



Contractor



**Forth Crossing** Bridge Constructors

HOCHTIEF Solutions  
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DRAGADOS  
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Project **FORTH REPLACEMENT CROSSING**

Document title

**CONSTRUCTION NOISE MONITORING REPORT: SEPTEMBER 2013**

Rev	Rev. Date	Purpose of revision	Made	Checked	Reviewed
00	07/10/13	First Revision	ESE	MWN	MWN

Document status

**FOR REVIEW**

Made by: Ellie Slee      Checked By: Martin Wilson

Initials: ESE      Initials: MWN

Document number

**REP-00138**

Rev  
**00**

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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 September 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 September 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 September 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 September 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 September 2013
M1	Whinny Hill	Network	Excavation and breaking rock at Castlandhill Road.  N.B. No evening, night time or Sunday daytime construction in vicinity.
M3	Tigh-Na-Grian	Crossing	Central Tower rebar, formwork & concreting works North Tower rebar, formwork & concreting works North Tower crane platform piling
M4	North Leg	Crossing	Central Tower rebar, formwork & concreting works North Tower rebar, formwork & concreting works North Tower crane platform piling Pier N1 airlifting & trestle bridge foundation works
M6	Port Edgar	Crossing	Central Tower rebar, formwork & concreting works South Tower underwater concrete, dewatering & blinding, rebar & formwork Pier S1 final caisson excavation & airlifting Pier S4 airlifting Pier S5 rebar & formwork Demobilisation of Trial Pit Society Road works
M7	Butlaw Fisheries	Crossing	Central Tower rebar, formwork & concreting works South Tower underwater concrete, dewatering & blinding, rebar & formwork Pier S1 final caisson excavation & airlifting Pier S4 airlifting Pier S5 rebar & formwork Demobilisation of Trial Pit 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 – assembly of stillages, delivery and assembly of structural steel sections Installation of rebar and formwork and preparation of construction joints at S7/S8 Works at pier trials area works Society Road works
M11	Linn Mill	Network	Launch – assembly of stillages, delivery

		(close proximity to Crossing)	and assembly of structural steel sections Installation of rebar and formwork and preparation of construction joints at S7/S8 Works at pier trials area works Society Road works
M13	Clufflat Brae	Crossing	Launch – assembly of stillages, delivery and assembly of structural steel sections Installation of rebar and formwork and preparation of construction joints at S7/S8 Works at pier trials area works Society Road works Echline field – excavation of mainline
M14	Springfield	Network	Launch – assembly of stillages, delivery and assembly of structural steel sections Installation of rebar and formwork and preparation of construction joints at S7/S8 Works at pier trials area works Echline field – excavation of mainline Gyratory – structures  N.B. No evening, night time or Sunday daytime construction in vicinity.
M15	Echline Field	Network	Launch – assembly of stillages, delivery and assembly of structural steel sections Installation of rebar and formwork and preparation of construction joints at S7/S8 Works at pier trials area works Echline field – excavation of mainline Gyratory – structures  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	Backfilling of utility works Environmental 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](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 Echline from 12 to 16 September 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 September 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 following periods and the locations listed; Sunday daytime average at Butlaw Fisheries, Inchgarvie, Clufflat Brae and Linn Mill, and Sunday night time average at Butlaw Fisheries, Clufflat Brae, Linn Mill and Tigh-Na-Grian.
- 3.4** The exceedance of the night time average at Butlaw is 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. Where audio is available, it demonstrates that the increased levels were caused by waves. It should also be noted that screening and distance attenuation should be considered as these factors result in a lowering of the noise levels to within the threshold level at the nearest sensitive receptors; attended monitoring has illustrated a drop of at least 5 – 10 dB from Butlaw Fisheries to the nearest sensitive receptors with respect to noise generated around the south shore area of the estuary.
- 3.5** With regard to the exceedances of the Sunday averages, both daytime and night time, at the locations noted, a review of the Sunday works has confirmed that only marine activities were undertaken during these periods. When the specific works undertaken are considered, alongside locations and associated distances, it is deemed highly unlikely that the exceedances of the Sunday averages were related to construction works.
- 3.6** 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.
- 3.7** 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 September is consistent with that recorded in previous months.
- 3.8** During September 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.

- 3.9** 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.
- 3.10** 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.
- 3.11** The daytime  $L_{AFmax}$  threshold was exceeded during September on six occasions. Three exceedances, recorded at Butlaw Fisheries, Clufflat Brae and Inchgarvie during the night time period, were found to be caused by the night works at Society Road. A daytime construction related exceedance was also recorded at Butlaw Fisheries which was caused by the removal of the trial pit in the estuary. A further daytime exceedance was recorded at Clufflat Brae, where grass cutting in close proximity to the meter caused an exceedance of the threshold. At Dundas, a daytime exceedance was also caused by a tipper tipping material for the construction of the environmental bund at this location. All construction related exceedances were investigated and mitigation measures implemented where possible; the relevant NVIRs provide more detail with regard to each exceedance.
- 3.12** 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 September the maximum noise threshold was exceeded on 41 occasions (daytime, 9; evening, 8; night time, 24). One night time exceedance was caused by works at Society Road, with one daytime exceedance due to the removal of the trial pit. All other exceedances were attributed to non-construction factors, notably birds and waves.
Clufflat Brae	During September the maximum noise threshold was exceeded on 37 occasions (daytime, 10; evening, 7; night time, 20). Two exceedances were attributable to construction works; one night time exceedance was related to the night works at Society Road, with one day time exceedance caused by grass cutting close to the meter. All other exceedances were found to be largely due to birds, dogs barking, wind and residents at nearby properties.
Inchgarvie Lodge	During September the maximum noise threshold was exceeded on 42 occasions (daytime, 9; evening, 9; night time, 24). One night time exceedance was 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 September the maximum noise threshold was exceeded on 34 occasions (daytime, 7; evening, 5; night time, 22). The exceedances were largely caused by birds.
Tigh-Na-Grian	During September the maximum noise threshold was exceeded on 55 occasions (daytime, 28; evening, 1; night time, 26). Exceedances were due to non-construction factors, notably birds.
Dundas Home Farm	During September the maximum noise threshold was exceeded on 10 occasions. One exceedance was caused by the works at the earth bund at this location. Exceedances were largely due to gardening works at the property.
Echline	During September the maximum noise threshold was exceeded on 19 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 September the maximum noise threshold was exceeded on 9 occasions. The exceedances were not caused by construction works at this location. The majority of exceedances were largely due to local residents and dogs barking.
Scotstoun	During September the maximum noise threshold was exceeded on 25 occasions. Exceedances were largely attributed to vehicles passing by on the adjacent road.
Whinny Hill	During September the maximum noise threshold was exceeded on 13 occasions. Exceedances were not due to construction activities. A range of factors were found to cause exceedances at this location, including birds, dogs barking, and vehicles.

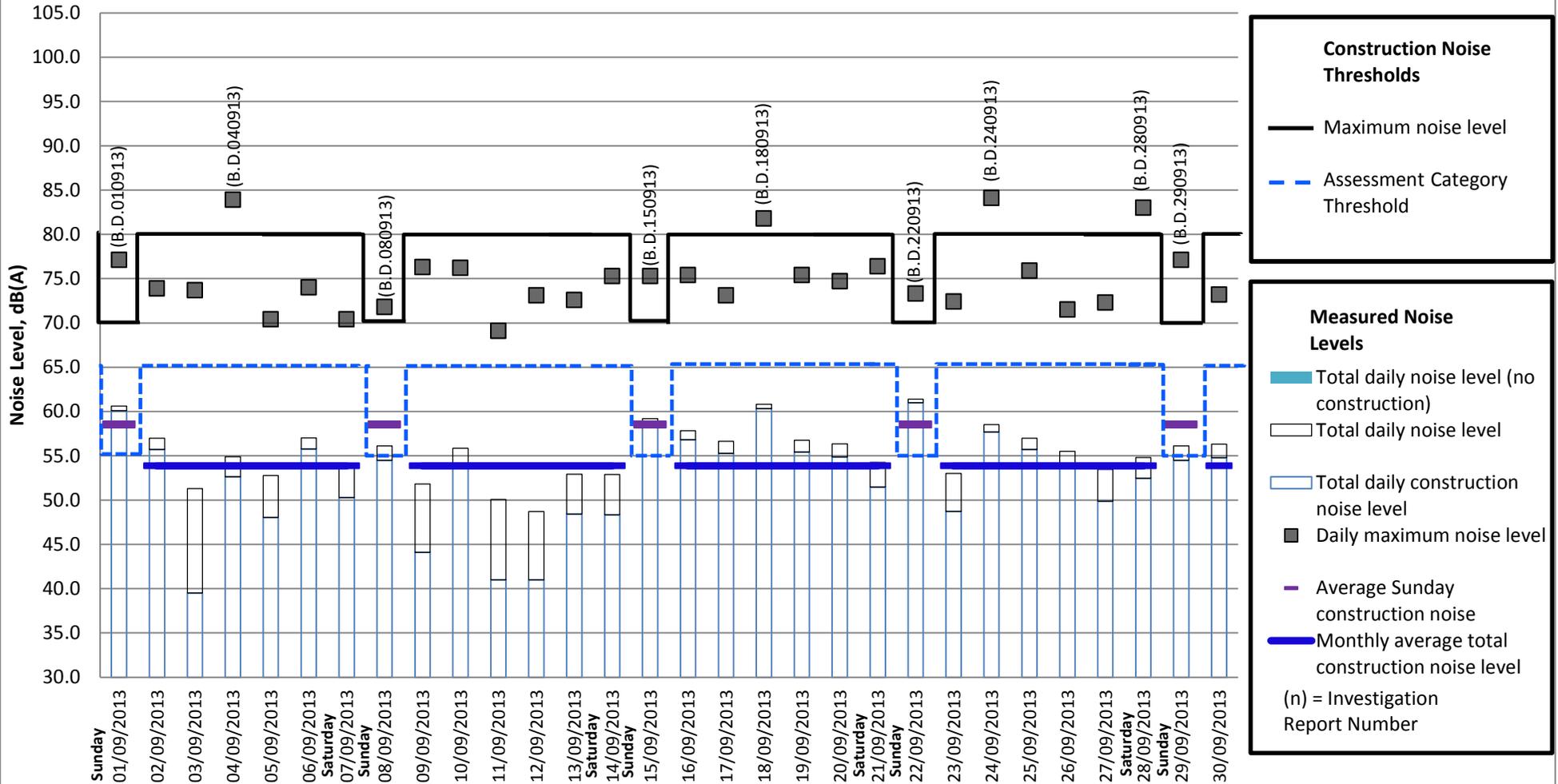
**Table 3: Summary of Construction Exceedances at Monitoring Locations**

Construction Related Noise Exceedances - September 2013						
Date	Monitor	Period	Description	Lmax (dB(A))	Threshold (dB(A))	NVIR No.
06/09/2013	Dundas Home Farm (South Network)	Day	Tipper Tipping for Earthbund	81.7	80.0	D.D.060913
23/09/2013	Clufflat Brae (Echline Field)	Day	Grass Cutting in public area of site	94.9	80.0	C.D.230913
01/10/2013		Night	Screech from Society Rd Works	67.5	65.0	C.N.300913
23/09/2013	Springfield (Echline Field)	Day	Grass Cutting in public area of site	89.5	80.0	C.D.230913
24/09/2013	Butlaw Fisheries (South Shore)	Day	Removal of Trial Pit with Vibro Hammer	84.1	80.0	B.D.240913
01/10/2013		Night	Society Rd Nightworks - Metal Clang	70.6	65.0	B.N.300913
01/10/2013	Inchgarvie Lodge (Society Road)	Night	Society Rd Nightworks - Tipper & Vibratory Roller	70.8	65.0	B.N.011013

## APPENDIX A

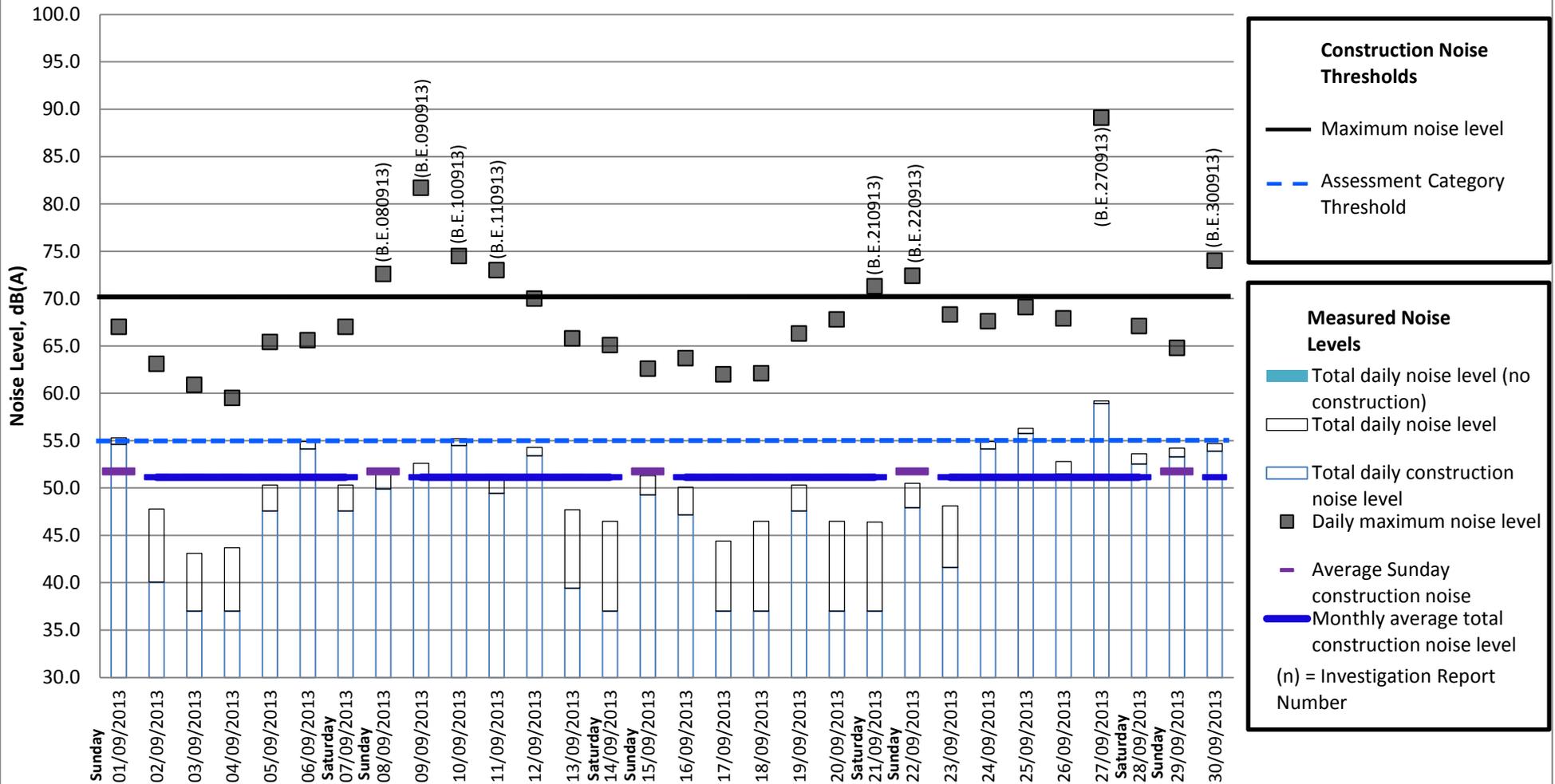
# Measured Daytime Noise Levels at Butlaw Fisheries

