




Contractor



Forth Crossing Bridge Constructors

HOCHTIEF Solutions
American Bridge International
DRAGADOS
Morrison Construction

Project **FORTH REPLACEMENT CROSSING**

Document title

CONSTRUCTION NOISE MONITORING REPORT: MARCH 2013

Rev	Rev. Date	Purpose of revision	Made	Checked	Reviewed
01	16/05/13	Response to EDT comments	ESE	MWN	MWN
00	16/04/13	First Revision	ESE	MWN	MWN

Document status

FOR APPROVAL

Made by: Ellie Slee Checked By: Martin Wilson

Initials: ESE Initials: MWN

Document number

REP-00104

Rev
01

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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 March 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 March 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 March 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 March 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 March 2013
M1	Whinny Hill	Network	Breaking of rock Loading of rock Drilling and Blast 15 (conducted 01/03/13) N.B. No evening, night time or Sunday daytime construction in vicinity.
M3	Tigh-Na-Grian	Crossing	Placement & dewatering of Central Tower cofferdam North Tower caisson excavation North Tower jet grouting
M4	North Leg	Crossing	Placement & dewatering of Central Tower cofferdam North Tower caisson excavation North Tower jet grouting Installation of pier N1 cofferdam South Tower jet grouting Pier S1 caisson excavation Pier S4 excavation & concrete works Pier S5 excavation & concrete works Excavation & Breaking works at pier S6 Drilling for de-stressing wells at pier S6 Backfilling at pier S7
M6	Port Edgar	Crossing	Placement & dewatering of Central Tower cofferdam South Tower jet grouting Pier S1 caisson excavation Pier S4 excavation & concrete works Pier S5 excavation & concrete works Excavation & Breaking works at pier S6 Drilling for de-stressing wells at pier S6 Backfilling at pier S7
M7	Butlaw Fisheries	Crossing	Placement & dewatering of Central Tower cofferdam South Tower jet grouting Pier S1 caisson excavation Pier S4 excavation & concrete works Pier S5 excavation & concrete works Excavation & Breaking works at pier S6 Drilling for de-stressing wells at pier S6 Backfilling at pier S7

M10	Inchgarvie Lodge	Crossing	<p>South Tower jet grouting Pier S1 caisson excavation Pier S4 excavation & concrete works Pier S5 excavation & concrete works Excavation & Breaking works at pier S6 Drilling for de-stressing wells at pier S6 Backfilling at pier S7 Excavation and temporary drainage works at launch Stabilising batters at launch Works at South Abutment, including erection of reinforcement and formwork</p>
M11	Linn Mill	Network (close proximity to Crossing)	<p>Backfilling at pier S7 Excavation and temporary drainage works at launch Stabilising batters at launch Works at South Abutment, including erection of reinforcement and formwork</p>
M13	Clufflat Brae	Crossing	<p>Backfilling at pier S7 Excavation and temporary drainage works at launch Stabilising batters at launch Works at South Abutment, including erection of reinforcement and formwork</p>
M14	Springfield	Network	<p>Excavation and temporary drainage works at launch Stabilising batters at launch Excavation of rock at Queensferry gyratory Drainage works at A904/U221</p> <p>N.B. No evening, night time or Sunday daytime construction in vicinity.</p>
M15	Echline Field	Network	<p>Excavation and temporary drainage works at launch Stabilising batters at launch Excavation of rock at Queensferry gyratory Drainage works at A904/U221</p> <p>N.B. No evening, night time or Sunday daytime construction in vicinity.</p>
M16	Scotstoun	Network	<p>Drainage works Soil/embankment strip Construction of South bound bus link haul road</p> <p>N.B. No evening, night time or Sunday daytime construction in vicinity.</p>

M17	Dundas Home Farm	Network	Utilities works Soil strip Excavation works 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 March resulting in loss of data for short periods at Echline and Tigh-Na-Grian and a five-day period at Port Edgar.
- 3.3** Results demonstrate that the monthly average total construction noise results for daytime were within the threshold limits for all monitoring locations for March 2013, with the exception of Scotstoun. For the evening period, the monthly average total construction noise results were within the threshold for all locations throughout March 2013, with the exception of Butlaw Fisheries. For night-time, results show exceedances of the threshold at Butlaw Fisheries, Clufflat Brae, Linn Mill and Tigh-Na-Grian, with all other monitoring locations within the threshold.
- 3.4** With regard to the Sunday averages (for applicable monitoring locations), exceedances of the threshold were noted for all Sunday averages at Butlaw Fisheries, the Sunday night time average at Clufflat and Tigh-Na-Grian, and the Sunday daytime average at Inchgarvie. All other locations were found to be within the Sunday average threshold for all periods.
- 3.5** The exceedances of the monthly averages and the Sunday average thresholds at each of the monitoring locations are not considered to have been caused by increased noise levels due to construction. The night time exceedances, the evening exceedance at Butlaw Fisheries, and the exceedances of the Sunday averages were caused by adverse weather conditions, with waves on the shore at Butlaw Fisheries further exacerbating the noise levels at this location. Furthermore, it should be noted that the averages for both night time and Sunday daytime periods are based only on the highest L_{Aeq} levels for 1 hour periods which can affect the averages.
- 3.6** 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.

- 3.7** During March 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, diaries and daily 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.
- 3.8** 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 spells of adverse weather conditions during March and birds. Local noises at nearby properties and monitor maintenance were also found to be contributing factors to maximum noise level exceedances. At some locations, notably Scotstoun and Echline, existing traffic noise had an effect on maximum noise levels during the period covered in this report.
- 3.9** 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.
- 3.10** The daytime L_{AFmax} threshold was exceeded on four occasions in March at Linn Mill due to network connection works. All of the exceedances were found to be attributable to plant operating and moving down through Echline fields which is in close proximity to the meter, with three occurring during the daytime period and one occurring during the night time period.
- 3.11** Marine works were found to be attributable for a total of six exceedances. Four exceedances were recorded at Tigh-Na-Grian, caused by works at the North Tower caisson, and two exceedances were also recorded at Butlaw Fisheries due to works being undertaken at Pier S1 caisson; more specifically the exceedances at these locations were caused by rocks falling in to the split barge and metal clangs.
- 3.12** 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.
- 3.13** 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 March the maximum noise threshold was exceeded on 50 occasions (daytime, 10; evening, 11; night time, 29). Two night time exceedances were due to works at Pier S1 caisson. However, a large number of exceedances were attributed to a range of non-construction factors, notably wind, waves and birds.
Clufflat Brae	During March the maximum noise threshold was exceeded on 38 occasions (daytime, 6; evening, 6; night time, 26). No exceedances were attributable to construction works. Exceedances were found to be largely due to wind and birds.
Inchgarvie Lodge	During March the maximum noise threshold was exceeded on 57 occasions (daytime, 16; evening, 12; night time, 29). No exceedances were found to be due to construction works. However, investigations found local noises at the property and birds to be the main contributing factors to the exceedances at this location.
Linn Mill	During March the maximum noise threshold was exceeded on 51 occasions (daytime, 14; evening, 8; night time, 29). Four exceedances were due to plant operating/moving in close proximity of the meter. However, the majority of exceedances were caused by adverse weather conditions and birds.
Tigh-Na-Grian	During March the maximum noise threshold was exceeded on 41 occasions (daytime, 12; evening, 1; night time, 28). Four night time exceedances were found to be due to construction works; these were caused by works at the North Tower caisson. However, the majority of exceedances were due to non-construction factors including wind and birds.
Dundas Home Farm	During March the maximum noise threshold was exceeded on 10 occasions. Exceedances were not attributable to construction works. Exceedances were due to monitor maintenance, crow bangers and birds.
Echline	During March 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 March the maximum noise threshold was exceeded on 12 occasions. No exceedances were caused by construction works at this location. The majority of exceedances were due to local residents.
Scotstoun	During March the maximum noise threshold was exceeded on 26 occasions. Exceedances were attributed to vehicles passing by on the adjacent road.
Whinny Hill	During March the maximum noise threshold was exceeded on 10 occasions. Exceedances were not due to construction activities. A range of factors were found to cause exceedances at this location, including wind and birds.

Table 3: Summary of Construction Exceedances at Monitoring Locations

Monitor	Date	Period	Description	NVIR No.
Butlaw Fisheries	16/03/13	Night	Works at Pier South 1 Caisson	B.N.160313
	30/03/13			B.N.300313
Tigh-Na-Grian	12/03/13	Night	Repositioning of jet grouting working platform	T.N.120313
	13/03/13			T.N.130313
	14/03/13			T.N.140313
	25/03/13			T.N.250313
Linn Mill	15/03/13	Day	Plant operating/moving close proximity to monitor	L.D.150313
	19/03/13			L.D.190313
	21/03/13			L.D.210313
	20/03/13	Night		L.N.200313



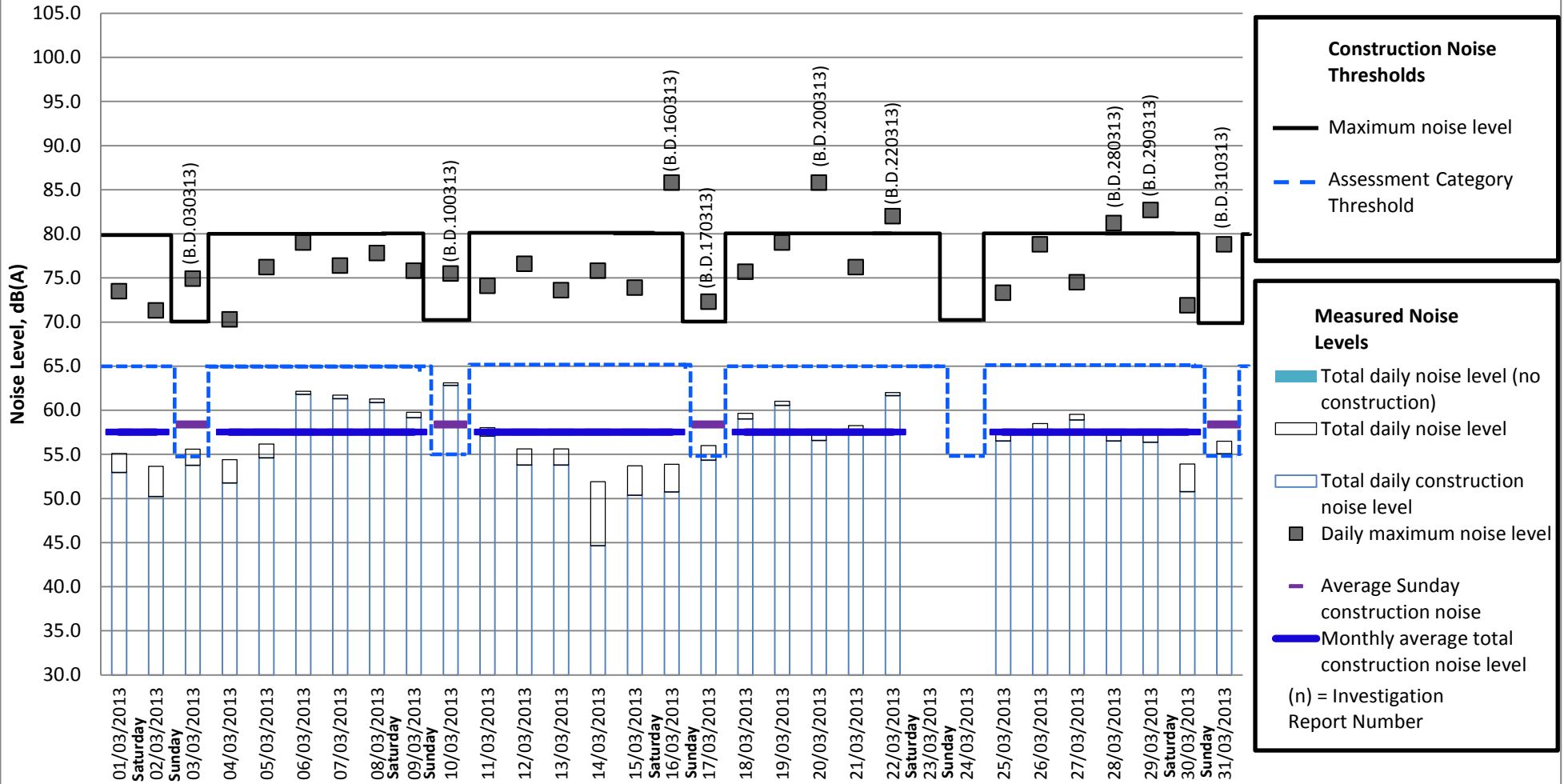
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APPENDIX A

