



# **WOLVERCOTE & WATERWAYS**

## **RAIL NOISE SURVEY & MITIGATION STATEMENT**

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**March 2019**

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# 1. EXECUTIVE SUMMARY

- 1.1. A week-long noise survey was carried out for 5 properties in Wolvercote and Waterways in Oxford to determine the resultant free field noise levels due to the East West Rail (EWR) scheme after noise mitigation measures were carried out including the installation of a 2.5m high timber absorptive noise barrier scheme.
- 1.2. The survey results were assessed against the Noise and Vibration Mitigation Policy (Jan 2011) adopted by Chiltern Railways. The assessment has shown that measured daytime noise levels post mitigation comply with the policy being less than the daytime Noise Impact Threshold level at ground and at first floor level. However, the night-time LAeq levels for 4 of the 5 properties show exceedances of 3dB or greater. In one case at Cox's Ground the exceedance at first floor level was 7dB over the daytime Noise Impact Threshold level. There may therefore be a case to examine the need for further noise mitigation for the properties considered and those in the vicinity.
- 1.3. Furthermore, the night-time LAMax levels at Cox's Ground showed exceedances over the additional insulation criterion which may be considered to be routine. If this is the case, it would justify the need to consider the property for insulation.
- 1.4. The performance specification of the installed noise barrier system was also examined and found to be unclear, requiring CE Marked products where no such harmonised product standard as yet exists for rail barriers and referring to the airborne sound insulation test standard for diffuse fields when the application appears to be for a noise barrier scheme in a direct field. All of which would show the need to clarify and confirm the specification and certified performance of the installed system.
- 1.5. The barrier height in the scheme had also been intentionally constrained on the basis of practicability. Whilst it was hard to comment on the risk and safety aspects specific to this particular rail application, limiting the barrier height to 2.5m appeared surprising when compared to other road and rail noise barrier schemes with substantially taller barriers. This was also relevant since the barrier height limitation would have a direct impact on the limitation of noise mitigation at first floor level as appears to be the case at Cox's Ground.
- 1.6. If the need for further noise mitigation is explored, the Tata SilentTrack system may be a worthwhile option to consider if it can reduce the noise at source without the need to increase the barrier height. This would however appears to depend on the track type and condition and the nature of the noise being generated.

## 2. DOCUMENT ASSESSMENT

### 2.1. Document List

As part of this study the following documents relating to the scheme were assessed:

- Noise Scheme of Assessment for Route Section H (ERM) – Dec 2014
- Noise Scheme of Assessment for Route Section I/1 (ERM) Main Report – Dec 2015
- Noise Scheme of Assessment for Route Section I/1 (ERM) Annexes A-E and G – Dec 2015
- Noise Scheme of Assessment for Route Section I/1 (ERM) Annexes F – Dec 2015
- Noise and Vibration Mitigation Policy – Jan 2011
- East West Rail Phase 1 – Measurement of Effect of Noise Barrier in Route Section H to I1 (Atkins)
- DEFRA Noise Action Plan Railways - Jan 2014
- Brian Hemsworth Report on Assessment of Route Section I – Sep 2015

The approach adopted in the Noise and Vibration Mitigation Policy in particular was used as the basis for assessing the noise survey results once gathered. This is discussed in greater detail in Chapter 4 below.

The resultant noise barrier design specification is illustrated and detailed in the Section I/1 Noise Barrier Planning Details, a copy of which is included in Appendix B of this report. This was examined alongside the ERM Noise Scheme Assessments with particular attention given to Box 5.1 – Constraints on the Practicability of Noise Barriers which appears to have been used to govern the choice of barrier height for the scheme.

### 2.2. Tata SilentTrack

The following two papers were also considered with regard to the development of the SilentTrack system by Tata Steel for reducing railway noise:

- Tata SilentTrack paper
- Silent track Univ of Southampton research paper

Both papers report the potential of reducing rail track noise by 3-6dB (or 5-7 dB in the paper by ISVR Southampton) using a damper manufactured from steel embedded with rubber. ISVR state that the noise reduction achieved depends strongly on the track it is fitted to.

What is also not apparent is the age of the track that has been treated in tests and whether the high-performance benefits are achieved when fitted to relatively new tracks as well as to move degraded old track systems. The potential as a possible mitigation solution is still worth investigating especially where barriers have already been installed.

On the basis of these papers, the SilentTrack system has been shown to reduce track noise ‘at source’ thus reducing the need for external noise mitigation systems such as high noise barriers. In the case of the properties that have been assessed in the study, the barriers are not high (at only 2.5m) but are already installed. in place. Retrofitting existing barriers to increase their height is difficult since the foundations have been designed for low barriers. It usually requires a full replacement. The potential to reduce the noise at source is therefore an attractive one worthy of further investigation.

### **3. MEASUREMENT SURVEY**

#### **3.1. Measurement Approach**

A noise survey of 5 key residential properties was carried out in May August and September 2018. Each property is positioned behind different sections of the recently installed 2.5m high timber absorptive barrier. The properties were:

3 Bladon Close (Wolvercote)

5 First Turn (Wolvercote)

61 Lakeside (Wolvercote)

25 Cox’s Ground (Waterways)

40 Stone Meadow (Waterways)

Measurements were carried out over a week period to determine the current daytime and night time LAeq noise levels and these were compared to the Noise Impact Threshold Levels and the Noise Insulation Trigger Levels outlined in Noise and Vibration Mitigation Policy (1992) adopted by Chiltern Railways. The night-time LAMax noise levels were also recorded during the survey to determine if they would result in a significant impact as an additional criterion for noise insulation in the N&V Mitigation Policy.

At each location unattended noise monitoring was carried out either at 1.5m, representative of ground floor levels or at 4.0m, representative of first floor levels in free-field conditions (away from reflective walls and surfaces. At the same time a weather station was also installed to monitor the weather conditions on a synchronised basis.

By monitoring over a week-long period ensured that only the noise levels recorded under suitable weather conditions were considered in the analysis. In other words when it was dry and the general windspeed and momentary wind gusts were low enough for them not to affect the measured noise levels. This would ensure that the data collected was as robust as possible. The monitoring equipment used is described below.

