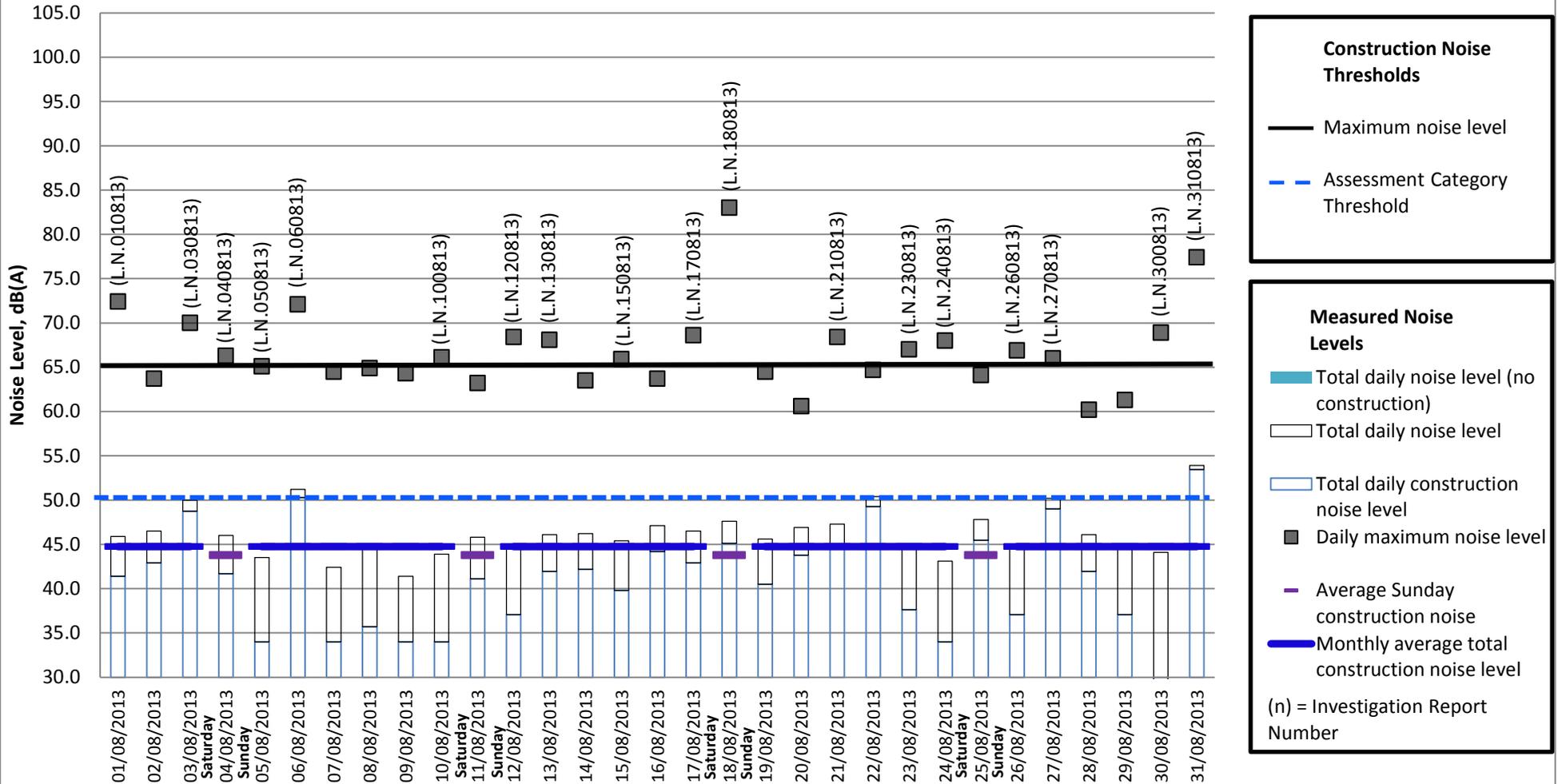
Measured Evening Noise Levels at Linn Mill

