



Contractor



Forth Crossing Bridge Constructors

HOCHTIEF Solutions
American Bridge International
DRAGADOS
Morrison Construction

Project **FORTH REPLACEMENT CROSSING**

Document title

CONSTRUCTION NOISE MONITORING REPORT: MAY 2013

Rev	Rev. Date	Purpose of revision	Made	Checked	Reviewed
01	23/07/13	Response to comments	ESE	MWN	MWN
00	14/06/13	First Revision	ESE	MWN	MWN

Document status

FOR REVIEW

Made by: Ellie Slee Checked By: Martin Wilson
 Initials: ESE Initials: MWN

Document number **REP-00118** Rev **01**

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 May 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 May 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 May 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 May 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 April 2013
M1	Whinny Hill	Network	Loading of rock at Whinny Hill for transport to the south side N.B. No evening, night time or Sunday daytime construction in vicinity.
M3	Tigh-Na-Grian	Crossing	Works within Central Tower cofferdam North Tower airlifting works
M4	North Leg	Crossing	Works within Central Tower cofferdam North Tower airlifting works South Tower excavation Pier S1 caisson excavation Pier S4 airlifting Pier S5 airlifting & concrete works Cleaning, concreting, fixing of rebar and placing of formwork at pier S6 Construction of access causeway between piers S6 and S5
M6	Port Edgar	Crossing	Works within Central Tower cofferdam South Tower excavation Pier S1 caisson excavation Pier S4 airlifting Pier S5 airlifting & concrete works Cleaning, concreting, fixing of rebar and placing of formwork at pier S6 Construction of access causeway between piers S6 and S5
M7	Butlaw Fisheries	Crossing	Works within Central Tower cofferdam South Tower excavation Pier S1 caisson excavation Pier S4 airlifting Pier S5 airlifting & concrete works Cleaning, concreting, fixing of rebar and placing of formwork at pier S6 Construction of access causeway between piers S6 and S5
M10	Inchgarvie Lodge	Crossing	South Tower excavation Pier S1 caisson excavation Pier S4 airlifting Pier S5 airlifting & concrete works Cleaning, concreting, fixing of rebar and placing of formwork at pier S6 Construction of access causeway between piers S6 and S5 Excavation of launch Excavation of launch South Abutment works Works on launch foundations including concreting

			Pier trials
M11	Linn Mill	Network (close proximity to Crossing)	Excavation of launch South Abutment works Works on launch foundations including concreting Pier trials
M13	Clufflat Brae	Crossing	Excavation of launch South Abutment works Works on launch foundations including concreting Pier trials
M14	Springfield	Network	Excavation of launch South Abutment works Works on launch foundations including concreting Structure works at gyratory Pier trials N.B. No evening, night time or Sunday daytime construction in vicinity.
M15	Echline Field	Network	Excavation of launch Works on launch foundations including concreting Structure works at gyratory Drainage works at A904/U221 U221 paving Bulk excavation for mainline N.B. No evening, night time or Sunday daytime construction in vicinity.
M16	Scotstoun	Network	Drainage works Placing rock/clay for embankment N.B. No evening, night time or Sunday daytime construction in vicinity.
M17	Dundas Home Farm	Network	Utilities works Fill using clay for road network 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. Some device errors were encountered in May resulting in loss of data for short periods at Tigh-Na-Grian and Springfield. There are also two periods at Scotstoun in May for which data is missing due to an issue with the power supply to the device.
- 3.3** Results demonstrate that the monthly average total construction noise results for daytime were within the threshold limits for all monitoring locations for May 2013, with the exception of Scotstoun. For the evening period, all monitoring locations, with the exception of Butlaw Fisheries, were within the threshold limits. With regard to the night time periods, with exceedances were recorded at Butlaw Fisheries, Inchgarvie and Tigh-Na-Grian for the night time period. All other monitoring stations not listed were within the threshold limits for the night time period.
- 3.4** With regard to the Sunday averages (for applicable monitoring locations), adverse weather and bird calls were also found to significantly affect the averages. Exceedances of the threshold were noted for the following Sunday averages; Sunday daytime and evening average at Inchgarvie and Sunday night time average at Tigh-Na-Grian, Butlaw Fisheries and Linn Mill. All other locations not listed were found to be within the Sunday average threshold for all periods.
- 3.5** The exceedances of the monthly and Sunday averages are not considered to have been caused by increased noise levels due to construction. The exceedances of the night time averages at Tigh-Na-Grian and Inchgarvie and the Sunday night time average threshold at Tigh-Na-Grian can be attributed to bird calls at dawn; where the data affected by bird calls is removed, the night time average at Tigh-Na-Grian is lowered by over 10dB, at Inchgarvie by 8dB and the Sunday night time average at Tigh-Na-Grian by around 9dB.
- 3.6** At Butlaw, the night time monthly average and the night time Sunday average are also partially affected by dawn bird calls. However, at this location, the averages are further increased due to noise levels due to waves on the shore. Windy conditions, causing increased noise levels associated with waves, were also found to influence the evening monthly average at Butlaw Fisheries. With regard to Butlaw Fisheries, 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.

- 3.7** The exceedances of the daytime and evening Sunday averages at Inchgarvie were found to be caused by private works at the property. With regard to the exceedance of the night time Sunday average at Linn Mill, adverse weather conditions were found to cause a gate to bang repeatedly, which increased the noise levels at this monitoring location.
- 3.8** Furthermore, it should be noted that for all the averages reported for both night time and Sunday daytime periods, these are based only on the highest L_{Aeq} levels for 1 hour periods which can affect the averages.
- 3.9** The exceedance of the daytime average at Scotstoun is due to increased background noise levels due to the location of the meter directly adjacent to the road. Traffic noise at this location is further increased during periods of wet weather.
- 3.10** During May 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.
- 3.11** 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.
- 3.12** 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.
- 3.13** The daytime L_{AFmax} threshold was exceeded on 11 occasions in May. Four of these occurred at Butlaw Fisheries due to marine works with 7 occurring at Linn Mill as a result of works in the south networks work area. Each of the marine based exceedances was due to excavation work at the Pier S1 caisson. All the exceedances at Linn Mill were associated with excavation works at the west SUDS basin which is in close proximity to the noise meter. All construction related exceedances have been investigated and mitigation measures have been implemented where possible; the relevant NVIRs provide more detail with regard to these exceedances.

3.14 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 May the maximum noise threshold was exceeded on 61 occasions (daytime, 12; evening, 18; night time, 31). Four night time exceedances occurred due to excavation works at Pier S1. The majority of exceedances, however, were attributed to a range of non-construction factors, notably birds, wind, waves and vehicles.
Clufflat Brae	During May the maximum noise threshold was exceeded on 72 occasions (daytime, 18; evening, 23; night time, 31). 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 May the maximum noise threshold was exceeded on 73 occasions (daytime, 17; evening, 25; night time, 31). No exceedances were found to be due to construction works. However, investigations found private works at the property and birds to be the main contributing factors to the exceedances at this location.
Linn Mill	During May the maximum noise threshold was exceeded on 66 occasions (daytime, 20; evening, 16; night time, 30). Seven exceedances were due to works associated with the excavation of the West SUDS pond. However, the majority of exceedances were caused by winds causing a gate (or similar) to bang in the wind and birds.
Tigh-Na-Grian	During May the maximum noise threshold was exceeded on 73 occasions (daytime, 26; evening, 19; night time, 28). Exceedances were due to non-construction factors, notably birds.
Dundas Home Farm	During May the maximum noise threshold was exceeded on 9 occasions. Exceedances were not attributable to construction works. Exceedances were due to a range of factors, including gardening works and children playing.
Echline	During May the maximum noise threshold was exceeded on 26 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 May the maximum noise threshold was exceeded on 23 occasions. The exceedances were not caused by construction works at this location. The majority of exceedances were due to local residents and birds.
Scotstoun	During May the maximum noise threshold was exceeded on 16 occasions. Exceedances were attributed to vehicles passing by on the adjacent road and monitor maintenance.
Whinny Hill	During May 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 wind and quarry works.

Table 3: Summary of Construction Exceedances at Monitoring Locations

Monitor	Date	Period	Description	NVIR No.
Linn Mill	15/05/13	Day	Excavation works at West SUDS pond	L.D.150513
	17/05/13			L.D.170513
	18/05/13			L.D.180513
	20/05/13			L.D.200513
	22/05/13			L.D.220513
	24/05/13			L.D.240513
	29/05/13			L.D.290513
Butlaw Fisheries	01/05/13	Night	Excavation works at Pier S1 caisson	B.N.010513
	07/05/13			B.N.070513
	24/05/13			B.N.240513
	27/05/13			B.N.270513



