



Contractor



**Forth Crossing** Bridge Constructors

HOCHTIEF Solutions  
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Project **FORTH REPLACEMENT CROSSING**

Document title

**CONSTRUCTION NOISE MONITORING REPORT: APRIL 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 April 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 April 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 April 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 April 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<br>N.B. No evening, night time or Sunday daytime construction in vicinity.   |
| M3   | Tigh-Na-Grian       | Crossing                     | Works within Central Tower cofferdam<br>North Tower caisson excavation<br>North Tower airlifting preparation works  |
| M4   | North Leg           | Crossing                     | Works within Central Tower cofferdam<br>North Tower caisson excavation<br>South Tower excavation<br>Pier S1 caisson excavation<br>Pier S4 airlifting<br>Pier S5 airlifting & concrete works<br>Drilling of de-stressing wells at pier S6<br>Construction of access causeway between piers S6 and S5   |
| M6   | Port Edgar          | Crossing                     | Works within Central Tower cofferdam<br>South Tower excavation<br>Pier S1 caisson excavation<br>Pier S4 airlifting<br>Pier S5 airlifting & concrete works<br>Drilling of de-stressing wells at pier S6<br>Construction of access causeway between piers S6 and S5   |
| M7   | Butlaw Fisheries    | Crossing                     | Works within Central Tower cofferdam<br>South Tower excavation<br>Pier S1 caisson excavation<br>Pier S4 airlifting<br>Pier S5 airlifting & concrete works<br>Drilling of de-stressing wells at pier S6<br>Construction of access causeway between piers S6 and S5   |
| M10  | Inchgarvie Lodge    | Crossing                     | South Tower excavation<br>Pier S1 caisson excavation<br>Pier S4 airlifting<br>Pier S5 airlifting & concrete works<br>Drilling of de-stressing wells at pier S6<br>Construction of access causeway between piers S6 and S5<br>Excavation of launch<br>South Abutment works<br>Works on launch foundations including fixing steel, erecting formwork and concreting |
| M11  | Linn Mill           | Network (close proximity to) | Excavation of launch<br>South Abutment works<br>Works on launch foundations including   |

|     |                  |           |   |
|-----|------------------|-----------|---|
|     |                  | Crossing) | fixing steel, erecting formwork and concreting  |
| M13 | Clufflat Brae    | Crossing  | Excavation of launch<br>South Abutment works<br>Works on launch foundations including fixing steel, erecting formwork and concreting  |
| M14 | Springfield      | Network   | Excavation of launch<br>South Abutment works<br>Works on launch foundations including fixing steel, erecting formwork and concreting<br>Structure works at gyratory<br><br>N.B. No evening, night time or Sunday daytime construction in vicinity.                                |
| M15 | Echline Field    | Network   | Excavation of launch<br>Works on launch foundations including fixing steel, erecting formwork and concreting<br>Structure works at gyratory<br>Drainage works at A904/U221<br>U221 topsoil batters<br><br>N.B. No evening, night time or Sunday daytime construction in vicinity. |
| M16 | Scotstoun        | Network   | Drainage works<br>Placing rock/clay for embankment<br><br>N.B. No evening, night time or Sunday daytime construction in vicinity.   |
| M17 | Dundas Home Farm | Network   | Utilities works<br>Fill using clay for road network<br><br>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. Some device errors were encountered in April resulting in loss of data for short periods at Inchgarvie and Tigh-Na-Grian due to device error associated with adverse weather experienced during this period, and also at Linn Mill 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 April 2013, with the exception of Scotstoun and Inchgarvie Lodge. For the evening and night time periods, the monthly average total construction noise results were affected by adverse weather conditions. The graphs show exceedances at Butlaw Fisheries, Clufflat Braw and Linn Mill for the evening period, with exceedances at Butlaw Fisheries, Clufflat, Inchgarvie, Linn Mill and Tigh-Na-Grian for the night time period. All other monitoring stations not listed were within the threshold limits for the evening and night time periods
- 3.4** With regard to the Sunday averages (for applicable monitoring locations), adverse weather was also found to significantly affect the averages. Exceedances of the threshold were noted for all Sunday averages at Butlaw Fisheries and Inchgarvie, with the Sunday evening and night time average at Clufflat, and the Sunday night time average at Linn Mill and Tigh-Na-Grian. All other locations not listed 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 exceedances of the evening, night time, and the Sunday averages were caused by adverse weather conditions, in particular strong winds. 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. The exceedance of the daytime average at Inchgarvie is due to a high total daily construction noise level on 12 April; the causes of the increased levels on this date were home DIY works at the property and the use of a lawnmower or similar.
- 3.7** During April 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, in particular strong winds, during April, birds and localised noise 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.
- 3.9** 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 three occasions in April, all of which occurred as a result of works in the south networks work area. Two of the exceedances occurred at Linn Mill due to plant moving down the Echline access track during the evening and night time periods in association with the concreting works at the south abutment. A further exceedance occurred at Springfield due to an excavator and dumper moving materials close to the meter.
- 3.11** 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.
- 3.12** 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**

| <b>Monitoring Location</b> | <b>Summary of Exceedance Details</b>   |
|----------------------------|--|
| Butlaw Fisheries           | During April the maximum noise threshold was exceeded on 56 occasions (daytime, 10; evening, 16; night time, 30). Exceedances were attributed to a range of non-construction factors, notably wind, waves and birds.   |
| Clufflat Brae              | During April the maximum noise threshold was exceeded on 56 occasions (daytime, 16; evening, 14; night time, 26). No exceedances were attributable to construction works. Exceedances were found to be largely due to wind and birds.  |
| Inchgarvie Lodge           | During April the maximum noise threshold was exceeded on 61 occasions (daytime, 20; evening, 18; night time, 23). No exceedances were found to be due to construction works. However, investigations found local noises at the property, wind and birds to be the main contributing factors to the exceedances at this location.   |
| Linn Mill                  | During April the maximum noise threshold was exceeded on 33 occasions (daytime, 9; evening, 9; night time, 15). Two exceedances were due to plant moving down the access track in association with the concrete pour at the south abutment. However, the majority of exceedances were caused by adverse weather conditions (including strong winds causing a gate or similar to bang in the wind) and birds. |
| Tigh-Na-Grian              | During April the maximum noise threshold was exceeded on 67 occasions (daytime, 28; evening, 11; night time, 28). Exceedances were due to non-construction factors, notably wind and birds.  |
| Dundas Home Farm           | During April 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 April 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 April the maximum noise threshold was exceeded on 22 occasions. The exceedance on one date was due to construction works. All other exceedances were caused by construction works at this location. The majority of exceedances were due to local residents.  |
| Scotstoun                  | During April the maximum noise threshold was exceeded on 26 occasions. Exceedances were attributed to vehicles passing by on the adjacent road.  |
| Whinny Hill                | During April the maximum noise threshold was exceeded on 16 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**

| <b>Monitor</b> | <b>Date</b> | <b>Period</b> | <b>Description</b>  | <b>NVIR No.</b> |
|----------------|-------------|---------------|---|-----------------|
| Linn Mill      | 02/04/13    | Night         | South Abutment concrete pour – plant moving down Echline access track | L.N.020413      |
|                | 03/04/13    | Evening       |   | L.E.030413      |
| Springfield    | 10/04/13    | Day           | Excavator and dumper moving materials in close proximity to meter     | S.D.100413      |



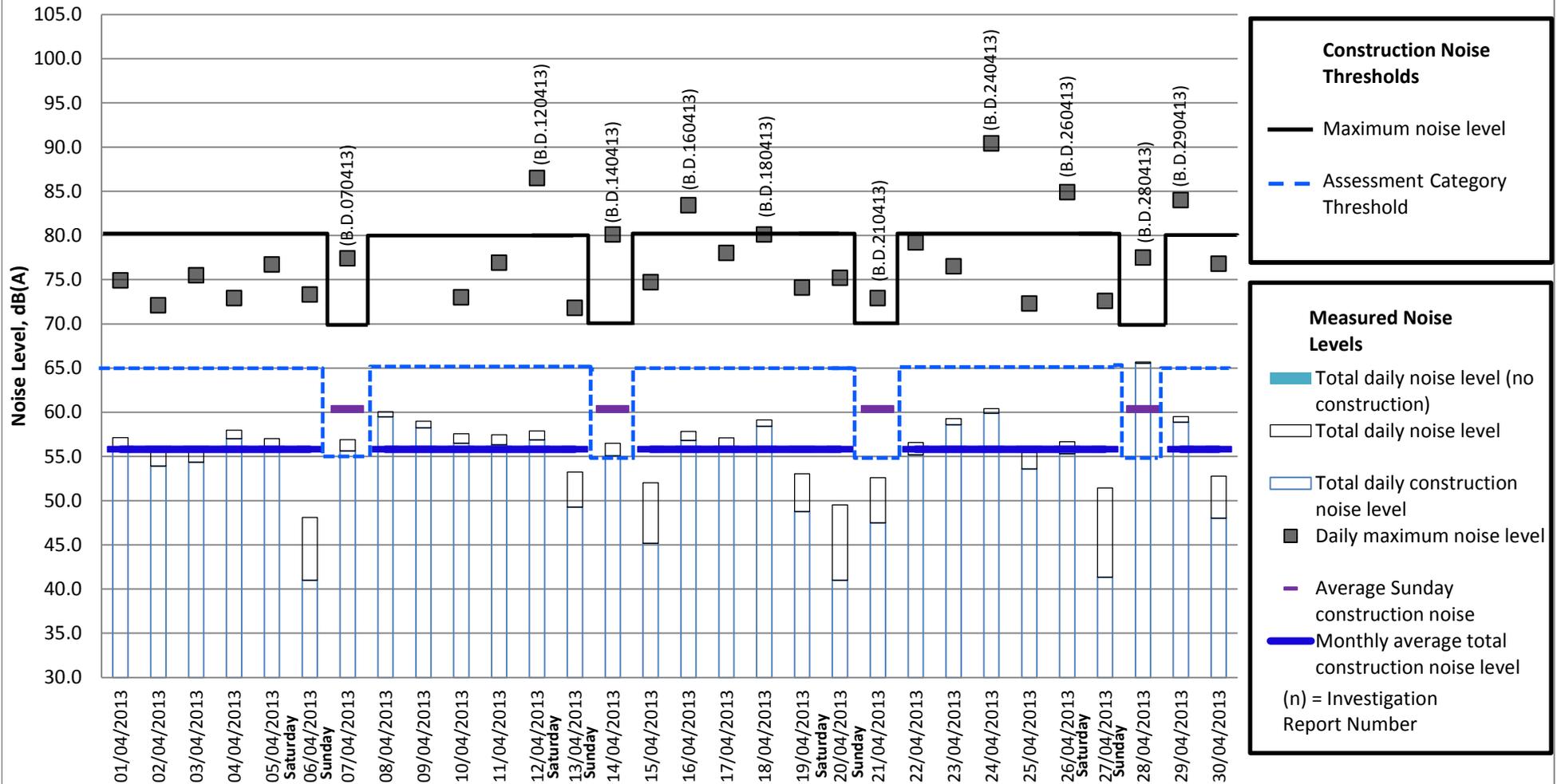
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## APPENDIX A

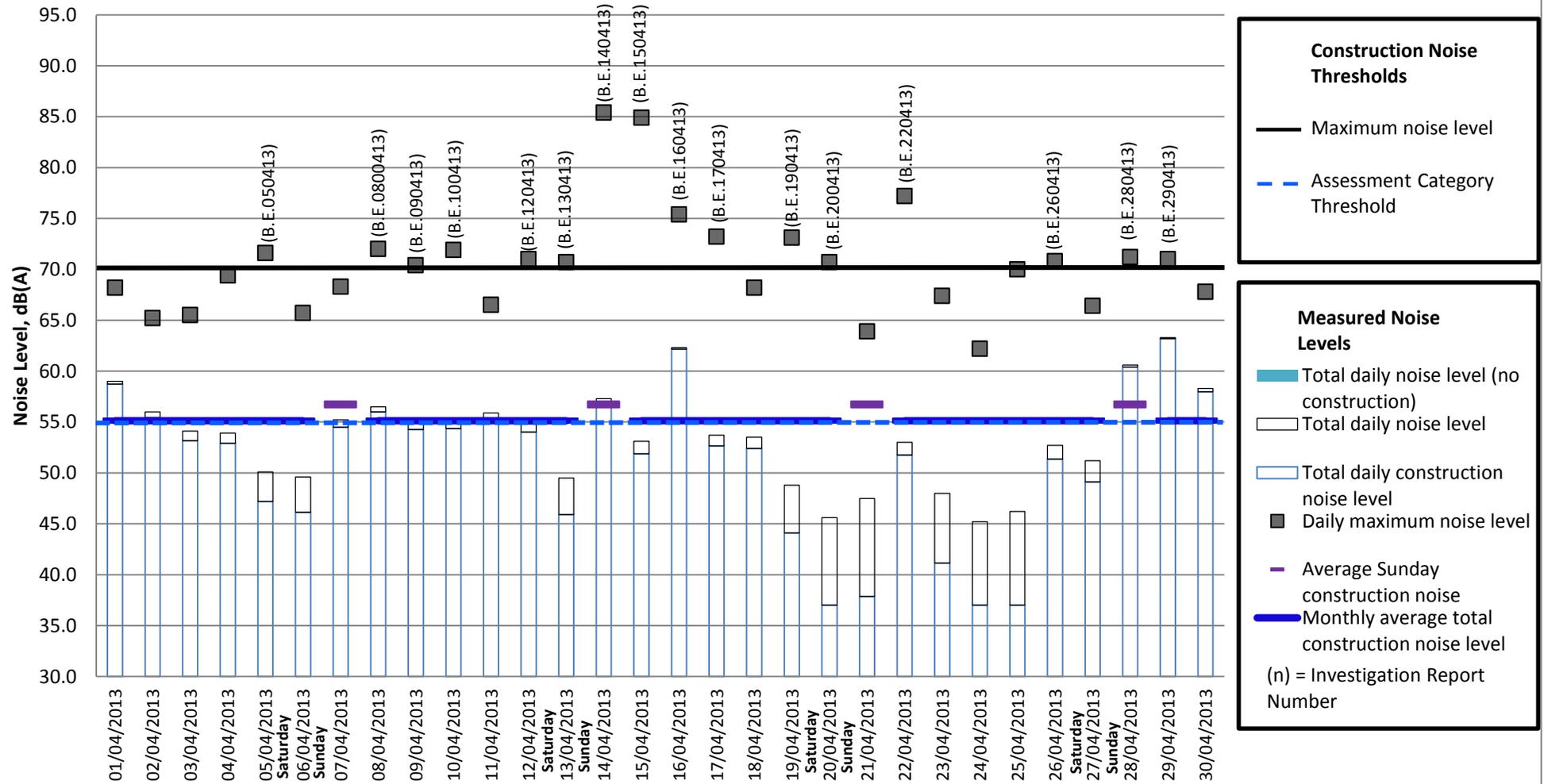
# Measured Daytime Noise Levels at Butlaw Fisheries