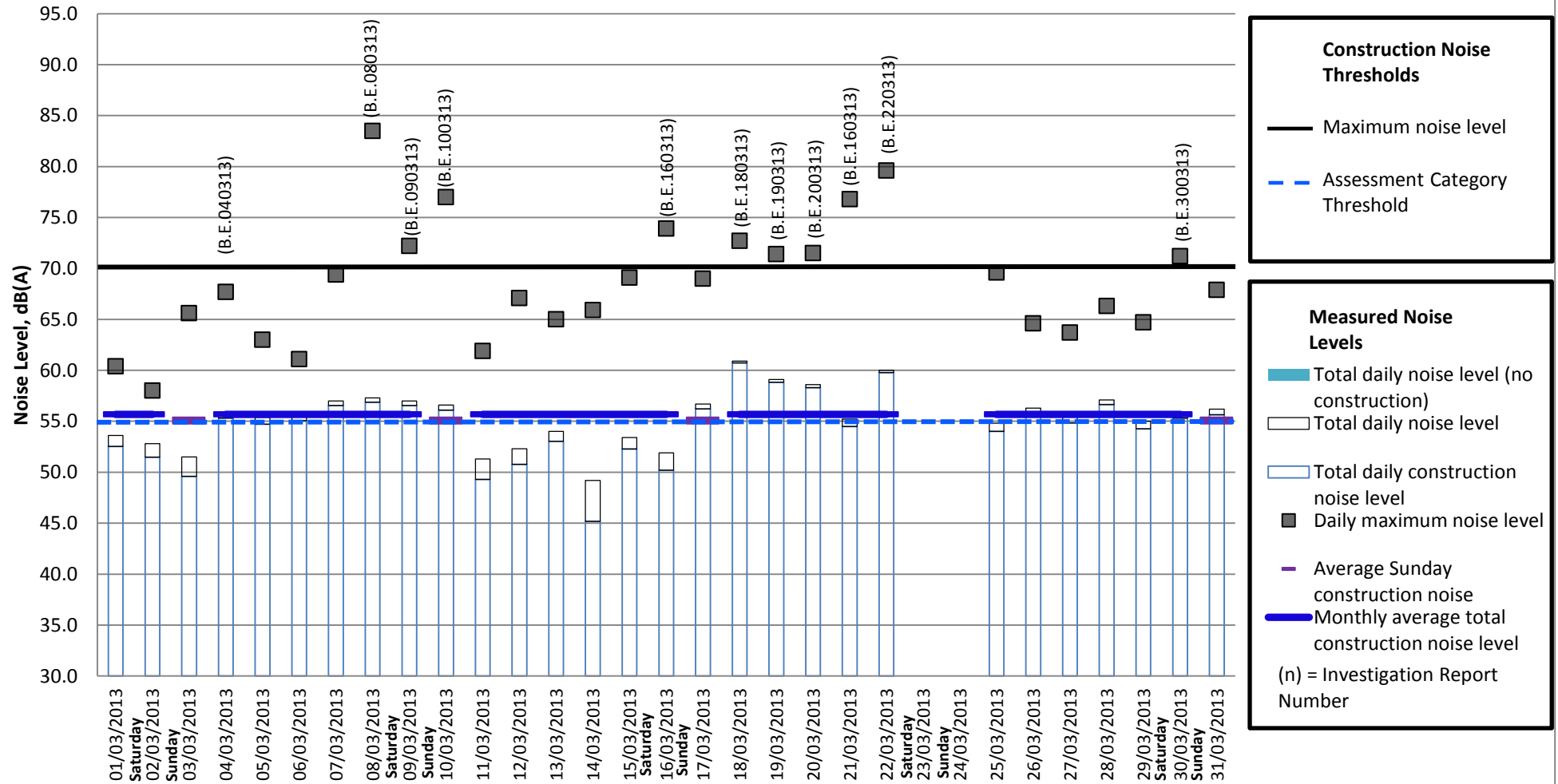
Measured Daytime Noise Levels at Butlaw Fisheries

Measurement period: March 2013



Note: Data is missing for 23/03/13 and 24/03/13 due to device error.

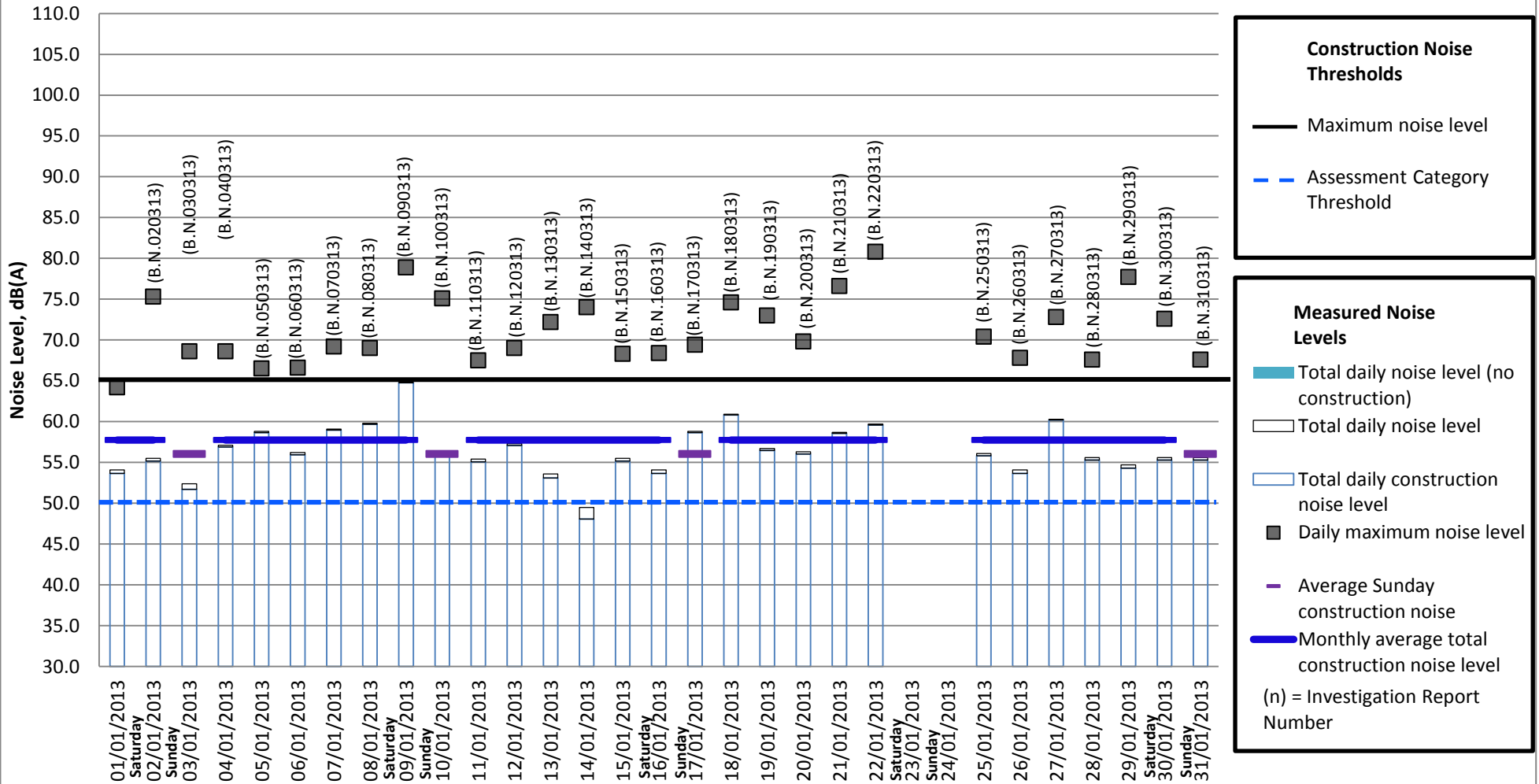
Measured Evening Noise Levels at Butlaw Fisheries Measurement period: March 2013



Note: Data is missing for 23/03/13 and 24/03/13 due to device error.

Measured Night time Noise Levels at Butlaw Fisheries

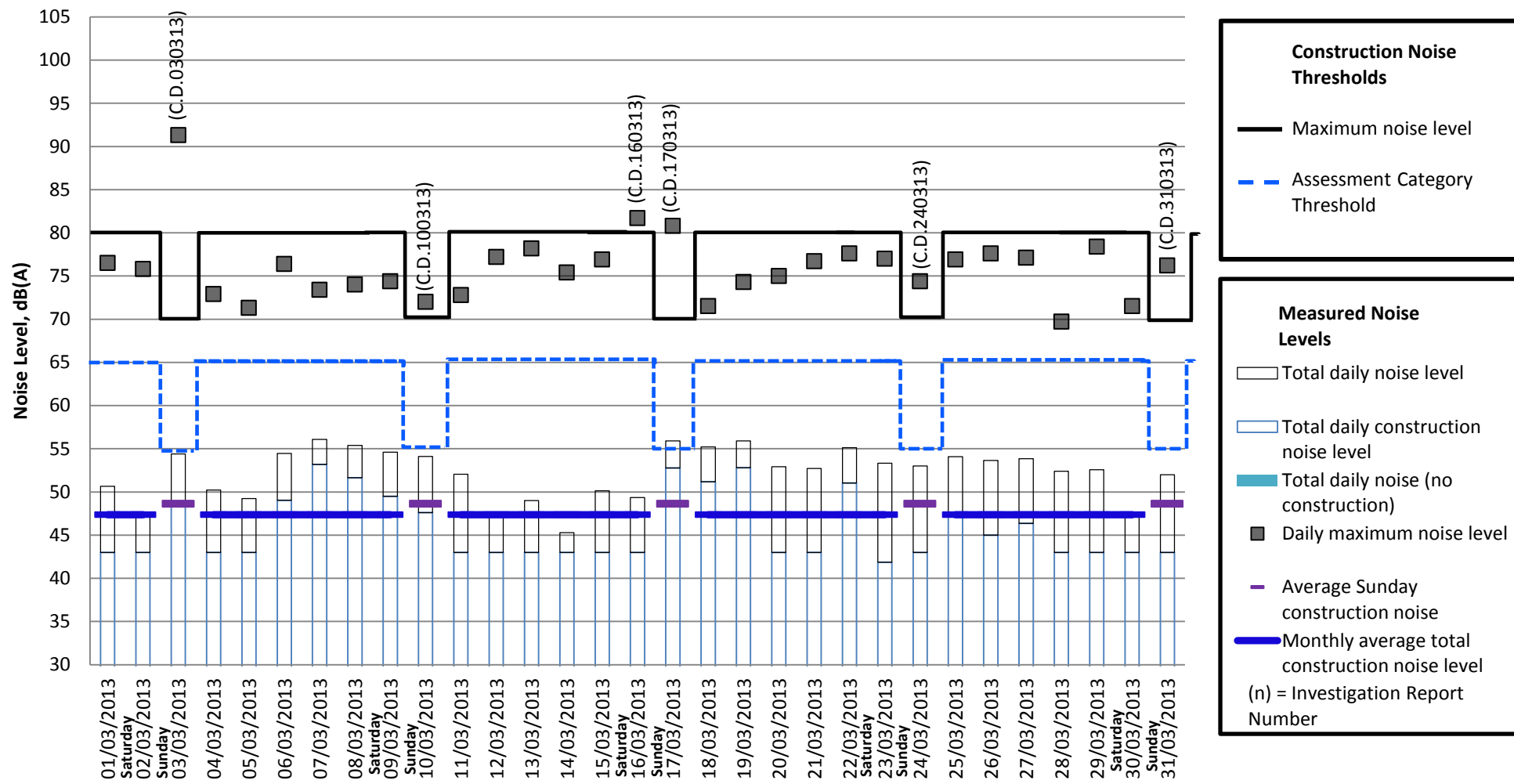
Measurement period: March 2013



Note: Data is missing on 23/03/13 and 24/01/13 due to device error.

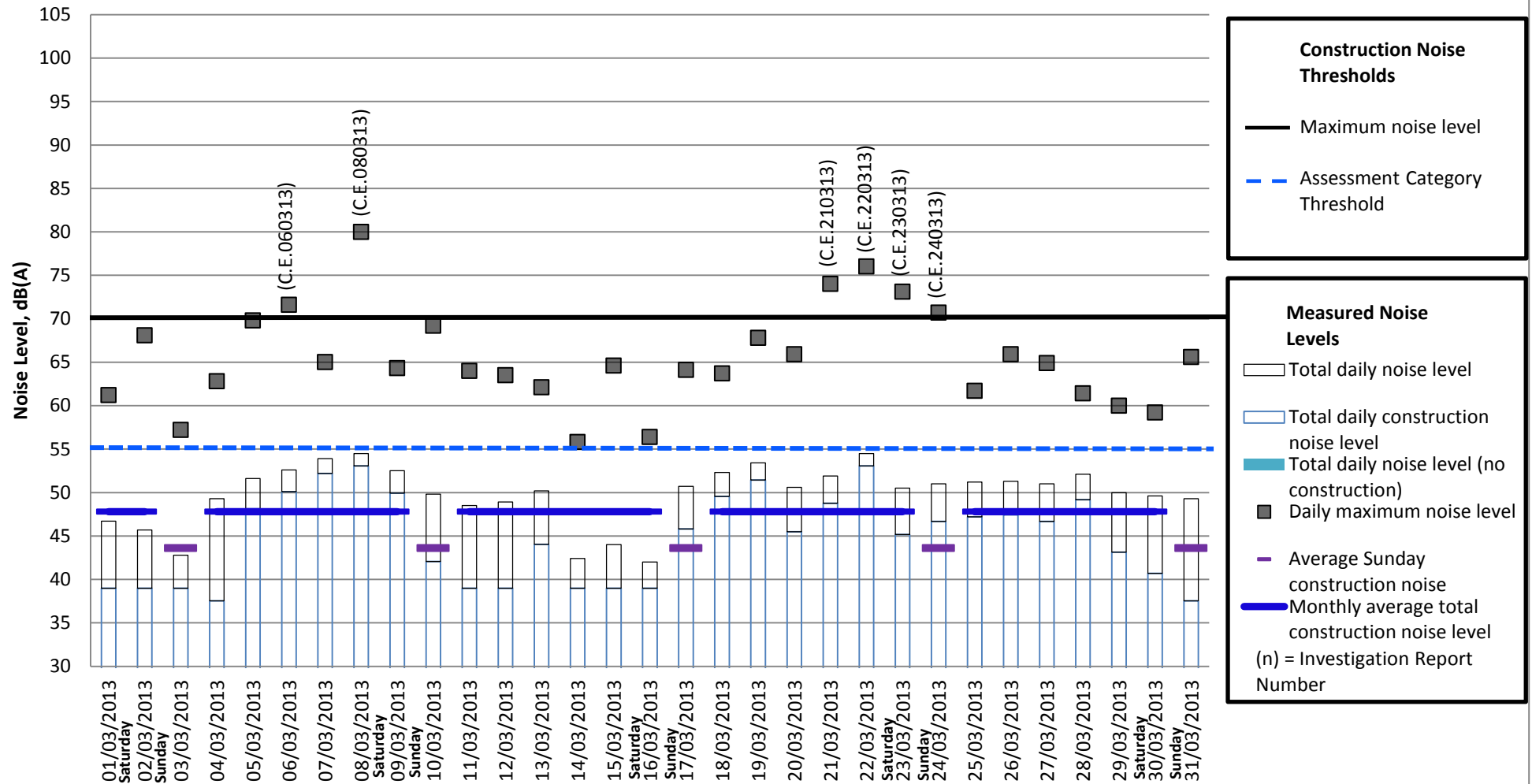
Measured Daytime Noise Levels at Clufflat Brae