Measurement period: August 2013

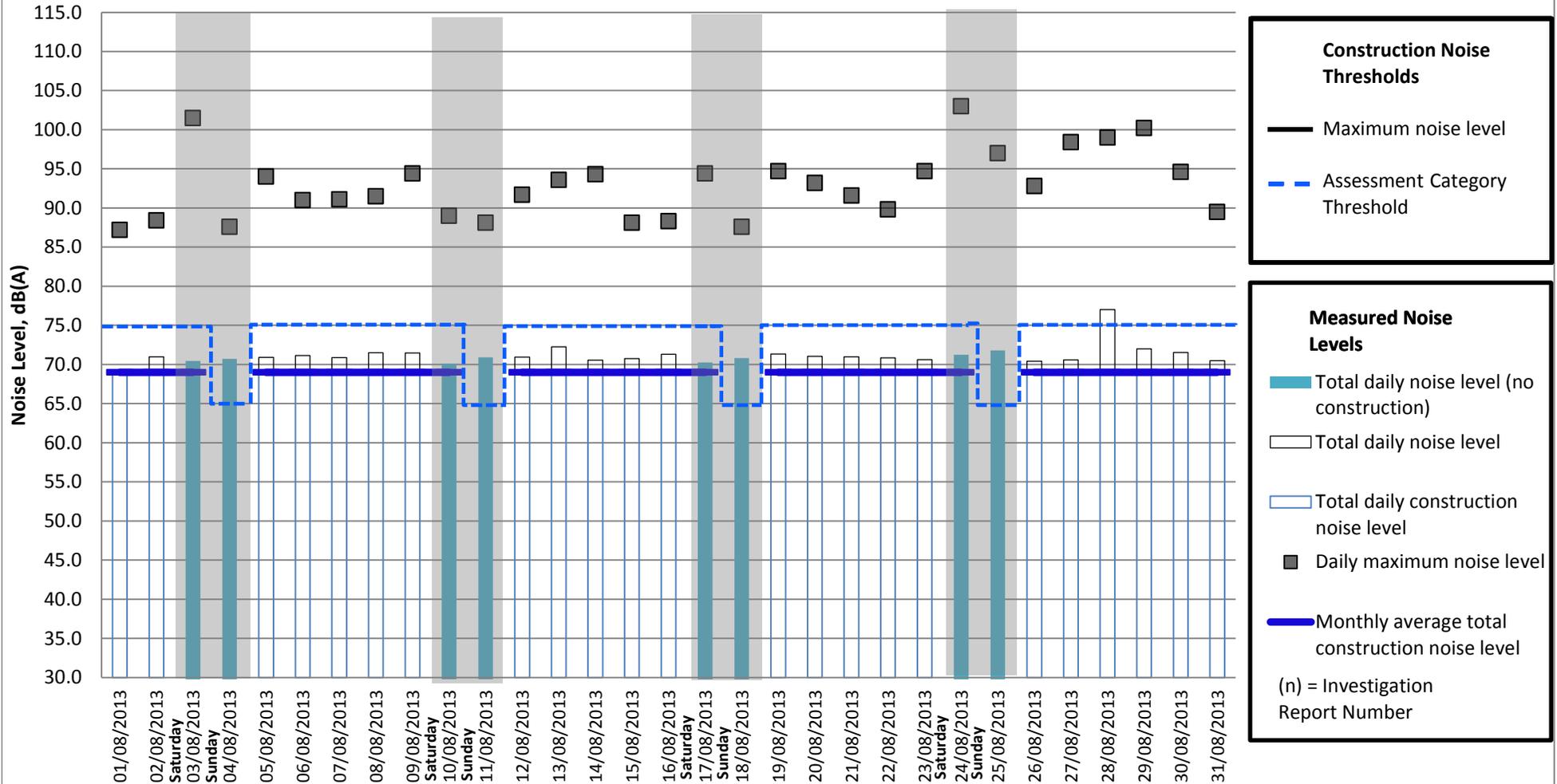


Measured Night-time Noise Levels at Linn Mill

Measurement period: August 2013

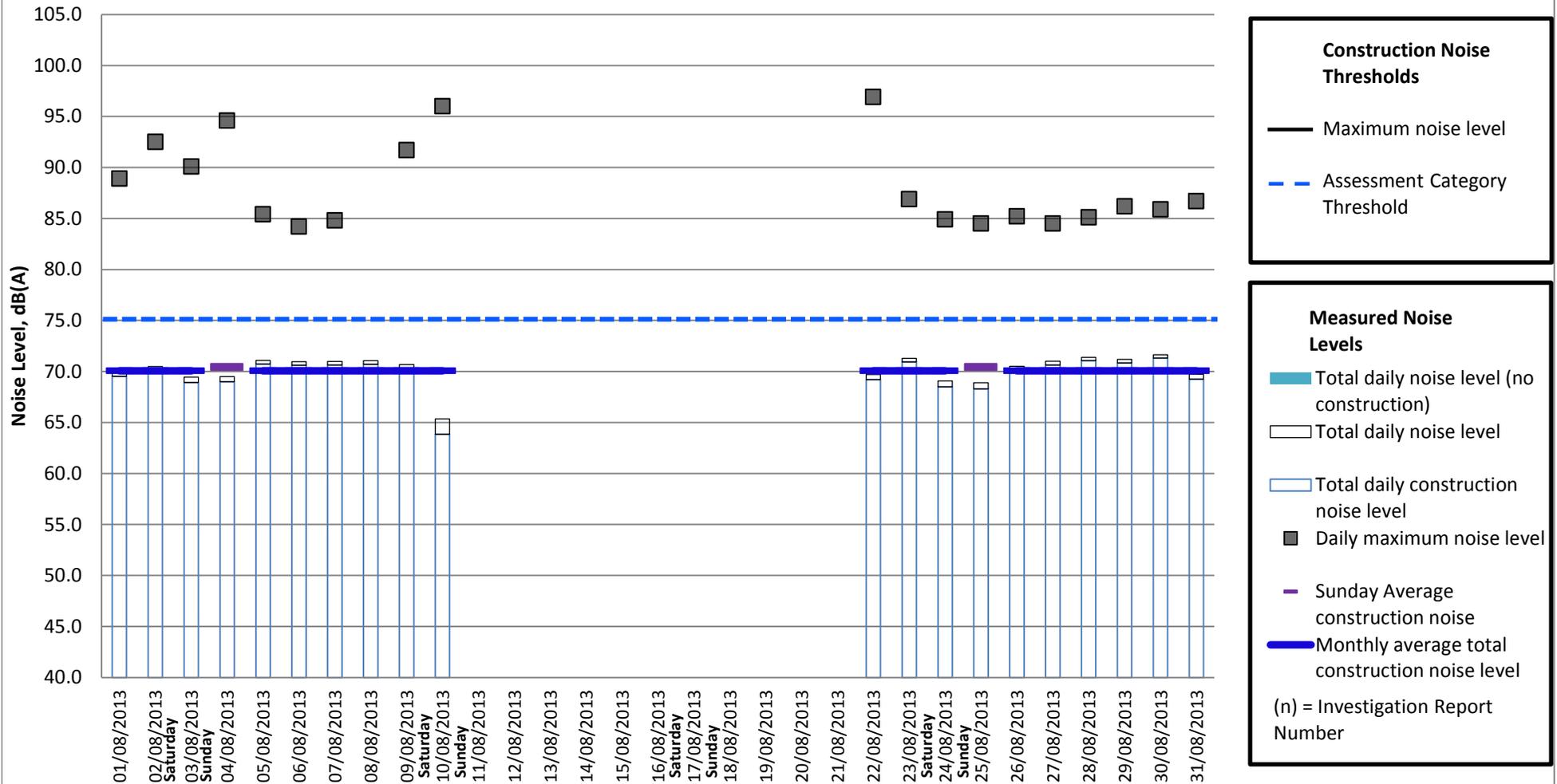


Measured Daytime Noise Levels at Newton Measurement period: August 2013



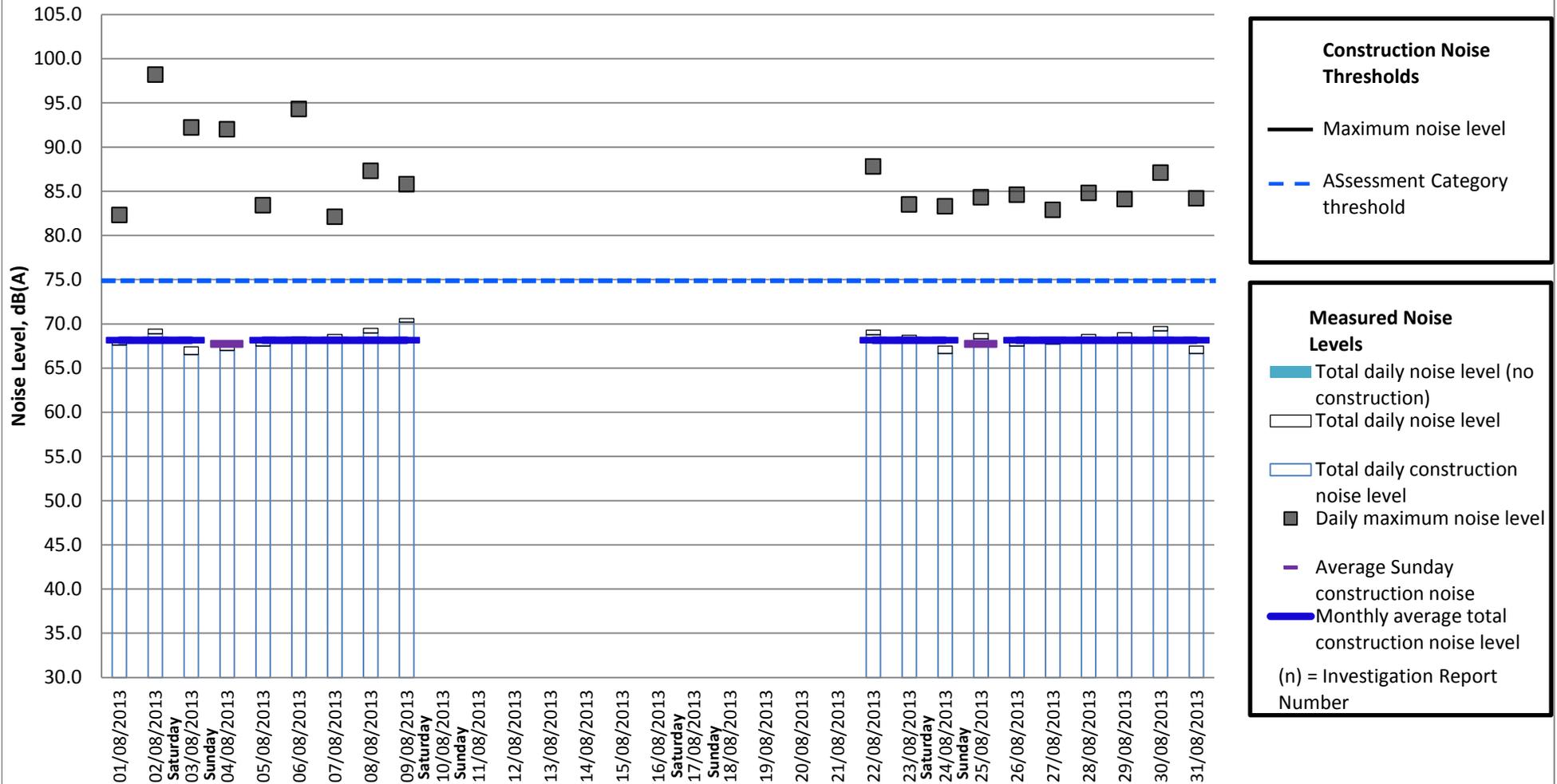
Note: The grey areas of the chart represent days on which no construction works have been conducted. It should be noted that the measured noise levels Mon - Fri can not be attributed to construction works due to the considerable distance (1.75 kilometers) between this monitoring location and the closest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