## Measurement period: April 2013



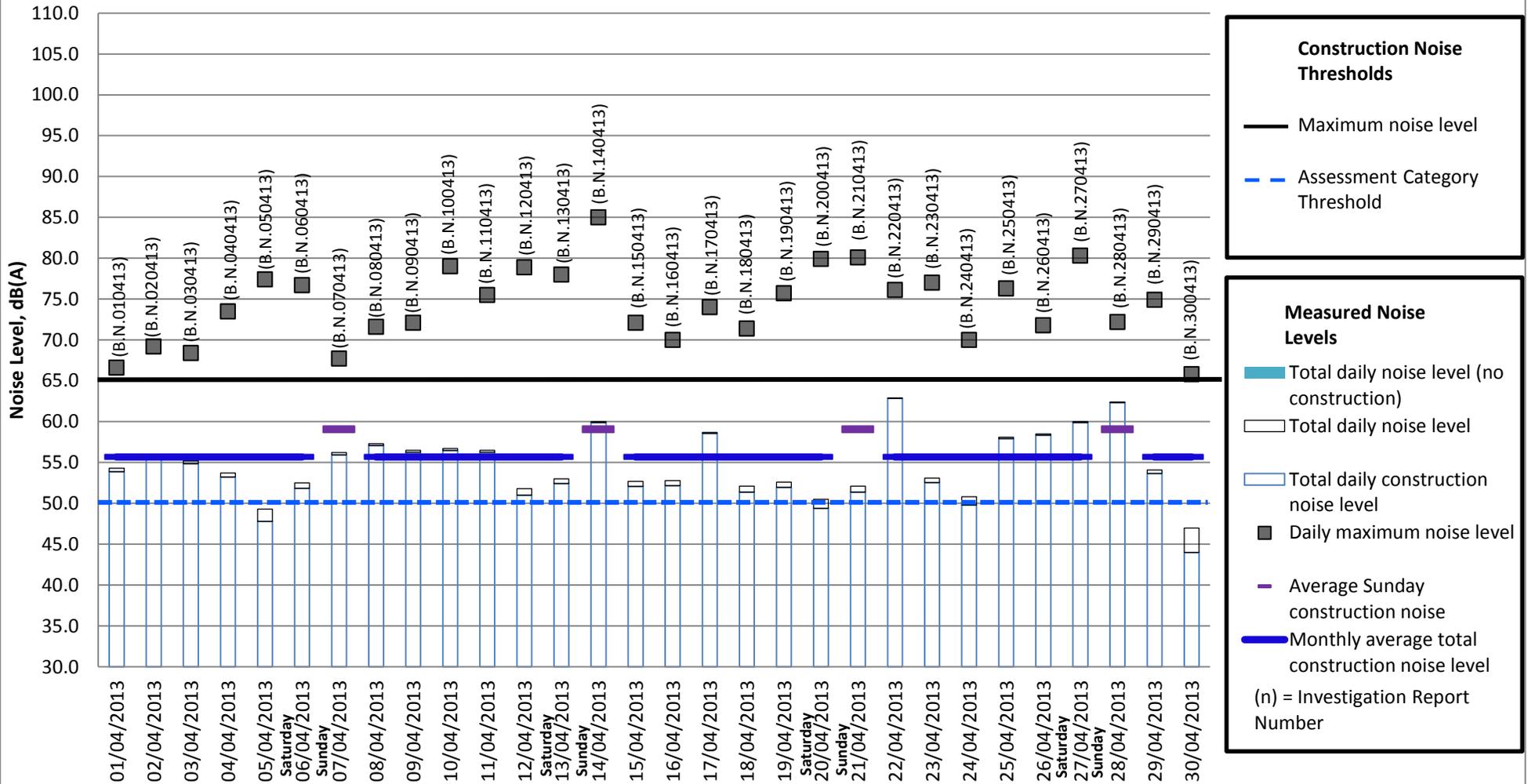
# Measured Evening Noise Levels at Butlaw Fisheries

## Measurement period: April 2013



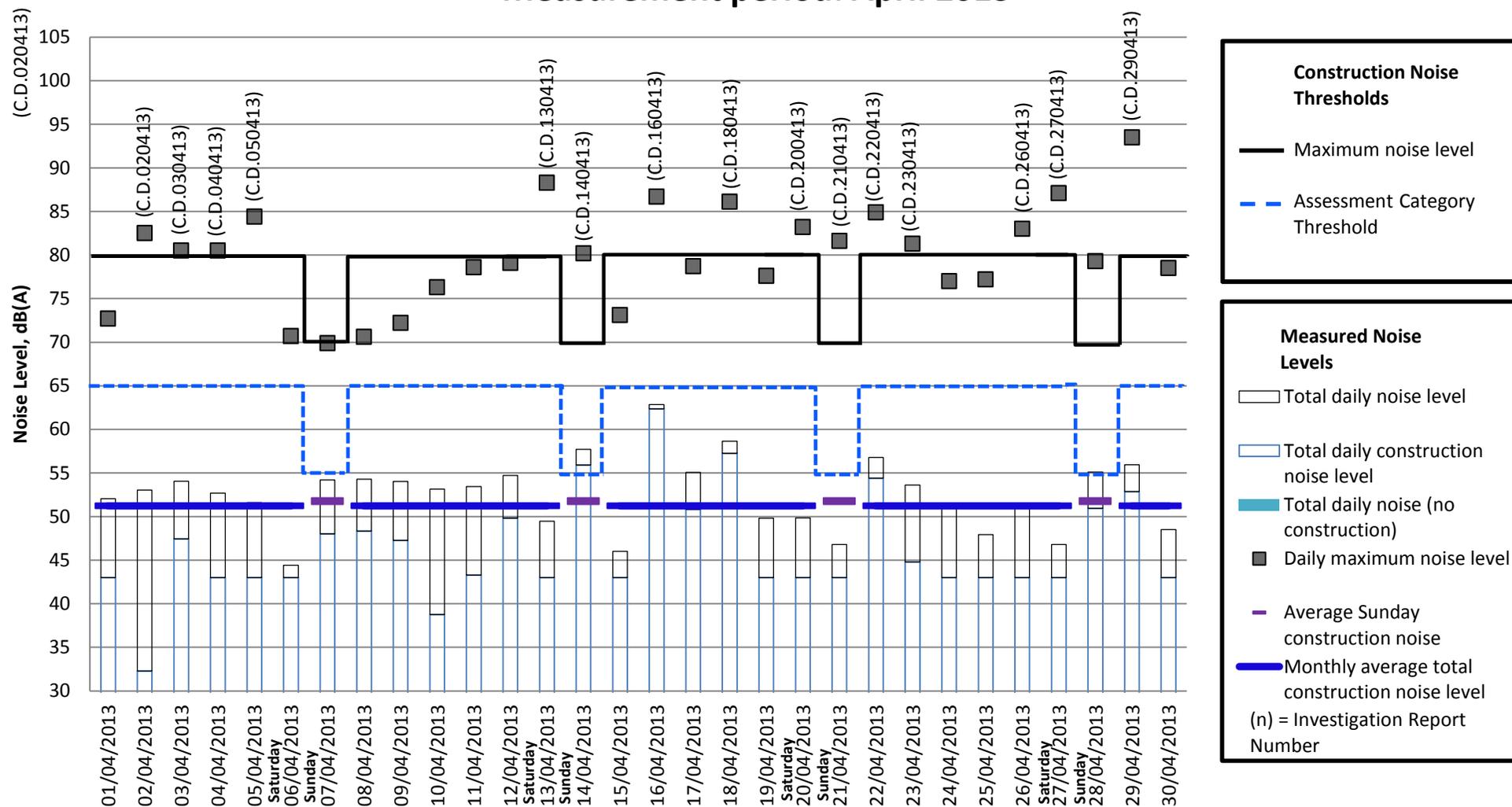
# Measured Night time Noise Levels at Butlaw Fisheries

## Measurement period: April 2013



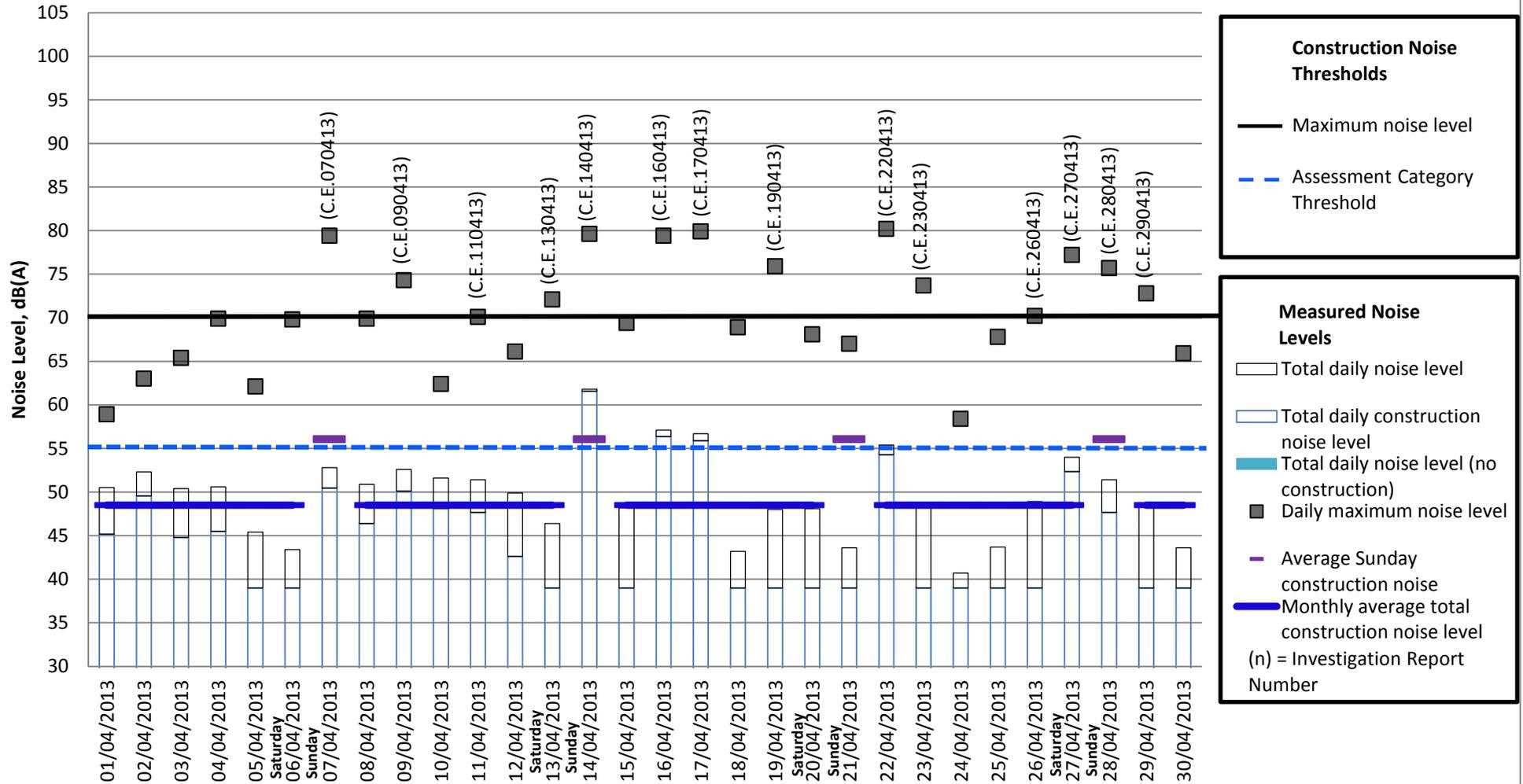
# Measured Daytime Noise Levels at Clufflat Brae