### 3.2. Survey Apparatus

For the noise survey independent noise logging analysers were deployed. These were self-powered and calibrated on site prior to and after the noise survey was carried out. The analysers have been verified according to the procedure given in BS7580:1997. The analysers also conform to BS7580:1997 verifying conformance to BSEN60851:1994 Type 1, BSEN60804:1994 Type 1. Calibration certificates can be made available on request. Sound Level meters and calibrators have been calibrated to traceable standards within the past two years. The instruments used were as follows:

Instrument	No	Type
Integrating Real Time Analysers	2	01-dB type SIP95 (type 1)
Integrating Real Time Analysers	1	B&K type 2250E (type 1)
Sound Calibrator	1	01-dB type CAL01 (class 1)
Weather Station	1	DAV 6250 - Davis Vantage Vue

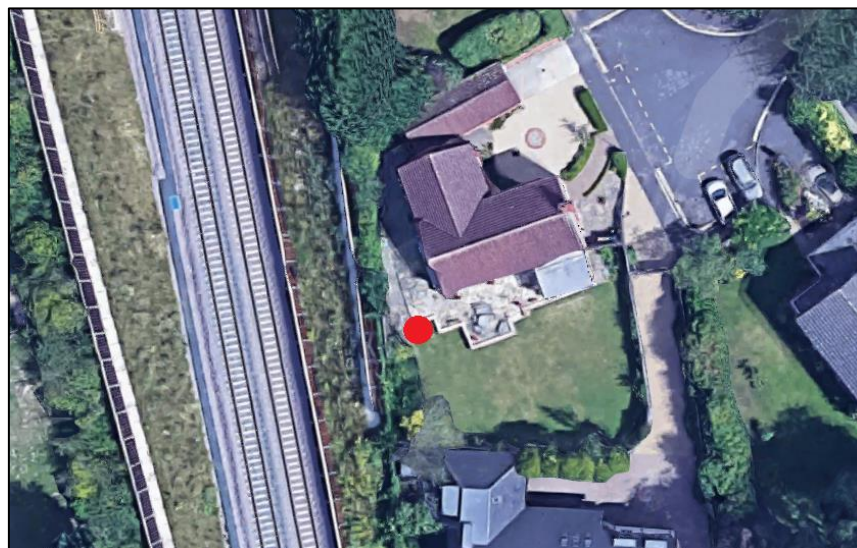
### 3.3. MEASUREMENT LOCATIONS AND CONDITIONS

#### 3.3.1 3 BLADON CLOSE (WOLVERCOTE)

Noise measurements were carried out at 3 Bladon Close, Wolvercote, in the rear garden of the property at a height of 1.5m and under free field conditions. Measurements were carried out from 6<sup>th</sup> – 13<sup>th</sup> September 2018. A weather station was also installed to monitor the weather simultaneously. The property is partially shielded from rail traffic by two overlapping sections of the 2.5m high timber absorptive noise barrier system.

#### Conditions:

During the monitoring, the weather recorded was generally dry and still, though there was brief rainfall from midnight to 05:00 on 12<sup>th</sup> September and this data was discounted from the analysis. The average daytime and night time LAeq noise levels were recorded together with the highest LAMax noise levels. The results of the noise monitoring are details below in Chapter 4.



### 3.3.2 5 FIRST TURN (WOLVERCOTE)

Noise measurements were carried out at 5 First Turn, Wolvercote, in the rear garden of the property at a height of 4.0m and under free field conditions. Measurements were carried out from 22<sup>nd</sup> – 29<sup>th</sup> May 2018. The property is partially shielded from rail traffic by a section of the 2.5m high timber absorptive noise barrier system.

#### Conditions:

During the monitoring, the weather recorded was dry and still at the beginning of the week, with rainfall on 24<sup>th</sup> (04:30-07:00), 25<sup>th</sup> (01:00-10:00) and 27<sup>th</sup> (00:40 to 02:45). There was also high wind levels on 26<sup>th</sup> (12:00-22:00). Data over these periods was therefore discounted from the analysis. The average daytime and night time LAeq noise levels were recorded together with the highest LAMax noise levels. The results of the noise monitoring are details below in Chapter 4.

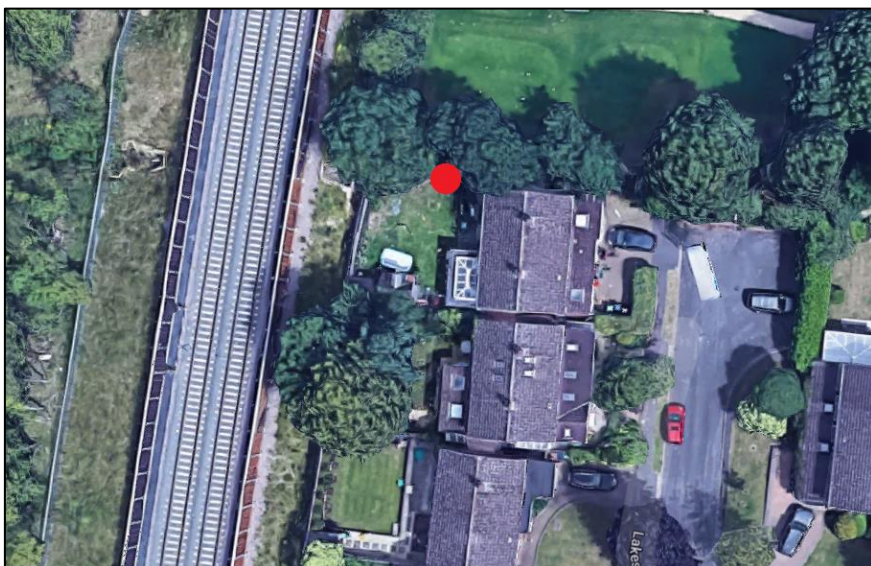
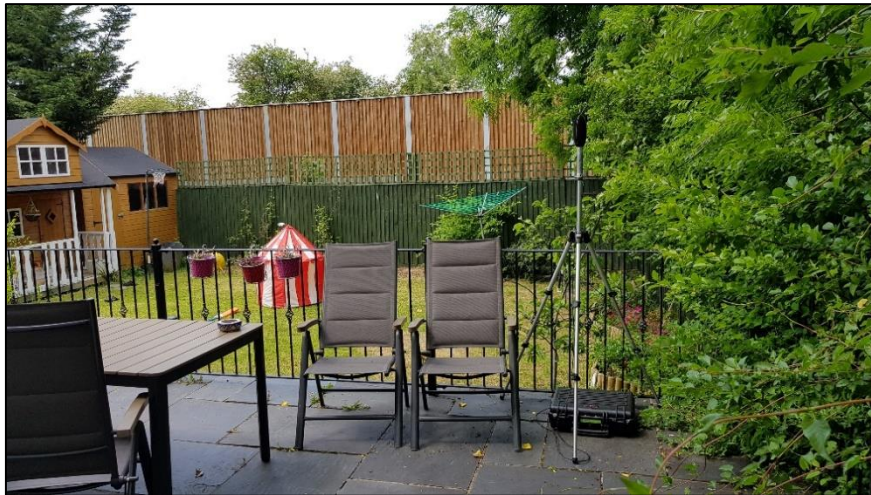


