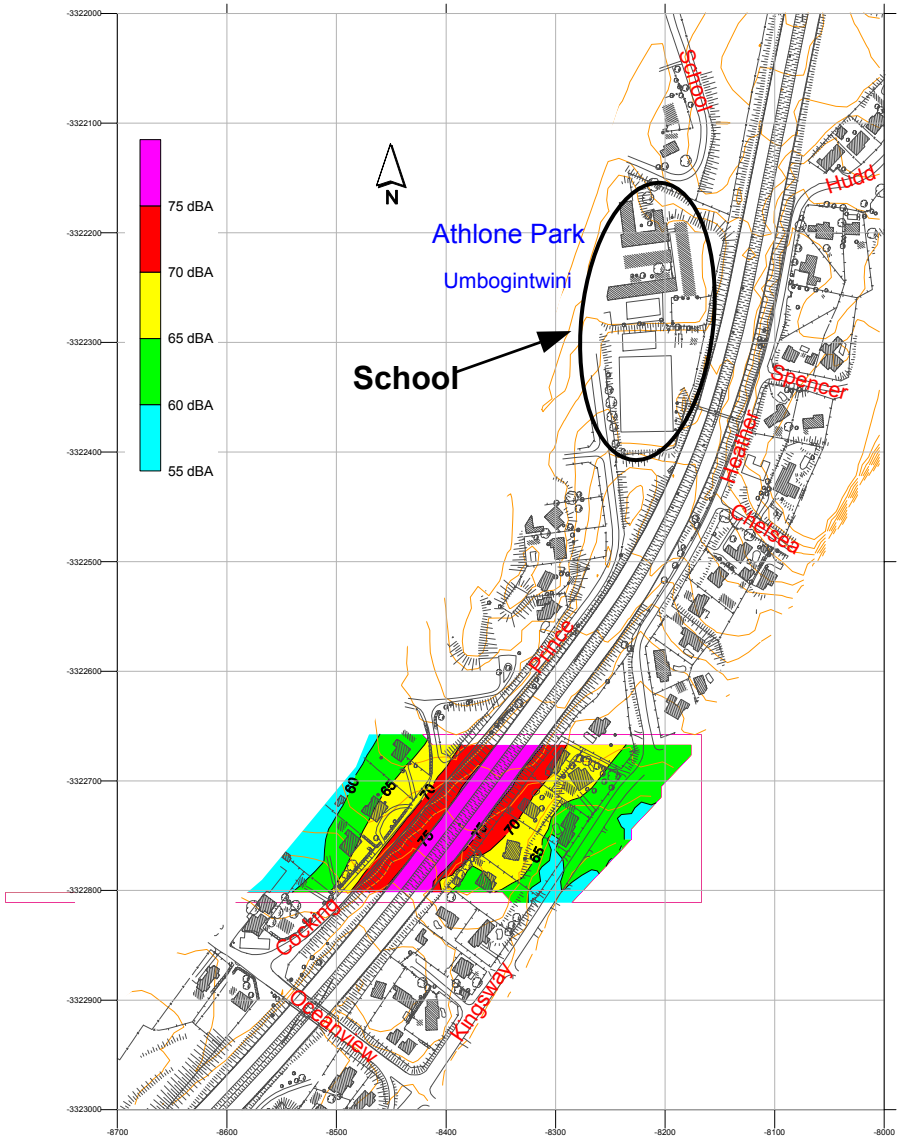
either side of the toll booth might be required. No noise sensitive land is located within 100 m of the toll plaza on the western off-ramp. No noise mitigation procedures would be required.

4.11.8 Calculation of road traffic noise in the vicinity of Umbogintwini

The levels of existing road traffic noise on land adjacent to the existing N2 passing through Umbogintwini are shown in Figure 27. The road is flanked by residential properties as well as a school site at Athlone Park. At the section shown, the road is below the level of residential and school land to the west of the road but is raised above residential land lying to the east of the road.



Vehicles per hour: 500 in each of two lanes in both directions; total 2000
Percentage heavy duty vehicles: 4,6%
Mean vehicle speed: 120 km/h
Road surface: dense asphalt
Receiver: 1,5 m above local ground level

Figure 27 Existing $L_{Req,d}$ on residential land adjacent to the N2, Umbogintwini

Figure 27 indicates that residential properties on both sides of the road are exposed to $L_{Req,d}$ in excess of 65 dBA. Some of the residential properties on the eastern side of the road are exposed to $L_{Req,d}$ in excess of 70 dBA. The road passes through undulating terrain. However, the noise levels shown may be extrapolated and it is expected that the Athlone Park School is currently exposed to $L_{Req,d}$ in excess of 65 dBA. These levels exceed the limit of 65 dBA contained in the Noise Control Regulations.

In terms of SANS 10103, the recommended maximum rating level of noise outside classrooms (with windows open) is 50 dBA. The existing noise levels are, therefore, expected to significantly exceed the recommended maximum levels for school sites as well as for residential properties along the route. In terms of SANS 10103 the existing intensity of impact of noise on school and residential land adjacent to the road is ***very high*** with a **very high** significance.

4.11.9 Future noise due to road widening

The addition of an extra lane in each direction will increase the capacity of the road, particularly during peak periods. This will result in reduced congestion and increased speeds. Increased traffic volume and increased speed would each contribute to increasing the noise levels on adjacent land.

In accordance with the Noise Control Regulations, noise mitigation measures would need to be implemented along these sections of the road in order to ensure that the $L_{Req,d}$ on adjacent land do not exceed 65 dBA. This implies the reduction of existing levels that are significantly higher than this value.

4.11.10 Noise Mitigation

Portions of this section of the proposed route are clearly in excess of the Noise Control Regulations. Since in addition noise sensitive land uses may be in close proximity, careful attention will have to be paid to noise mitigation.

