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Royal HaskoningDHV

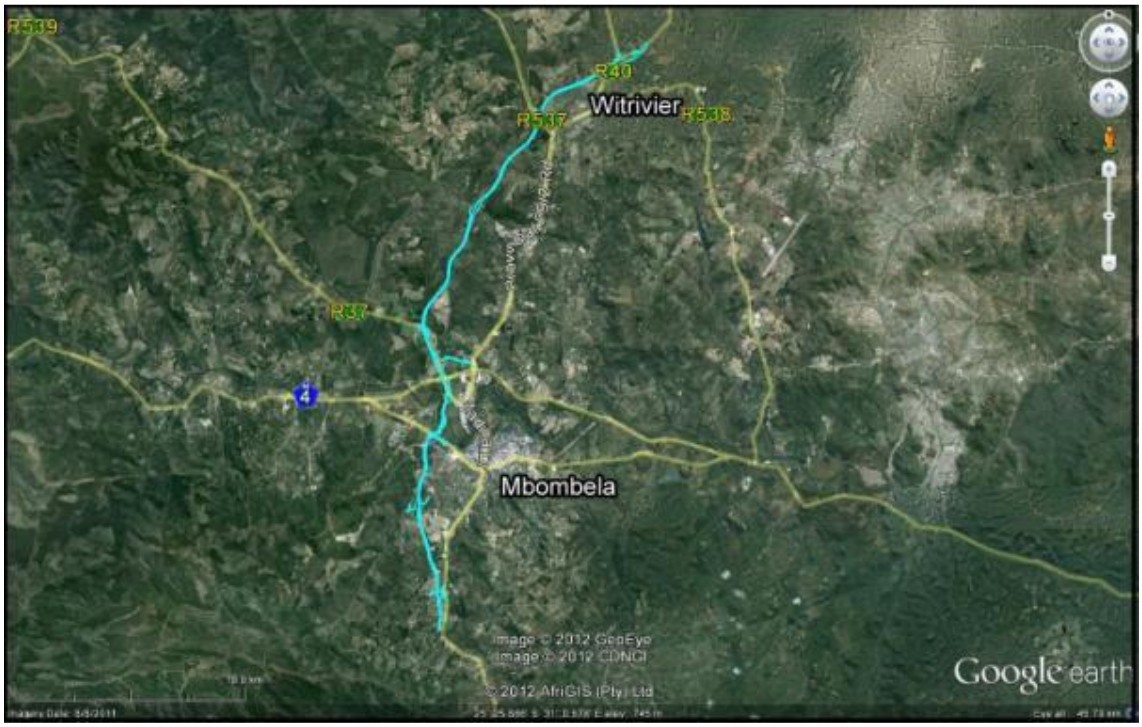
Environmental Scoping Report for the Establishment of the P166 Road, Mbombela, Mpumalanga.