## Measurement period: April 2013



# Measured Evening Noise Levels at Clufflat Brae

## Measurement period: April 2013



**Construction Noise Thresholds**

- Maximum noise level
- Assessment Category Threshold

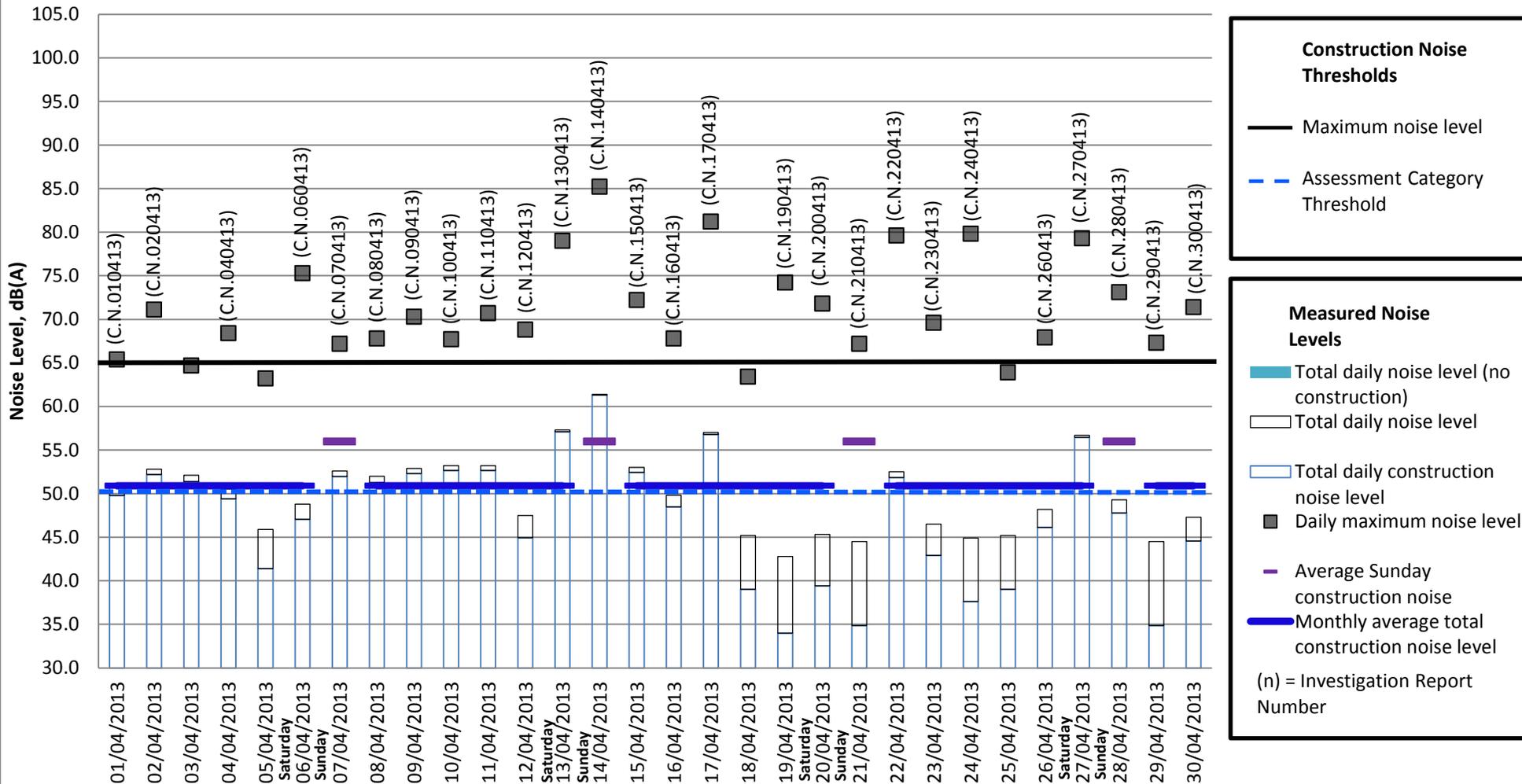
**Measured Noise Levels**

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

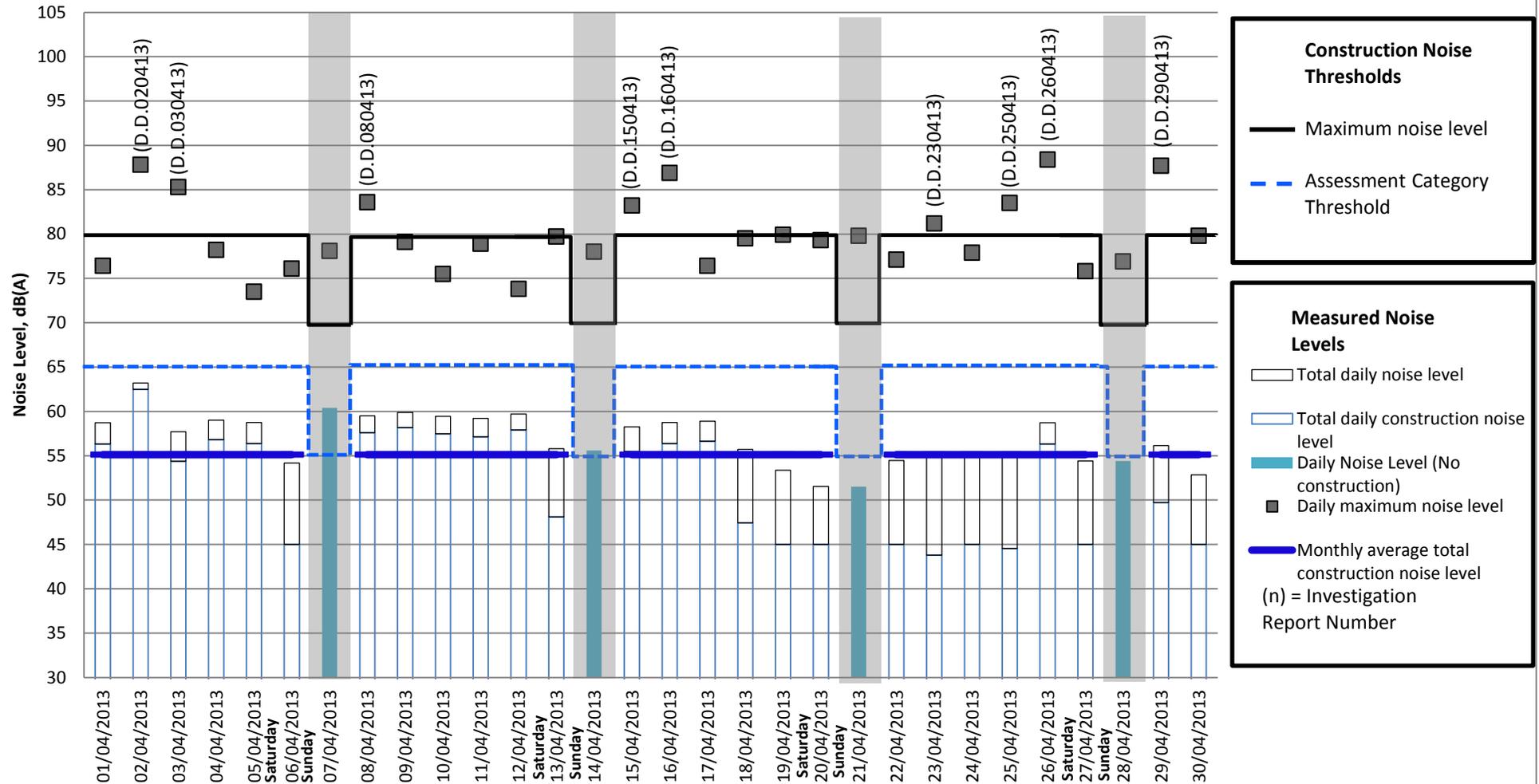
(n) = Investigation Report Number

# Measured Night-time Noise Levels at Clufflat Brae

## Measurement period: April 2013



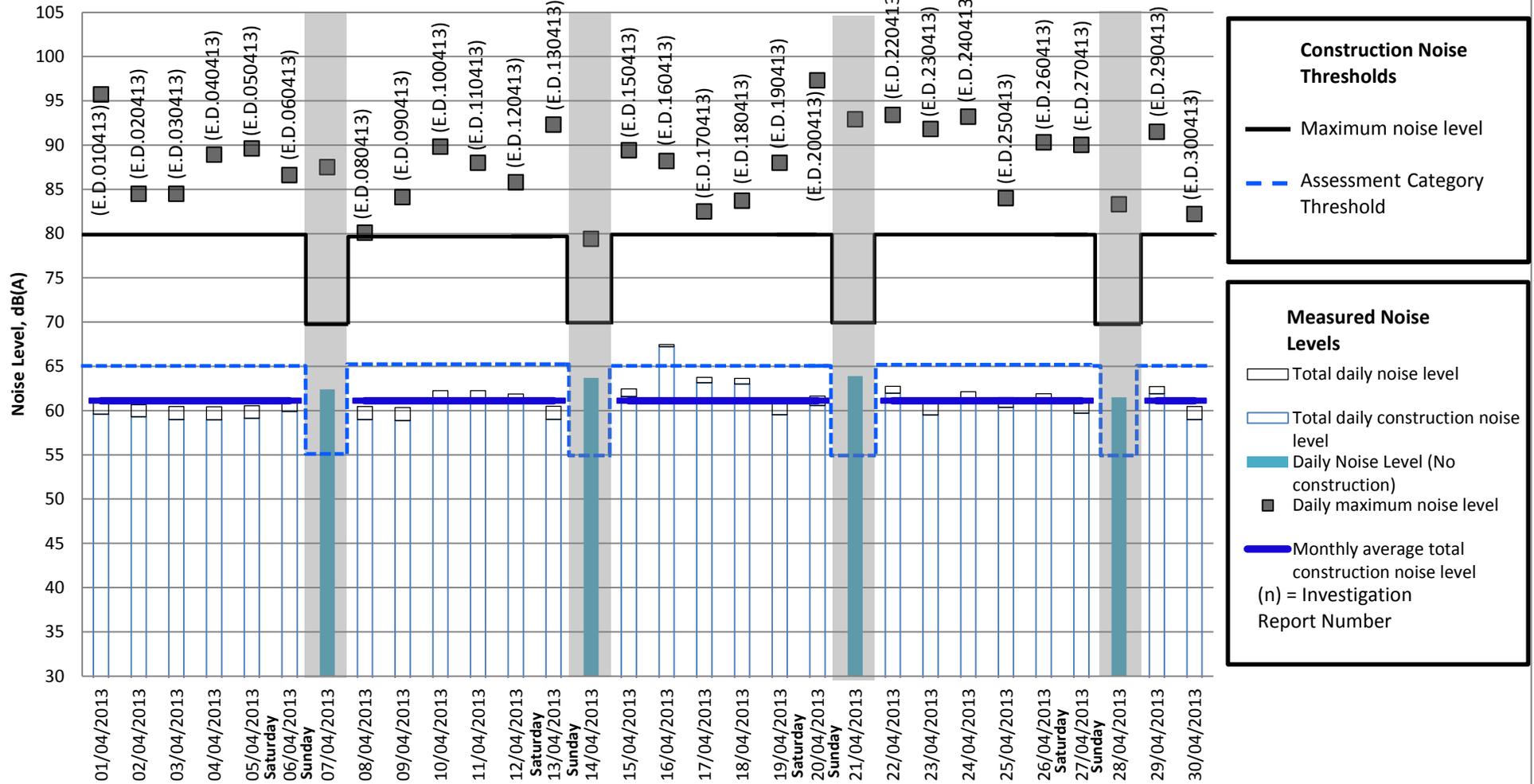
## Measured Daytime Noise Levels at Dundas Home Farm Measurement period: April 2013