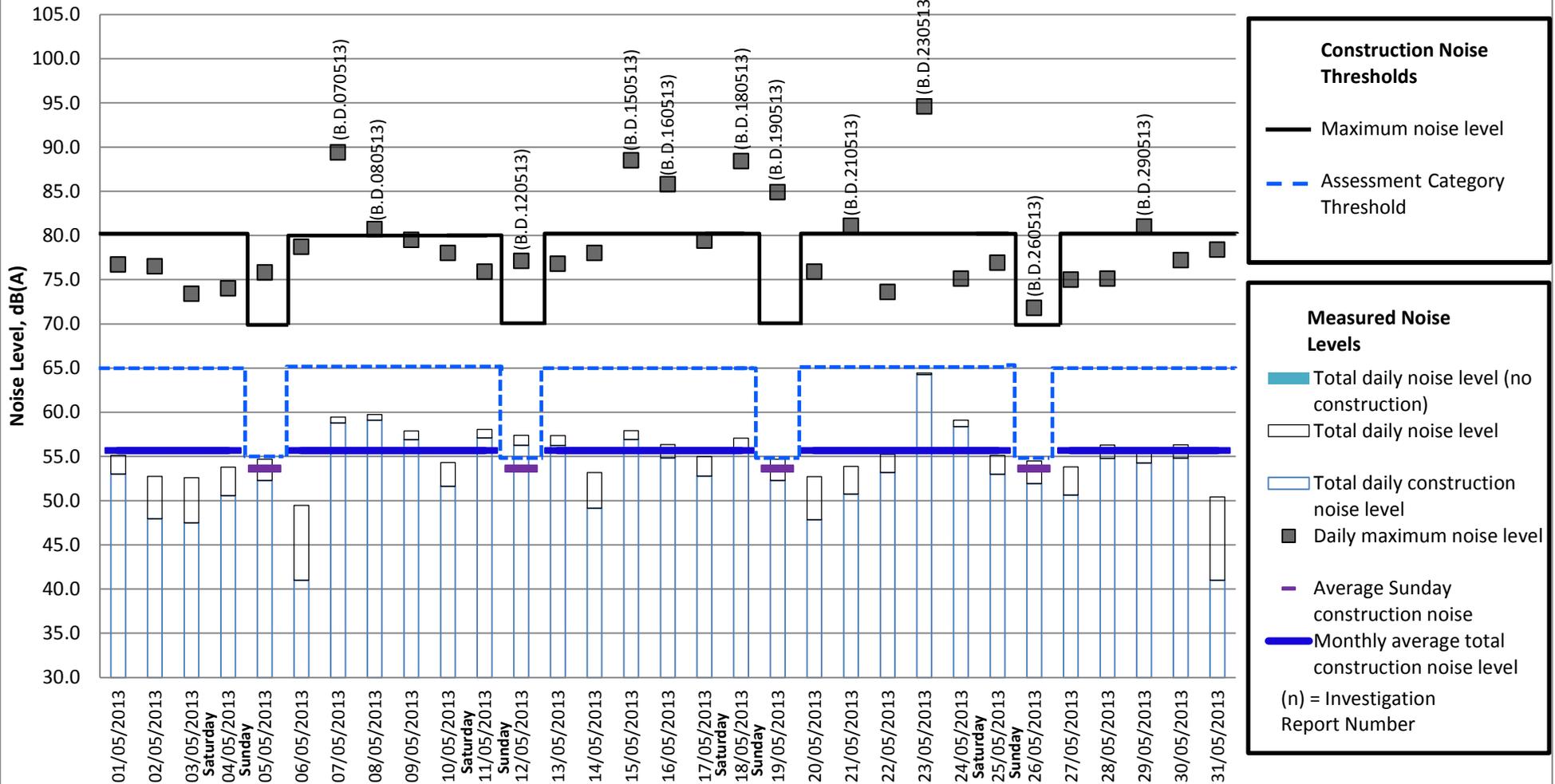
Forth Crossing Bridge Constructors

HOCHTIEF Solutions
American Bridge International
DRAGADOS
Morrison Construction

APPENDIX A

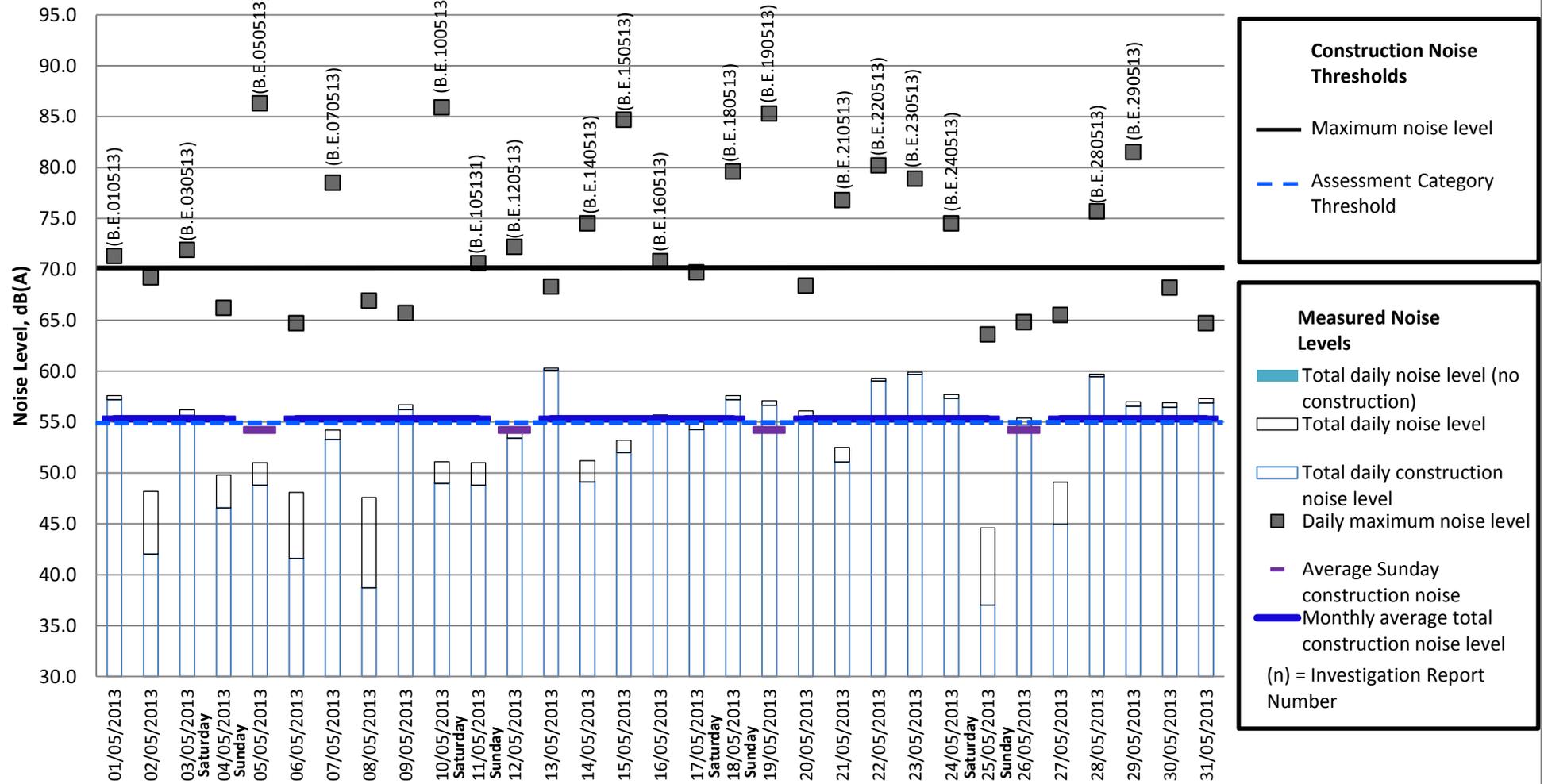
Measured Daytime Noise Levels at Butlaw Fisheries

Measurement period: May 2013



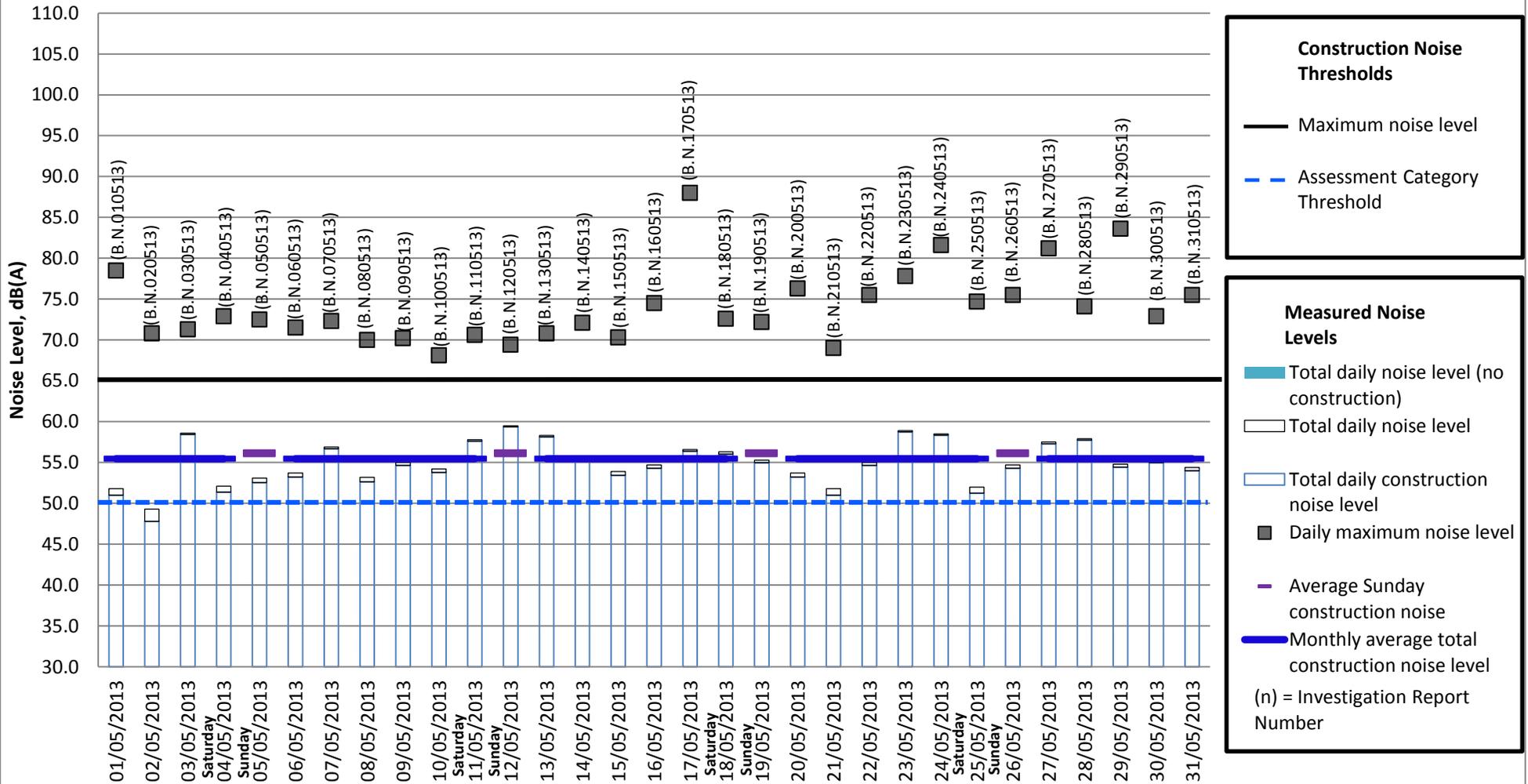
Measured Evening Noise Levels at Butlaw Fisheries