### 3.3.3 61 LAKESIDE (WOLVERCOTE)

Noise measurements were carried out at 61 Lakeside, Wolvercote, in the rear garden of the property at a height of 1.5m and under free field conditions. Measurements were carried out from 22nd – 29th May 2018. The property is partially shielded from rail traffic by a section of the 2.5m high timber absorptive noise barrier system.

#### Conditions:

During the monitoring, the weather recorded was dry and still at the beginning of the week, with rainfall on 24th (04:30-07:00), 25th (01:00-10:00) and 27th (00:40 to 02:45). There was also high wind levels on 26th (12:00-22:00). Data over these periods was therefore discounted from the analysis. The average daytime and night time LAeq noise levels were recorded together with the highest LAMax noise levels. The results of the noise monitoring are details below in Chapter 4.

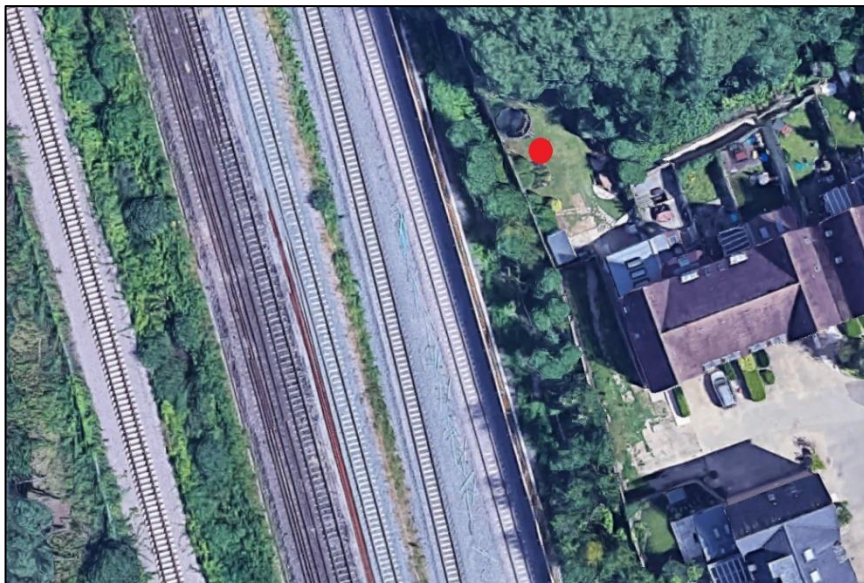


### 3.3.4 25 COX'S GROUND (WATERWAYS)

Noise measurements were carried out at 25 Cox's Ground, Waterways, in the rear garden of the property at a height of 4.0m and under free field conditions. Measurements were carried out from 29<sup>th</sup> August – 5<sup>th</sup> September 2018. The property is partially shielded from rail traffic by a section of the 2.5m high timber absorptive noise barrier system.

#### Conditions:

During the monitoring, the weather recorded was completely dry and still for the whole week with no significant incidents of rainfall or high wind levels. The average daytime and night time LAeq noise levels were recorded together with the highest LAMax noise levels. The results of the noise monitoring are details below in Chapter 4.



### 3.3.5 40 STONE MEADOW (WATERWAYS)

Noise measurements were carried out at 40 Stone Meadow, Waterways, in the rear garden of the property at a height of 4.0m and under free field conditions. A weather station was also installed to monitor the weather simultaneously. Measurements were carried out from 29th August – 5th September 2018. The property is partially shielded from rail traffic by a section of the 2.5m high timber absorptive noise barrier system.

#### Conditions:

During the monitoring, the weather recorded was completely dry and still for the whole week with no significant incidents of rainfall or high wind levels. The average daytime and night time LAeq noise levels were recorded together with the highest LAMax noise levels. The results of the noise monitoring are details below in Chapter 4.





## Noise Insulation Trigger Levels

The Noise Insulation Trigger Levels (2.5) defined the Noise Impact Threshold levels as those levels above which noise insulation will be offered, provided the corresponding existing or ambient noise level is routinely exceeded by at least 1dB. The free-field daytime and night time threshold levels are as follows:

$$\begin{aligned} \text{Noise Insulation Trigger Levels} \quad & \text{Day} > L_{Aeq, (0600-0000 \text{ hours})} 66 \text{ dB} \\ & \text{Night} > L_{Aeq, (0000-0600 \text{ hours})} 61 \text{ dB} \end{aligned}$$

The table below provides the averaged free field daytime and night time noise levels measured at the 5 properties assessed:

Property	Height (m)	Type	Daytime LAeq (06-00hrs)	Night-time LAeq (00-06hrs)
3 Bladon Close	1.5	Freefield	49	43
5 First Turn	4.0	Freefield	53	50
61 Lakeside	1.5	Freefield	53	45
25 Cox's Ground	5.0	Freefield	53	49
40 Stone Meadow	1.5	Freefield	51	50

On the basis of these measurements, neither the daytime nor the night-time N.I.Trigger levels are exceeded for any of the properties. There is therefore no entitlement for further insulation for any of the 5 properties based on these figures.

## 4.3 SUMMARY LAMax NOISE LEVELS

### Noise Impact Threshold Levels

The Noise and Vibration Policy (2.7) states that the maximum pass-by free-field LAMax level regularly exceeds 82dB at night. Regularly is hard to define but the policy states, '*one or two events per night would not be interpreted as regular, but the 8 assumed freight movements each night in Phase 2B are considered to be regular*'.