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



Note: Data is missing for this location between 11/08/13 and 21/08/13 due to device error; the error was resolved as soon as reasonably practicable, however this was restricted due to the limited accessibility to this device.

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



Construction Noise Thresholds

- Maximum noise level
- - - Assessment Category threshold

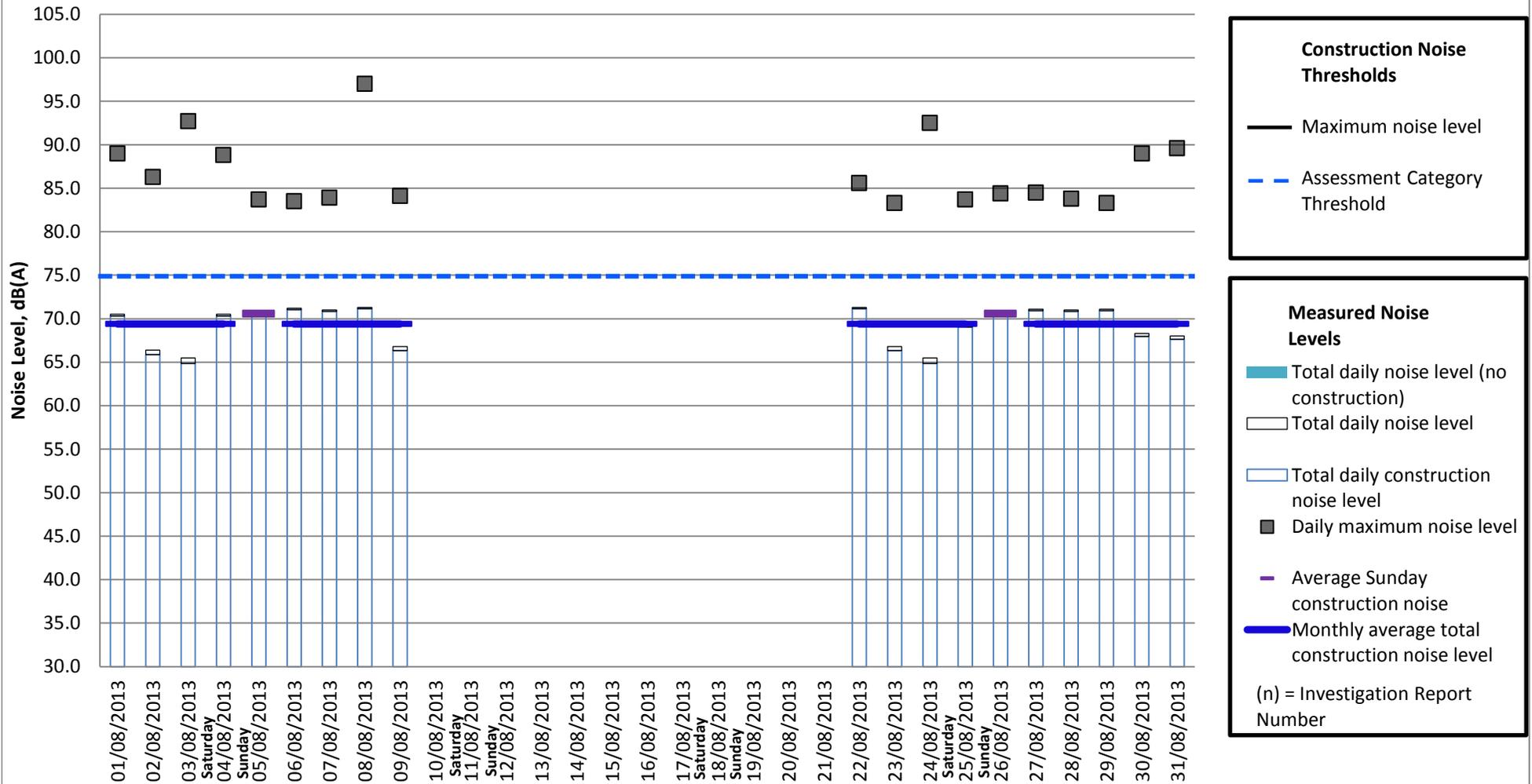
Measured Noise Levels

- 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: Data is missing for this location between 11/08/13 and 21/08/13 due to device error; the error was resolved as soon as reasonably practicable, however this was restricted due to the limited accessibility to this device.