Measurement period: May 2013



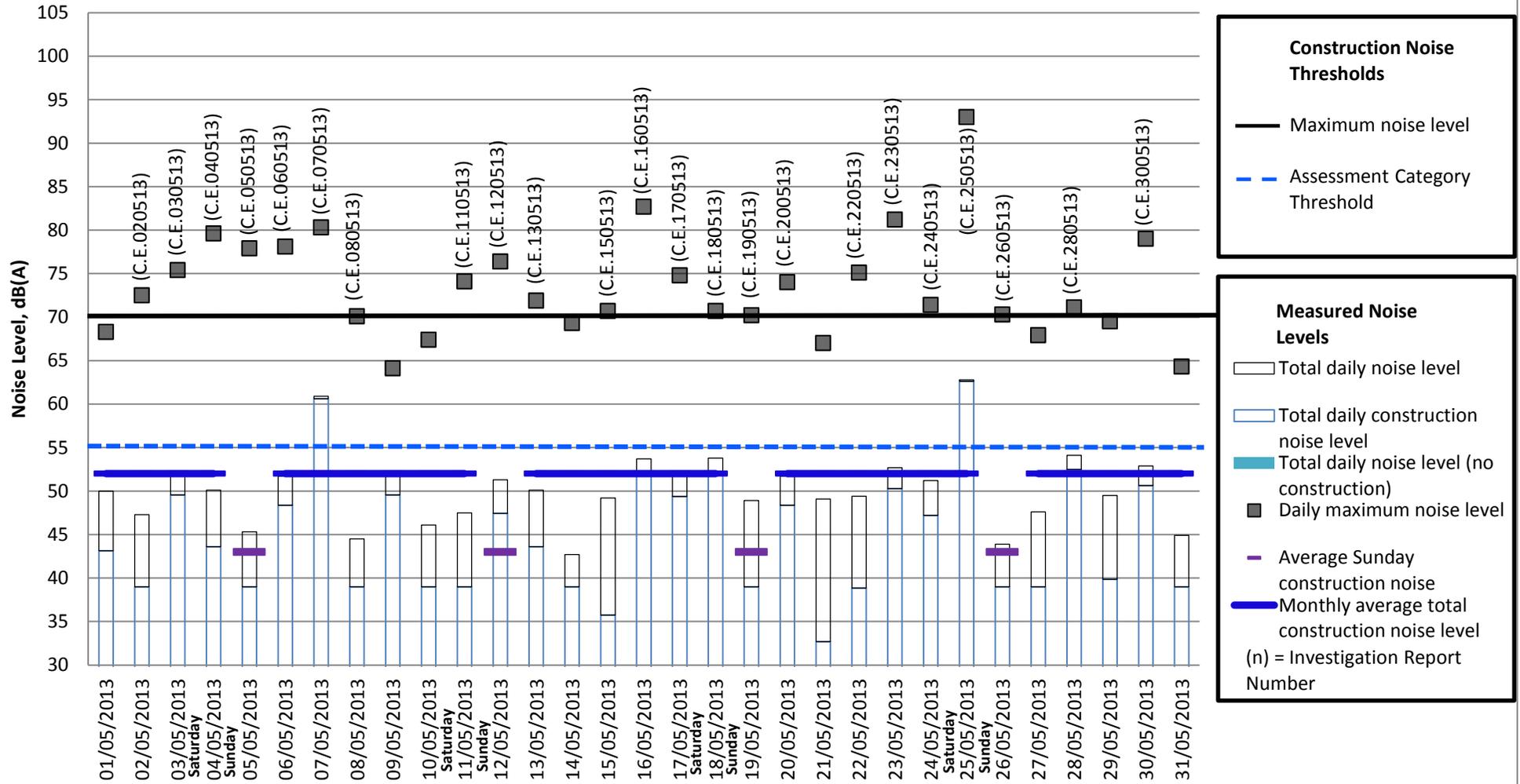
Measured Night time Noise Levels at Butlaw Fisheries

Measurement period: May 2013



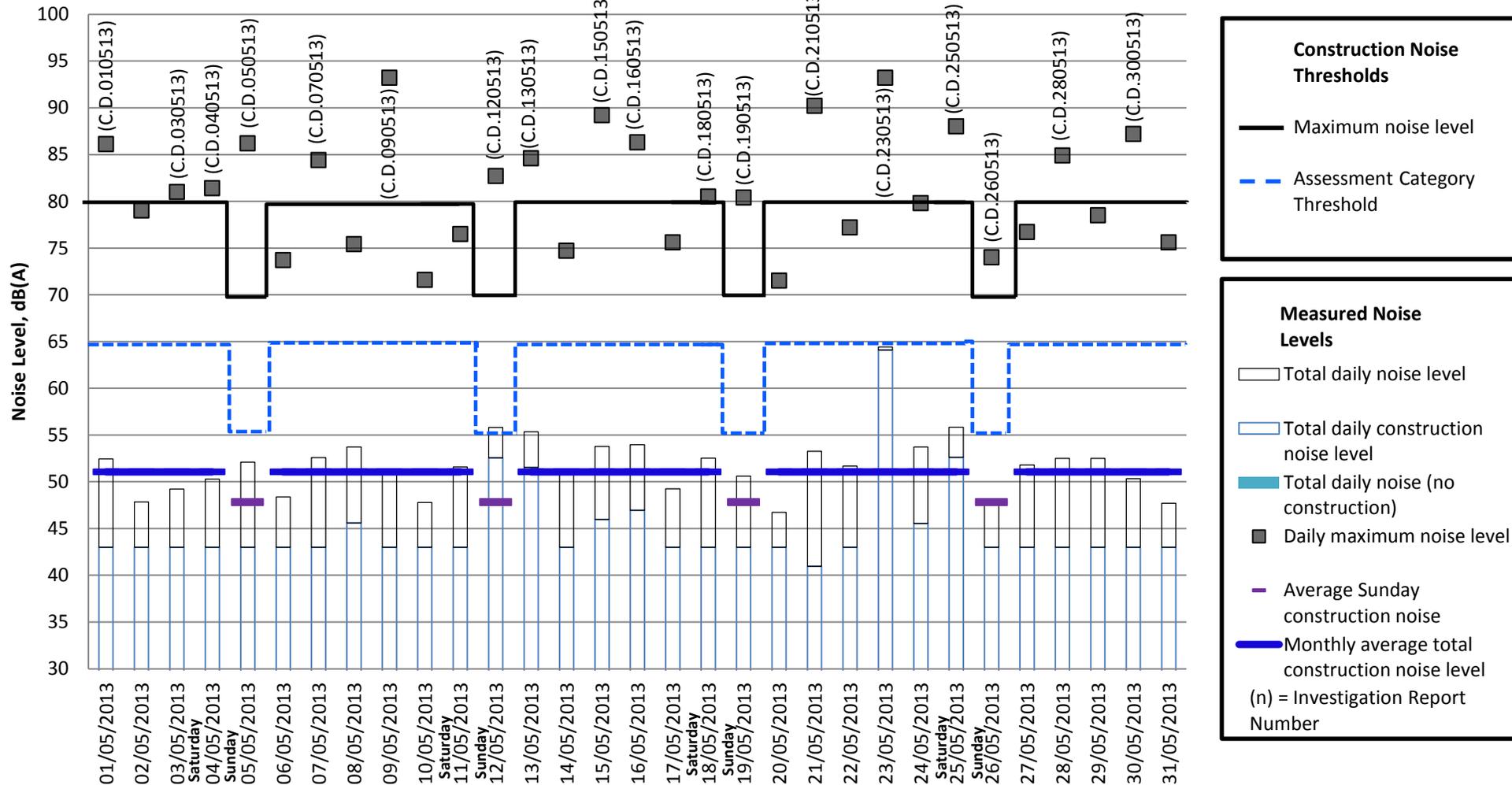
Measured Evening Noise Levels at Clufflat Brae

Measurement period: May 2013



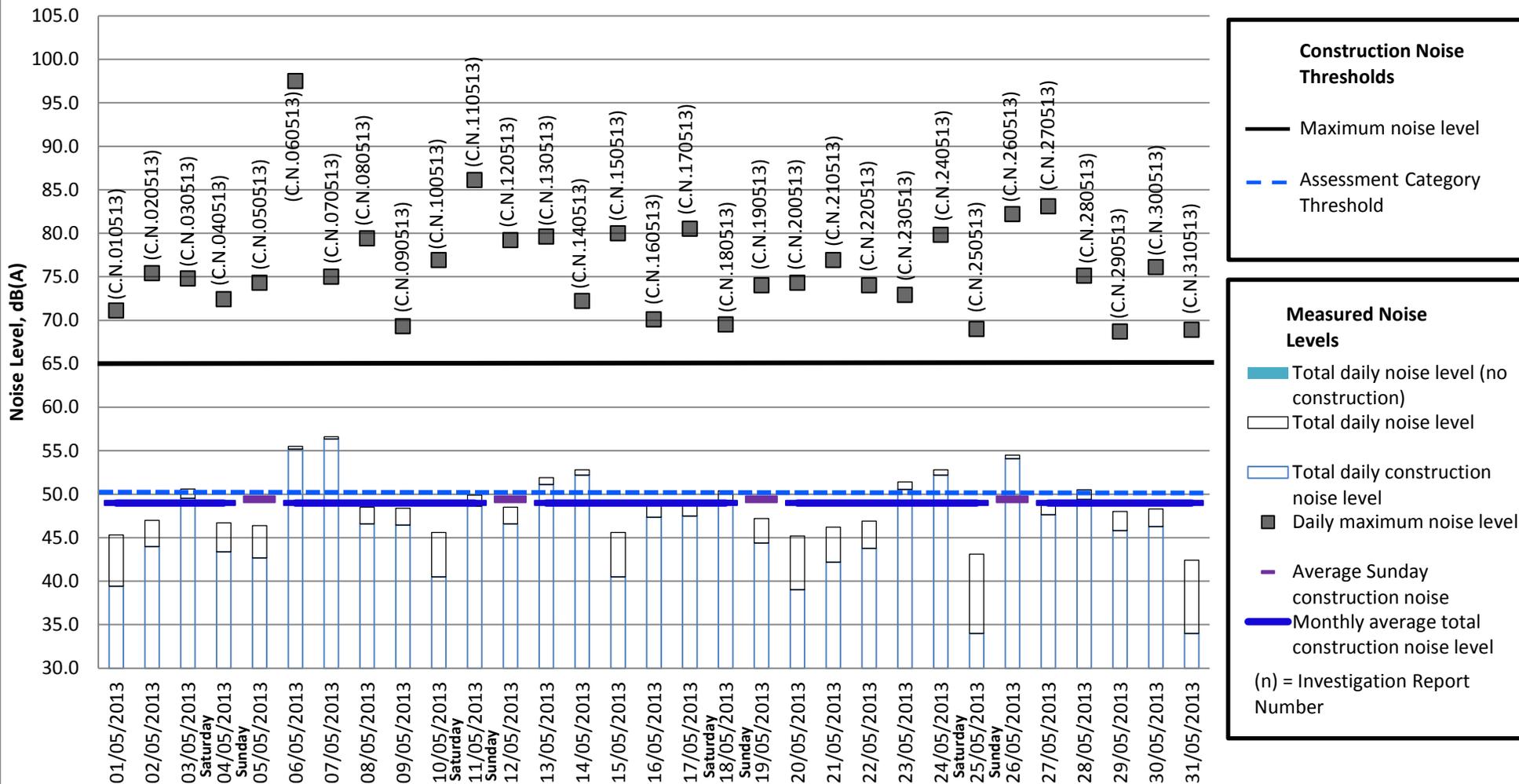
Measured Daytime Noise Levels at Clufflat Brae

