The Sizewell C Project

6.14 Environmental Statement Addendum
Volume 3: Environmental Statement Addendum Appendices
Chapter 9 Rail
Appendices 9.3.A-E Noise and Vibration Part 2 of 2

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APPENDIX 9.3.E DRAFT RAIL NOISE MITIGATION STRATEGY

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TABLES

None provided.

PLATES

None provided.

FIGURES

None provided.

APPENDICES

1 INTRODUCTION

1.1.1 This document sets out the draft Rail Noise Mitigation Strategy (RNMS), as described in **paragraphs 4.7.10 and 4.7.22** in **Volume 9, Chapter 4** of the **Environmental Statement (ES)** (Doc Ref. 6.10) [APP-545]. It sets out the proposed measures to mitigate and minimise railway noise and vibration that might arise from running construction trains on the East Suffolk line, the Saxmundham to Leiston branch line, and the rail extension route, as part of the Sizewell C project. The final Rail Noise Mitigation Strategy will be concluded following further engagement with Network Rail and freight operating companies, as well as further measurements of groundborne and airborne noise during the 'early years' of the project after the Saxmundham to Leiston branch line has been upgraded and all physical mitigation installed.

1.1.2 The RNMS has been informed by:

- The noise and vibration assessment contained in **Volume 9, Chapter 4** of the **ES**, and associated appendices and figures (Doc Ref. 6.10) [APP-545 to APP-547.
- The reference material, guidance, survey results and analysis set out in **Volume 1, Appendix 6G** of the **ES** (Doc Ref. 6.2) [APP-171].
- The results of noise and vibration survey work undertaken in summer and autumn 2020, as set out in **Volume 3, Appendix 9.3.A** of the **ES Addendum** (Doc Ref. 6.14).
- The updated noise and vibration assessment presented in **Volume 1, Chapter 9** of the **ES Addendum** (Doc Ref. 6.14).
- Engagement with stakeholders, including Network Rail.

2 PHYSICAL MITIGATION MEASURES

2.1.1 This section of the RNMS sets out those measures that are proposed to mitigate and reduce railway noise or vibration and result in a physical change to the rail infrastructure. These measures should be in place before the operation of the first construction train operates.

2.2 Change Arrangements at Saxmundham

2.2.1 A crossover north of Saxmundham station and an upgrade to the line signalling system will be delivered as part of the Development Consent Order (DCO), allowing the potential for construction trains to enter or leave the Saxmundham to Leiston branch line without stopping. This removes the need to pull away from a stationary position and will deliver lower locomotive noise levels in the area around the junction.

2.2.2 The crossover will be located 457 to 528 metres of the northernmost point of the Saxmundham station platforms. For reference, the existing junction onto the branch line is 529 metres north of the northernmost point of the Saxmundham station platforms and will move approximately 11 metres further north if the DCO is consented.

2.2.3 The precise position of the crossover may change as the detailed design progresses. The revised position will be between 140 metres and 20 metres to the south of the position stated above.

2.2.4 The crossover will include either:

- NR56DV switches, with 1 in 15 crossings and concrete bearers; or
- NR56CV switches, with 1 in 13 crossings and concrete bearers.

2.2.5 Prior to the installation of the final crossover design, a further noise and vibration assessment will be submitted to the local planning authority, setting out the expected noise and vibration levels at the closest receptors.

2.3 Saxmundham to Leiston Branch Line - Track

2.3.1 The Saxmundham to Leiston branch line will be upgraded with a refurbished trackbed, concrete or steel sleepers and new welded rails. New rails with a consistent cross-section, consistent gauge, and smooth running surface will reduce noise and vibration.

2.3.2 The track will be continuous as-rolled rail, but shall avoid aluminothermic joints within 25 metres of any sensitive receptors, wherever possible.

2.3.3 The specification of the Saxmundham to Leiston branch line track is subject to ongoing design with Network Rail.

2.4 Saxmundham to Leiston Branch Line - Track Support System

2.4.1 Where the Saxmundham to Leiston branch line passes within 15 metres of a residential property, the track bed will be further upgraded to include an under-ballast mat for a minimum distance of 10 metres either side of the property.

2.4.2 The specification of the under-ballast mat is included in **Appendix A** of this RNMS.

2.4.3 An equal and approved alternative to the under ballast mat may be proposed.

2.5 Rail Extension Route - Track

2.5.1 The rail extension route will be a newly-installed track, using concrete or steel sleepers and welded rails. New rails with a consistent cross-section, consistent gauge, and smooth running surface will reduce noise and vibration.

2.5.2 The track will be continuous as-rolled rail, but shall avoid aluminothermic joints within 25 metres of any sensitive receptors, wherever possible.

2.5.3 The specification of the rail extension route is subject to ongoing design with Network Rail.

3 OPERATIONAL MITIGATION MEASURES

3.1.1 This section of the RNMS sets out those measures that will be implemented through the operation of the construction trains. These measures will be used to manage all construction trains.

3.2 Speed Limits

3.2.1 The speed of night-time construction trains will be limited to 10mph at Woodbridge/Melton, Campsea Ashe and Saxmundham. These locations are covered by three speed limit zones, as shown in **Figures 4.2, 4.3** and **4.4** from **Volume 9, Appendix 4B** of the **ES** (Doc Ref. 6.10) [APP-547]. The figures are replicated in **Appendix B** of this RNMS for ease of reference.

3.2.2 Night-time is defined as 23:00 hours to 07:00 hours.

3.2.3 The speed limit zones will not be conventionally signed along the route, but the speed limit zones start and end at clearly identifiable points along the route, such as footpath crossings, overbridges, or level crossings to facilitate easy identification en-route. The exact mechanism to identify speed limit zones on an operational level will be determined through liaison with Network Rail and the Freight Operating Company.