The following criterion for noise insulation is applied:

$$\text{Significant impact, need for further mitigation likely to be noise insulation:} \quad \text{Night} > L_{Amax} 82 \text{ dB}$$

The table below provides the LAMax levels and number over 80dB measured over the night-time (23:00-0700) at the 5 properties assessed:

3 Bladon Close	15 min Period	Night-time LAMax (23-07hrs)
08/09/2018	06:00:00	80

61 Lakeside	15 min Period	Night-time LAMax (23-07hrs)
23/05/2018	06:30:00	83
24/05/2018	06:30:00	83
25/05/2018	06:30:00	84

25 Cox's Ground	15 min Period	Night-time LAMax (23-07hrs)
30/08/2018	05:30:00	84
30/08/2018	04:30:00	82
30/08/2018	04:00:00	81
31/08/2018	04:00:00	83
31/08/2018	01:00:00	83
31/08/2018	04:15:00	82
31/08/2018	04:30:00	82
31/08/2018	00:00:00	82
31/08/2018	23:00:00	81
31/08/2018	05:45:00	80
01/09/2018	00:00:00	86
01/09/2018	00:30:00	82
01/09/2018	00:45:00	81
01/09/2018	01:15:00	81
04/09/2018	00:45:00	84
04/09/2018	06:30:00	83
04/09/2018	00:30:00	81
04/09/2018	06:00:00	81
04/09/2018	04:00:00	80

40 Stone Meadow	15 min Period	Night-time LAMax (23-07hrs)
01/09/2018	06:30:00	81

For 4 of the properties there are insufficient LAMax pass-by peaks to be considered against the additional insulation criterion. However, 25 Cox's Ground would appear to be exceeding 80dB regularly and (on 31<sup>st</sup> August) it exceeds the 82dB criterion 5 times in the night and there could be consideration for insulation against the LAMax criterion. It was not possible to assess the LAMax levels at Cox's Ground past 04/09/18 and no LAMax levels over 80dB were recorded at 5 First Turn.

## 5 NOISE BARRIER SPECIFICATION

### 5.1 Proposed Noise Barrier Design

Appendix B provides the Section I/1 noise barrier planning details for the noise barrier system. This is shown to be based on a 2.5m high timber absorptive noise barrier design. The drawing itself provides specification details for the barrier itself which is dealt with below in 5.3. It is not entirely clear how authoritative the drawing is or whether it constitutes the specification for the tender for the barrier scheme.

For further guidance it recommends the Gramm Absorptive Noise Barrier or equivalent supplied by Gramm Barrier Systems Ltd based in Seaford East Sussex. Having viewed the noise barrier itself, whilst we are not aware who the manufacturer of installer of the barrier is, it is our understanding that Gramm Barrier Systems were not involved as installer or even in the tender process.

### 5.2 Practicability Constraints

At 2.5 metres the noise barrier design does appear to be lower than anticipated considering the need to provide sufficient noise mitigation especially at night at the bedroom first floor level. The result of this noise survey would also suggest that typical night time LAeq levels are in some cases substantively higher (>3dB) than the Threshold Impact Levels.

In Box 5.1 of the design documents *Constraint on the Practicability of Noise Barriers*, the barrier design height has been intentionally constrained for the following reason which we have commented on:

- 5.2.1 The need to reduce risk in accordance with the CDMR (2007) and the ECSM – as far as is reasonably practicable. We cannot comment on the specific risk level afforded by installing barrier adjacent to this or any other rail network, however we are aware of considerably higher barriers being installed close to rail, for example we recently assessed the 4-metre high timber absorptive barrier installed next to the Reading Rail depot.
- 5.2.2 The need to use access platforms for barrier higher than 3 metres; Again, this is common practice on busy motorway networks unless what is being referred to is a risk specific only to rail applications. Steep embankments are also mentioned as a difficulty both in terms of access and in terms of the need for larger foundations that could destabilise the embankment. This is not a problem on barriers that we have been involved with. It adds

to the cost of the scheme but that is a different matter. On the M25 nr Staines, barriers up to 5.5metre high have been installed on steep embankments overlooking a busy motorway and have remained stable for over 20 years.

- 5.2.3 Cost has also been highlighted as a constraint though this would need to be judged in the round against other objectives such as the need to demonstrate that best practicable means (BPM) has been pursued in the design. Other constraints such as potential landscape and visual impact have been included however these should be considered taking into account the views of local residents.

In summary the constraints on Practicability appear unusual compared to other far more substantial noise barrier schemes that we have been involved in over the past 25 years. In terms of performance the resultant barrier scheme at 2.5m appears to be too low based on the noise survey carried out.

### 5.3 Specification Standards

The drawing in Appendix B refers to BSEN acoustic test standards to specify the performance of the barrier however the specification details are somewhat confusing:

- At the time of design (2016), an absorptive noise barrier for the UK rail network under direct sound field conditions would need to be tested and certified for the following standards:
  - 16272-6:2014 for in situ airborne sound insulation under direct sound field conditions
  - 16272-1:2012 for sound absorption under diffuse conditions.

*(at the time of design there was not an equivalent rail test standard published for sound absorption based on barriers under direct field conditions).*
  
- Item 7 in the drawing requires the following:
  - Noise insulation performance shall be tested in accordance with BSEN 16272-2. *(at the time of design this was not the correct rail test standard published for airborne sound insulation based on barriers under direct field conditions).*
  - All panels shall carry a CE Marking in accordance with the Construction Products Regulations (2013) ... to demonstrate conformity with this specification. *(to this date there is no hEN harmonised standard for the specification and CE Mark certification of rail noise barriers. There is one for road noise barrier: BSEN 14388:2005 (current harmonised version) which I co-authored but this is based on a different suite of test standards)*