Measurement period: March 2013



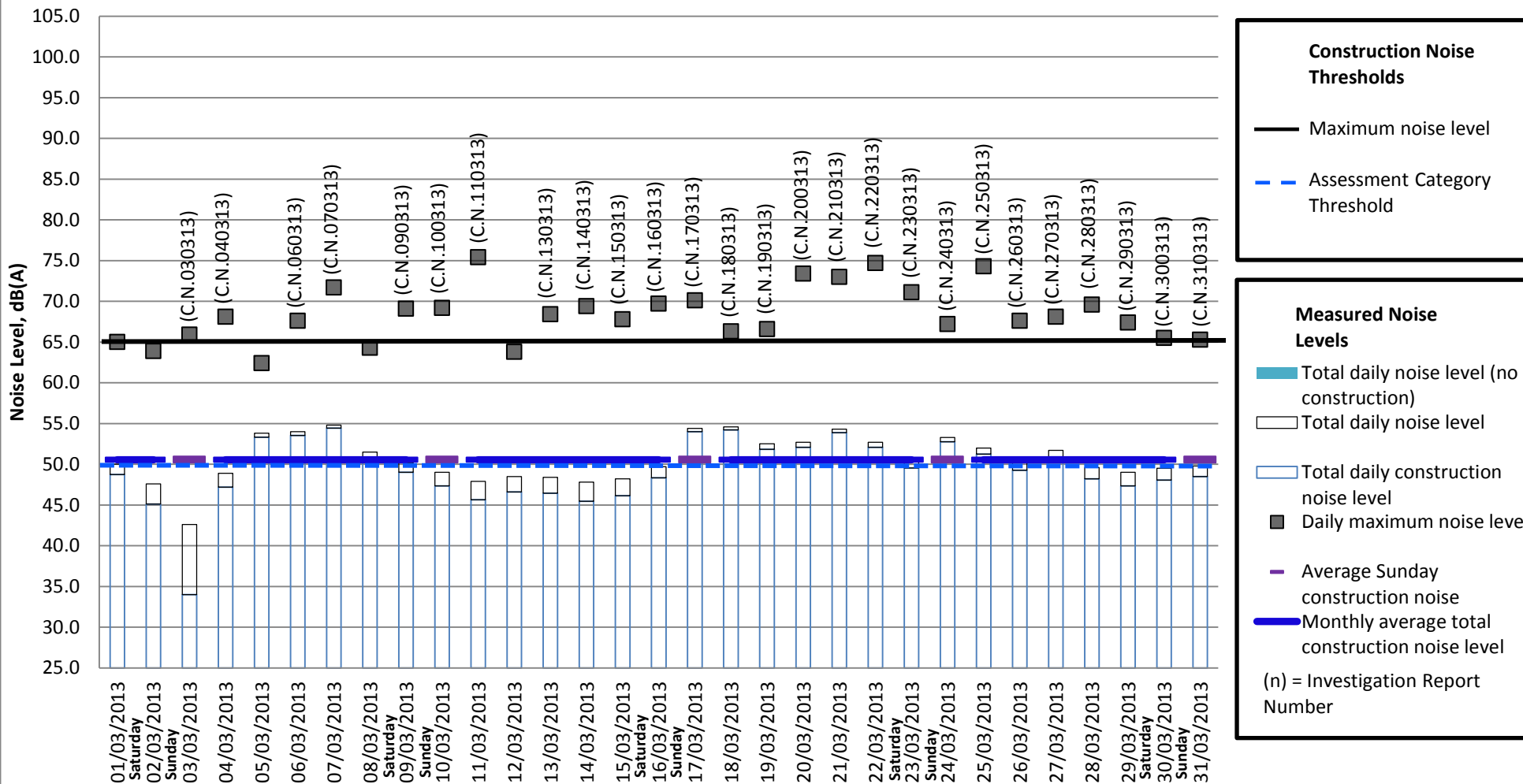
Measured Evening Noise Levels at Clufflat Brae

Measurement period: March 2013



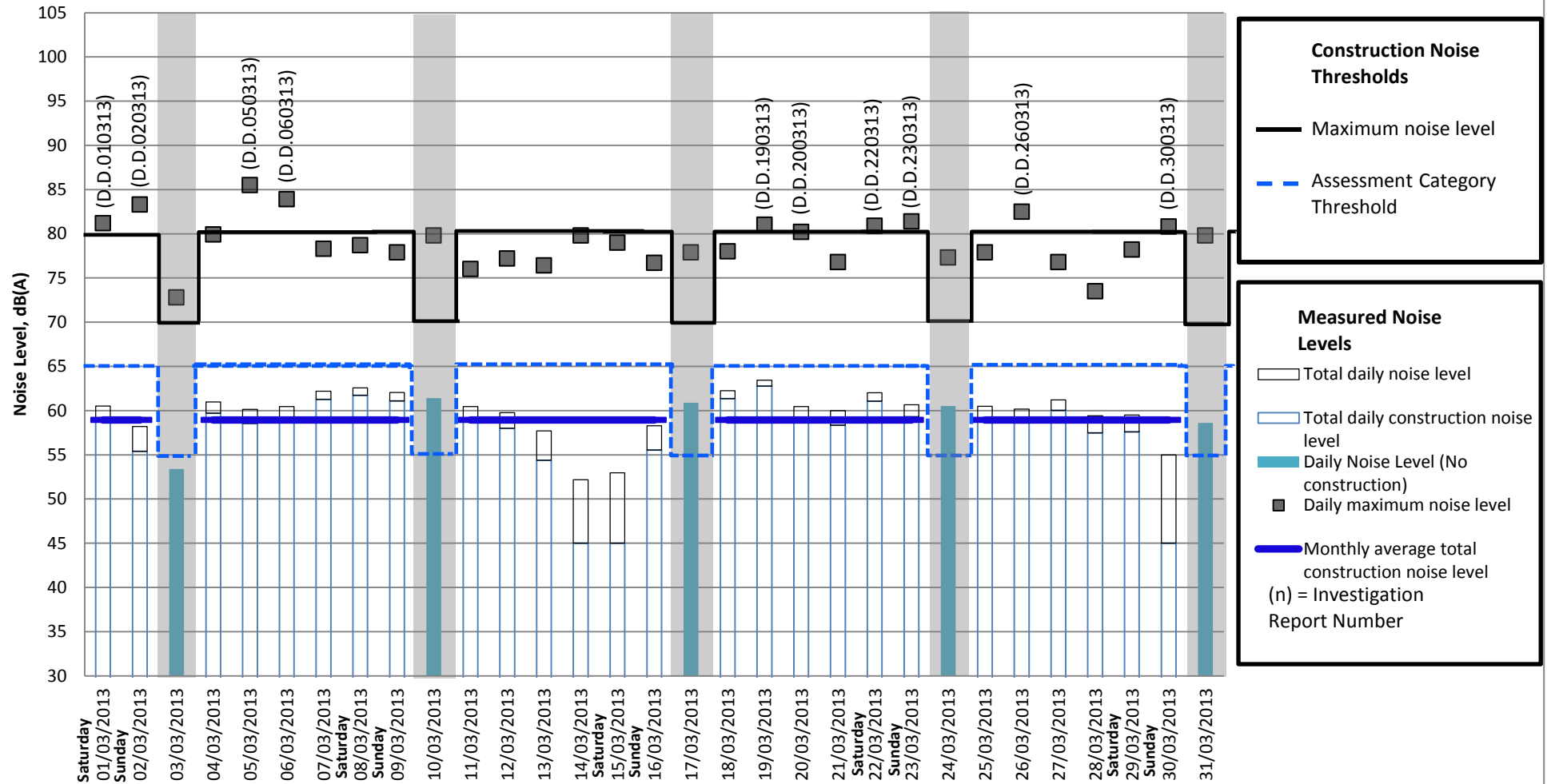
Measured Night-time Noise Levels at Clufflat Brae

Measurement period: March 2013



Measured Daytime Noise Levels at Dundas Home Farm

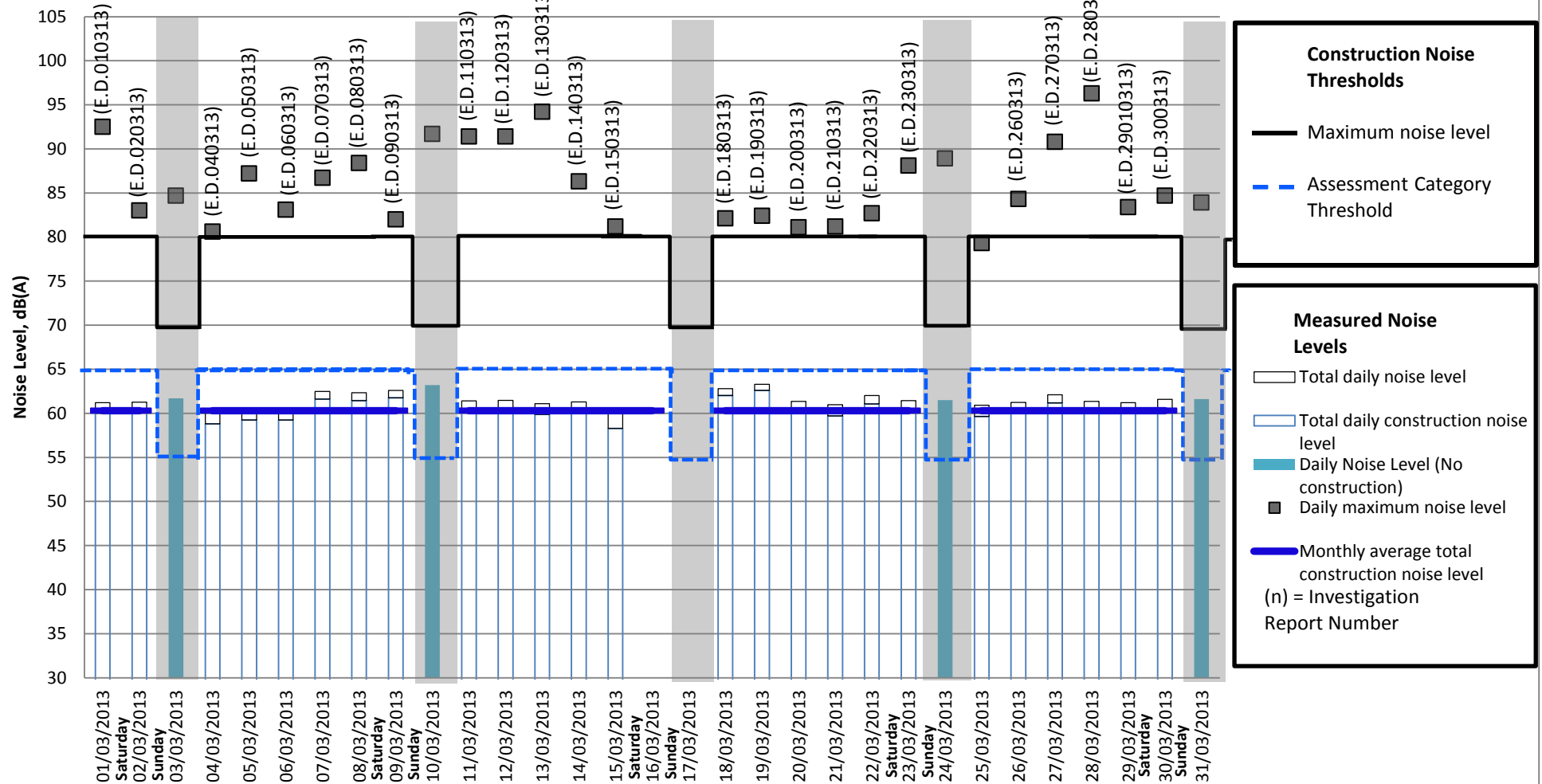
Measurement period: March 2013



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

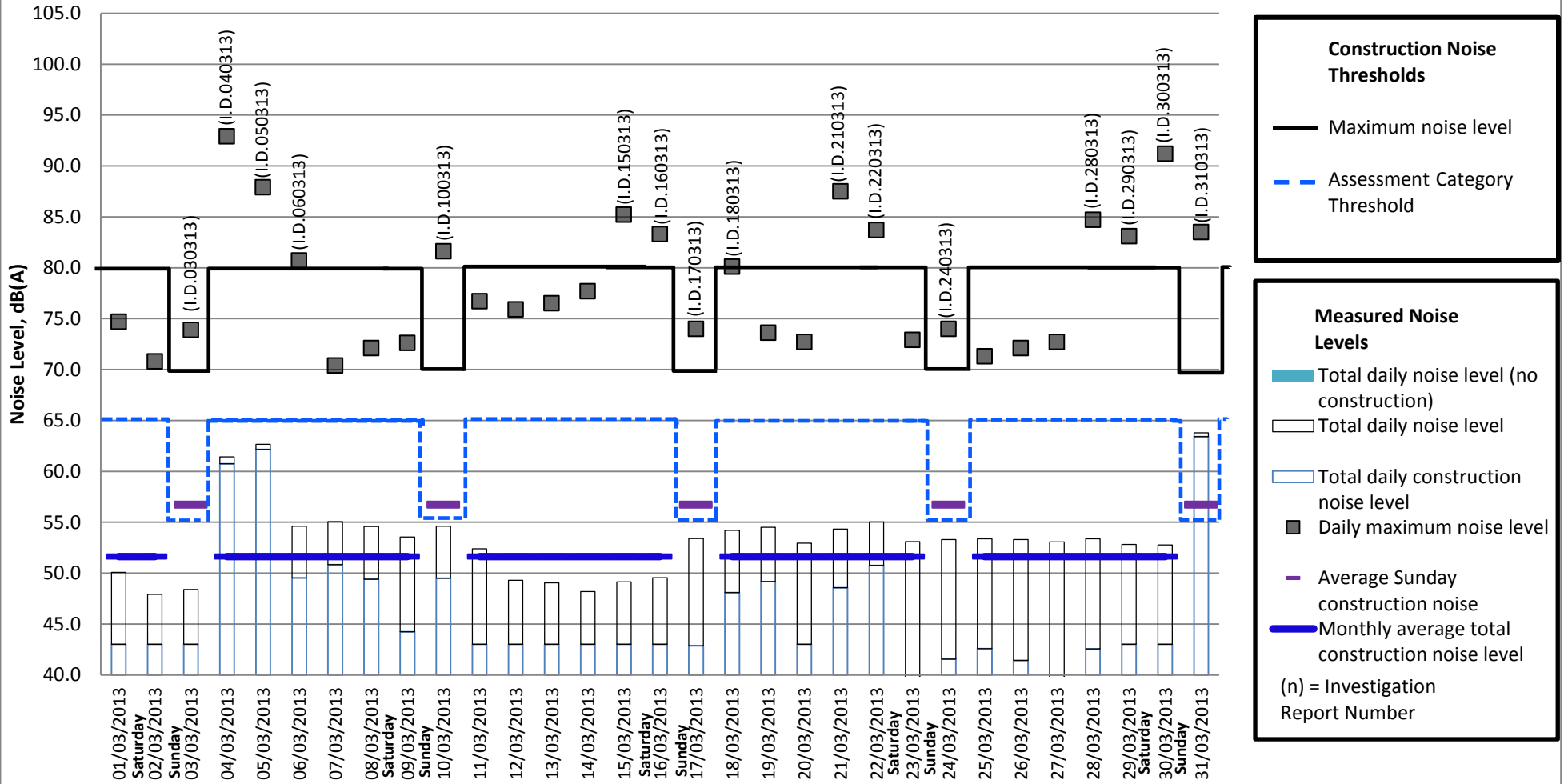
Measurement period: March 2013



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. Data is missing for 16/03/13 and 17/03/13 due to device error.

