Technical Guidance for CNMA to NMA

1. Introduction

The aim of this guidance is to provide guidance to stakeholders in determining whether or not an identified Candidate Noise Management Area (CNMA) should progress to Noise Management Area (NMA) status or whether the declaration of a NMA would not be appropriate in the circumstances.

In so far as is reasonably practical every effort has been made to ensure that the published noise contours are accurate. Where the current guidance reveals that the CNMA status is inaccurate either as a result of erroneous data or where local topography and design have reduced the number of people affected then the area will not be progressed to a NMA.

During implementation of the Action Plan, a review process should be applied to each CNMA to determine whether or not it should become a Noise Management Area (NMA). Prior to any CNMA being progressed to a NMA status it is necessary to subject the CNMA to detailed scrutiny. To assist in this process the Scottish Government have provided a tool in the form of a layered Acrobat Portable Document Format (PDF) files to enable each of the stakeholders to view the attribute data used in the production of the strategic noise maps. There is a separate series of layered PDF files available for each of the following: the Glasgow agglomeration (one set each for road and rail), the Edinburgh agglomeration (one set each for road and rail), the major roads outwith the agglomerations and the major railways outwith the agglomerations.

It should be appreciated that an area defined on a map as being a CNMA does not define an absolute area for CNMA to NMA consideration. Instead the designated coverage of a CNMA is simply indicative of the likely area that should be considered as being a CNMA. It may be that following further analysis that the area will need to be extended or, perhaps decreased. Remember, CNMAs simply prioritise areas were people are most likely to be annoyed by either road or railway generated noise.

Regulation 18 of the Environmental Noise (Scotland) Regulations 2006 states inter alia that the competent authority, in this case the Scottish Government, shall ensure that the public is consulted in the preparation of Action Plans. Part of the process in preparing the action plans for the agglomerations and the transport network in Scotland has therefore involved consulting the public in line with Regulation 18. Beyond this, the public should be informed of any conclusions that an area, included in any of the noise action plans, is a NMA or not, after following the assessment outlined in the technical guidance, in line with regulation 18(d) of the 2006 Regulations. This will be done by updating the relevant action plans on the web which can be found at scottishnoisemapping.org

Given the requirement to consult it is recommended that that a group of NMAs be consulted upon at the one time. Once any consultations are complete the relevant LAs or Transport Scotland should then approach the Scottish Government seeking approval of the proposed NMAs, which would then adopt them, as changes to the action plan under regulation 22 of the 2006 Regulations. A similar process should be followed where it is proposed that a CNMA need not, based on the technical assessment, become a NMA.

Finally, it is the intention of the Scottish Government to produce further guidance on mitigation measures for consideration during the noise management process.

2. What is a CNMA?

In line with the aim of Article 1 of the European Noise Directive, a prioritisation matrix has been developed to facilitate a common approach to avoiding, preventing or reducing, on a prioritised basis, harmful effects due to environmental noise exposure. The Scottish Government has developed this prioritisation based on the areas where people are most likely to be annoyed by noise from the sources defined within the Directive[1].

The objective of the prioritisation matrix is to identify areas where people living within these areas are most likely to be annoyed by noise from either road or railway traffic noise sources. The identification of such areas has been based on a scoring system which takes into account the number of people potentially affected, and the annoyance response to the particular noise source under consideration (either rail or road). The derivation and details of the Prioritisation Matrix is fully explained in Appendix 1 of this document. It is important to note that at this stage in the Action Planning process it has been decided by the Scottish Government Working Groups, through consultation with SEPA and the relevant local authorities, that an industrial noise source or an area affected by industrial noise should not be included in the prioritisation matrix and that any prioritisation, or noise intervention, of such industrial areas/sources should be at the request of the regulatory authority.

A statistical analysis of the calculated prioritisation scores was undertaken and a consensus was reached to identify the top three percent (3%) of each of the road and rail networks within each of the Glasgow and Edinburgh agglomerations and the qualifying[2] major roads and railways outwith the two main agglomerations. The top 3% of calculated scores were then subdivided into 1% bands and it has been agreed by the Scottish Government Working Groups, endorsed through public consultation, that the top 1% in each of the agglomerations and areas affected by qualifying road and rail links outwith the two main agglomerations are to be identified as CNMAs.

It should be remembered that, in general, each CNMA was determined from a 100m length of line noise source (rail or road) and the prioritisation process. Therefore, it is important to appreciate that the aim of CNMAs is to identify the most likely areas where the highest population noise exposures occur and, as such, it may be appropriate to reduce or extend the coverage of these areas where local conditions warrant changes in CNMA coverage. Examples where this may occur are: where there is a series of terraced houses, it would be inappropriate to restrict consideration to just those properties that lie along a 100m stretch of road if there are a small number of properties that lie outwith the existing CNMA coverage; conversely, if the CNMA coverage simply takes in one or two tall flatted buildings then it may be more appropriate to reduce the extent of the CNMA. Stakeholders will be required to exercise careful judgment in this regard.

3. CNMA Variables

A very general outline of the process involved in validation of a CNMA is outlined in each of the Glasgow, Edinburgh and Transportation Action Plan documents: these can be viewed at www.scottishnoisemapping.org . However, this document provides further detailed guidance.

1The Directive has now been transposed in to the Environmental Noise (Scotland) Regulations 2006 which came into force on 5 October 2006. The Regulations apply to environmental noise to which humans are exposed, in particular in built up areas, public parks or other quiet areas in an agglomeration, near schools, hospitals, and other noise sensitive buildings and areas. The regulations apply to noise from road railway and airport sources, as well as industrial noise. The regulations do not apply to noise that is caused by the person exposed to the noise, noise from domestic activities, noise created by neighbours, noise at work places, or noise inside means of transport or due to military activities in military areas.

2 For first round mapping the major roads to be mapped are essentially motorways and A roads having more than 6 million passages per year, Similarly for rail the first round railways are those having more than 60,000 train passages per year

The input variables used in the aforementioned prioritisation matrix (see Appendix 1), are as follows:

- the noise levels at a property,
- the number of people within that property and
- the annoyance response to that actual noise source, i.e. road or railway traffic noise.