3.2.4 A suitable mechanism for the communication and implementation of the speed limit zones will be put in place between SZC Co. and the Freight Operating Company.

3.2.5 In the ‘early years’, the speed limit on the Saxmundham to Leiston branch line for construction trains will be 10mph during both the daytime and night-time.

3.2.6 Subject to further airborne and groundborne noise measurements once the Saxmundham to Leiston branch line is upgraded and all physical mitigation installed, the speed limit may be reviewed for the later years.

3.2.7 The speed limit on the rail extension route will match that applied to the Saxmundham to Leiston branch line. This will enable constant train speeds to be maintained, thereby avoiding accelerating locomotive noise close to the north-western corner of Leiston.

3.2.8 Other than where stated above, construction train speeds will be not be limited for the purposes of noise and vibration control.

3.3 Locomotive Selection

3.3.1 SZC Co. will seek to use Class 66 locomotives where there is equivalent choice. The submitted noise assessments show that Class 66 and Class 68 locomotives fall within the assessment envelope, but Class 66 locomotives are preferred, where there is equivalent choice.

3.3.2 A suitable mechanism for delivering this preference, where there is equivalent choice, will be put in place between SZC Co. and the Freight Operating Company.

3.4 Night-time Leiston Restrictions

3.4.1 No construction trains will be permitted to operate between the two points shown in **Figure C.1** in **Appendix C** between 23:00 hours and 07:00 hours during the early years, before the rail extension route is in operation.

3.4.2 Any construction trains that would not be able to fully pass through the restricted Leiston zone shown in **Figure C.1** in **Appendix C** before 23:00 hours will be held at the locations shown in **Figure C.2** in **Appendix C**.

3.4.3 Any locomotives held on the Saxmundham to Leiston branch line during the night will not be permitted to idle; all such locomotives will be required to shut down until departure the following morning.

3.4.4 A suitable mechanism will be agreed between SZC Co. and the Freight Operating Company to enforce these restrictions.

APPENDIX 9.3.E APPENDIX A: UNDER BALLAST MAT SPECIFICATION

Under Ballast Mats

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1 | Functional Principle

Under ballast mats made of the Getzner materials Sylomer® and Sylodyn® limit the static and dynamic forces exerted on the ballast bed by railway operations.

The most important applications are:

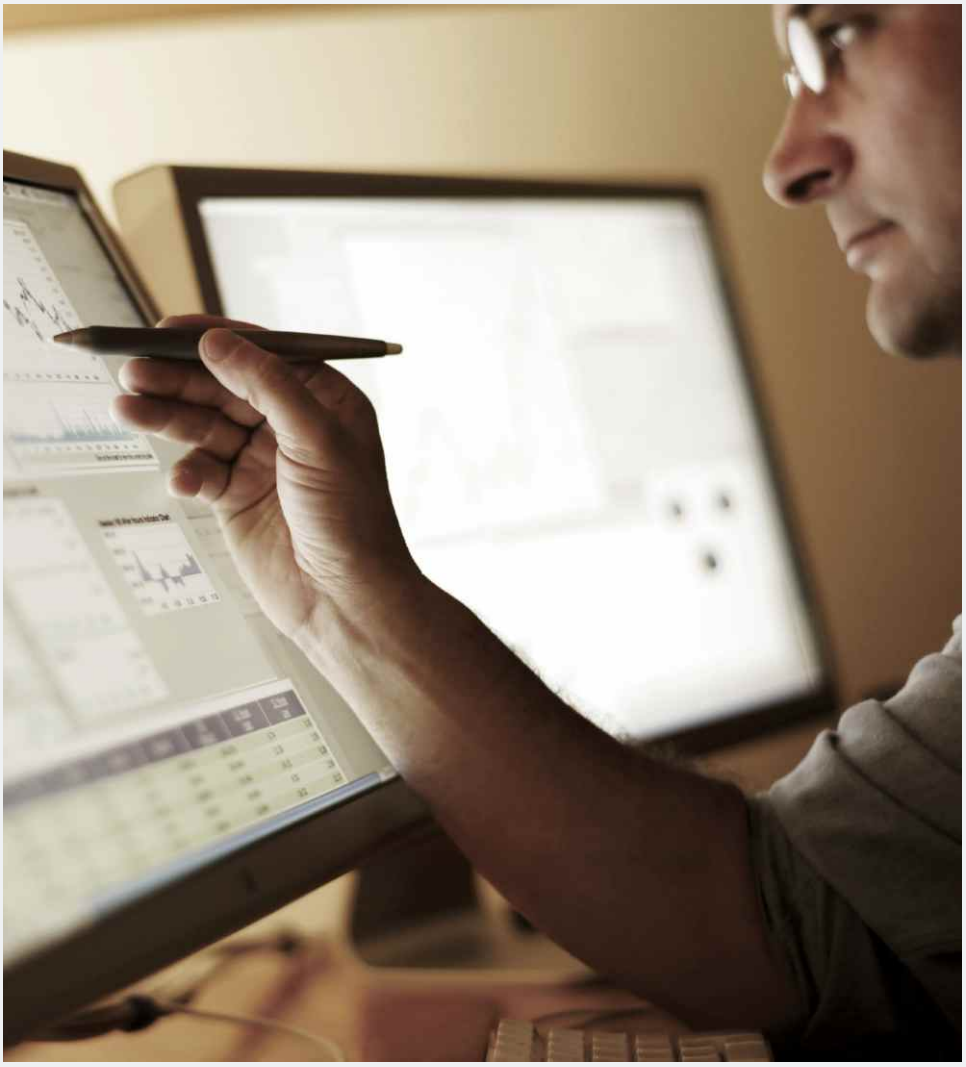
- Isolation of structure-borne noise on railway lines in densely populated regions: local transport railways and standard-gauge railways in the vicinity of buildings.
- Protection of structures and buildings sensitive to vibrations or with elevated vibration protection requirements such as concert halls, museums, hospitals, historic structures or vibration-sensitive laboratory, testing or measurement equipment.
- Reduction of the emission of secondary air-borne sound on bridge structures.
- Increased track geometry stability and reduction of ballast compression decrease the maintenance costs for heavily laden track sections.