**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

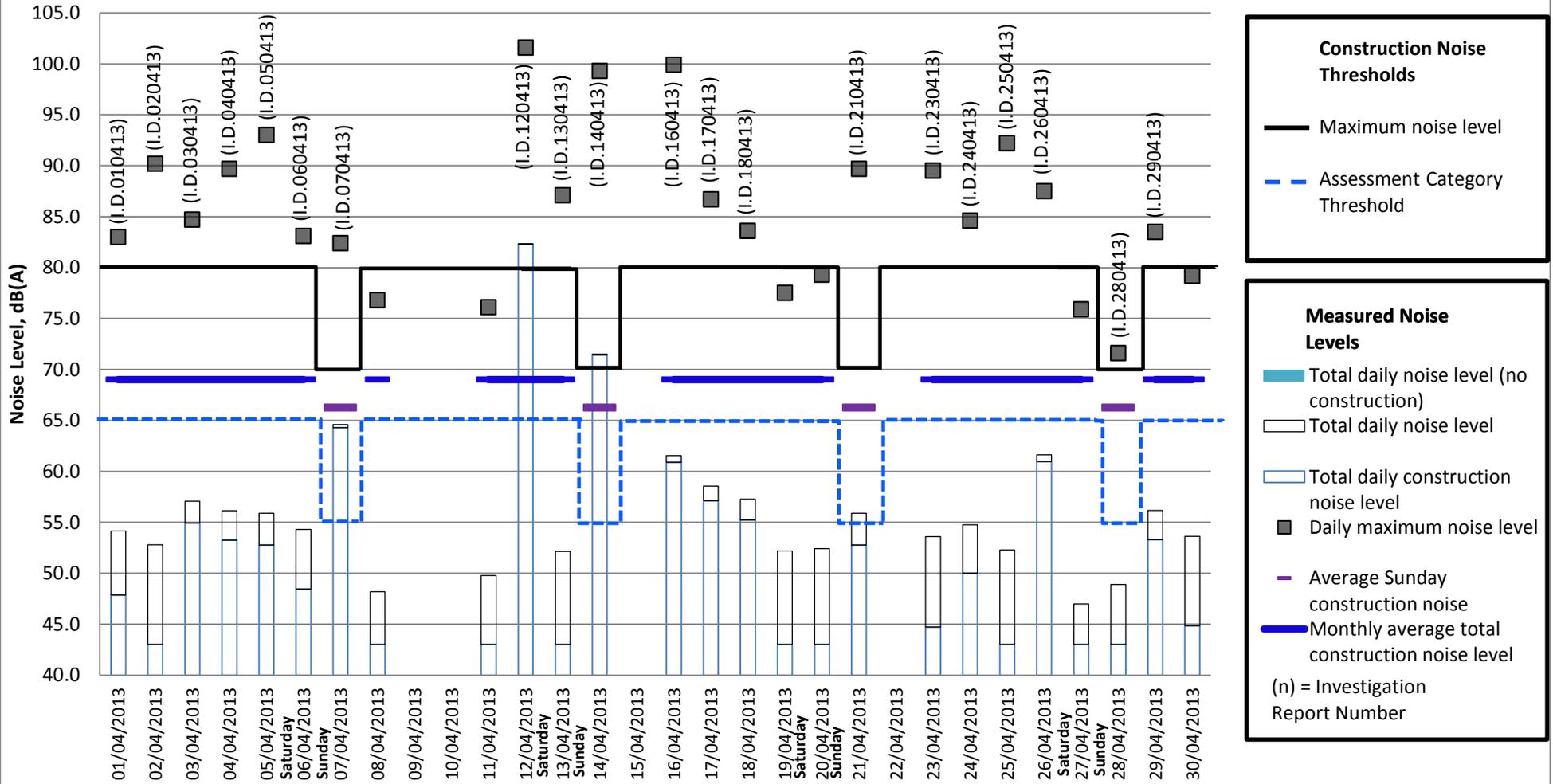
### Measurement period: April 2013



**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.

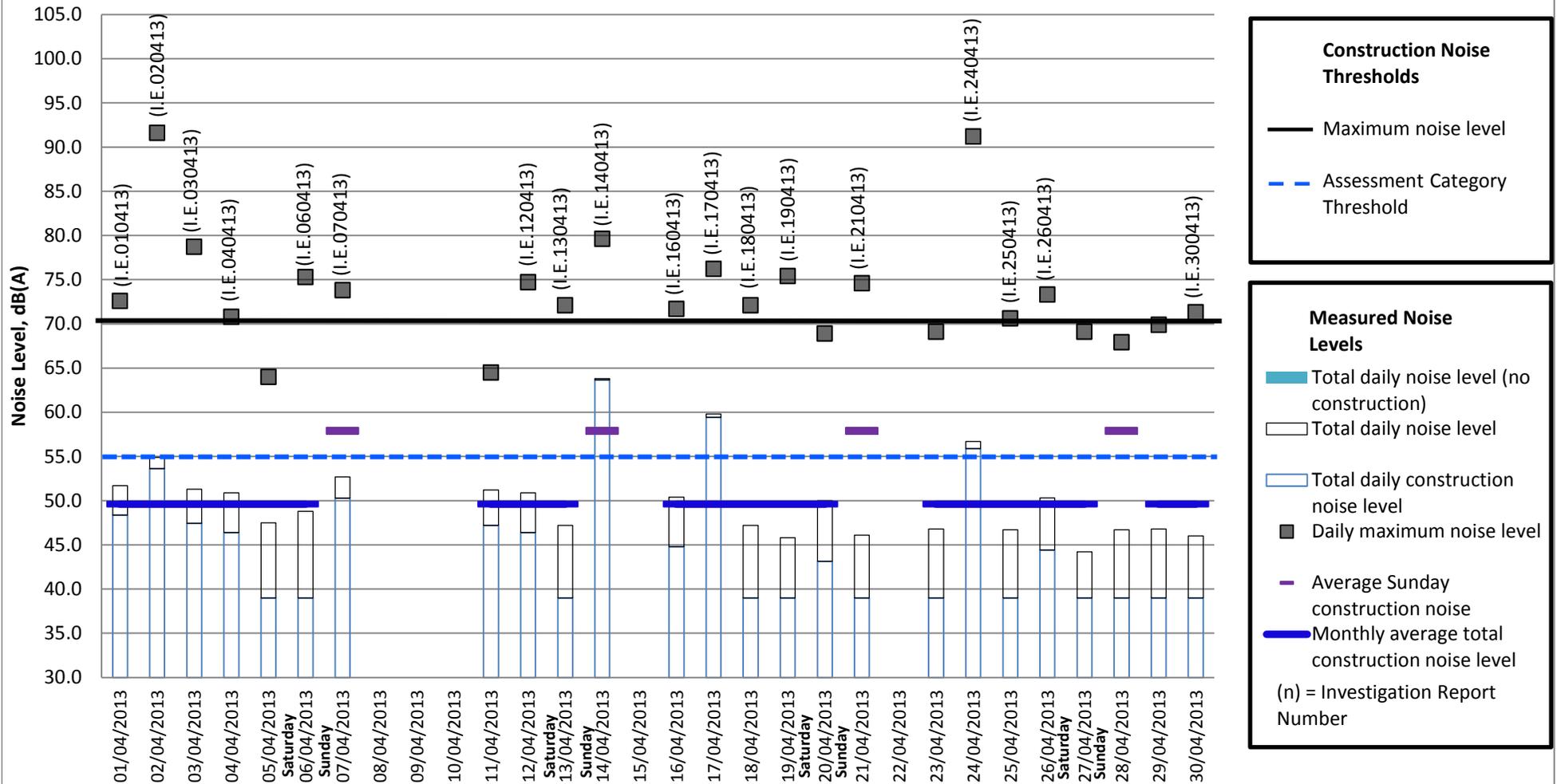
# Measured Daytime Noise Levels at Inchgarvie

## Measurement period: April 2013



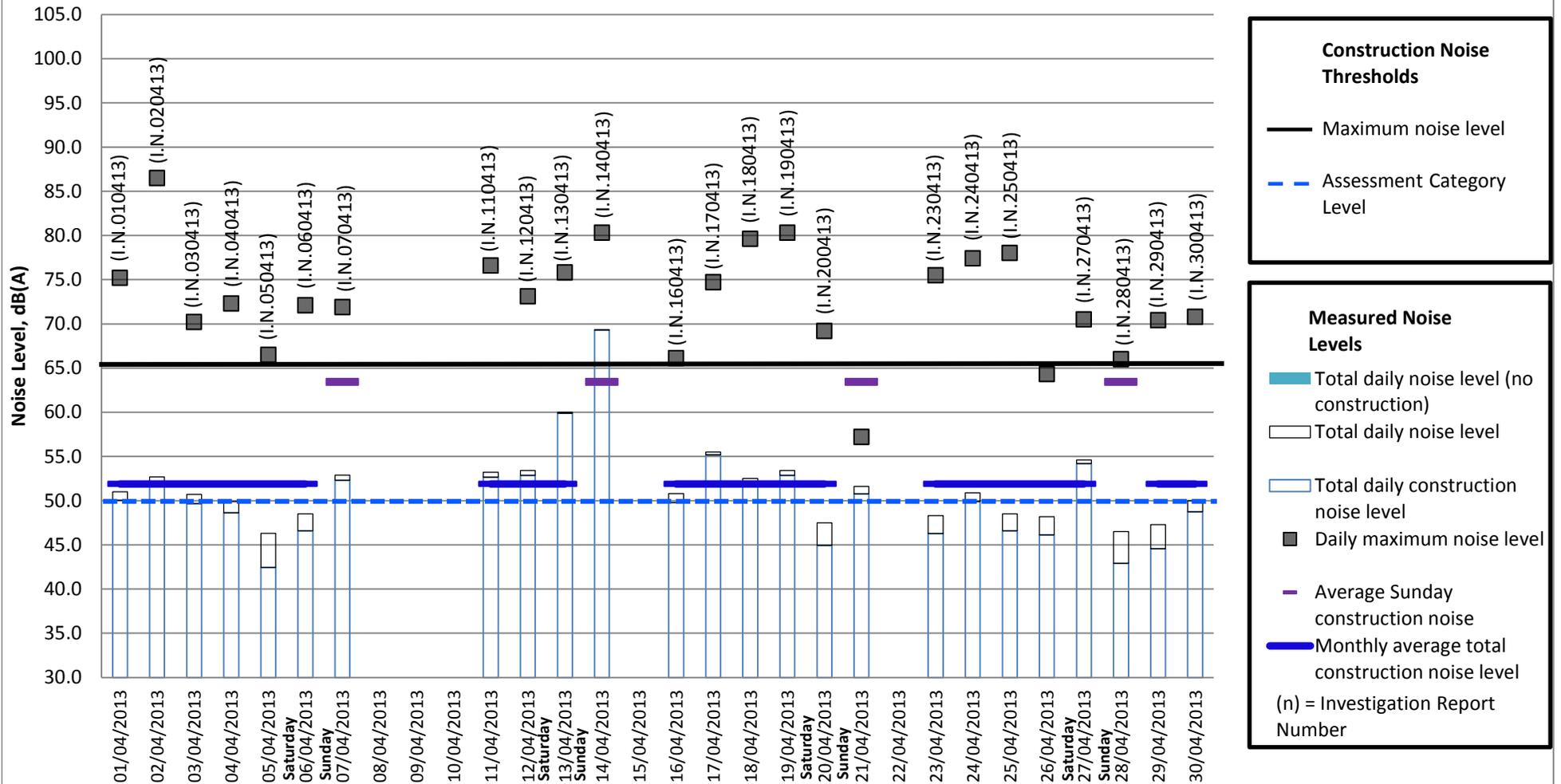
**Note:** Data is missing for this location for 09/04/13 to 10/04/13, 15/04/13 and 22/04/13 due to device error associated with adverse weather conditions.

## Measured Evening Noise Levels at Inchgarvie Measurement period: April 2013



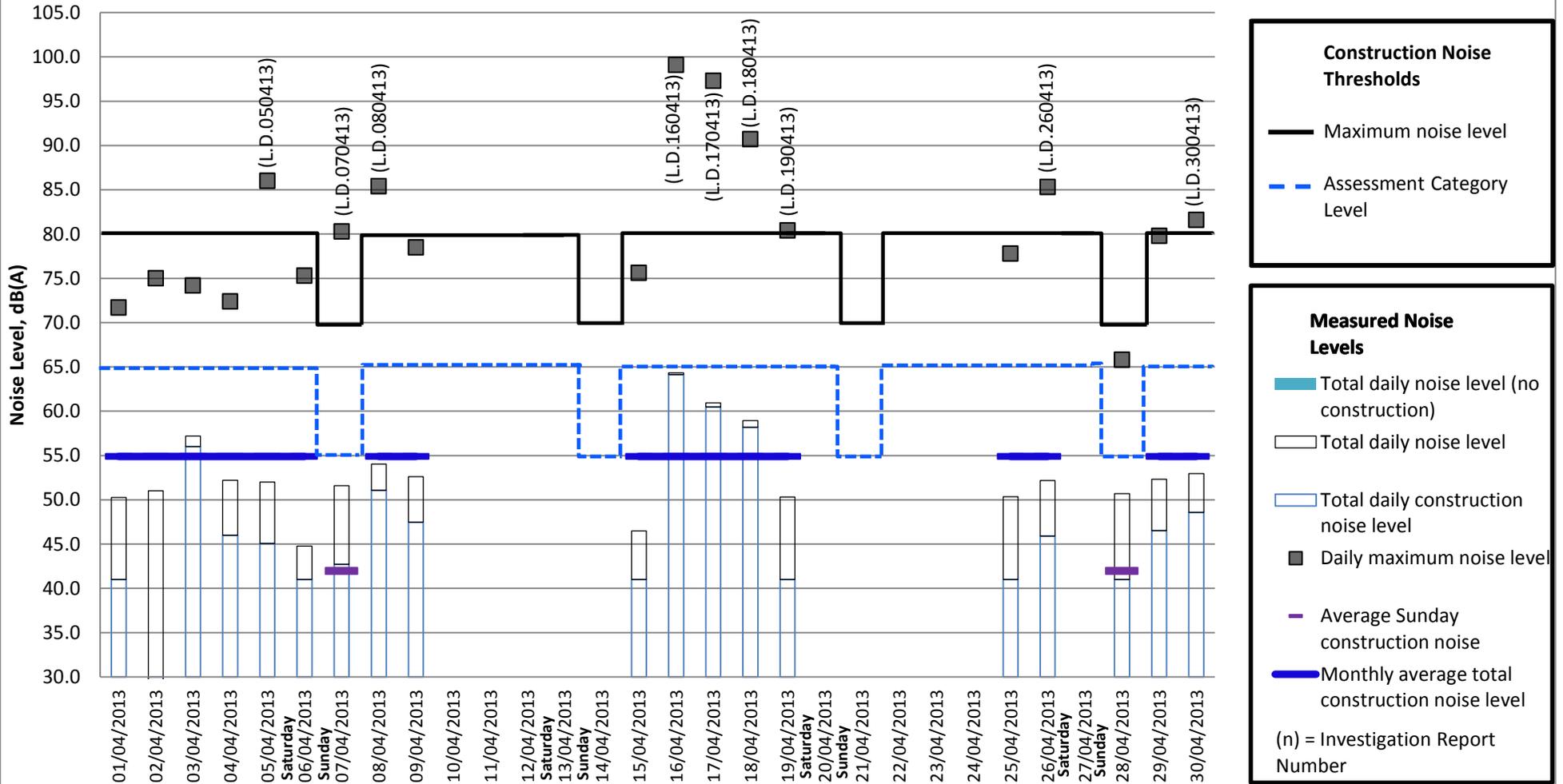
**Note:** Data is missing for this location for 08/04/13 to 10/04/13, 15/04/13 and 22/04/13 due to device error associated with adverse weather conditions.

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



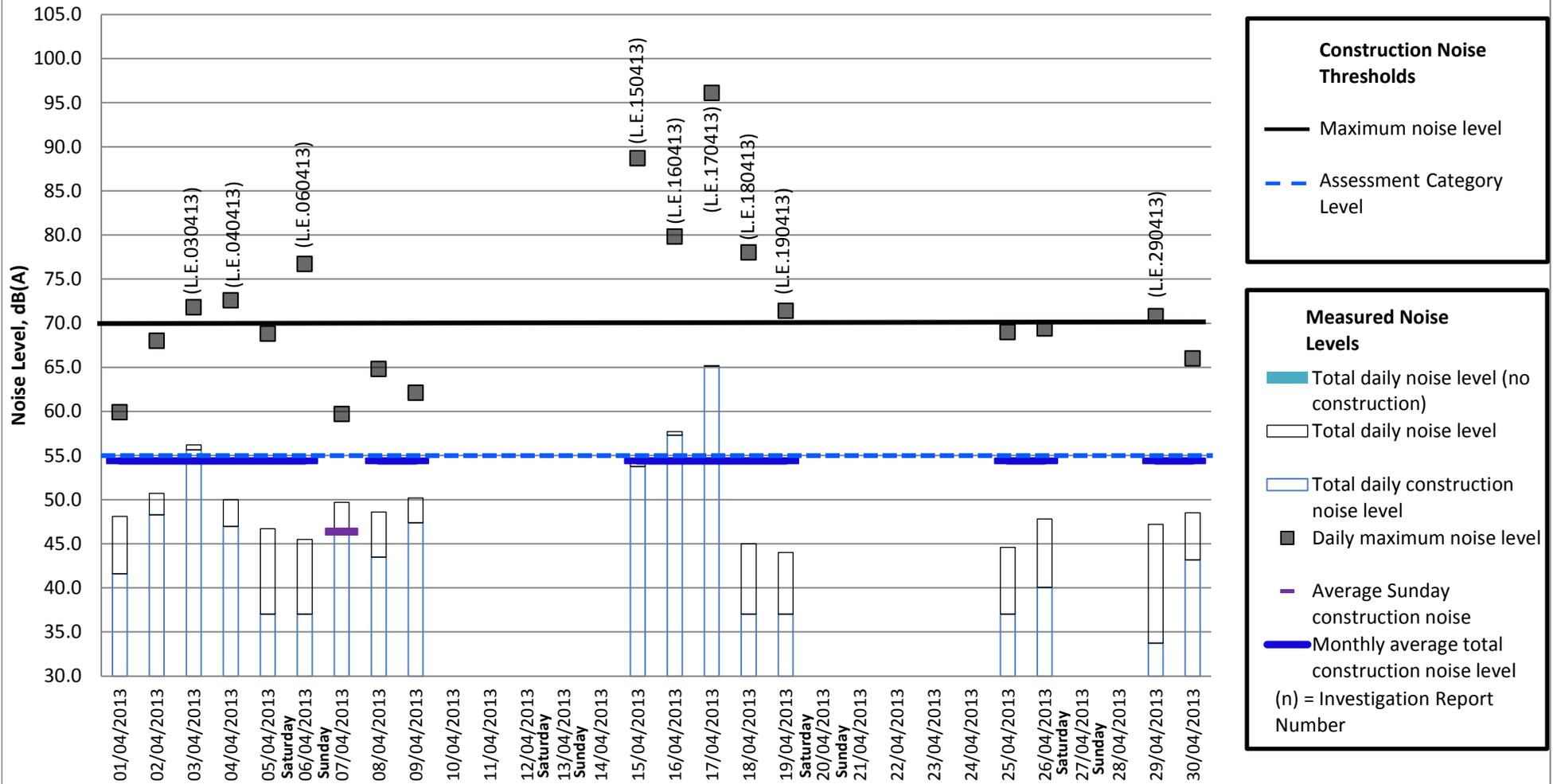
**Note:** Data is missing for this location for 08/04/13 to 10/04/13, 15/04/13 and 22/04/13 due to device error associated with adverse weather conditions.