## Measurement period: September 2013



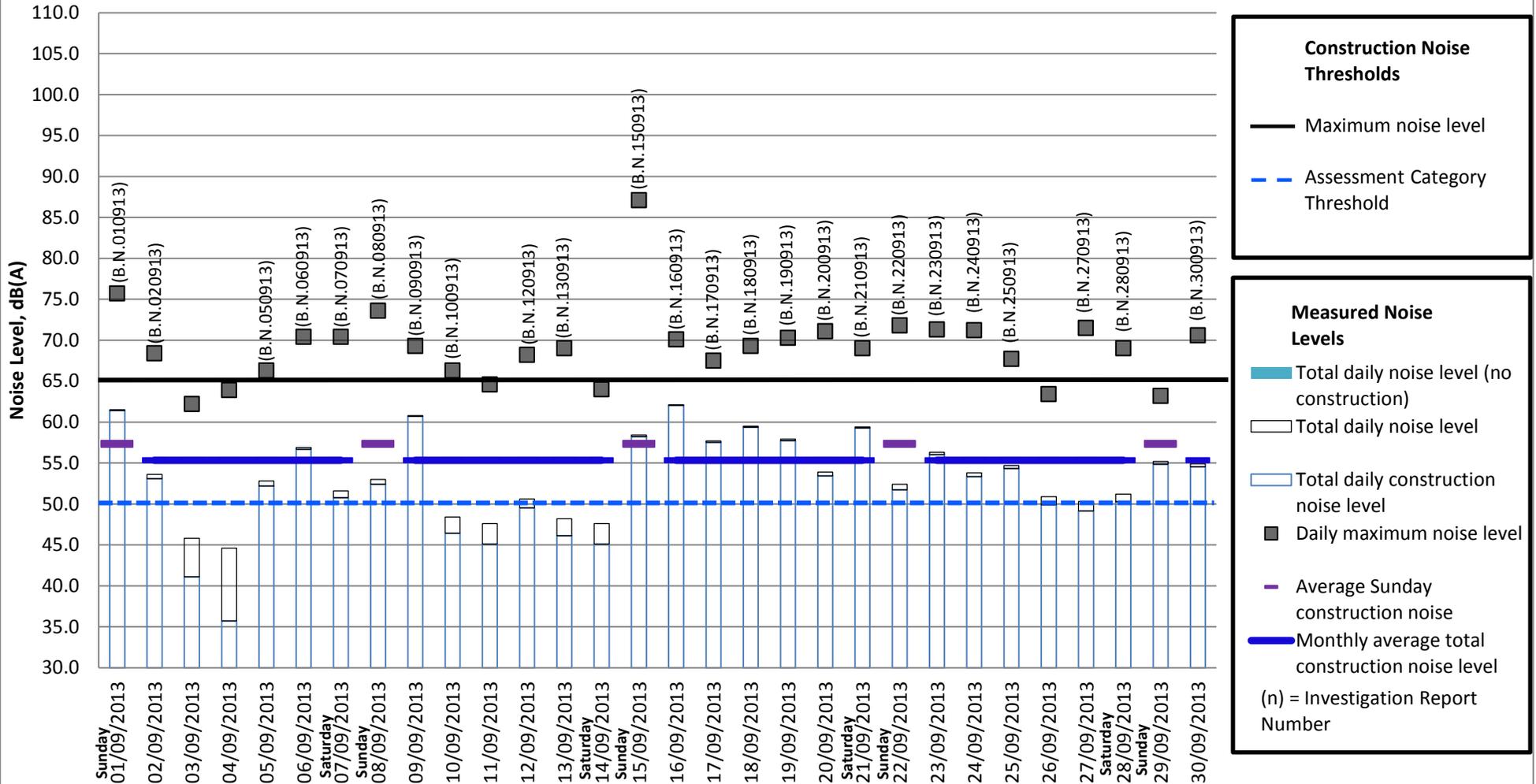
# Measured Evening Noise Levels at Butlaw Fisheries