Getzner under ballast mats have a multi-layer structure:

- **Load distribution layer**
  The top layer of the mats consists of a geotextile or fleece with high stretch and tear resistance. This layer deforms under the load of the ballast. The ballast rocks are embedded and their positions are stabilized by the increased contact surface. Forces introduced to the mat are distributed over the full area and transmitted to the underlying resilient layers.
- **Resilient layer**
  The resilient layer consists of microcellular polyurethane materials. The materials are volume-compressible, meaning that no profiles or cavities are required for shaping. Depending on the mat type, the resilient layer is comprised of one or two layers, each with a density specifically selected to yield the desired overall static and dynamic stiffness.

2 Engineering Service

Getzner has developed a specialized computational model for the installation of under ballast mats that allows for reliable prediction of the achievable vibration reduction.



Multiple series of tests by various railway operators under a variety of test conditions have shown that Getzner's predictions correspond to the actual results. As part of Getzner's service to its customers, experts generate separate predictions for each application and mat type.

Additional examples of the comprehensive service offered by Getzner include the creation of CAD installation plans, specific calculation models for determining rail deflection, individual on-site construction support or installation instructions for the mats. The state-of-the-art testing laboratory helps make this possible.

In close cooperation with customers and various research and testing agencies, Getzner continuously modifies and tests its product selection. The engineers, product managers and physicists at Getzner are constantly focused on the rising expectations of the market and of customers.

Under ballast mats made of Sylomer® and Sylodyn® have proven their quality on operational track sections many times over the past few decades.

Tests and measurements are available from the following institutes (excerpt):

- **Chair and Testing Institute for Construction of Transport Routes at the Munich University of Technology**
- **TÜV Rhineland**, Cologne, Central Department of Vibration Technology and Vibration Protection
- **Deutsche Bahn**, Testing Institute
- **Arsenal Research**, Vienna
- **Müller BBM GmbH**, Planegg near Munich
- **ISMES Spa**, Bergamo, Italy
- **Institute for Road and Rail Transportation**, Berlin University of Technology
- **Prof. Peter Steinhauser**, Civil Engineer for Technical Physics, Vienna
- **Ruthishauser Engineering Office for Construction, Transportation and the Environment**, Zurich
- **EMPA**, Federal Materials Testing and Research Institute, Dübendorf
- **Fritsch, Chiari & Partner Ziviltechniker GmbH**, Vienna

Research and test reports are available upon request.

3 Technical Product Information

Bedding modulus and static stiffness

The correct stiffness of a mat depends on the application, the superstructure design (ballast bed height, sleeper area and spacing, rail type) and the operating conditions (axle load, maximum speed).

The measure of stiffness is the bedding modulus, given in N/mm³. This value is largely responsible for determining the rail deflection during train passes. If the recommendations are observed, the rail deflection is generally less than 3 mm and less than 1.5 mm for high-speed traffic.

Getzner determines the actual deflection in the individual case by calculating the bending line of the rails.

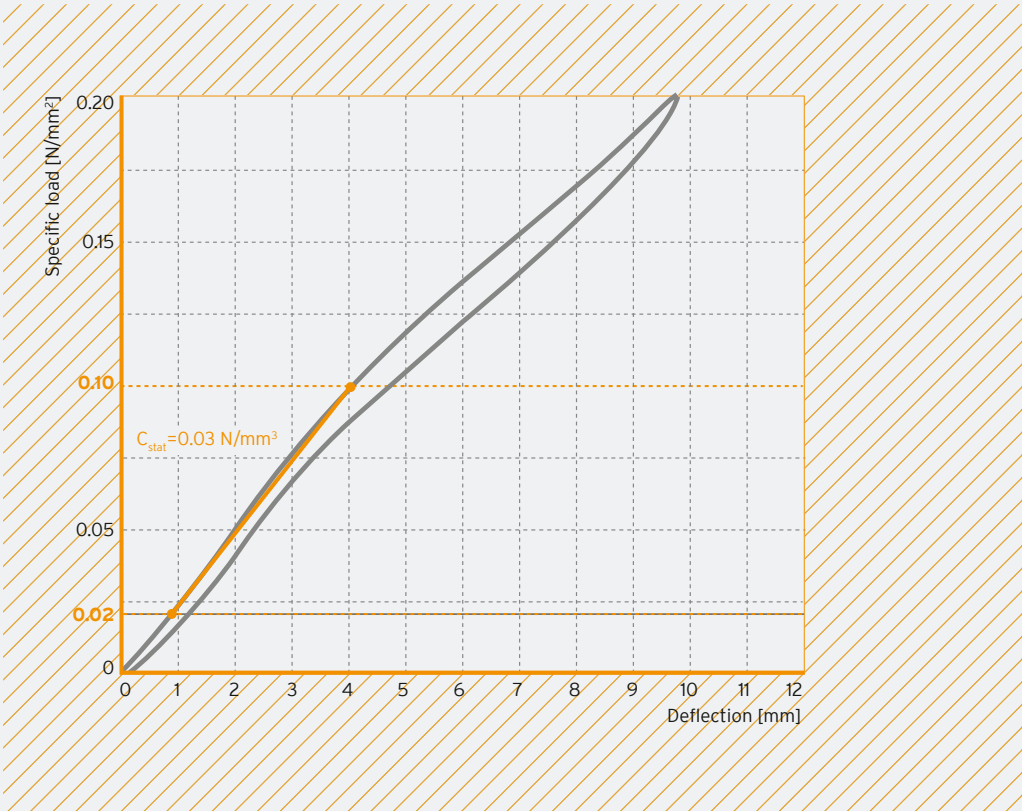
Effectiveness and insertion loss

The effectiveness of a under ballast mat can be seen in the form of a reduced structure-borne sound level.

