




Contractor



Forth Crossing Bridge Constructors

HOCHTIEF Solutions
American Bridge International
DRAGADOS
Morrison Construction

Project **FORTH REPLACEMENT CROSSING**

Document title

CONSTRUCTION NOISE MONITORING REPORT: FEBRUARY 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 February 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 February 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 February 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 February 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 February 2013
M1	Whinny Hill	Network	Breaking of rock Loading of rock Drilling and blast 14 N.B. No evening, night time or Sunday daytime construction in vicinity.
M3	Tigh-Na-Grian	Crossing	Placement of Central Tower cofferdam sections North Tower caisson excavation North Tower jet grouting Installation of pier N1 cofferdam
M6	Port Edgar	Crossing	Placement of Central Tower cofferdam sections South Tower jet grouting Pier S1 caisson excavation Pier S4 excavation Installation of Pier S5 cofferdam Pier S6 Piling and excavation works
M7	Butlaw Fisheries	Crossing	Placement of Central Tower cofferdam sections South Tower jet grouting Pier S1 caisson excavation Pier S4 excavation Installation of Pier S5 cofferdam Pier S6 Piling and excavation works Backfilling at S7 & S8 Excavation and rock breaking works at S6 Drilling for de-stressing wells at S6
M10	Inchgarvie Lodge	Crossing	Placement of Central Tower cofferdam sections South Tower jet grouting Pier S1 caisson excavation Pier S4 excavation Installation of Pier S5 cofferdam Pier S6 Piling and excavation works Backfilling at S7 & S8 Excavation at launch Temporary drainage works at launch Works at South Abutment, including placing of structural backfill and erection of reinforcement
M11	Linn Mill	Network (close proximity to Crossing)	Excavation at launch Temporary drainage works at launch Works at South Abutment, including placing of structural backfill and erection of reinforcement

M13	Clufflat Brae	Crossing	Excavation at launch Temporary drainage works at launch Works at South Abutment, including placing of structural backfill and erection of reinforcement
M14	Springfield	Network	Excavation at launch Temporary drainage works at launch Generate rock at Queensferry gyratory N.B. No evening, night time or Sunday daytime construction in vicinity.
M15	Echline Field	Network	Excavation at launch Temporary drainage works at launch Generate rock at Queensferry gyratory Soil strip at A904 N.B. No evening, night time or Sunday daytime construction in vicinity.
M16	Scotstoun	Network	Drainage works Spread of material from launch at North-bound bus link N.B. No evening, night time or Sunday daytime construction in vicinity.
M17	Dundas Home Farm	Network	Utilities works Soil strip Topsoil bund 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 February resulting in loss of data for short periods at the following locations: Butlaw Fisheries, Linn Mill and Scotstoun. Device errors at Port Edgar and the North Leg also resulted in longer periods of missing data. Additionally, due to a power failure that was out with FCBC control, data is missing for a short period at Butlaw Fisheries. Due to an internal server issue, downloaded data from Scotstoun was lost for Scotstoun at the end of February.

- 3.3** Results demonstrate that the monthly average total construction noise results for daytime were within the threshold limits for all monitoring locations for February 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 February 2013. For night-time, results show exceedances of the threshold at Butlaw Fisheries, 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 the Sunday daytime and evening averages at Butlaw Fisheries, and also for the Sunday night time average at the following locations: Butlaw Fisheries, Clufflat Brae, Linn Mill and Tigh-Na-Grian. 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, with the exception of Scotstoun, can be attributed to increased noise levels due to adverse weather conditions during February. For Butlaw, waves on the shore also exacerbated these noise levels. 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. In each instance, removing data affected by adverse weather lowers the averages below the threshold values at the nearest sensitive receptors.
- 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 February 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.

- 3.8** 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 February 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 February due to network connection works. All of the exceedances were found to be attributable to plant operating in close proximity to the meters, with two exceedances recorded at Linn Mill and two recorded at Springfield.
- 3.11** Marine works were found to be attributable for a total of 13 exceedances. Two exceedances were recorded at Tigh-Na-Grian; these were caused by the repositioning of the jet grouting working platform. Works at the Pier S1 caisson were also found to be the cause of two evening exceedances and 9 night time exceedances at Butlaw Fisheries during February.
- 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 February the maximum noise threshold was exceeded on 40 occasions (daytime, 8; evening, 10; night time, 22). Two evening and nine 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 February the maximum noise threshold was exceeded on 40 occasions (daytime, 11; evening, 9; night time, 20). No exceedances were attributable to construction works. Exceedances were found to be largely due to wind, though birds and children playing were also found to cause exceedances of the threshold.
Inchgarvie Lodge	During February the maximum noise threshold was exceeded on 38 occasions (daytime, 15; evening, 13; night time, 10). No exceedances were found to be due to construction works. However, investigations found movements at the property and birds to be the main contributing factors to the exceedances at this location.
Linn Mill	During February the maximum noise threshold was exceeded on 32 occasions (daytime, 6; evening, 7; night time, 19). Two exceedances were due to construction works in close proximity of the meter. However, the majority of exceedances were caused by adverse weather conditions and birds.
Tigh-Na-Grian	During February the maximum noise threshold was exceeded on 30 occasions (daytime, 10; evening, 0; night time, 20). Two night time exceedances was found to be due to construction works; these were caused by the repositioning of the jet grouting working platforms. However, other exceedances were also due to non-construction factors including works at neighbouring properties and the existing Forth Road Bridge, wind and birds.
Dundas Home Farm	During February the maximum noise threshold was exceeded on 4 occasions. Exceedances were not attributable to construction works. Exceedances were due to monitor maintenance, crow bangers and birds.
Echline	During February the maximum noise threshold was exceeded on 23 occasions. No exceedances at this location were due to construction activities. Exceedances were largely attributed to vehicles passing by on the adjacent roads, with additional exceedances caused by dogs and monitor maintenance.
Springfield	During February the maximum noise threshold was exceeded on 11 occasions. Two exceedances at this location were due to construction activities in close proximity to the meter. The majority of non-construction related exceedances were due to local residents, including children playing, wind and birds.
Scotstoun	During February the maximum noise threshold was exceeded on 13 occasions. Exceedances were attributed to vehicles passing by on the adjacent road.

Whinny Hill	During February the maximum noise threshold was exceeded on 7 occasions. Exceedances were not due to construction activities. A range of factors were found to cause exceedances at this location, including wind, residents and birds.
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Table 3: Summary of Construction Exceedances at Monitoring Locations

Monitor	Date	Period	Description	NVIR No.
Butlaw Fisheries	01/02/13	Evening	Works at Pier South 1 Caisson	B.E.010213
	16/02/13			B.E.160213
	08/02/13	Night		B.N.080213
	12/02/13			B.N.120213
	15/02/13			B.N.150213
	16/02/13			B.N.160213
	17/02/13			B.N.170213
	18/02/13			B.N.180213
	21/02/13			B.N.210213
	25/02/13			B.N.250213
	26/02/13			B.N.260213
Tigh-Na-Grian	06/02/13	Night	Repositioning of jet grouting working platform	T.N.060213
	16/02/13			T.N.160213
Linn Mill	18/02/13	Day	Plant operating in close proximity to monitor	L.D.180213
	20/02/13			L.D.200213
Springfield	18/02/13	Day	Plant operating in close proximity to monitor	S.D.180213
	23/02/13			S.D.230213



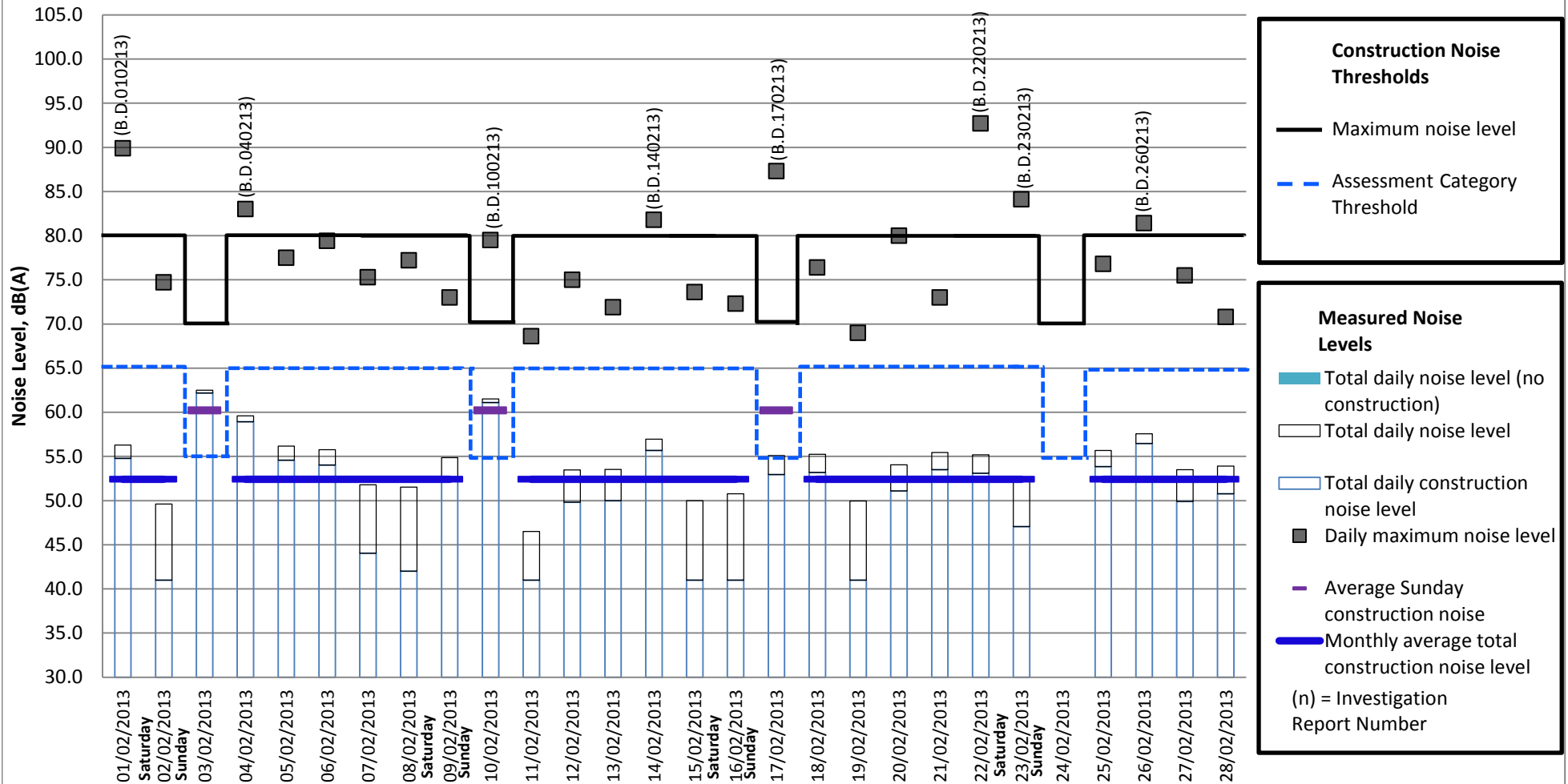
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APPENDIX A

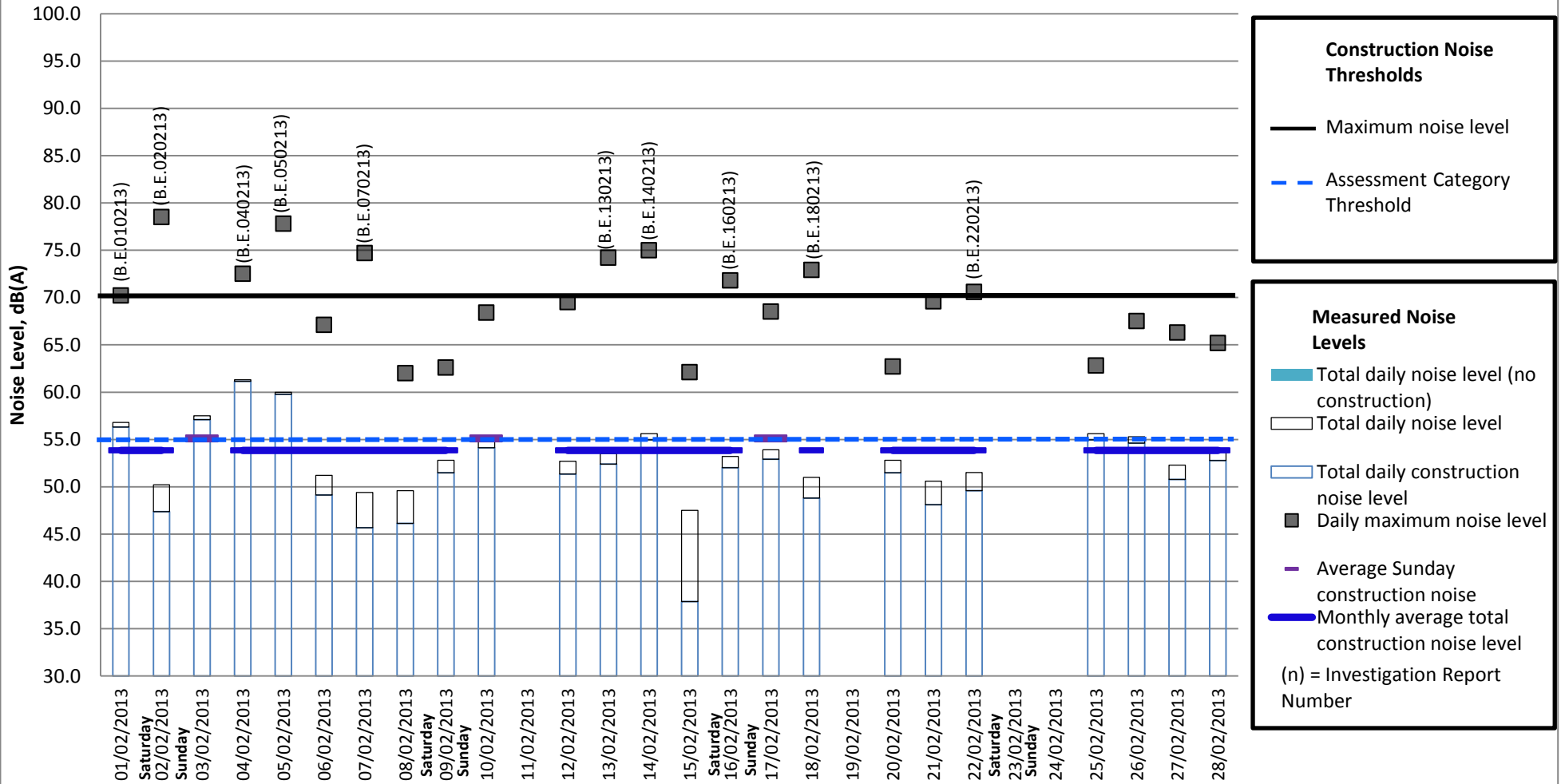
Measured Daytime Noise Levels at Butlaw Fisheries

Measurement period: February 2013



Note: Data is missing on 24/02/13 due to a power failure . Lmax data is missing for 03/02/13 due to device error.

