Technical Note 2

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DATE	**14 January 2020**	CONFIDENTIALITY	**Internal**
SUBJECT	**70064876 – TNAP 2019-2023 Noise Mitigation Pilot – A82 Renton – Noise Modelling Approach and WebTAG**		

BACKGROUND AND INTRODUCTION

Further to the Technical Note dated 20 December 2019, this additional Technical Note has been prepared to document the approach adopted to the noise modelling work undertaken in the assessment of the noise barrier options that have been appraised for the A82 Renton pilot location.

This Technical Note also includes the results of appraisal work undertaken using the *Transportation Assessment Guidance (TAG) Noise Workbook* to calculate the monetised benefit (Net Present Value) of the assessed noise barrier options. These assessment results have been prepared to provide additional information for the benefit for the wider Transportation Noise Action Plan (TNAP) 2019-2023 Noise Mitigation Pilot Study, which the A82 Renton pilot area forms part of. For comparative purposes, Net Present Values (NPVs) have been determined based on the modelled noise level results for both ground and first floor receptor heights.

It is recognised that the TAG Workbook strictly only applies in England. However, the Scottish Transportation Appraisal Guidance (STAG) stops short of completing a monetised benefit calculation, and it is considered that these results may be of benefit for the pilot study, e.g. to assist in determining the value for money of the noise mitigation measures brought forward as part of the pilot.

APPROACH TO NOISE MODELLING

The completed noise modelling work has been undertaken by application of the road traffic noise level prediction method detailed within the *Calculation of Road Traffic Noise* memorandum 1988 and the supplementary procedures detailed within the Annex 4 *Additional Advice to CRTN Procedures* of the *Design Manual for Roads and Bridges,* Volume 11: *Environmental Assessment*, Section 3: *Environmental Assessment Techniques*, Part 7: HD 213/11 – *Revision 1, Noise and Vibration* (November 2011).

The above prediction method has been implemented through the generation of a detailed noise model within the CadnaA PC based noise modelling suite.

Input / Source Data

The following key source data sets were used to inform the noise level prediction exercise:

- Ordnance Survey 1:1250 Mastermap® Topography layer mapping (which includes kerb edges and building locations etc.);
- LiDAR Digital Terrain Model (DTM) data with 1m grid spacing;
- AddressBase Premium data (which marries the UK postal address database with Ordnance Survey six-figure grid coordinates);
- Traffic flow data for the A82 provided by Transport Scotland; and
- Road surface data for the A82 provided by Transport Scotland.

Modelled Approach

TOPOGRAPHY

The 1m grid LiDAR DTM data was processed into 0.5m ground contours and incorporated within the noise modelling software, forming the foundation of the noise model.

RECEPTORS

The buildings layer of the 1:1250 OS Mastermap Topography mapping was incorporated into the noise model as ‘buildings’. Building heights were set within the model based upon the building footprint area (A). Building heights were set as follows:

- A < $20m^2$ – 2m height;
- $20m^2 \le A < 30m^2$ – 3m height;
- $30m^2 \le A < 40m^2$ – 4m height; and
- $40m^2 \le A$ – 8m height.

Building heights were set to be relative to the ground model.

The AddressBase Premium data were reviewed and used to identify those buildings at the site that are likely to be subject to residential occupation. For the identified residential buildings, receptor (noise level prediction) points were located 1m in front of the façade closest to, and facing in the direction of, the A82. Receptor points were located at both ground floor height (1.5m) and first floor height (4m). Noise level predictions were not undertaken for other facades, e.g. those facing away from the A82.