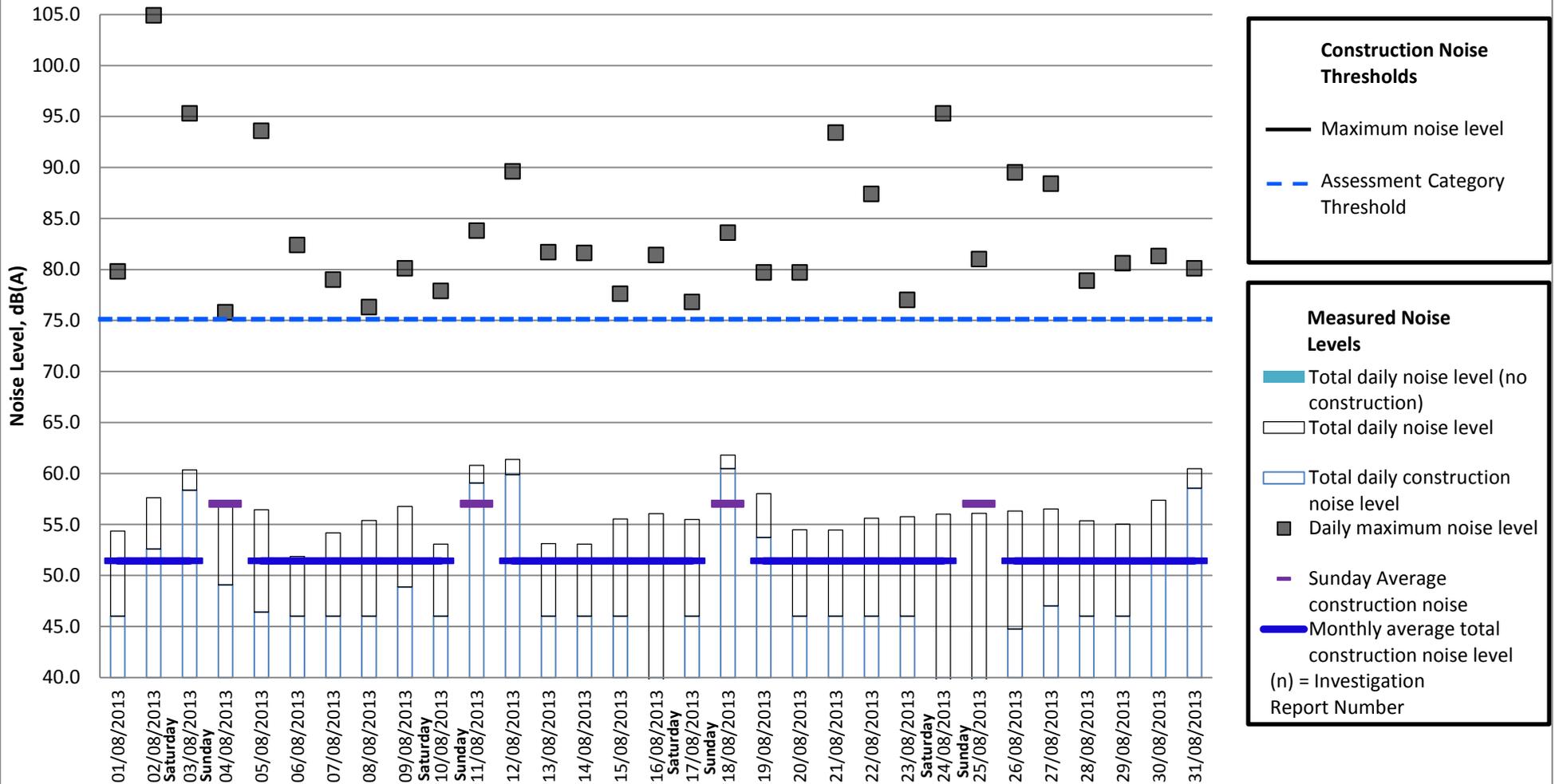
Measured Night-time Noise Levels at North Leg Measurement period: August 2013



Note: Data is missing for this location between 10/08/13 and 21/08/13 due to device error; the error was resolved as soon as reasonably practicable, however this was restricted due to the limited accessibility to this device.

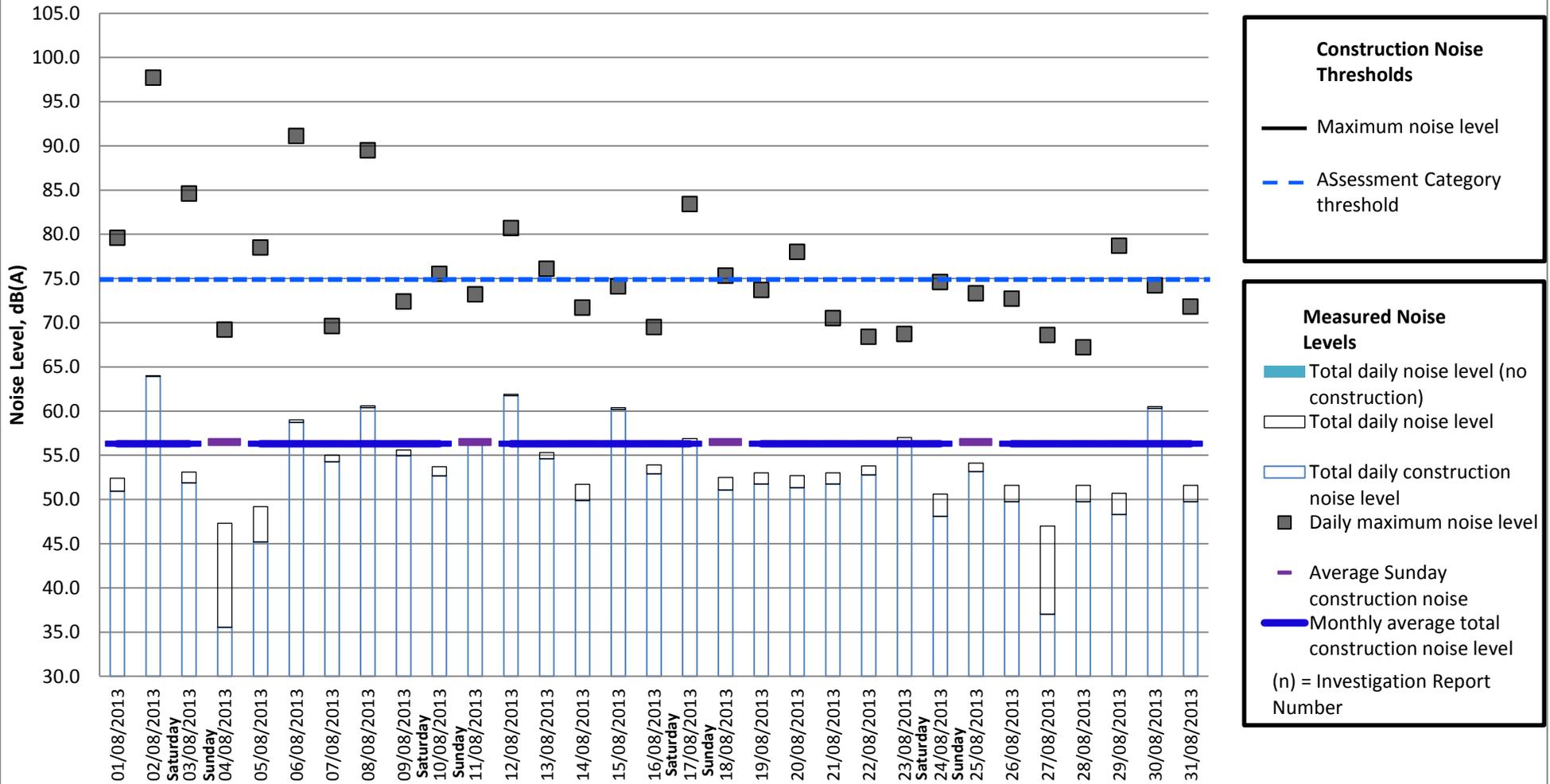
Measured Daytime Noise Levels at Port Edgar