The main "scoring" variable to be checked by the stakeholders in consideration of the progression from CNMA to NMA is the predicted noise level at the property. The predicted noise level is dependant upon both map data and attribute data. The road and railway traffic noise levels at the property has been calculated using the Department of Transport and Welsh Office 1988 publication entitled *Calculation of Road Traffic Noise* (with a correction to produce L_{den} levels) and the Department of Transport 1995 publication entitled *Calculation of Railway Noise* (with a correction for rail/wheel roughness), respectively.[3]

Each of the aforementioned prediction methodologies rely on both the map and attribute data and each of these will now be considered in turn with reference to the checking that can be undertaken by the relevant stakeholders.

3.1 Outline Consideration of Map Data

Map data identifies the geographical location of objects and features included in the noise model. This map data is 'captured' digitally as either points, lines or polygons. The data required for the calculations of noise levels have been determined by consultation with various organisations including Transport Scotland, SEPA, Network Rail, British Airports Authority (B) and relevant Local Authorities. The generated noise contour maps have been created by computer analysis using the aforementioned input data and specialised software. To generate the noise contours the noise level at individual points is calculated on a 10m grid basis, at a reception height of 4m, as required by the Regulations. Hence, it should be appreciated that the predicted noise level will not represent every situation at a local level and, therefore, a more detailed examination of CNMAs is necessary prior to any declaration of NMAs.

It will not be possible for stakeholders to check map data such as ground contours or indeed building heights, but they will be able to check for the presence of features such as acoustic barriers, new or demolished buildings, road surface type and traffic management systems. It may also be possible for local authority planning departments to check any planning conditions that may have been attached to the consent prior to the construction of buildings to determine whether or not the buildings within the CNMA have in fact been designed to minimise the noise exposure of occupiers. For example, noise mitigation measures such as the inclusion of an appropriate acoustic glazing specification, acoustic barriers or the orientation/layout of the habitable rooms within the buildings may have been incorporated into the design of existing properties/housing schemes. When dealing with major road and rail CNMAs outwith the Glasgow and Edinburgh agglomerations the checking of such data will require the cooperation of the relevant local authority departments.

3.2 Outline Consideration of Attribute Data

Attribute data is basically the input noise source data. For roads, this includes traffic flow, speeds, percentage of heavy goods vehicles, road gradient and road surface type. For

[3] For CRTN correction see http://www.defra.gov.uk/environment/noise/research/crtn/pdf/noise-crtn-update2006.pdf
For CRN correction see http://www.defra.gov.uk/environment/noise/mapping/research/rail/pdf/railway-noise.pdf

railways, this includes train vehicle types, number of carriages, speed, rail track type and support structure type.

4. General Checking Process for CNMAs

4.1 Use of Checking Tool

Where a CNMA has been included in the relevant Action Plan a site visit will almost certainly be required to fully appreciate the nature of the area being considered. A site visit should, however, be undertaken prior to the final decision to declare a NMA. Meanwhile, to assist in the preparatory work for any site visit, sets of layered PDF files have been prepared that provide a graphical representation (maps) of the road/rail segments which contribute to the CNMA (remember the entire road and rail network work which has been mapped has been divided into 100m segments for the purposes of prioritisation). CNMAs have, where possible, been geographically grouped within PDF files. Opening a road traffic PDF file reveals 10 layers, namely;

- Data Frame,
- Road Name Labels,
- Road Traffic Data,
- Road Centrelines,
- Railway Tracks
- CNMA,
- Buildings,
- Ordnance Survey,
- Relevant Area (e.g. Glasgow or Edinburgh) Noise Contours (L_{den} or L_{night}) and
- Aerial Photograph.

Opening a railway PDF file reveals 10 layers, namely

- Data Frame,
- Road Name Labels,
- Railway Traffic Data,
- Railway,
- Road Centrelines[4]
- CNMA,
- Buildings,
- Ordnance Survey,
- Relevant Area (e.g. Glasgow or Edinburgh) Noise Contours (L_{den} or L_{night}) and
- Aerial Photograph.

Each of these layers can be viewed individually, or in combination with other layers, by switching on or off the appropriate layers, as necessary. An outline explanation of each of layer is included in Table 1.

Table 1 Explanation of Layers in PDF Files

Name of Layer	Explanation
Data Frame	The Map Frame, including legend and North Arrow
Road Name Labels	Street road names.

[4] Not applicable to railways, used here simply for geographical reference as centerlines have road names attached.

Name of Layer	Explanation
Road Traffic Data	Coloured boxes containing: traffic flows, speed and %HGV and road surface type, i.e., the CRTN variables required for calculation. Note that flows, speed and %HGVs are 2005 data.
Railway Traffic Data	Coloured boxes containing: L_{day}, $L_{evening}$ and L_{night} noise levels, wheel roughness correction and average speed.
Road Centrelines	Road centrelines for qualifying roads, i.e., those roads as used in the noise models. Note that only roads with flows above 1000 vehicles per day were modelled within agglomerations. For major roads outwith agglomerations roads were modelled where the flow exceeded 16,000 vehicles per day.
Railway Tracks	Railway tracks as taken from OS Mastermap.
CNMA	Segment of modelled road within the top one percent of source prioritisation scores
Buildings	Building footprints from OS MasterMap
Ordnance Survey	Ordnance Survey data
Relevant Area (e.g. Glasgow or Edinburgh) Noise Contours (L_{den} or L_{night})	Predicted noise contours. These can also be viewed at www.scottishnoisemapping.org
Aerial Photograph	Aerial photograph of area*

*Due to licensing issues this layer may be removed!

Guidance in relation to the evaluation of road and rail CNMAs follows. However, this guidance is not prescriptive and, as such, should be used with appropriate care in reaching a balanced judgement.

4.2 General Information to be Gathered

In addition to the information provided as listed in Table 1 there are other general considerations to be evaluated. The list below should not be considered as prescriptive or exhaustive, it is intended simply to provide generic guidance.

a) Identifying the actual locations within the CNMA where people are most likely to be annoyed by noise.

b) Identifying the location and orientation of nearby sensitive buildings.

c) The relevant provisions of the local plan for area and its immediate surroundings.

d) Any relevant unimplemented planning permissions.

e) The mix of residential and commercial properties.

f) The nature and composition of the noise source.

g) If appropriate identify local traffic management plans for the location.

h) Any changes to road or rail layout and buildings since 2005.