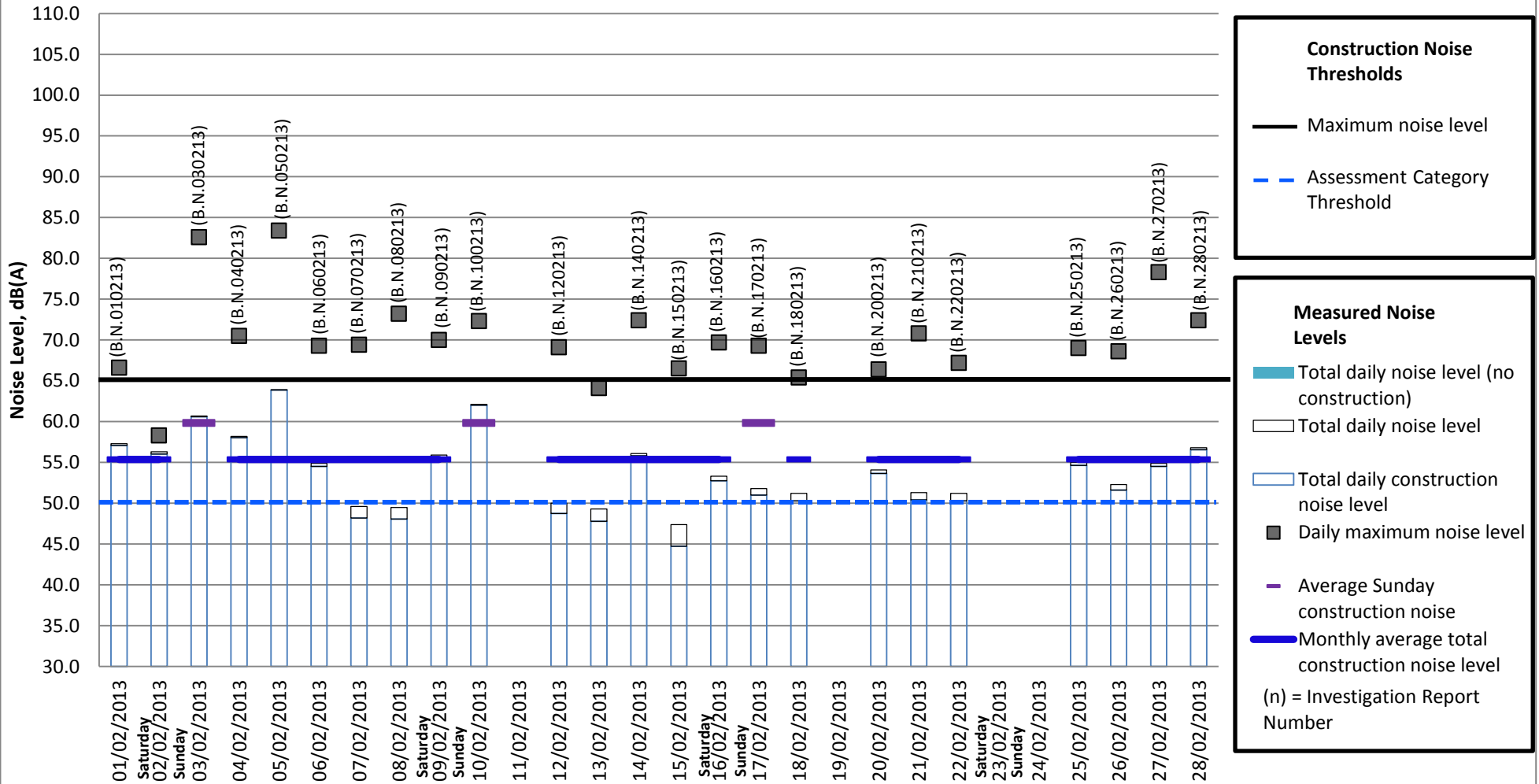
Measured Evening Noise Levels at Butlaw Fisheries Measurement period: February 2013



Note: Data is missing on 11/02/13 and 19/02/13 and Lmax data is missing on 03/02/13 due to device error. Data is missing on 23/02/13 and 24/02/13 due to a power failure.

Measured Night time Noise Levels at Butlaw Fisheries

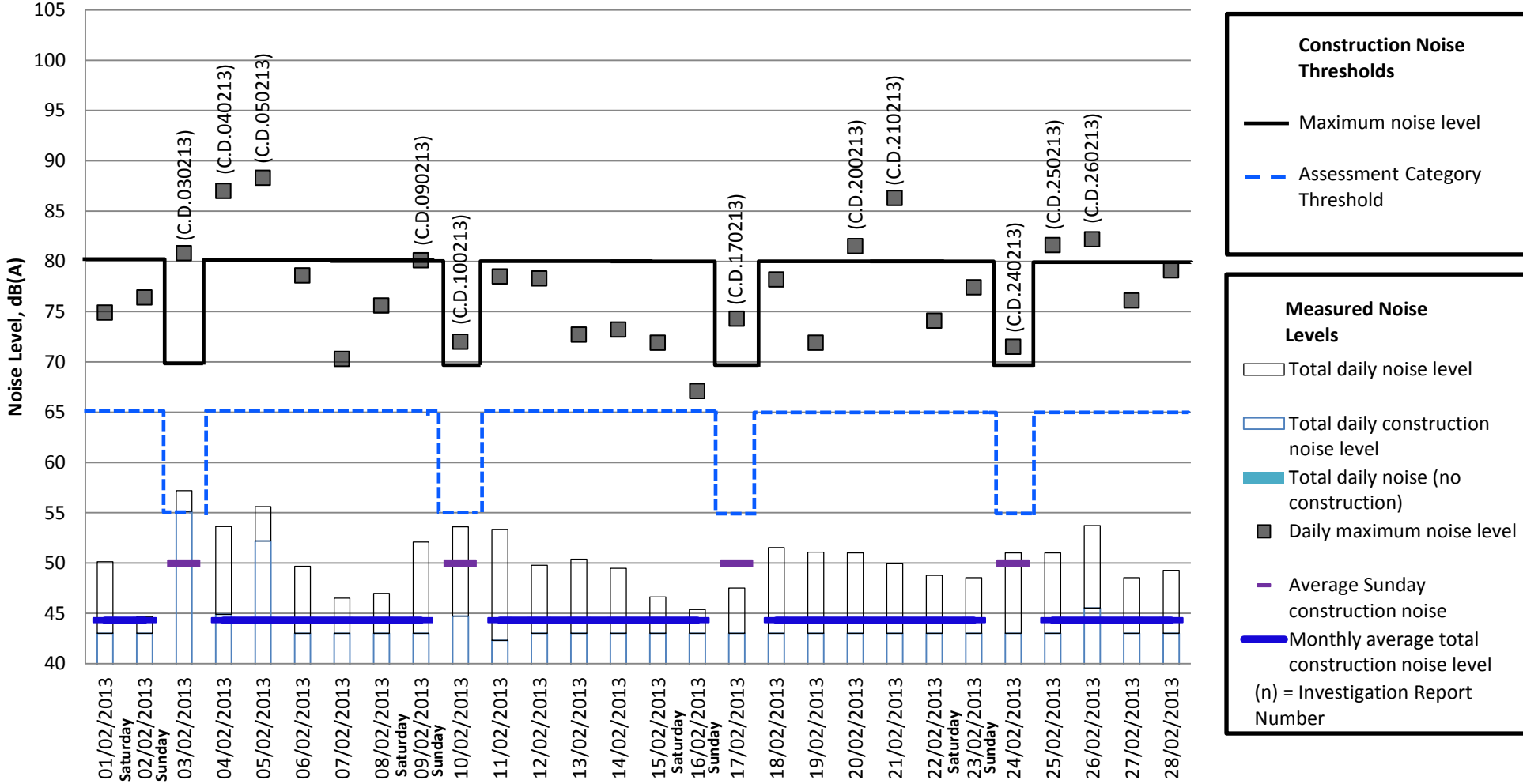
Measurement period: February 2013



Note: Data is missing on 11/02/13 and 19/02/13 due to device error. Data is missing on 23/02/13 and 24/02/13 due to a power failure.

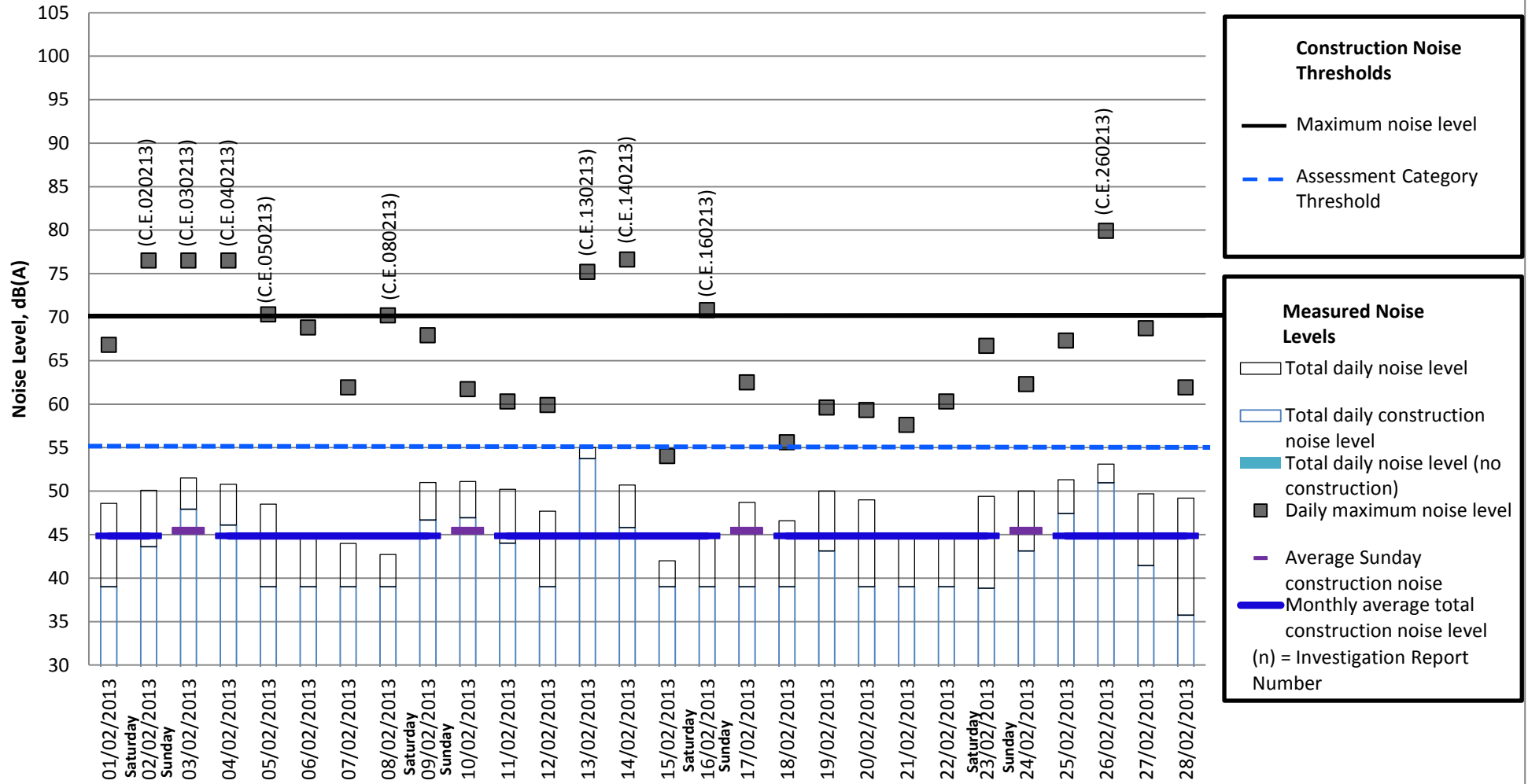
Measured Daytime Noise Levels at Clufflat Brae