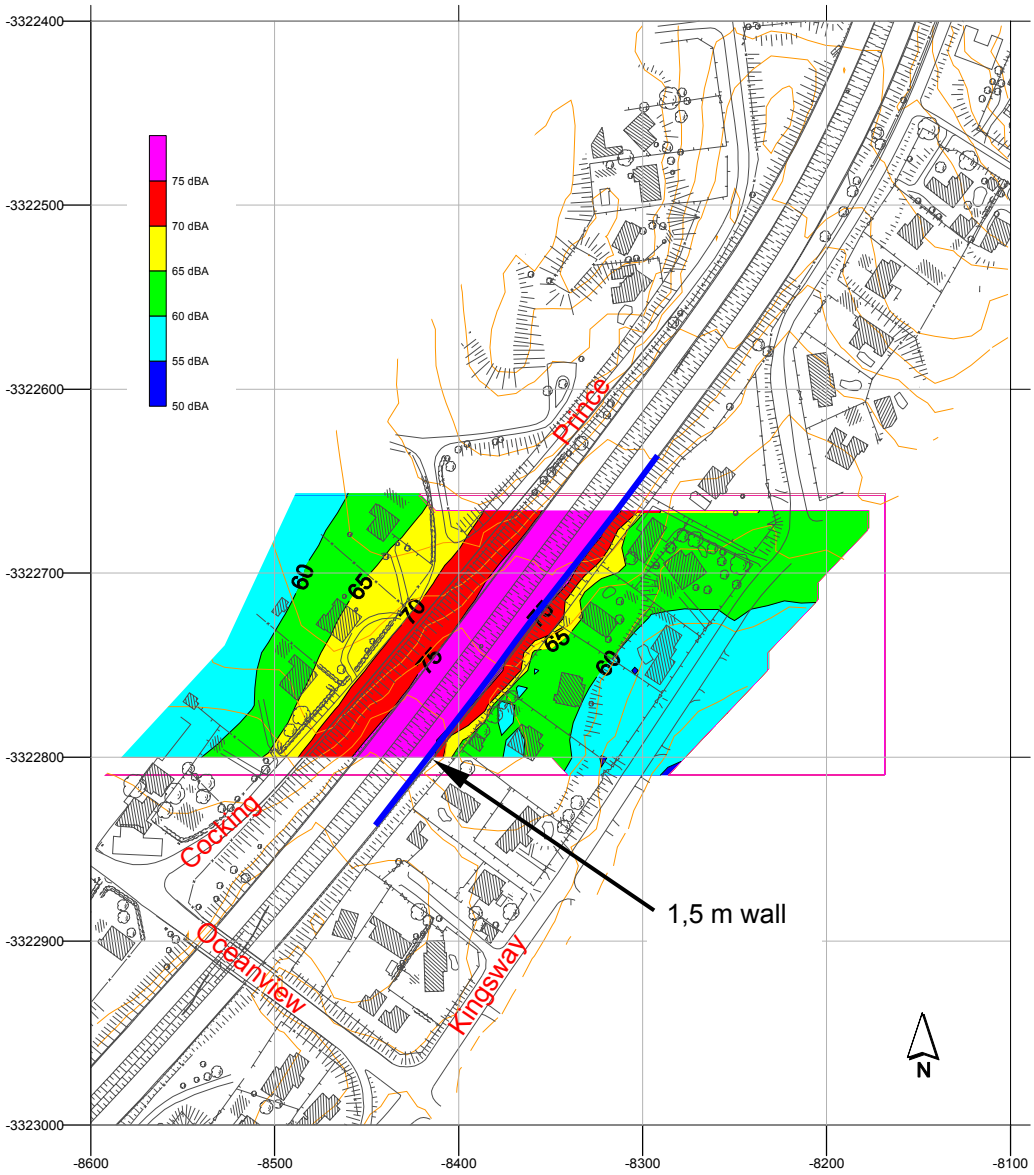
A number of specific noise mitigation measures are modelled in this Section in order to illustrate their effectiveness, or otherwise. Other noise mitigation measures such as reducing the noise at source by reducing vehicle speed (refer to Chapter 3.2.3), or the separation of source and receiver, or a combination of individual procedures could be considered. These examples are included to show what may be achieved through addressing road surface design and noise barrier design.

Initial calculations were conducted in order to obtain an insight into the effects of applying either of two noise mitigation measures along the section of road shown in Figure 27, i.e. either erecting noise barriers, or resurfacing the road with low-noise, two-layer, porous asphalt. The same traffic flow data was used in all cases. It is to be noted that the land slopes down from west to east.

The mitigation affects of noise barriers are displayed in Figures 28 through 29. The mitigation effects of using low-noise, porous asphalt are displayed in Figures 31 and 32 for a receiver, respectively, at 1,5 m above local ground level and at a level of upstairs windows of two-storey dwellings, namely, 5 m above local ground level.