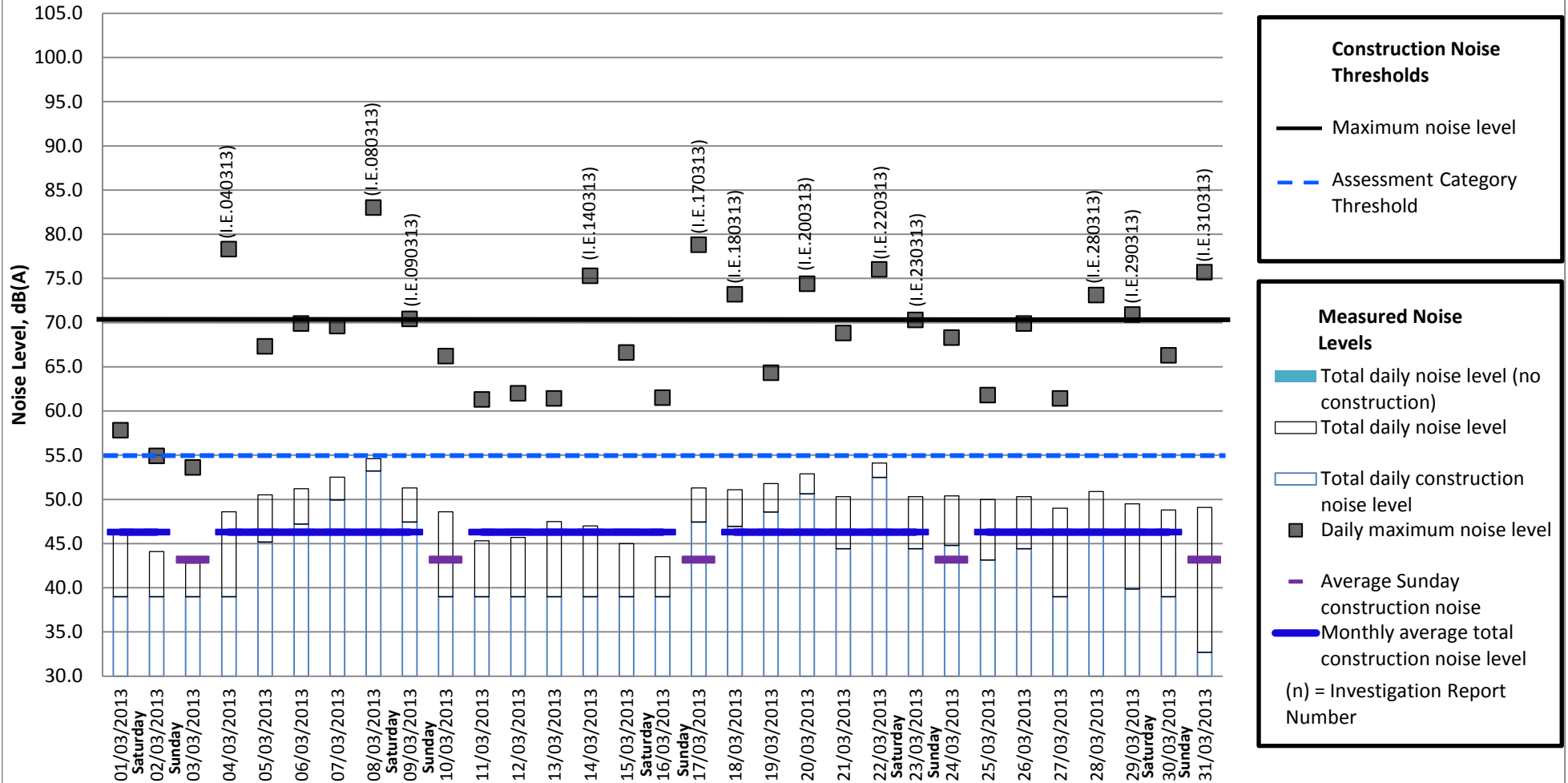
Measured Daytime Noise Levels at Inchgarvie

Measurement period: March 2013



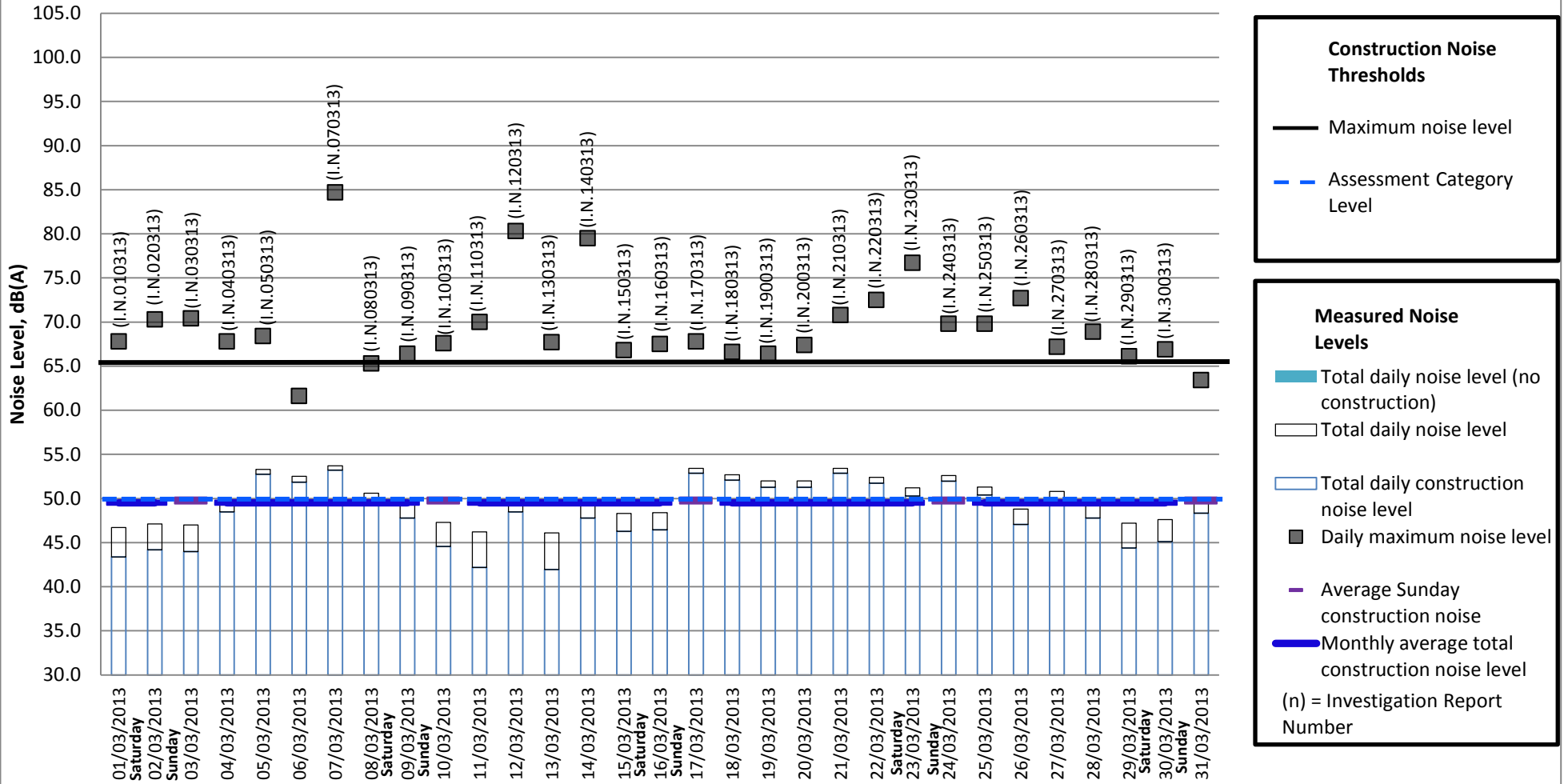
Measured Evening Noise Levels at Inchgarvie

Measurement period: March 2013



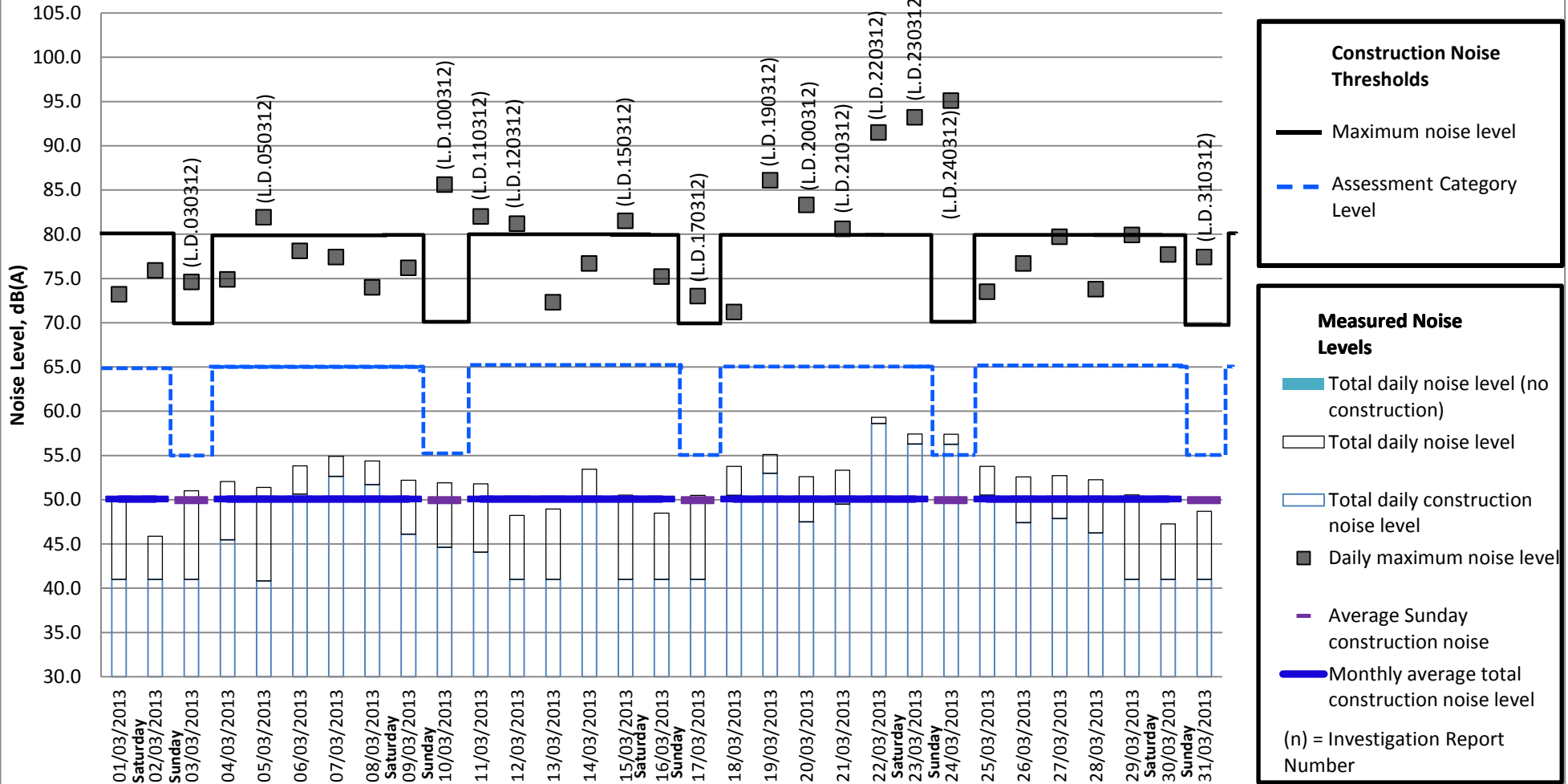
Measured Night-time Noise Levels at Inchgarvie