Measurement period: February 2013

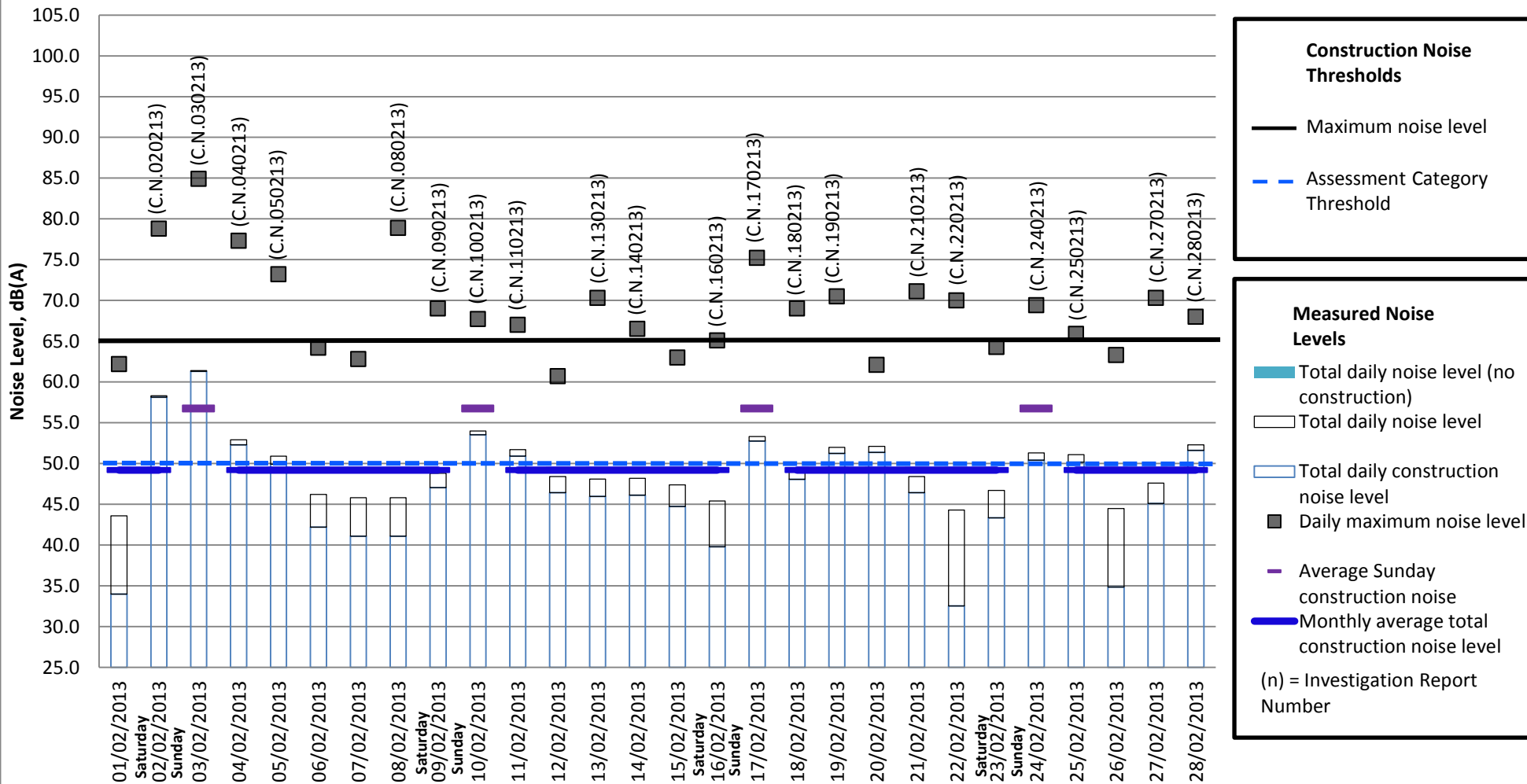


Measured Evening Noise Levels at Clufflat Brae

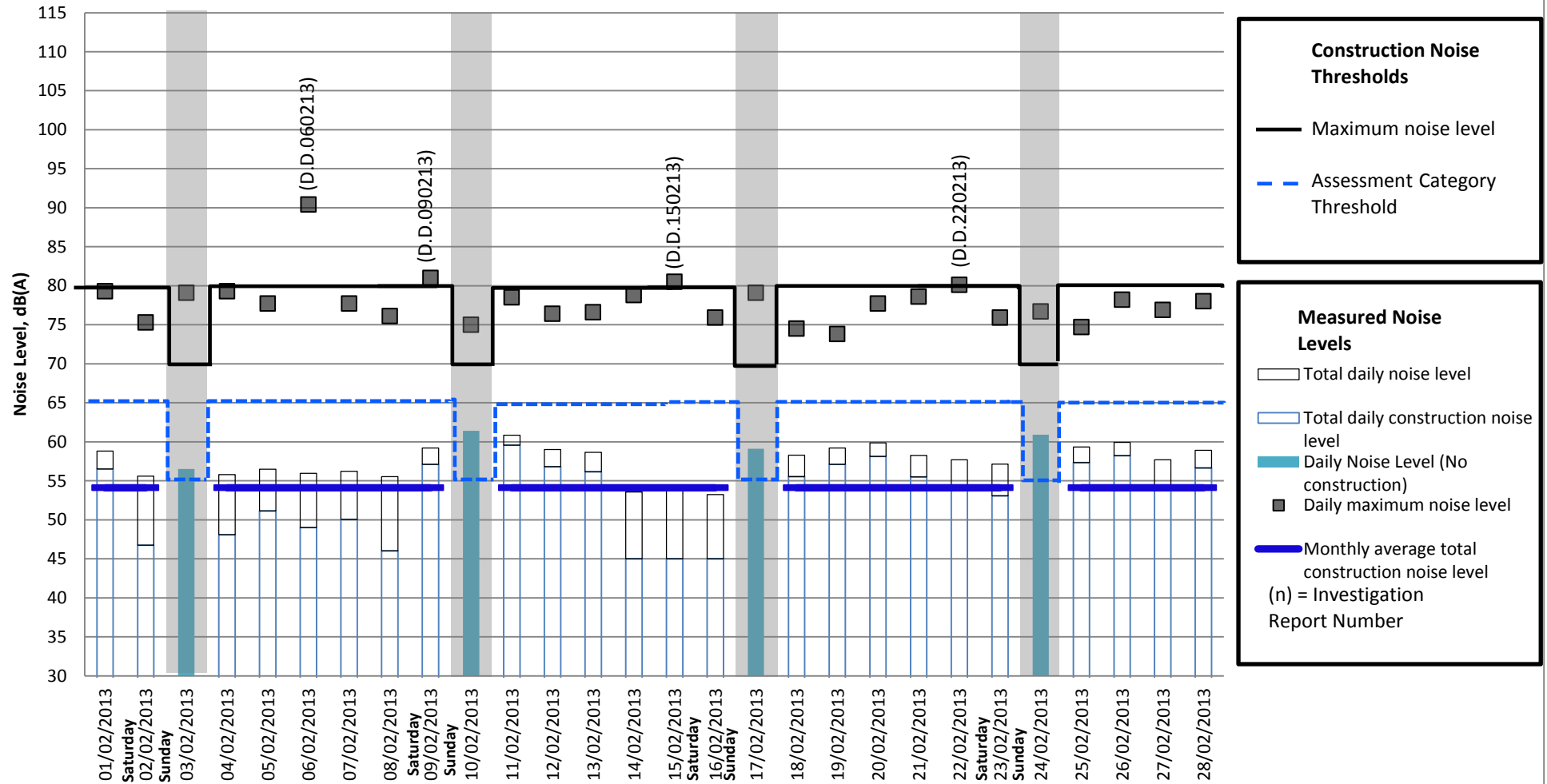
Measurement period: February 2013



Measured Night-time Noise Levels at Clufflat Brae Measurement period: February 2013



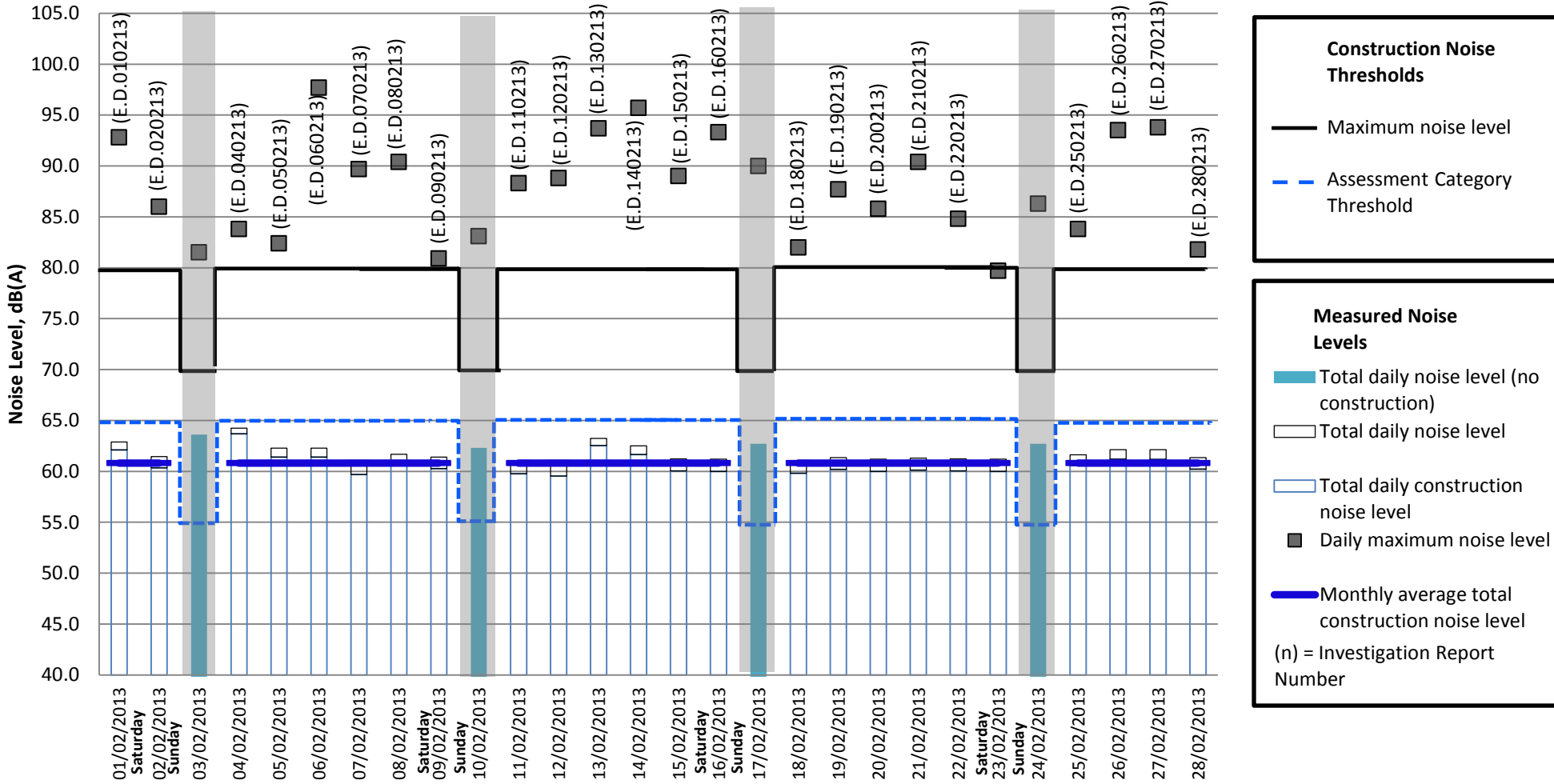
Measured Daytime Noise Levels at Dundas Home Farm Measurement period: February 2013



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

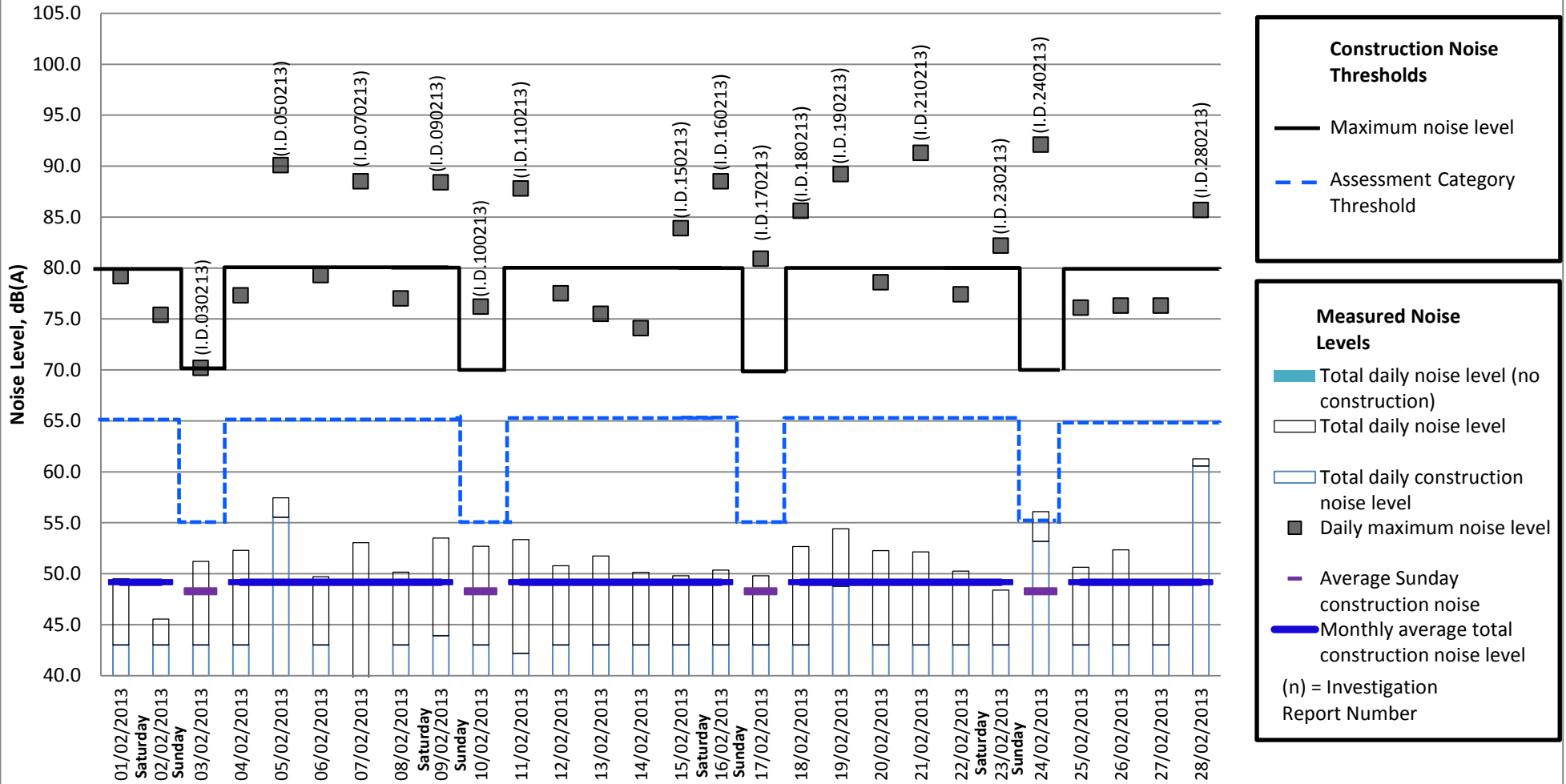
Measured Daytime Noise Levels at Echline Field