Environmental Scoping Report

Date: 7 February 2013

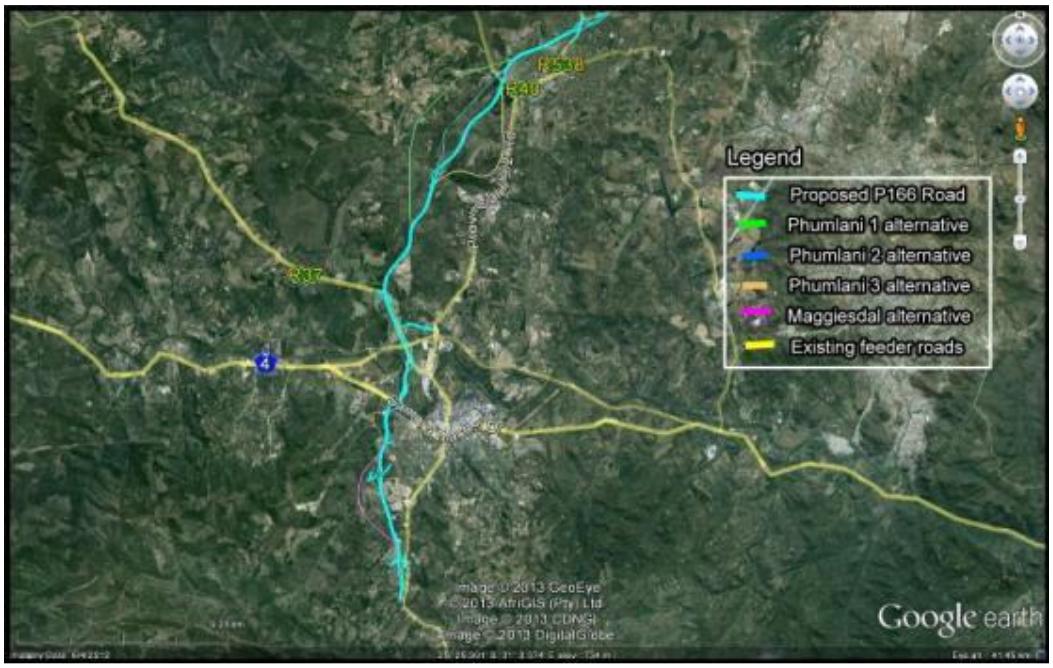
Executive summary

The proposed P166 road will run along existing noise sensitive areas, open land, existing roads and future residential areas. The proposed P166 route is illustrated in the following aerial imagery of the study area.



Proposed P166 route

There is however alternative routes to some of the sections of the proposed P166 route and these alternative routes are illustrated in the following aerial imagery.



Alternative routes

Noise is defined as unwanted sound and the sound travel through the air as waves outward from the source exerts as a sound pressure level that is measured in decibels (dB). The pressure wave travel through the air exerts a force registered by the human ear as sound.

In any given situation and/or area is an existing ambient noise level (prevailing ambient noise level) and the introduction of a new activity in an area can be determined, evaluated and controlled for the receptor of the sound to perceive it as acceptable or an intrusion.

The following issues should be investigated when doing a route selection assessment:

Would the project result in the exposure of persons to or generation of noise levels in excess of standards established in the local noise control regulations?

Would the project result in a substantial temporary or periodic increase in the prevailing ambient noise levels in the project vicinity and above noise levels existing without the project?

Would the project result in a substantial permanent increase in the prevailing ambient noise levels in the project vicinity and above levels existing without the project?

Would the project expose people residing or working in the project area to excessive noise levels?

The noise impact assessment which forms part of the specialist noise investigation process, will address the above issues and a noise management plan will be designed to control the possible noise intrusion.

The purpose of the route selection study will be to minimise the impact on the noise sensitive areas abutting such a linear noise source.

The project cycle will consist out of a Construction phase, Operational phase and a Maintenance phase.

A noise survey will be carried out at all the noise sensitive areas in and around the proposed P166 road. The noise survey will be done in terms of SANS 10103 of 2008 – "The measurement and rating of environmental noise with respect to annoyance and to speech communication" as well as the Environmental Health and Safety Guidelines of the International Finance Corporation of the World Bank.

It is proposed to make use of the following six-stage process approach to assessment and mitigation:

- Step1- Define the project requirements and noise problem – gather technical support information;
- Step 2 – Agree on the assessment criteria, establish baseline noise environment and determine extent of the noise impact of the initial proposal;
- Step 3 – Identify and agree on noise mitigations options;
- Step 4 – Assess noise impact against criteria of Step 2 and evaluate key considerations and significance for each mitigation option;
- Step 5 – Determine optimal noise control solution;
- Step 6 – Review, implement, monitor and audit;

The new road will be a linear type noise source of which traffic will be the main source which will have to be evaluated in terms of the prevailing ambient noise levels of the study area.

The noise increase for the preferred route will be between 0,0dBA to 15,0dBA and 5dBA to 20.0dBA which according to Table 2 in the report (SANS 10103 of 2008 – Table 5) will be little to medium and medium to strong respectively. These will lead to for the alternative routes medium to strong community actions which can result into widespread to threats of community or group action. For the preferred route the community action may be sporadic to widespread.