4.3 Site Visit

As has been previously identified there is very likely to be a need for a site visit. A table has been included as Appendix 2 which may assist in the gathering of data on site and subsequent reporting.

5. The Evaluation of Road CNMAs

This process consists of three stages; Stage 1, Stage 2 and Stage 3.

5.1 Road Stage 1

It is suggested that the first stage is to compare the L_{den} noise contour layer with the aerial photograph. Therefore the following layers should be switched on: Data Frame, Road Name Labels, CNMA, Relevant Area Grid, and Ariel Photograph. This comparison should confirm that the online published maps (www.scottishnoisemapping.org) actually represent the road layout as seen using aerial photography. This stage of the process may also reveal a difference in the building footprints shown in the aerial photography and the PDF document/online published noise maps. This could be the result of buildings being either erected or demolished after the mapping data collection exercise; the data used for creation of the three dimensional noise models which used 2005 data. It is also possible that local knowledge will reveal that the road layout has changed since the publication of the online maps.

There is also the issue of roadside acoustic barriers. Such barriers can be in the form of close boarded timber fences, metal or brick/masonry screens or any material with sufficient mass per unit area, height and extent to act as an acoustic screen. The roadside barriers used in the mapping process were taken from the information contained within the Transport Scotland SERIS database. Note that barriers formed by virtue of cuttings and embankments should have been captured in the creation of the three dimensional model used in the mapping process. Should, following a site visit, there be any reason to suspect that a noise barrier formed by virtue of a cutting or an embankment may not have been captured in the 3D model used in the mapping process this should be reported to the Scottish Government for consideration and checking of mapping data.

If for a particular CNMA, discrepancies are found then these should be relayed to the Scottish Government, who can then consider the implications of the findings and, thus, whether or not the CNMA merits inclusion in the top 1% of scores that were determined from the prioritisation matrix process.

5.1.1 Possible Outcome of Stage 1

Road Stage 1 Outcome 1 Report that the area mapped within the vicinity of the highlighted CNMA matches the layout as shown in the aerial photography and that it is in fact representative of the current layout in terms of roads, building footprints and roadside acoustic barriers.

Road Stage 1 Outcome 2 Report to the Scottish Government the details of:

- any significant variations between the location of modelled roads and buildings within the PDF document/published online maps and the aerial photography;
- any significant variations between either the PDF document or aerial photograph and the existing road/building layout (this will most likely become apparent during site visits to CNMAs);
- the presence or otherwise of roadside barriers and other mitigating factors.

The detail reported should be simple and concise and should only refer to the area in the vicinity of the highlighted CNMA. It is suggested that where checks reveal a discrepancy in terms of existing buildings that, where possible, photographic evidence is supplied to support Stage 1 Outcome 2. Any discrepancies in road layouts can be evidenced by submission of road centreline (where a road is dual carriageway or motorway, two centrelines should be

provided, one for each carriageway) drawings, which should be in an appropriate format[5] and should be correctly geo-referenced. Where the presence of roadside barriers are being reported it is suggested that the start and end point of such barriers are reported in terms of their, X, Y and Z coordinates if possible and also accompanied by photographic evidence to assist in the determination of the effectiveness of the barrier. Alternatively, these can also be supplied as geo-referenced shapefile or dxf formatted files.

5.2 Road Stage 2

In this stage the road traffic data should be checked. The information relating to the modelled road traffic data can be viewed on the "**Road Traffic Data**" layer. These traffic variables can be checked against any other data held by stakeholders. However, it must be borne in mind that the modelled data may not necessarily agree with current data held by stakeholders, as the data used in the mapping exercise was that for the year 2005. In addition, the traffic input data was drawn from strategic road traffic modelling and, therefore, caution must be exercised when comparing these variables with those obtained from more localised traffic models. It is also worth noting that, in terms of traffic flows, for an increase of 1dB, or indeed a decrease of 1dB to occur, there has to be a corresponding +25% or -20% change in the traffic flow. Furthermore, the speed, percentage of HGVs[6] and road surface type all contribute to the overall noise level and any check of these variables is aimed at establishing reasonable agreement with conditions that would have existed in the year 2005. If, for example, a local authority roads department has records which show that in the year 2005 the percentage of HGVs on a particular road was 15% and the equivalent road in the PDF document indicates that 5% was used for modelling purposes this discrepancy must be reported to the Scottish Government. For further guidance on the effect of changes in percentage HGVs please refer to Appendix 3.

5.2.1 Possible Outcome of Road Stage 2

Road Stage 2 Outcome 1 Report that the traffic variables used within the vicinity of the highlighted CNMA are in reasonably close agreement with the situation as it would have existed in the year 2005.

Road Stage 2 Outcome 2 Report any variations between the traffic data shown in the PDF document for a particular CNMA to the Scottish Government. The detail reported should be simple and concise and should only refer to the area in the vicinity of the highlighted CNMA, and the stakeholder should also identify the data source from which the comparison has been made. It is suggested that where a check reveals a discrepancy in the road surface type that, where possible, photographic evidence is supplied to support Road Stage 2 Outcome 2.

5.3 Road Stage 3

With the road layout, building footprint and traffic variables checked the calculated noise levels are effectively validated. However, it may be the case that cognisance of the noise climate was taken into account when planning permission was granted for residential dwellings and that the buildings were designed to ensure that the occupiers are exposed to reduced levels of noise. Therefore, the checking process then moves onto the consideration of the actual building layout, noise mitigation incorporated into the building construction specification and any incorporated external mitigation. It is, of course, important to check that the planning conditions have been properly implemented. The relevant data at this stage will include the following:

[5] E.g. shapefile or dxf format

[6] HGVs as defined in CRTN, 1988, i.e. all vehicles with an unladen eight exceeding 1525Kg.