Measurement period: May 2013

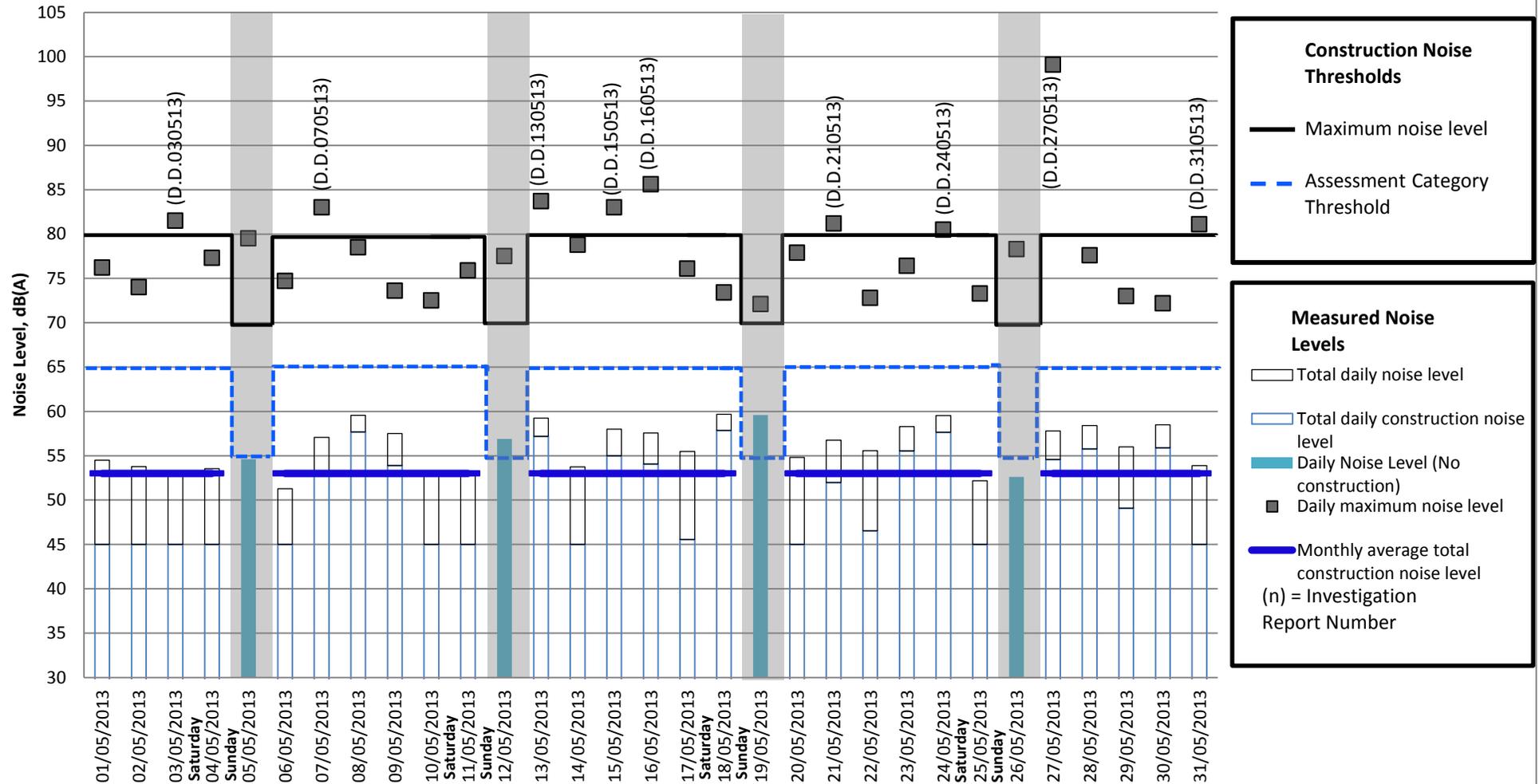


Measured Night-time Noise Levels at Clufflat Brae

Measurement period: May 2013



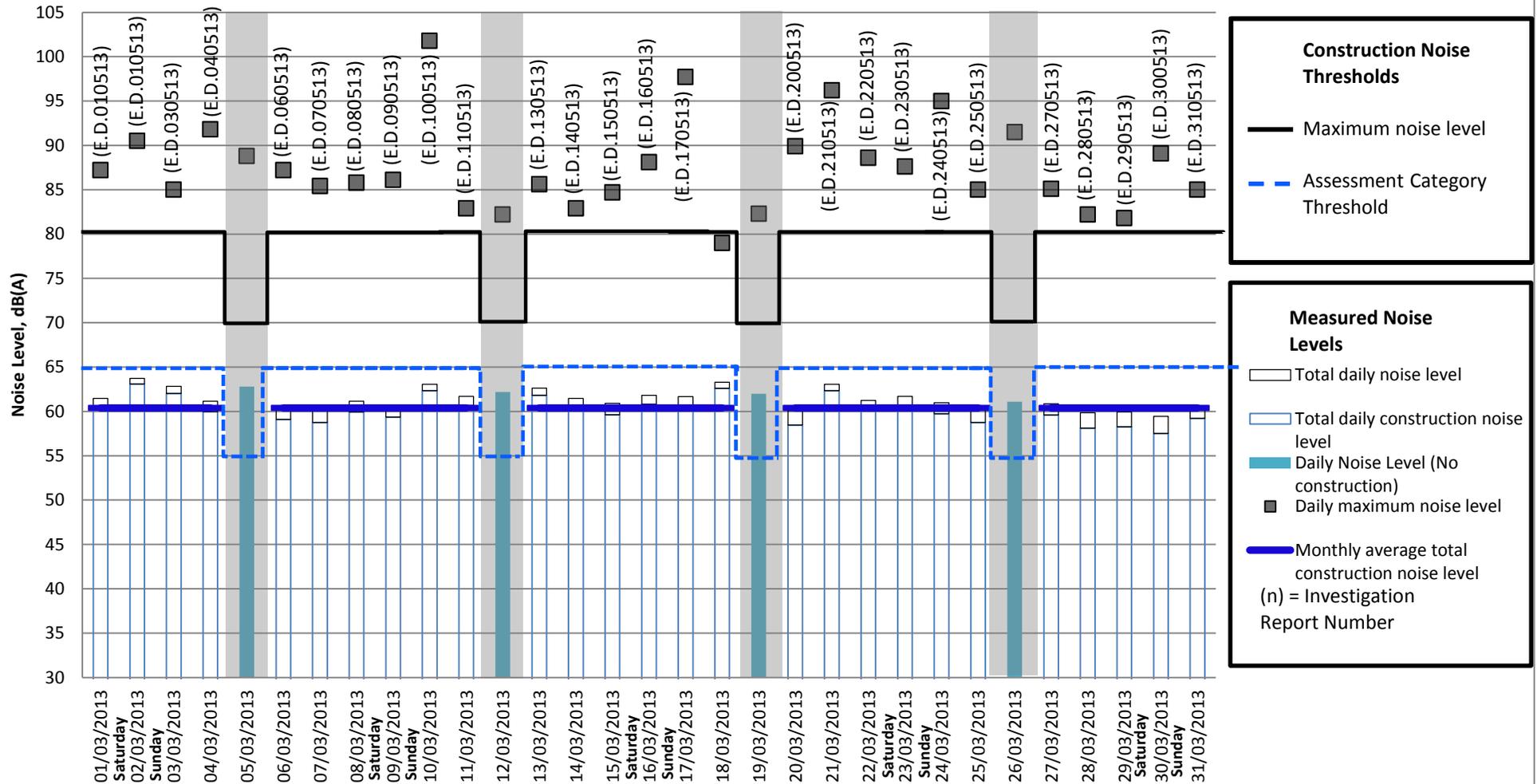
Measured Daytime Noise Levels at Dundas Home Farm Measurement period: May 2013



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

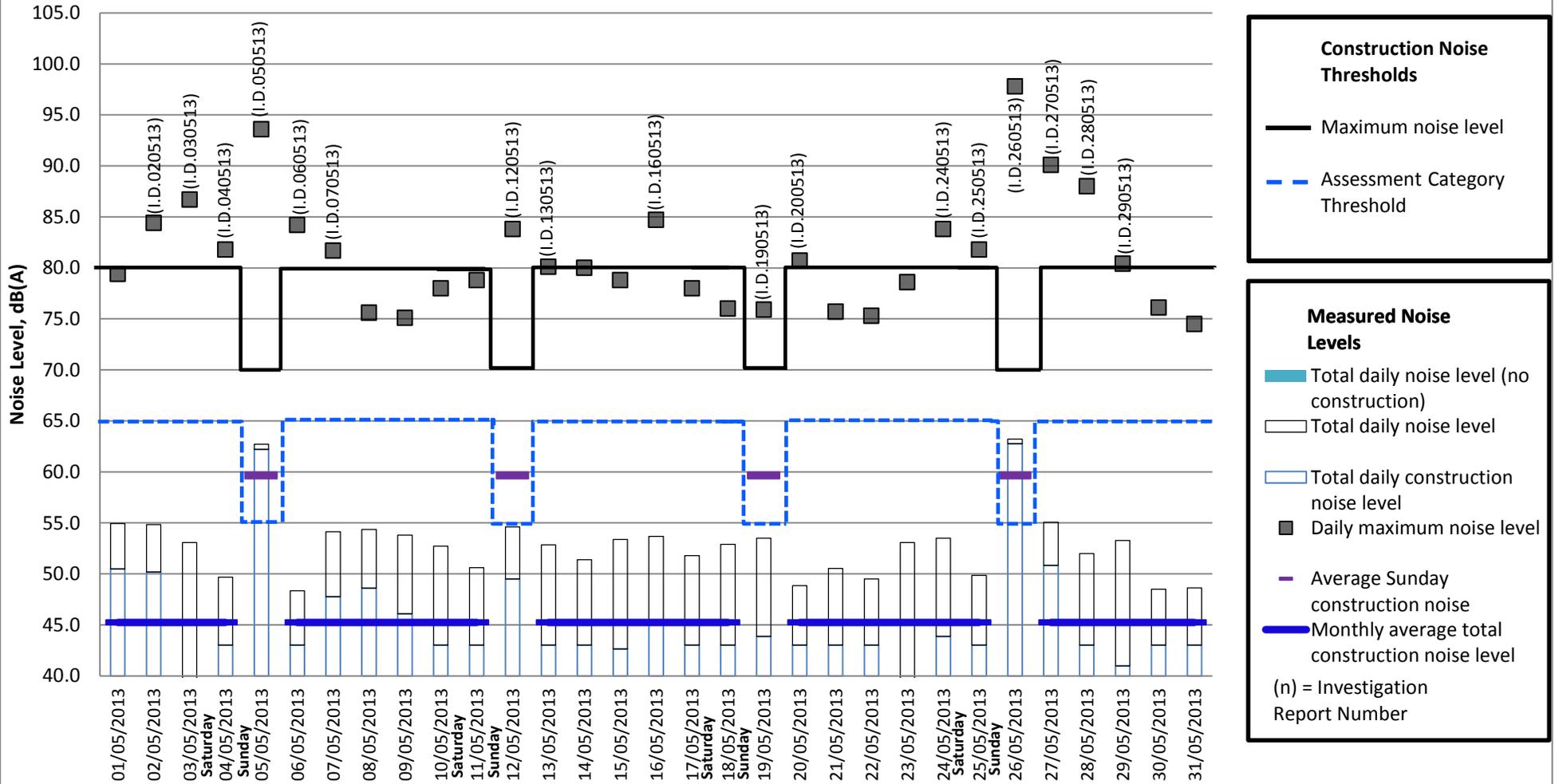
Measurement period: May 2013



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.