## Measurement period: September 2013

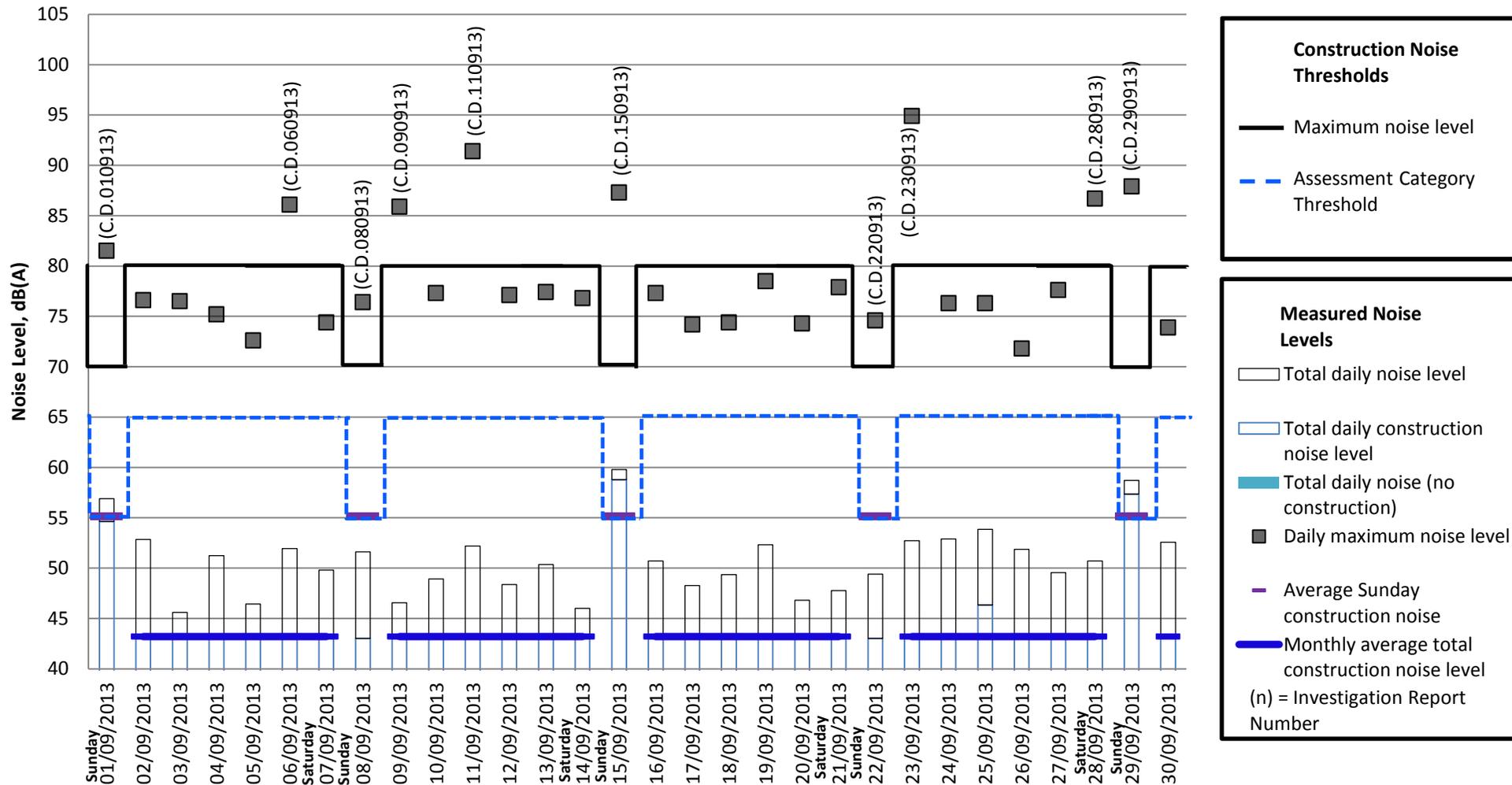


# Measured Night time Noise Levels at Butlaw Fisheries

## Measurement period: September 2013

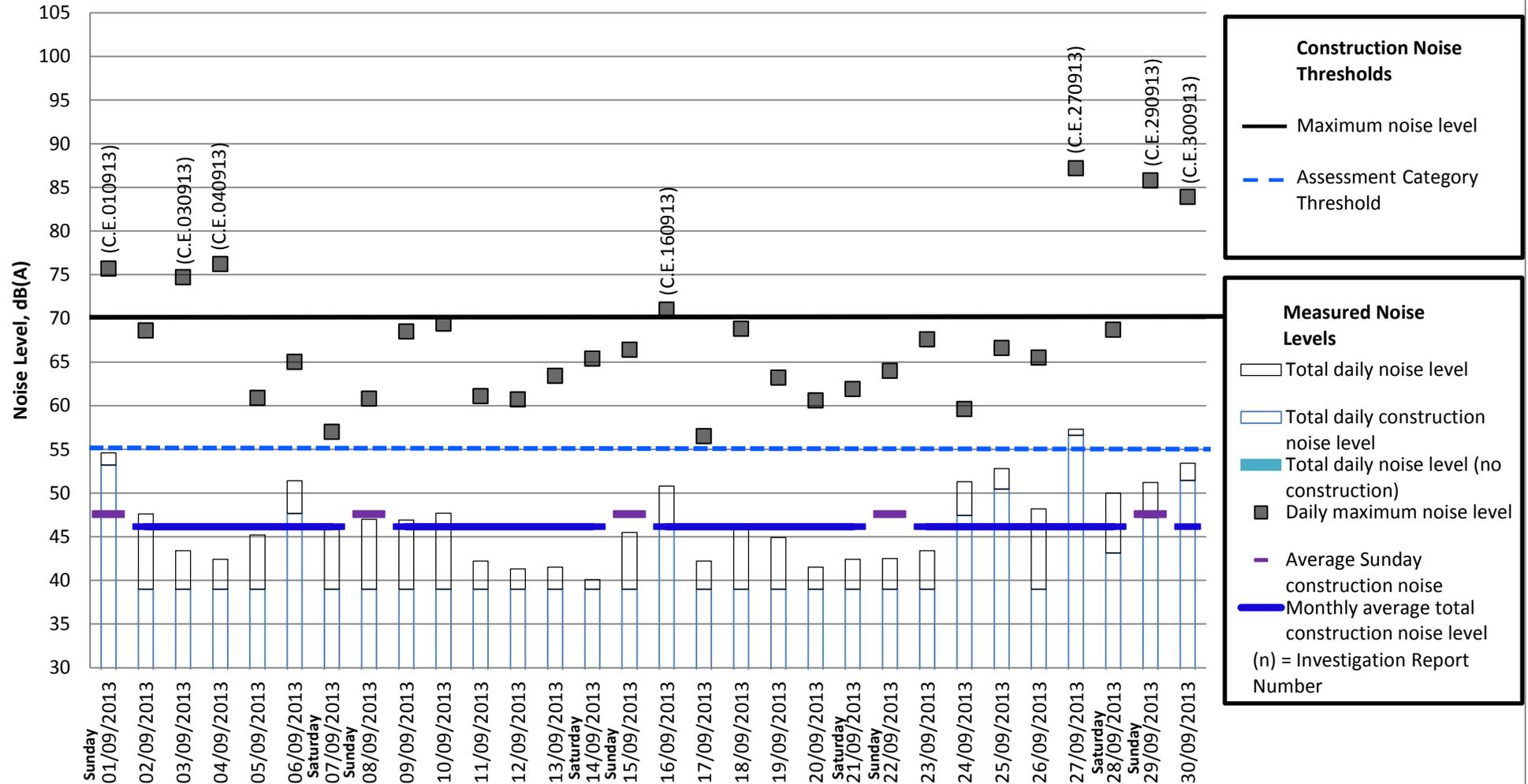


## Measured Daytime Noise Levels at Clufflat Brae Measurement period: September 2013



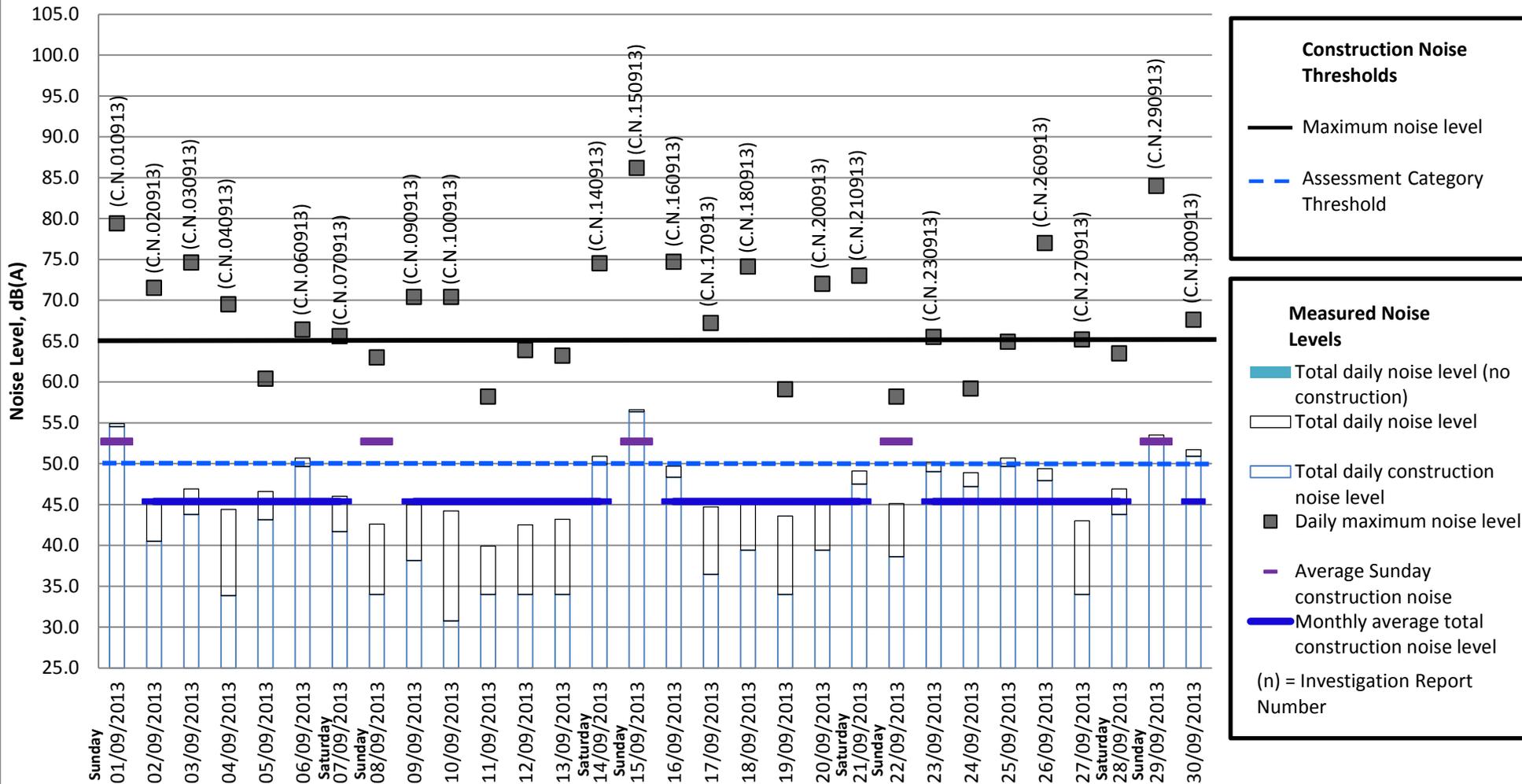
# Measured Evening Noise Levels at Clufflat Brae

## Measurement period: September 2013

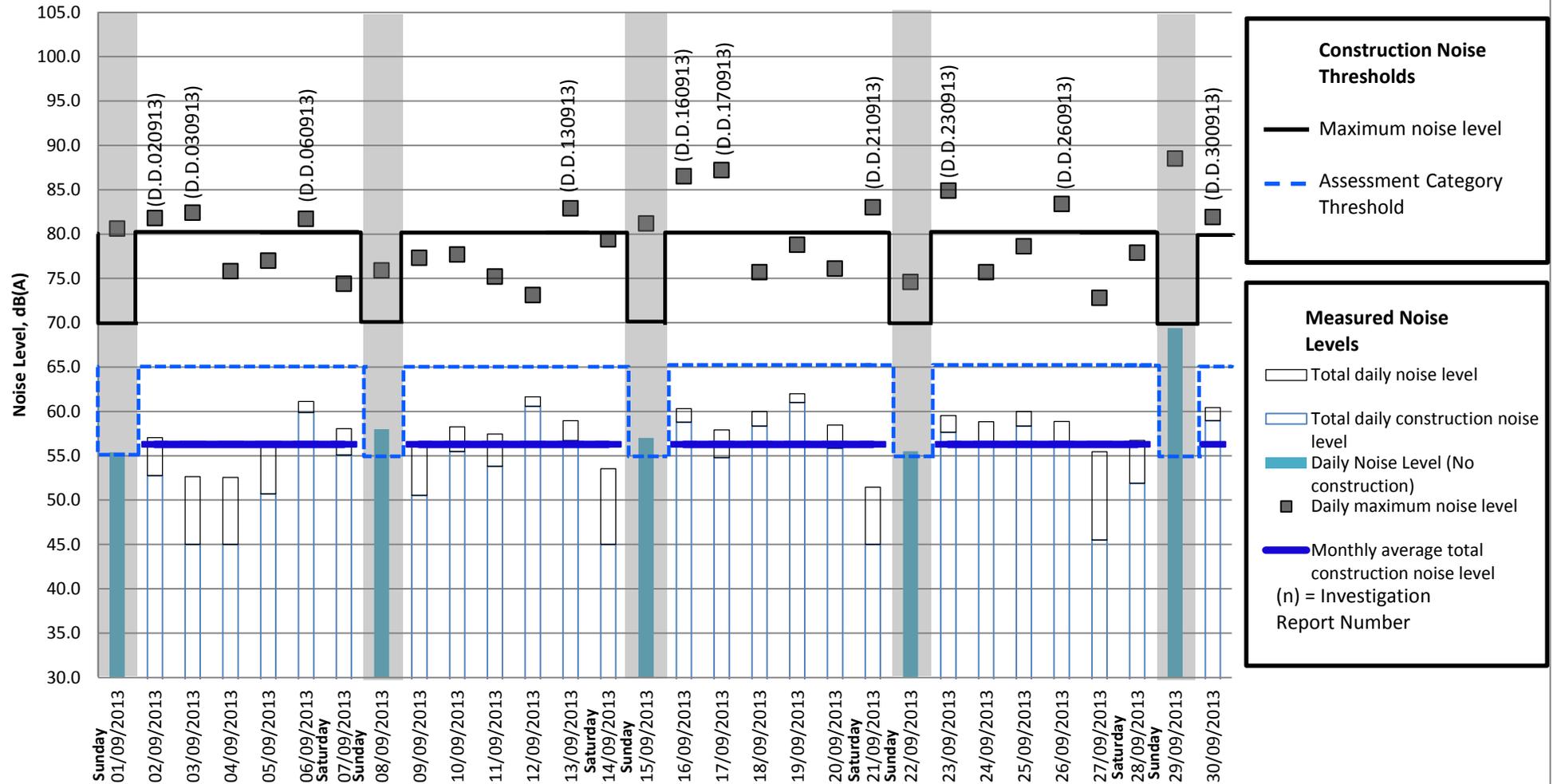


# Measured Night-time Noise Levels at Clufflat Brae

## Measurement period: September 2013

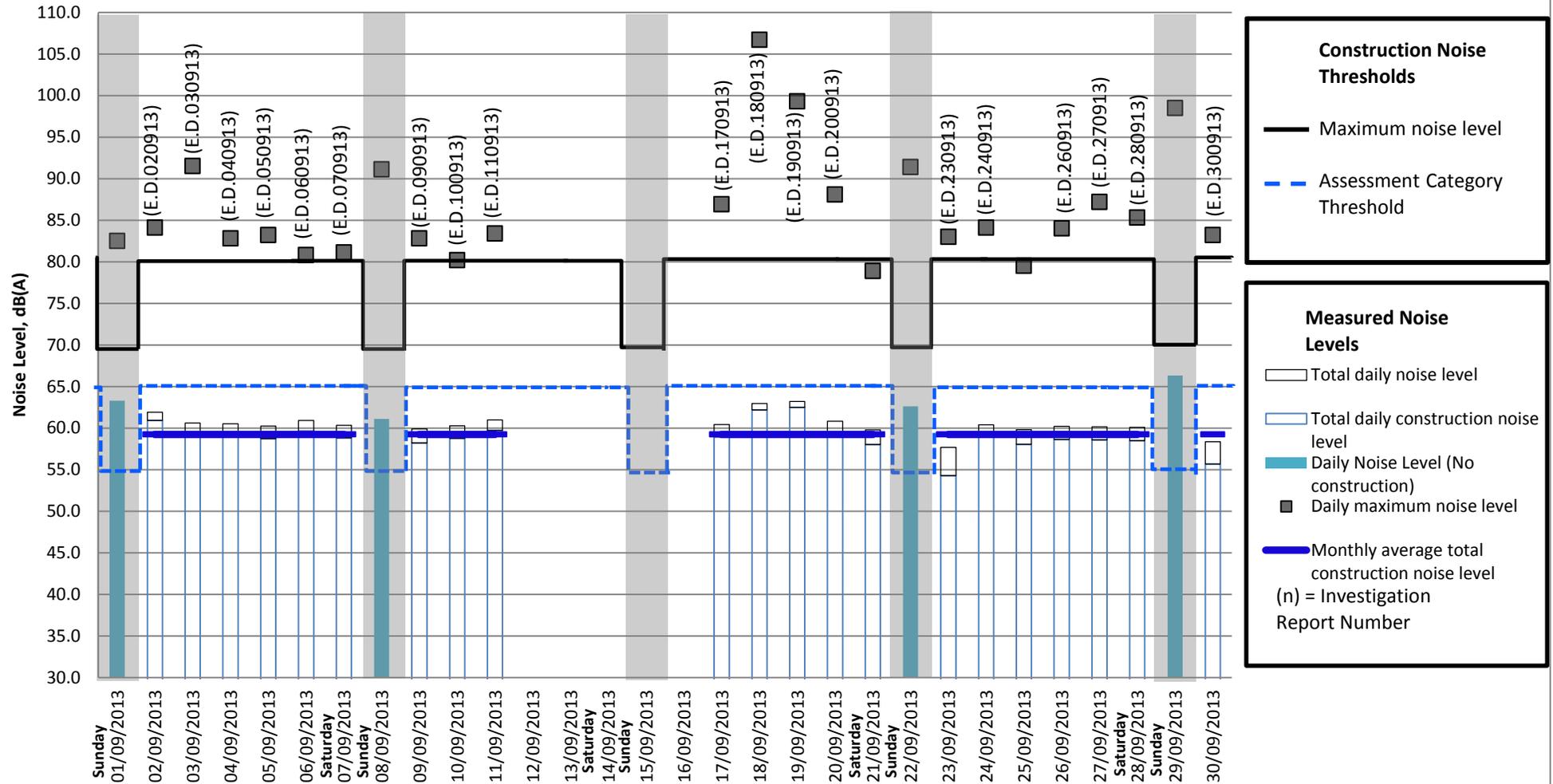


## Measured Daytime Noise Levels at Dundas Home Farm Measurement period: September 2013



**Note:** The grey areas of the chart represent days on which no construction works have been undertaken at this location; no Sunday works have been undertaken at this location

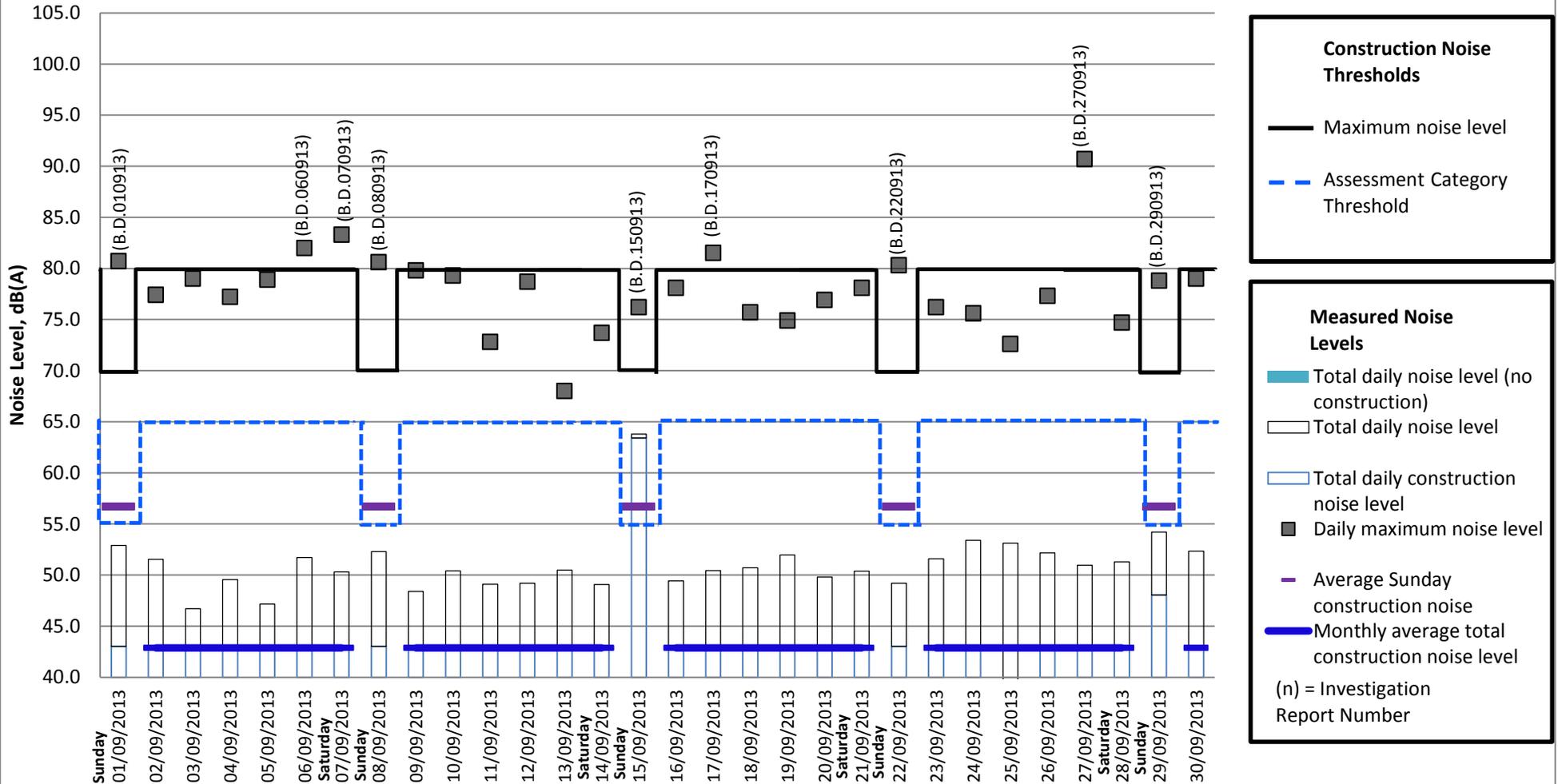
## Measured Daytime Noise Levels at Echline Measurement period: September 2013