- date of construction of the properties alongside the roads in question
- the glazing specifications used in the buildings
- ventilation specification, e.g. if any whole house ventilation or acoustic trickle vents
- consideration of whether or not habitable rooms (e.g. living rooms and bedrooms) face the noise sources
- the presence of any intervening mitigation such as an acoustic barrier

The "Buildings" and "Ordnance Survey" layers may prove useful in identifying properties requiring further investigation regarding noise mitigation measures. Good sources of further relevant information are likely to be building warrants and planning consents, which may provide some or all of the following details[7]:

- the date of the property's/housing schemes construction;
- details of sound reduction required across the building envelope;
- internal layouts;
- glazing specifications; and
- acoustic barriers that were required to be erected by the developer.

Local knowledge will also be invaluable at this stage of the process, and, therefore a site visit maybe appropriate at this stage.

All information passed to the Scottish Government relating to Stage 3 will be taken into account when assessing whether a CNMA is to be progressed to a NMA, for example, the presence of effective acoustic barriers and acoustic glazing systems will facilitate a recalculation of the prioritisation scores that may result in a particular area no longer being assigned to the top 1% of the source prioritisation scores and, therefore, removed from the first round of CNMAs.

5.3.1 Possible Outcome of Road Stage 3

Road Stage 3 Outcome 1 Report that the area mapped within the vicinity of the highlighted CNMA does not contain residential buildings with specific noise reduction measures incorporated into their design nor are there specific noise barriers erected to mitigate noise.

Road Stage 3 Outcome 2 Report the detail of any additional noise mitigation measures incorporated into the building/layout design to the Scottish Government. The detail reported should be simple and concise and should only refer to the area within the highlighted CNMA. Where possible photographic or documented evidence should be supplied to support Road Stage 3 Outcome 2.

[7] A check on the points below may require the reader to refer back to Planning documents

6. The Evaluation of Rail CNMAs

When evaluating rail CNMAs the process is simply a variation of the process undertaken when evaluating the road CNMA. The main difference between the road and rail evaluation is for Stage 2, with changes to Stages 1 and 3 simply reflecting that the discussion is of railways and not roads. However, for completeness all three stages are reproduced below.

6.1 Rail Stage 1

It is suggested that the first stage is to compare the L_{den} noise contour layer with the aerial photograph. Therefore the following layers should be switched on: Data Frame, Road Name Labels (this layer helps to identify particular locations within maps), CNMA, Relevant Area Grid, and Aerial Photograph. This comparison should confirm that the online published maps (www.scottishnoisemapping.org) actually represent the rail layout as seen using aerial photograph. This stage of the process may also reveal a difference in the building footprints shown in the aerial photography and the PDF document/online published noise maps. This could be the result of buildings being either erected or demolished after the mapping data collection exercise; the data used for creation of the three dimensional noise models used 2005 data. It is also possible that local knowledge will reveal that the rail layout has in fact changed since the publication of the online maps.

There is also the issue of trackside acoustic barriers. Such barriers can be in the form of close boarded timber fences, metal or brick/masonry screens or any material with sufficient mass per unit area, height and extent to act as an acoustic screen. Note that barriers formed by virtue of cuttings and embankments should have been captured in the creation of the three dimensional model used in the mapping process. Should, following a site visit, there is any reason to suspect that a noise barrier formed by virtue of a cutting or an embankment may not have been captured in the 3D model used in the mapping process this should be reported to the Scottish Government for consideration and checking of mapping data.

If for a particular CNMA, discrepancies are found then these should be relayed to the Scottish Government, who can then consider the implications of the findings and, thus, whether or not the CNMA merits inclusion in the top 1% of scores that were determined from the prioritisation matrix process.

6.1.1 Possible Outcome of Rail Stage 1

Rail Stage 1 Outcome 1 Report that the area mapped within the vicinity of the highlighted CNMA matches the layout as shown in the aerial photography and that it is in fact representative of the current layout in terms of railways, building footprints and railside acoustic barriers.

Rail Stage 1 Outcome 2 Report to the Scottish Government details of:

- any significant variations between the location of modelled railways and buildings within the PDF document/published online maps and the aerial photography;
- any significant variations between either the PDF document or aerial photograph and the existing railway/building layout (this will most likely become apparent during site visits to CNMAs);
- the presence or otherwise of railside barriers.

The reported information should be simple and concise and should only refer to the area in the vicinity of the highlighted CNMA. It is suggested that where checks reveal a discrepancy in terms of existing buildings that, where possible, photographic evidence is supplied to support Stage 1 Outcome 1. Any discrepancies in rail layouts can be evidenced by submission of railway centreline (one for each track) drawings, which should be in an

appropriate format[8] shapefile or dxf format and should be correctly geo-referenced. Where the presence of railside barriers are being reported it is suggested that the start and end points of such barriers are reported in terms of their, X, Y and Z coordinates if possible and also accompanied by photographic evidence to assist in the determination of the effectiveness of the barrier. Alternatively, these can also be supplied as geo-referenced shapefile or dxf formatted files.

6.2 Rail Stage 2

In this stage where possible rail L_{den}, $L_{evening}$ L_{night} noise levels should be checked. The information relating to the modelled railways can be viewed in the "**Rail Traffic Data**" layer. In conjunction with Calculation of Rail Noise[9] (CRN) this information can be checked against any other data held by stakeholders. However, it must be borne in mind that the modelled data may not necessarily agree with current data held by stakeholders, as the data used in the mapping exercise was that for the year 2005. Moreover, it is derived from ACTRAFF data (Network Actual Traffic Data) which reports the actual rail movements rather than those published in passenger and freight timetables. Moreover, the data is based on average rail movements on a weekday and, thus, the predicted noise levels are based on statistical data rather than that for a particular weekday in the year. However, it should be appreciated that in terms of rail traffic flows, for an increase of 1dB, or indeed a decrease of 1dB to occur, there has to be a corresponding +25% or -20% change in the flow of trains of the same type. Furthermore, the speed, track and structure type all contribute to the overall noise level and any check of these variables is aimed at establishing reasonable agreement with conditions that would have existed in the year 2005. If, for example, in the year 2005 the train speeds is significantly different or the track and track structure is different from that detailed in the PDF document indicates these discrepancies must be reported to the Scottish Government.