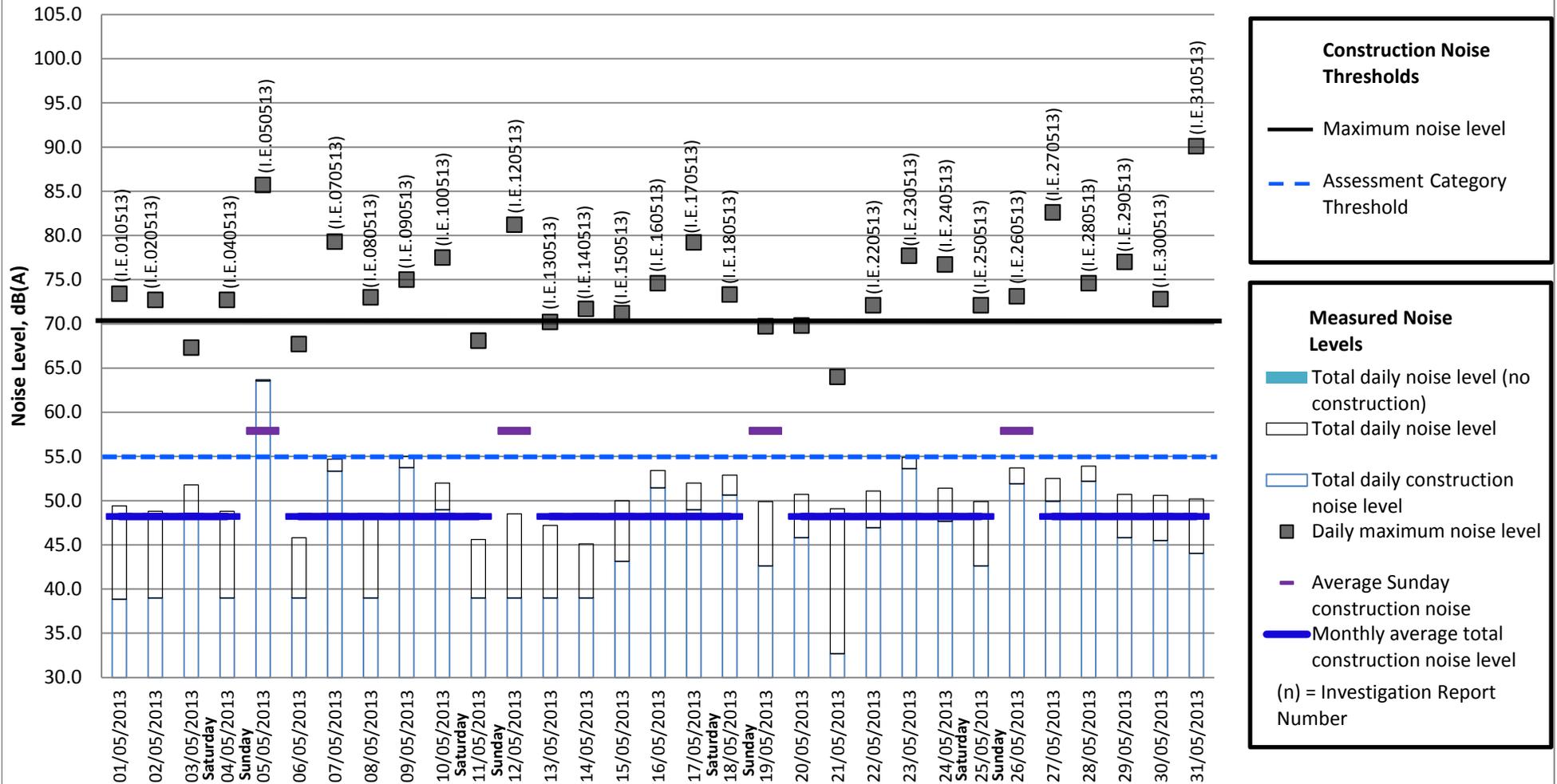
Measured Daytime Noise Levels at Inchgarvie

Measurement period: May 2013



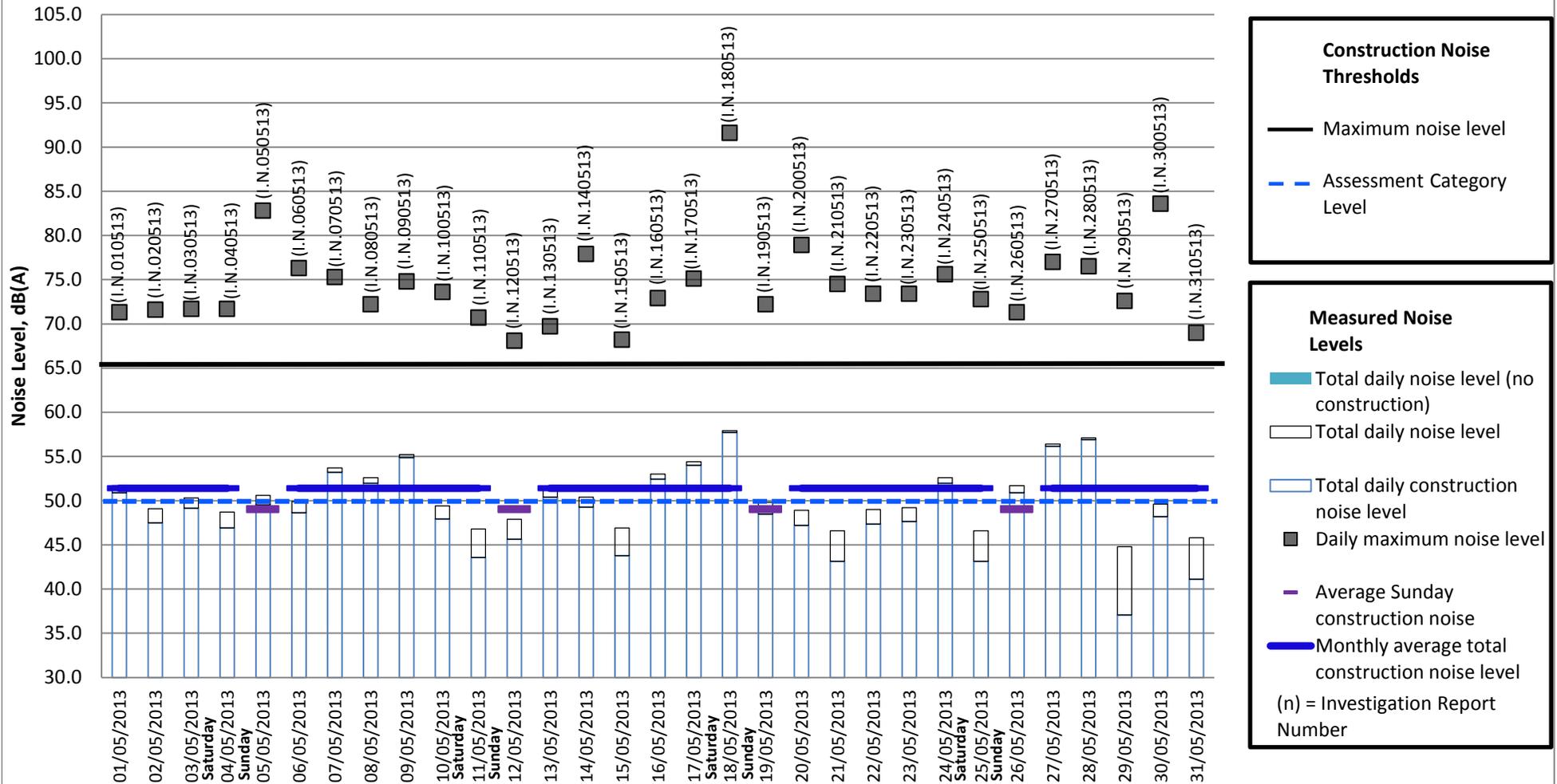
Measured Evening Noise Levels at Inchgarvie

Measurement period: May 2013



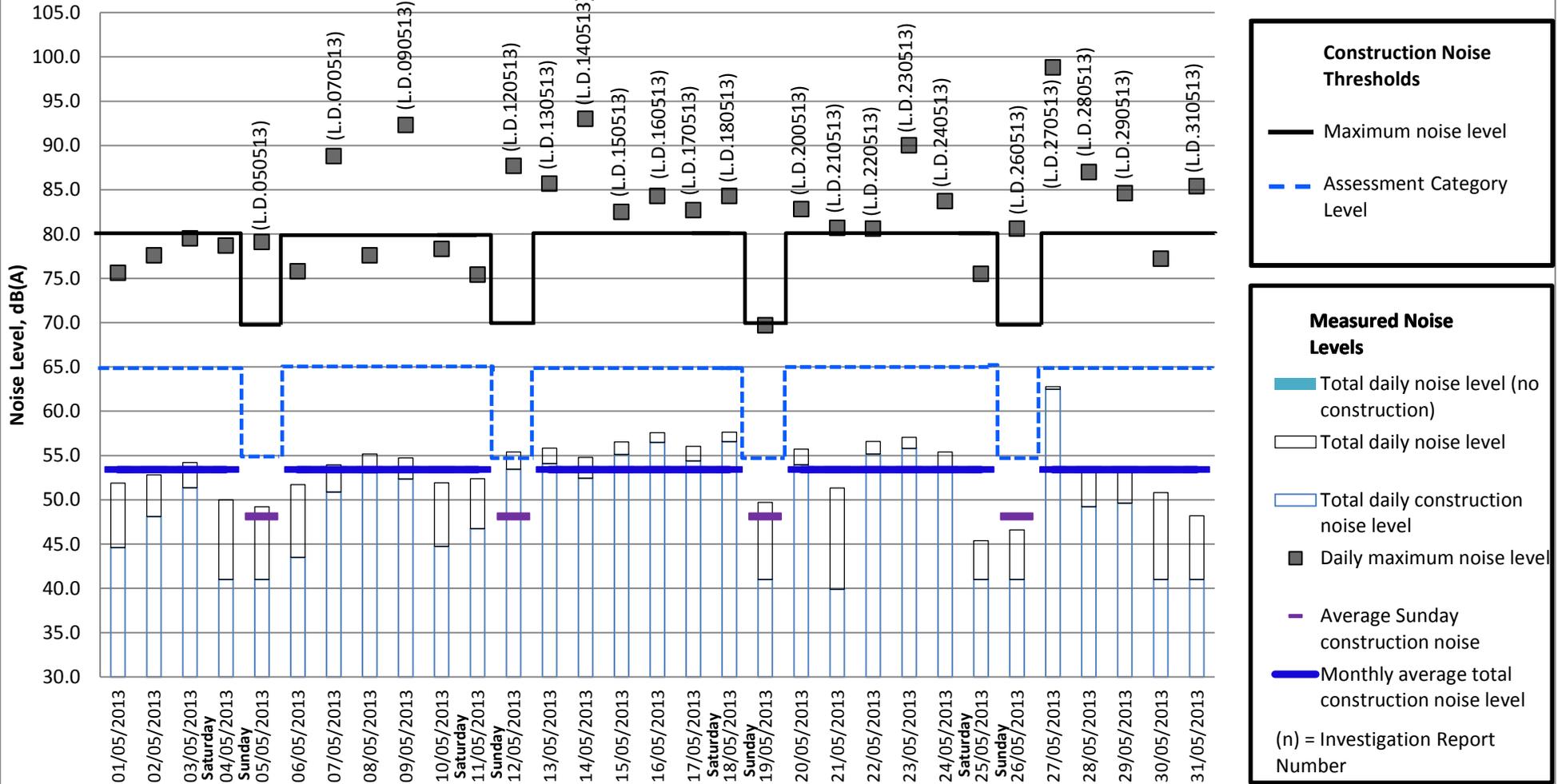
Measured Night-time Noise Levels at Inchgarvie