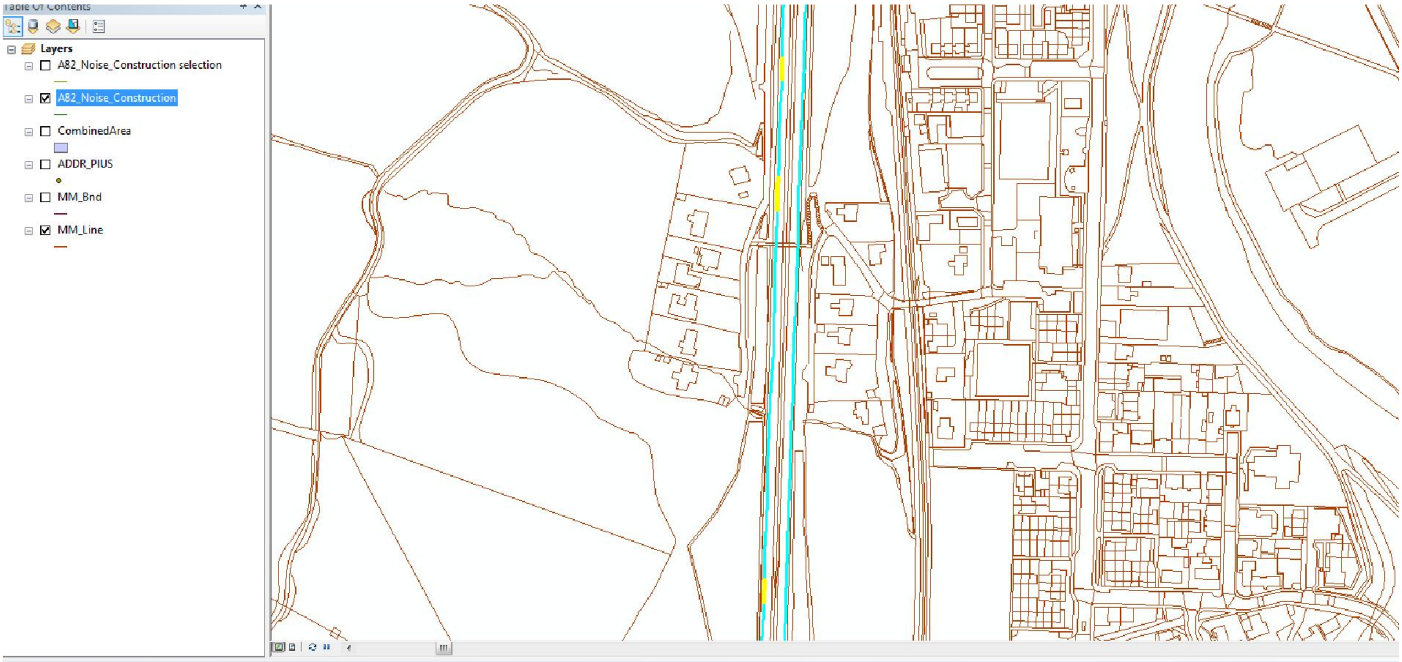
ROAD TRAFFIC SOURCES

Two separate road traffic noise sources were included within the noise model for the A82, one for the northbound carriageway, and one for the south-bound carriageway. The A82 was considered likely to be the dominant noise source at the adjacent dwellings. Noise from other local road traffic routes was therefore not included within the noise model, notwithstanding that traffic data for other such routes was not available for this study.

The road traffic source widths and alignments were set to follow the road kerb edges as depicted in the 1:1250 OS Mastermap Topography layer mapping.

A review of carriageway surface data (as provided by Transport Scotland) was undertaken. It was identified that the vast majority of both the northbound and southbound carriageways of the A82 were last resurfaced in 1982 with the surface type logged as '*?*' (i.e. unknown). Short sections of some lanes had subsequently been resurfaced with TS 2010 10mm in 2016. The provided data are depicted in Figure 1 below (yellow depicts areas where some lanes are TS 2010, cyan depicts surface type unknown).

<u>Figure 1 - Road Surface Data</u>



Table

A82_Noise_Construction

FID	Shape	ROAD_NAME	SECTION_CO	ROAD_UID	SECTION_UI	CROSS_SECT	START_METR	END_METRES	EASTING	NORTHING	MAJOR_STRE	PSV	SURFACE_TY	SURFACE_SO	SURFACE_SP	SURFACE_DA
50	Polyline	A82	10821/05	A82	1016	CL1	124	715	238665	677477	03/01/1982	0	?	?	?	03/01/1982
51	Polyline	A82	10821/05	A82	1016	CL1	715	738	238665	677477	03/01/1982	62	TS2010 10mm Surf	Chryston	z-TS2010 AI04 - Not progressed	26/05/2016
52	Polyline	A82	10821/05	A82	1016	CL1	738	809	238665	677477	03/01/1982	0	?	?	?	03/01/1982
53	Polyline	A82	10821/05	A82	1016	CL1	809	824	238665	677477	03/01/1982	65	TS2010 10mm Surf	Duntilland Quarry	TS2010 AI06 - Plant=Duntilland	26/05/2016
54	Polyline	A82	10821/05	A82	1016	CL1	824	1225	238665	677477	03/01/1982	0	?	?	?	03/01/1982
62	Polyline	A82	10821/05	A82	1016	CL2	91	430	238665	677477	03/01/1982	0	?	?	?	03/01/1982
63	Polyline	A82	10821/05	A82	1016	CL2	430	445	238665	677477	03/01/1982	62	TS2010 10mm Surf	Duntilland Quarry	TS2010 AI01 - Plant=Duntilland	26/05/2016
64	Polyline	A82	10821/05	A82	1016	CL2	445	1233	238665	677477	03/01/1982	0	?	?	?	03/01/1982
148	Polyline	A82	10821/06	A82	2203	CL1	0	1286	238678	677487	03/01/1982	0	?	?	?	03/01/1982
150	Polyline	A82	10821/06	A82	2203	CL2	0	1286	238678	677487	03/01/1982	0	?	?	?	03/01/1982