6.2.1 Possible Outcome of Rail Stage 2

Rail Stage 2 Outcome 1 Report that the L_{day} $L_{evening}$ L_{night} noise levels and train variables (speed, track and structure type), as used within the vicinity of the highlighted CNMA, are in reasonably close agreement with the situation as it would have existed in the year 2005.

Rail Stage 2 Outcome 2 Report any variations between the data shown in the PDF document for a particular CNMA to the Scottish Government. The information reported should be simple and concise and should only refer to the area that is in the vicinity of the highlighted CNMA, and the stakeholder should also identify the data source from which the comparison has been made. It is suggested that where a check reveals a discrepancy in the track structure or track type that, where possible, photographic evidence is supplied to support this Rail Stage 2 Outcome 2.

6.3 Rail Stage 3

It may be the case that cognisance of the noise climate was taken into account when planning permission was granted for residential dwellings and that the buildings were designed to ensure that the occupiers are exposed to reduced levels of noise. Therefore, the checking process then moves onto the consideration of the actual building layout, noise mitigation incorporated into the building construction specification and any incorporated external mitigation. The relevant data at this stage will include the following:

- date of construction of the properties alongside the railways in question;
- the glazing specifications used in the buildings;

[8] E.g. shapefile or dxf format

[9] Calculation of Rail Noise 1995 (CRN) The Department of Transport, HMSO

- consideration of whether or not habitable rooms (e.g. living rooms and bedrooms) face the noise sources; and
- the presence of any intervening mitigation such as an acoustic barrier.

The “Buildings” and “Ordnance Survey” layers may prove useful in identifying properties that further noise mitigation enquiries may be needed. Good sources of information are likely to be building warrants and planning consents, which may provide some or all of the following details:

- the date of the property’s/housing schemes construction;
- details of sound reduction required across the building envelope;
- internal layouts;
- glazing specifications; and
- any acoustic barriers that were required to be erected by the developer.

Local knowledge will also be invaluable at this stage of the process, and, therefore a site visit maybe appropriate at this stage.

All information passed to the Scottish Government relating to Stage 3 will be taken into account when assessing whether a CNMA is to be progressed to a NMA, for example, the presence of effective acoustic barriers and acoustic glazing systems will facilitate a recalculation of the prioritisation scores that may result in a particular area no longer being assigned to the top 1% of the source prioritisation scores and, therefore, removed from the first round of CNMAs.

6.3.1 Possible Outcome of Rail Stage 3

Rail Stage 3 Outcome 1 Report that the area mapped within the vicinity of the highlighted CNMA does not contain residential buildings with specific noise reduction measures incorporated into their design nor are there specific noise barriers erected to mitigate noise.

Rail Stage 3 Outcome 2 Report the detail of any additional noise mitigation measures incorporated into the building/layout design to the Scottish Government. The detailed report should be simple and concise and should only refer to the area within the highlighted CNMA. Where possible photographic or documented evidence should be supplied to support Rail Stage 3 Outcome 2.

Appendix 1 Explanation of Prioritisation Matrix

1 Purpose

The purpose of the prioritisation matrix is to evaluate strategic noise levels within the first round noise maps in terms of the road, rail and air noise sources most likely to cause annoyance to people potentially affected. The prioritisation will enable appropriate actions, required to be determined, based on a consideration of noise levels, the number of people potentially affected and the annoyance response to the noise source.

It is important, in broad terms, to ensure the developed methodology can be used consistently for all three action planning working groups (Edinburgh, Glasgow, and Transportation). It is also, however, important to bear in mind organisational needs and responsibilities.

The matrix must be straightforward, transparent, and consistent. Although the matrix will provide a strategic focus for action planning, a check on the strategic noise levels, all matrix input data and any proposed interventions will be required prior to the implementation of any suggested actions. In this regard, the matrix will be subject to regular review during the Action Plan process.

The prioritisation matrix, and the related graphics, will be based on Building and Noise Source evaluations as described below. The Source Prioritisation Score being derived from the Building Prioritisation Score.

2 Building Prioritisation Score (BPS)

The Building Prioritisation Score (BPS) is an individual value assigned to each building. The input factors for the BPS are as follows:

- Building use (only residential considered at this stage, although other building types may be considered in later phases of development)
- Appropriate strategic noise level at building (for the particular noise metric being assessed).
- The number of properties within each building[10]
- The population density[11]
- The Annoyance response[12]

The BPS for each building is then calculated as follows:

$$BPS = (\text{Noise level at building} + 10 \times \log_{10}(\text{number of people annoyed})$$

Where:

Noise Level at building = L_{den}

Number of people annoyed = $(N_A \times P_A \times A) / 100$

where

N_A = Number of address points within building

[10] All address points that lie within a building are used

[11] Using a multiplication factor of 2.36 for each Address Point. From Scot-Tag

[12] Miedema and Oudshoorn "Annoyance from Transportation Noise: Relationship with Exposure Metric DNL and DENL and Their Confidence Intervals. Environmental Health Perspectives Vol 109 No 4 April 2001

P_A = Population per address

A = % people annoyed

Property 1 Berkeley Street (Adjacent to M8 in Glasgow)

Noise level at building ..... 80.9dB L_{den}

No. of Address Points within building (N_A) 16

Population per Address (P_A) 2.36

% people likely to be annoyed by road traffic noise (A) 79.7

BPS .....80.9 + (10 x $\log_{10}$((16 x 2.36 x 79.7)/100)) = 95.7

Property 2 309 Great Western Road, Glasgow

Noise level at building .....72.1 L_{den}

No. of Address Points within building (N_A) 6

Population per Address (P_A) 2.36

% people likely to be annoyed by road traffic noise (A) 52.3

BPS .....72.1 + (10 x $\log_{10}$((6 x 2.36 x 52.3)/100)) = 80.7

3 BPS Maps

To facilitate an understanding of the distribution of BPS values for a particular noise source these have been represented visually in map format. The BPS maps were prepared by assigning each building a score as calculated above. The resultant scores were then divided into 5 point bands, each represented by a different coloured circle. The diameter of each circle is a function of the BPS (the bigger the coloured circle the greater the BPS). The resultant mapped pattern of coloured circles provides a visual representation of where the greatest noise annoyance is likely to occur. As part of the action planning process the maps can, if required, be cross referenced with received noise complaints for particular noise sources. In this way the maps can, if required, be developed for future action planning.