Measurement period: May 2013



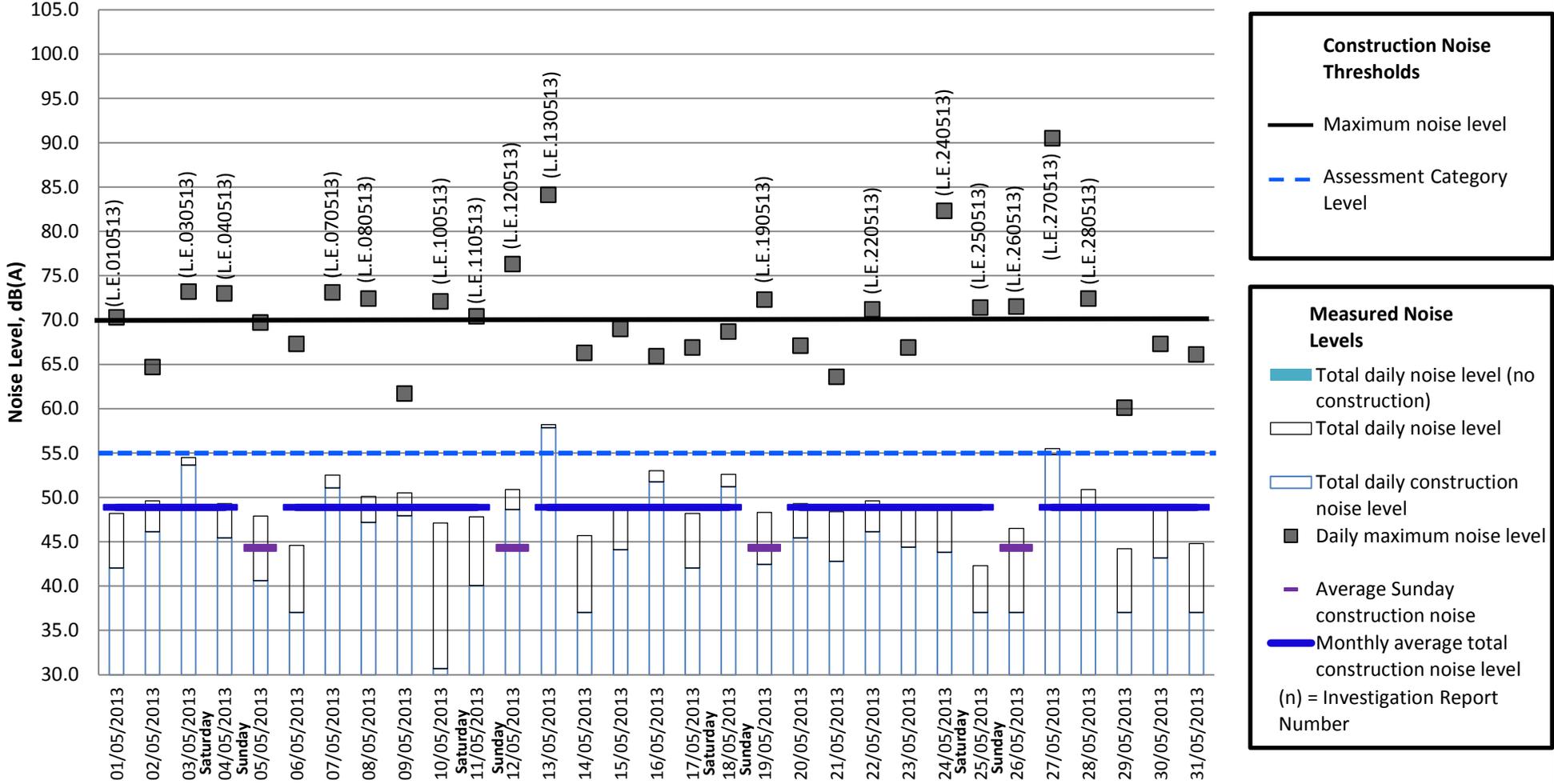
Measured Daytime Noise levels at Linn Mill

Measurement period: May 2013



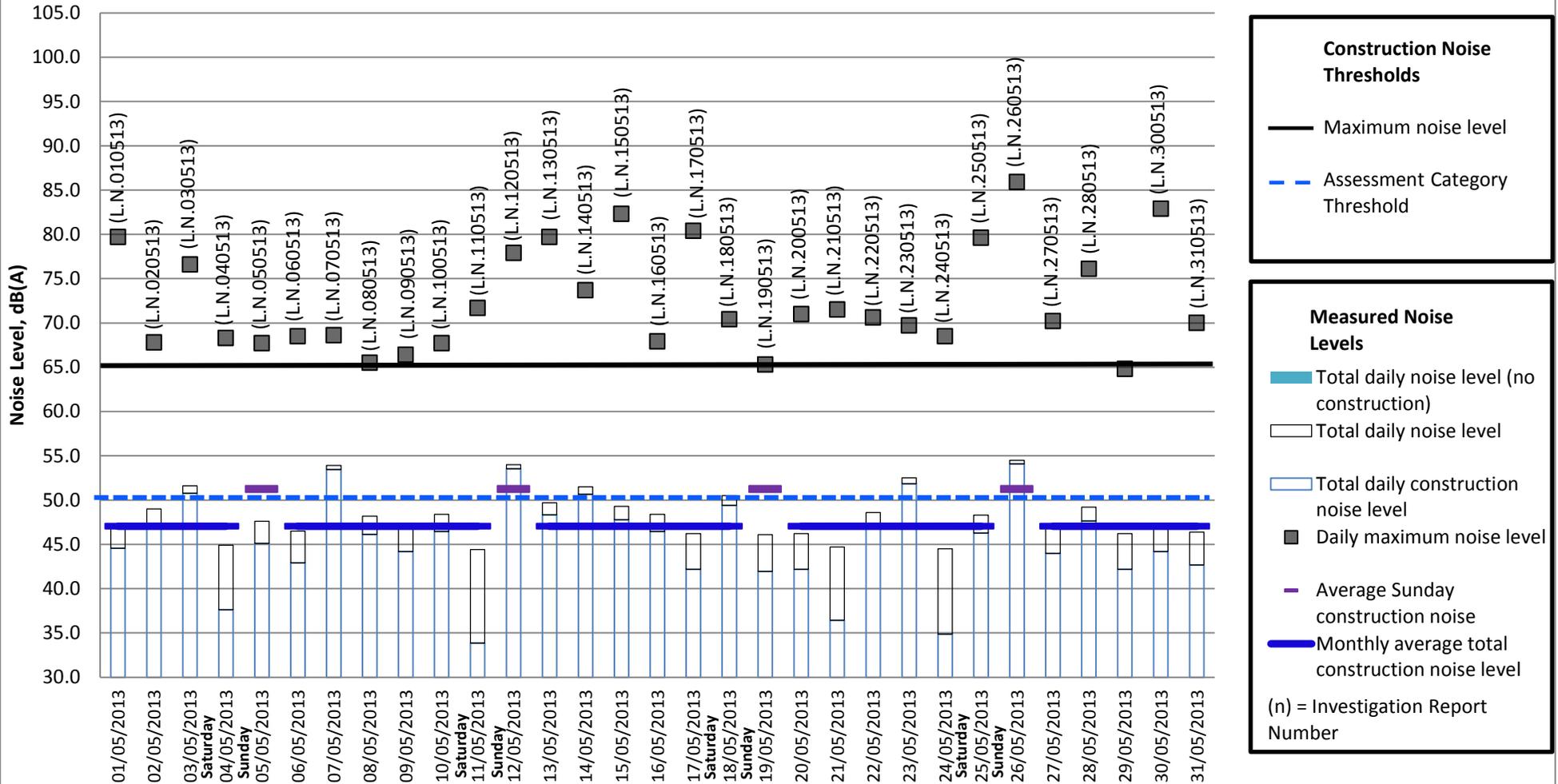
Measured Evening Noise Levels at Linn Mill