This measure is referred to as "insertion loss" and is indicated as the difference of 1/3-octave levels (cumulative level within a 1/3-octave frequency band) as a function of the 1/3-octave band center frequency. The effectiveness is not determined solely by the under ballast mat; rather, it results from the characteristics of the entire system – from the vehicle to the substructure.

The following parameters are particularly important:

- Unsprung mass of the bogie
- Dynamic stiffness, damping and mass of the ballast superstructure excluding the mat
- Dynamic stiffness and damping of the mat (depends on load, frequency and amplitude)
- Vibration resistance (impedance) of the substructure



Spring load deflection curve for Sylodyn® DN 335 under ballast mat

Prediction model

By considering the entire system and including the various structural factors, Getzner is able to apply a prediction model to calculate the effectiveness of a measure in advance.

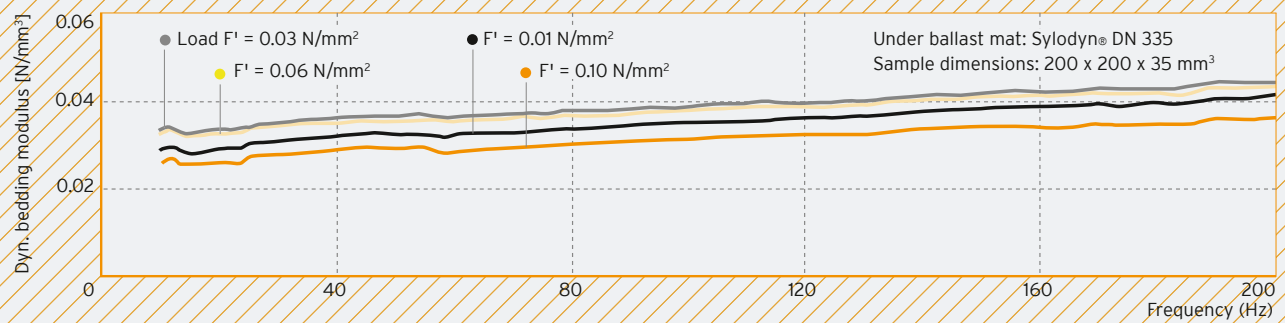
The model assumes that the "dynamic stiffness" and the "loss factor" are sufficient for a nearly complete description of the dynamic properties of the under ballast mat in the relevant load and frequency range.

Getzner under ballast mats satisfy this condition because the dynamic stiffness is only minimally dependent on frequency, load and amplitude. The under ballast mats are particularly effective in the frequency range corresponding to the wheel/rail superstructure resonance for a superstructure without mats. Depending on the bedding stiffness, this is between approx. 50 Hz and 80 Hz.

In most applications, the effectiveness in the frequency range under about 80 Hz is particularly important since these low-frequency vibrations are very strongly stimulated. Buildings and building elements can easily be stimulated within this frequency range, as can be seen in the natural vibration of ceilings and walls.

Due to the advanced technology of Getzner under ballast mats, the values for their effectiveness based on experience and prediction models are not applicable to other types of under ballast mats (examples: compact elastomer mats with profiling or interior cavities).

Load and frequency dependence of dynamic stiffness (from: Müller-BBM, Report No. 32242/12)



4 Long-Term Behavior

Long-term behavior under the harshest conditions

Getzner under ballast mats exhibit extremely high effectiveness even after years of exposure to operational loads. This has been proven by a study evaluating the long-term properties of Getzner under ballast mats.

After more than 16 years of operation and a daily load of roughly 150 000 tons, samples were removed from the superstructure and subjected to various tests. The test results showed that the under ballast mats still exhibited outstanding functionality. Despite more than 16 years of use, the under ballast mats from Getzner still had an impressive, constant stiffness behavior. In verification measurements on samples that had lain in silty subsoil for over 20 years, no contamination was found inside the mats.

Getzner under ballast mats retain their function even under extreme conditions. Environmental influences such as complete flooding, frost or heavy soiling of the ballast bed with sand or material worn away from the ballast rocks cannot affect the mats.

Quote from the test report by an external testing institute:

"... The Sylomer® B 851 under ballast mat superbly withstood the extremely high operating loads totalling over 760 million tons within a period of more than 16 years."

5 Installation Technology and Retrofitting

Delivery form and installation

Getzner manufactures under ballast mats in a uniform width of 1.50 m. The mat sheets are cut to the local track width before leaving the factory.

After being cut to size, the mats are rolled up and packaged. After the installation position has been marked on the mat, it is delivered directly to the construction site. Starting from a mat thickness of 35 or 40 millimeters, it is sometimes useful to deliver the mats in two separately rolled layers to allow for easier handling.

The mat rolls are distributed and laid out at the destination site according to their labeling. Any fine adaptations necessary are performed by inserting fitting blocks or by cutting the mats to the correct size and shape, which may be necessary in the area of curves.

The continuous further development of installation techniques by Getzner has now made it possible to thermally glue the upper layer of the individual mats and the fitting blocks together.

The mat covering is fully functional immediately after laying – in other words, even without the mats being bonded to the subsoil.

Rubber-tired construction vehicles can drive over the mat covering with no problems. If the mats are not covered with ballast immediately after laying, it is useful to secure the position of the mats through partial bonding with the subsoil (construction site traffic, incoming water). Getzner uses solvent-free adhesive, such as 2-component PUR adhesives, for this task. The bonding takes place so that any water that may have penetrated under the mats can flow or seep to the next drain inlet.