**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 from 12/09/13 to 16/09/13 due to device error.

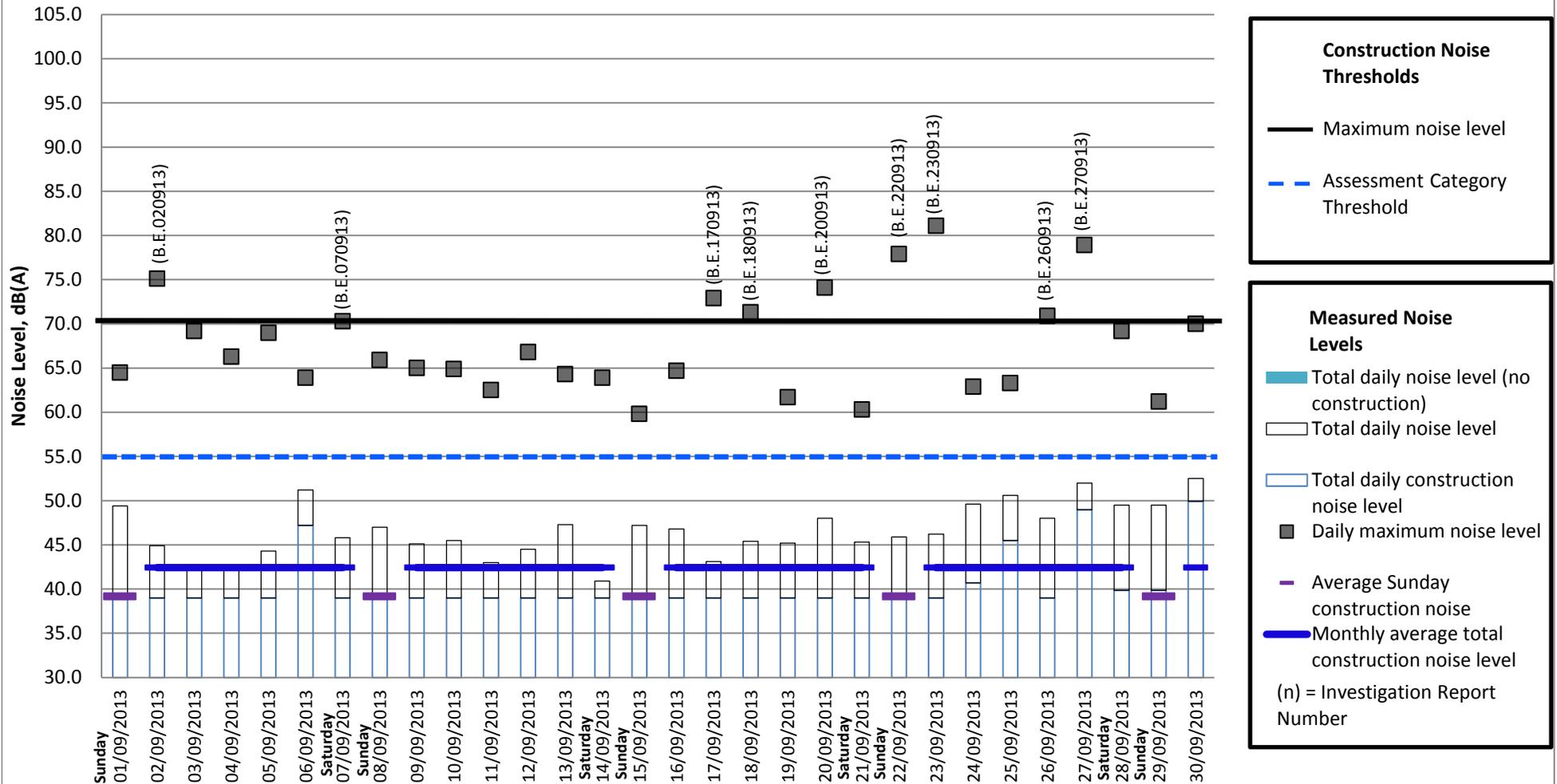
# Measured Daytime Noise Levels at Inchgarvie

## Measurement period: September 2013

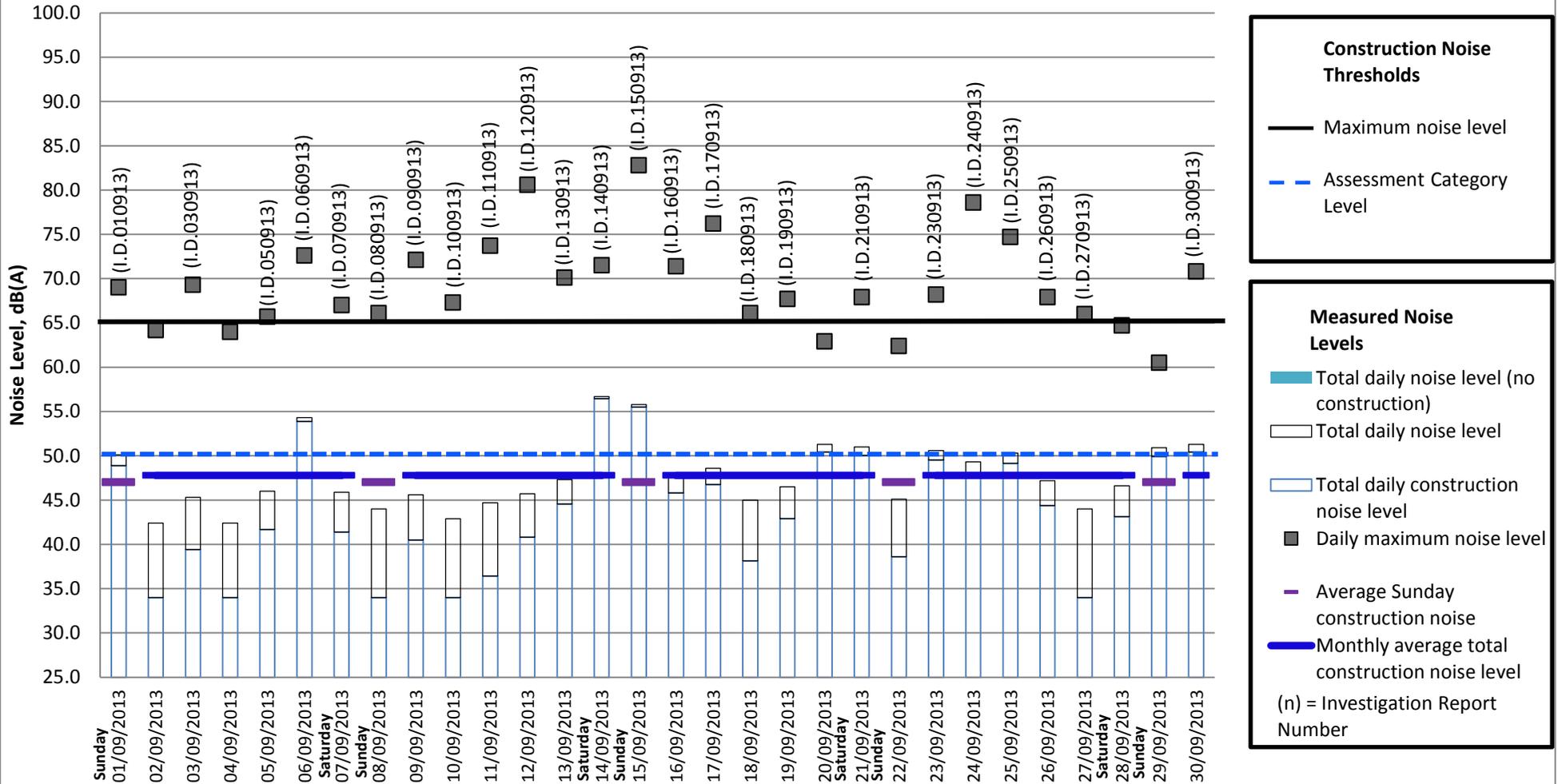


# Measured Evening Noise Levels at Inchgarvie

## Measurement period: September 2013

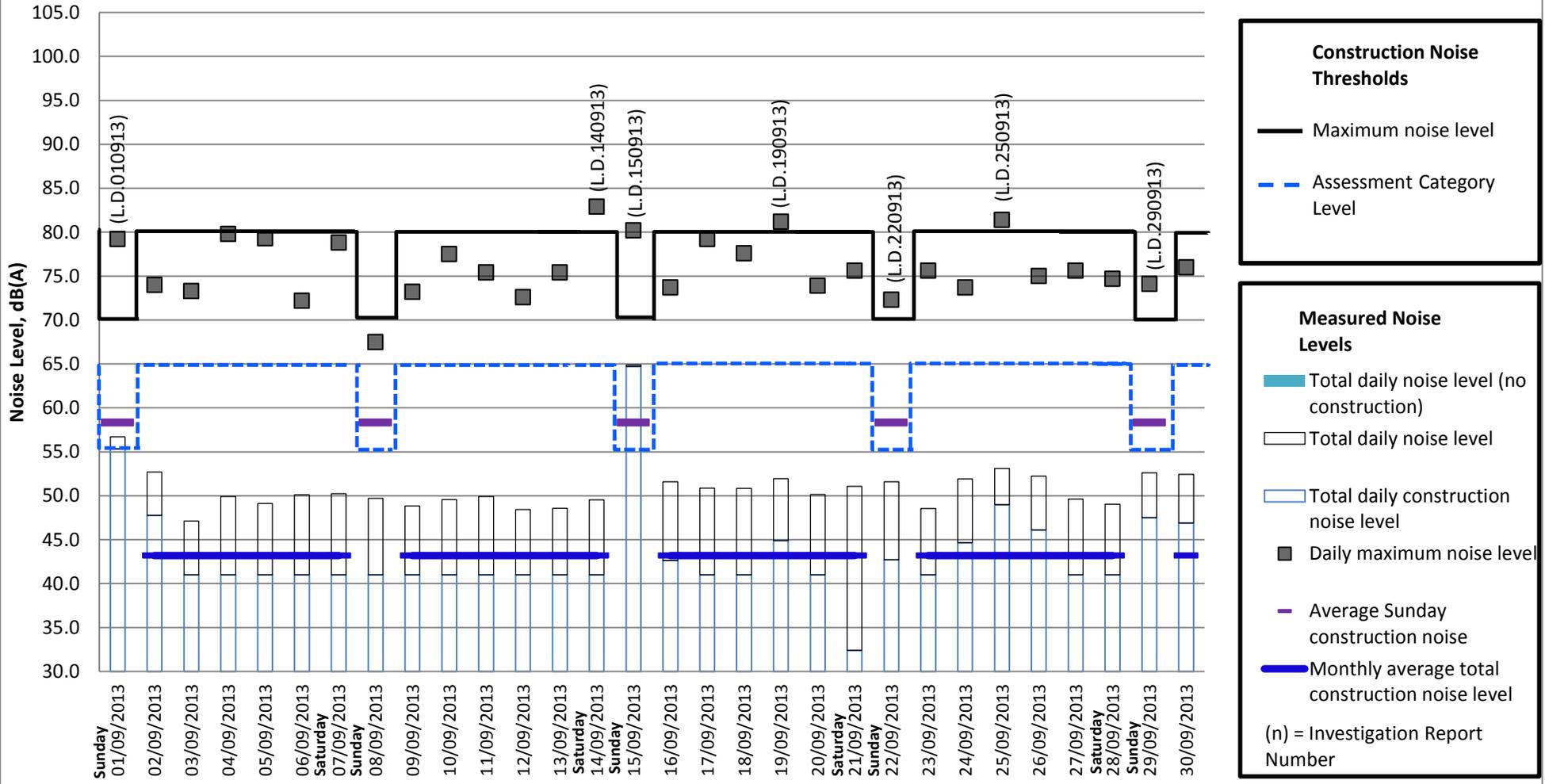


## Measured Night-time Noise Levels at Inchgarvie Measurement period: September 2013



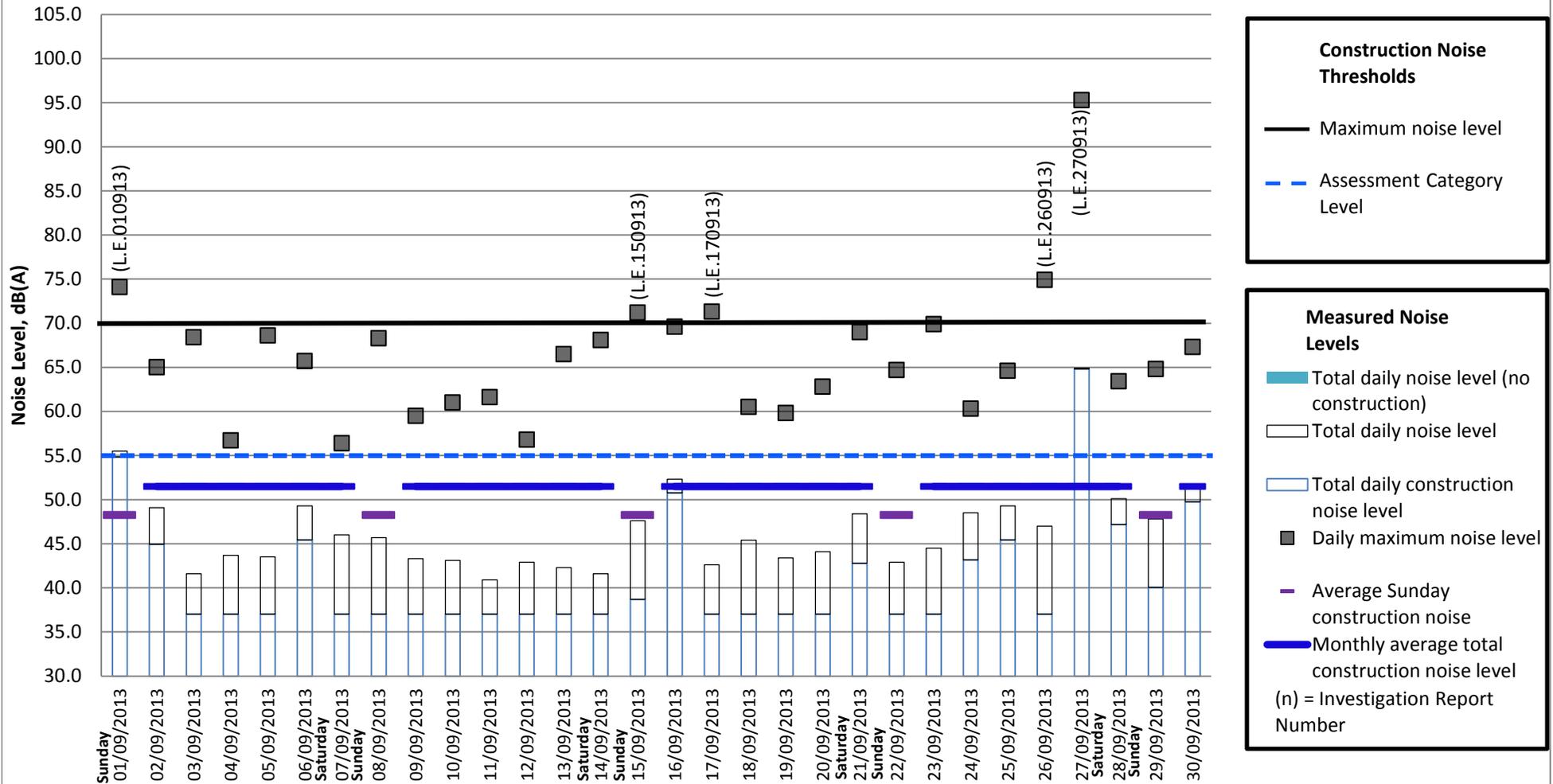
# Measured Daytime Noise levels at Linn Mill