Measurement period: August 2012



Measured Night-time Noise Levels at Linn Mill

Measurement period: May 2013



Construction Noise Thresholds

- Maximum noise level
- - - Assessment Category Threshold

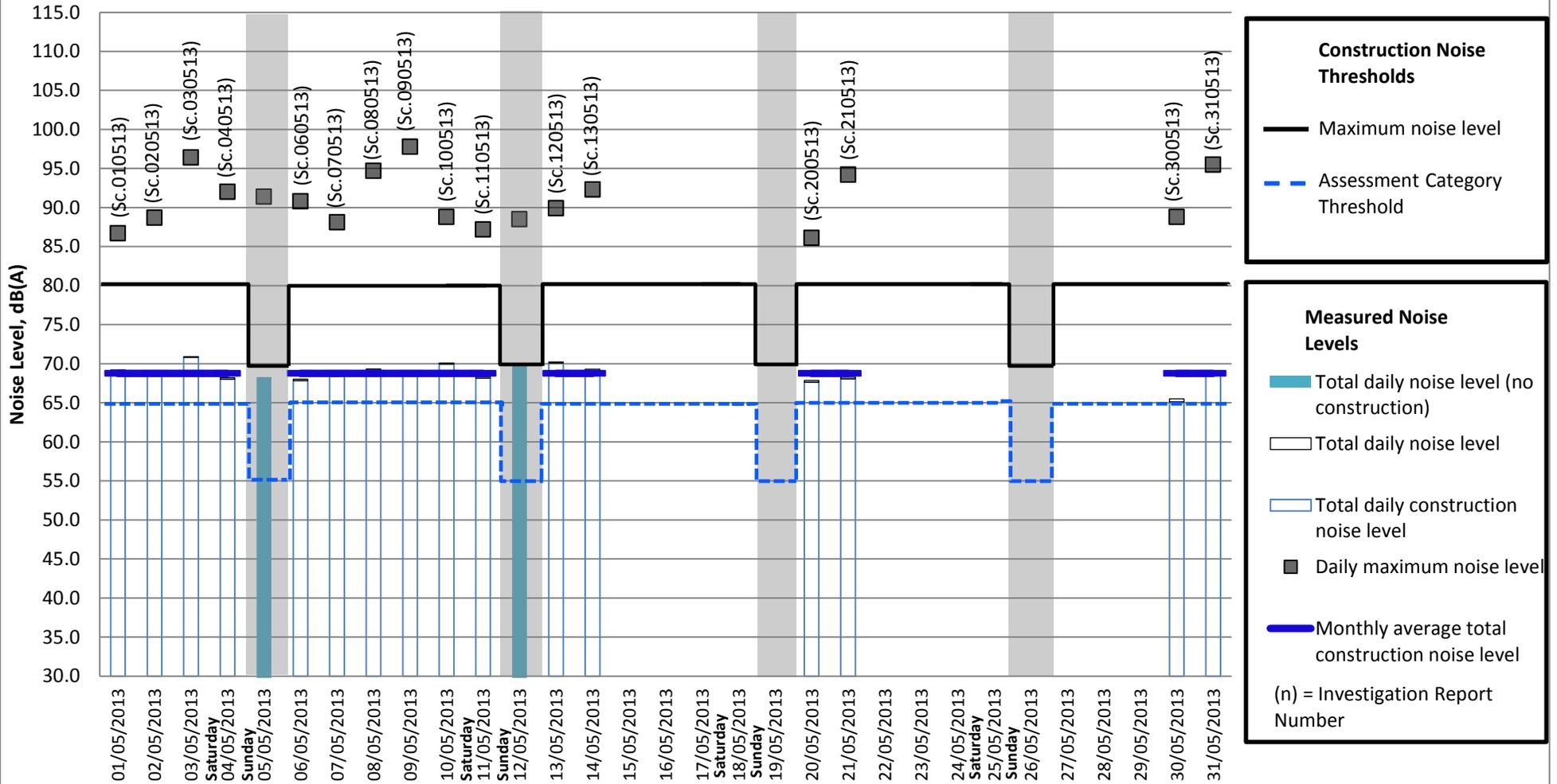
Measured Noise Levels

- 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

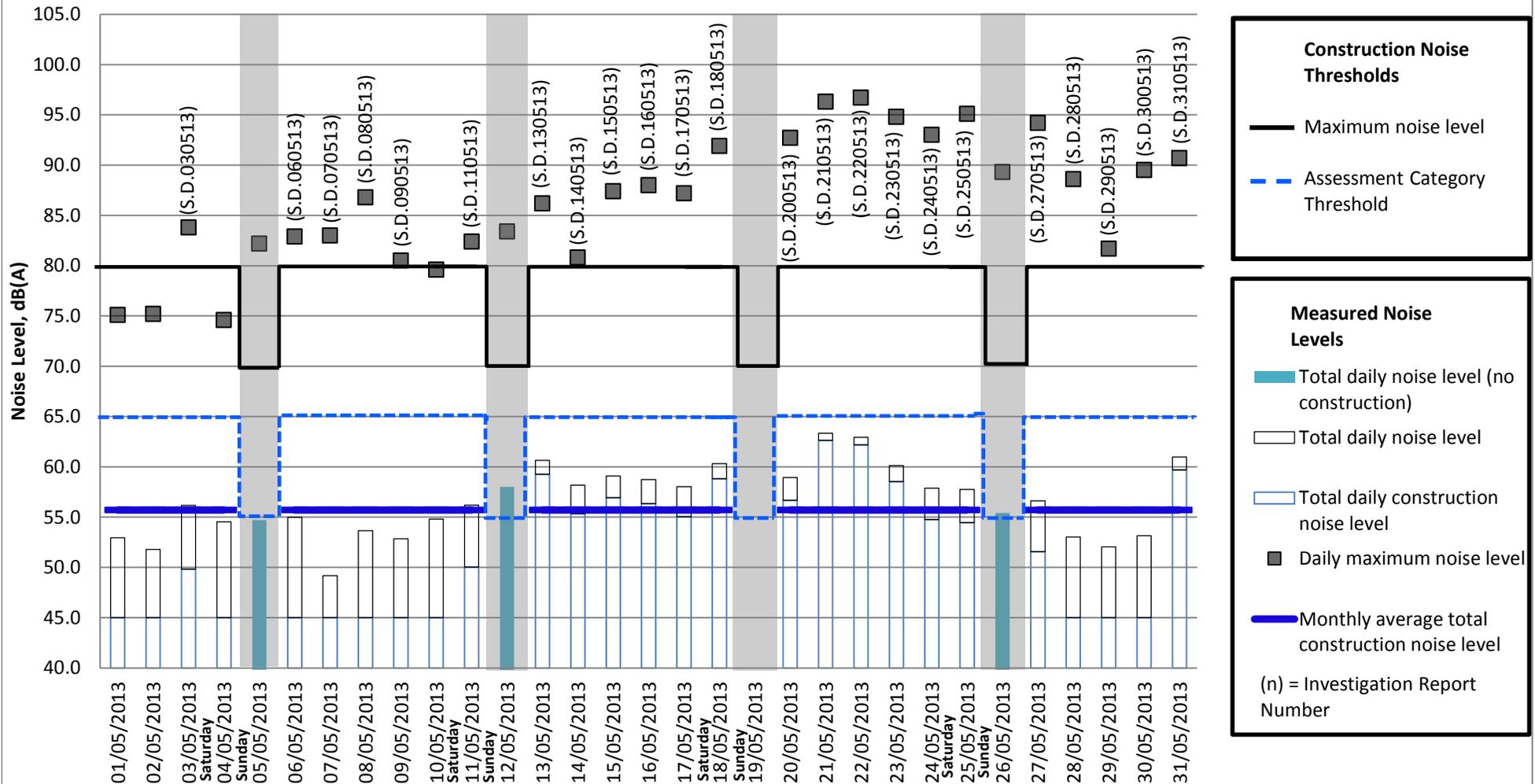
Measured Daytime Noise Levels at Scotstoun

Measurement period: May 2013



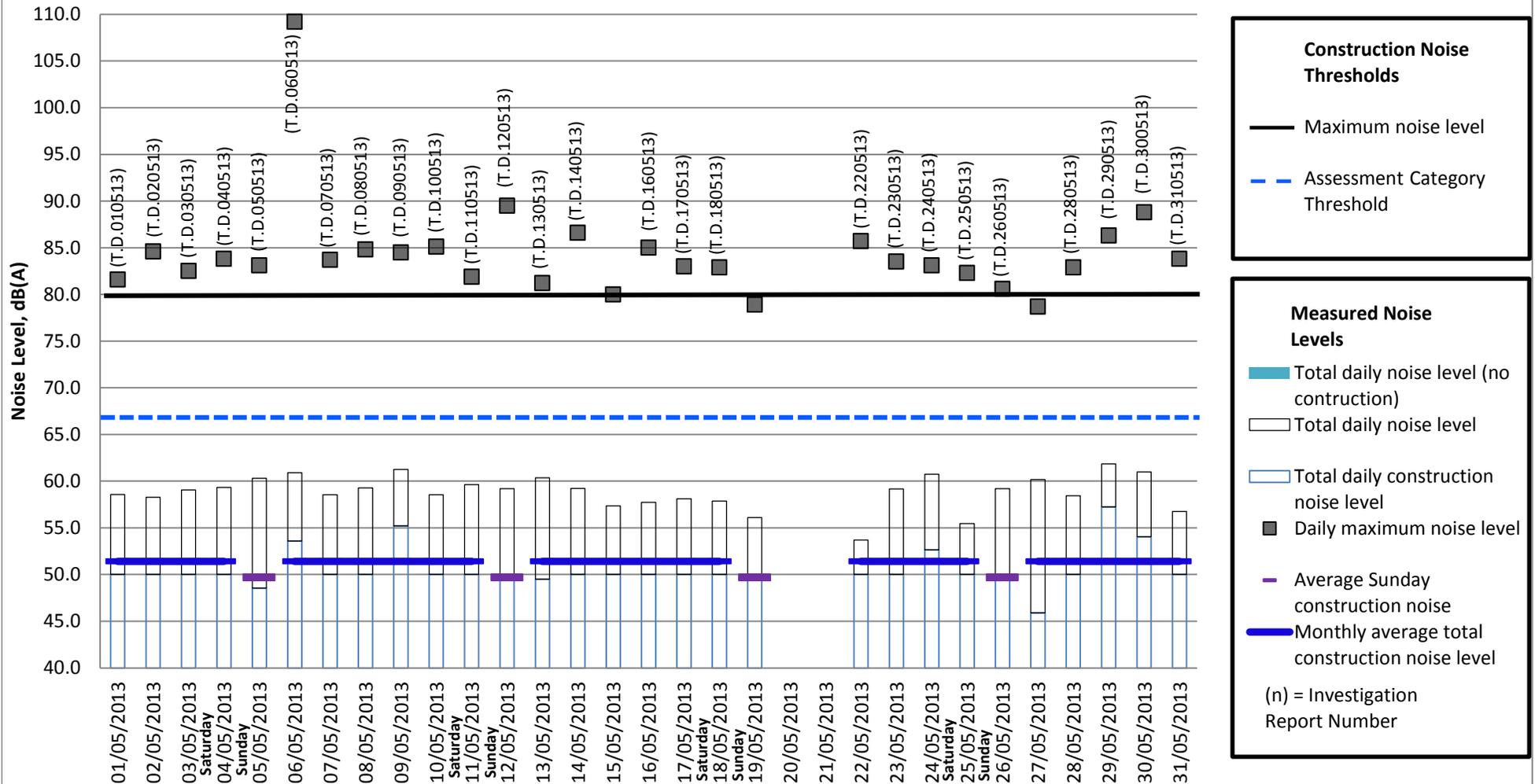
Note: The grey areas of the chart represent days on which no construction works have been conducted. The monthly average construction noise for Sunday has not been included as no Sunday works have been conducted at this location. Data is missing for this location for 14/05/13 to 19/05/13 and for 22/05/13 to 29/05/13 due to a loss of power to this device.