Measurement period: March 2013



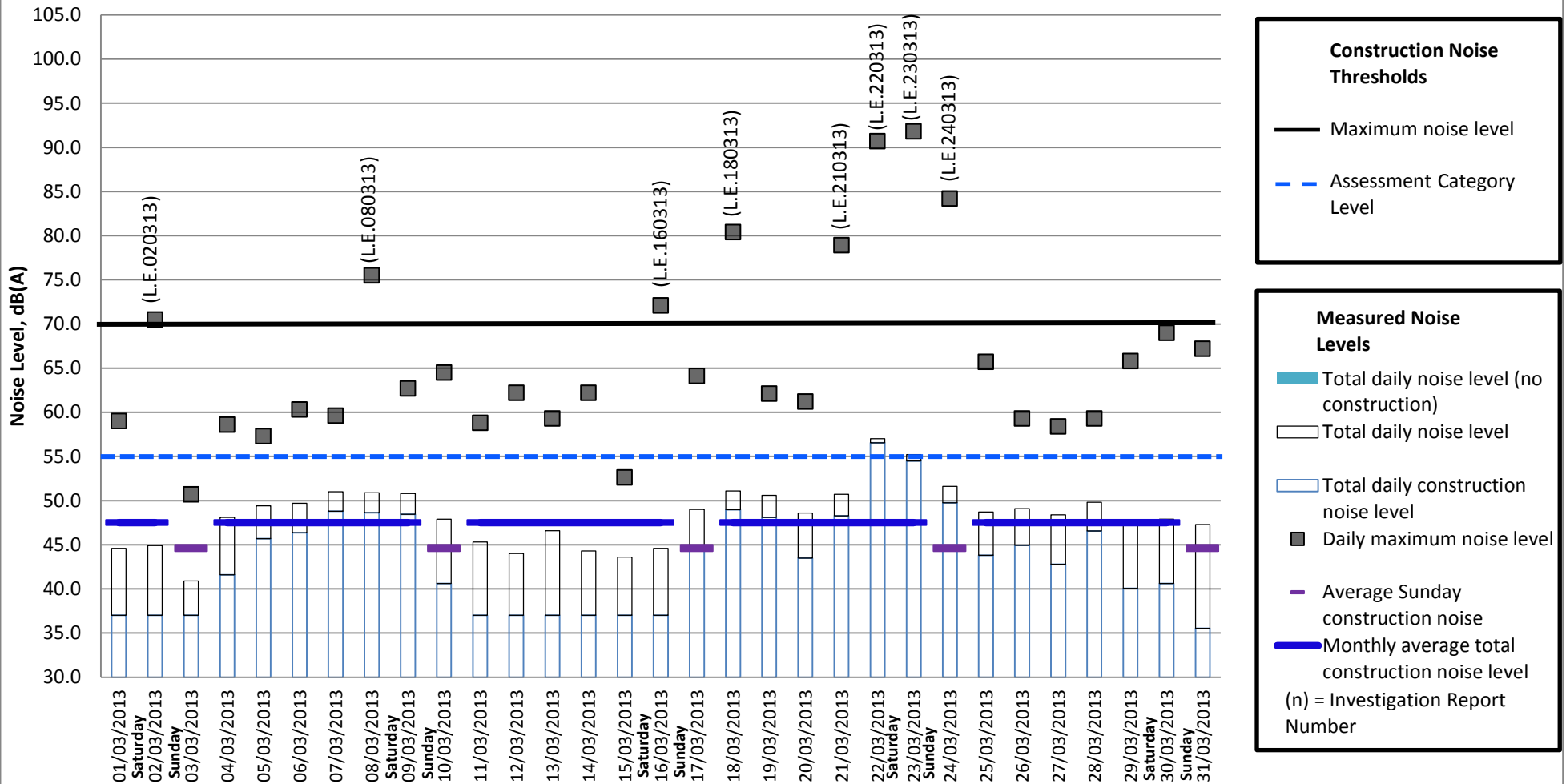
Measured Daytime Noise levels at Linn Mill

Measurement period: March 2013



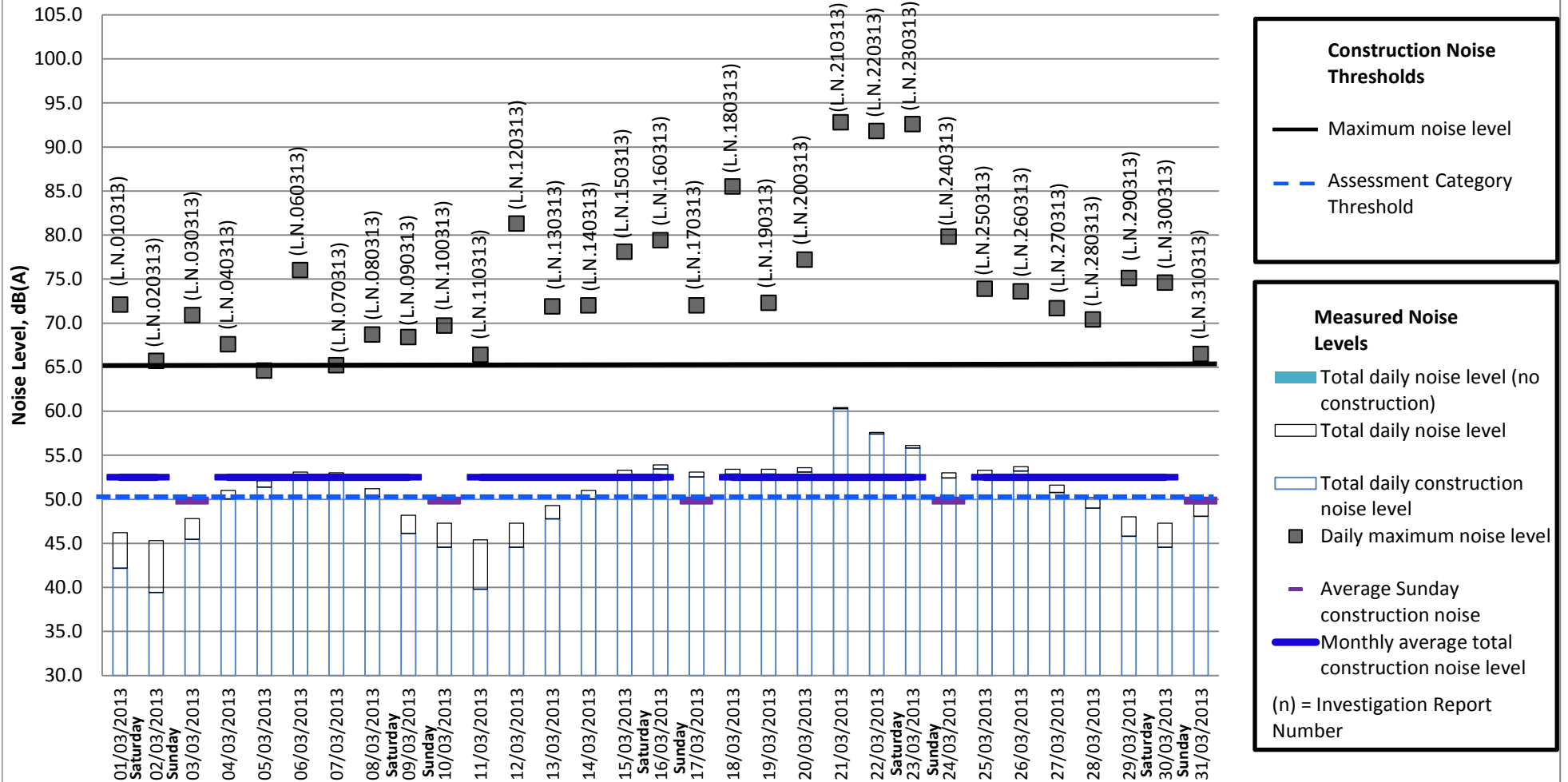
Measured Evening Noise Levels at Linn Mill

Measurement period: March 2013

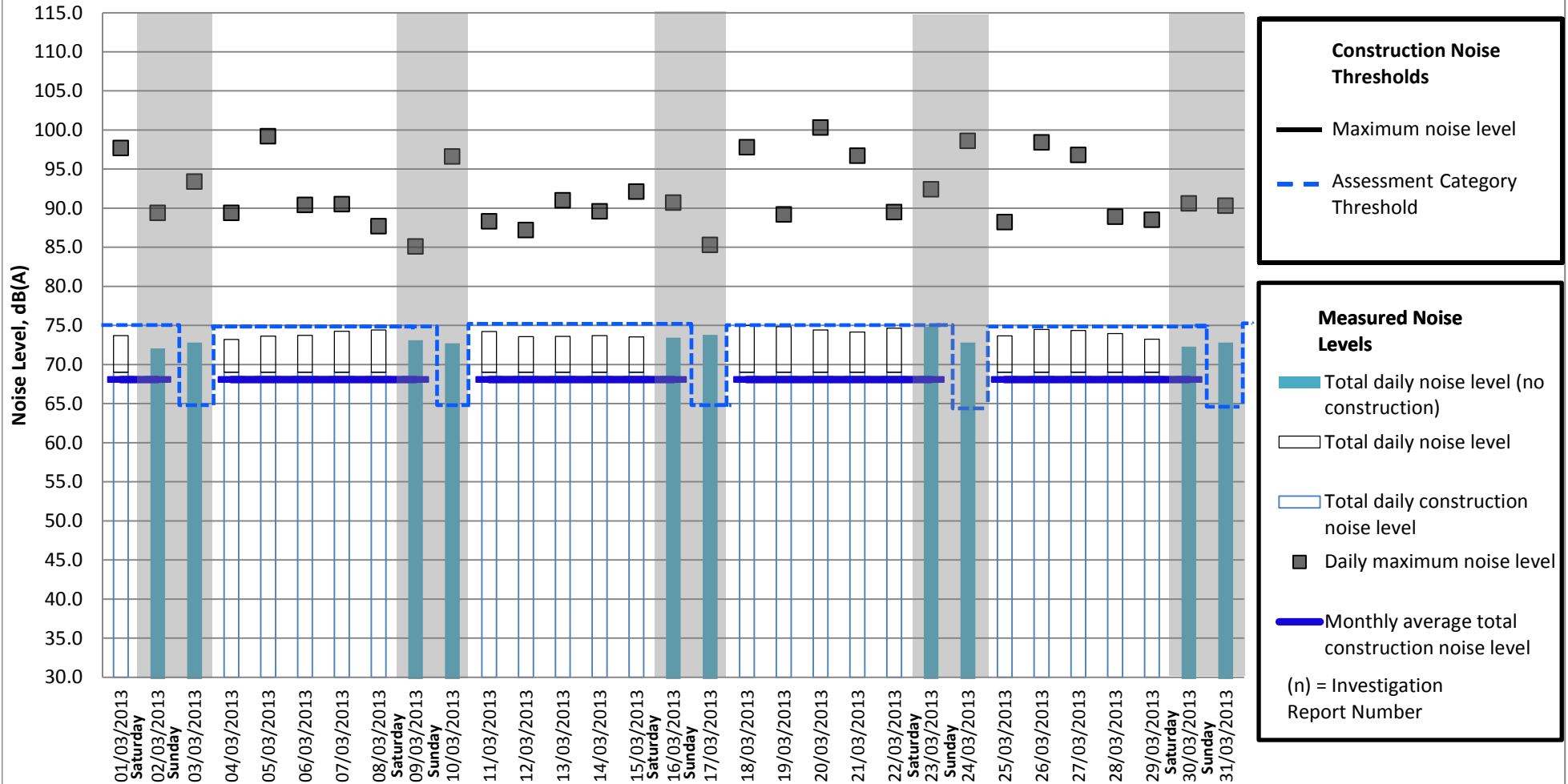


Measured Night-time Noise Levels at Linn Mill

Measurement period: March 2013



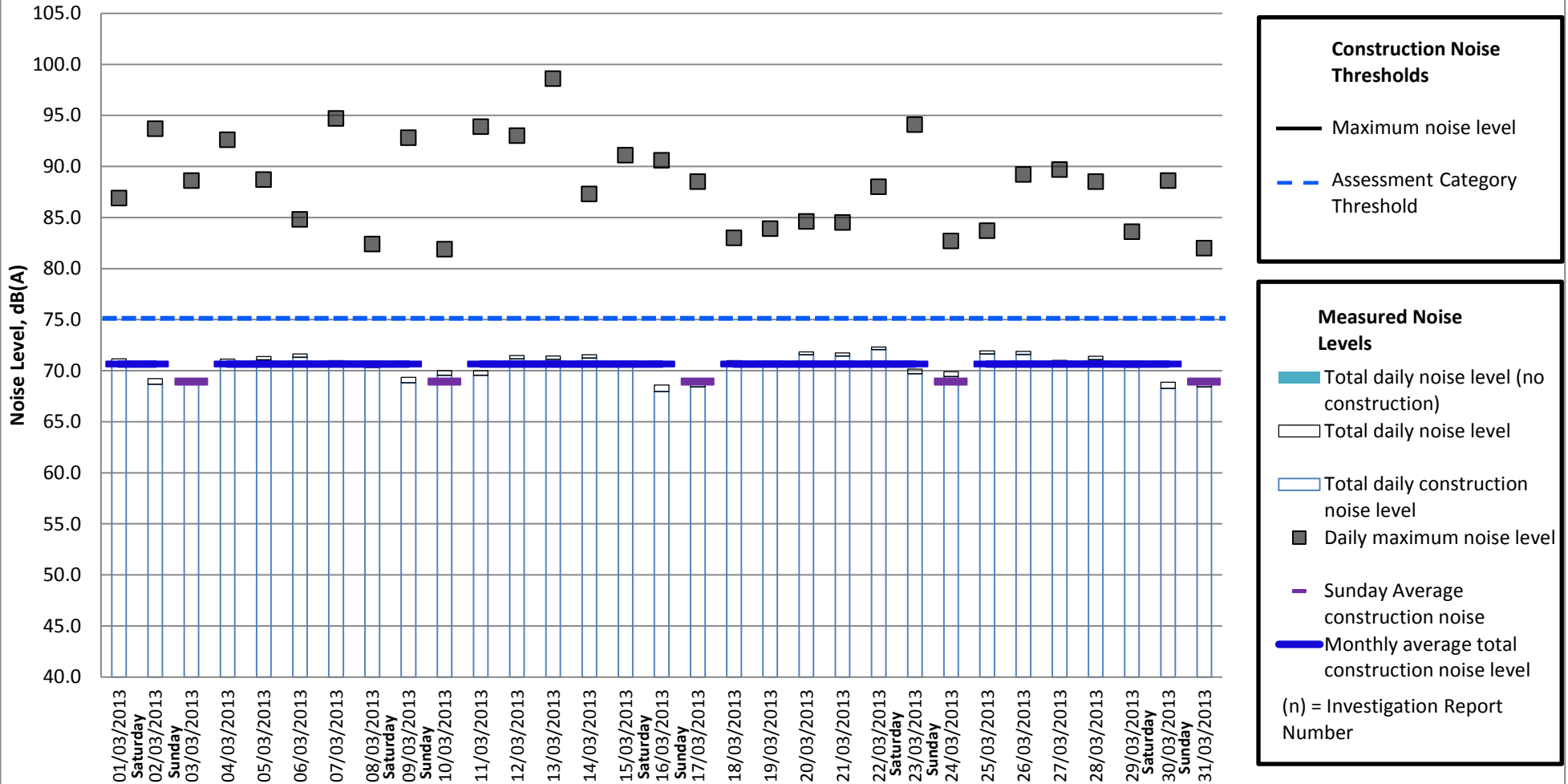
Measured Daytime Noise Levels at Newton Measurement period: March 2013



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.