Figure 28 provides an indication of the noise mitigation provided by a 1,5 m high barrier (wall) along the eastern edge of the freeway on the land to the east of the N2 freeway for existing traffic. The

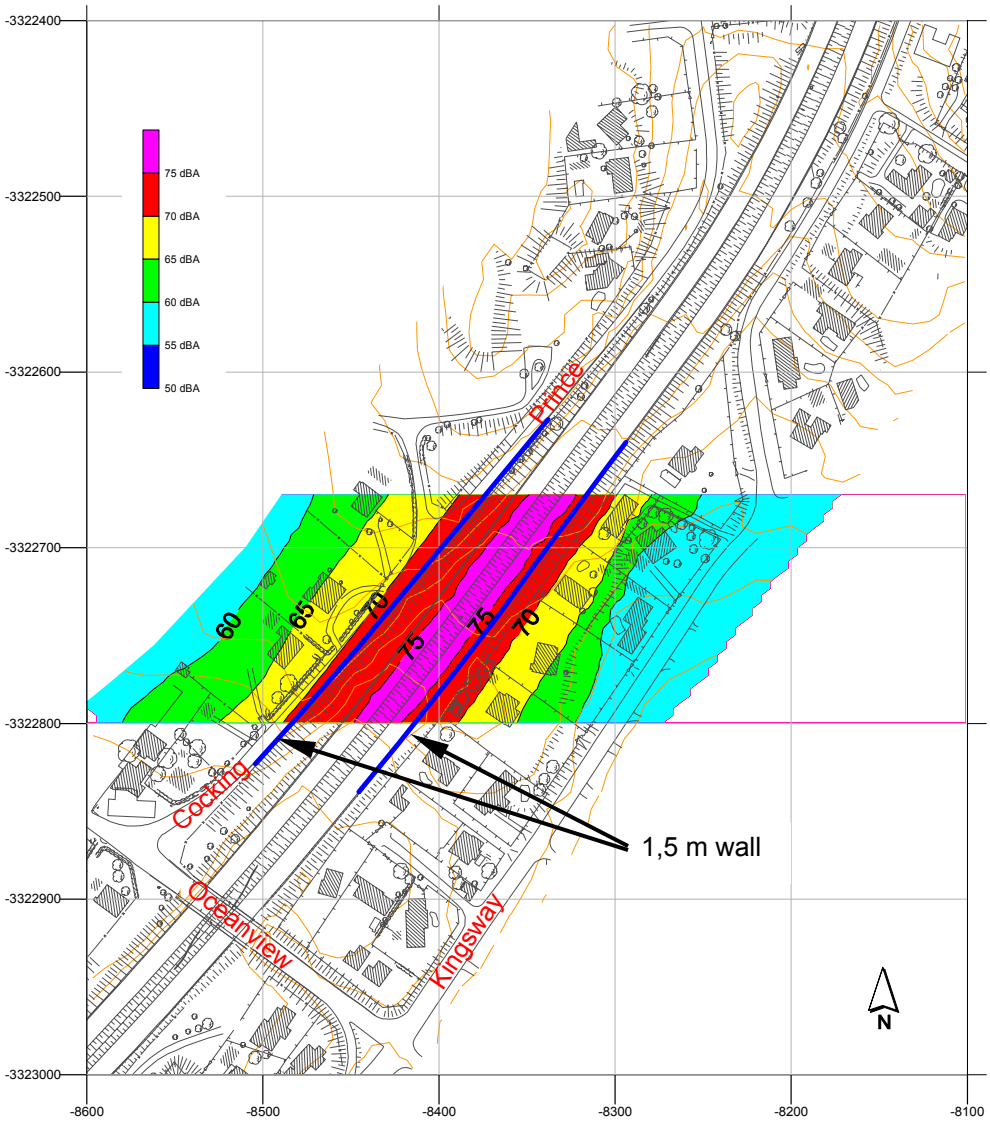
calculations indicate that the noise exposure, measured 1,5 m above local ground level, would be reduced but would still exceed the 65 dBA limit on portions of the residential properties shown.



Vehicles per hour: 500 in each of two lanes in both directions; total 2000
Percentage heavy duty vehicles: 4,6%
Mean vehicle speed: 120 km/h
Road surface: dense asphalt
Receiver: 1,5 m above local ground level
Noise barrier: 1,5 m high wall along the eastern edge of the freeway

Figure 28: $L_{Req,d}$ on residential land adjacent to the N2, Umbogintwini, with 1,5 m high wall along eastern edge of the freeway

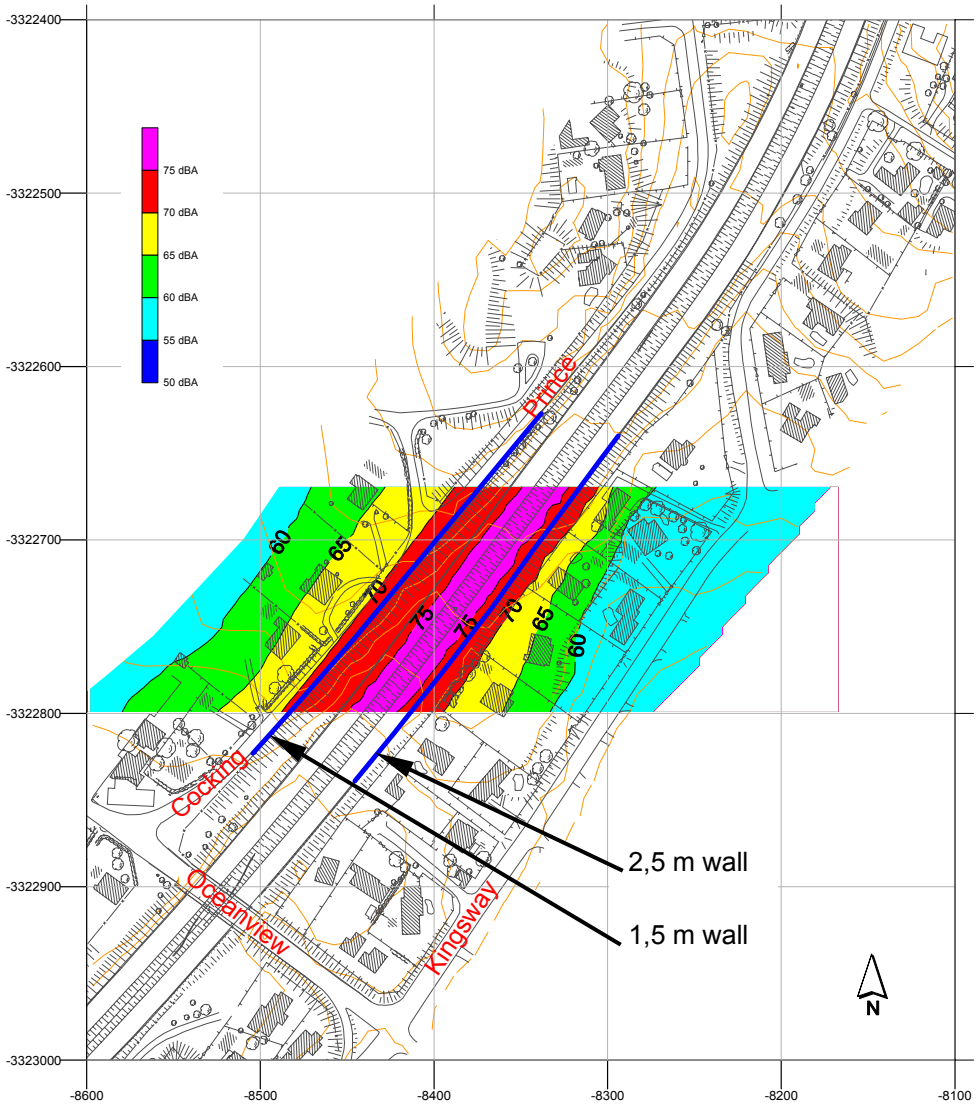
The Noise Control Regulations stipulate that noise be assessed at a receiver height of 1,5 m. This, however, provides no information regarding the exposure to noise from the freeway at upper storey windows of two-storey dwellings that are located along this section of the N2. The influence of a 1,5 m barrier (wall) placed at the upper edge of the embankment on the western side of the road and a 1,5 m high barrier at the eastern edge of the road on the $L_{Req,d}$, measured at the level of an upper storey window, namely, 5 m above local ground level, is shown in Figure 29.