## Measured Daytime Noise levels at Linn Mill Measurement period: April 2013



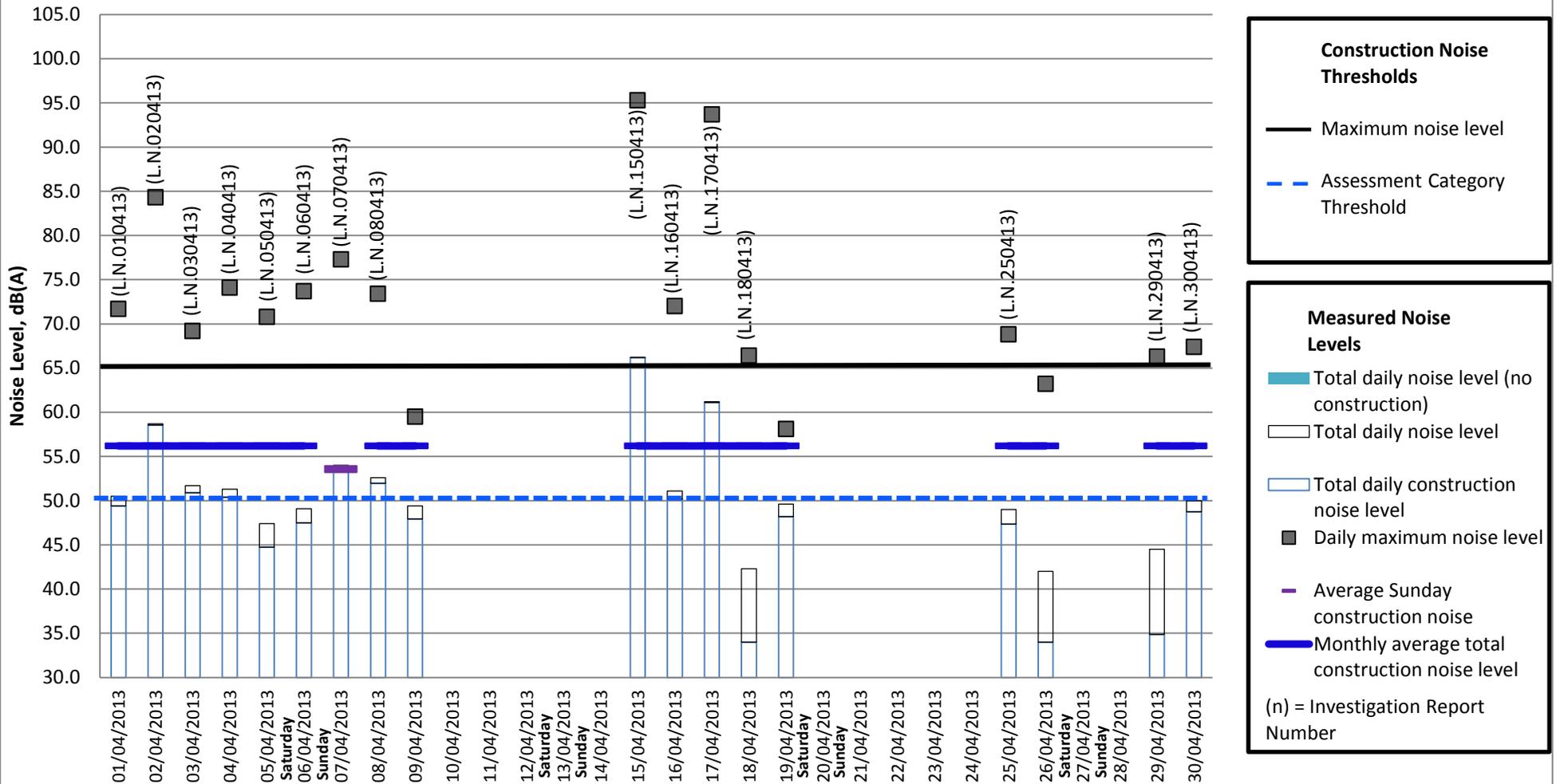
**Note:** Data is missing from this locations on 10/04/13 to 14/04/13, 20/04/13 to 24/04/13 and 27/04/13 due to an issue with the power supply to this device.

## Measured Evening Noise Levels at Linn Mill Measurement period: April 2013



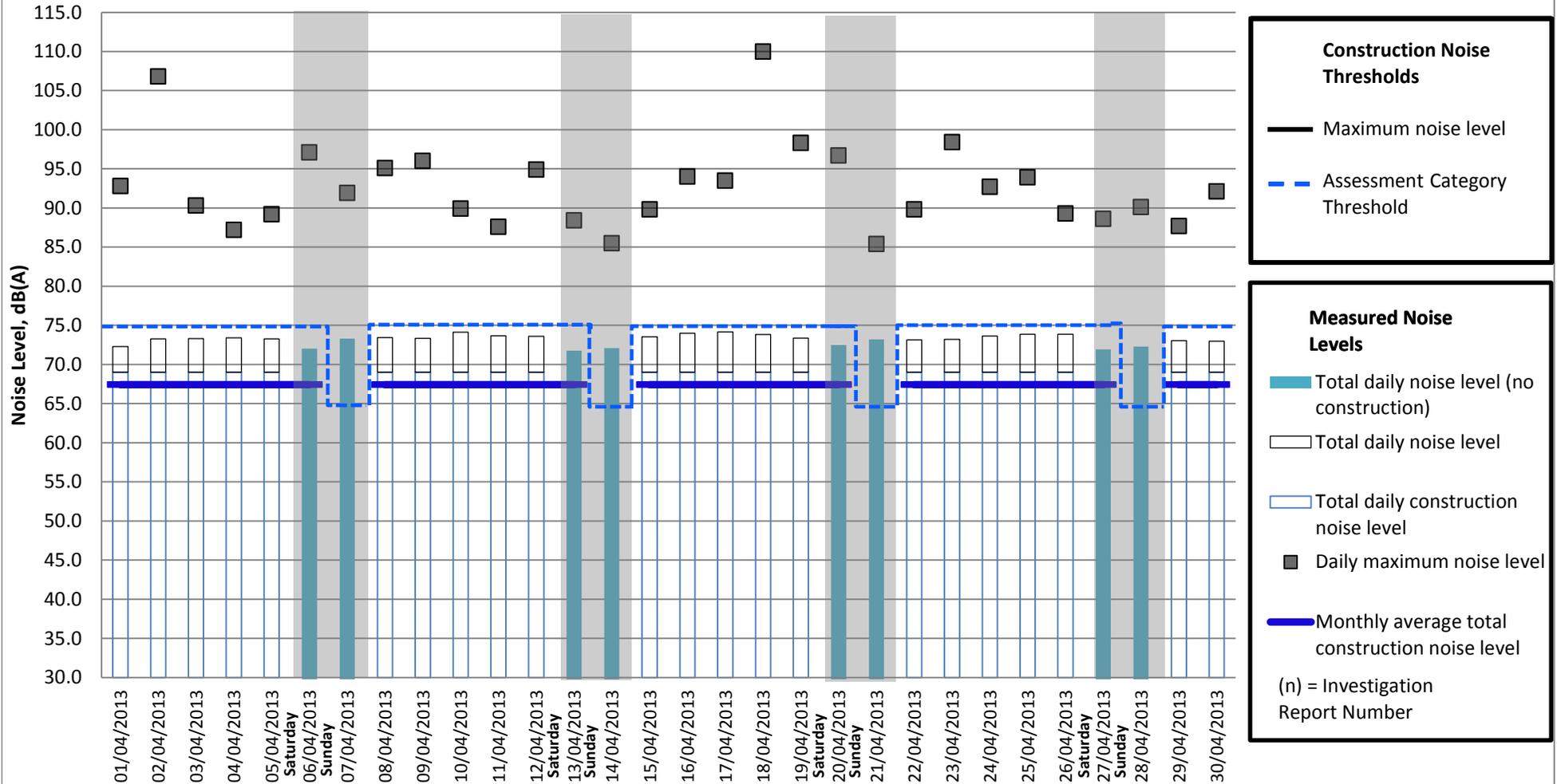
**Note:** Data is missing for 10/04/13 to 14/04/13, 20/04/13 to 24/04/13 and 27/04/13 to 28/04/13 due to an issue with the power supply to the device.

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



**Note:** Data is missing on 10/04/13 to 14/04/13, 20/04/13 to 24/04/13 and 27/04/13 to 28/04/13 due to an issue with the power supply to the device.

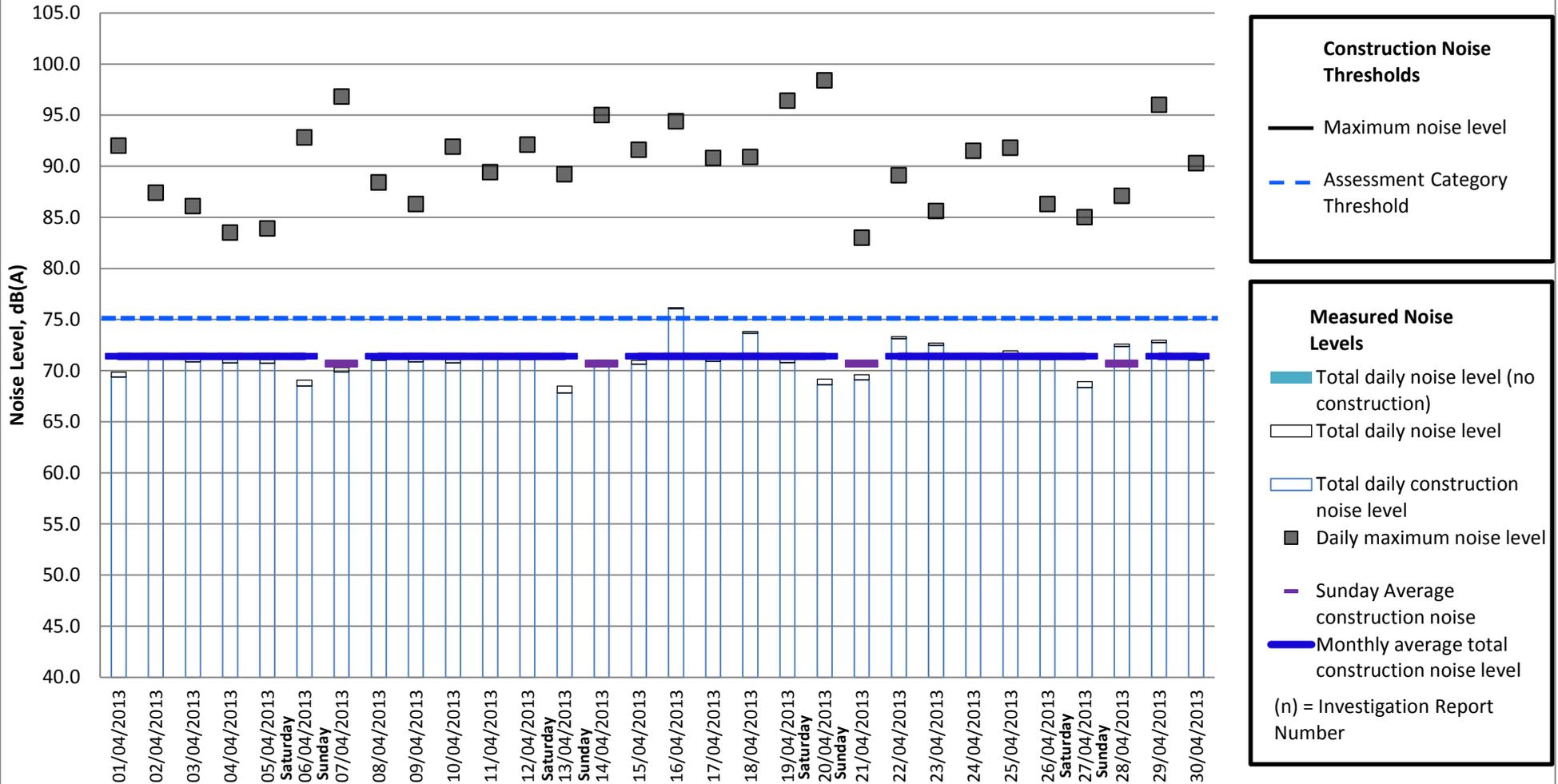
## Measured Daytime Noise Levels at Newton Measurement period: April 2013