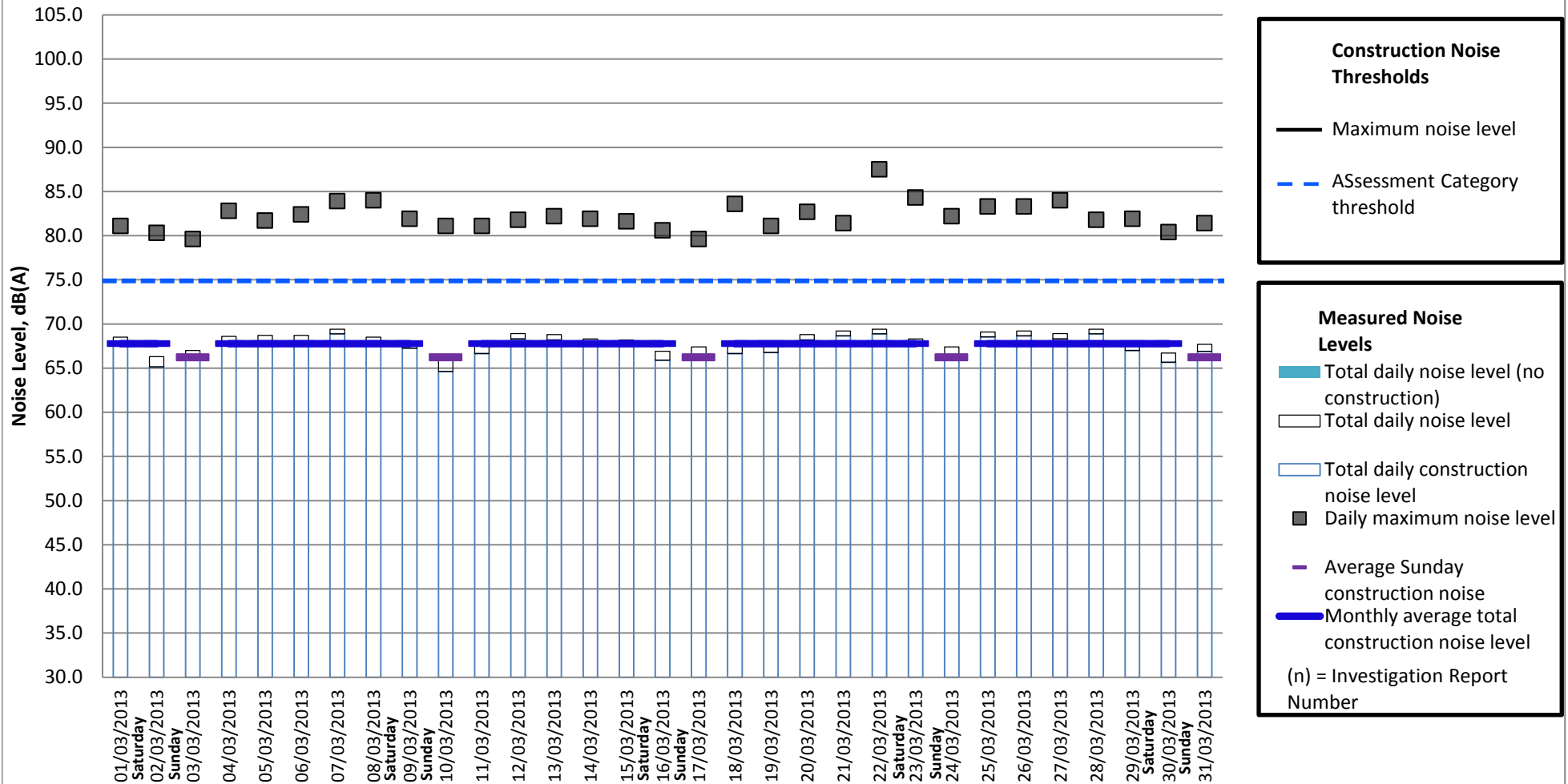
Measured Daytime Noise Levels at North Leg

Measurement period: March 2013



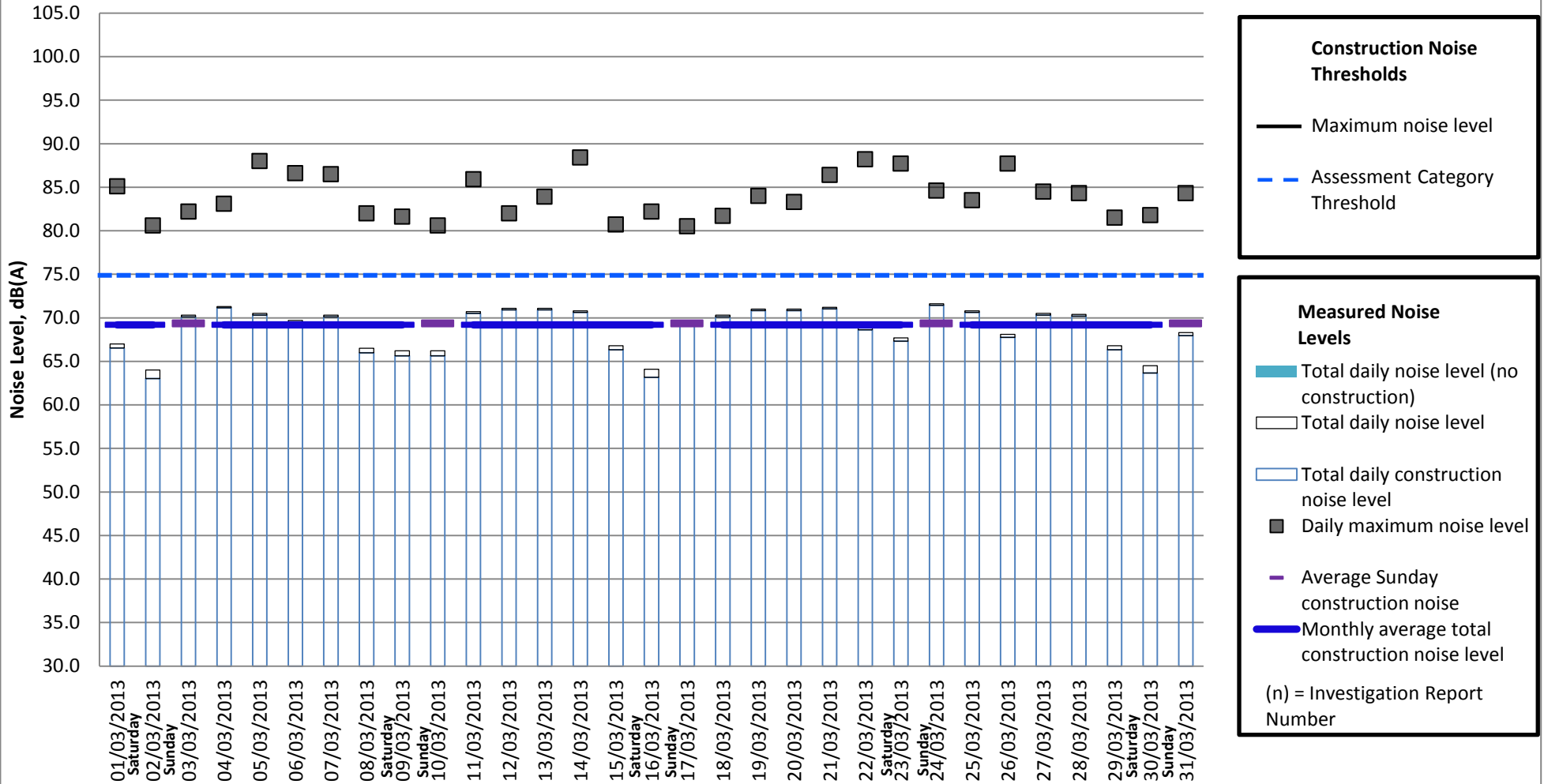
Measured Evening Noise Levels at North Leg

Measurement period: March 2013



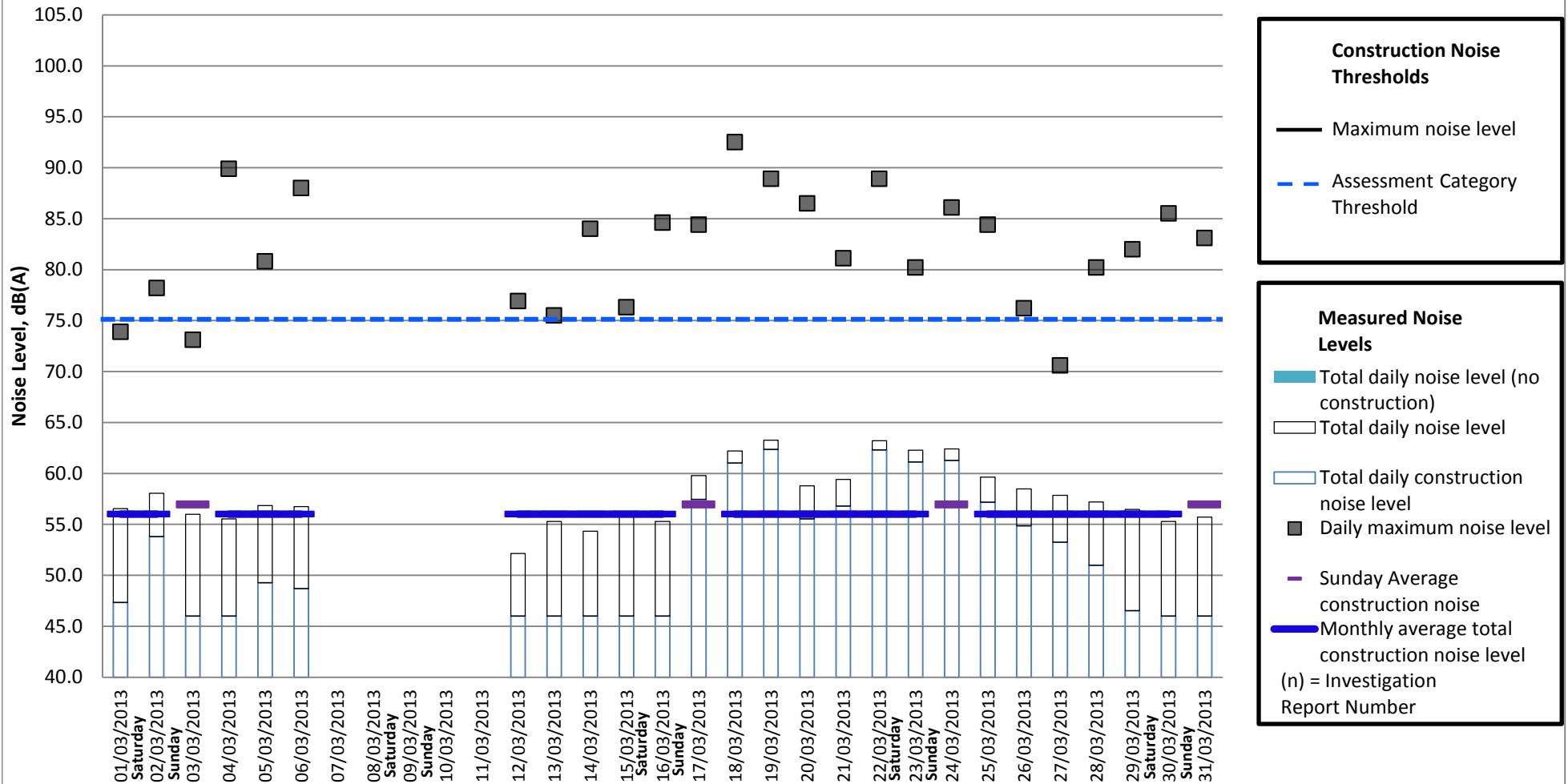
Measured Night-time Noise Levels at North Leg

Measurement period: March 2013



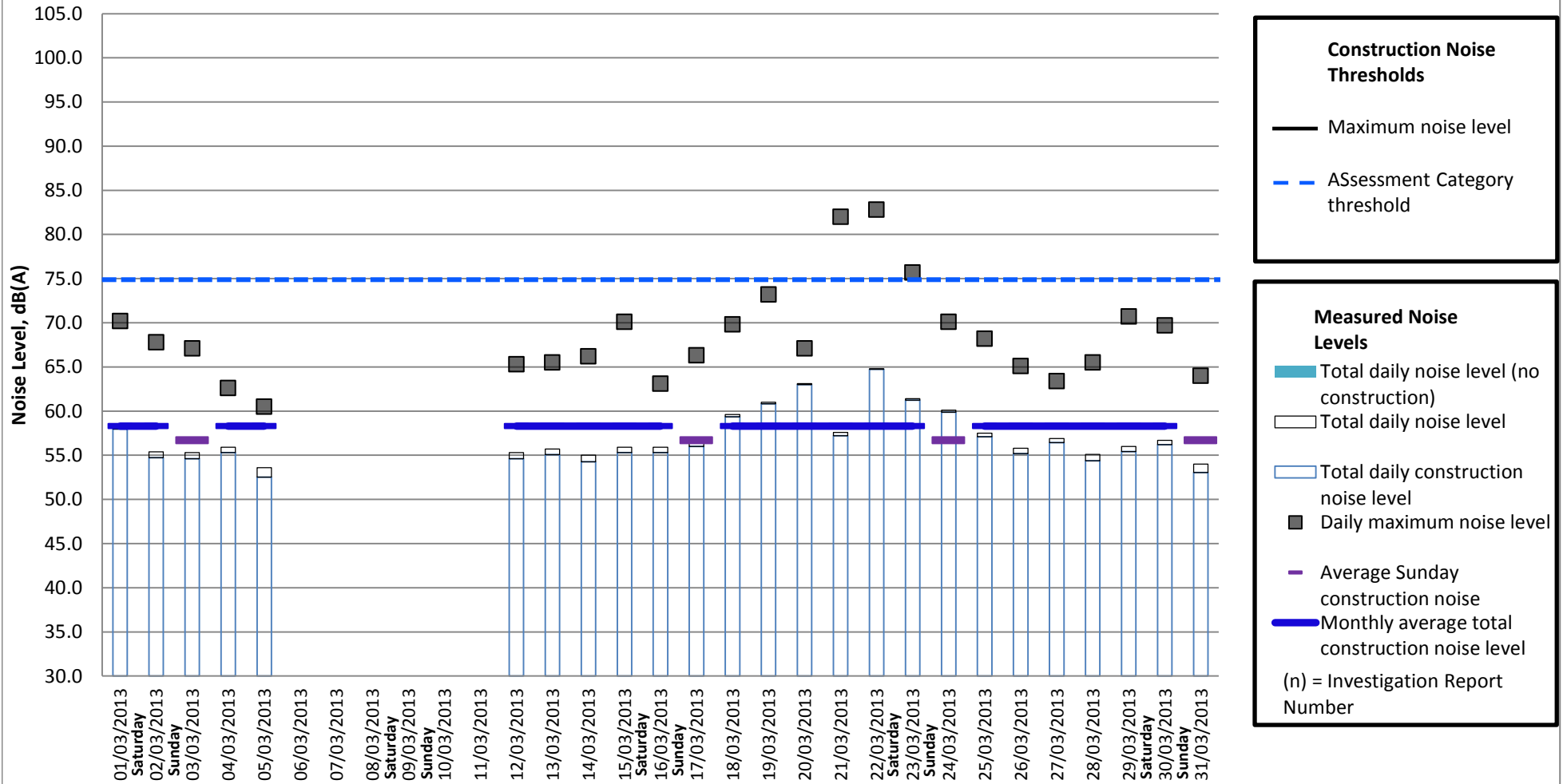
Measured Daytime Noise Levels at Port Edgar