Vehicles per hour: 500 in each of two lanes in both directions; total 2000
Percentage heavy duty vehicles: 4,6%
Mean vehicle speed: 120 km/h
Road surface: dense asphalt
Receiver: 5 m above local ground level
Noise barriers: 1,5 m high wall on top of embankment on western side of freeway
1,5 m high wall on eastern edge of freeway

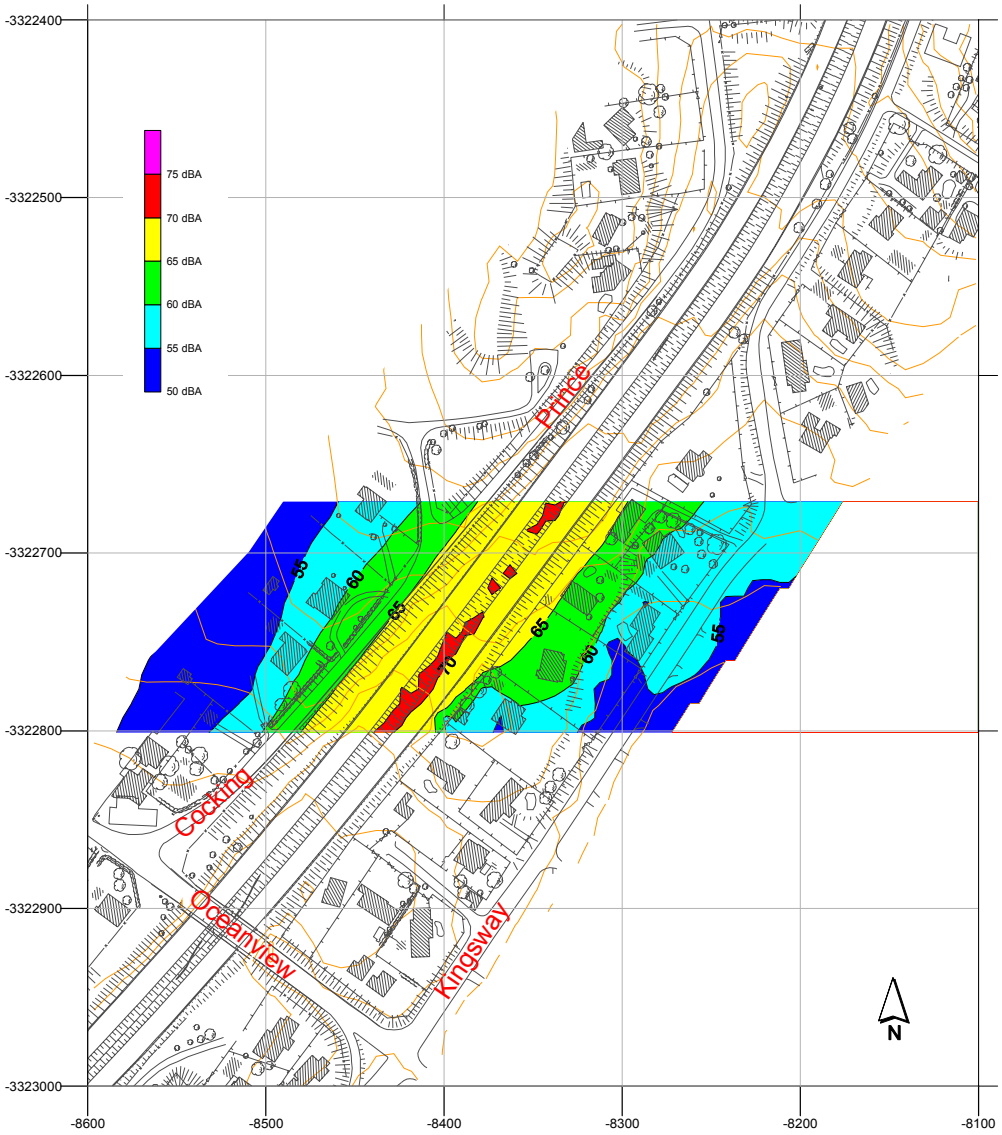
Figure 29 **$L_{Req,d}$ at level of 1st floor window of residences adjacent to the N2, Umbogintwini, with noise barriers along both sides of the freeway**

Comparison of the noise contours in Figure 29 with those in Figure 27 indicates that both 1,5 m high noise barriers do not provide a significant reduction in $L_{Req,d}$ for the upper storey windows. Figure 30 indicates that, by raising the eastern noise barrier to 2,5 m, this will still not provide sufficient reduction in $L_{Req,d}$.