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Scoping Impact Assessment for the Establishment of the P166 route at Mbombela, Mpumalanga.

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1 INTRODUCTION

1.1 Background

The proposed P166 and the alternative routes will run along the western side of Mbombela from the R40 road south of Mbombela where it will join again with the R40 road north of Witrivier. The proposed road will run in the vicinity of other main feeder roads, residential areas, future residential areas, businesses, informal settlements along a proclaimed road reserve.

The prevailing ambient noise levels along these routes vary between built-up areas with high prevailing ambient noise levels to areas where there are low prevailing ambient noise levels because of the rural type district of the area. The prevailing ambient noise levels are made up out of traffic noise, domestic noise, build-up area noise, industrial type noises and residential type noises. This road will be a linear type noise source with high noise levels during peak periods and low noise levels during periods with no to little traffic. This is a phenomenon along all feeder roads.

The levels of noise emissions from road traffic as given in SANS 10210 for the prediction of road traffic noise are a function of:

- The number of vehicles passing in a time period (determined for each hour);
- The mean speed of the vehicles;
- The percentage heavy-duty vehicles;
- The road surface texture;
- The road gradient;
- The road worthiness of the vehicles.
- Distance between road and receiver;
- Intervening topography and structures that may shield the noise from the receiver;
- Meteorological effects.

The aspects such as road surface texture and the gradient of the road can be dealt with during the designing stage of the road. The other aspects such as number of vehicles, speed of the vehicles and meteorological effects are all variables that may change on a daily basis, which may have an influence on the noise levels and how the resultant noise is perceived.

1.2 Scope and limitations

There is no noise data for each of the areas and the recommended noise levels according to Table 2 of SANS 10103 of 2008 will have to be used to determine the noise impact the preferred route may have on the abutting noise sensitive areas. This information will furthermore be used during the design stage of the road and the following aspects will be investigated and evaluated:

1.2.1 Would the project result in the exposure of persons to or generation of noise levels in excess of standards established in the noise control regulations?

1.2.2 Would the project result in a substantial temporary or periodic increase in the prevailing ambient noise level in the project vicinity above noise levels existing without the project?

1.2.3 Would the project result in a substantial permanent increase in the prevailing ambient noise level in the project vicinity above levels existing without the project?

1.2.4 Would the project expose people residing or working in the project area to excessive noise levels?

A noise study of the entire route and noise sensitive areas within the vicinity of the road will have to be carried out in order to determine the existing noise regime.

Limitations:

1. There are no noise data available on the prevailing ambient noise levels of the study area, the formal residential areas, and informal residential areas along the route.
2. There is an encroachment of informal residential areas within the proclaimed reserve for the road.

1.3 **Methodology**

1.3.1 Study area sensitivity analysis

A site visit was carried out to identify the different noise sensitive areas. The sensitivity analysis of the study area was done according to the following rating scale: sensitive area (1), medium sensitive (3) and not sensitive (5).

Table 1: Sensitivity analysis

Sensitivity area	Rating
P166 route	3.5
Phumlani 1-Alternative	3.5
P166 route	3.5
Phumlani 2-Alternative	2
P166 route	3.5
Phumlani 3-Alternative	2
P166 route	3
Maggiesdal-Alternative	1.5

The following study methodology will be followed:

• Identify all the noise sensitive areas (single and high density) within the vicinity of the proposed road and to identify such by means of their spatial position on Google Imagery;

• Determine the prevailing ambient noise level at each of the above noise sensitive areas by means of the recommended noise measuring procedure in SANS 10103 of 2008;

• Calculate or determine the acceptable rating level for each noise sensitive area.

2 DESCRIPTION OF THE RECEIVING ENVIRONMENT

The receiving environment will be all noise sensitive areas in the vicinity of the proposed P166 and alternative routes.

2.1 General Study Area

The proposed P166 road is illustrated in the following aerial imagery in Figure 1 which is along existing proclaimed sections.