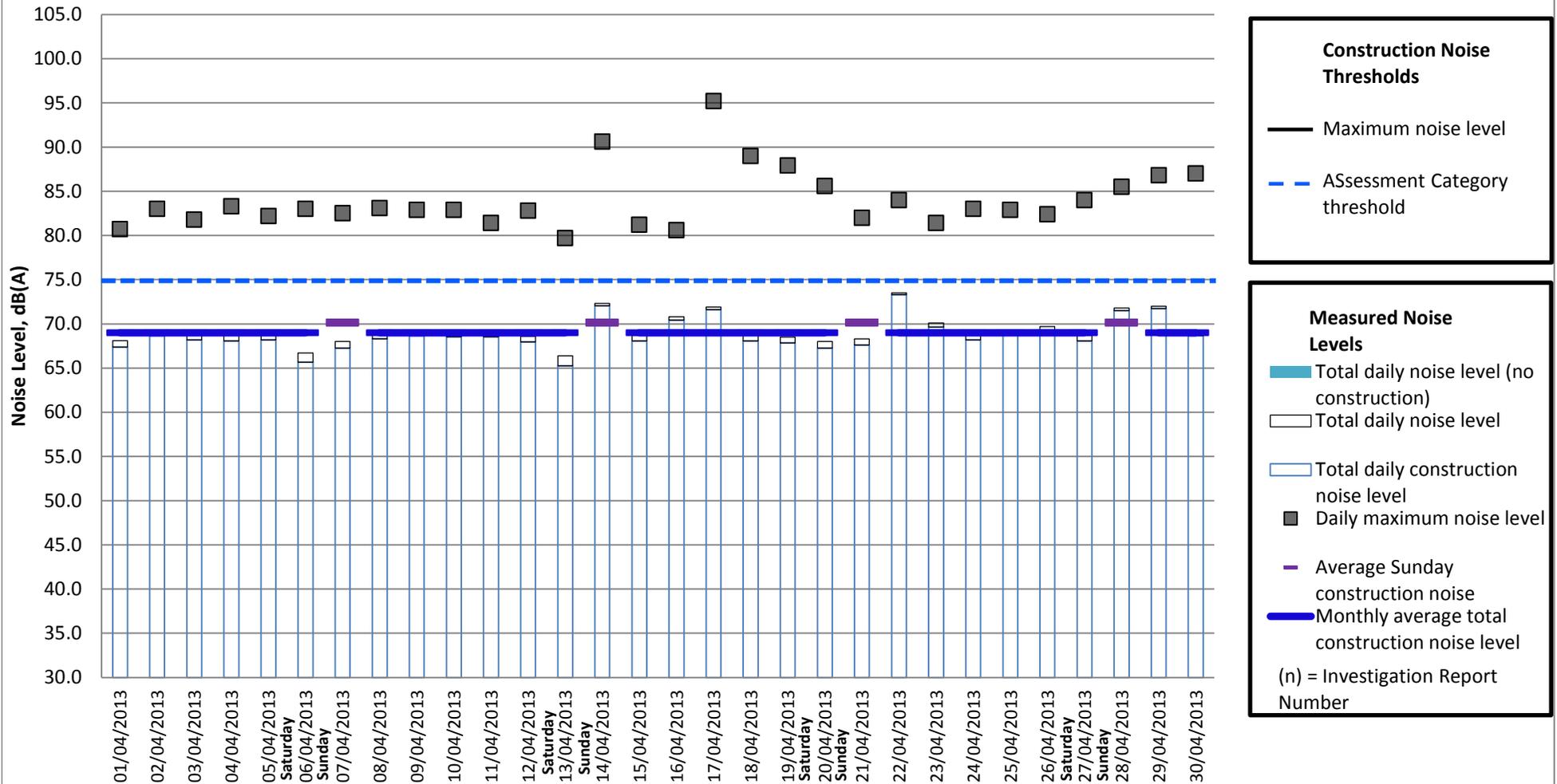
**Note:** The grey areas of the chart represent days on which no construction works have been conducted. It should be noted that the measured noise levels Mon - Fri can not be attributed to construction works due to the considerable distance (1.75 kilometers) between this monitoring location and the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

# Measured Daytime Noise Levels at North Leg

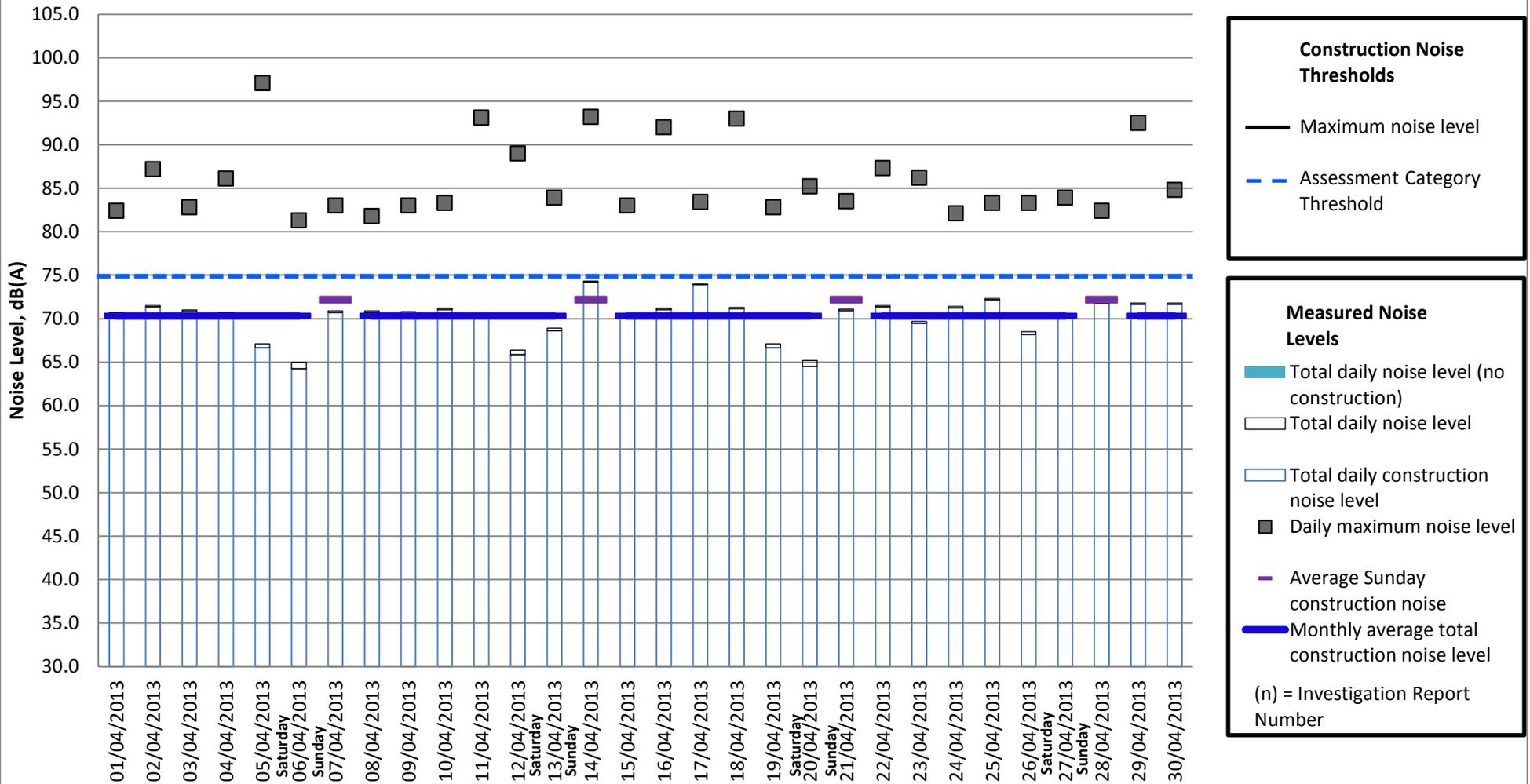
## Measurement period: April 2013



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



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



**Construction Noise Thresholds**

- Maximum noise level
- Assessment Category Threshold

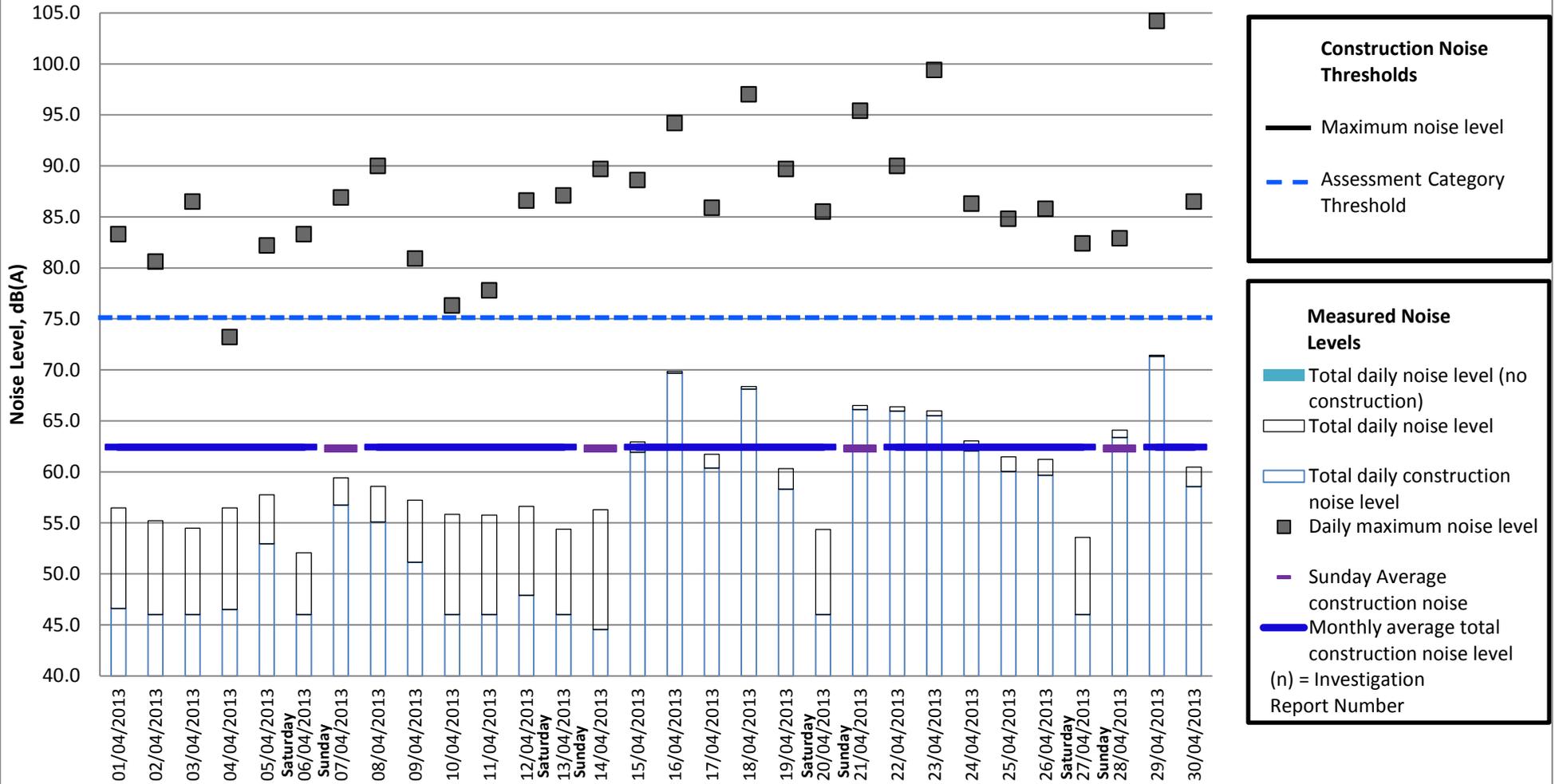
**Measured Noise Levels**

- 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

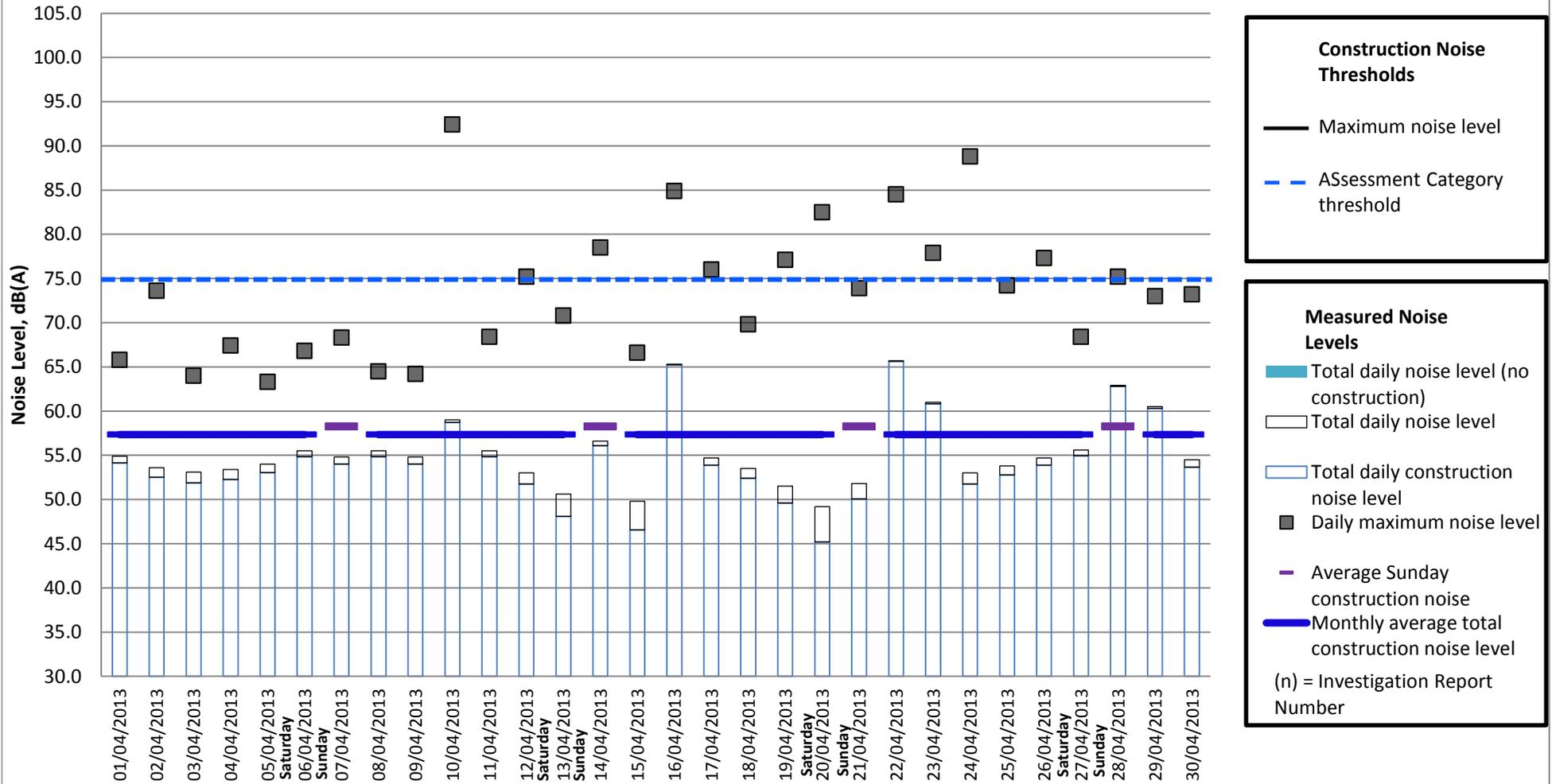
# Measured Daytime Noise Levels at Port Edgar