Vehicles per hour: 500 in each of two lanes in both directions; total 2000
Percentage heavy duty vehicles: 4,6%
Mean vehicle speed: 120 km/h
Road surface: dense asphalt
Receiver: 5 m above local ground level
Noise barriers: 1,5 m high wall on top of embankment on western side of freeway
2,5 m high wall along eastern edge of freeway

Figure 30 **$L_{Req,d}$ at level of 1st floor window of residences adjacent to the N2, Umbogintwini, with noise barriers along both sides of the freeway**



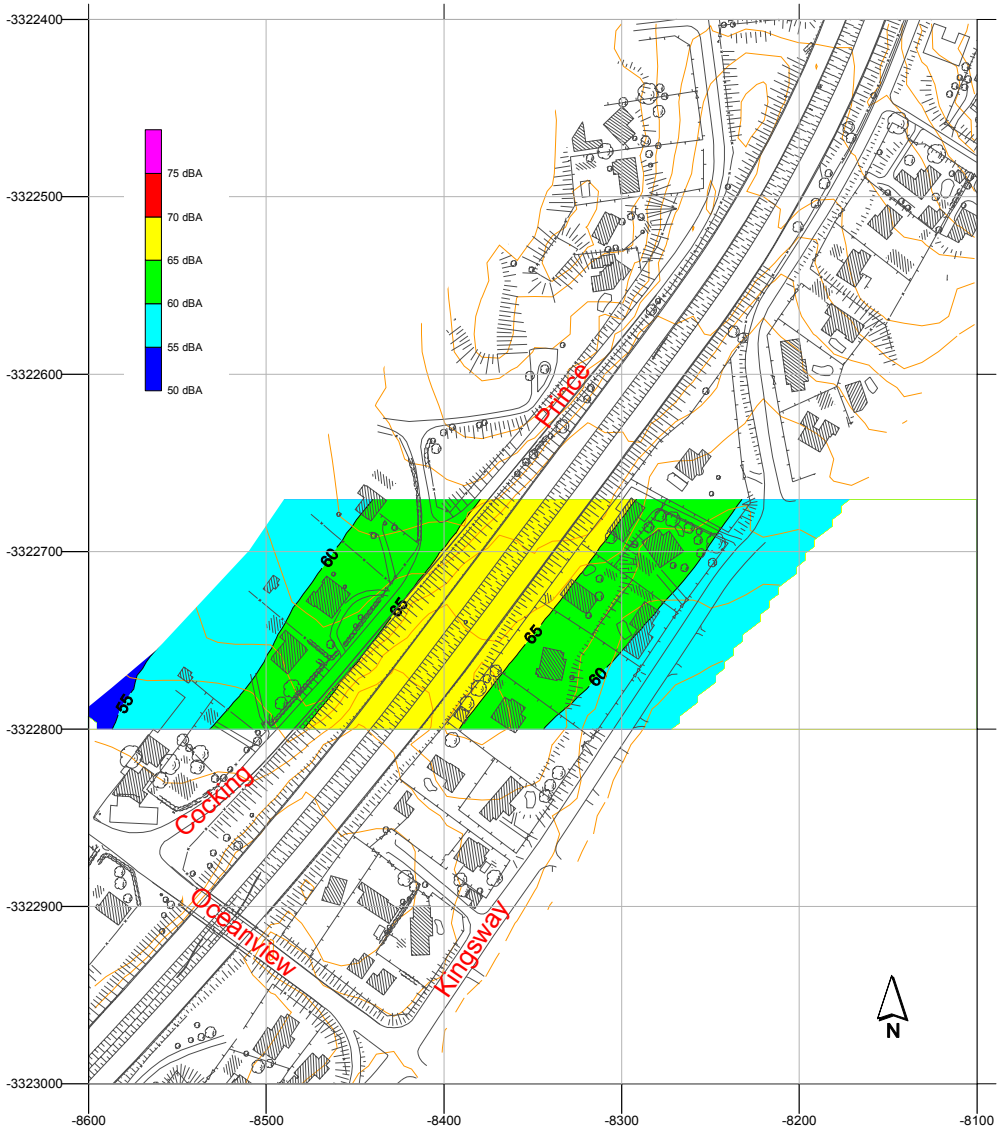
Vehicles per hour: 500 in each of two lanes in both directions; total 2000
Percentage heavy duty vehicles: 4,6%
Mean vehicle speed: 120 km/h
Road surface: low-noise, two-layer, porous asphalt
Receiver: 1,5 m above local ground level

Figure 31 **$L_{Req,d}$ on residential land adjacent to the N2, Umbogintwini, surfaced with low-noise, two-layer, porous asphalt**

Comparison of the noise contours in Figure 31 with those in Figure 28 indicate the following:

- The $L_{Req,d}$ values on all residential land to the west of the road are below 65 dBA and, therefore, would comply with the Noise Control Regulations. The lower L_{Aeq} values in Figure 31compared to Figure 28 are due to the combined effects of the low-noise road surface and the noise screening provided by the western embankment.