Measurement period: February 2013



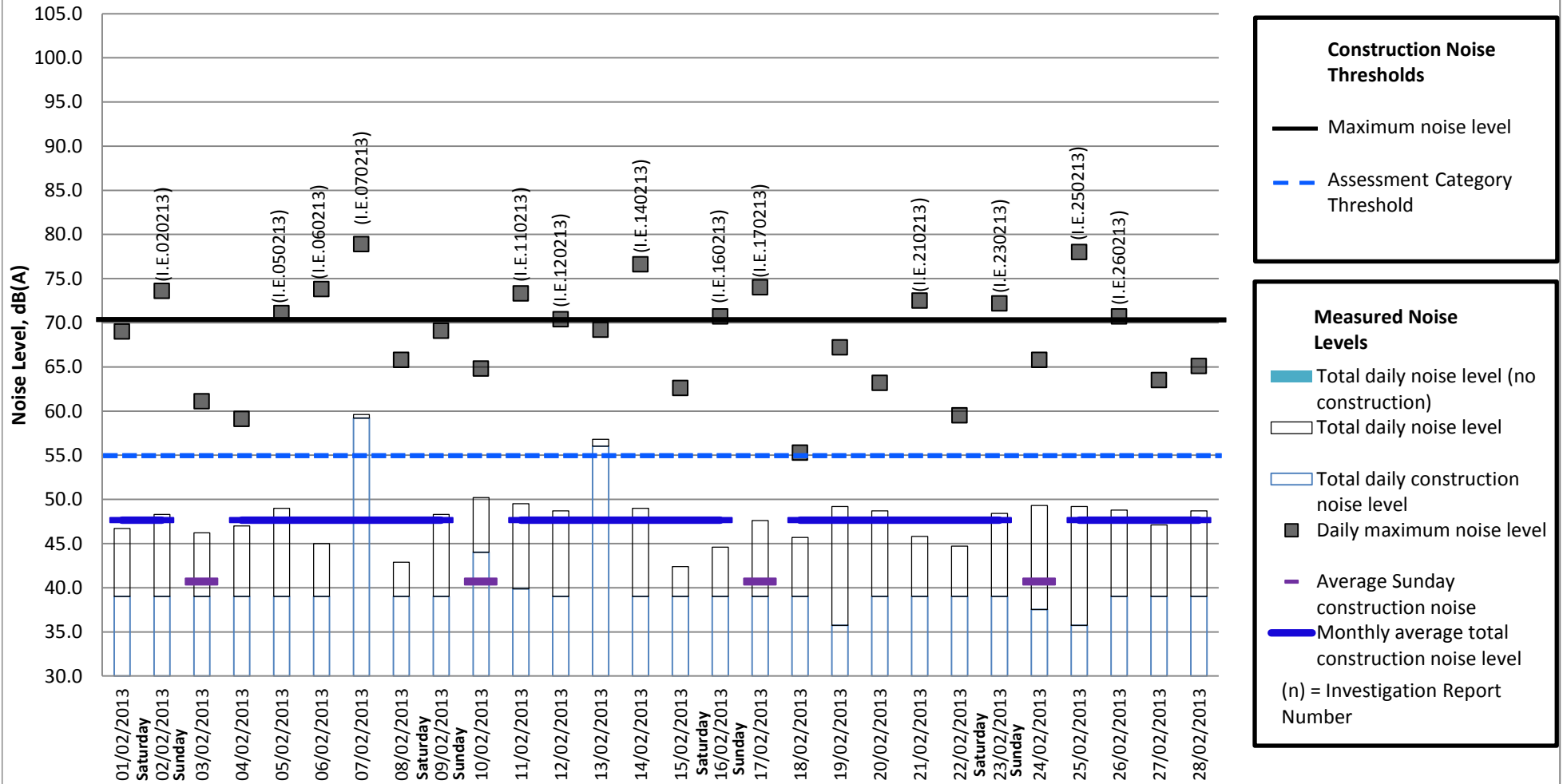
Note: The grey areas of the chart represent days on which no construction works have been conducted. A Sunday average has not been included on the graph as no Sunday works have been undertaken at this location.