Requirements for the subsoil

Getzner under ballast mats lie on the subsoil with full surface contact. Because they are flexible and elastic in all directions, they largely adapt to the contour of the subsoil.

Since the mat optimally adapts to the subsoil beneath, sharp-edged recesses or bumps in the laying surface can damage the mats. Concrete decking must first be scraped or smoothed to an approximate evenness. No special measures are required for laying Getzner under ballast mats on subsoil of compressed gravel (sub-grade), on a cement-paved support layer or on a bitumen support layer.

When existing track sections are retrofitted with mats, the laying surface frequently consists of old

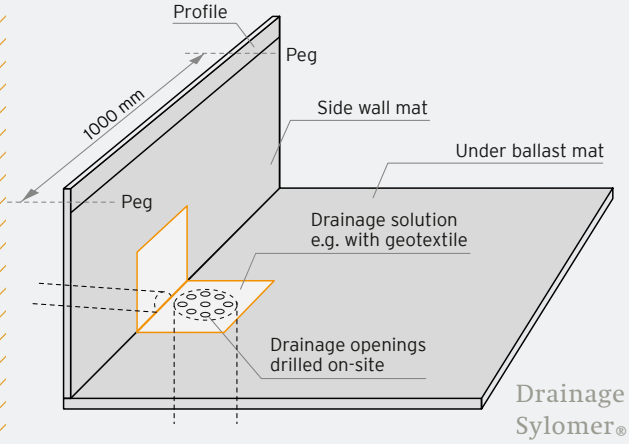



ballast. In this case, it has proven effective to provide a load distribution layer on both sides of the mat.

If the mats are subject to constant and extensive water exposure, drainage mats can be laid under the mats in a linear arrangement. To avoid sound bridges in the area of the water channels, the grills or grates are covered with perforated under ballast mats; however, these can also be elastically supported themselves.

The Getzner under ballast mats delivery program naturally also includes detailed, written installation instructions as well as the adhesive required for laying. If the laying surface is coated with plastic (e.g. epoxy resin for steel bridges), no special measures are required.

Sylomer® and Sylodyn® are free of softening agents and other oils. If the under ballast mats are to be bonded, the subsoil must first be dry and swept clean.



Drainage principle: Sylomer® and Sylodyn® under ballast mats

Retrofitting existing track sections

Getzner under ballast mats are particularly valued in many retrofitting projects due to their low weight and easy installation.

Under ballast mats made of Sylomer® and Sylodyn® have also proven themselves well in sensitive areas with the highest requirements for vibration protection as well as under extreme structural conditions.

The retrofitting procedure from Getzner has been tested frequently in practice and ensures rapid construction progress. Because it is not necessary to remove the entire track panel, only short track closure times are required for the installation. Since it is not possible to adapt the size of the mats in advance, they must be cut on-site to the exact lengths required. They can be cut with simple, widely available carpet cutters.

If the signs of wear on the superstructure are not too extreme after years of operational loads without under ballast mats, it is naturally possible to reinstall all components. Rails, sleepers, rail fastenings and ballast do not have to be replaced, as is the case for other vibration-related refurbishment measures. Getzner trumps with economy and efficiency.

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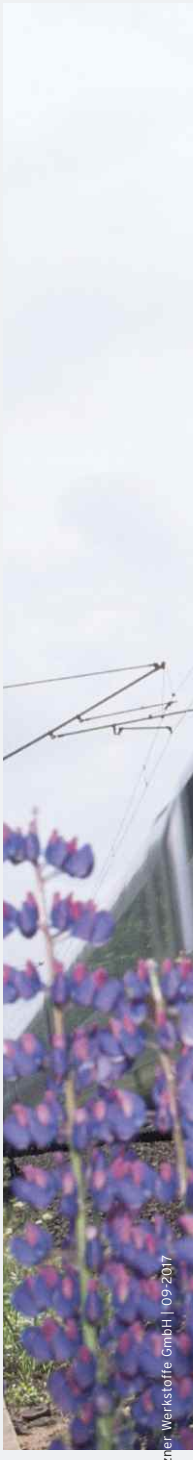