It should be noted that the BPS is an absolute value, and individual properties in Glasgow, Edinburgh, and elsewhere can be directly compared. The colours used in the BPS maps are also absolute, and identify the same BPS values in all areas.

4 Source Prioritisation Score (SPS) for Roads and Rail

Once the BPS is calculated for each building the Source Prioritisation Score (SPS), for sections of source line, is calculated as follows.

- Firstly the road network is rationalised so that there is a single centreline to represent motorways, and dual carriageways. Previously these were represented by two separate lines representing opposing carriageways. In addition, junctions are simplified in a similar manner. Similarly, the rail network is reduced to a series of single centrelines that represent railway lines that consist of multiple tracks.

- Road and rail source lines are split into 100m sections (some will necessarily be less than 100m, and these sections have a weighting applied to compensate for the decreased segment length. These shorter sections, in general, occur at junctions and the ends of road/rail sections).
- Each road/rail segment is then given a unique ID.
- For each building with a noise level greater than or equal to L_{den} 55dB the ID of the road/rail segment that is closest to it is assigned to that building.
- The logarithmic sum of BPS values for all buildings with the same nearest road/rail segment ID is then assigned to the relevant road segment. For *n* Building Prioritisation Scores the logarithmic sum is given by the follow equation:

$$SPS = 10\log_{10}\left(\sum_{i=1}^{n} 10^{\left(\frac{x_i}{10}\right)}\right)$$

Where x_i is the i^{th} Building Prioritisation Score.

- Since some segments are shorter than 100m, a weighting has been applied to each segment that has a length between 50m and 100m. The following weighting was applied, SPS x 10 x log10 (100 ÷(segment length)). Hence the maximum correction is 3 and, basically, assumes that if the section was in fact 100m long the distribution of buildings and BPS values would remain constant along the additional length. For lengths less than 50m the correction is not applied due to the large error in summed BPS for such short lengths.. However, since these shorter lengths occur at road ends, lengths of less than 50m are deemed insignificant. Furthermore, in general, they represent less than 0.5% of all source segments. For example, there are 12664 major road sections of which 51 are less than 50m in length. The total length of major roads is approx 1,267km of which the sections with lengths less than 50m sum to approximately 1.5km.

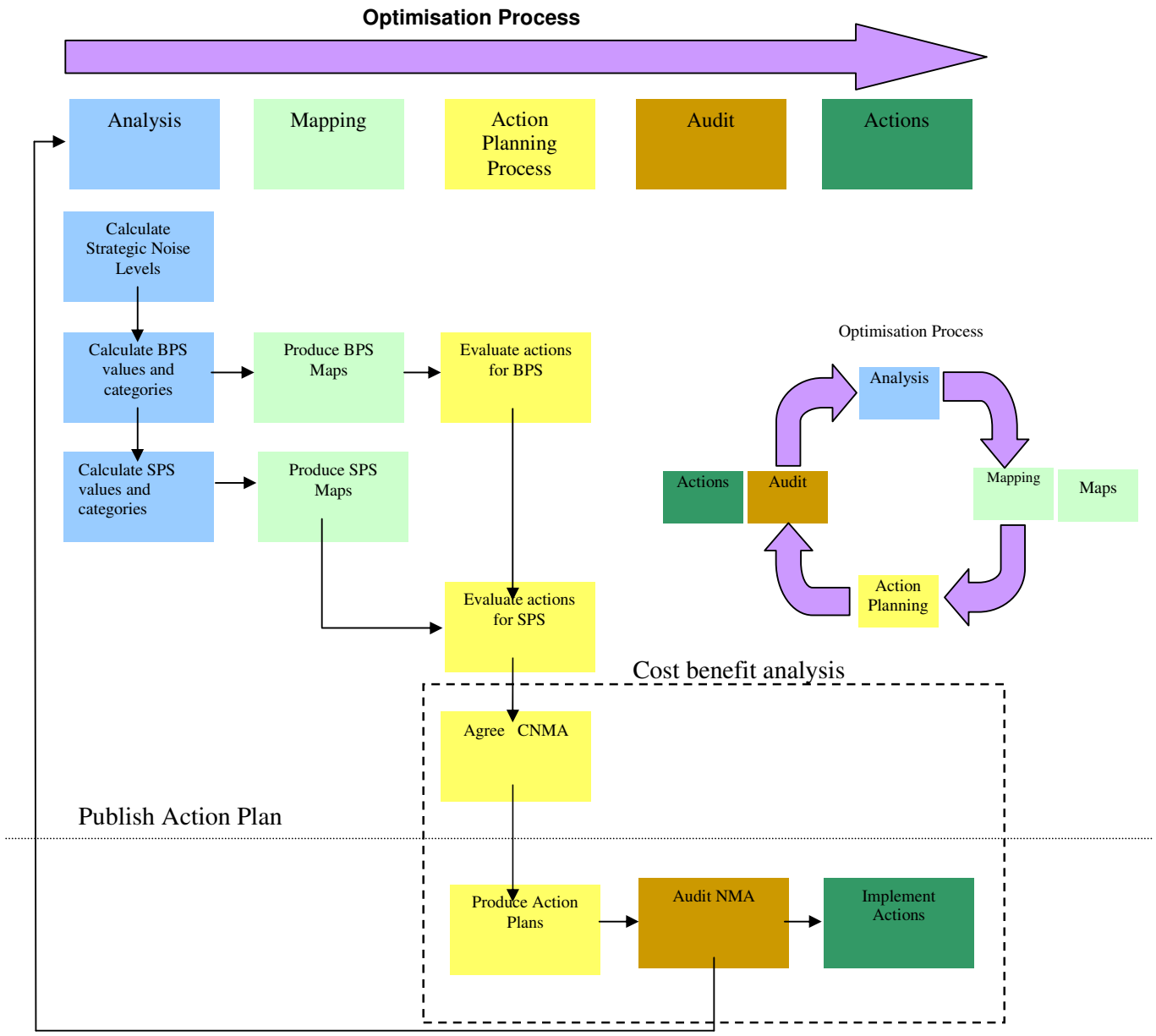
An example of the SPS calculation methodology is presented in Section 7 of this Appendix.