Measured Daytime Noise Levels at Inchgarvie Measurement period: February 2013

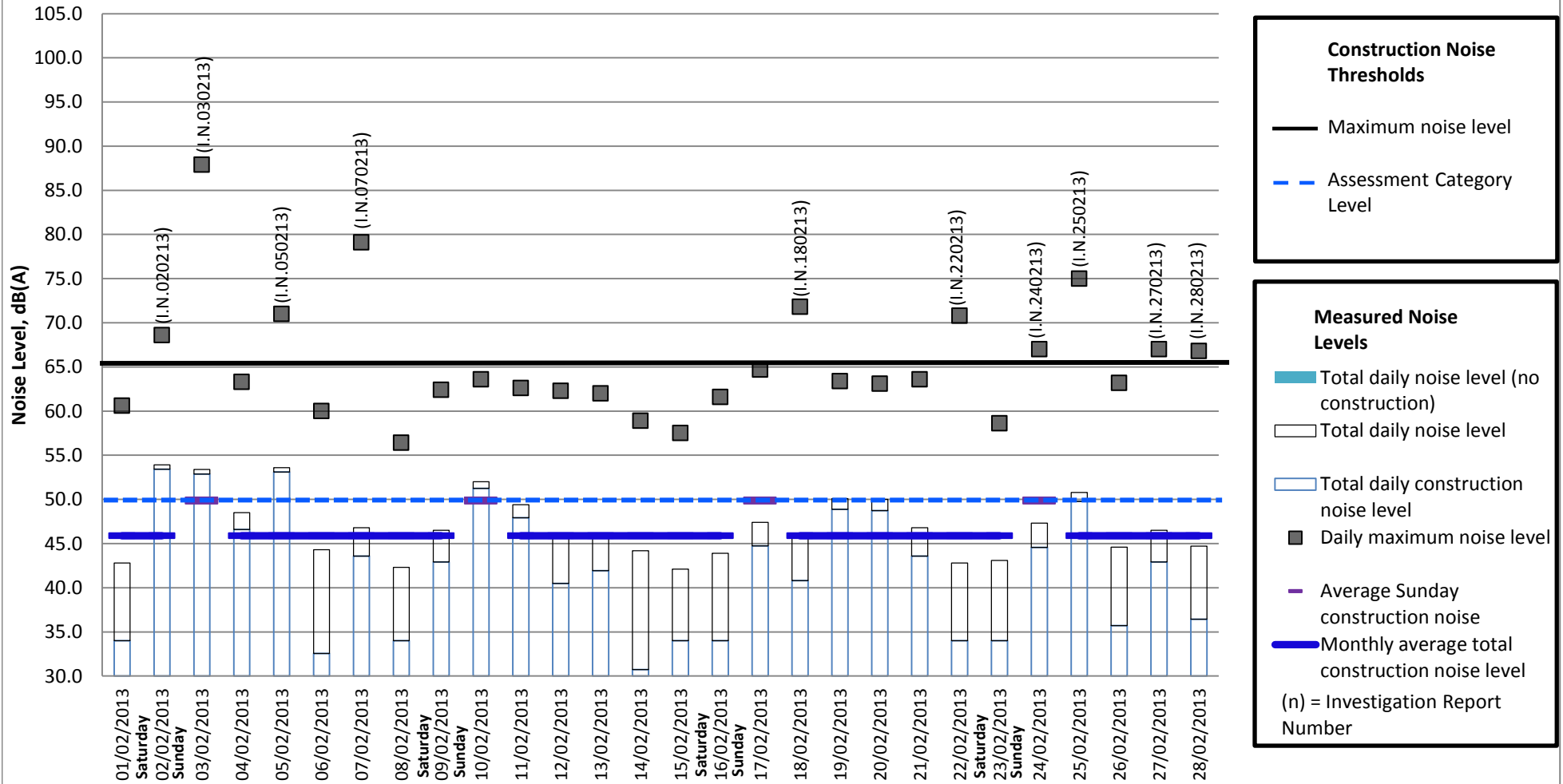


Measured Evening Noise Levels at Inchgarvie

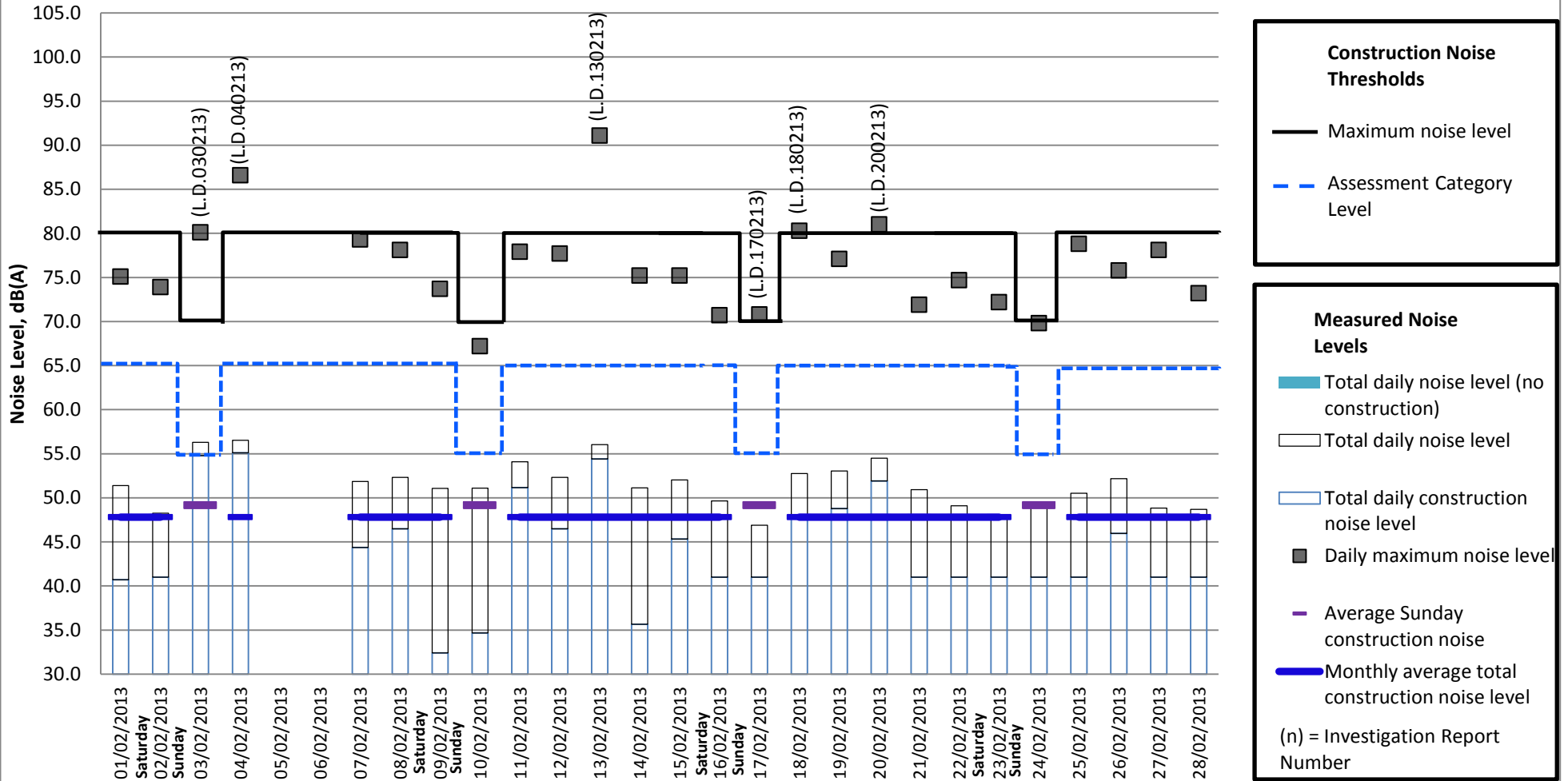
Measurement period: February 2013



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

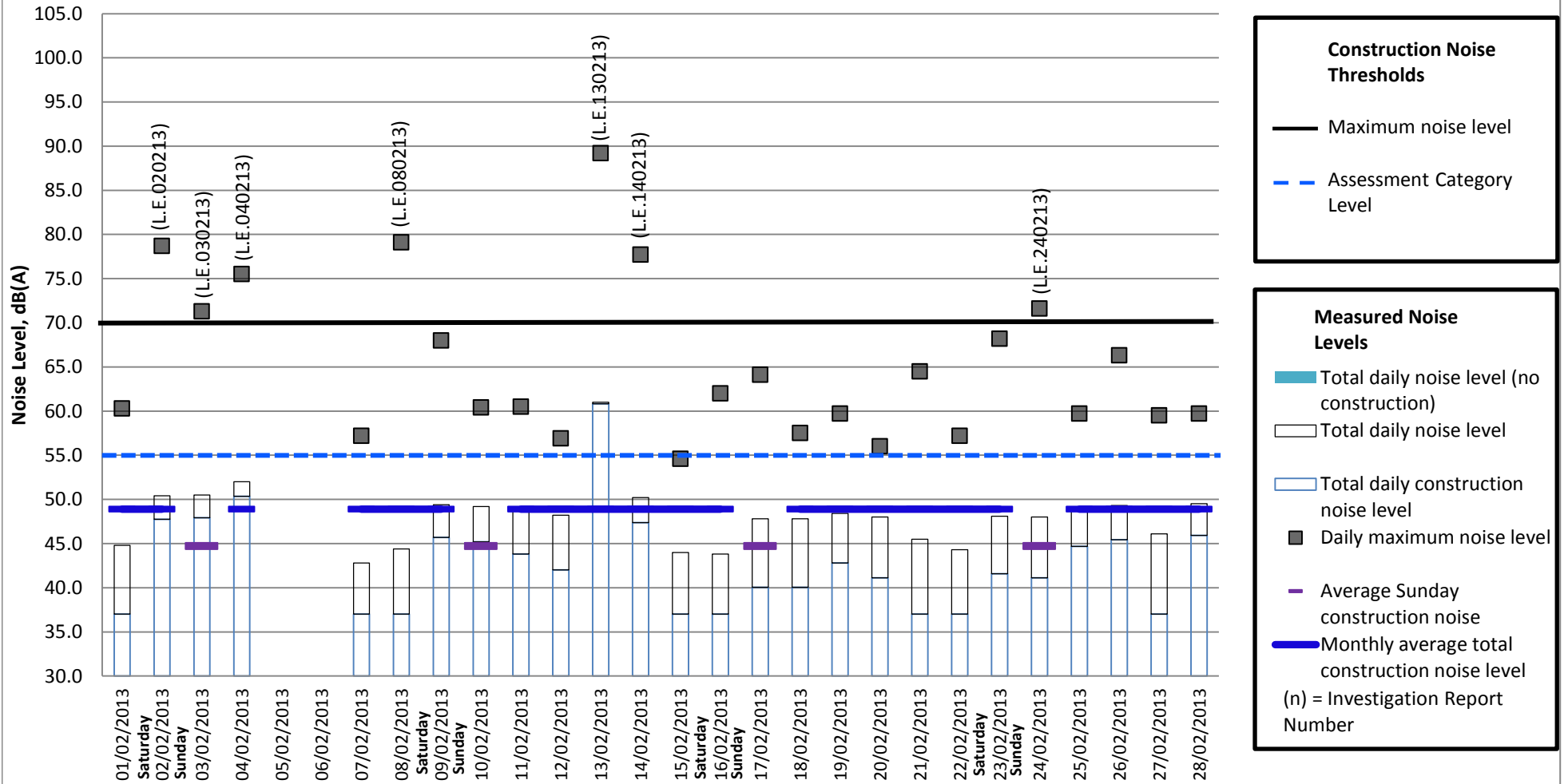


Measured Daytime Noise levels at Linn Mill Measurement period: February 2013



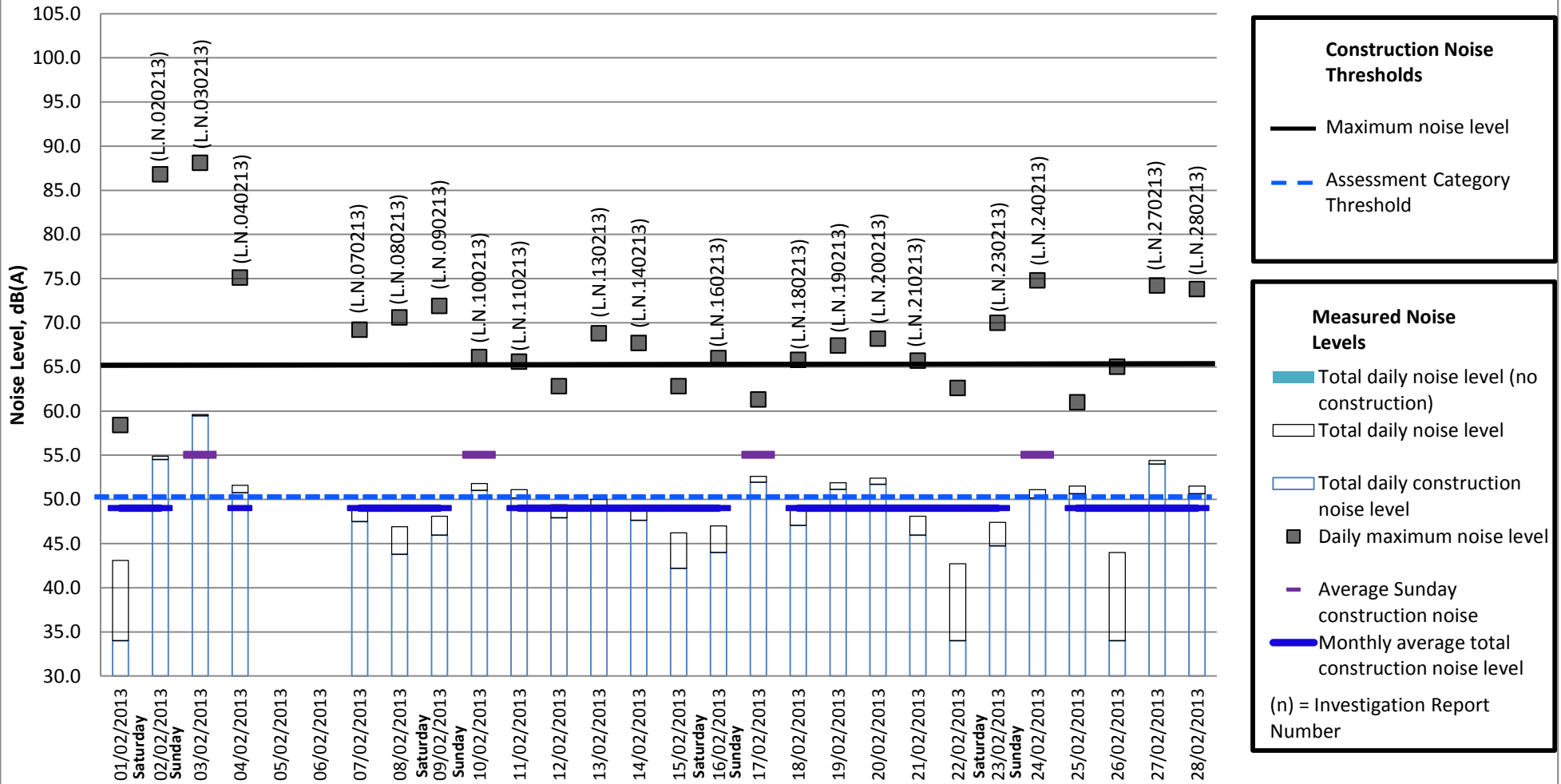
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Measured Evening Noise Levels at Linn Mill Measurement period: February 2013



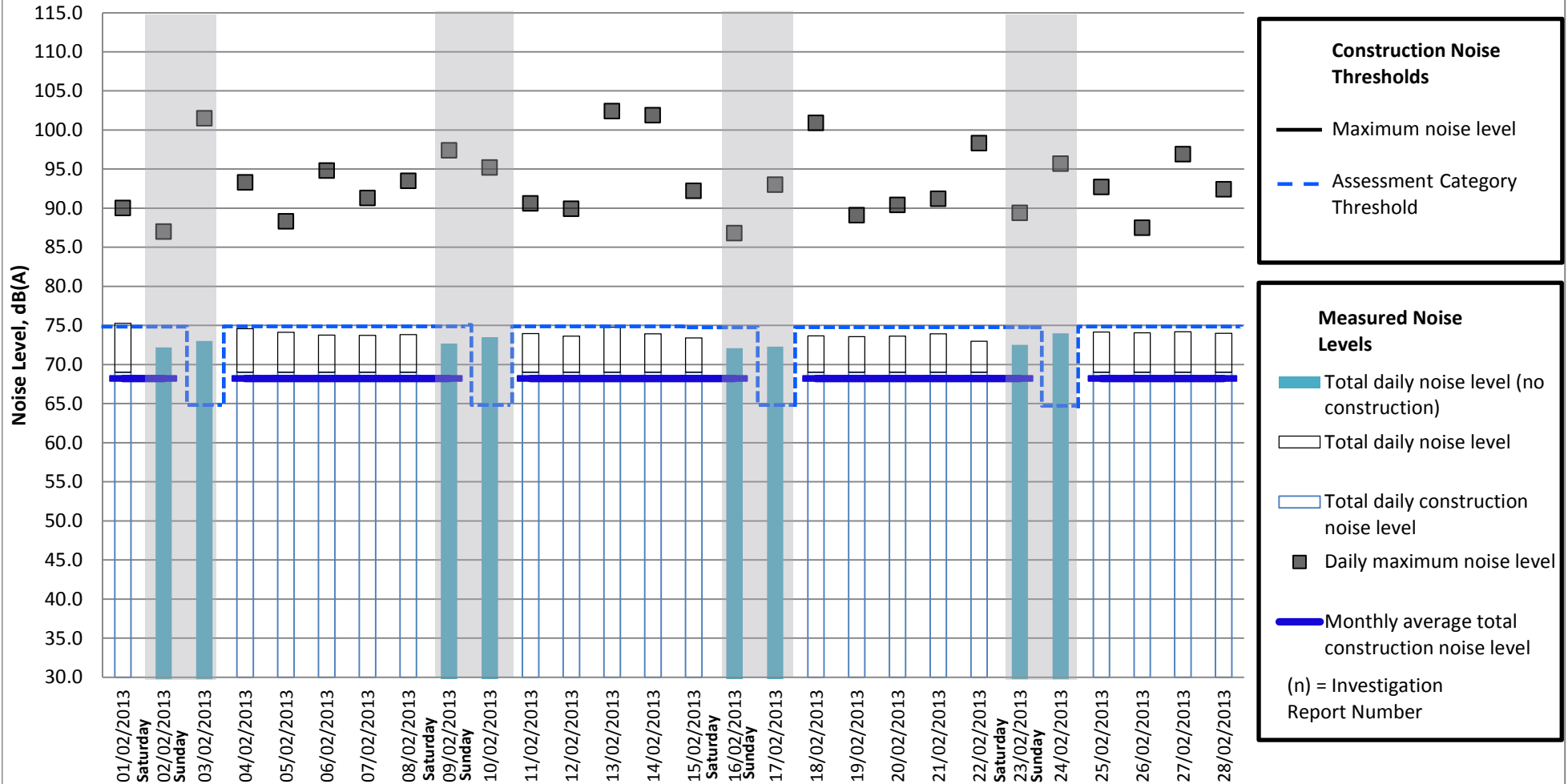
Note: Data is missing for 05/02/13 and 06/02/13 due to device error.

Measured Night-time Noise Levels at Linn Mill Measurement period: February 2013



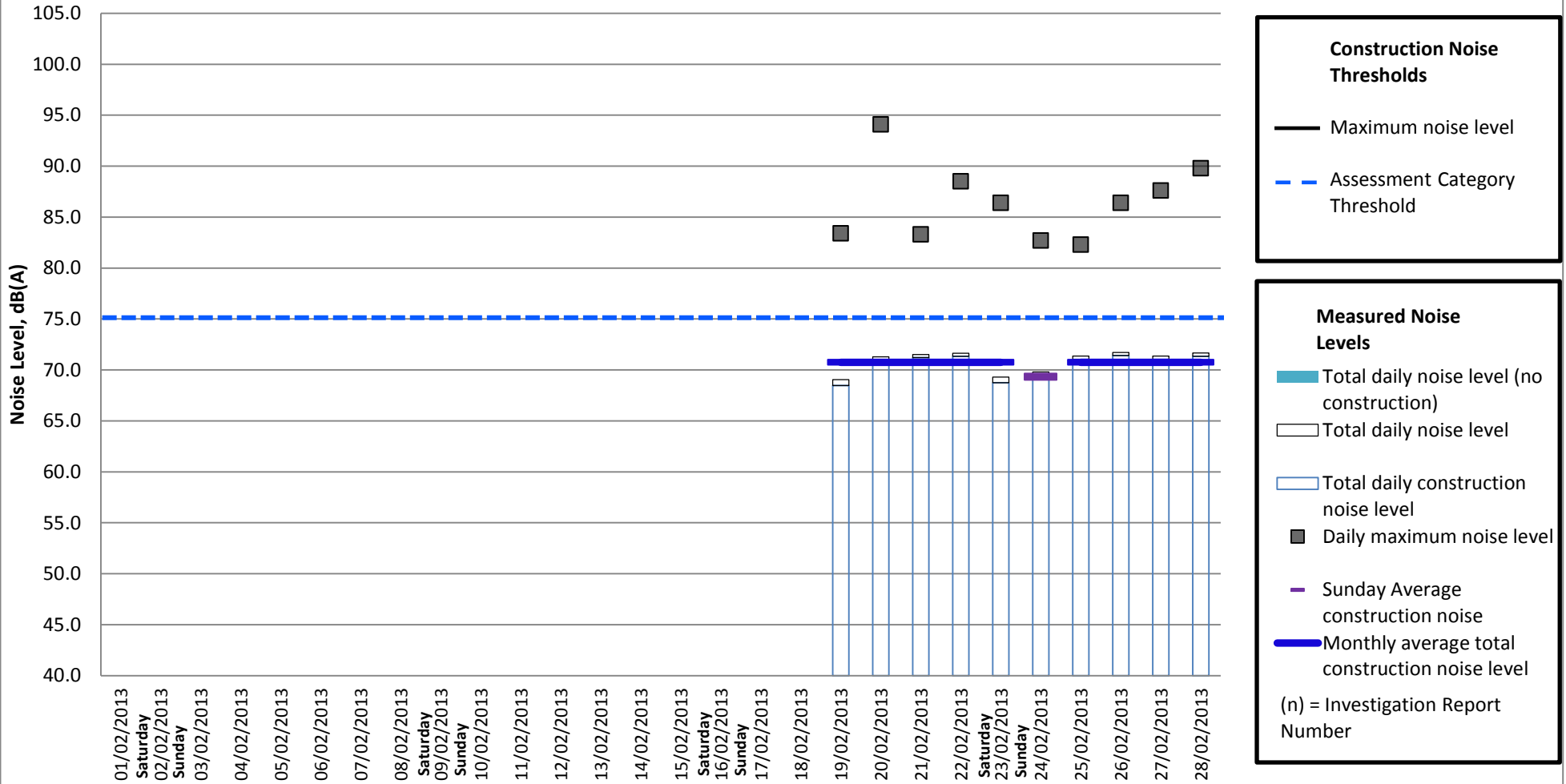
Note: Data is missing for 05/02/13 and 06/02/13 due to device error.