Measurement period: March 2013



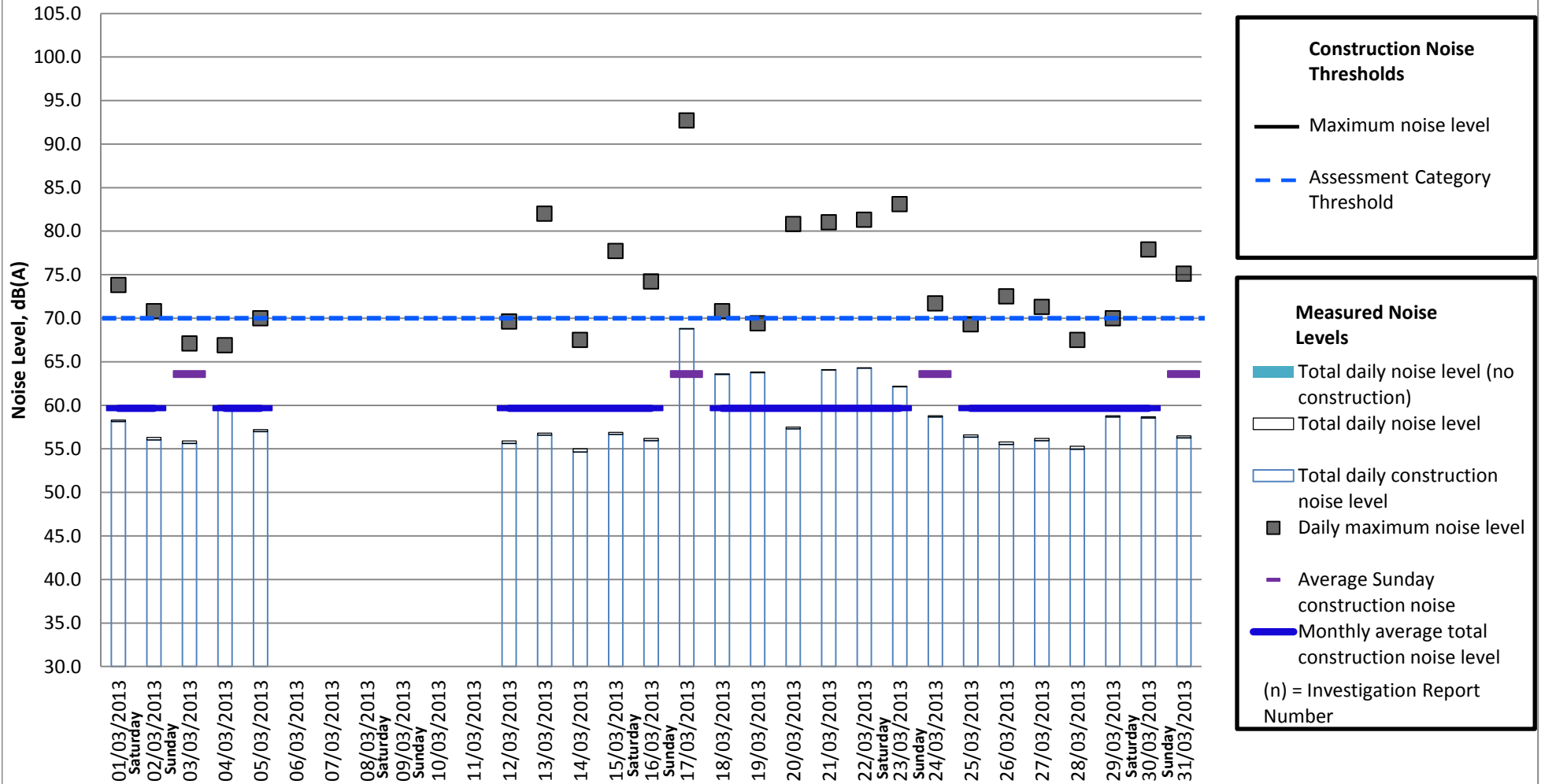
Note: Data is missing between 07/03/13 and 11/03/13 due to device error.

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



Note: Data is missing between 06/03/13 and 11/03/13 due to device error.

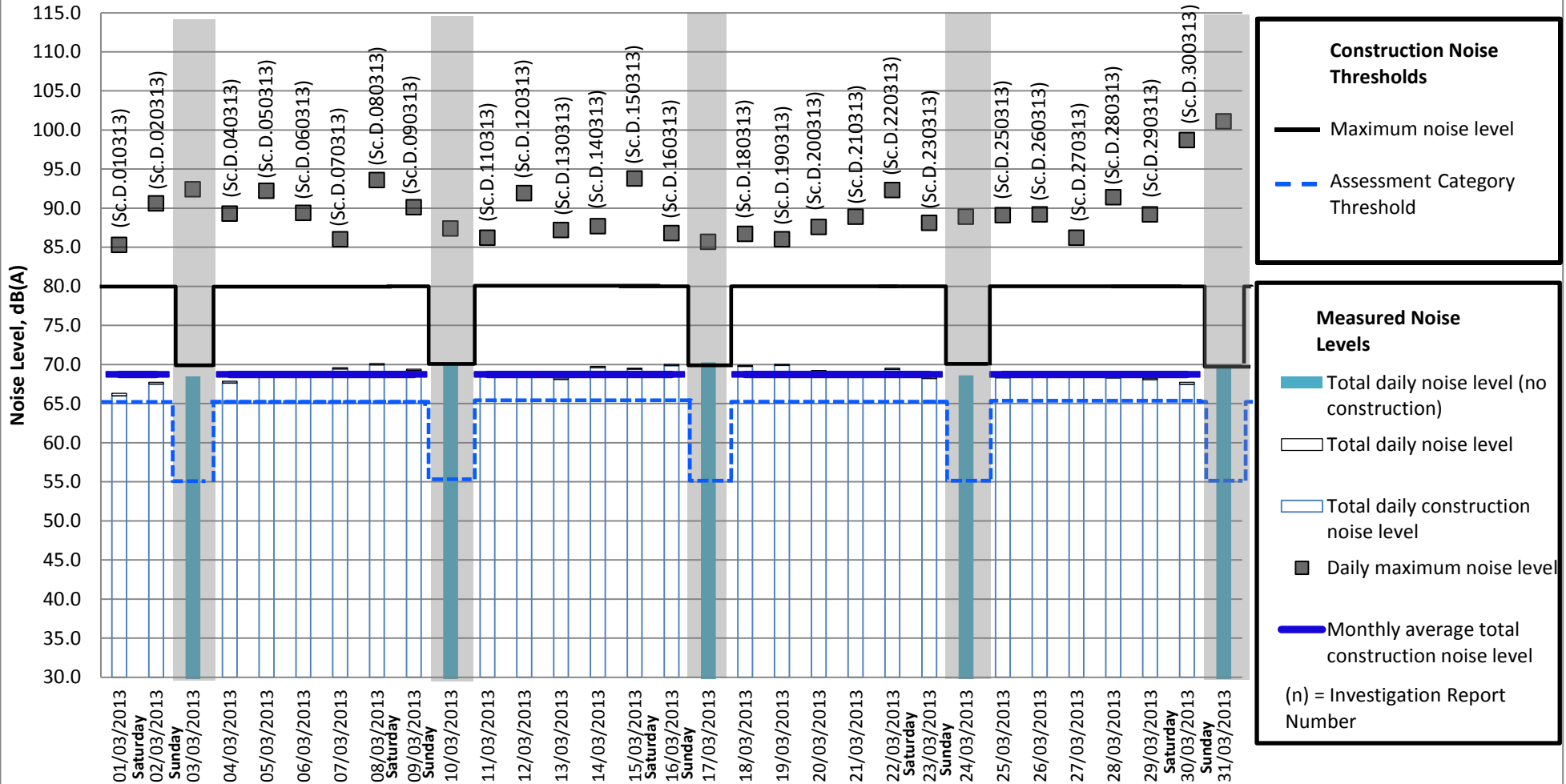
Measured Night-time Noise Levels at Port Edgar Measurement period: March 2013



Note: Data is missing between 06/03/13 and 11/03/13 due to device error.

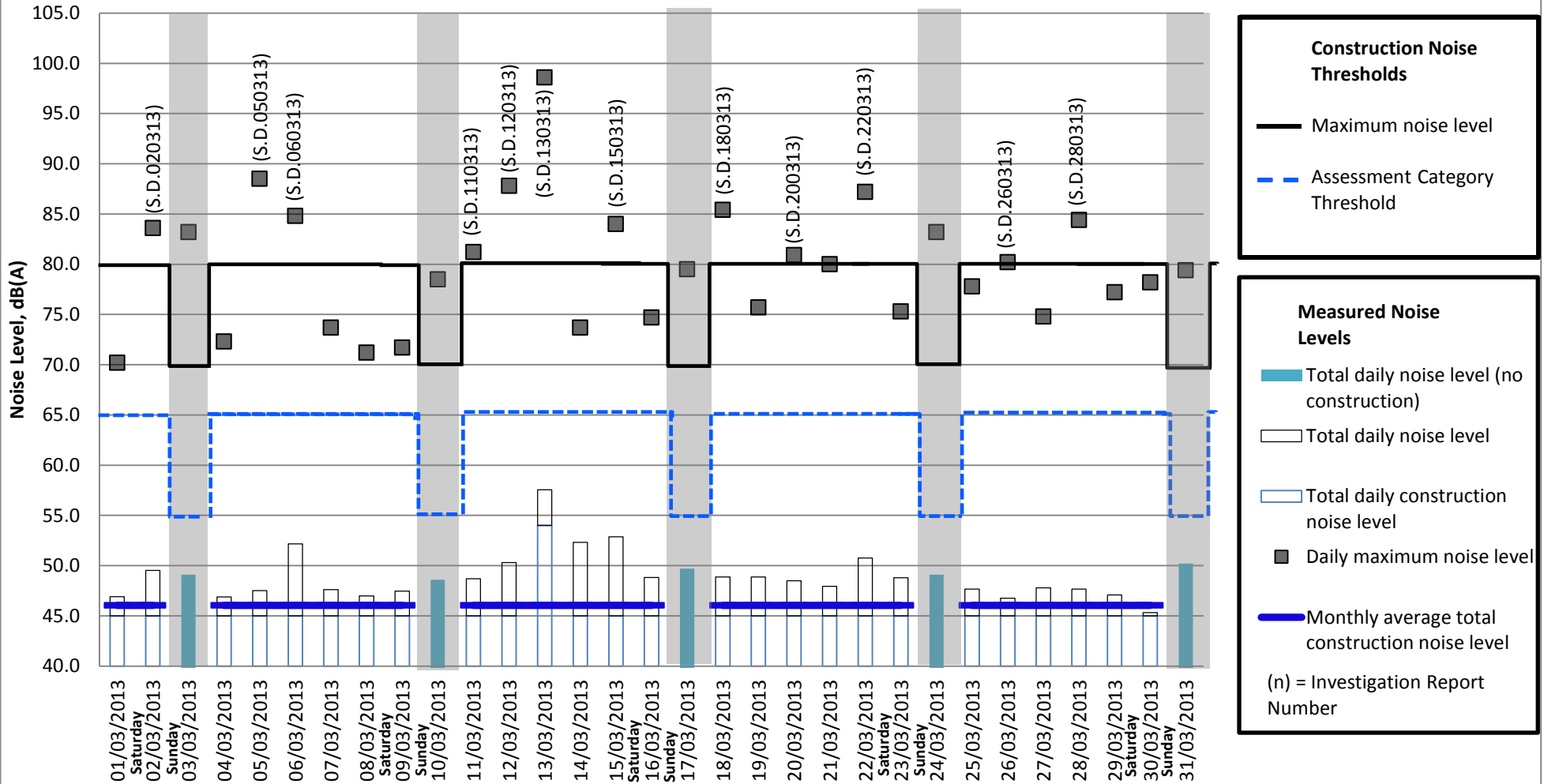
Measured Daytime Noise Levels at Scotstoun