## Measurement period: April 2013



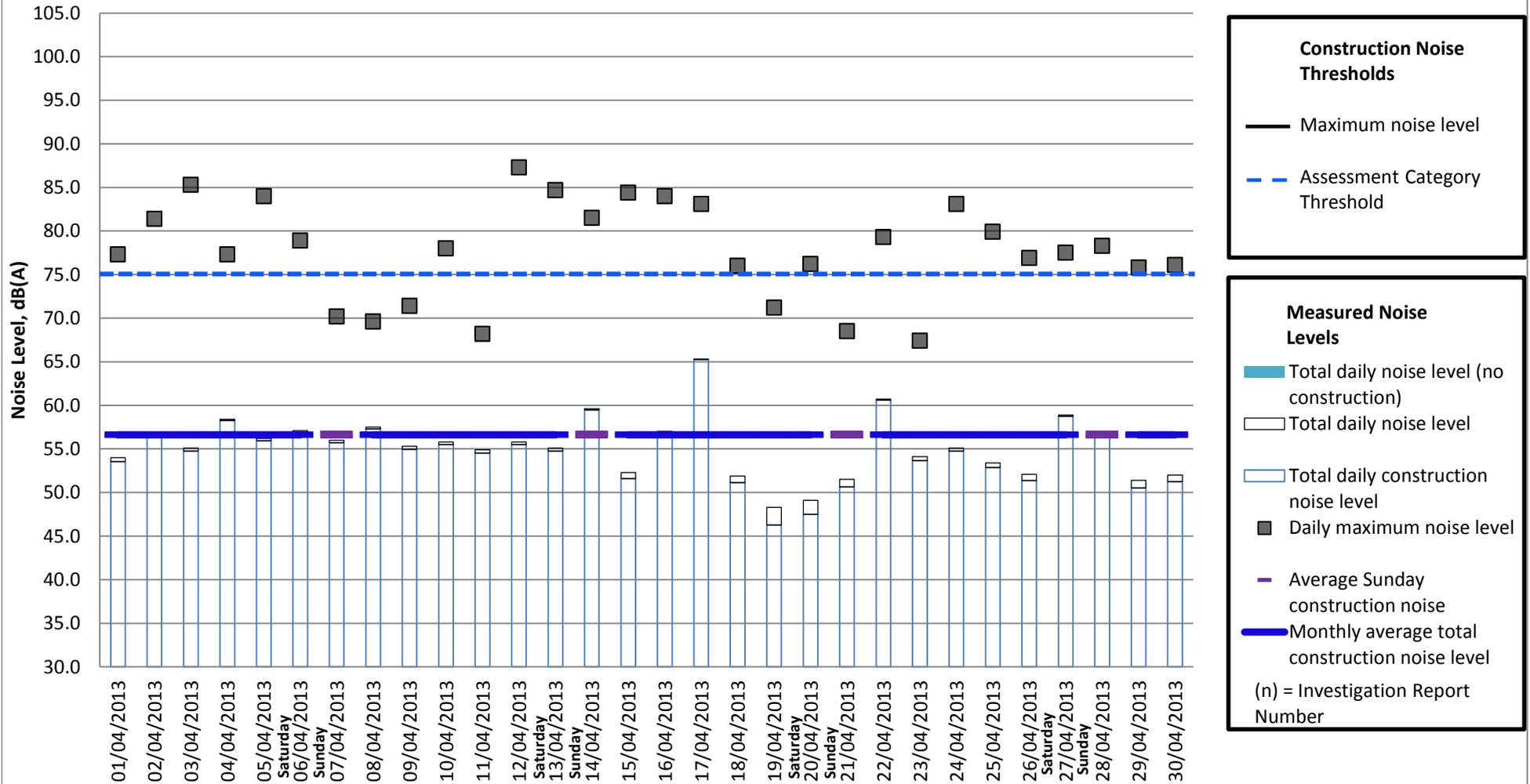
## Measured Evening Noise Levels at Port Edgar

### Measurement period: April 2013



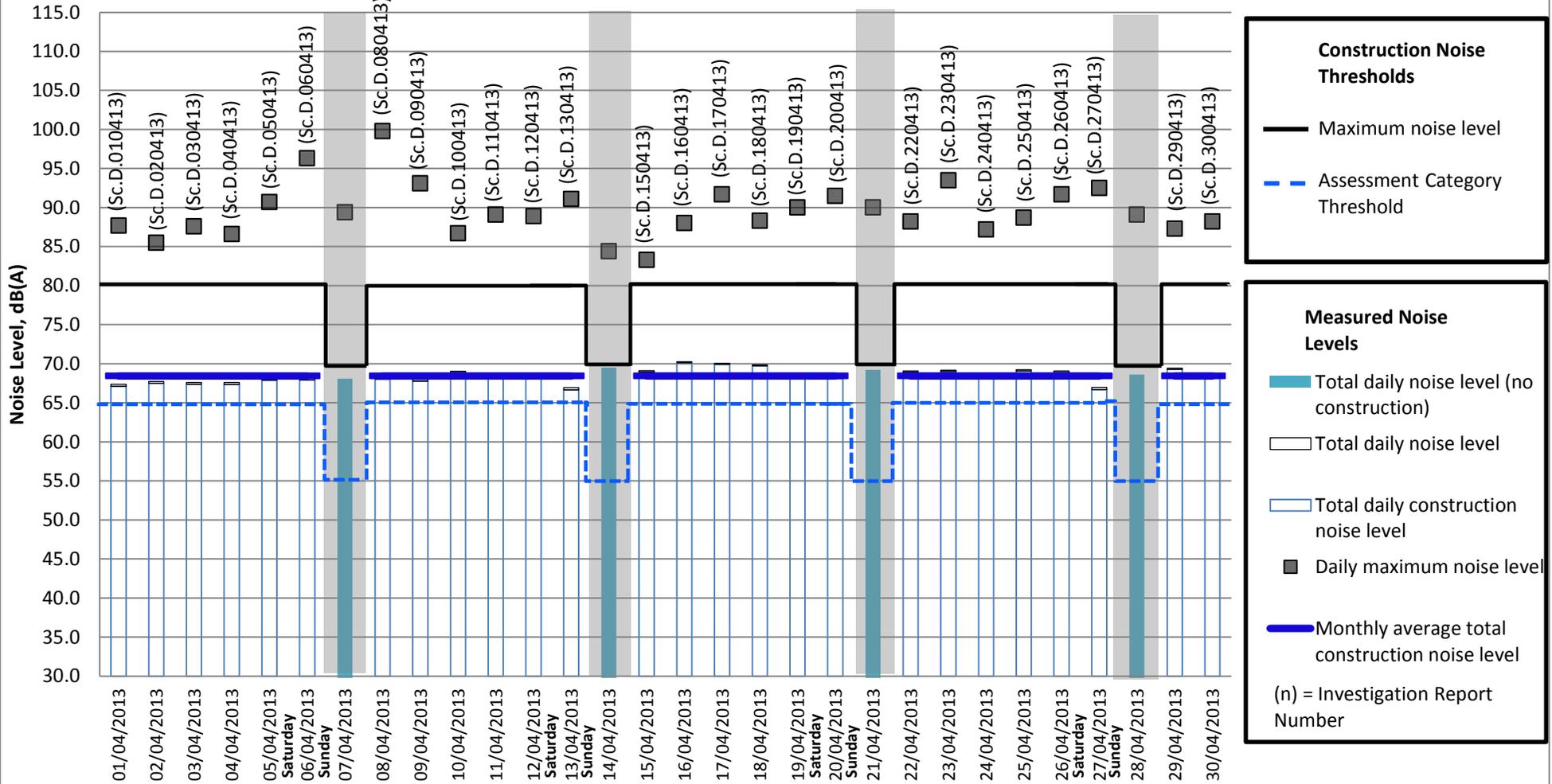
# Measured Night-time Noise Levels at Port Edgar

## Measurement period: April 2013



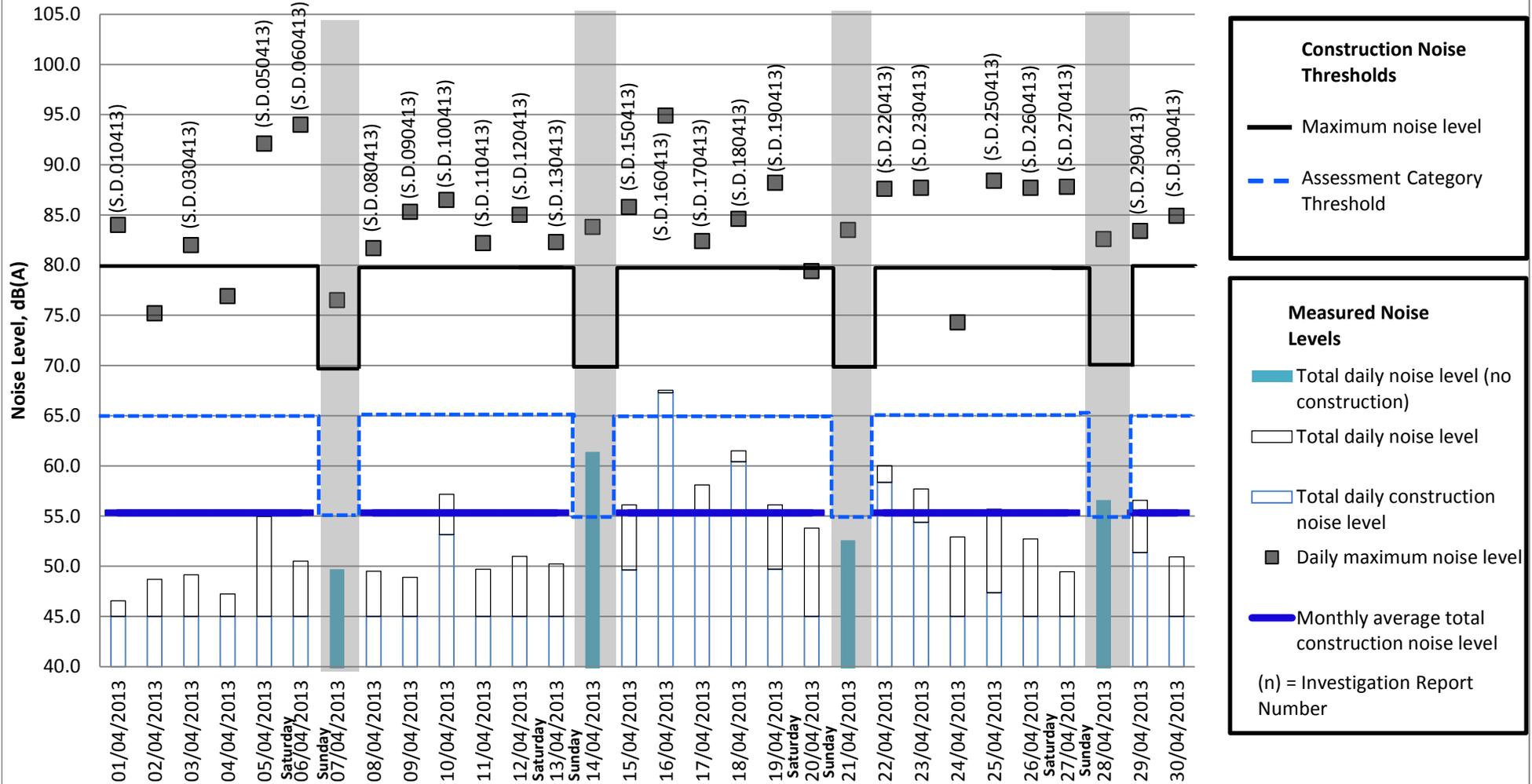
# Measured Daytime Noise Levels at Scotstoun