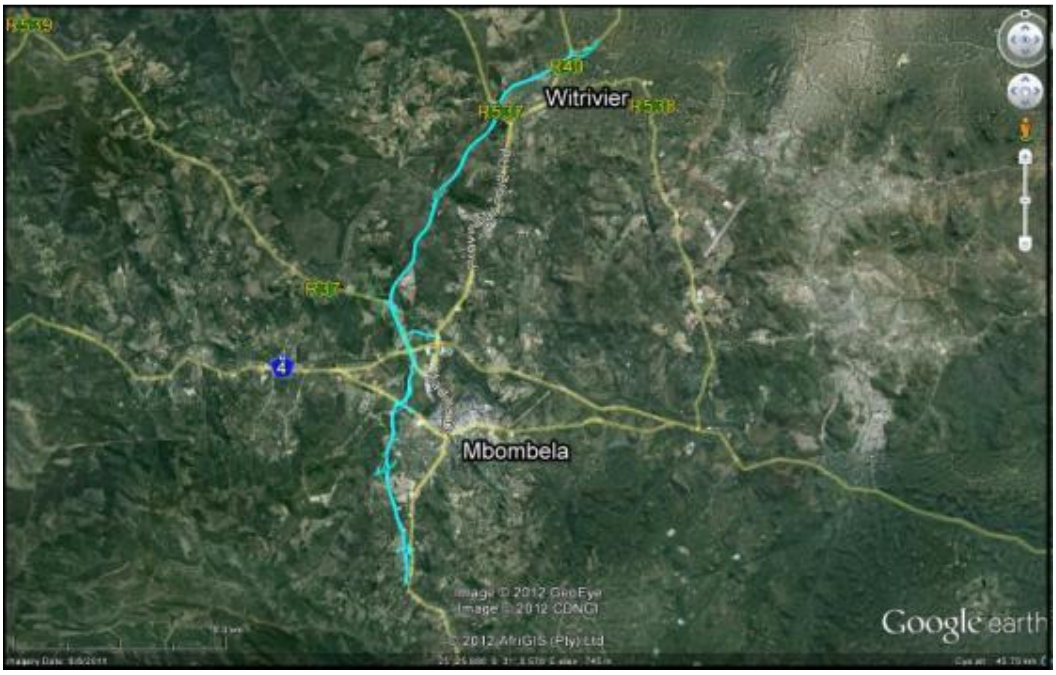

Figure 1: Proposed P166 road

The alternative routes for the study area are illustrated in Figure 2 and they are Phumlani 1(green), Phumlani 2(blue), Phumlani 3(light brown) and Maggiesdal (pink). The existing feeder roads through Nelspruit are shown with yellow lines.