Measurement period: August 2013



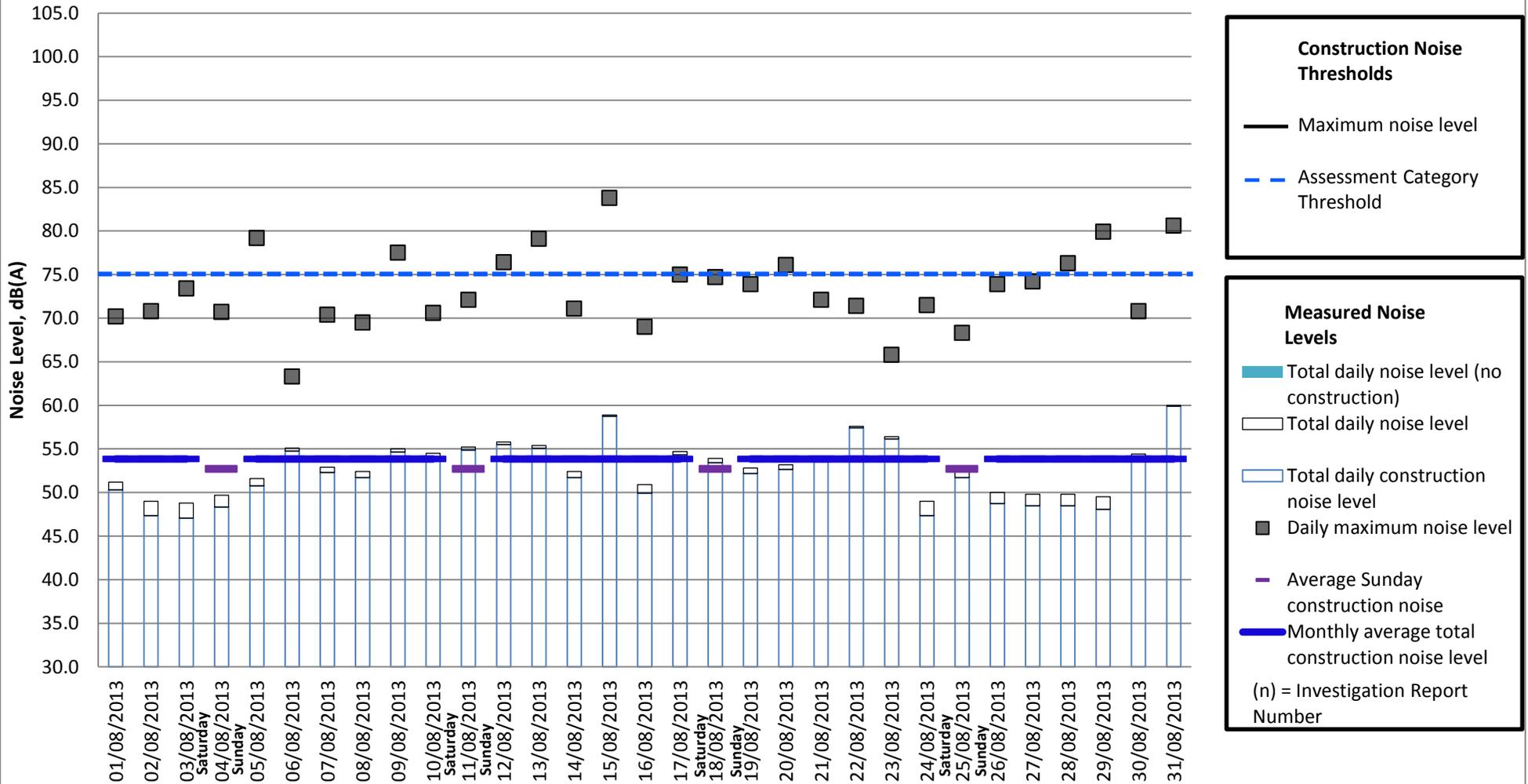
Measured Evening Noise Levels at Port Edgar

Measurement period: August 2013



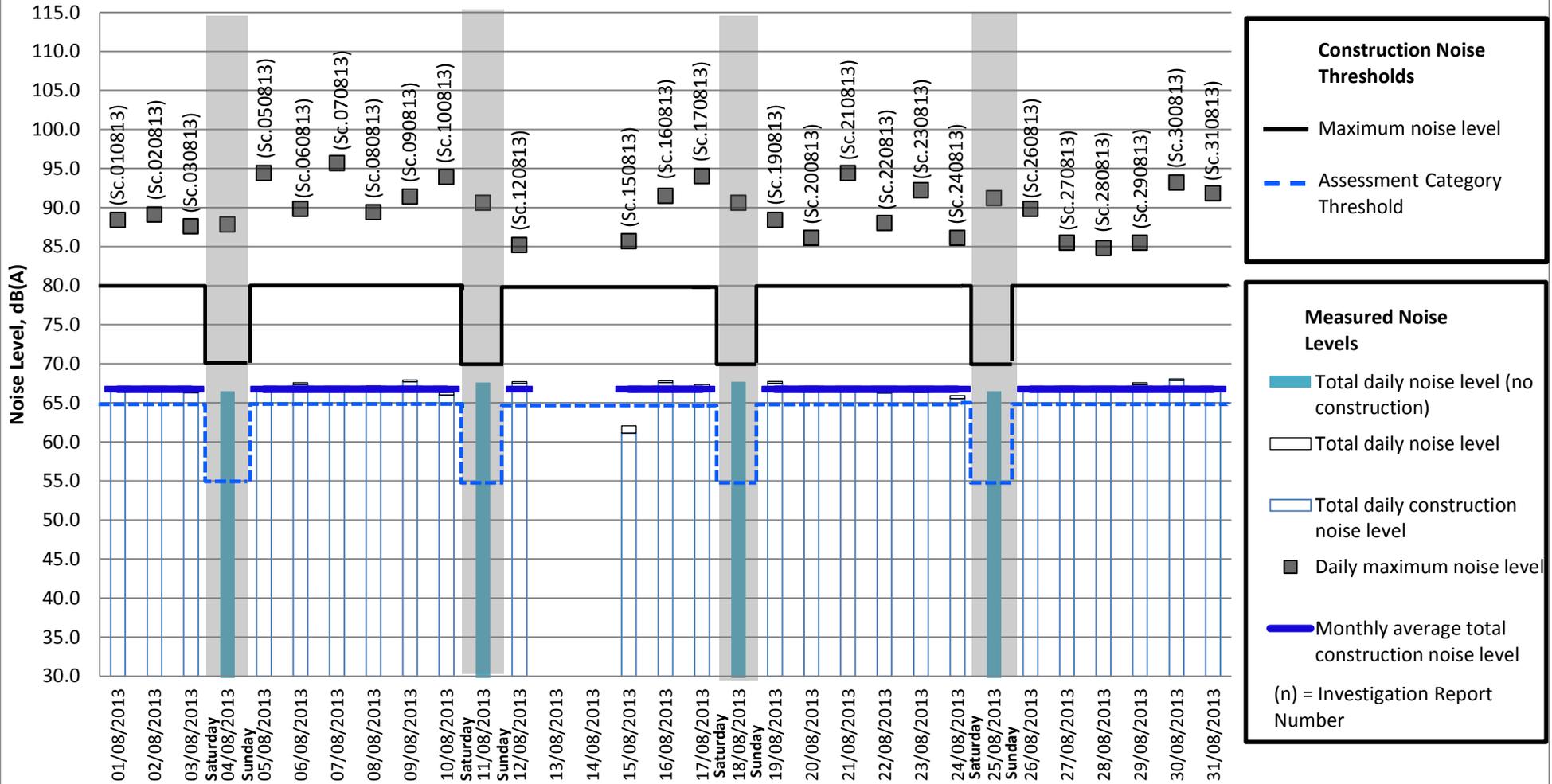
Measured Night-time Noise Levels at Port Edgar