## Measurement period: September 2013



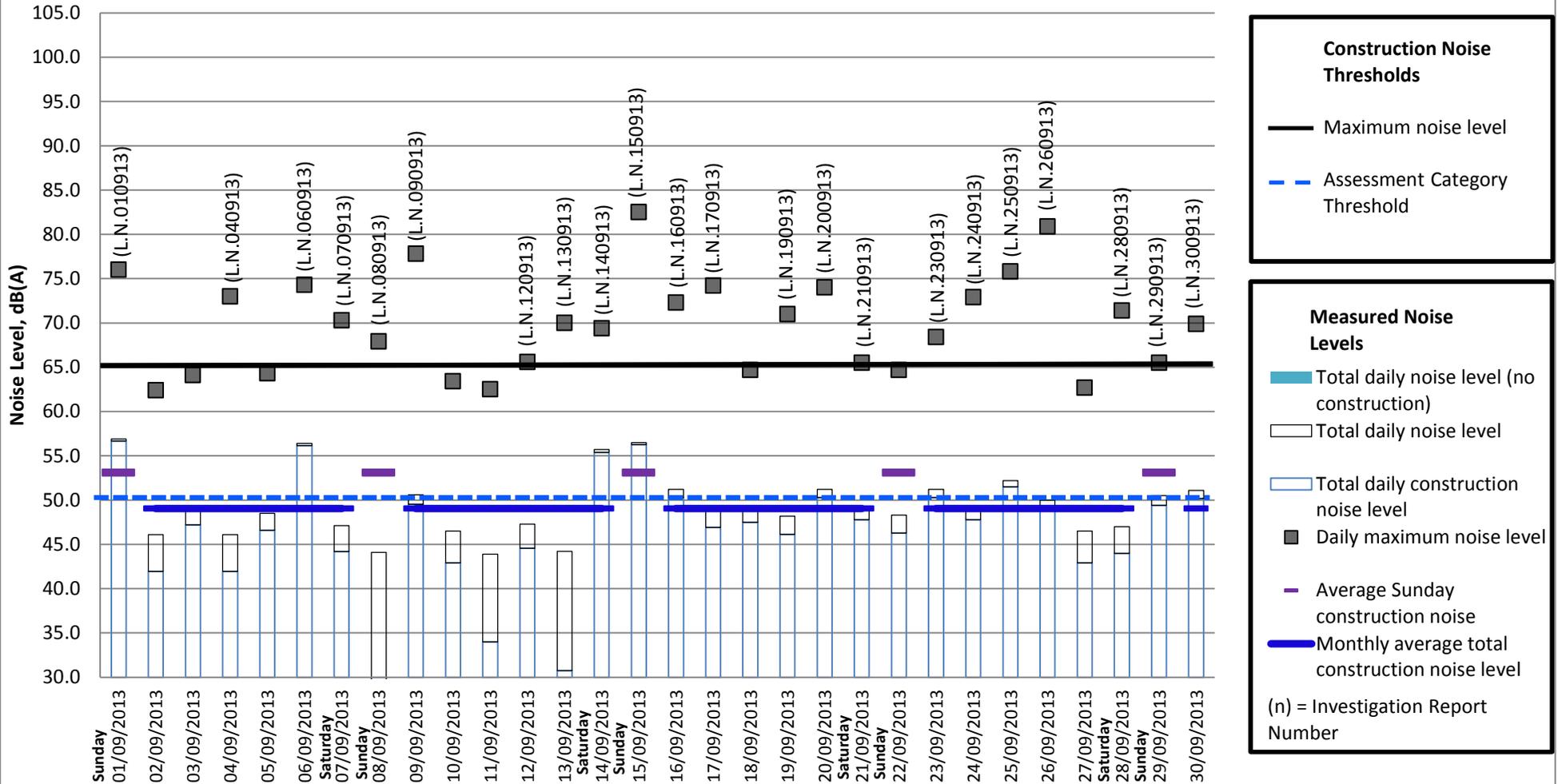
# Measured Evening Noise Levels at Linn Mill