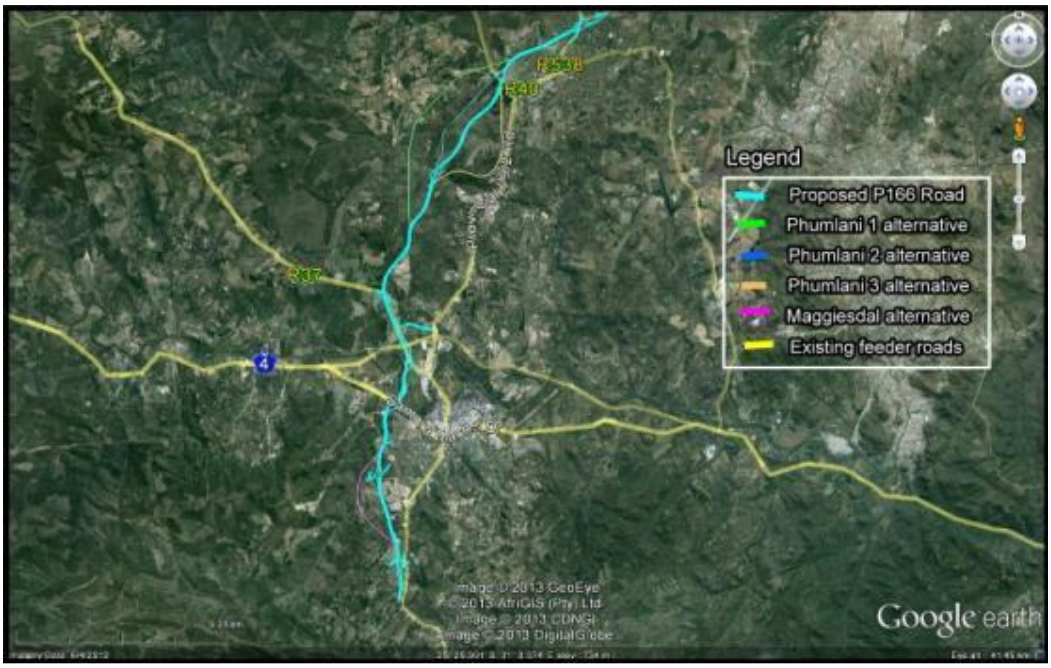

Figure 2: Alternative routes

3 IMPACTS AND ISSUES IDENTIFICATION

Sound is a wave motion, which occurs when a sound source sets the nearest particles of air in motion. The movement gradually spreads to air particles further away from the source. Sound propagates in air with a speed of approximately 340 m/s.

The sound pressure level in free field conditions is inversely proportional to the square of the distance from the sound source – inverse square law. Expressed logarithmically as decibels, this means the sound level decrease 6 dB with the doubling of distance. This applies to a point source only. If the sound is uniform and linear then the decrease is only 3 dB per doubling of distance.

The decibel scale is logarithmic therefore decibel levels cannot be added together in the normal arithmetic way, for example, two sound sources of 50 dB each do not produce 100 dB but 53 dB, nor does 50 dB and 30 dB equal 80 dB, but remains 50 dB.

Air absorption is important over large distances at high frequencies, depends on the humidity but is typically about 40 dB/km @ 4000 Hz. Road Traffic noise frequencies are mainly mid/low and will be unaffected below 200m.

When measuring the intensity of a sound, an instrument, which duplicates the ear variable sensitivity to sound of different frequency, is usually used. This is achieved by building a filter into the instrument with a similar frequency response to that of the ear. This is called an A weighting filter because it conforms to the internationally standardized A-weighting curves. Measurements of sound level made with this filter are called A-weighted sound level measurements, and the unit is dB.

Sound propagation is affected by wind gradient rather than the wind itself. The profile of the ground causes such a gradient. Sound propagation upwind is refracted upwards creating a sound shadow and downwind refracted towards the ground producing a slight increase in sound level over calm isothermal conditions.

The velocity of sound is inversely proportional to the temperature so a temperature gradient produces a velocity gradient and a refraction of the sound. Temperature decreases with height and the sound is refracted upwards.

For a source and receiver close to the ground quite large attenuation can be obtained at certain frequencies over absorbing surfaces, noticeably grassland. This attenuation is caused by a change in phase when the reflected wave strikes the absorbing ground and the destructive interference of that wave with the direct wave. The reduction in sound tends to be concentrated between 250 Hz and 600 Hz.

Noise screening can be effective when there is a barrier between the receiver and the source i.e. walls, earth mounds, cuttings and buildings. The performance of barriers is frequency dependent. To avoid sound transmission through a barrier the superficial mass should be greater than 10 Kg/m^2.

There is a complex relation between subjective loudness and the sound pressure level and again between annoyance due to noise and the sound pressure level. In general the ear is

less sensitive at low frequencies and the ear will only detect a difference in the sound pressure level when the ambient noise level is exceeded by 3-5 dBA.

People exposed to an increase in the prevailing ambient noise level will re-act differently to the noise levels and the response is given in Table 2.

Table 2: Estimated community/group response when the ambient noise level is exceeded.

1	2	3
Excess $)L_{Req,T}$ [1)] dB	**Estimated community/group response**	
	Category	**Description**
0	None	No observed reaction
0-10	Little	Sporadic complaints
5-15	Medium	Widespread complaints
10-20	Strong	Threats of community/group action
>15	Very strong	Vigorous community/group action

1) Calculate $)L_{Req,T}$ from the appropriate of the following:

a) $)L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS $L_{Req,T}$ of the residual noise (determined in the absence of the specific noise under investigation).

b) $)L_{Req,T}$ = $L_{req,T}$ of ambient noise under investigation MINUS the maximum rating level for the ambient noise given in table 1.

c) $)L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS the typical rating level for the applicable district as determined from table 2.