Measurement period: August 2013



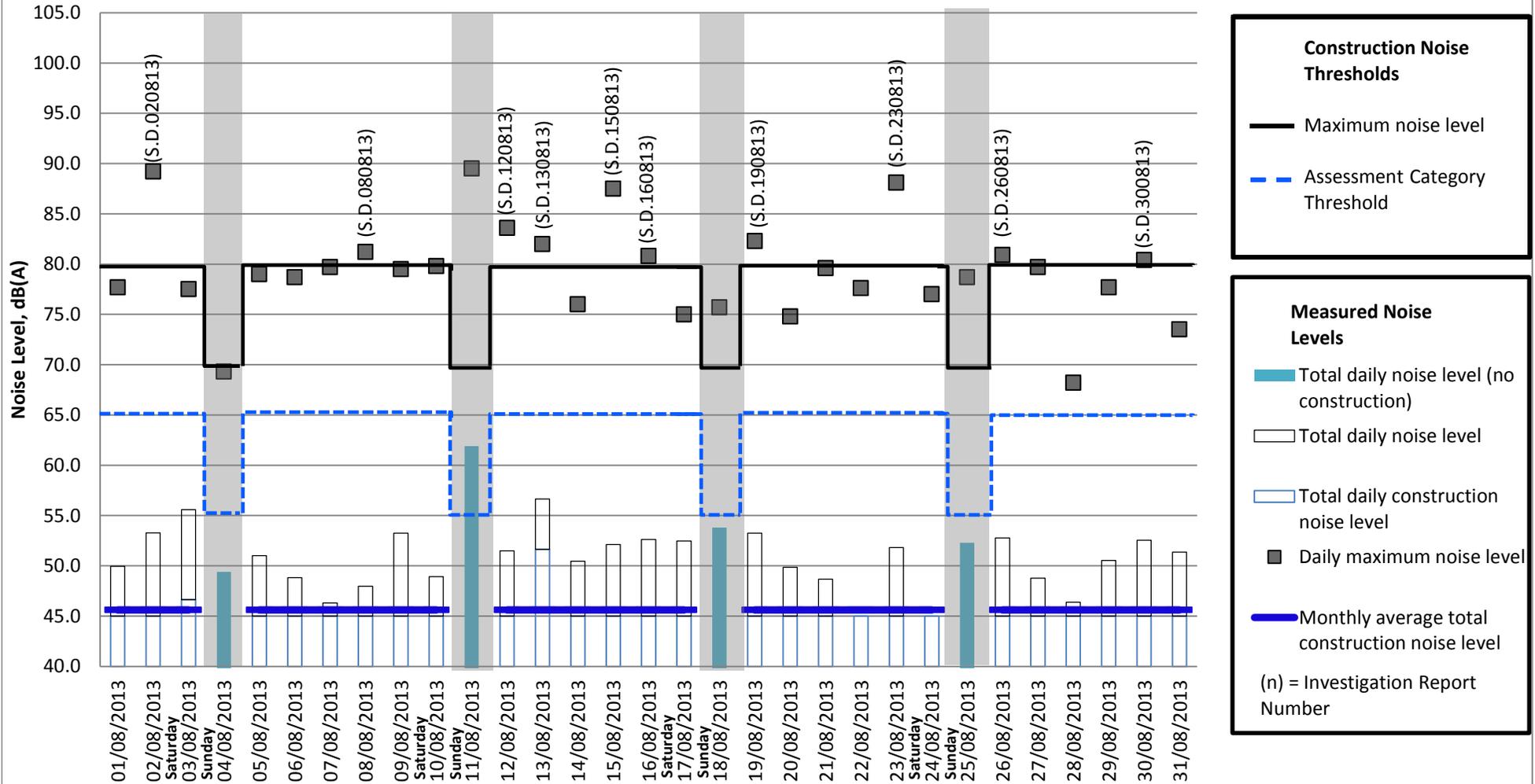
Measured Daytime Noise Levels at Scotstoun

Measurement period: August 2013



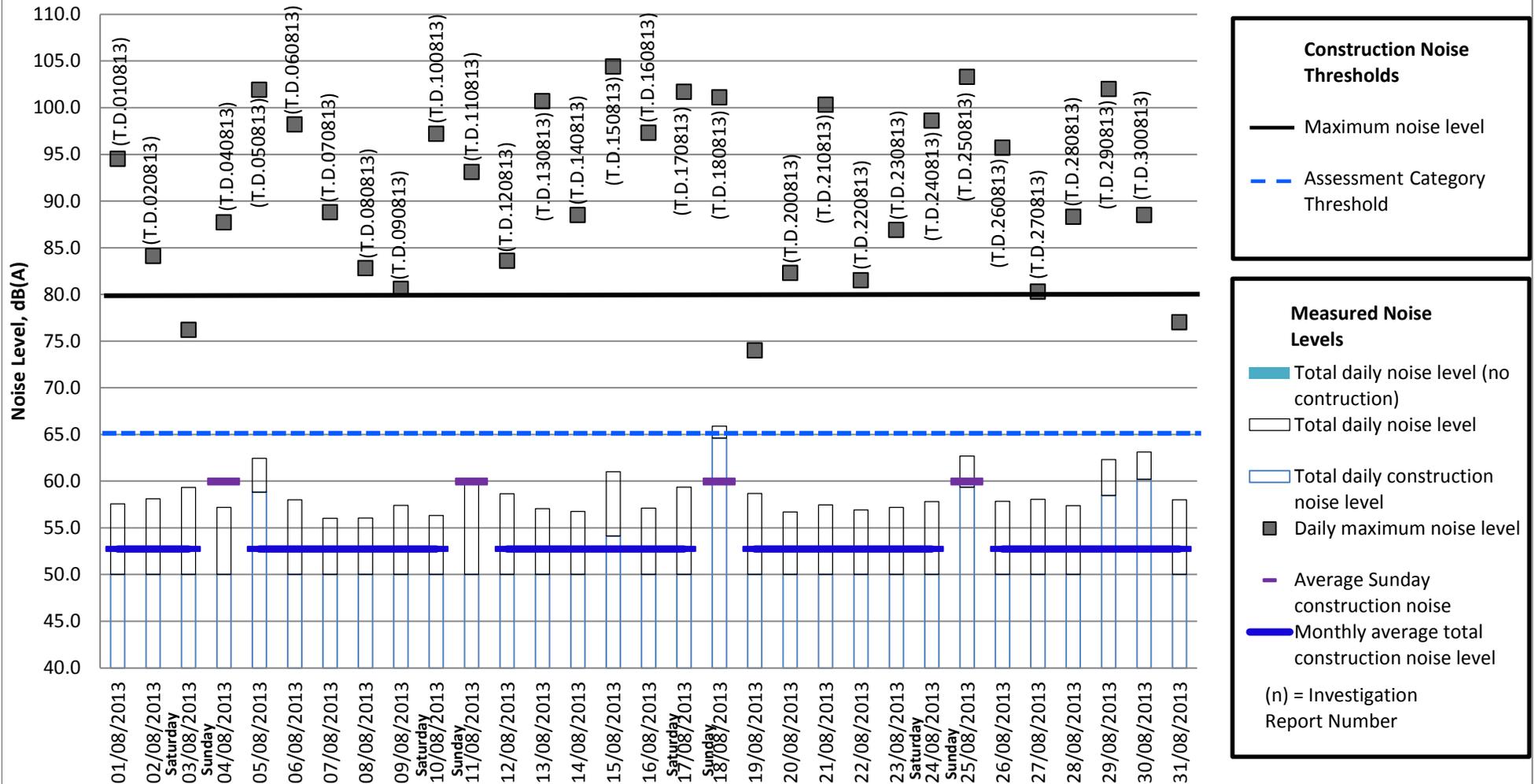
Note: The grey areas of the chart represent days on which no construction works have been conducted. The monthly average construction noise for Sunday has not been included as no Sunday works have been conducted at this location. Data is missing for this location for 13/08/13 and 14/08/13 due to device error.