## Measurement period: April 2013



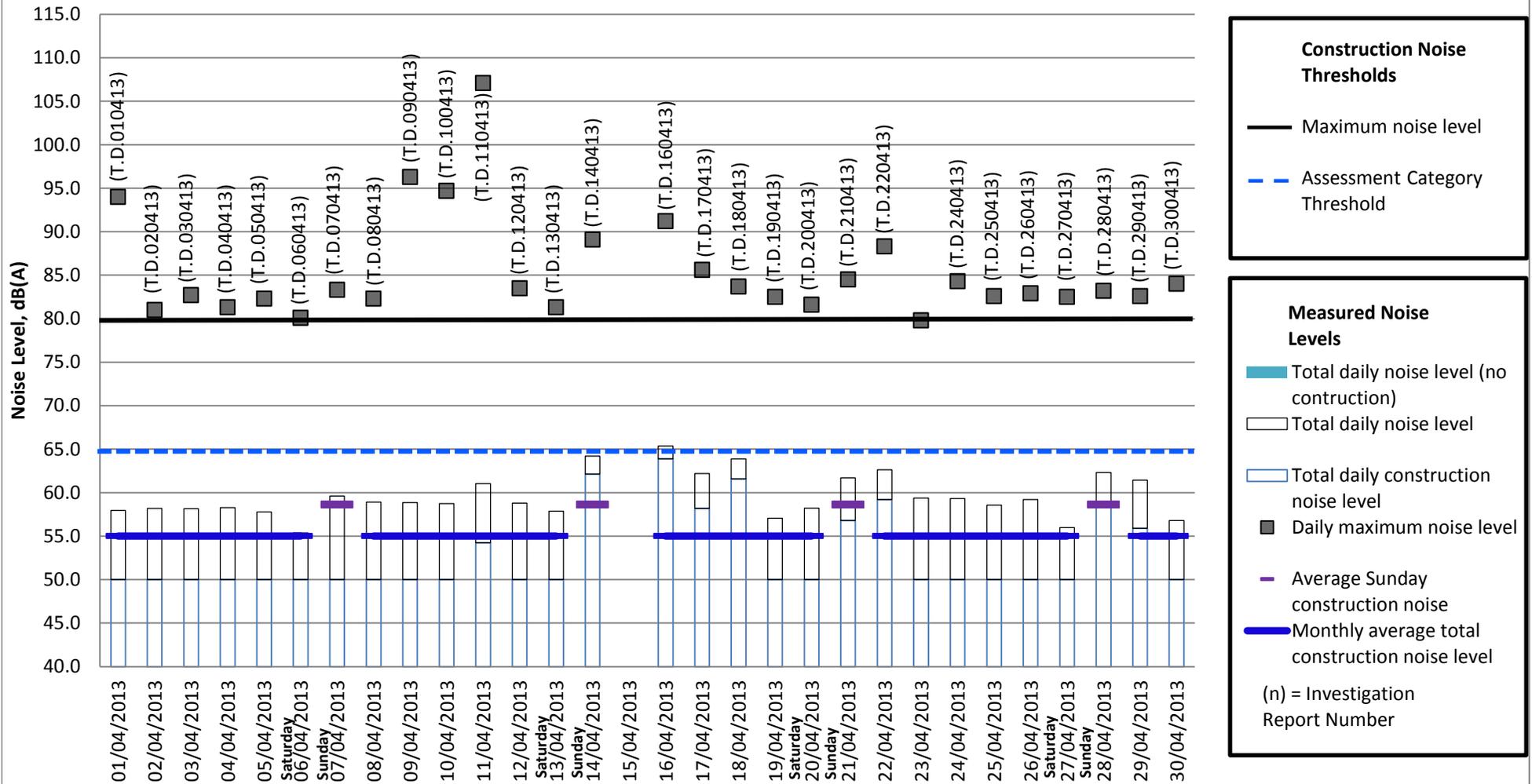
**Note:** The grey areas of the chart represent days on which no construction works have been conducted. The monthly average construction noise for Sunday has not been included as no Sunday works have been conducted at this location .

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



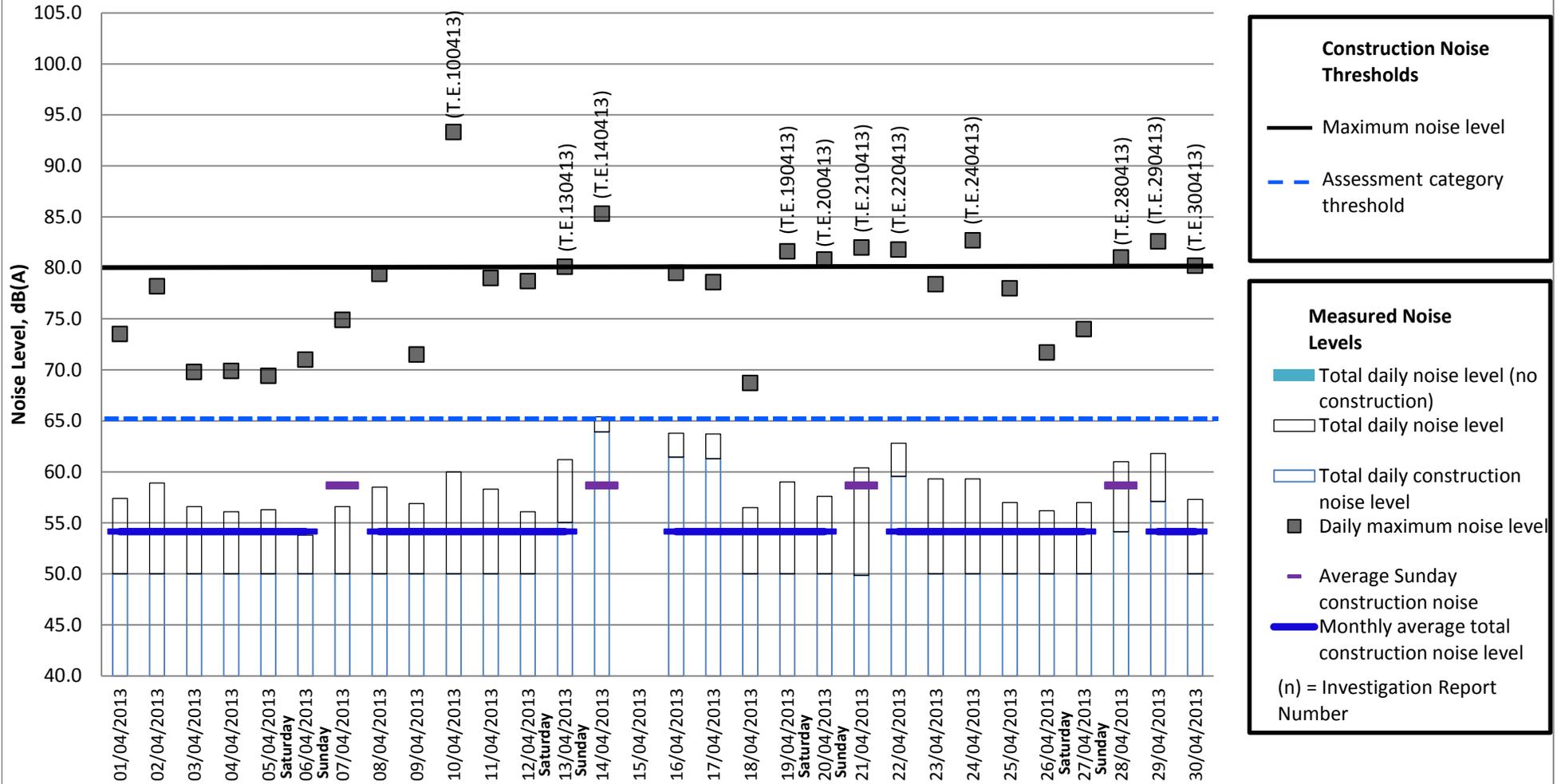
**Note:** The grey areas of the chart represent days on which no construction works have been conducted. The monthly average construction noise for Sunday has not been included as no Sunday works have been conducted at this location.

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



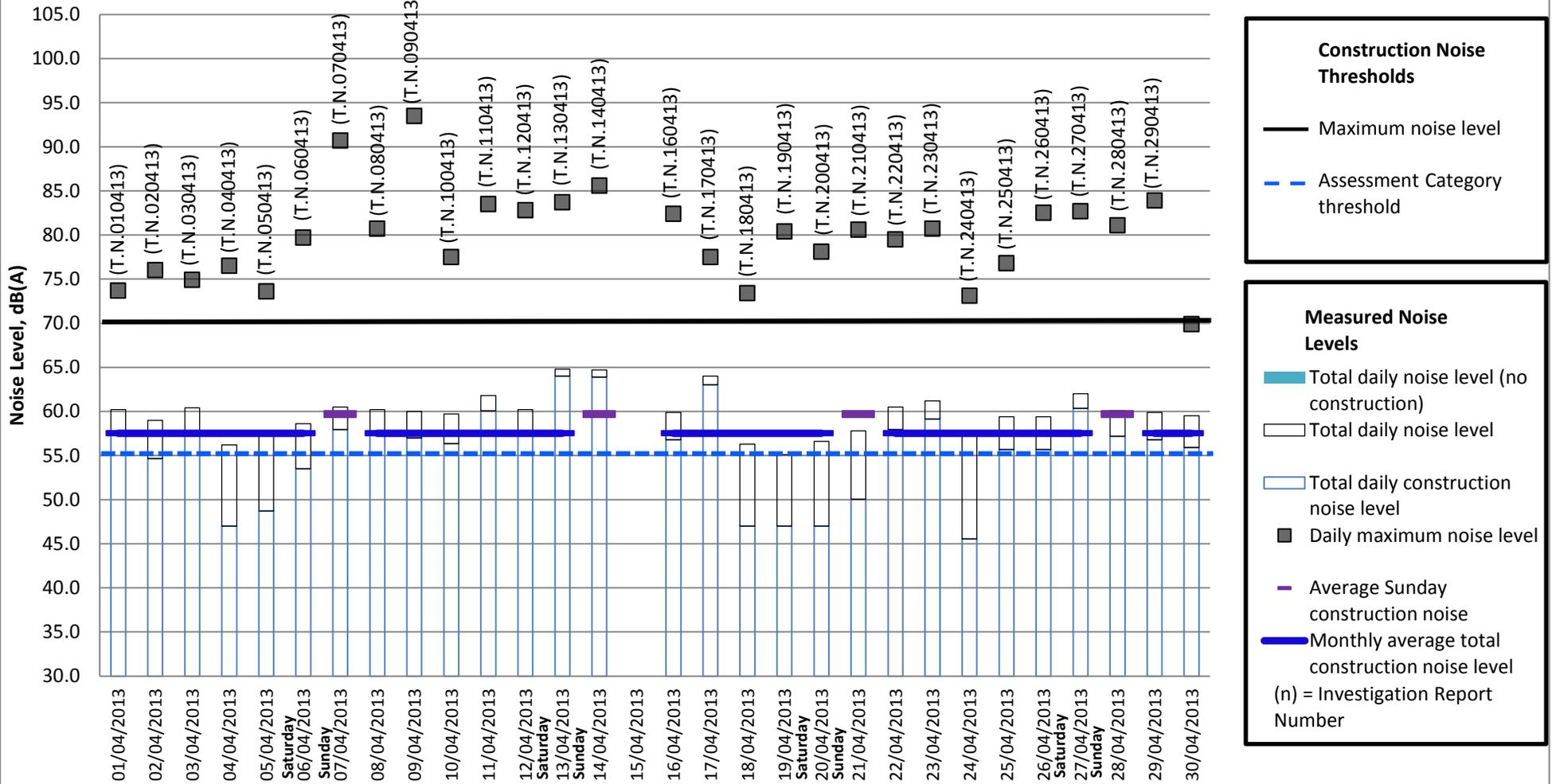
**Note:** Data is missing on 15/04/13 due to device error associated with adverse weather conditions.

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



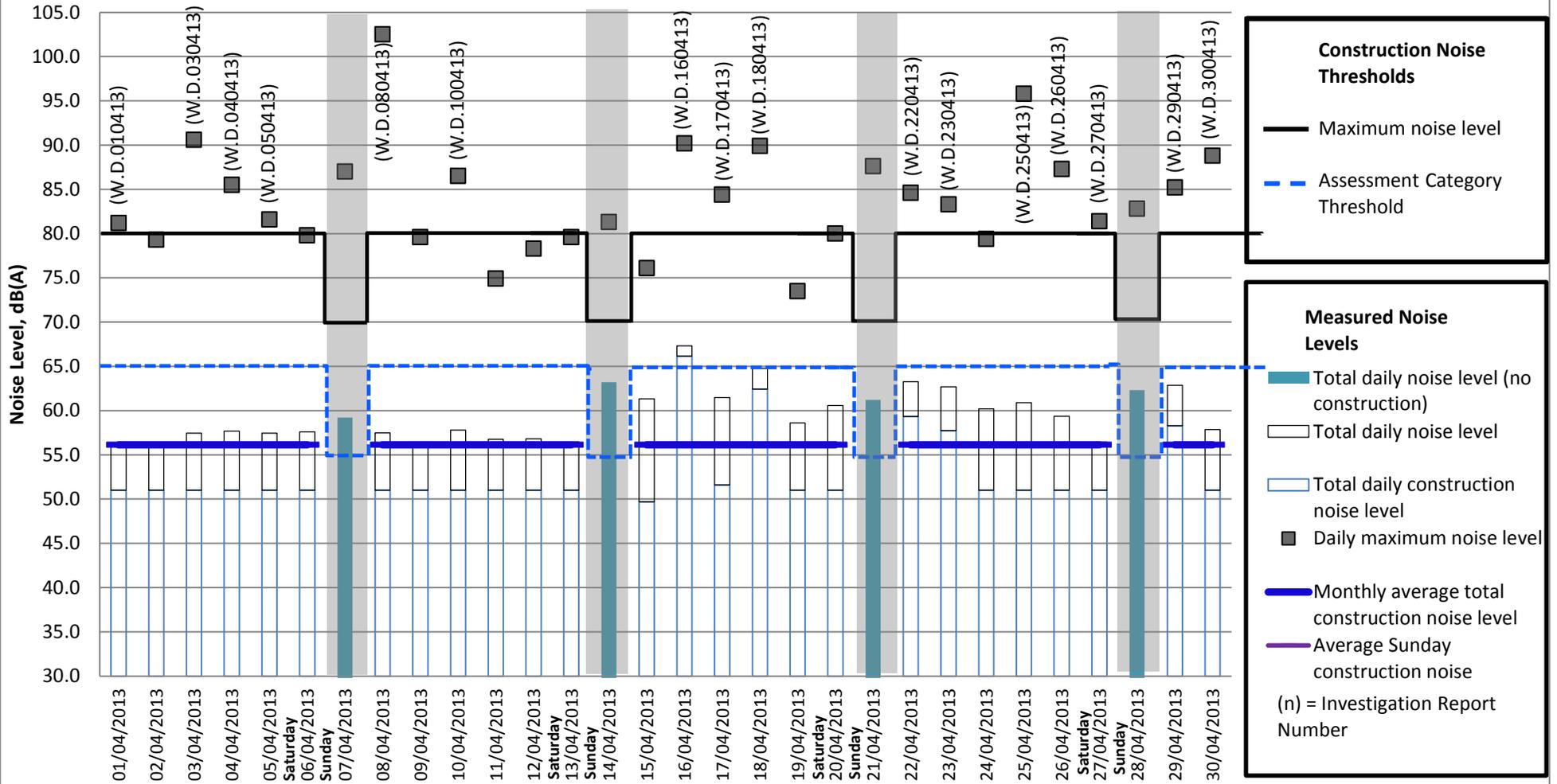
**Note:** Data is missing for 15/04/13 due to device error associated with adverse weather conditions.

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



**Note:** Data is missing for 15/04/13 due to device error associated with adverse weather conditions.

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



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