The difference between the actual noise and the ambient noise level will determine how people will respond to sound.

The recommended noise level for a residential area according to the General Environmental Health and Safety Guidelines is 55.0dBA during the day time period and 45.0dBA during the night time period. The South African National Standards have different recommended ambient noise levels and is illustrated in Table 3.

Table 3: Recommended noise levels for different districts.

1	2	3	4	5	6	7
	Equivalent continuous rating level $L_{Req.T}$ for ambient noise dBA					
	Outdoors			**Indoors, with open windows**		
Type of district	***Day-night*** L_{Rdn} [2)]	**Daytime** L_{Rd} [1)]	**Night-time** L_{Rn} [1)]	***Day-night*** L_{Rdn} [2)]	**Daytime** L_{Rn} [1)]	**Night-time** L_{Rn} [1)]
a) Rural districts	45	45	35	35	35	25
b) Suburban districts with little road traffic	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
d) Urban districts with some workshops, with business premises and with main roads	60	60	50	50	50	40
e) Central business district	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

The reference time intervals can be specified to cover typical human activities and variations in the operation of noise sources and are for daytime between 6h00 to 22h00 and for night time between 22h00 and 6h00.

In terms of noise increases, persons exposed to an increase of 2 dBA or less would not notice the difference. Some people exposed to increases of 3-4 dBA will notice the increase in noise level, although the increase would not be considered serious. Noise increases of 5dBA and above are very noticeable, and, if these are frequent incidents, or continuous in nature, could represent a significant disturbance.

4 TERMS OF REFERENCE FOR IMPACT ASSESMENT PHASE

A standardised impact assessment methodology will be used to evaluate the impact during the construction, operational and maintenance phases of the project on each and every noise sensitive area. The prevailing ambient noise levels of during each of these phases will differ due to the location of these areas to other point and/or linear noise sources.

The following potential impacts will be evaluated for the project:

Construction phase:

- Preparation of the foot print areas;
- Civil construction;
- Grading and building of new roads;
- Asphalt laying;
- Marking of roads.

Operational phase:

- Traffic volumes.

Maintenance Phase

- Maintenance of the road surface

5 IMPACT ASSESSMENT OF THE PROPOSED ROUTES

The rating of the alternative routes in relation to the proposed P166 route is illustrated in Table 4. This impact assessment is only for the alternative routes and not the construction and operational phases which will be addressed later on. This rating is to select a route which will have little to no significant impact regarding noise issues on the environment and the abutting noise sensitive areas.

Table 4: Preferred route Impact assessment

Noise	Scoring	Scoring average rating 1 to 5. (1 = sensitive, 3 = Medium and 5 not sensitive)
P166 vs Phumlani 1 alternative	3.5	
P166 vs Phumlani 2 alternative	2.0	
P166 vs Phumlani 3 alternative	2.0	
P166 vs Maggiesdal alternative	3.0	

A new road will increase the prevailing ambient noise levels of a specific area and by shifting the route to another area will only illuminate the noise for the original area but increase the prevailing ambient noise level for the selected route. A road becomes a linear noise source and alternative mitigatory measures such as speed, road surface noise barriers and distance between the road and noise sensitive areas should be holistically evaluated.

The preferred route from an environmental noise point of view will be Phumlani 1 alternative, proposed route P166 and Maggiesdal alternative route. There will be an increase in the prevailing ambient noise levels for these areas from a noise point of view. The final EIA process must however be done to determine what the noise impacts will be for the construction and operational phases of the project.

6 CONCLUSIONS AND RECOMMENDATIONS

The noise increase for the preferred route will be between 0,0dBA to 15,0dBA and 5dBA to 20.0dBA which according to Table 2 in the report (SANS 10103 of 2008 – Table 5) will be little to medium and medium to strong respectively. These will lead to for the alternative routes medium to strong community actions which can result into widespread to threats of community or group action. For the preferred route the community action may be sporadic to widespread. In Table 4 are some of the noise levels to which people are already exposed to on a daily basis in homes and/or offices.