Measured Daytime Noise Levels at Newton Measurement period: February 2013



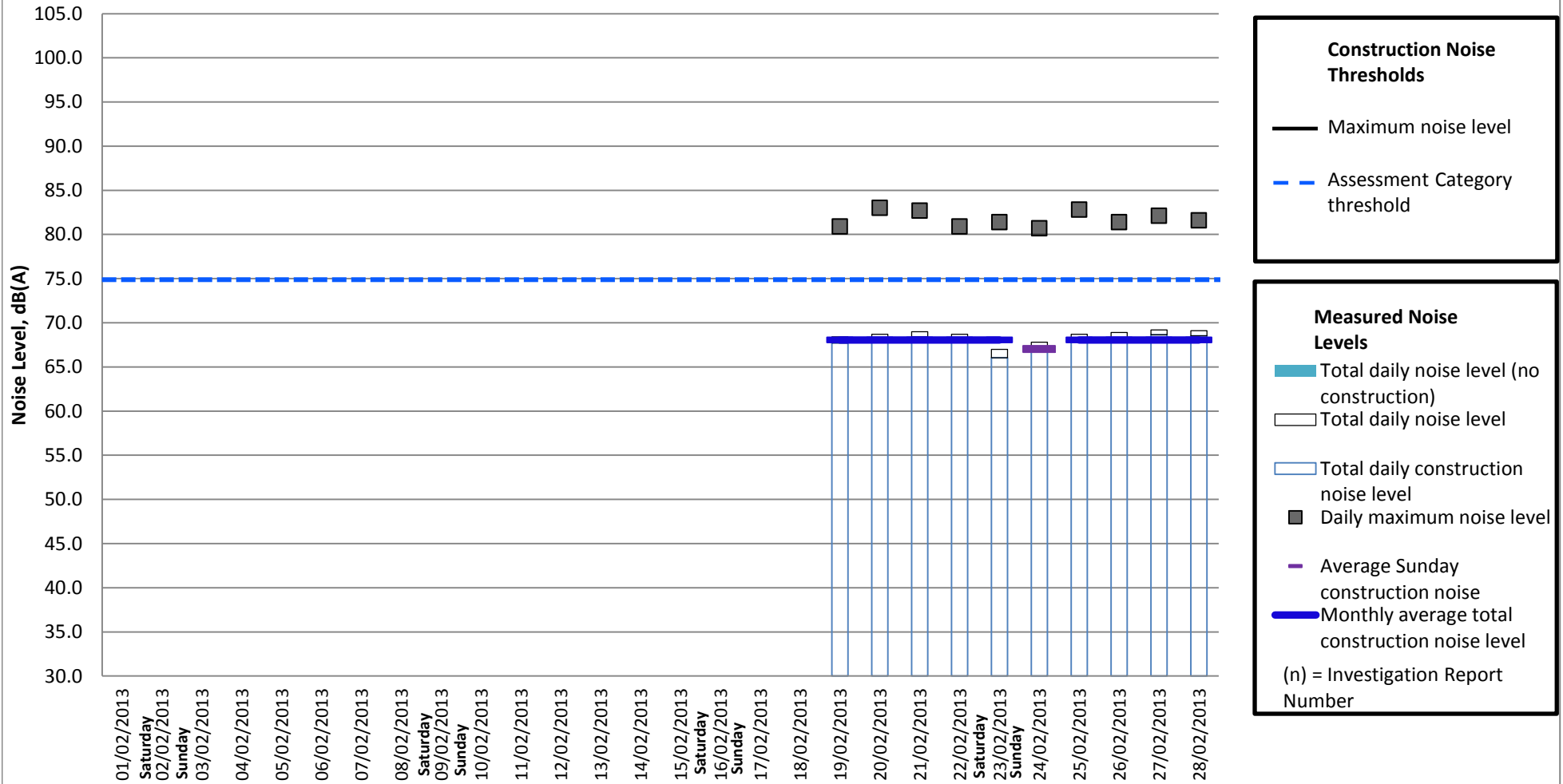
Note: The grey areas of the chart represent days on which no construction works have been conducted; no works have been conducted near this location on Saturday or Sunday. It should be noted that the measured noise levels Mon - Fri can not be attributed to construction works due to the considerable distance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

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



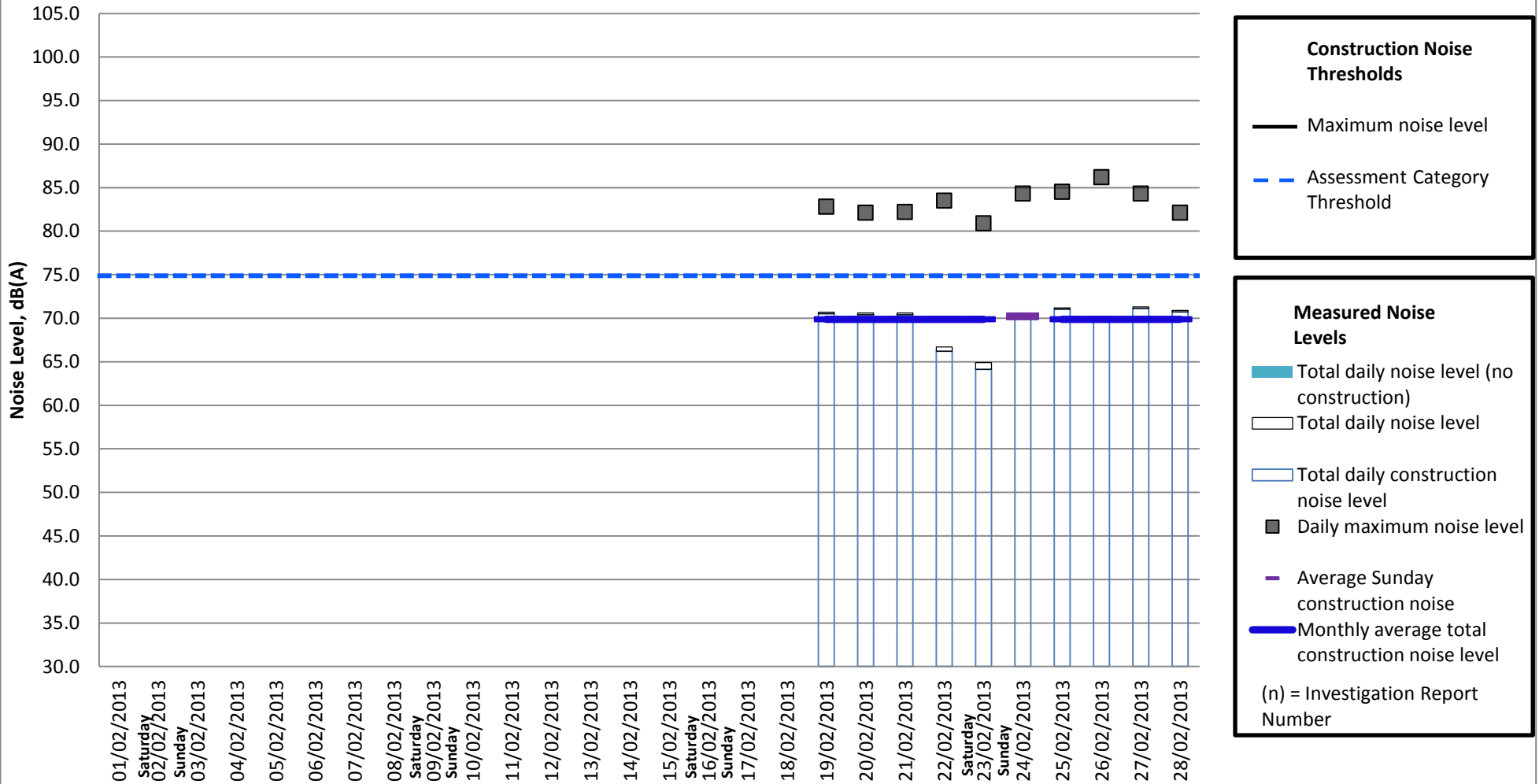
Note: Data is missing between 01/02/13 and 18/02/13 due to device error and limited access to the device due to its positioning on the North Leg of the current Forth Road Bridge.

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



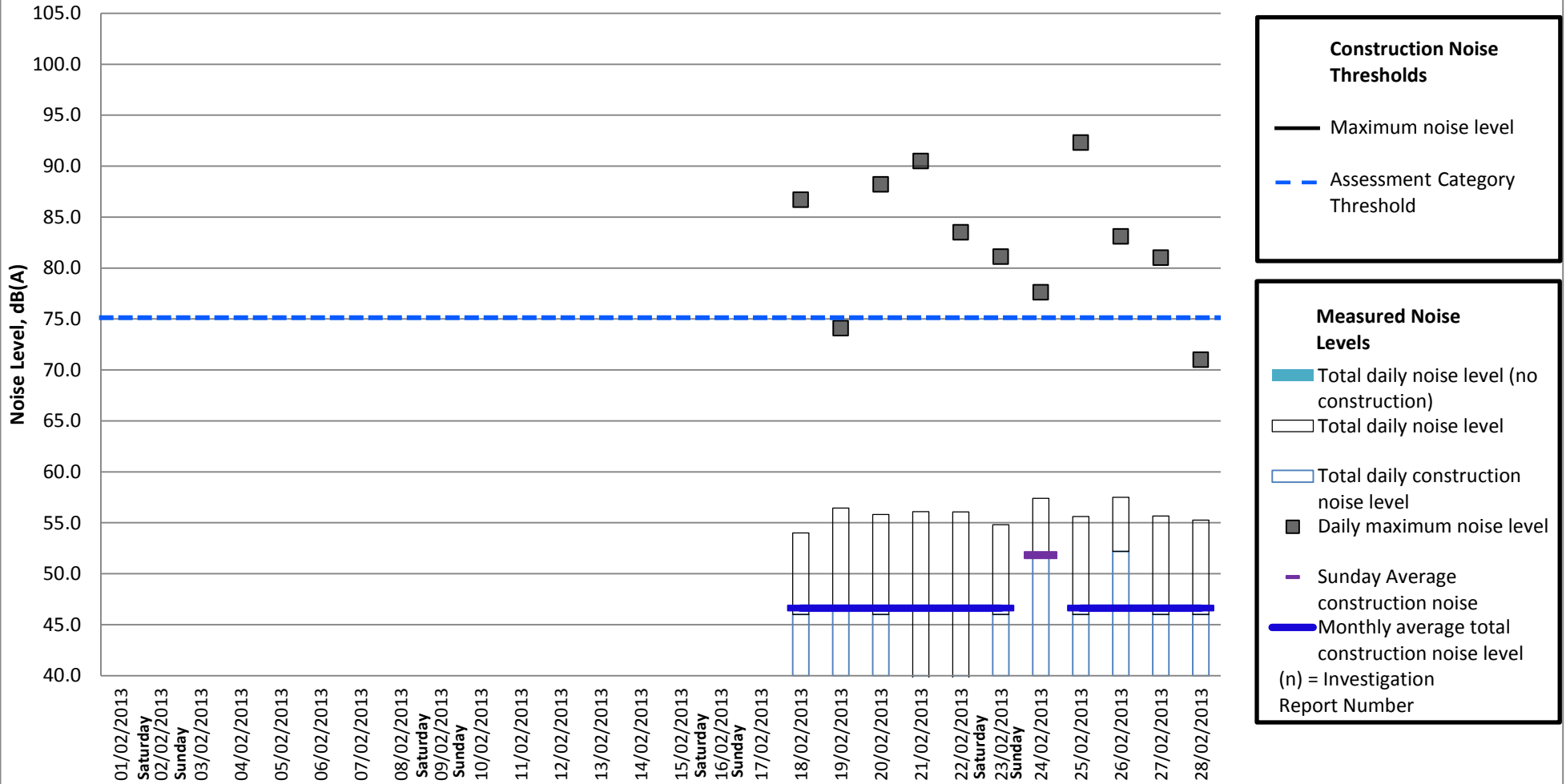
Note: Data is missing between 01/02/13 and 18/02/13 due to device error and limited access to the device due to its positioning on the North Leg of the current Forth Road Bridge.

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



Note: Data is missing between 01/02/13 and 18/02/13 due to device error and limited access to the device due to its positioning on the North Leg of the current Forth Road Bridge.