Measured Daytime Noise Levels at Springfield Measurement period: August 2013



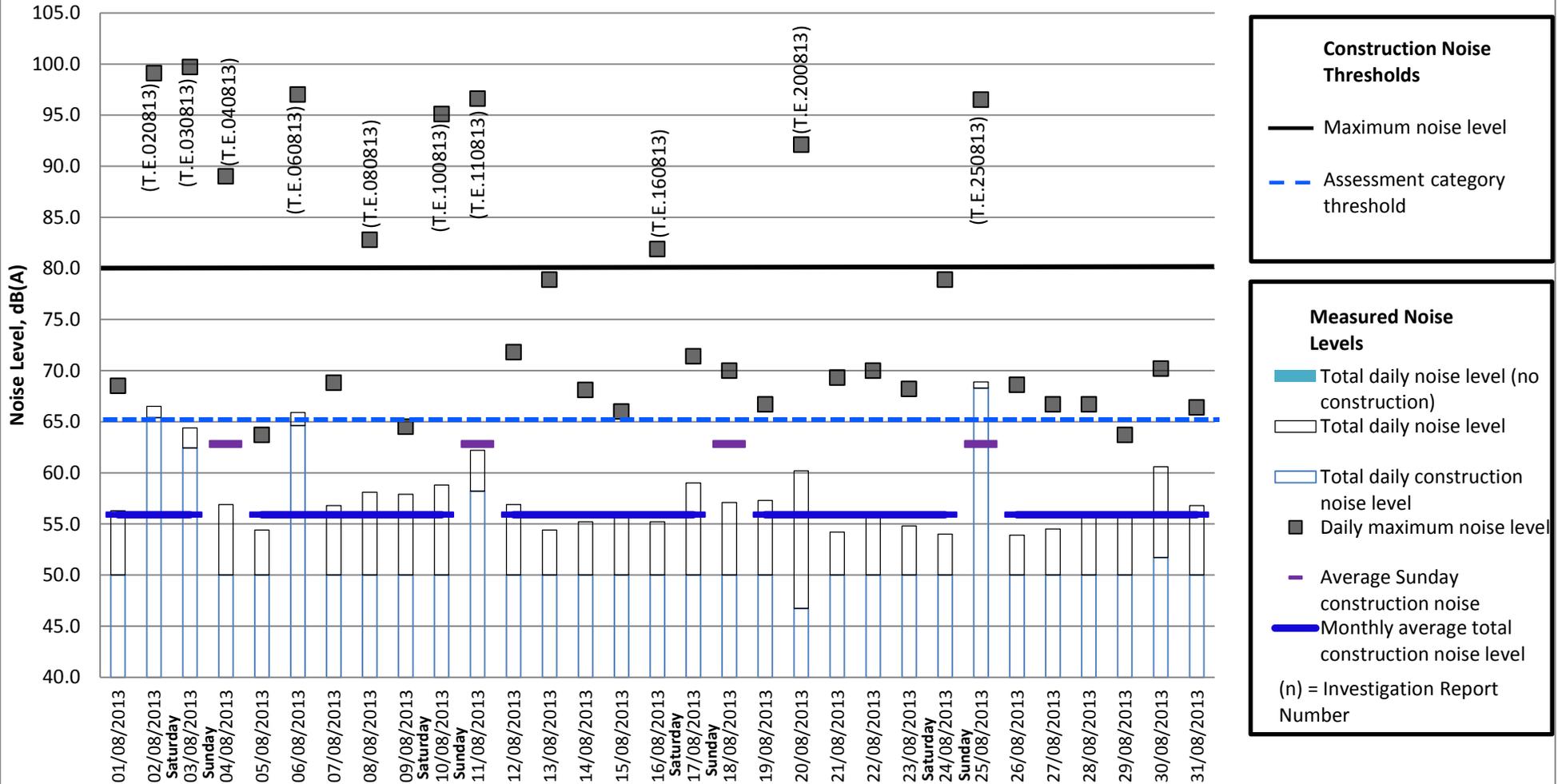
Note: The grey areas of the chart represent days on which no construction works have been conducted. The monthly average construction noise for Sunday has not been included as no Sunday works have been conducted at this location.