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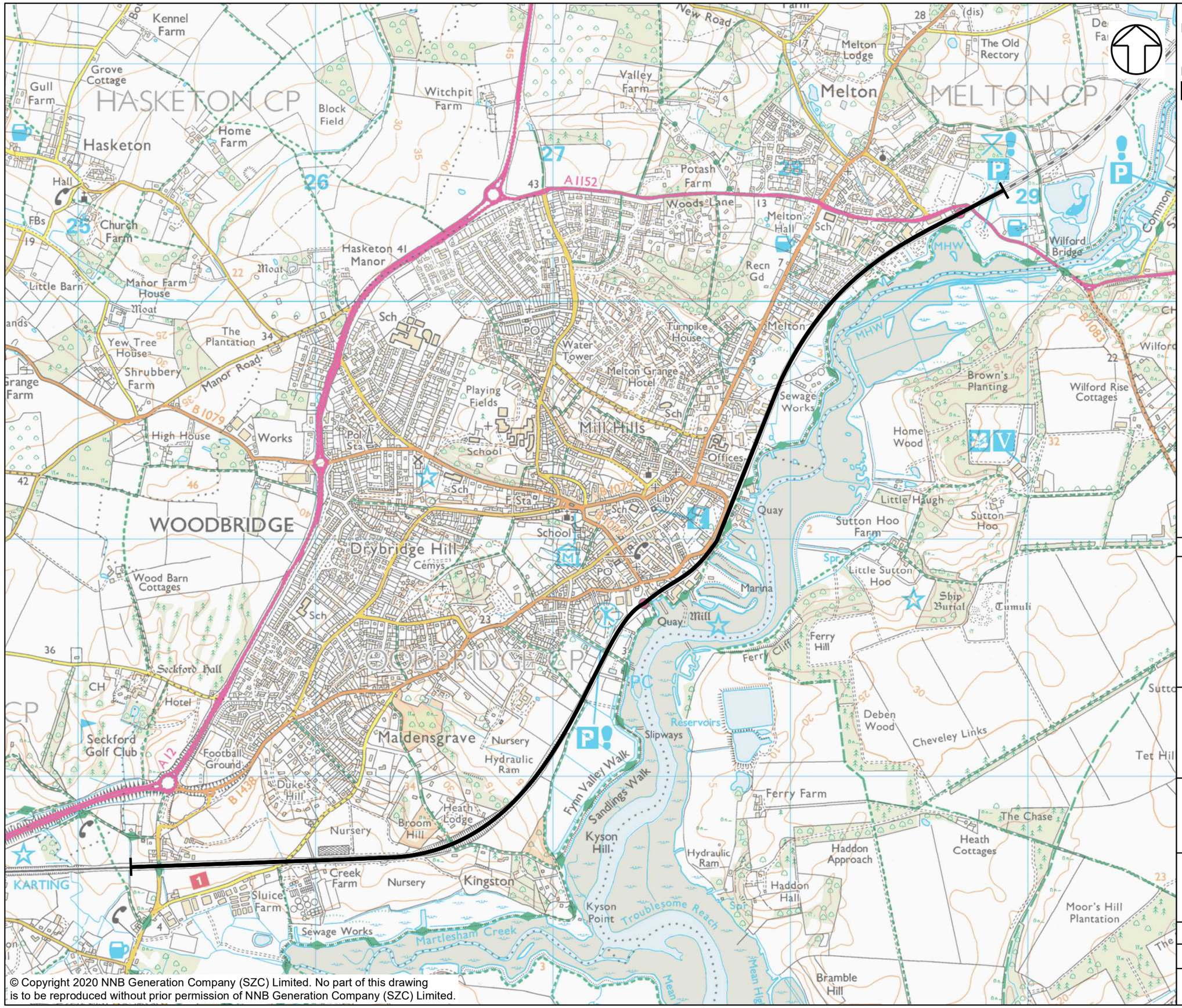
APPENDIX 9.3.E APPENDIX B: NIGHT-TIME SPEED LIMIT ZONES



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SIZEWELL C
ENVIRONMENTAL STATEMENT
VOLUME 9
CHAPTER 4
NOISE AND VIBRATION

DRAWING TITLE:
MAP SHOWING LOCATION OF SPEED RESTRICTION IN WOODBRIDGE AND MELTON

DRAWING NO:
FIGURE 4.2

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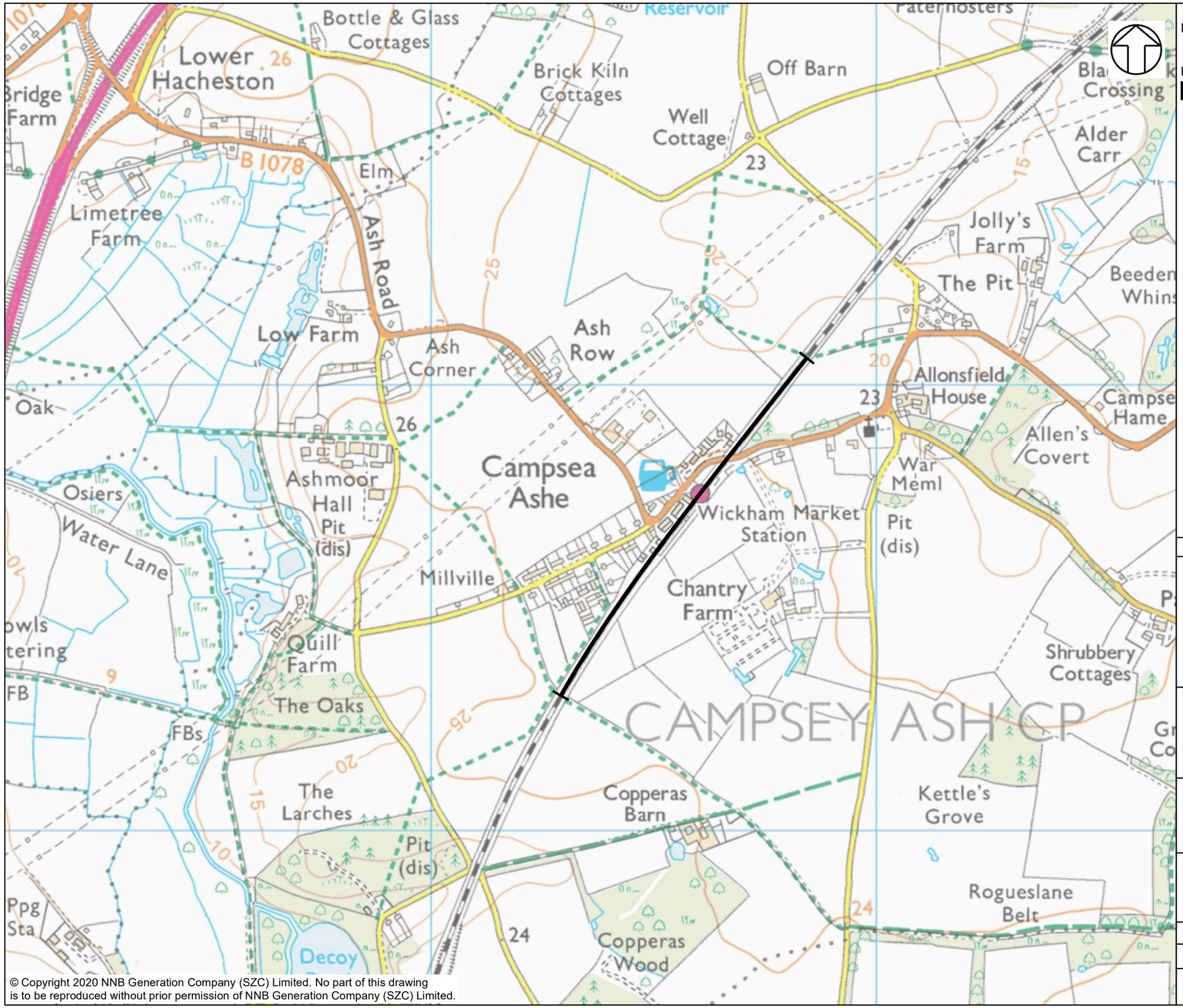