Residential land to the east of the road is partially exposed to L_{Aeq} values in excess of 65 dBA. The land area so exposed is similar in extent to that shown in Figure 28. However, at distances further removed from the road, the L_{Aeq} values are less than those shown in Figure 28.



Vehicles per hour: 500 in each of two lanes in both directions; total 2000
Percentage heavy duty vehicles: 4,6%
Mean vehicle speed: 120 km/h
Road surface: low-noise, two-layer, porous asphalt
Receiver: 5 m above local ground level

Figure 32: **$L_{Req,d}$ at level of 1st floor window of residences adjacent to the N2, Umbogintwini, surfaced with low-noise, two-layer, porous asphalt**

Comparison of the noise contours in Figure 32 with those in Figures 29 and 30 indicate the following:

- The $L_{Req,d}$ values at 1st floor window level of residential properties to the west of the road are below 65 dBA and therefore would comply with the Noise Control Regulations. The lower $L_{Req,d}$ values in Figure 31 compared to Figure 28 are due to the combined effects of the low-noise road surface and the noise screening provided by the western embankment.

- The $L_{Req,d}$ values at 1st floor window level of residential properties to the east of the road are lower than those shown in Figure 22 for a 1,5 m high wall located at the eastern edge of the road.

- The $L_{Req,d}$ values at 1st floor window level of residential properties to the east of the road are similar to those shown in Figure 30 with a 2,5 m high wall located at the eastern edge of the road when measured at the facades of the buildings shown. At distances further removed from the road the levels are slightly higher.

The various scenarios presented indicate that, when using a conventional smooth asphalt road surface, barrier heights would need to exceed the 1,5 m height used in the foregoing examples in order to reduce the noise levels due to existing traffic to 65 dBA and thereby comply with the Noise Control Regulations. The noise barriers along this section of the route would need to be higher than 2,5 m in order to reduce the $L_{Req,d}$ at upper storey windows of dwellings to 65 dBA.

The use of low-noise, two layer, porous asphalt along this section of the route would reduce the $L_{Req,d}$ to levels compliant with the Noise Control Regulations on residential land west of the road as well as at the level of 1st floor windows. However, on residential land east of the road, the use of low-noise, porous asphalt would not reduce the $L_{Req,d}$ values sufficiently so as to comply with the Noise Control Regulations.

It is expected that the combined use of low-noise, porous asphalt and a 1,5 m high barrier along the eastern edge of the road would result in $L_{Req,d}$ values on all residential land shown in the Figures being compliant with the Noise Control Regulations.

This Chapter has illustrated the effectiveness and limitations of two noise mitigation procedures, namely, low-noise road surface and noise barriers. During the Environmental Management Plan stage and final design the most appropriate measures for the particular portions of the route would need to be incorporated. These include:

- Road surface design (sub-options as described in Chapter 3.2.1 and others)
- Noise barriers (sub-options as described in Chapter 3.2.2 and others);
- Addressing the noise at source (speed restrictions, signage)
- Increasing the separation between source and receiver (through a change in land use or zoning, or moving the affected receiver). This should only be considered if the first three options, either singly or in combination, cannot be implemented.

Recommendations

In terms of the legal requirements contained in the Noise Control Regulations, noise mitigation measures along this section of the road would be required to be implemented to reduce the $L_{Req,d}$ to 65 dBA on all land zoned for residential, educational, hospital and office use. Due to the variation in topography, the distance to nearest noise sensitive land, the available space and the ground

conditions for the erection of noise barriers, the mitigation measures along this section would need to be determined at the detailed design stage of the project with due regard to cost implications of each alternative and/or combined noise mitigation procedure.

It is reiterated that compliance with the legal requirements of the NCR might still result in a noise impact that is unacceptable in terms of SANS 10103 and WHO.

4.11.11 Proposed Joyner Road ramp toll plazas

The Joyner Road interchange is situated in an industrial zone with no noise sensitive land in the vicinity. For this reason no noise impact is expected from the proposed ramp toll plazas.

4.11.12 Proposed mainline toll plaza at Isipingo

It is proposed to locate a mainline toll plaza between Moss Kolnick Road and the Isipingo interchange. This section of the road is located close to the Durban International Airport and is flanked by land zoned for industrial use. For this reason no noise impact is expected from the proposed toll plaza.

4.11.13 Road traffic noise on alternative routes

Drivers wishing to avoid the N2 Toll Highway are able to travel on the R102 that runs close to the coast from Isipingo to Pennington before turning inland. This represents the primary alternative route with the largest amount of traffic travelling on a two lane, single carriageway through Umbogintwini flanked by residential properties with boundaries within 6 m of the nearest road edge.

Existing and predicted future Average Daily Traffic (ADT) figures made available by the traffic specialist were used to calculate the $L_{Req,d}$ at the nearest property boundaries flanking Kingsway in Umbogintwini in accordance with procedures outlined in Chapter 4.1. Kingsway forms part of the R102 and is shown in Figures 28 through 32 in Chapter 4.11.10. It is to be noted that the noise contours displayed in those Figures are solely due to noise emanating from the N2.

Table 8 records the year; the ADT for no tolling and with tolling of the N2; and the calculated $L_{Req,d}$, to the nearest dB at the property boundary for conventional smooth asphalt, for porous asphalt and for two-layer low-noise porous asphalt. Refer to Chapter 4.2. An average mean speed of 70 km/hr and 5,2% heavy-duty traffic was assumed. The $L_{Req,d}$ recorded in the Table are only due to noise emanating from traffic on Kingsway. The $L_{Req,d}$ on the residential properties, due to the combined noise from the N2 plus Kingsway, will be somewhat higher.