Given that the vast majority of the carriageway surfaces are unknown, the full length of each road traffic source (i.e. northbound and southbound carriageways) was assumed to be Hot Rolled Asphalt (HRA) (i.e. *not* a low noise road surface) with a texture depth of 1.5mm. This corresponds to a surface correction of -0.5dB. Application of this correction is also consistent with the guidance contained within LA111 *Noise and vibration,* (the recent replacement to HD 213/11), for HRA surfaces where traffic speeds are greater than 75km/h, which is the case here.

Gradient corrections were applied based on the start and finish elevations of each carriageway in accordance with CRTN.

Traffic data were provided by Transport Scotland in the form of hourly counts for the year 2017 to 2018 from Automated Traffic Count (ATC) site reference JTC000016 named *A82 - South of Balloch Roundabout with A811*. This ATC is located at OS grid reference 238545, 680310, north of the site, with no vehicular access or egress points to/from the A82 between the site and this ATC.

The data were processed in order to determine the 18 hour Annually Averaged Weekday Traffic (AAWT) flows, percentage Heavy Duty Vehicles (HDVs) and speeds, as required for CRTN noise level prediction. Data were calculated for the base year (2018) and also a future (+15) year (2033) by application of TEMPro growth factors. The final traffic data applied within the noise model are detailed in Table 1 below.

Table 1 – Traffic Flow Data

	Northbound	**Southbound**
18hr AAWT 2018	11748	11938
18ht AAWT 2033	14291	14521
% HDV	4%	4%
Average Speed (km/h)	97.8	95.8

MODEL SETTINGS

The following key settings were applied within the noise modelling software:

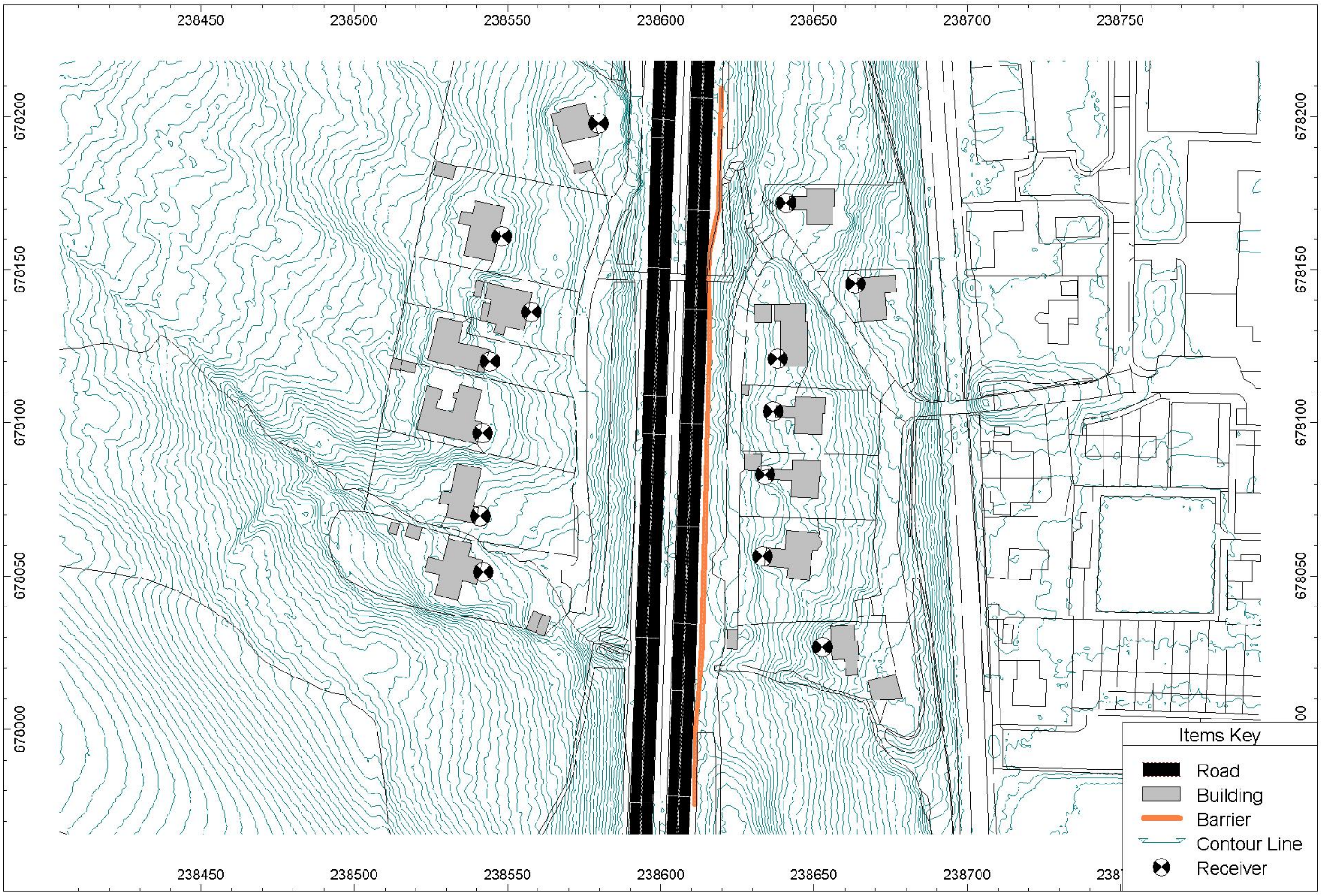
- The model was set to apply the CRTN prediction method for road traffic sources and '*Calculation according to DMRB*' was selected;
- The model search radius was set to 2km;
- Ground absorption was set to G=1 (acoustically absorptive ground) with the exception of roads which were set to G = 0 (acoustically reflective ground);
- Acoustic reflections were set to be determined as '*reflection via correction, not mirror sources*', i.e. in accordance with CRTN; and
- A manual façade correction of +2.5dB was added to calculated receptor noise levels.