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NOTES

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CAMPSEY ASH CP

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VOLUME 9
CHAPTER 4
NOISE AND VIBRATION

DRAWING TITLE:
MAP SHOWING LOCATION OF SPEED RESTRICTION IN CAMPSEA ASHE

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FIGURE 4.3

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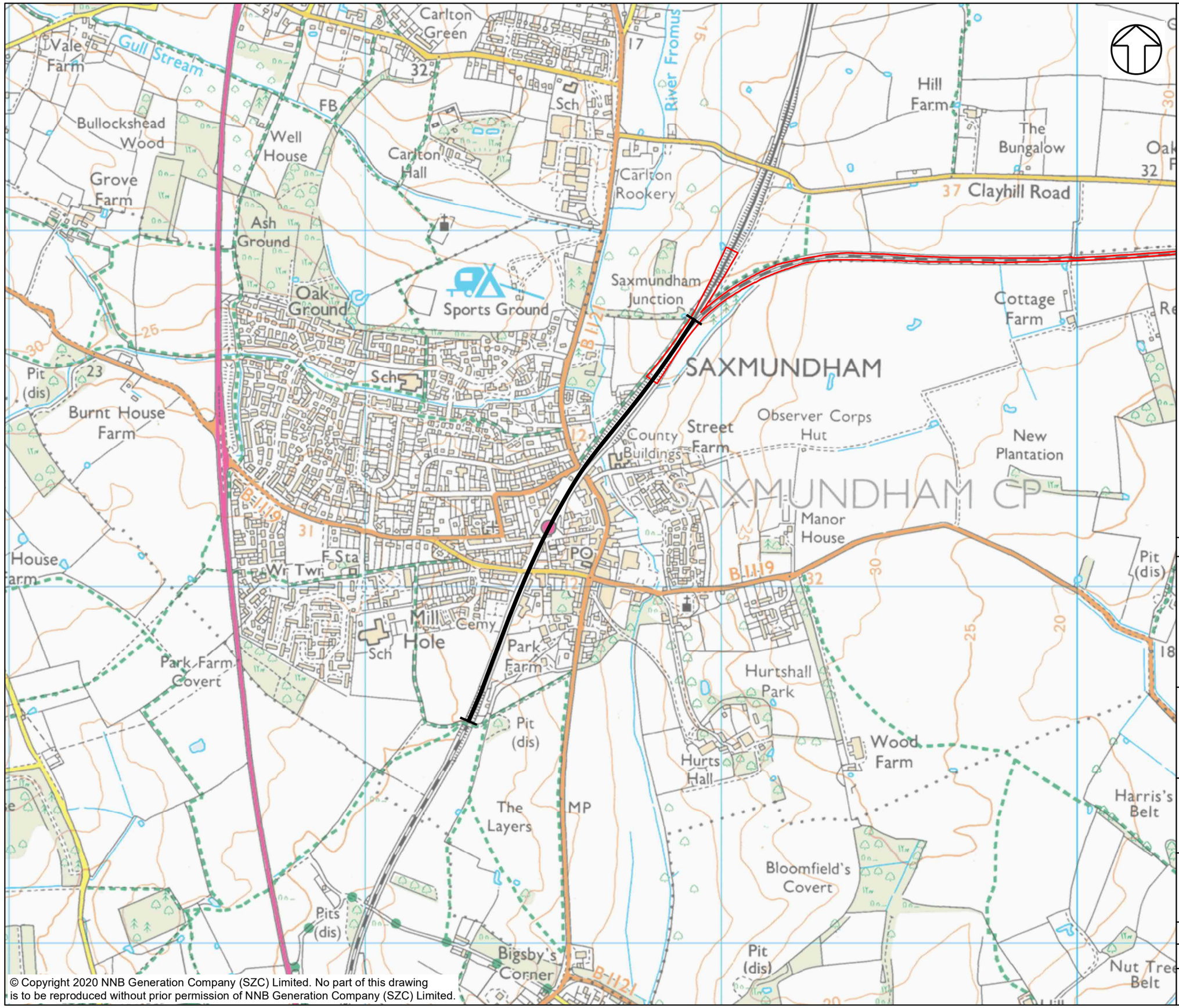

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NOTES

KEY

SAXMUNDHAM TO LEISTON BRANCH LINE UPGRADES DEVELOPMENT SITE BOUNDARY

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CHAPTER 4
NOISE AND VIBRATION

DRAWING TITLE:
MAP SHOWING LOCATION OF SPEED RESTRICTION IN SAXMUNDHAM

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FIGURE 4.4

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APPENDIX 9.3.E APPENDIX C: SAXMUNDHAM TO LEISTON BRANCH LINE LOCATIONS