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



Construction Noise Thresholds

- Maximum noise level
- - - Assessment Category Threshold

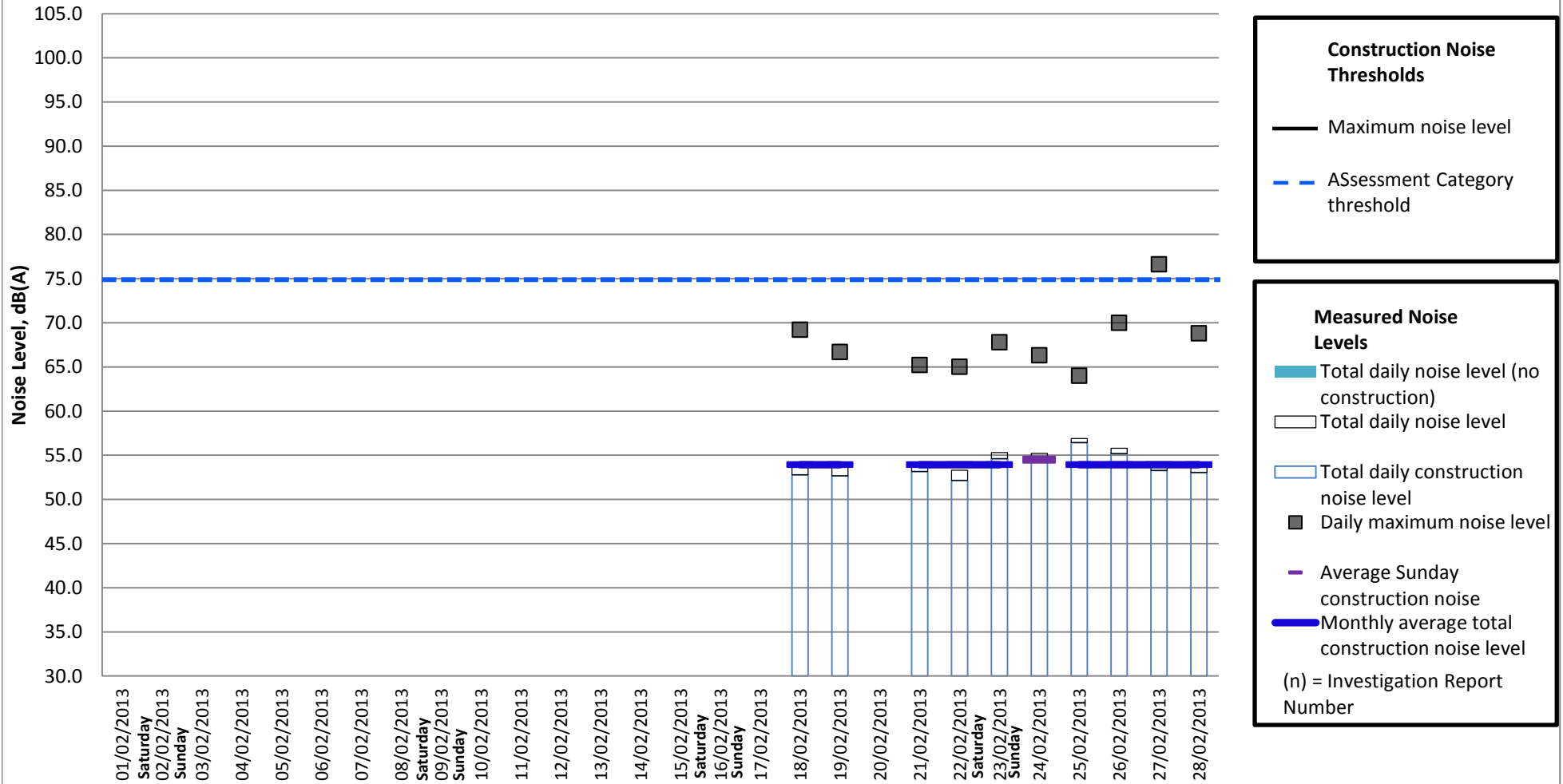
Measured Noise Levels

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

(n) = Investigation Report Number

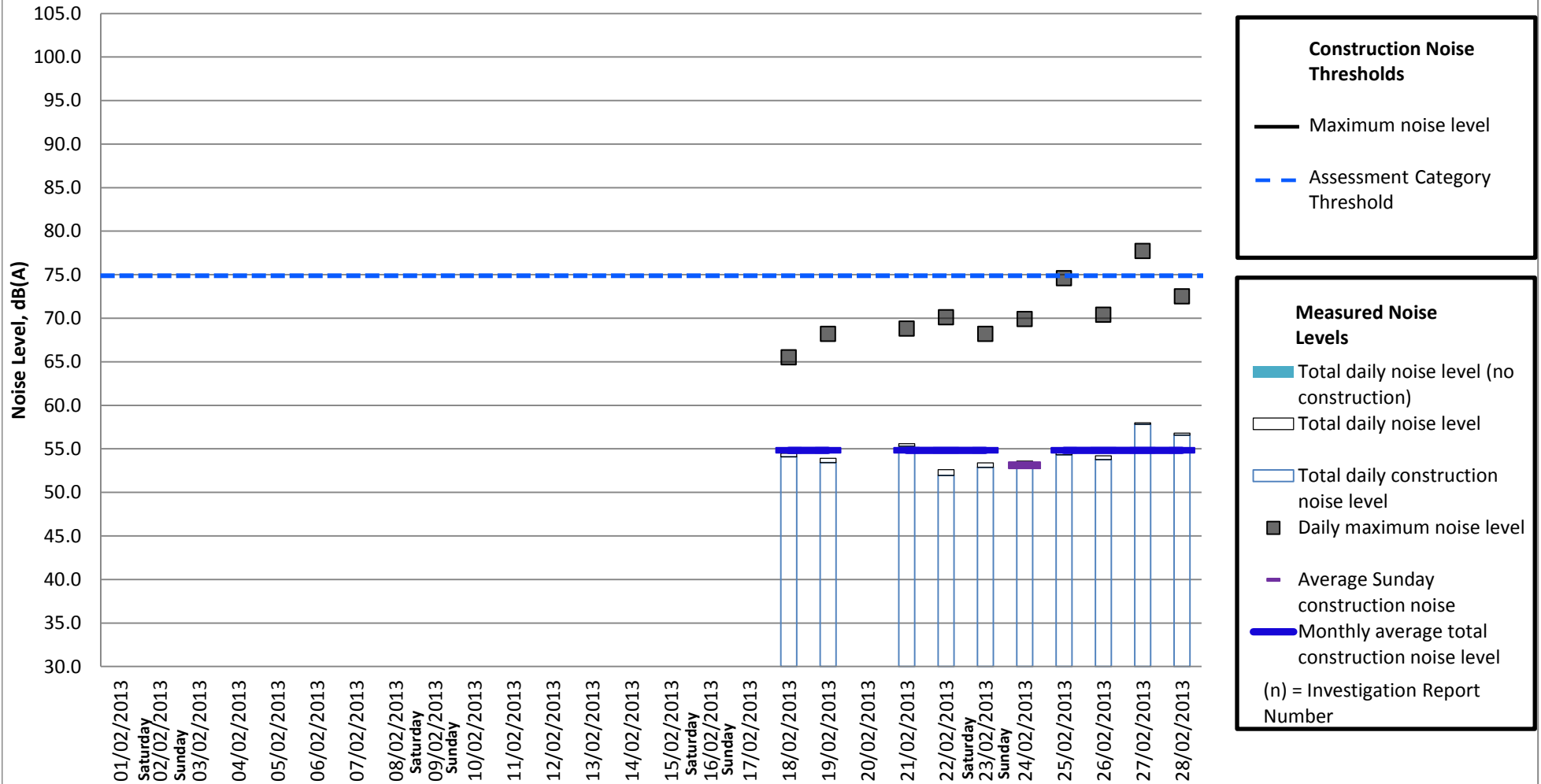
Note: Data is missing between 01/02/13 and 17/02/13 due to device error.

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



Note: Data is missing between 01/02/13 and 17/02/13 and on 20/02/13 due to device error.

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



Construction Noise Thresholds

- Maximum noise level
- - - Assessment Category Threshold

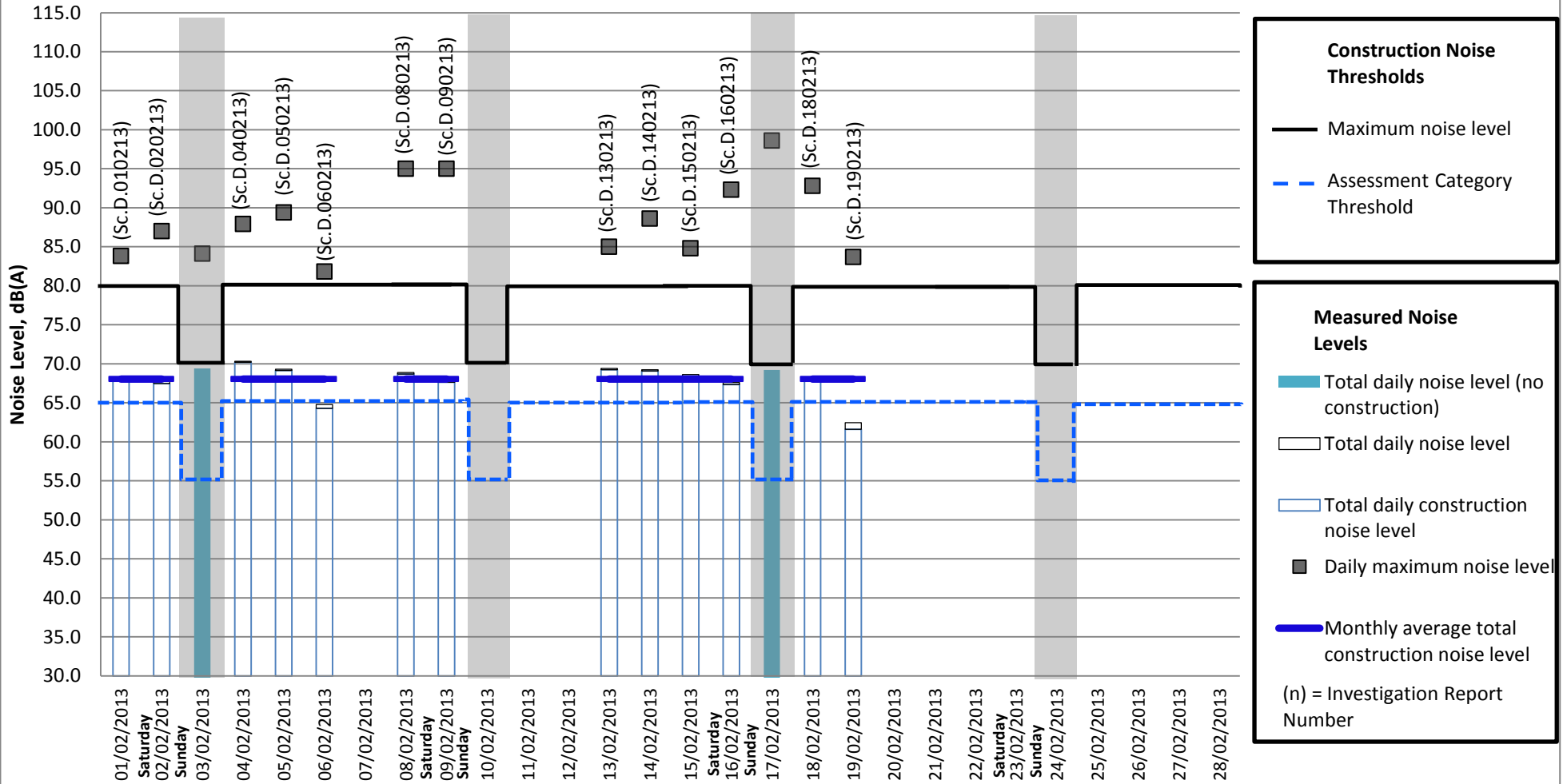
Measured Noise Levels

- 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

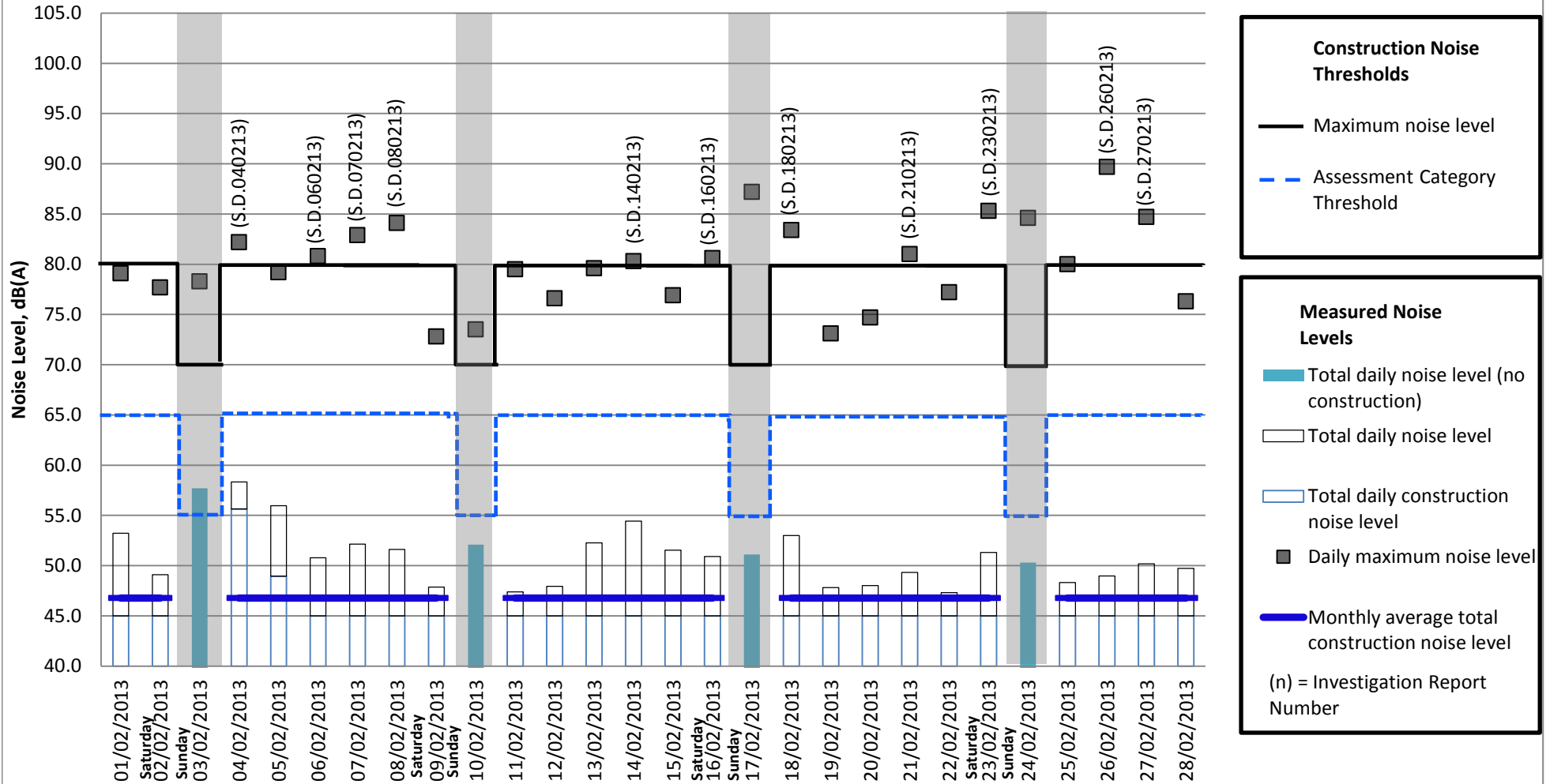
Note: Data is missing between 01/02/13 and 17/02/13 and on 20/02/13 due to device error.

Measured Daytime Noise Levels at Scotstoun Measurement period: February 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 07/02/13 and 10/02/13 to 12/02/13 due to device error. Data is missing for 20/02/13 to 28/02/13 due to a failure with the FCBC server.