## Measurement period: September 2013

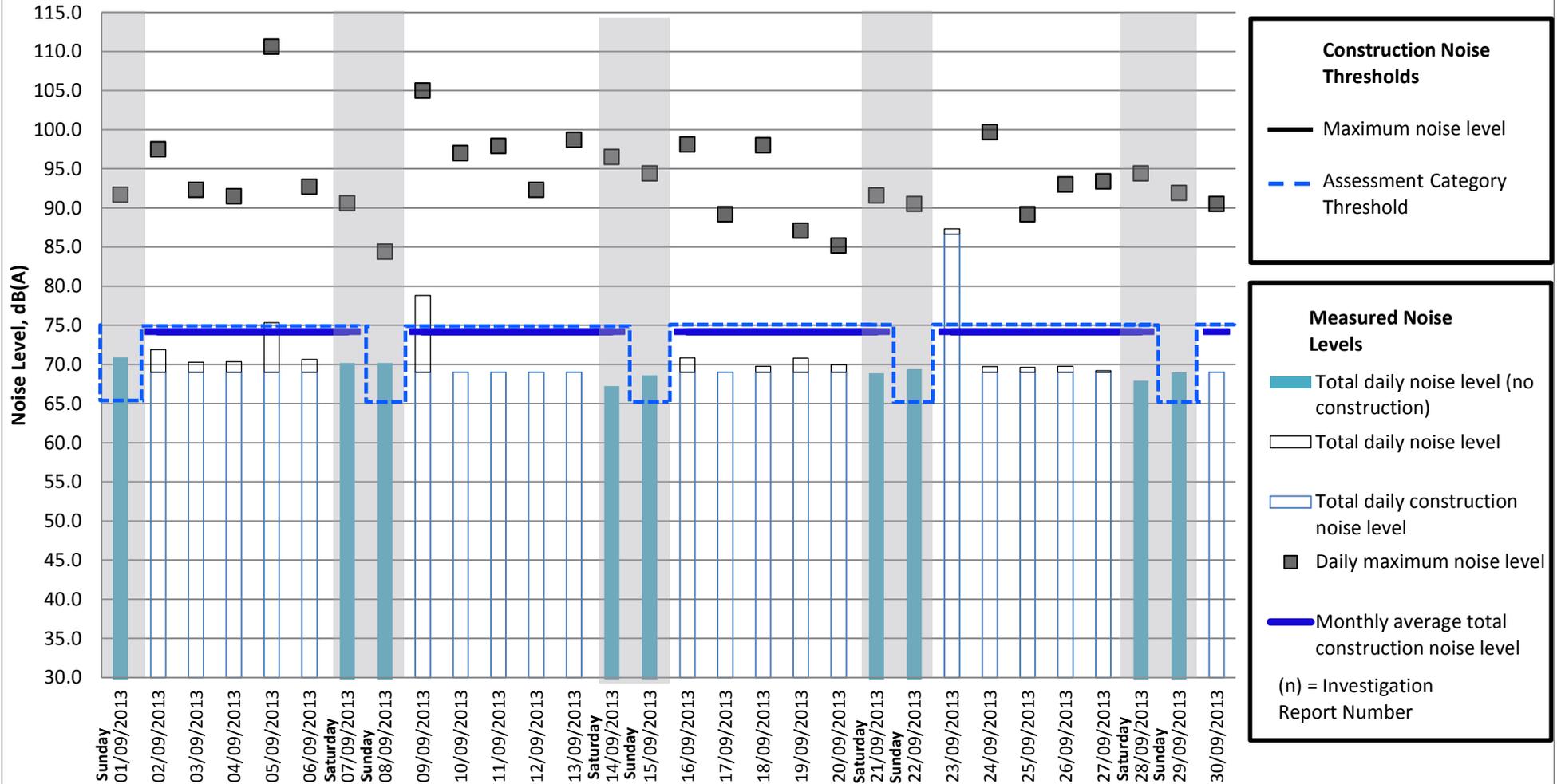


# Measured Night-time Noise Levels at Linn Mill

## Measurement period: September 2013

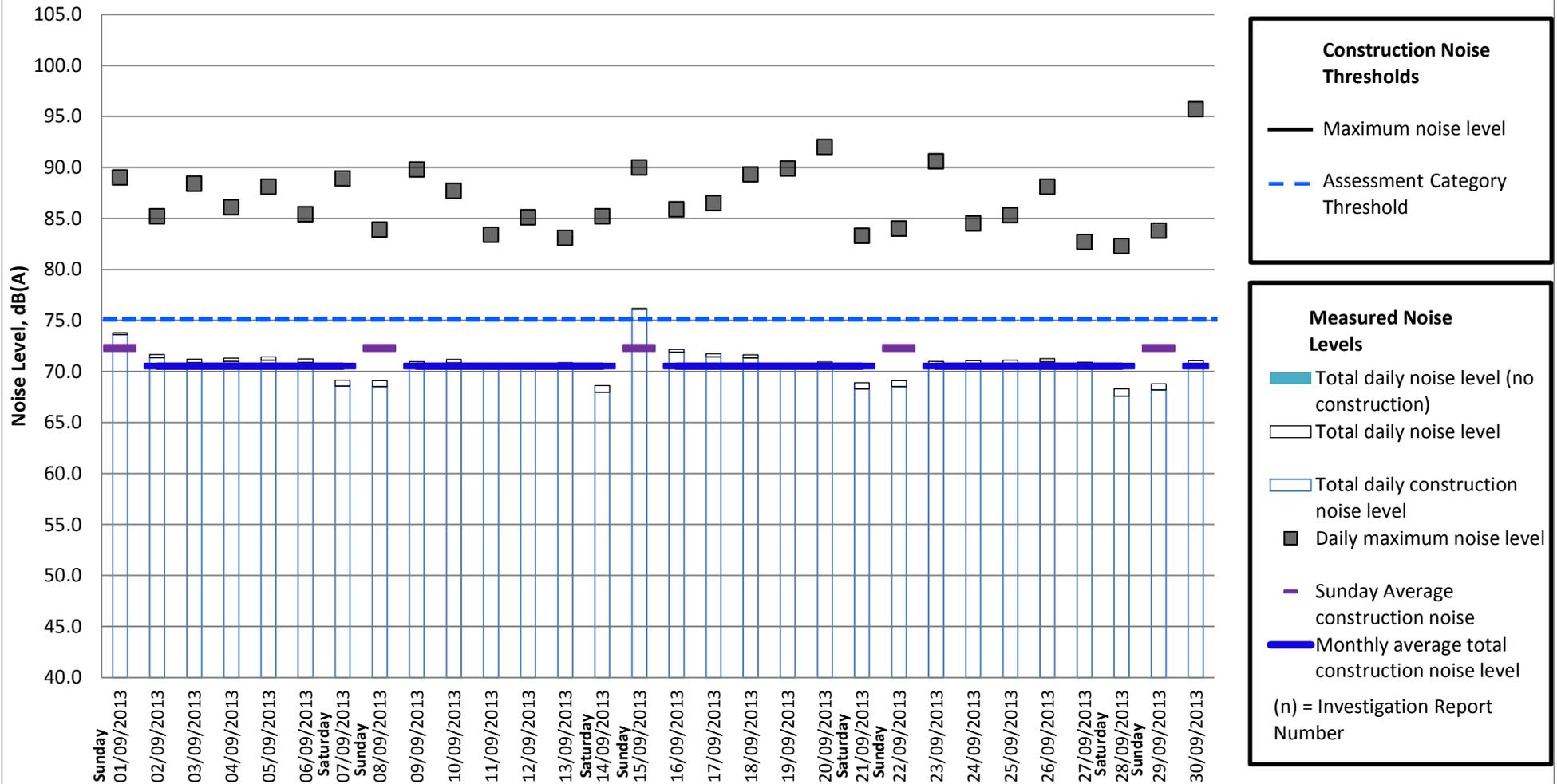


## Measured Daytime Noise Levels at Newton Measurement period: September 2013

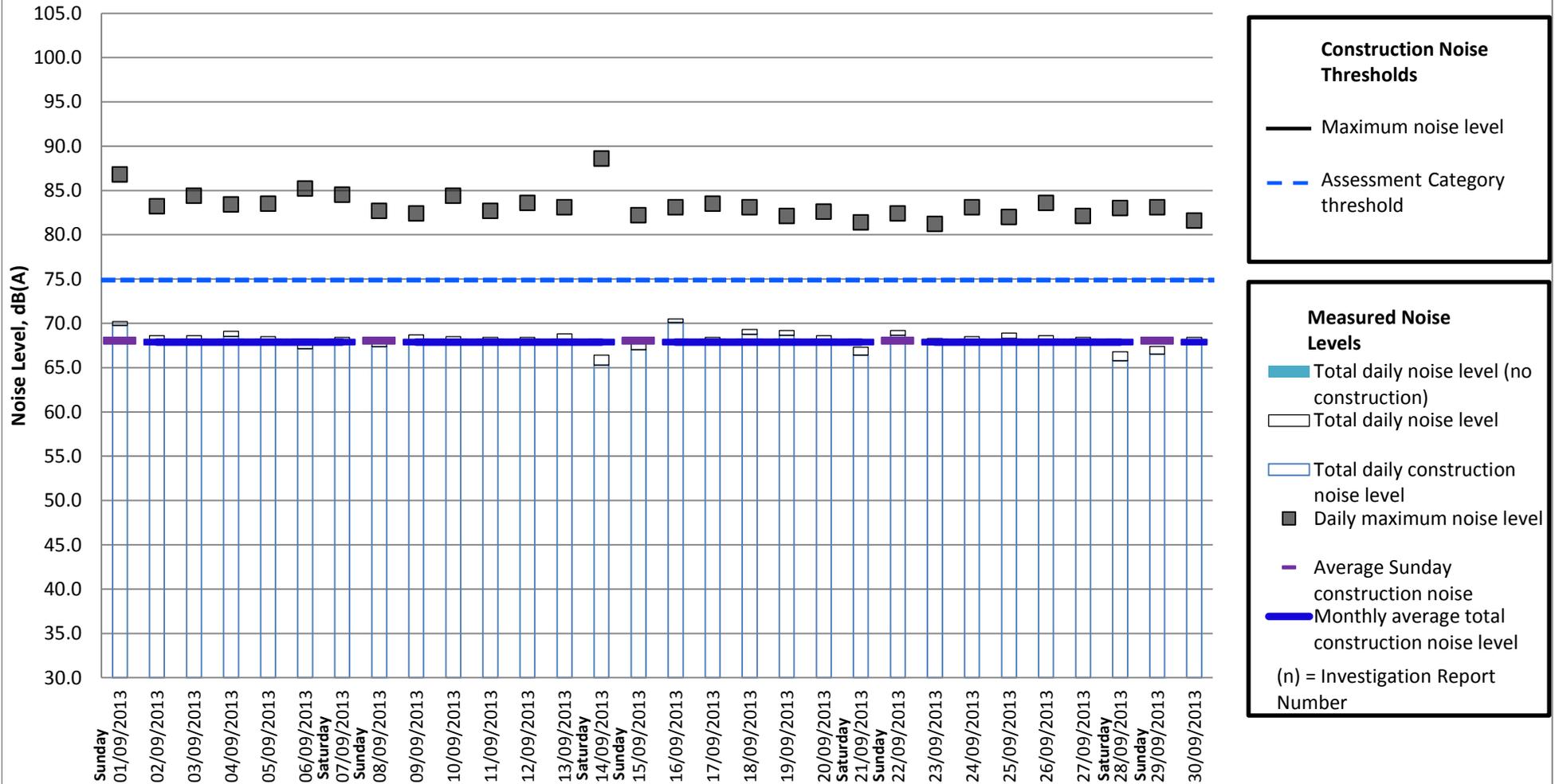


**Note:** The grey areas of the chart represent days on which no construction works have been conducted; no works have been conducted near this location on Saturday or Sunday. It should be noted that the measured noise levels Mon - Fri can not be attributed to construction works due to the considerable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

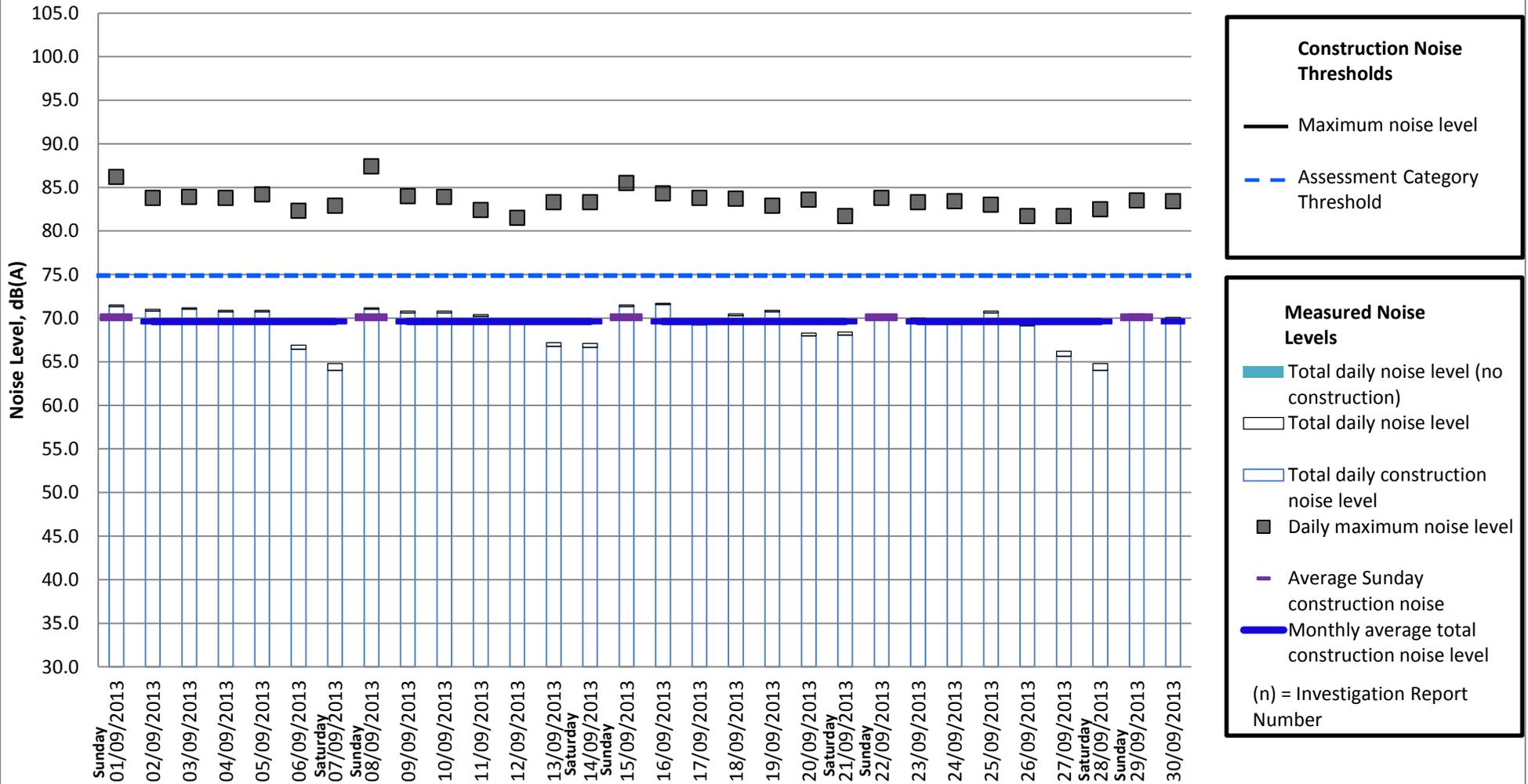
## Measured Daytime Noise Levels at North Leg Measurement period: September 2013



## Measured Evening Noise Levels at North Leg Measurement period: September 2013

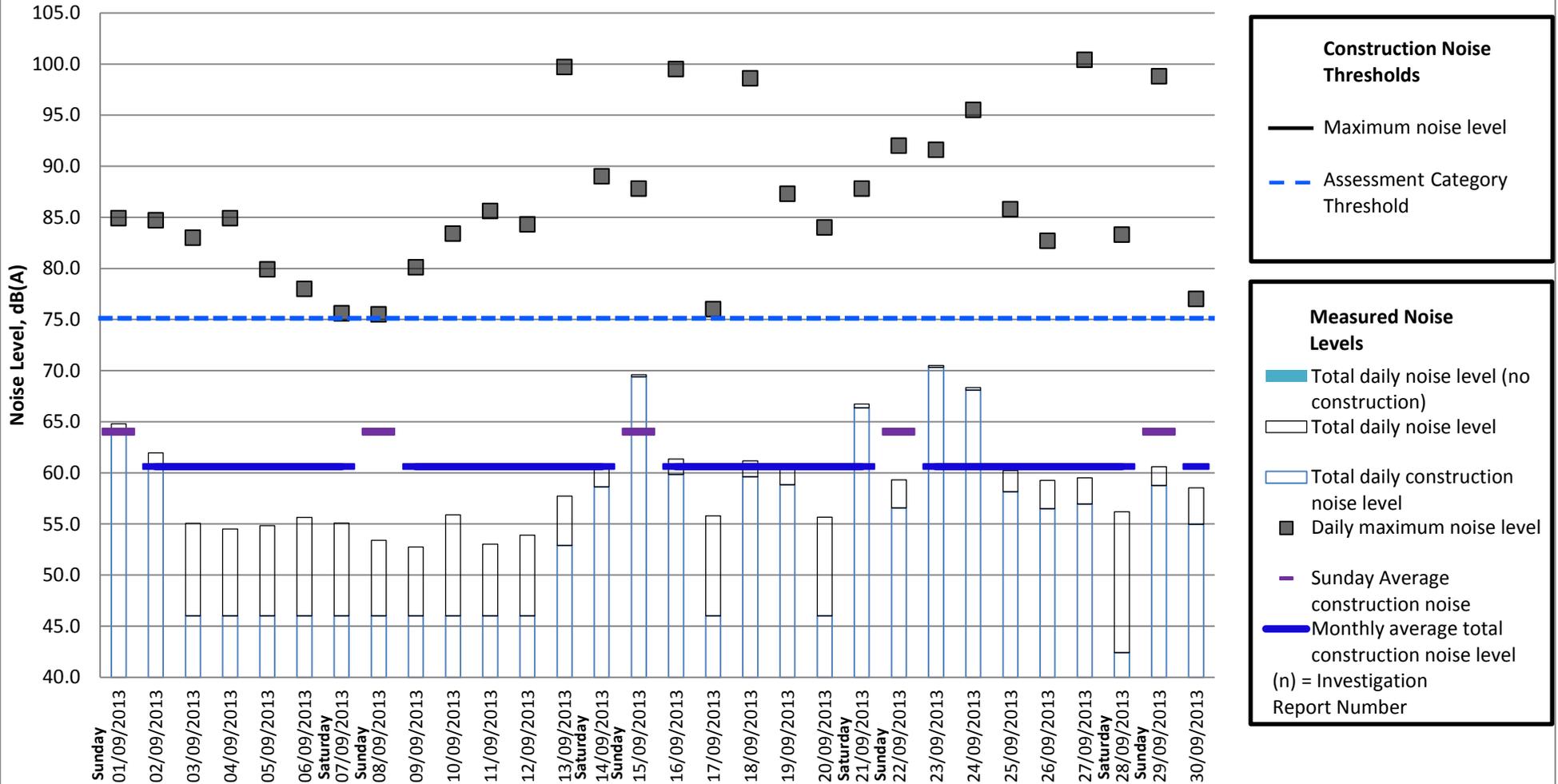


## Measured Night-time Noise Levels at North Leg Measurement period: September 2013



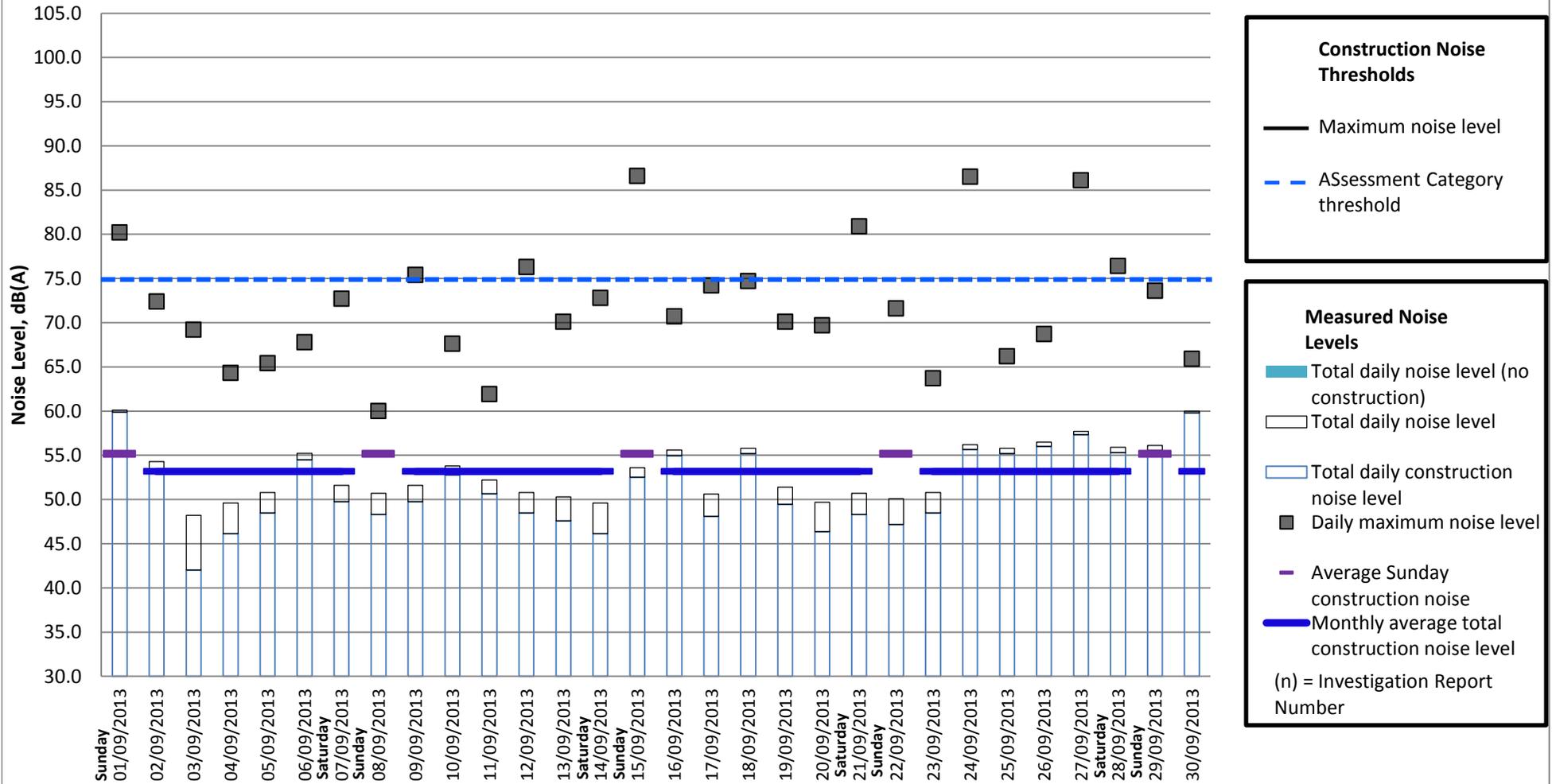
# Measured Daytime Noise Levels at Port Edgar