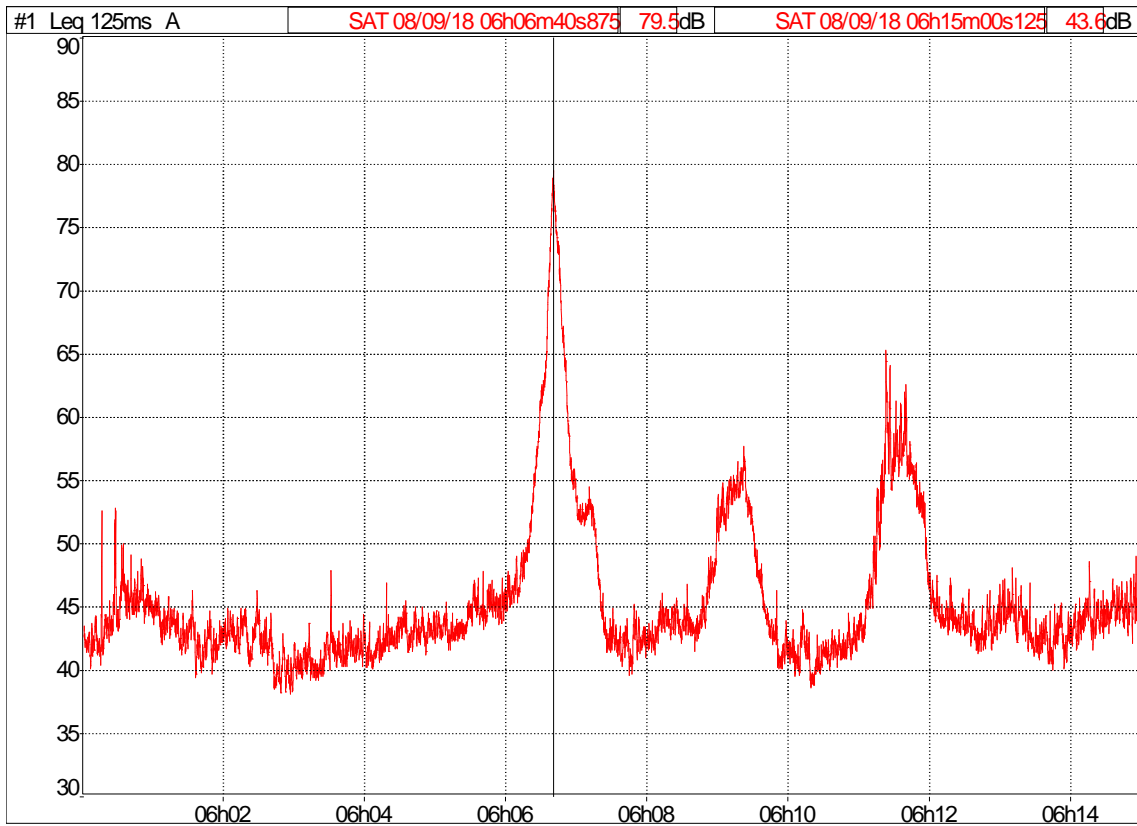
## 5.4 Summary Comments

In summary it is not clear what the performance specification of the installed 2.5m timber absorptive noise barrier system is nor its origin and whether the resulting barrier installed actually meets that specification. We would therefore recommend that a request is made to find out who the noise barrier contractor(s) are that both manufactured and installed the barrier and for the performance test certification of the barrier supplied and how it was assessed against the specification to determine whether it is actually fit-for-purpose. It would also be worth requesting a copy of the CE Mark and Declaration of Performance since that has been made a prime aspect of the specification.