Figure C.1: Leiston Restricted Night-time Zone – Early Years

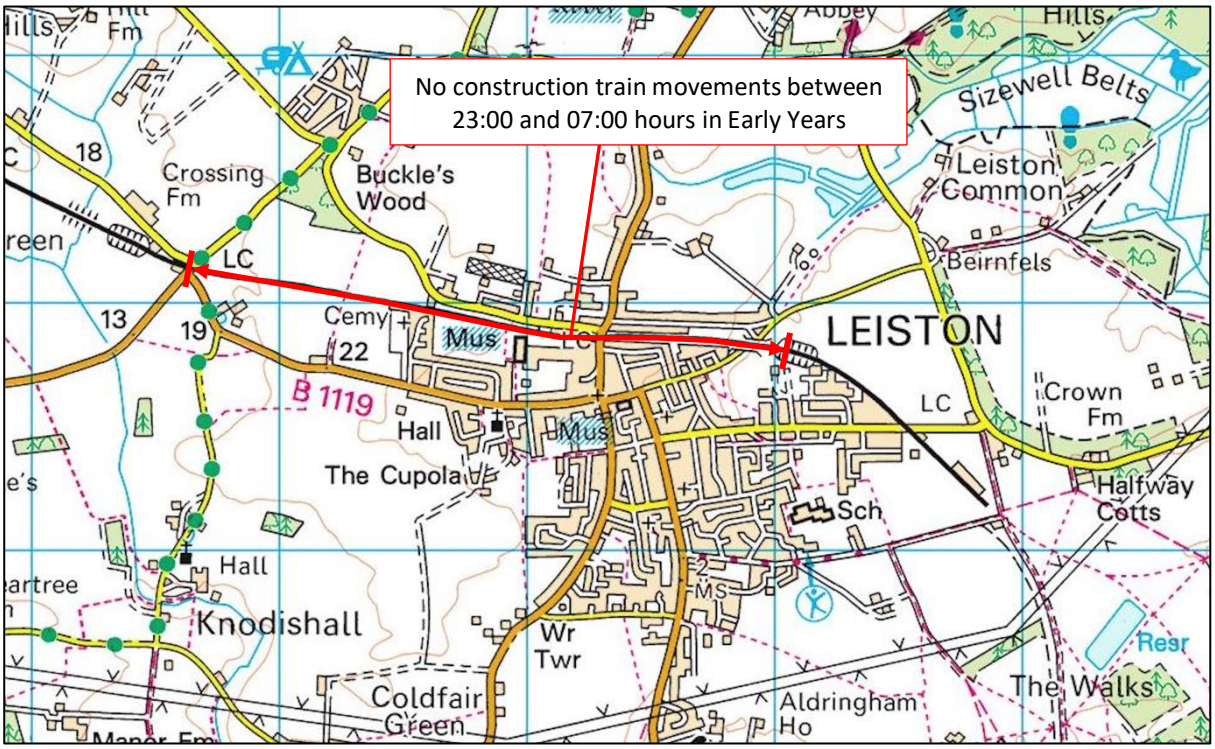
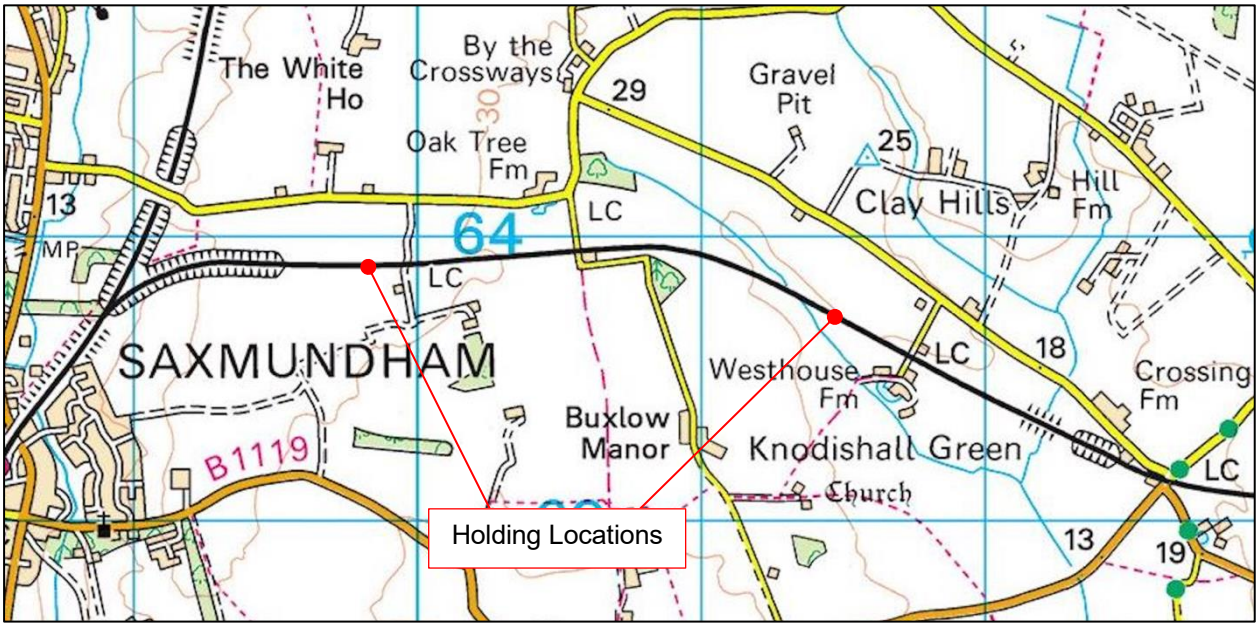


Figure C.2: Saxmundham to Leiston Branch Line Construction Train Holding Areas – Early Years



Note: locations shown are intended to be the locomotive positions for eastbound trains and the rear of the train for westbound trains.