Measured Daytime Noise Levels at Springfield Measurement period: May 2013



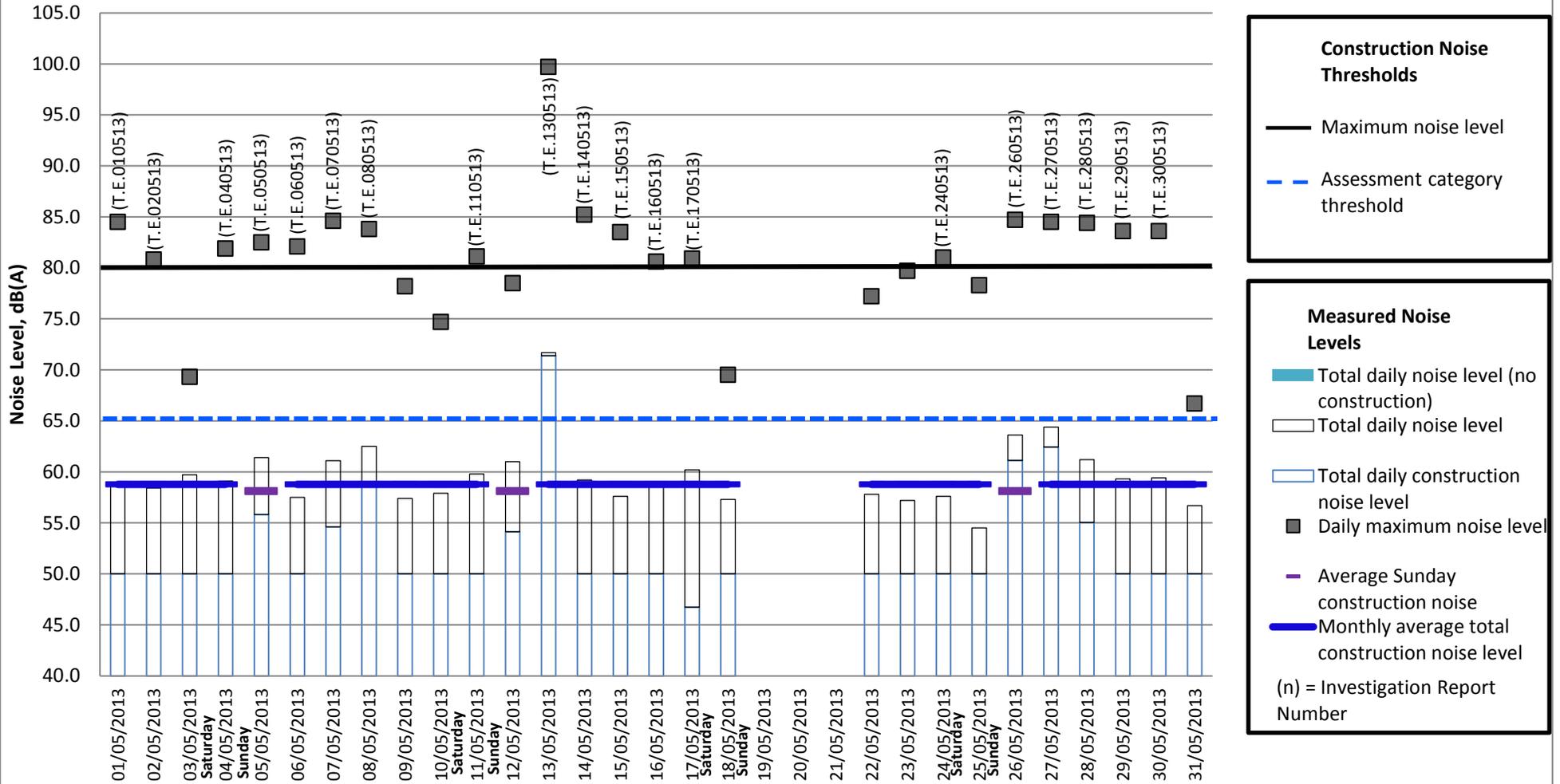
Note: The grey areas of the chart represent days on which no construction works have been conducted. The monthly average construction noise for Sunday has not been included as no Sunday works have been conducted at this location. Data is missing for 19/05/13 due to device error.

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



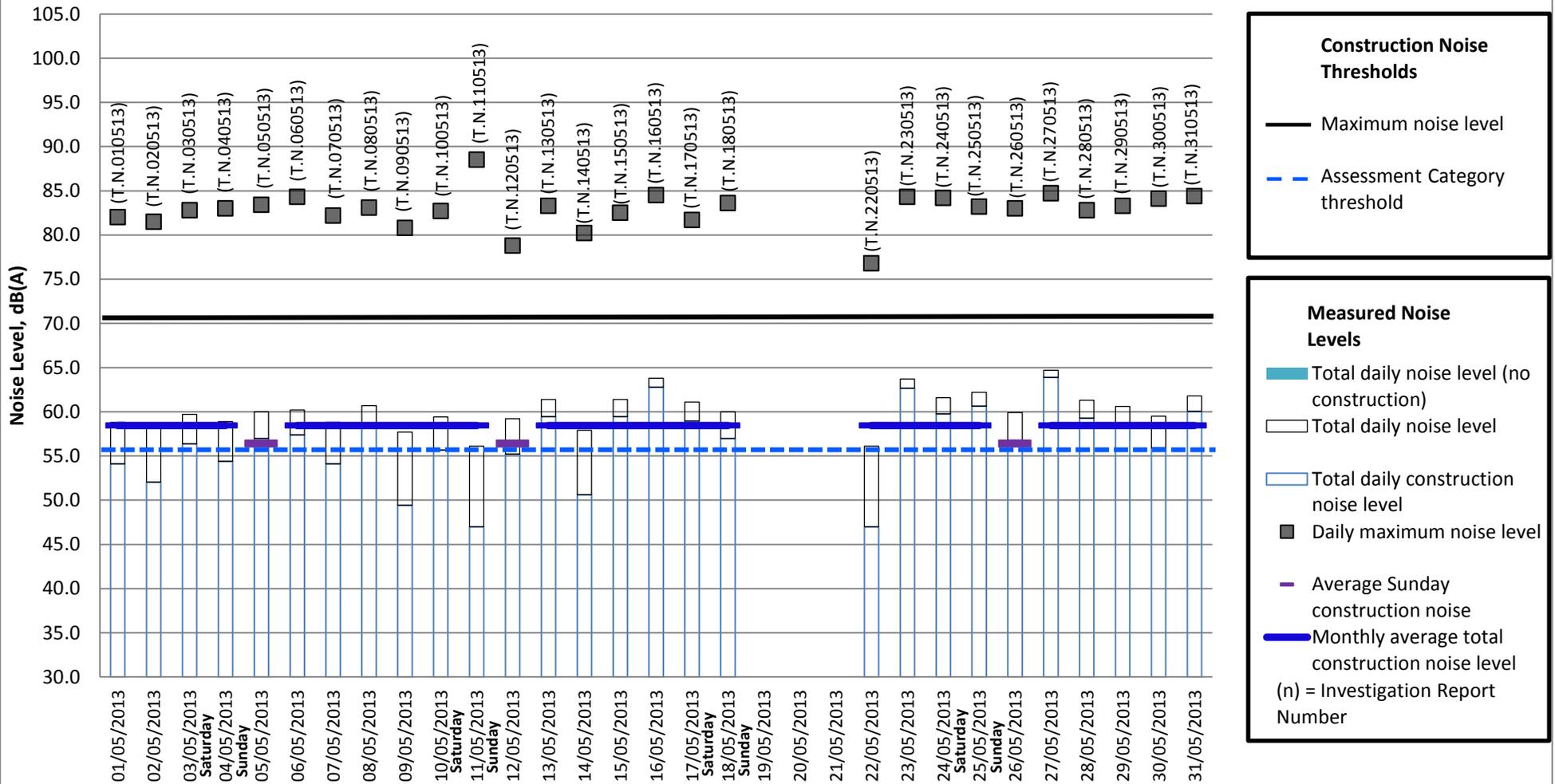
Note: Data is missing on 20/05/13 and 21/05/13 due to an error associated with remote access to the device.

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



Note: Data is missing on 19/05/13, 20/05/13 and 21/05/13 due to an error associated with remote access to the device.

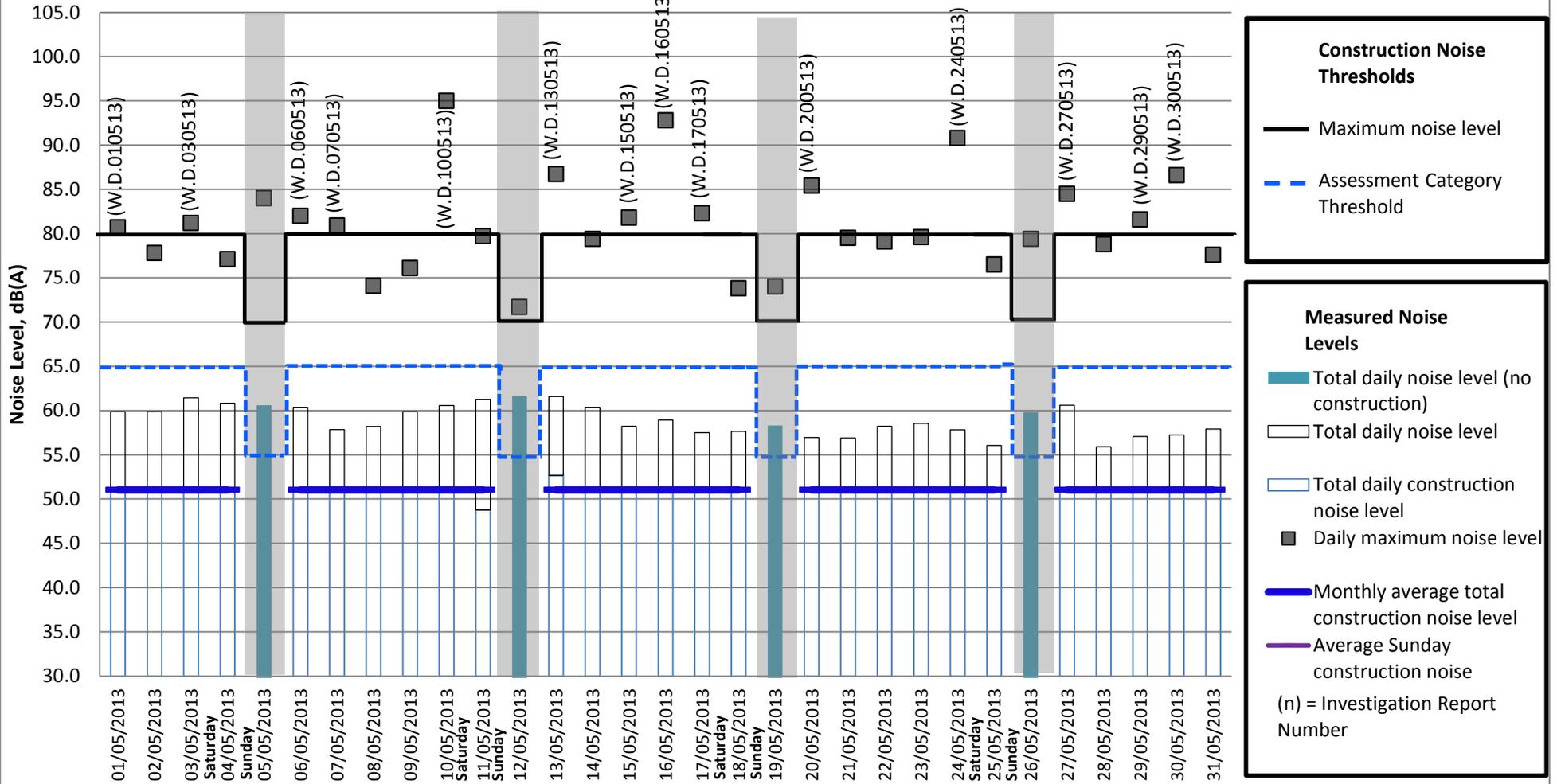
Measured Night-time Noise Levels at Tigh-Na-Grian Measurement period: May 2013



Note: Data is missing on 19/05/13, 20/05/13 and 21/05/13 due to an error associated with remote access to the device.

Measured Daytime Noise Levels at Whinny Hill

Measurement period: May 2013



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