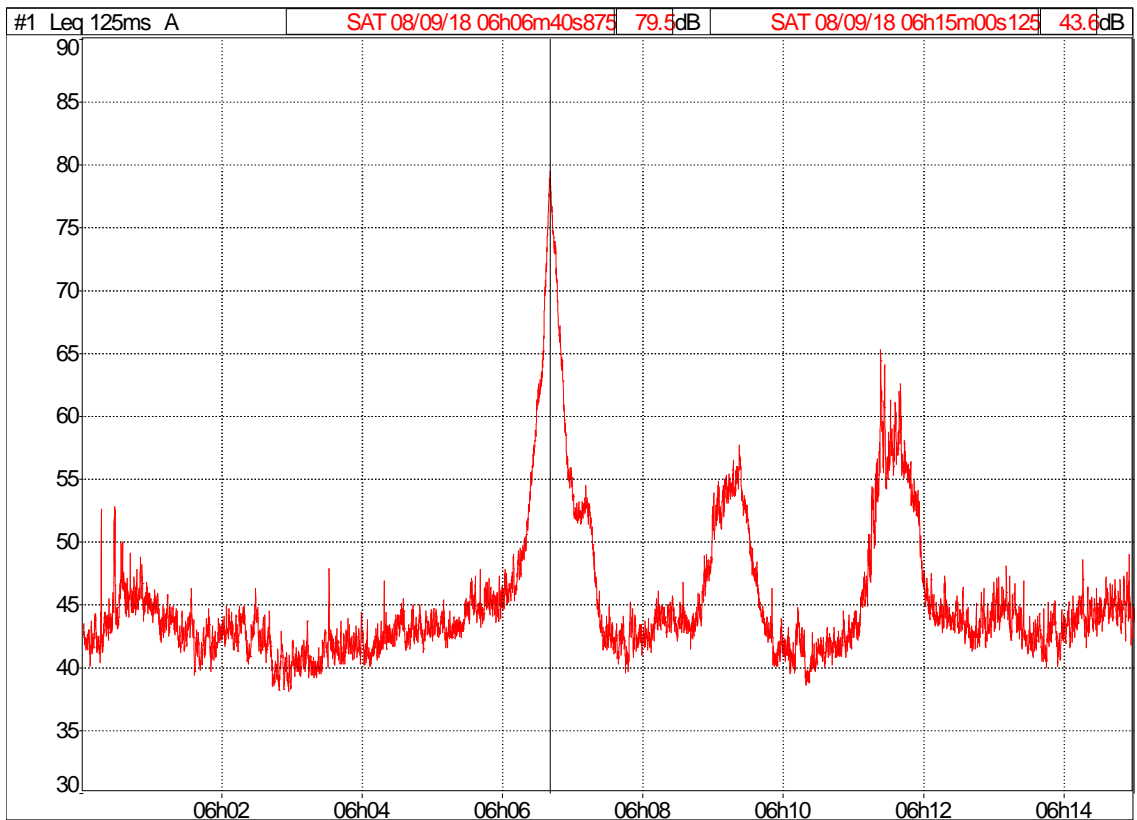
# APPENDIX A

## Example LAMax Levels

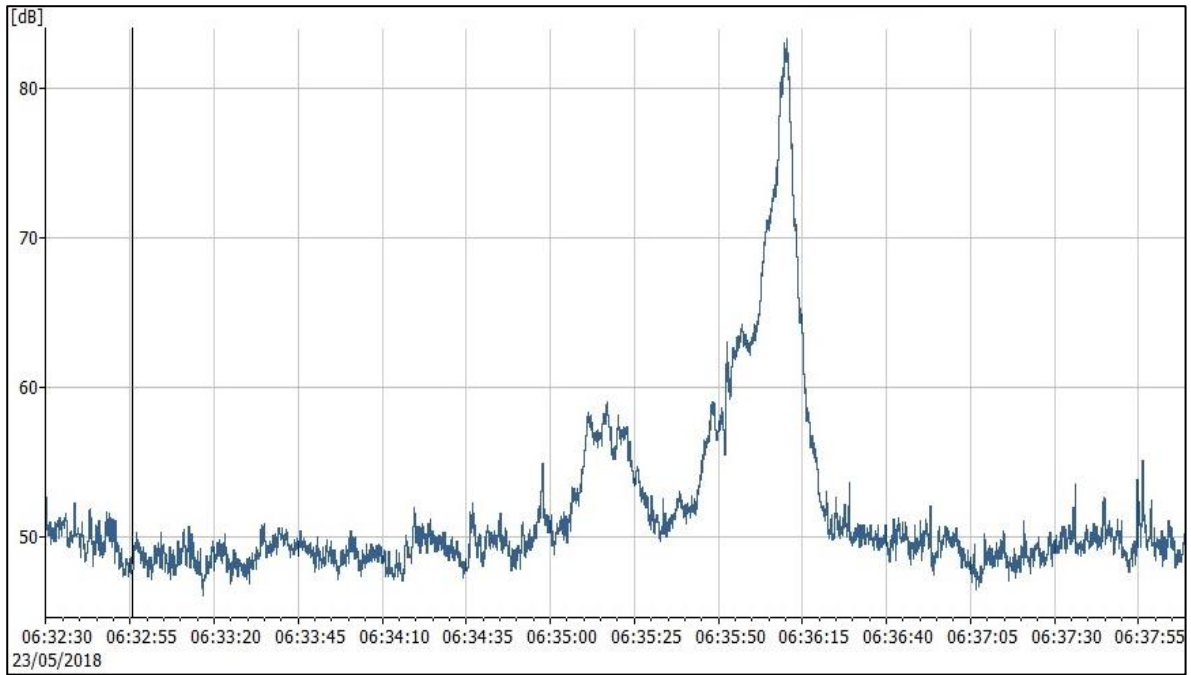
### 3 BLADON CLOSE – Example LAMax Level