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



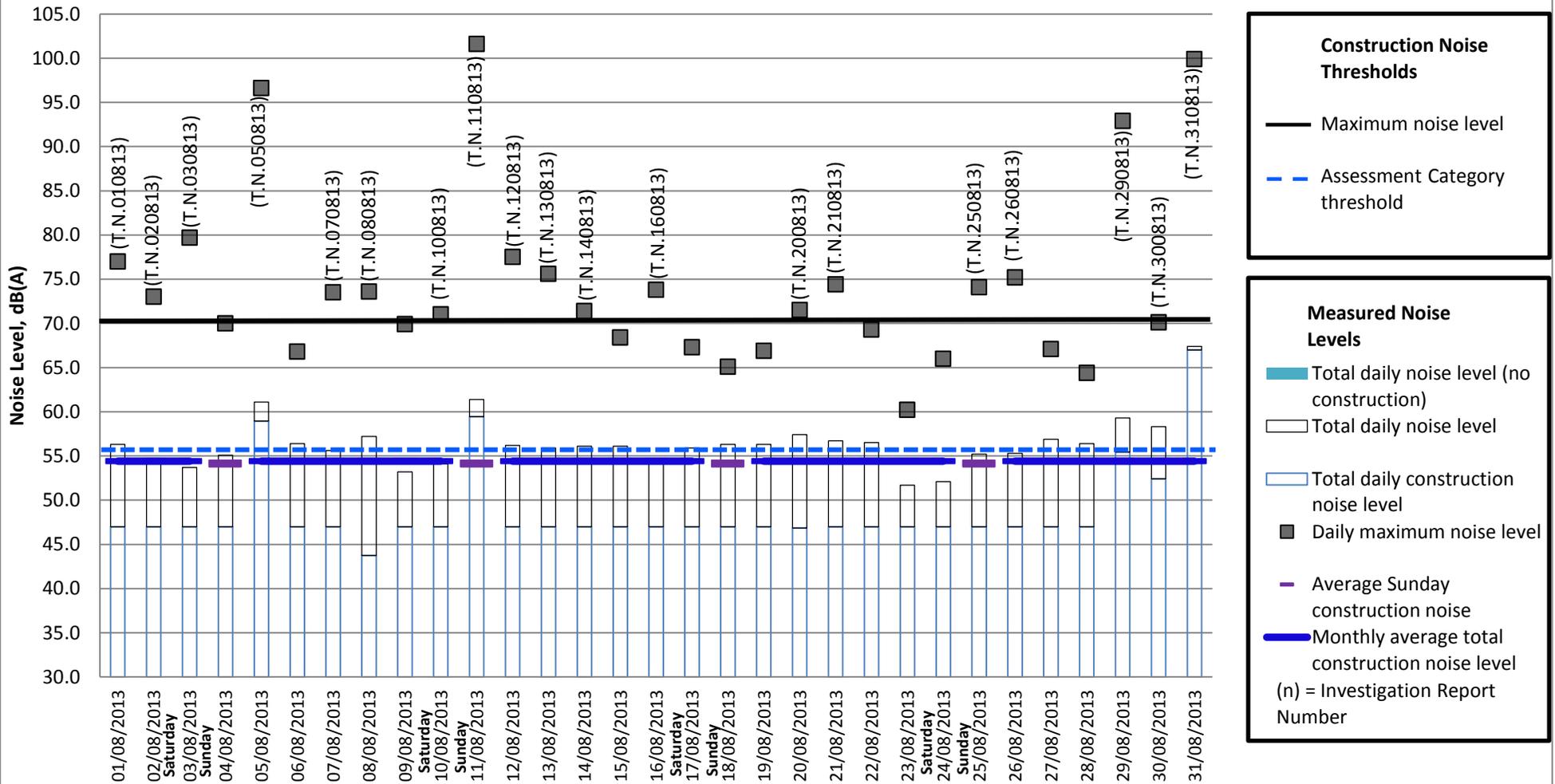
Measured Evening Noise Levels at Tigh-Na-Grian

Measurement period: August 2013



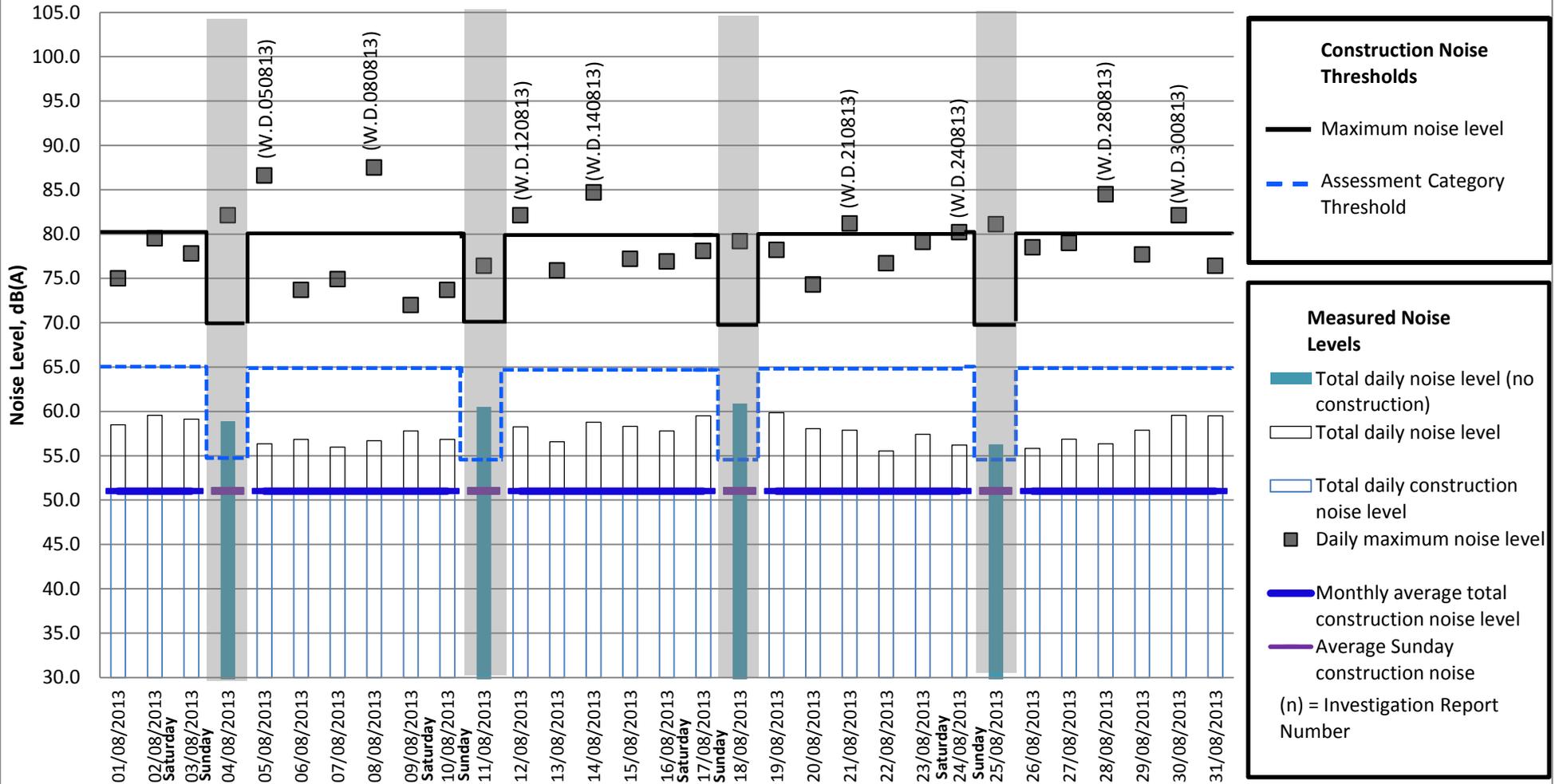
Measured Night-time Noise Levels at Tigh-Na-Grian

Measurement period: August 2013



Measured Daytime Noise Levels at Whinny Hill

Measurement period: August 2013



Note: The grey areas of the chart represent days on which no construction works have been conducted.