Table 4: Prevailing noise levels in and around a house or office

	Activity	**dBA**
Communication	Whisper	30
Communication	Normal Conversation	55-65
Communication	Normal Conversation	60
Communication	Shouted Conversation	90
Communication	Baby Crying	110
Communication	Computer	37-45
Home/Office	Refrigerator	40-43
Home/Office	Radio Playing in Background	45-50
Home/Office	Background Music	50
Home/Office	Washing Machine	50-75
Home/Office	Microwave	55-59
Home/Office	Clothes Dryer	56-58
Home/Office	Alarm Clock	60-80
Home/Office	Vacuum Cleaner	70
Home/Office	TV Audio	70
Home/Office	Flush Toilet	75-85
Home/Office	Ringing Telephone	80
Home/Office	Hairdryer	80-95
Home/Office	Vacuum Cleaner	84-89
Home/Office	Maximum Output of Stereo	100-110

The traffic volumes, slope of the road and road surface will be required to determine the noise impact on the different noise sensitive areas throughout the study area.

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7 REFERENCES

7.1 Environmental, Health and Safety Guidelines – Noise Management - International Finance Corporation.

6.2 South African National Standards 10103 of 2008 – The measurement and rating of environmental noise with respect to annoyance and to speech communication.

6.3 SANS 10210 of 2004 – Calculating and predicting road traffic noise.

6.4 Noise Control Regulations.

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GLOSSARY

Ambient noise
The totally encompassing sound in a given situation at a given time and usually composed of sound from many sources, both near and far

A-weighted sound pressure level (sound level) (L_{pA}), in decibels
The A-weighted sound pressure level is given by the equation:

$L_{pA} = 10 \log (p_A/p_o)^2$

Where

p_A is the root-mean-square sound pressure, using the frequency weighting network A in pascals; and

p_o is the reference sound pressure (p_o = 20 µPa).

NOTE The internationally accepted symbol for sound level is dBA.

Distant source
A sound source that is situated more than 500 m from the point of observation

Equivalent continuous A-weighted sound pressure level ($L_{Aeq,T}$), in decibels
The value of the A-weighted sound pressure level of a continuous, steady sound that, within a specified time interval T, has the same mean-square sound pressure as a sound under consideration whose level varies with time. It is given by the equation

$$L_{Aeq,T} = 10 \log \left[\frac{1}{t_2 - t_1} \int_{t_1}^{t_2} \frac{p_A^2(t)}{p_o^2} dt \right]$$

Where
$L_{Aeq,T}$ is the equivalent continuous A-weighted sound pressure level, in decibels, determined over a time interval T that starts at t_1 and ends at t_2;

p_o is the reference sound pressure (p_o = 20 µPa); and

$p_A(t)$ is the instantaneous A-weighted sound pressure of the sound signal, in pascals.

Impulsive sound
Sound characterised by brief excursions of sound pressure (acoustic impulses) that significantly exceed the residual noise

Initial noise
The component of the ambient noise present in an initial situation before any change to the existing situation occurs

Intelligible speech
Speech that can be understood without undue effort

Low frequency noise
Sound, which predominantly contains frequencies below 100 Hz

Nearby source
A sound source that is situated at a distance of 500 m or less from the point of observation

Residual noise
The ambient noise that remains at a given position in a given situation when one or more specific noises are suppressed

Specific noise
A component of the ambient noise which can be specifically identified by acoustical means and which may be associated with a specific source
NOTE Complaints about noise usually arise as a result of one or more specific noises.

Ambient sound level
Means the reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such meter was put into operation.

Disturbing noise
Means a noise that causes the ambient noise level to rise 7.0dBA above the designated zone level, or if no zone level has been designated, the typical rating levels for ambient noise in districts, indicated in table 2 of SANS 10103.

Noise nuisance
Means any sound which disturbs or impairs the convenience or peace of any person