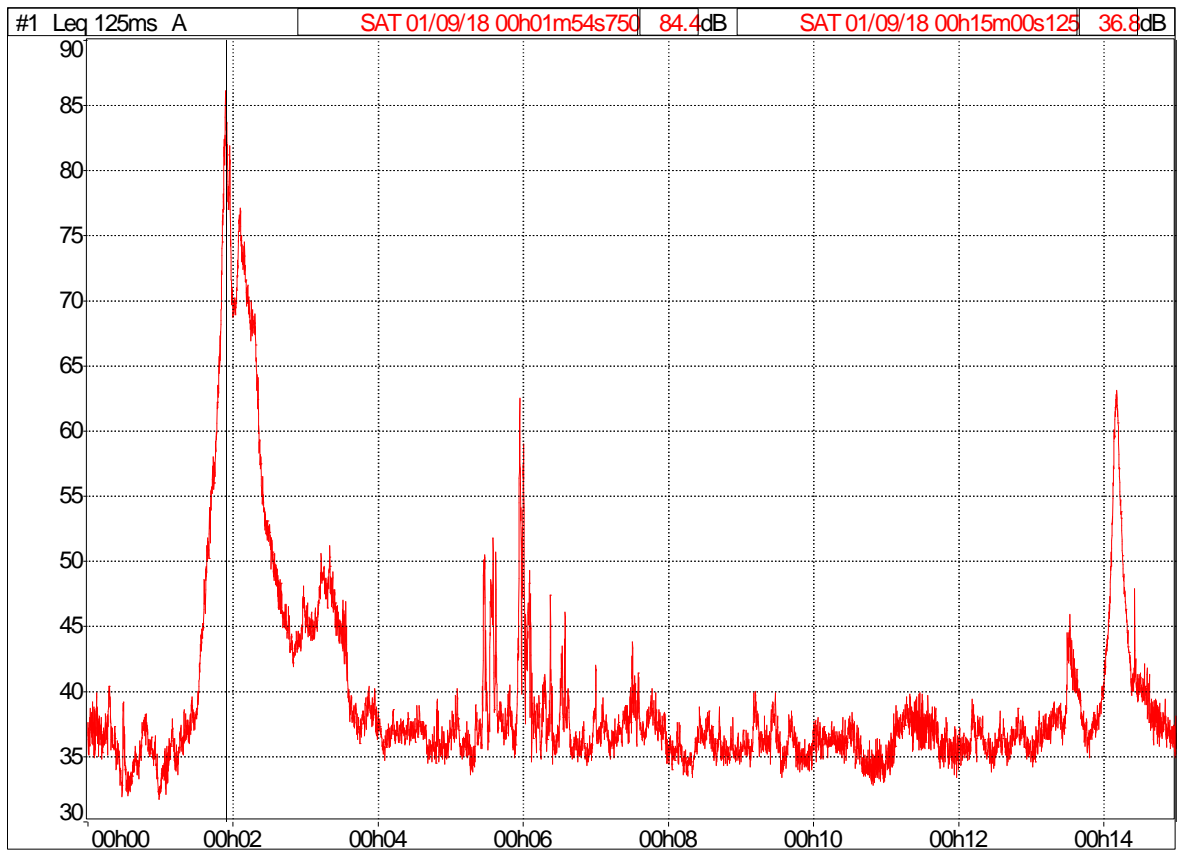
### 5 FIRST TURN – Example LAMax Level



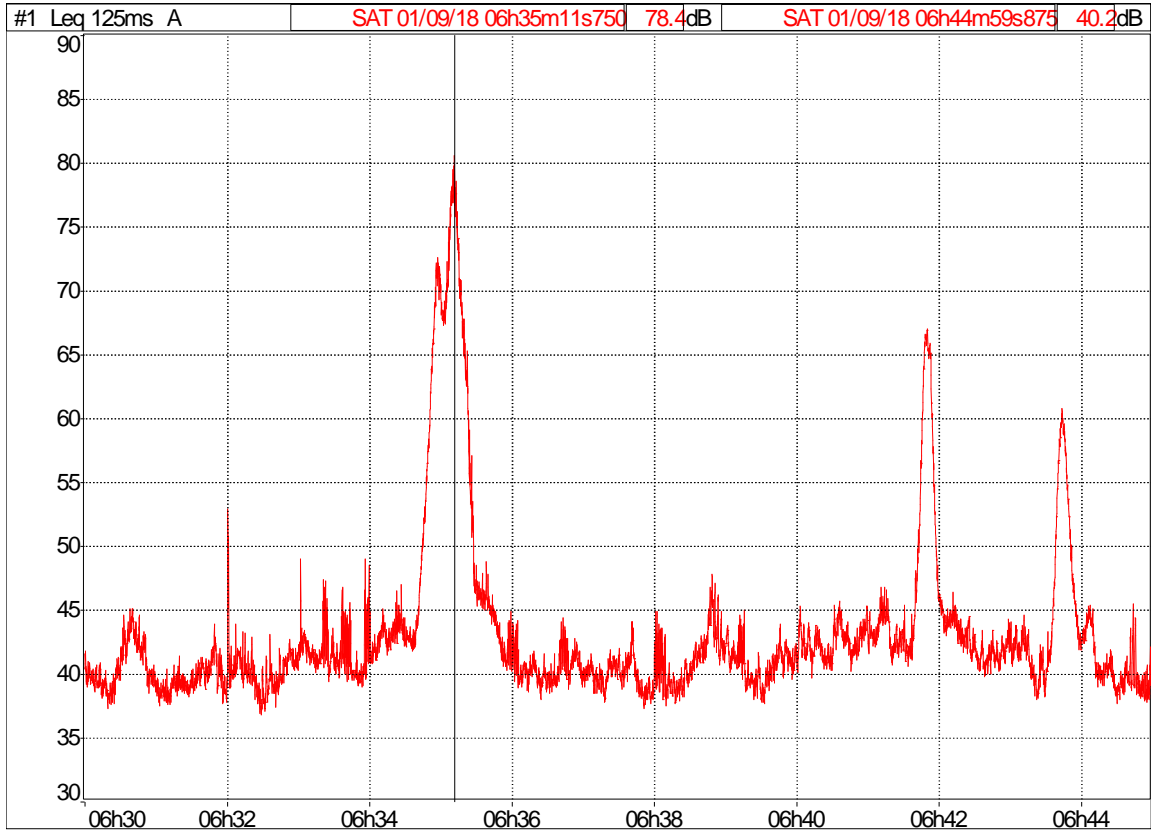
### 61 LAKESIDE – Example LAMax Level



### 25 COX's GROUND – Example LAMax Level

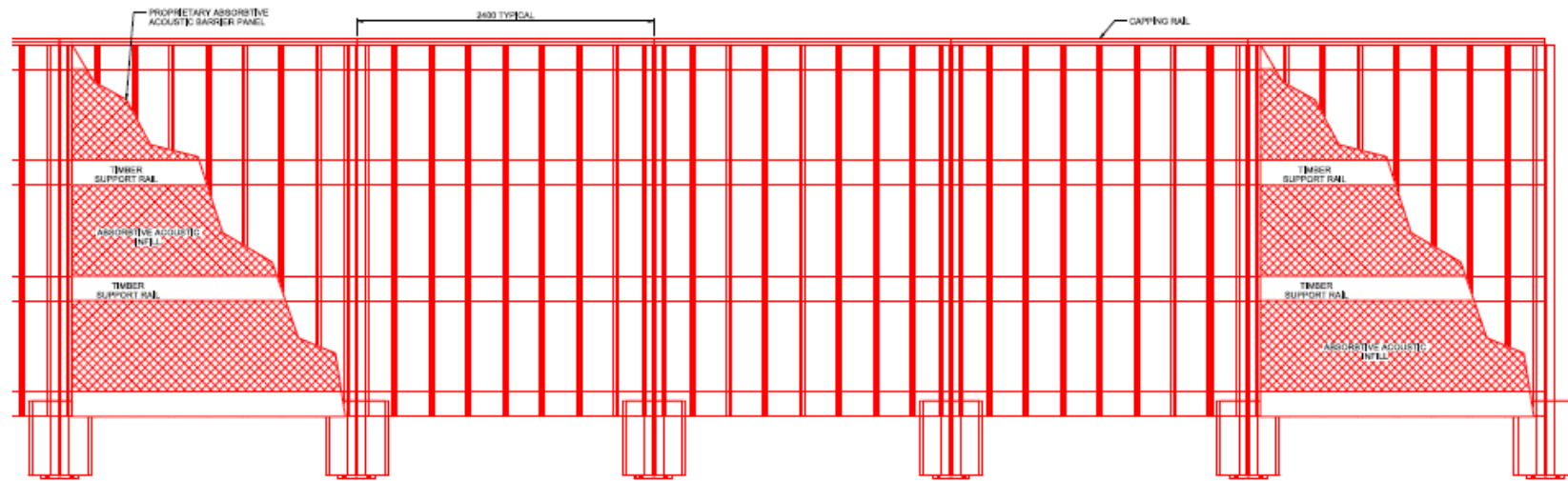


### 5.4.1 40 STONE MEADOW – Example LAMax Level

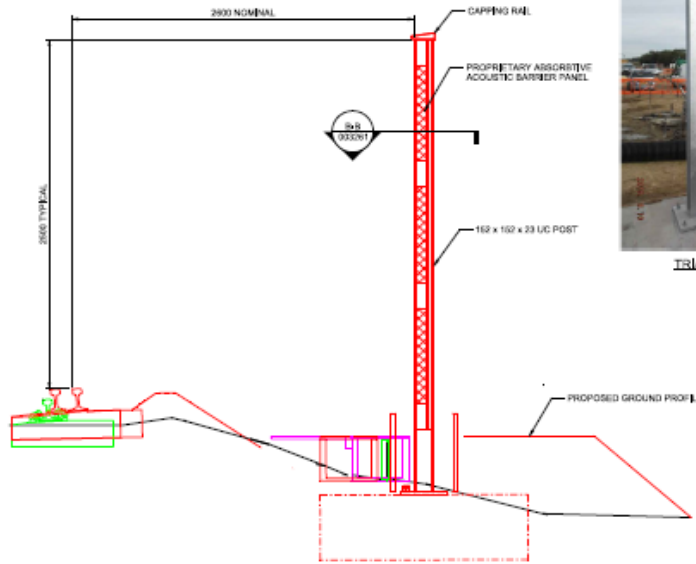


# **APPENDIX B**

## **NOISE BARRIER SPECIFICATION**



TYPICAL RAIL SIDE ELEVATION AT BARRIER END  
SCALE 1:25



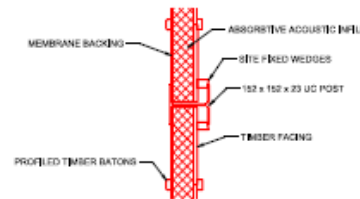
TYPICAL CROSS SECTION THROUGH BARRIER  
SCALE 1:25