Measurement period: March 2013



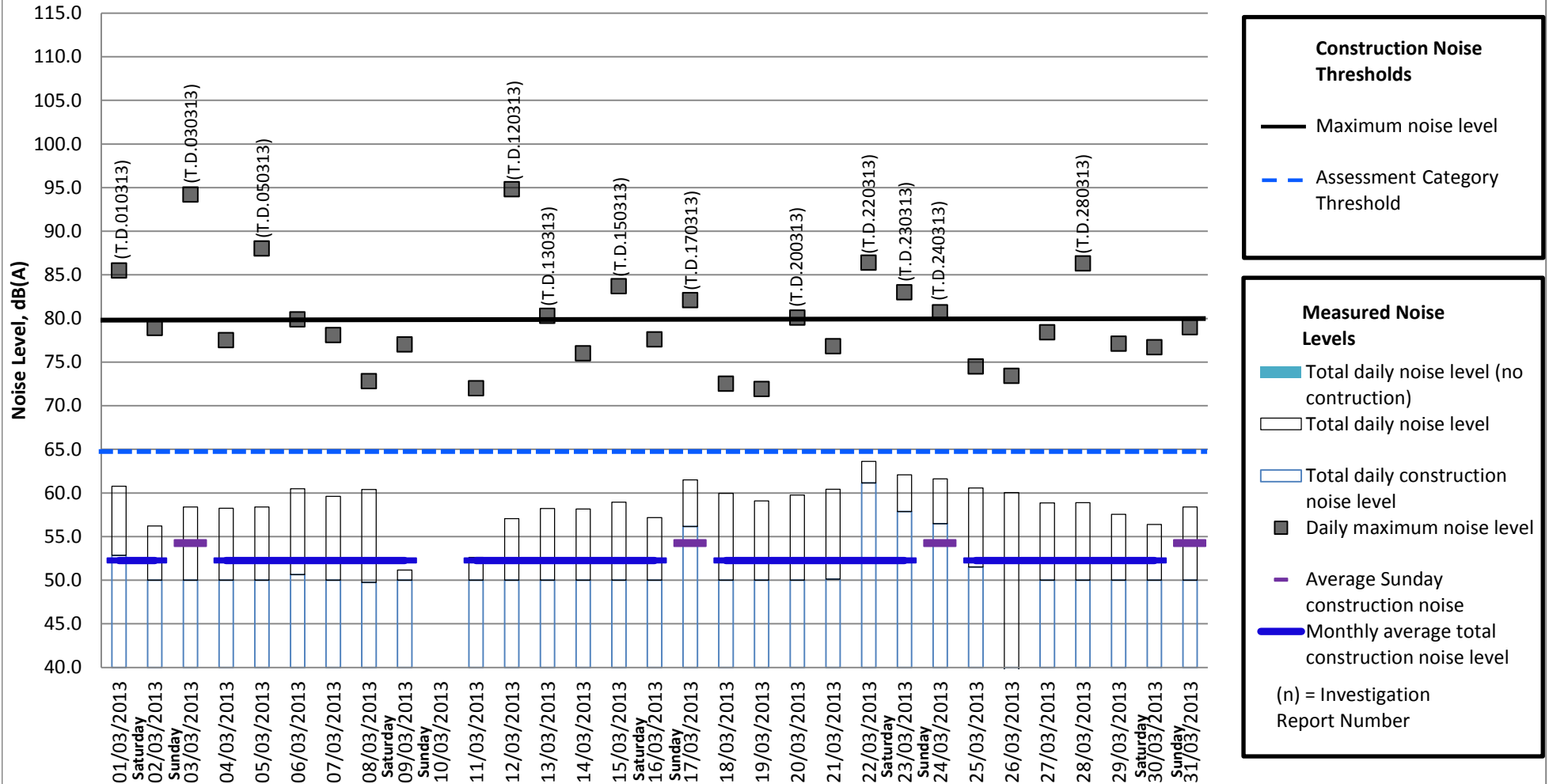
Note: The grey areas of the chart represent days on which no construction works have been conducted. The monthly average construction noise for Sunday has not been included as no Sunday works have been conducted at this location .

Measured Daytime Noise Levels at Springfield Measurement period: March 2013



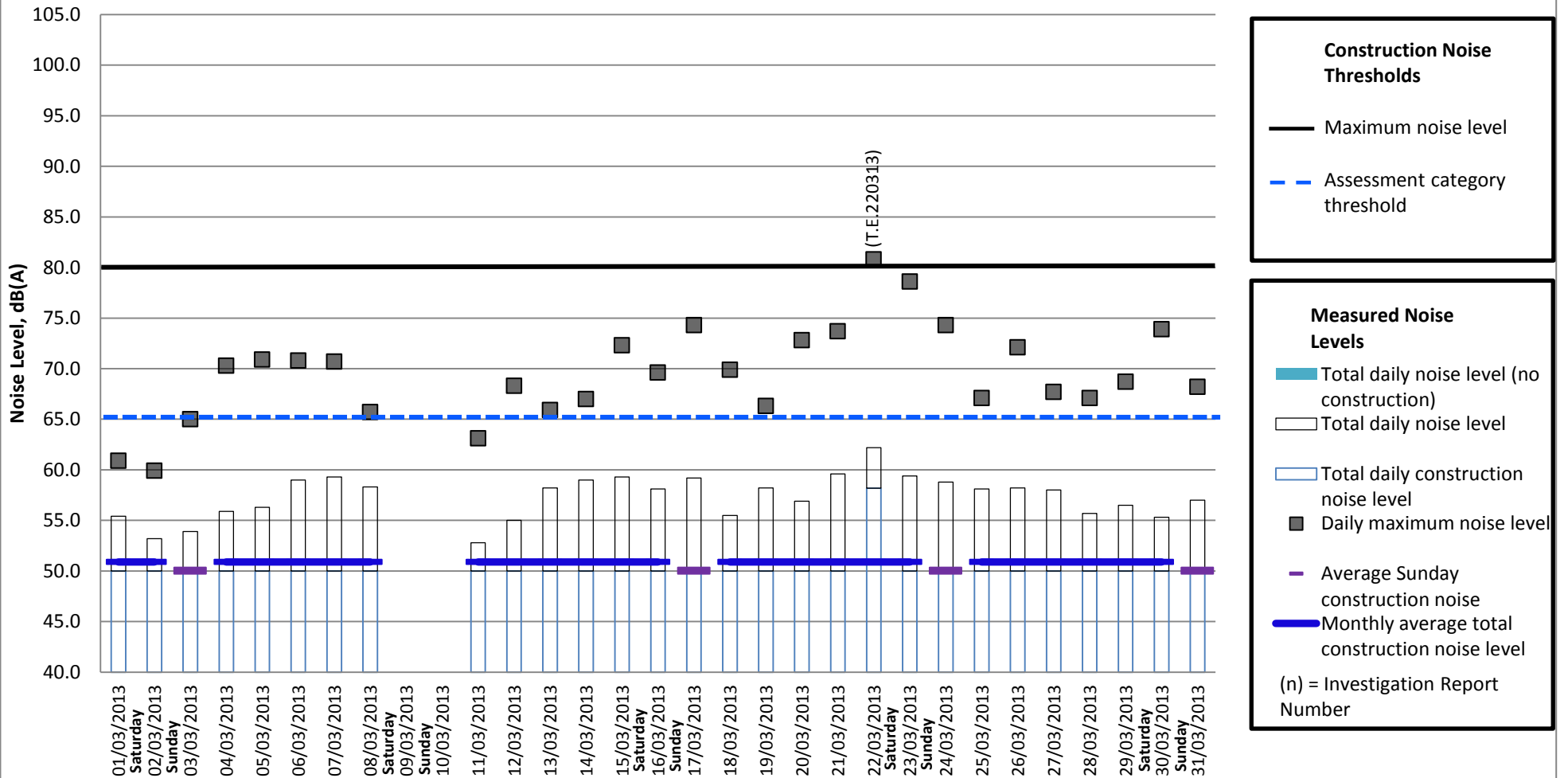
Note: The grey areas of the chart represent days on which no construction works have been conducted. The monthly average construction noise for Sunday has not been included as no Sunday works have been conducted at this location.

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



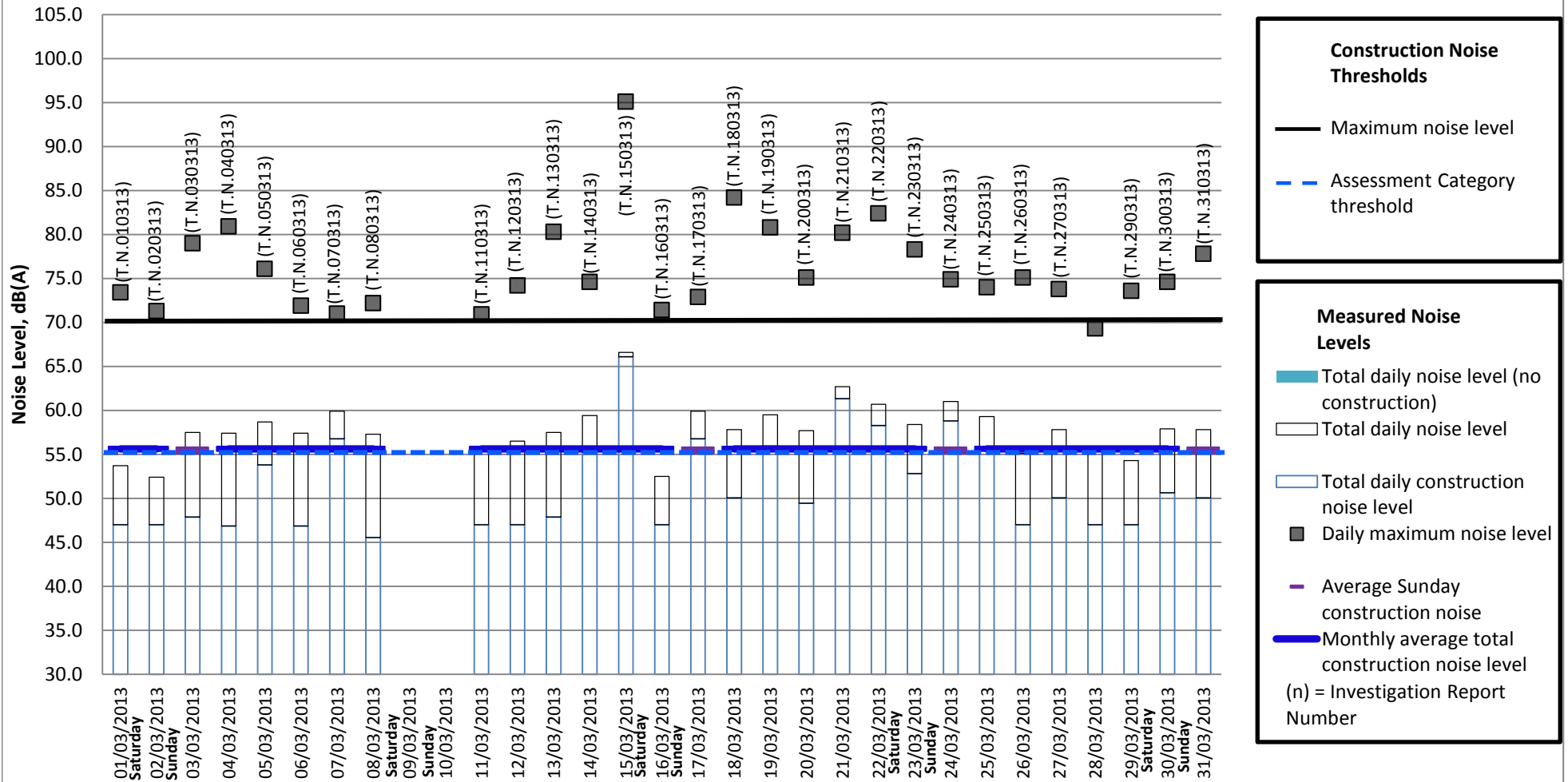
Note: Data is missing on 10/03/13 due to device error

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



Note: Data is missing on 09/03/13 and 10/03/13 due to device error

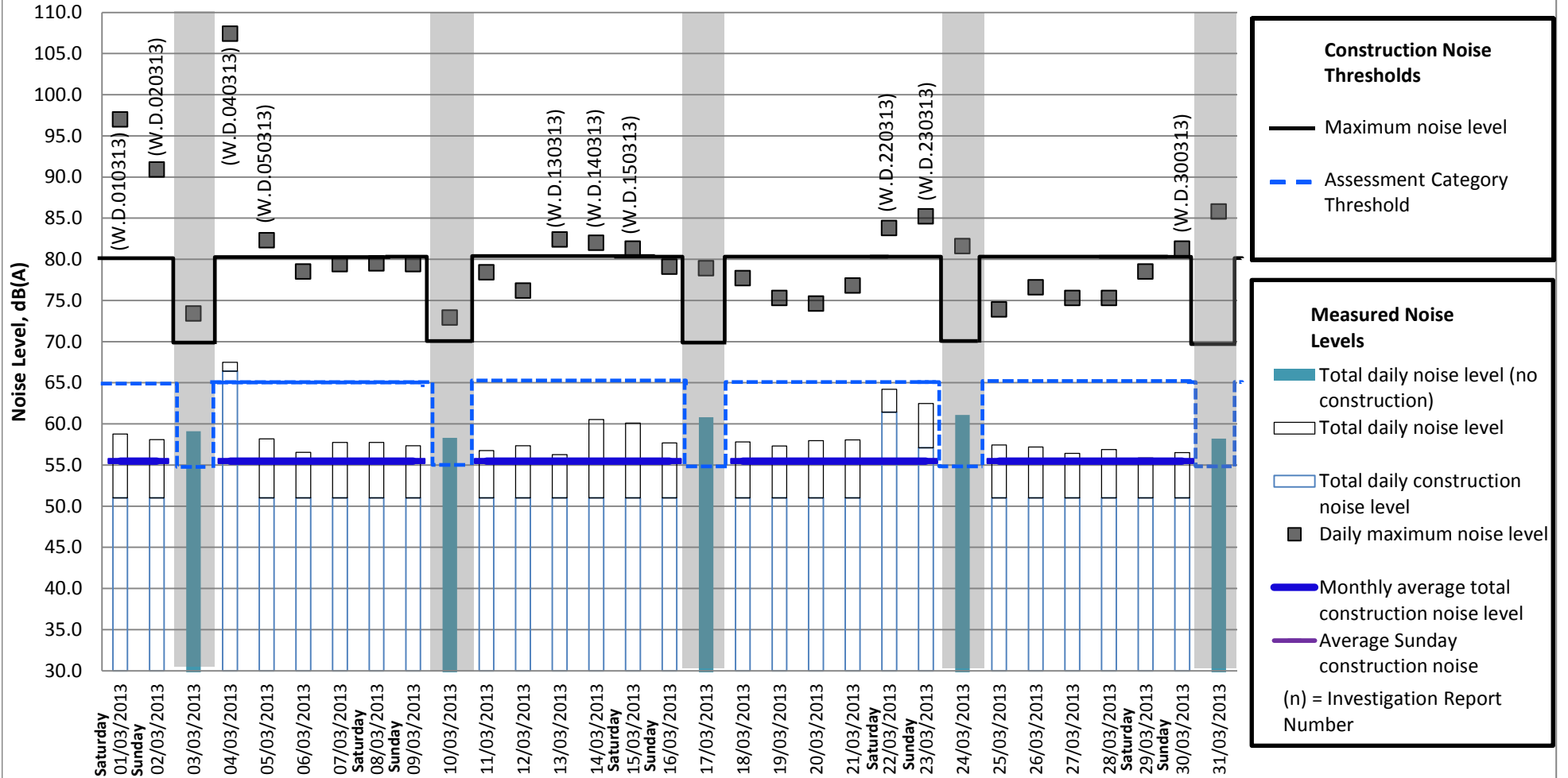
Measured Night-time Noise Levels at Tigh-Na-Grian Measurement period: March 2013



Note: Data is missing on 09/03/13 and 10/03/13 due to device error

Measured Daytime Noise Levels at Whinny Hill

Measurement period: March 2013



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