RESULTS

Receptor Noise Levels

The noise model was used to determine the noise levels arising at the receptor points both 'with' and 'without' noise barriers of different heights (2m, 2.5m, 2.8m and 3.0m), each located along the same defined alignment. The assessed barrier alignment is depicted in Figure 2 (orange line).

Figure 2 – Assessed Noise Barrier Alignment



Further information including the receptor results are presented within the Technical Note dated 20 December 2019. That note also includes the receptor noise level reductions afforded by each different barrier height that has been assessed.

TAG Noise Work Book Assessment

The results of the noise modelling exercise have been used to facilitate an assessment of each modelled barrier height option using the *Transportation Appraisal Guidance Noise Workbook*. This workbook allows the noise benefit to be 'monetised' through determination of the Net Present Value (NPV), i.e. a monetary value associated with the receptor noise level reductions that are identified.

A total of seven properties on the east side of the A82 would be screened by the proposed barrier and therefore benefit from noise reduction. A further seven properties are located on the opposite (west) side of the A82. In order to prevent increases in noise levels arising at the properties to the west (due to noise reflecting back from the barrier), it is proposed that the side of the barrier facing the road will be acoustically absorptive. The absorptive requirement for the noise barrier is detailed within the Technical Note dated 20 December 2019.

The monetisation method applied by the TAG Noise Workbook accounts for receptor results in terms of both noise level change that is identified to arise, and the before and after noise levels in absolute terms (i.e. whether high or low). However, where the change in level is zero at a given receptor, the results for that receptor have no contribution to the determined monetisation (NPV) value. The TAG Noise Workbook assessment has therefore been completed applying the modelled results for the seven receptors on the east side of the A82 only (i.e. those that would be subject to noise level changes). Including the seven receptors on the west side of the A82 would have no bearing upon the result, provided that the barrier is appropriately absorptive as proposed.

Two sets of NPV values have been generated, one based on the receptor results determined at ground floor height, and one based on the receptor results determined at first floor height. In both cases, results for each different modelled barrier height have been determined. Both sets of results are presented in Table 2 below.

The inputs to the TAG Noise Workbook were determined from the modelled daytime receptor noise level data. The TAG Noise Workbook was used to simulate the night-time input values as allowed.

Table 2 – TAG Noise Workbook Monetised Benefit (Net Present Value), £

Adopted Receptor Results Height	**Barrier Height (m)**	**Net Present Value (Monetised Benefit)**
Ground Floor	2.0	+£78,191
	2.5	+£80,101
	2.8	+£87,887
	3.0	+£90,486
First Floor	2.0	+£114,549
	2.5	+£128,197
	2.8	+£129,185
	3.0	+£144,660

We trust that data presented above, including the approach to the TAG Noise Workbook appraisal, is of value for the wider TNAP 2019-2023 Noise Mitigation Pilot Study.

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