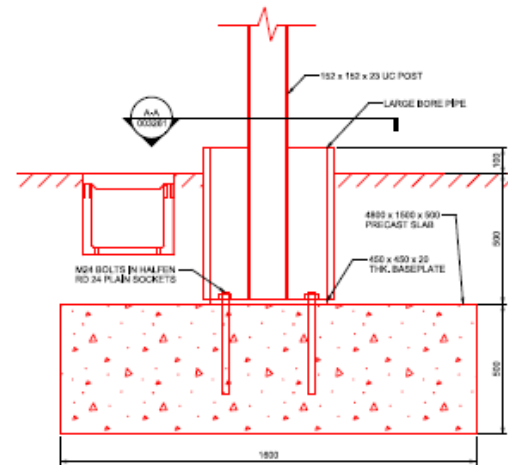
TRIAL PANEL PHOTO  
(RAIL FACE)



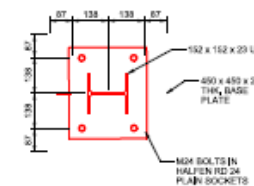
TRIAL PANEL PHOTO  
(PUBLIC FACE)



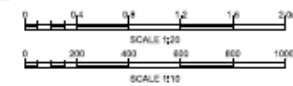
SECTION B-B  
SCALE 1:20



TYPICAL FOUNDATION DETAIL  
SCALE 1:20



SECTION A-A  
SCALE 1:20



1. ALL DIMENSIONS IN MM UNLESS SPECIFIED OTHERWISE, ALL LEVELS IN METRES TO ORDNANCE DATUM NEWLYN
2. THIS DRAWING TO BE READ IN CONJUNCTION WITH THE FOLLOWING SET:  
SECTION I/1 NOISE BARRIER PLANNING DETAILS W1002D-TTS-DRG-ECV-003261  
SECTION I/1 NOISE BARRIER PLANNING IGA W1002D-TTS-DRG-ECV-003261
3. BURIED SERVICES POSITIONS HAVE NOT BEEN VERIFIED. FOLLOW SAFE BENDING PRACTICE IN ACCORDANCE WITH H80 47 AND NR/LAW/G1030
4. GRAMM ABSORPTIVE NOISE BARRIER OR EQUIVALENT SUPPLIED BY:  
GRAMM BARRIER SYSTEMS LTD  
HEAD OFFICE  
18 COLTON PLACE  
SEAPOD  
EAST SUSSEX  
BN25 1NP  
TEL: +44 (0) 1442 29902  
EMAIL: GRAMM@GS@aol.com
5. HALFEN PLAIN SOCKET ANCHORAGE OR EQUIVALENT SUPPLIED BY:  
ATH JV PORTLAND CLODE  
110UGHTON RIDGE  
LUS SAW  
TEL: +44 (0) 1684 470800  
EMAIL: SALES@ATHJV.CO.UK
6. ADVA LARGE BORE PIPE OR EQUIVALENT SUPPLIED BY:  
BELMONT HOUSE  
GAINETT PLACE  
SKELMERDALE  
LANCASHIRE  
WB6 8US  
TEL: +44 (0) 1966 1983  
EMAIL: SALES@AQUAFAB.CO.UK
7. ACOUSTIC BARRIER SPECIFICATION (AS AGREED WITH ENVIRONMENTAL CONSULTANT)  
• OVERALL PERFORMANCE OF THE BARRIER FOR NOISE ABSORPTION SHALL PROVIDE A MINIMUM CLAD 15 DB IN ACCORDANCE WITH BS EN 16273-1.  
• NOISE ABSORPTION PERFORMANCE SHALL BE TESTED IN ACCORDANCE WITH BS EN 16274 AND RESULTS TO BE PRESENTED IN ACCORDANCE WITH THAT STANDARD FOR ACCEPTANCE.  
• OVERALL PERFORMANCE OF THE BARRIER FOR NOISE INSULATION SHALL PROVIDE A MINIMUM DLR OF 34 DB IN ACCORDANCE WITH BS EN 16273-2-1.  
• NOISE INSULATION PERFORMANCE SHALL BE TESTED IN ACCORDANCE WITH BS EN 16274-2 AND RESULTS TO BE PRESENTED IN ACCORDANCE WITH THAT STANDARD FOR ACCEPTANCE.  
• ALL PANELS SHALL CARRY A CE MARKING IN ACCORDANCE WITH THE CONSTRUCTION PRODUCTS REGULATIONS (CPR) IN ACCORDANCE WITH THE CONSTRUCTION PRODUCTS REGULATIONS (CPR) IN ACCORDANCE WITH BS EN 12601. A DECLARATION OF PERFORMANCE SHALL BE PROVIDED TO DEMONSTRATE CONFORMITY WITH THIS SPECIFICATION.  
• ALL TIMBER SHALL BE FROM FSC-CERTIFIED SOURCES.

8. BARRIERS WILL BE INSTALLED IN THE LOCATIONS SHOWN SUBJECT TO UNEXPECTED GROUND CONDITIONS/SUBSIDED SERVICES.

REV	NO	DATE	DESCRIPTION	BY	CHK	APP
001	00001A		ISSUED FOR PERMIT	SP	JK	DB
002	00001B		ISSUED FOR CONSTRUCTION	SP	JK	DB
003	00001C		ISSUED FOR CONSTRUCTION	SP	JK	DB

Detailed Design

Network Rail

Scale: S3

ATH JV

A Network - Tata Steel Joint Venture

Melton House  
The Crescent  
York  
YO24 1AW

OXFORD CORRIDOR PHASE 0 AND 1  
DETAILED DESIGN

SECTION I/1 NOISE BARRIER  
PLANNING DETAILS

Checked	J FOREMAN	Approved	DB	Date	15/03/2016	
Drawn	B PHILLIPS	Approved	SP	Date	15/03/2016	
Checked	J KENNEDY	Approved	DB	Date	15/03/2016	
Approved	D HENNELL	Approved	DB	Date	15/03/2016	
AS SHOWN						
Project Reference	W1002D-TTS-DRG-ECV-003261				Sheet	1 of 5