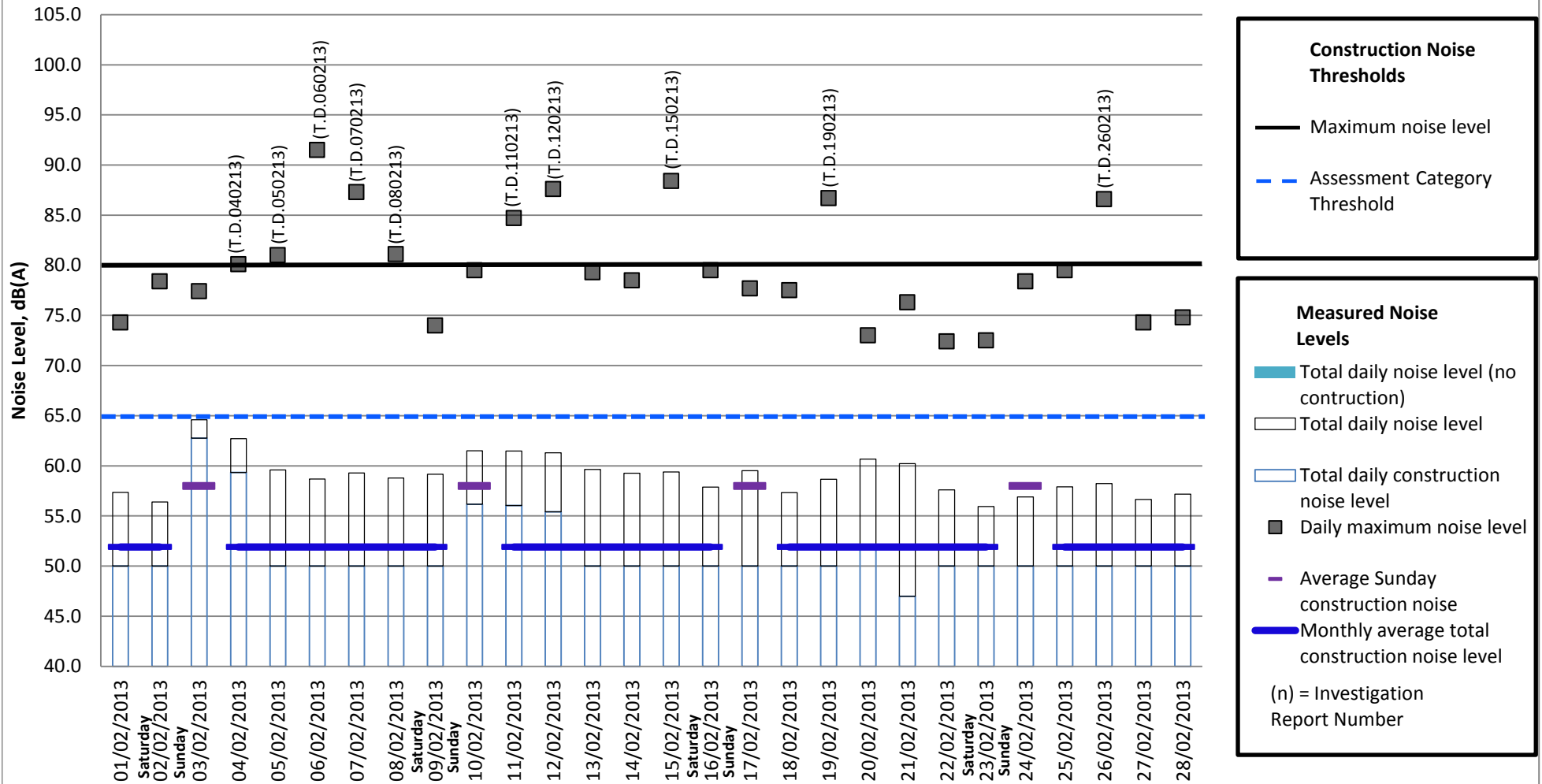
Measured Daytime Noise Levels at Springfield Measurement period: February 2013



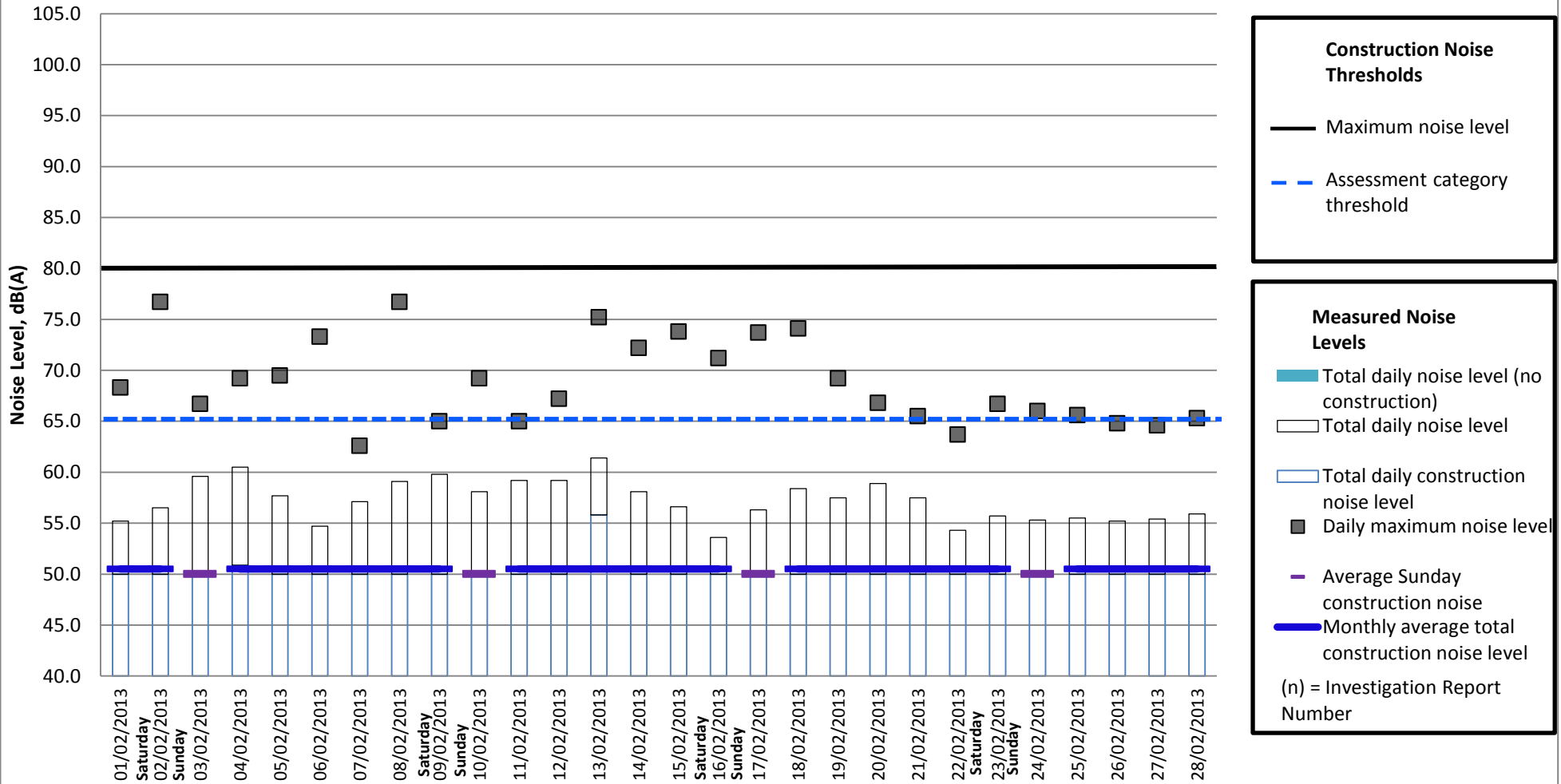
Note: The grey areas of the chart represent days on which no construction works have been conducted.

Measured Daytime Noise Levels at Tigh-Na-Grian

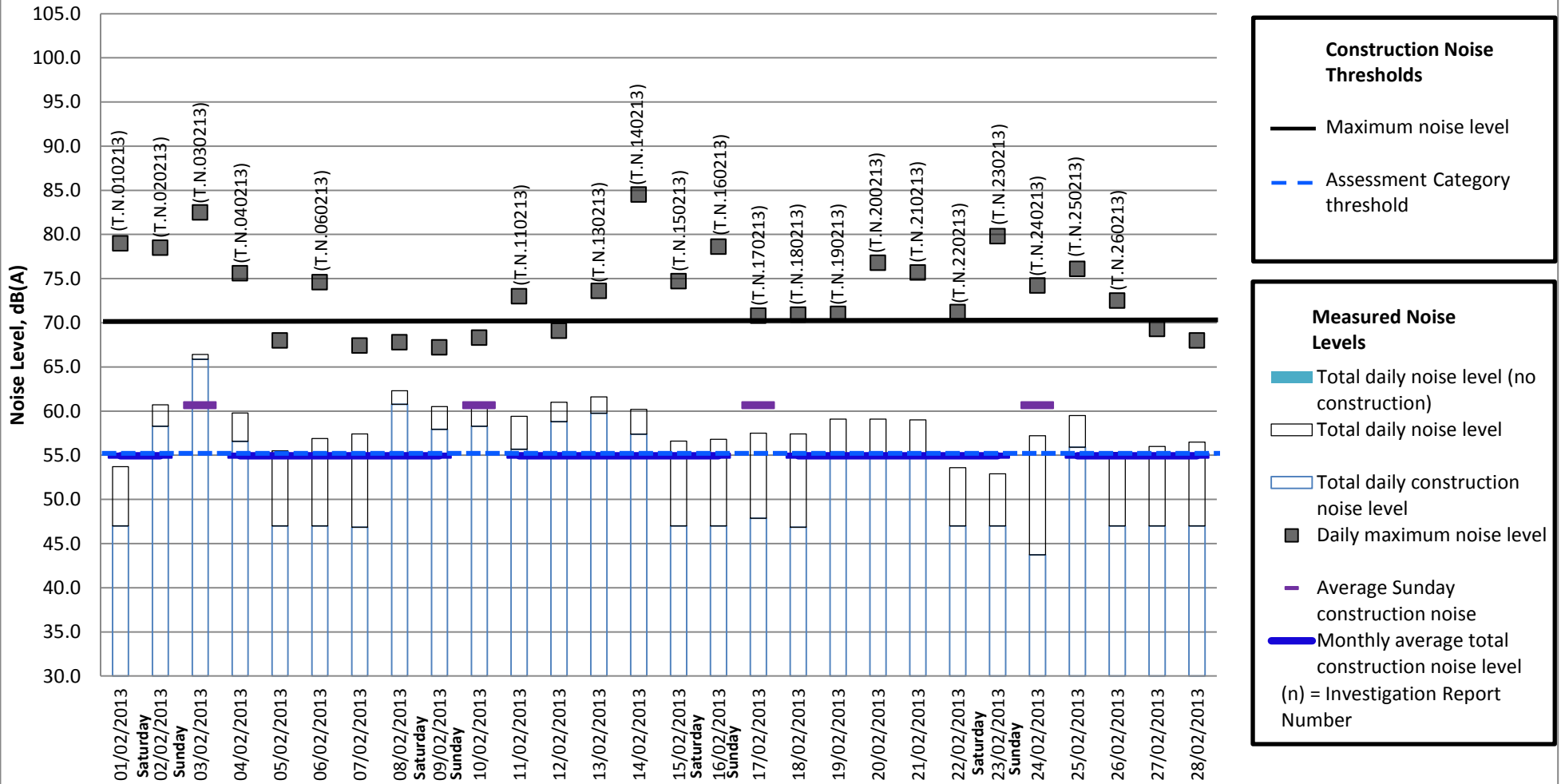
Measurement period: February 2013



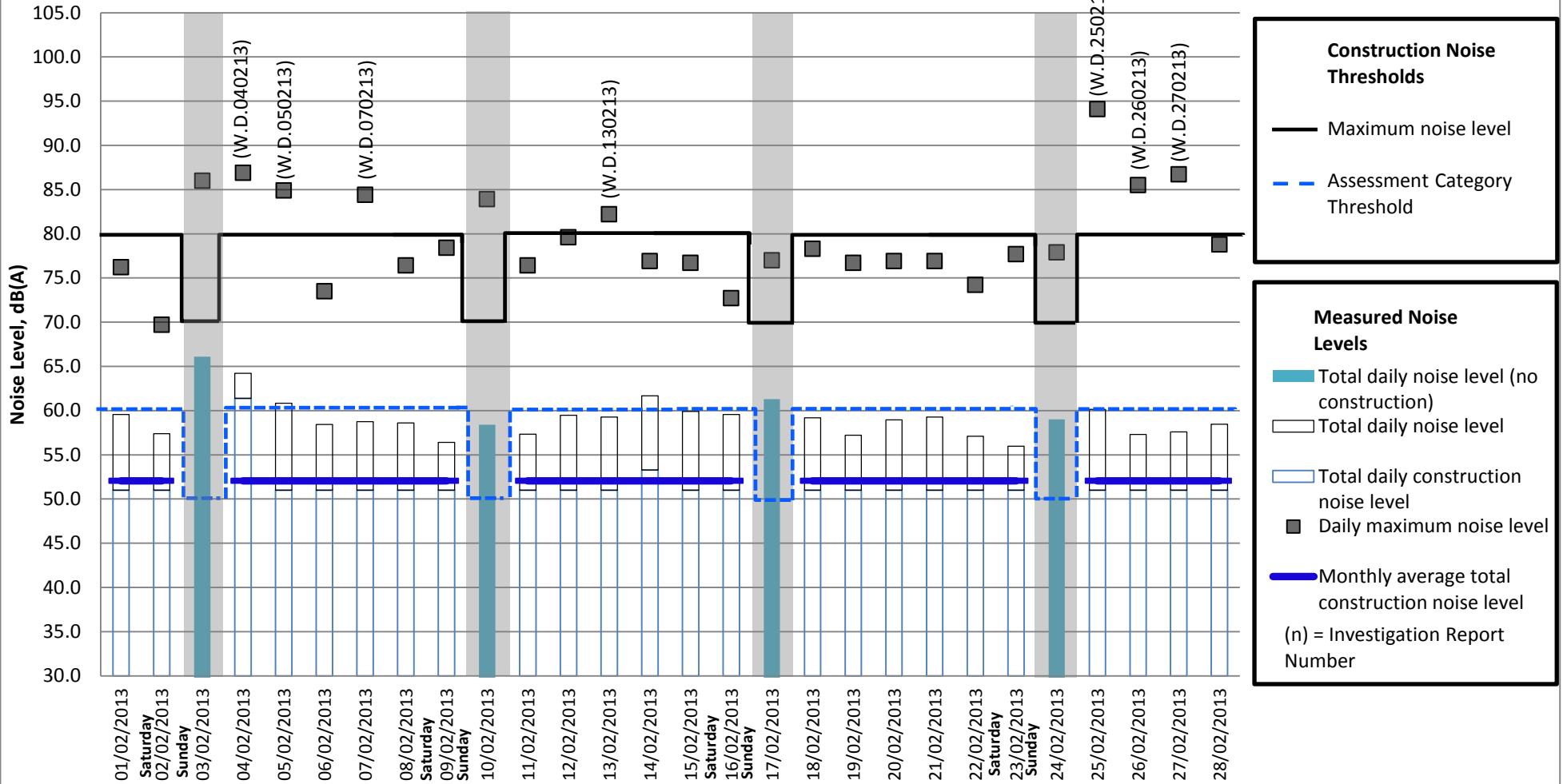
Measured Evening Noise Levels at Tigh-Na-Grian Measurement period: February 2013



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



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