Table 8 Existing and future $L_{Req,d}$ along Kingsway, Umbogintwini

Year	2007	2017		2022	
Situation	Existing	No toll	Toll	No toll	Toll
ADT	22735	33654	40160	40945	48861
Smooth asphalt $L_{Req,d}$ dBA	74	75	76	76	77
Porous asphalt $L_{Req,d}$ dBA	70	72	73	73	73
2-layer low-noise $L_{Req,d}$ dBA	68	69	70	70	71

Assessment
The results recorded in the 4th row of the Table indicate that the existing $L_{Req,d}$ of 74 dBA on residential land flanking Kingsway is exceptionally high; exceeding the acceptable outdoor $L_{Req,d}$ in a suburban district (with little road traffic) by 24 dB and in an urban residential district by 19 dB. However one may classify the area, the existing intensity of impact is ***very high*** with **very high** significance.

Based on the ADT values the predicted increase in $L_{Req,d}$ over the subsequent 10 and 15 years is barely significant, with or without tolling of the N2. However, any increase will exacerbate an already unacceptably high exposure to road traffic noise on residential land in this suburb.

The situation in Umbogintwini is sadly not unique but occurs throughout South Africa as a result of a lack of adequate, holistic planning that has taken place throughout the country.

Mitigation
Due to the close proximity of residential land to the R102, the use of low-noise road surfaces, as demonstrated in the 5th and 6th rows, will lessen the levels of noise but not sufficiently to even nearly approach the acceptable $L_{Req,d}$. In considering the erection of noise barriers their effectiveness is seriously compromised, if not nullified, where apertures are required for cross roads and driveway access. Noise barriers would only be effective if these could be erected between the R102 and, where space is available, parallel service roads providing access to the residences. One is faced with the consequence of inadequate planning whereby technical noise mitigation alternatives cannot be practically implemented.

Within the physical constraints imposed on noise mitigation alternatives in Umbogintwini and similar land further south along the R102 it is recommended that serious consideration be given to attracting through-traffic away from the R102 onto the N2. This would imply that the section of the N2 Highway skirting the residential suburbs south of Durban not be tolled.

5 CONSTRUCTION NOISE

Various forms of construction activities will take place along different parts of the proposed Toll Highway varying from extensive earth movement of virgin land, possibly including blasting, to rehabilitation and resurfacing of existing roads.

The level of noise emitted by machinery is related to the mechanical power required by the machine to perform the required function. Thus, greater power is required by, for example, a bulldozer to move earth than a paver to lay a new bituminous road surface. Thus, in principle, higher noise emissions may be expected from a bulldozer than machinery used during road rehabilitation. However, noise emission is strongly dependent on the “noise reduction packages” incorporated by the manufacturer of the machinery. With the increasing enforcement of noise control legislation throughout the world, manufacturers have been “encouraged” and are capable of supplying new heavy-duty machinery/vehicles with very low noise emission levels.

Blasting activities are very sophisticated and are strictly legislated. Contrary, perhaps to the uninitiated, blasting of rock can take place with little emission of airborne sound and of ground vibration. During blasting operations at a quarry, had the author not visually observed blasting taking place, he would not have been aware of the fact.

The noise emitted by earth moving machinery and heavy duty vehicles can vary considerably during normal operating conditions. The results are rarely repeatable making it difficult to compare the noise emissions of different vehicles. For this reason the noise emission is measured under controlled conditions such that the same values are obtained when repeated under the same operating condition.

The author has measured the noise emission of numerous types of heavy-duty vehicles and of earth moving machinery of different manufacturers under controlled conditions as well as under normal operating conditions. Results obtained under controlled conditions were within 0,5 dB of those provided by the manufacturer, where the information was supplied. However, such results excluded additional sounds as are produced by rocks falling into trucks during loading, squealing of the rubble as it slides out of the truck during dumping, reverse hooter and the effect of the engine operating under differing loads. Sound measurements were therefore also recorded of front end loaders, trucks and bulldozers during normal operating conditions.

The emission of noise by a source is normally recorded in octave frequency band sound power levels obtained from measured octave frequency band sound pressure levels at a known distance from the noise source thereby permitting direct comparison of sound energy sources and enabling the calculation of the sound pressure level at a known distance in accordance with SANS 10357.

Table 9 records the sound power levels, L_W (dB), emitted by typical heavy-duty machinery that might be used during new road construction and the calculated separation distance required for the outdoor $L_{Aeq,T}$ (dBA), during continuous operation, to decrease to 65, 55 and 45 dBA, respectively. These represent the $L_{Aeq,T}$ of two of the "noisier" activities recorded, including reverse hooters and noise associated with dumping of rubble, and can thus be considered to be worst-case scenarios.

Table 9 L_W emission of heavy-duty machinery and separation distances required for different $L_{Aeq,T}$ values

Machinery & operating conditions	L_W, dB	Separation distance, m, for,		
		65 dBA	55 dBA	45 dBA
CAT D11 bulldozer moving earth, reversing and repeating – several cycles	115	135	378	944
CAT5130B front-end loader loading CAT777D truck after approaching and subsequently leaving loading area – several cycles	112	79	229	602

Assessment

- The 3rd column provides an indication of the separation distance beyond which the $L_{Aeq,T}$ would comply with the NCR limit but with an associated impact of ***very high*** and ***high*** on rural and suburban land, respectively, and decreasing with increasing distance.
- The 4th column provides an indication of the separation distance at which the noise would be distinctly noticeable on rural land with an associated ***medium*** intensity of noise impact whereas in a suburban district it would be noticeable with an associated ***low*** intensity of noise impact.
- The 5th column provides an indication of the separation distance on rural land at which noise from the particular operation would barely be audible.