Once calculated, the road and rail network with assigned SPS values are ranked into four categories, based on each section's SPS. To initiate the prioritisation process for each noise source the initial categorisation used is as follows: 1%, 1%, 1%, 97%, from highest to lowest.

5 Airport SPS Maps

The airport source prioritisation maps are based on areas rather then line segments (road and rail). The area SPS values are determined by the logarithmic summation of the building prioritisation scores for all residential buildings that lie within postcode area boundaries. The airport area SPS values are then categorised into four bands as follows: 1%, 1% 1%, 97%. If deemed necessary, the size of the top three airport area SPS bands can be increased.

6 Prioritisation Matrix



7 Source Prioritisation Score Example

The following graphic shows a section of the major road network with buildings that have had their Building Prioritisation Scores (BPS) determined. Each of the road sections shown in the graphic equates to a 100 metre length of the major road network, each with a unique ID. In the graphic the road section ID is shown (03919 to 03922) for each road segment. Each line segment and their nearest buildings have been uniquely coloured.

The sequence of events for determining SPS values for segments of source line is as follows.

- Segment line source into 100m lengths.
- Assign Unique ID to each line source segment.
- Assign to each building the ID of the nearest source line segment.
- Logarithmically sum all the building prioritisation scores that have the same unique source segment ID.
- Each unique line source segment is then assigned the logarithmically summed BPS for that particular segment.

For Example:

In Figure 1, below, each 100m source segment has a unique ID. For illustrative purposes, each segment has been uniquely coloured. The ID of the nearest source segment to each building is then assigned to each building and again, for illustration purposes, each building has been assigned the same colour as its nearest source segment.

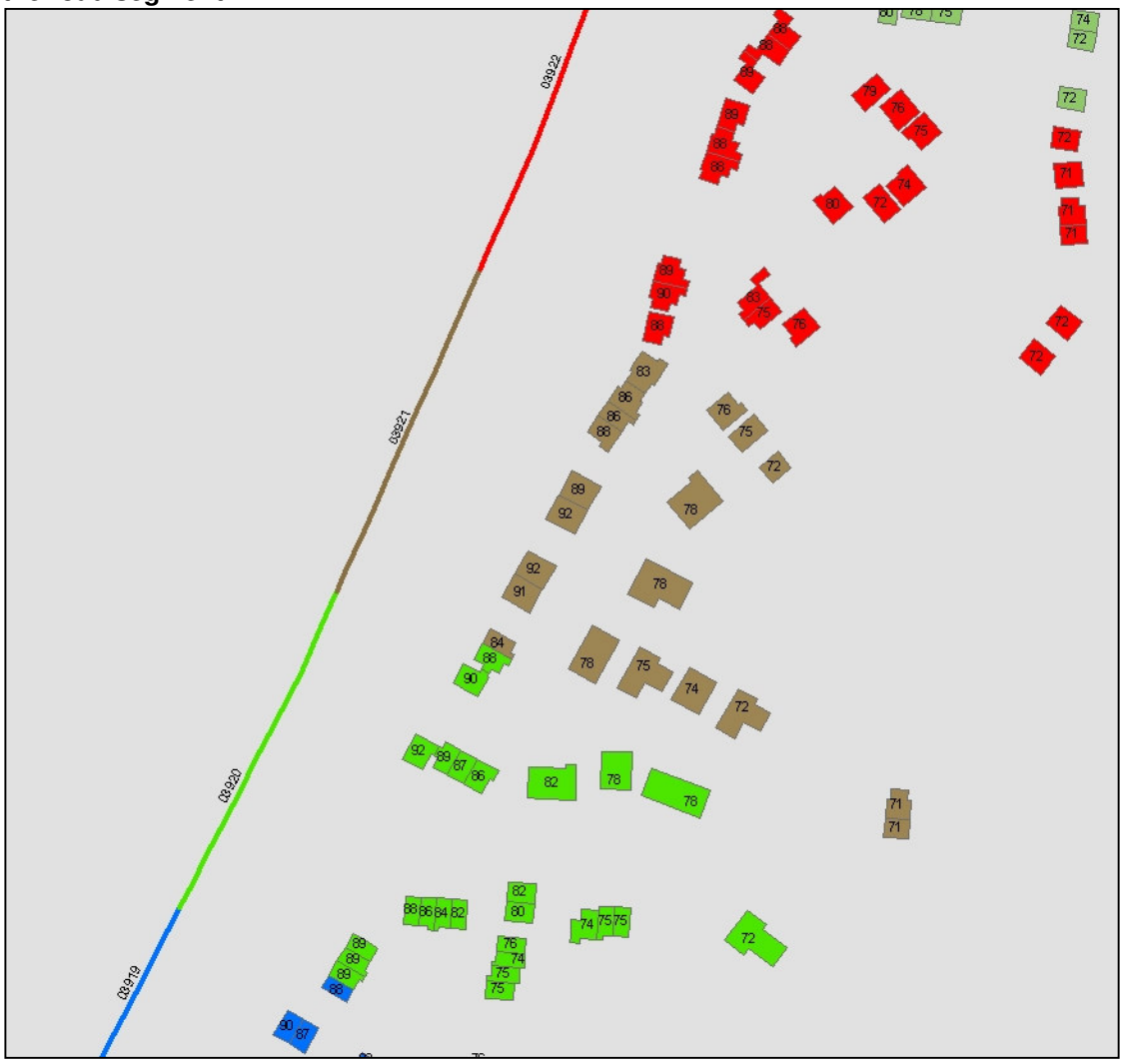
Taking road segment 03921 (Brown)as an example, the Source Prioritisation Score for this segment is equal to the logarithmic sum of the BPS scores for all properties for which this segment is the closest (i.e. all of the brown coloured buildings). These buildings have the following BPS: 83, 86, 86, 88, 89, 92, 92, 91, 84, 76, 75, 78, 78, 78, 75, 72, 75, 74, 72, 71, 71 and, as such, the Source Prioritisation Score is given by:

$$SPS = 10\log_{10}\left(\sum_{i=1}^{n} 10^{\left(\frac{x_i}{10}\right)}\right)$$

$$= 10\log_{10}(10^{\left(\frac{83}{10}\right)} + 10^{\left(\frac{86}{10}\right)} + 10^{\left(\frac{86}{10}\right)} + 10^{\left(\frac{88}{10}\right)} + 10^{\left(\frac{89}{10}\right)}$$
$$+ 10^{\left(\frac{92}{10}\right)} + 10^{\left(\frac{91}{10}\right)} + 10^{\left(\frac{84}{10}\right)} + 10^{\left(\frac{76}{10}\right)} + 10^{\left(\frac{75}{10}\right)} + 10^{\left(\frac{78}{10}\right)}$$
$$+ 10^{\left(\frac{78}{10}\right)} + 10^{\left(\frac{75}{10}\right)} + 10^{\left(\frac{72}{10}\right)} + 10^{\left(\frac{75}{10}\right)} + 10^{\left(\frac{74}{10}\right)} + 10^{\left(\frac{72}{10}\right)}$$
$$+ 10^{\left(\frac{71}{10}\right)} + 10^{\left(\frac{71}{10}\right)}$$
$$= 98.8$$

Please note that in this example integer BPS values have been used. However, when determining SPS values for all source segments BPS values to one decimal place have been used.

Figure 1: Noise Source Segments (With IDs) and Buildings with Associated BPS. The source segments have been uniquely coloured. All buildings have been assigned the ID of the road segment closest to it and then coloured using the same colour as the road segment.



Appendix 2 Example of Data Recording Sheet to be Used for Desk Study and/or Site Visit

CNMA Desk Study and/or Site Visit Report Sheet To be completed as part of a Desk Study and/or Site Visit to assist in completion of detailed report for each CNMA (sample text in italics used for illustration only)		
Location	Transportation Type	Road
	CNMA	*12*
	Location	*Auchenshoogle*
	Route	*A7*
	Local Authority/Infrastructure Manager (usually Network Rail for rail noise)	*East Lothian Council*
Technical Details	Flow	*16000*
	Surface Type (please state if taken form database or noted from observations on site	*SMA (If this was a rail example the considerations would be ballast or slab track, sleeper type (concrete, metal, wooden))*
	Gradient	*1/40 (anything other than at grade or steep negative or positive will be derived from database or interrogation of drawings held by roads authority)*
	Traffic Composition	*60/40 (If rail would consider Local Passenger Trains, Express Passenger rains, Freight Trains)*
Scoring	Population Attributed In Prioritisation Matrix	*100*
	Agglomeration Source Prioritisation Score (SPS)	*23*
	Rank	*4 of 38*
Visit (if undertaken)	Date and time of Site Visit	*Some time soon (or not deemed necessary)*
	Attendees	*Name of attendees (or not appropriate as no site visit undertaken)*
Physical Details	Traffic comments	*Moderate, heavy vehicle, major bus route (or not appropriate as no site visit undertaken)*
	Road type and condition	*Dual carriageway. (If rail would consider Single Track, Double Track, Multiple Track) (please state if different from data presented in toolkit provided))*

CNMA Desk Study and/or Site Visit Report Sheet To be completed as part of a Desk Study and/or Site Visit to assist in completion of detailed report for each CNMA (sample text in italics used for illustration only)		
	Surface	*SMA (If rail would consider jointed track, continuously welder rail, rail switches and crossings)(please state if different from data presented in toolkit provided)*
	Topography (including cuttings, embankments, over bridges, under bridges and tunnels)	*As 2005 mapping (see scottishnoisemapping.org) (please state if different from data presented in toolkit provided))*
	Speed Limits	*Note that HGVs and freight trains may have a lower limit.*
	Building orientation	*Parallel, as noise mapping (an indication of location/orientation of bedrooms would be useful if possible), otherwise reference to maps as shown in scottishnoisemapping.org.*
Site Observations (if relevant)	Noise Barrier or Other Mitigating Factors	*None (if noise barriers seen, photograph, dimensions and material type would be useful)*
	Subjective evaluation of noise climate	*Moderate, survey taken (if any measurements taken to substantiate subjective evaluation then all measurement parameters, measured levels, details of calibration, measurements location, distance from source, meteorological conditions etc must be provided).*
	Photographs taken	*Yes (maps may also be prepared from desk study)*
	Observation	*Footpaths on both sides. High level of pedestrian traffic. Housing date around 1940s. Carriageway added to road in 2003. Road will maintained. Major commuter route. Is traffic travelling a road design speed? (If rail would consider railway cutting, railway siding (or passing loop), railway signal, level crossing (or footpath crossing)).*
	Any other relevant comments/observations	*This Report Sheet is not intended to be fully prescriptive or exhaustive. Please use this section for any other information you consider to be relevant to the CNMA to NMA decision making process*

Appendix 3 Guidance on Evaluation of HGVs

Table A3.1: Change in BNL (Noise Level 10m from kerb) due to Changes in Road Traffic Speed and/or %HGV

	Modelled	Assumed
Speed	50	60
% HGV	10	10

The Noise Level will Increased by 0.8 dB(A)

If you are viewing the PDF version of this document, the tool for assessing changes in BNL due to changes in road traffic speed and/or percentage HGV can be accessed here (http://www.scottishnoisemapping.org/downloads/guidance/HGVBNL.doc).

In Table A3.1 there is an embedded Excel spreadsheet that can be used to determine changes to the BNL due to changes in speed and/or %HGV. To use the spreadsheet simple double click inside the table. On doing so, the spreadsheet will open and you can input the modelled and assumed speeds and %HGVs. Then click outside the excel table and the phrase will update, indicating where there has been an increase, decrease or no change in the BNL. Any increases or decreases in the value of the BNL will be shown.