## Measurement period: September 2013

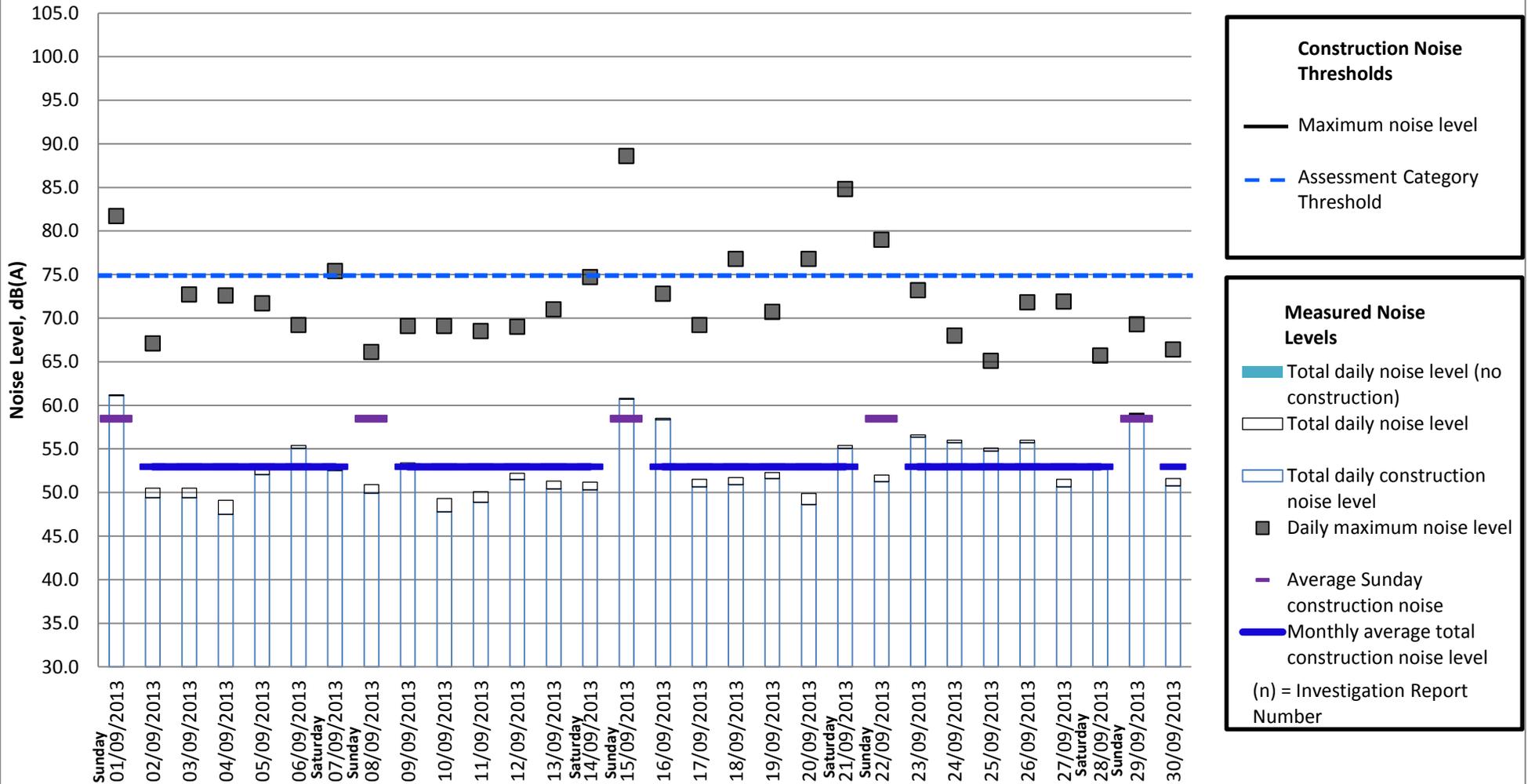


# Measured Evening Noise Levels at Port Edgar

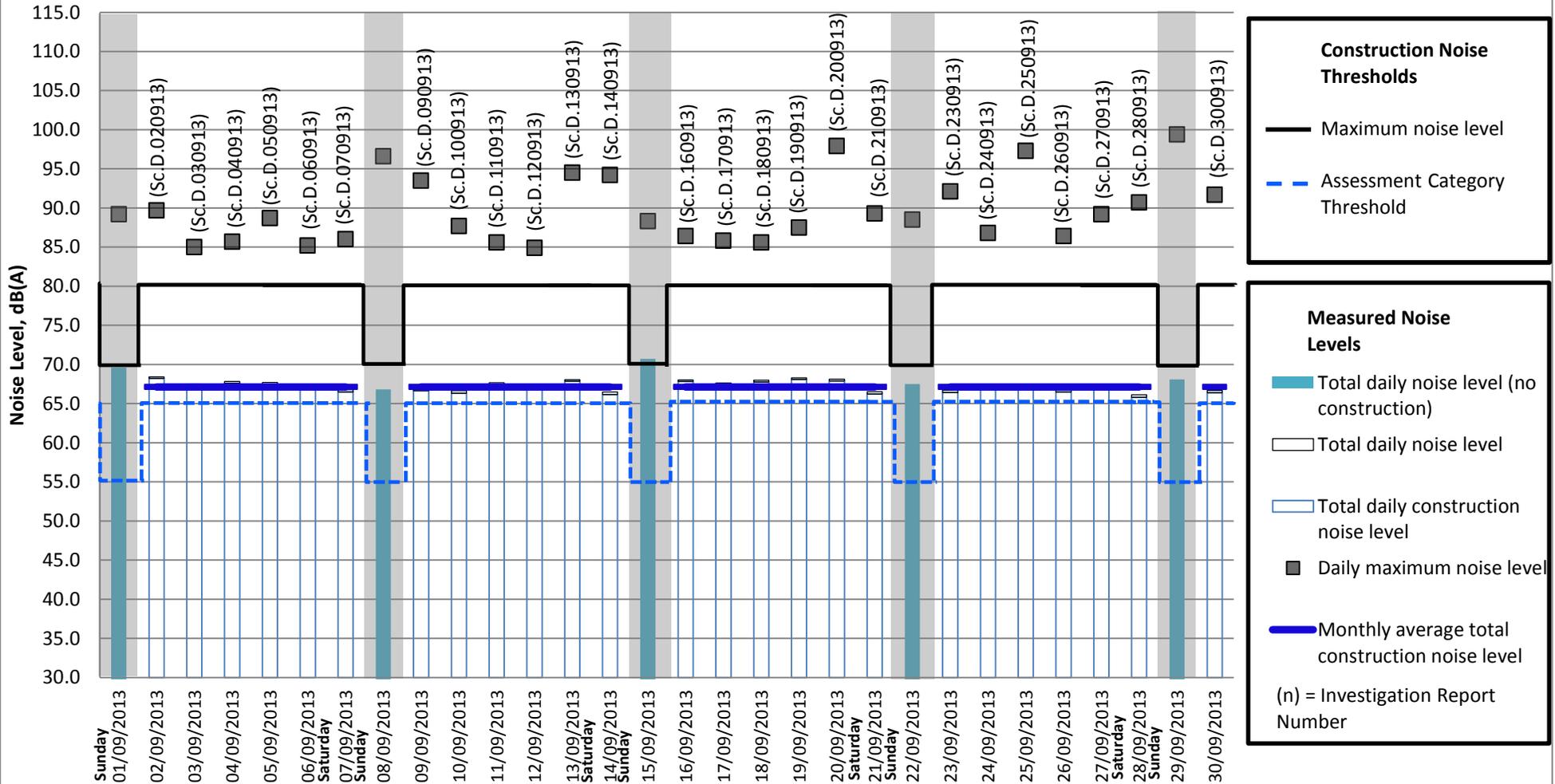
## Measurement period: September 2013



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

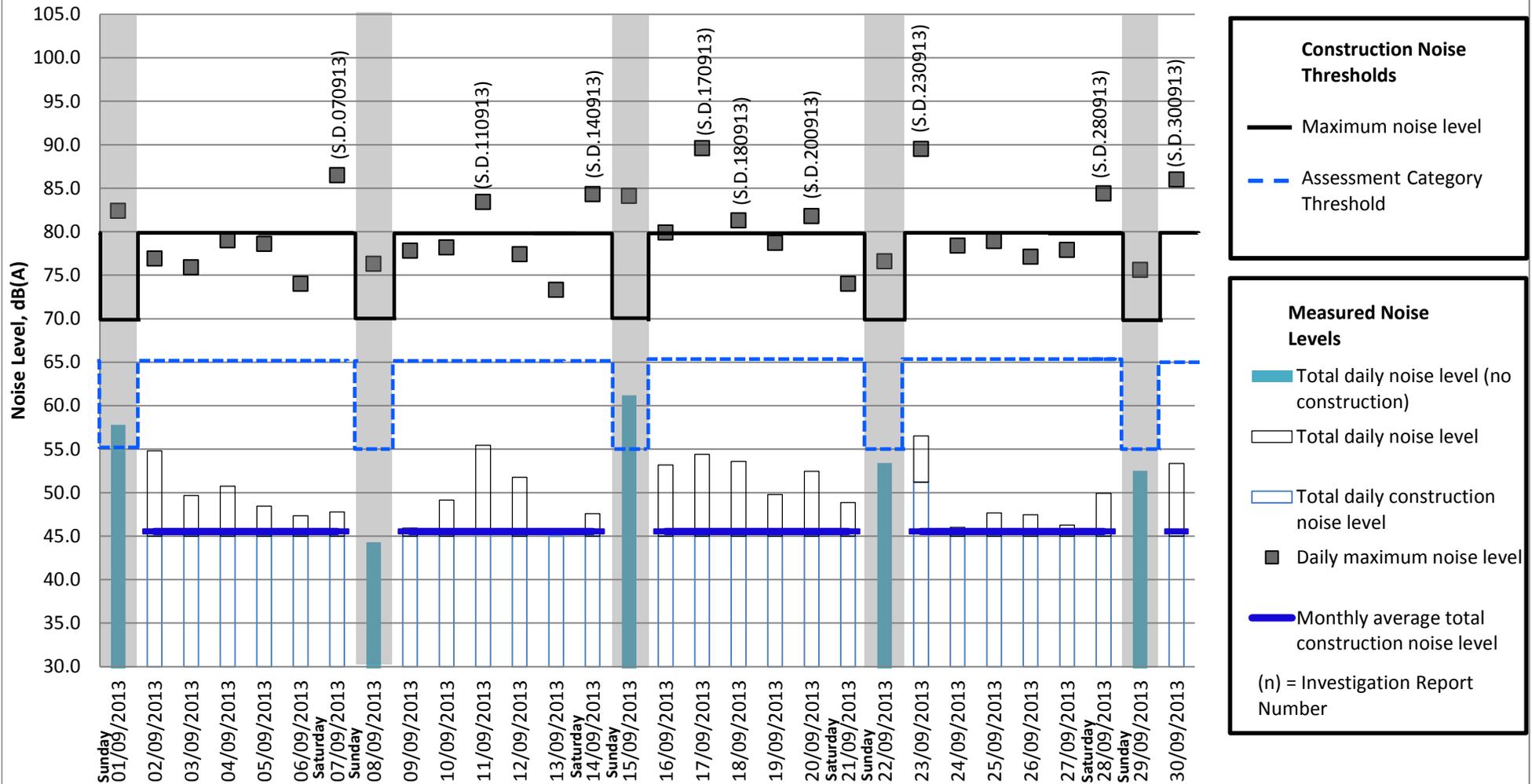


## Measured Daytime Noise Levels at Scotstoun Measurement period: September 2013



**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 .

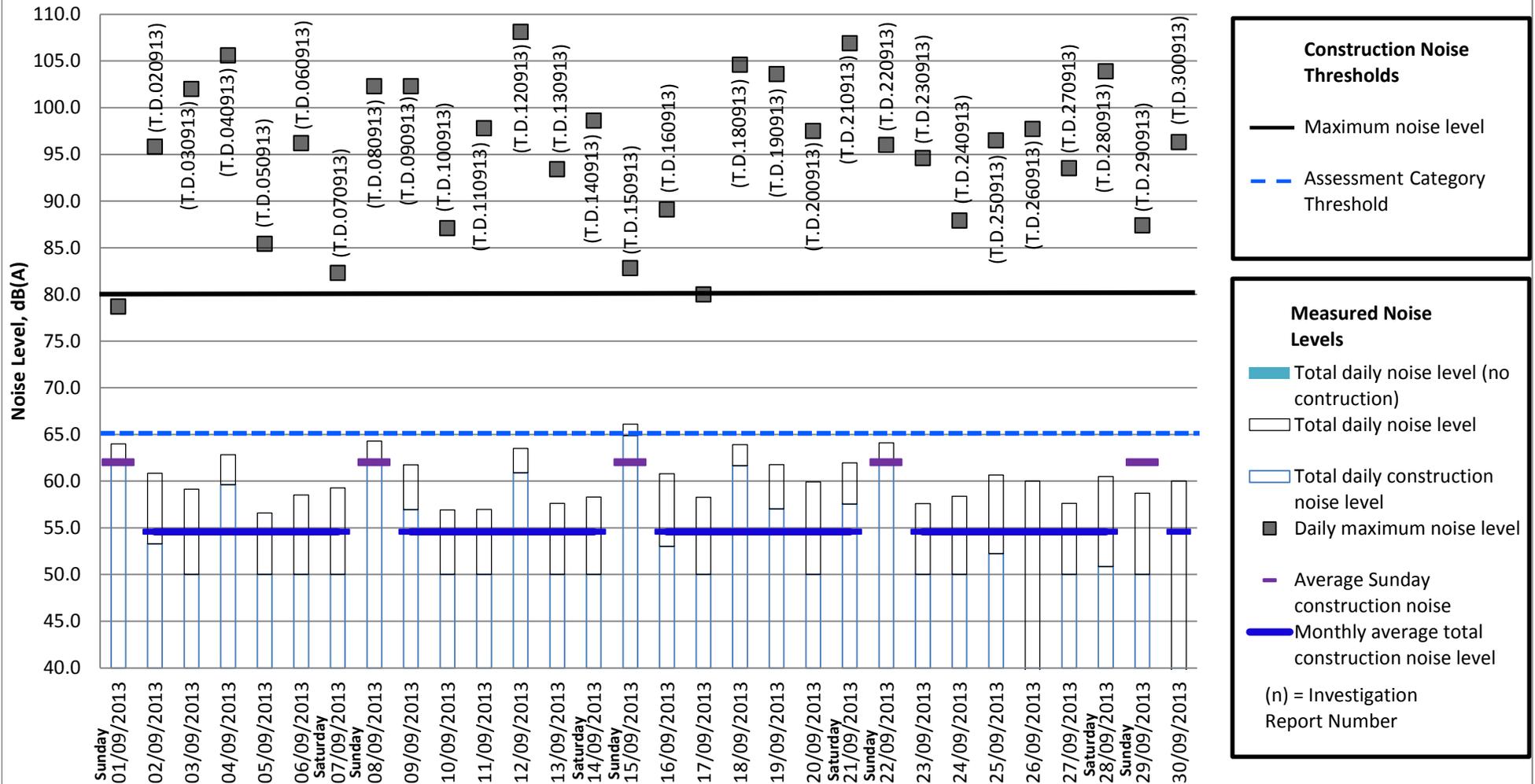
## Measured Daytime Noise Levels at Springfield Measurement period: September 2013



**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: September 2013



**Construction Noise Thresholds**

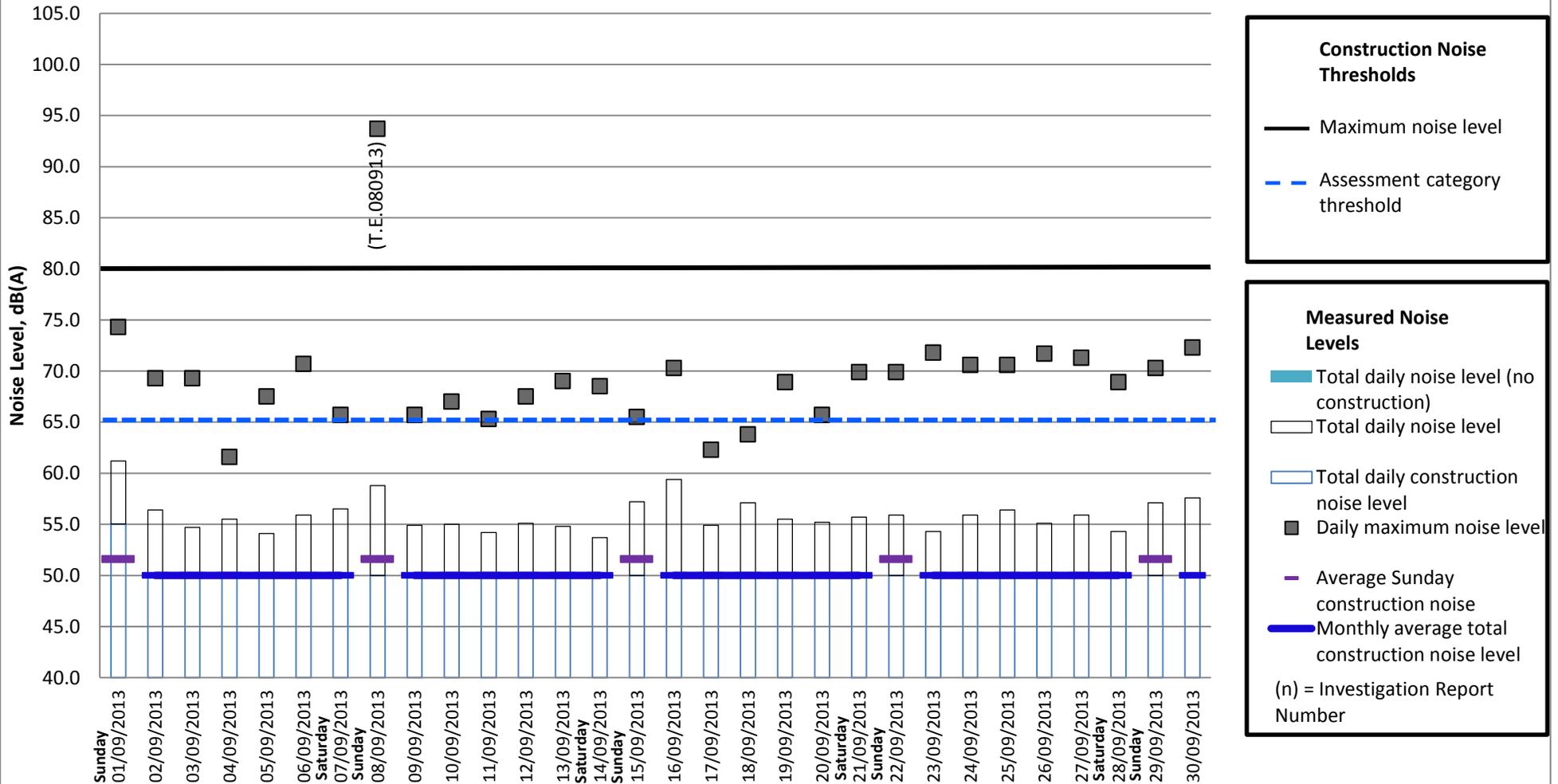
- Maximum noise level
- Assessment Category Threshold

**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

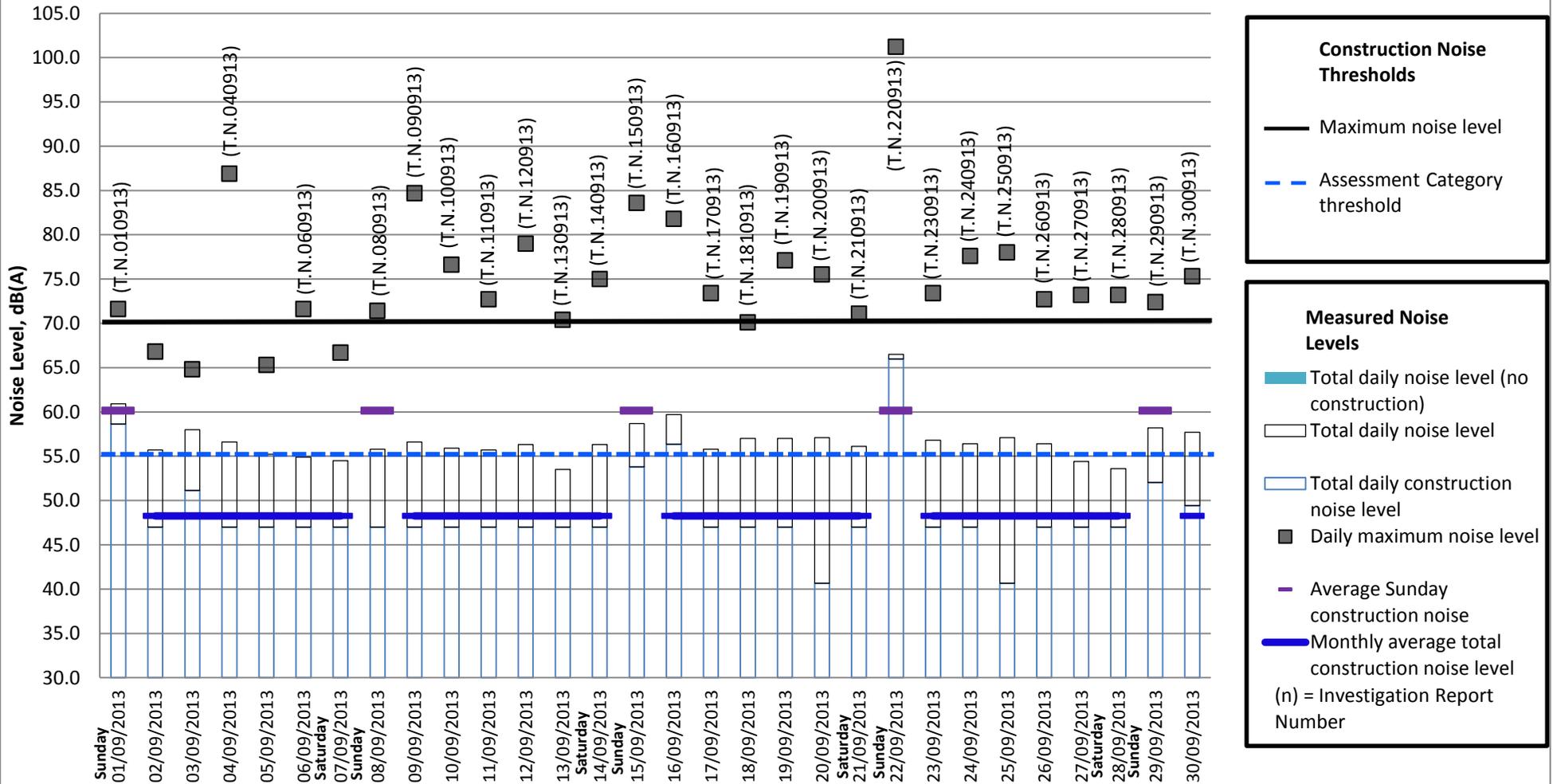
(n) = Investigation Report Number

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

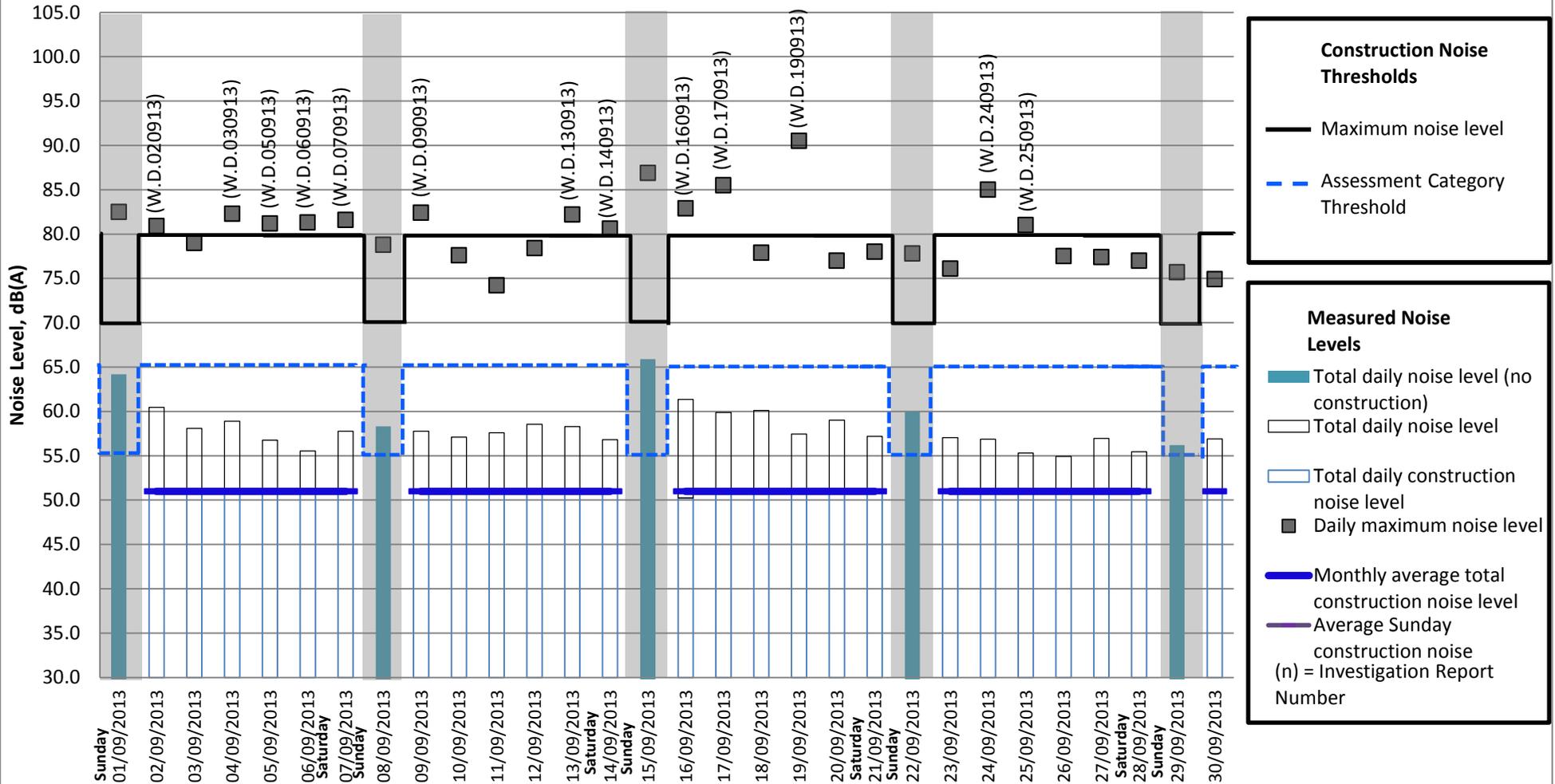


# Measured Night-time Noise Levels at Tigh-Na-Grian

## Measurement period: September 2013



## Measured Daytime Noise Levels at Whinny Hill Measurement period: September 2013



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