The significance of the impacts would depend upon the total duration of the construction activities in the vicinity of receiver locations. The impact may be reduced by not only utilising construction processes and machinery with low noise emission values, but also by increasing the number of vehicles/machinery needed to shorten the total construction duration in a particular area as much as possible. The latter is based on the scientific fact that a doubling of sound power emission results in only a 3dB increase in sound level at a receiver location; an almost imperceptible difference. Thus, utilising two similar trucks simultaneously will cause a 3 dB increase over that of one truck. Utilising four trucks simultaneously will result in a further 3 dB (total 6 dB). Utilising eight trucks simultaneously will add a further 3 dB (total 9 dB).

A 6 dB difference in sound level is perceived as significant while 9 dB is perceived as an almost doubling of “loudness”. In practice, however, vehicles/machinery on a construction site do not all generate noise simultaneously. For example, a truck idles (generating little noise) while a front-end loader emits noise while loading the truck. As a full truck generates noise as it moves away, the front-end loader idles (generating little noise) while waiting for the next truck.

No similar, quantitative record was available of noise emissions during rehabilitation of existing roads. It has been observed that, where rehabilitation occurs while maintaining traffic flow over part of a road, there is little increase in total $L_{Req,d}$ due to machinery used for rehabilitation over that due to the traffic.

The construction of additional of lanes, such as between Amanzimtoti and Isipingo, may result in ground vibration associated with compaction of the earth being perceived at nearby residences and on other noise sensitive land. This may be accompanied by noise of rattling of fixtures to buildings. It is difficult to quantify the noise impact associated with this activity. The intensity and significance of this impact may similarly be reduced by shortening the total duration of the compaction process.

Recommendations

The following recommendations are made where road construction/rehabilitation takes place within approximately 1 km of residential and other noise sensitive land:

- Construction processes and machinery/vehicles with the lowest noise emission values available are utilised.
- A well planned and co-ordinated “fast track” procedure is implemented to complete the total construction process in any area in the shortest possible time.
- Construction only takes place during normal daytime working hours. No construction activities are to be permitted during weekday evenings and night-time, on Saturdays after midday and the entire day on Sundays.

6 CONCLUSIONS

A Noise Impact Investigation was conducted into the proposed N2 Wild Coast Toll Highway in accordance with NEMA. The Investigation included sections of the proposed project consisting of either the construction of a new road, or changes to an existing road, for which proposed road alignment data was available. These were:

- The construction of a new road between Ndwalane and the Mtamvuna River,
- The construction of a third lane in each direction of the existing N2 between Amanzimtoti and the Isipingo interchange.

The proposed construction of a new road between Ndwalane and the Mtamvuna River was expected to cause a significant increase in noise levels on land extending up to approximately 700 m on either side of the road within the concession period with the noise level exceeding 65dBA up to 50m from the road edge. The actual distance would be dependent on the topography of the land.

Between Lusikisiki and the Magwa intersection, the road would replace an existing concrete road carrying low volume traffic. Dense rural settlements are located in the vicinity of this section of the road. The existing $L_{Req,d}$ on all residential land adjacent to the concrete road was expected to be less than 65 dBA, thereby complying with the NCR.

In the absence of noise mitigation measures, the increase in noise levels during the concession period, due to increased traffic volumes and speed on the proposed new road, were expected to result in the $L_{Req,d}$ exceeding the 65 dBA maximum limit contained in the NCR on land within approximately 50 m of the edge of the road for the entire section of the road between Ndwalane and the Mtamvuna River. The density of rural settlements adjacent to this section of the proposed road varies considerably. Where permanent residential dwellings are located within 50 m of the road edge, noise mitigation measures would be required to be implemented in terms of the Noise Control Regulations.

Road traffic on the existing N2 between Amanzimtoti and the Isipingo interchange causes the current $L_{Req,d}$ on adjacent land to significantly exceed the 65 dBA maximum limit stipulated by the Noise Control Regulations for all noise sensitive land excluding land zoned for industrial use. The addition of a third lane in each direction was expected to result in a further increase in the $L_{Req,d}$. The N2 passes through residential suburbs along this section of the road with residential properties extending up to the road reserve. At least one school site at Athlone Park also bounds the road reserve. In terms of the NCR, noise mitigation measures along this section of the road would be required to be implemented to reduce the $L_{Req,d}$ to 65 dBA on all land zoned for residential, educational, hospital and office use. As the road proceeds beyond Umbogintwini towards Isipingo the land use flanking the road changes from residential, through commercial, to industrial in the vicinity of Isipingo. No noise impact is anticipated on the latter land.

A number of mitigation measures are available to be used in reducing noise impact. These include:

- Road surface design
- Noise barriers
- Lowering vehicle speeds
- Increasing the separation between source and receiver.

Within the noise impact assessment, two alternative noise mitigation measures were actually modelled regarding noise emanating from free-flowing road traffic, namely, the use of a low-noise, porous road surface, and the erection of noise barriers close to the edge of the road. The results of detailed calculations indicated that a number of mitigation measures would be effective in addressing noise impact, including between Lusikisiki and the Mtamvuna River, and between Mtamvuna and Isipingo. The final mitigation measures selected may include other measures which, employed in combination, would ensure that the $L_{Req,d}$ remains below 65 dBA.

It has been stressed throughout this report that implementation of noise mitigation procedures in order to comply with the legal limit of 65 dBA imposed by the NCR on land adjacent to the road, could still result in the intensity off noise impact on large areas of land still being high due to the $L_{Req,d}$ exceeding the acceptable levels contained in SANS 10103 and exceeding the levels recommended by WHO. It is recommended that adequate noise mitigation procedures be implemented to ensure an $L_{Req,d}$ = 55 dBA not be exceeded on residential and other noise sensitive land.

Mainline toll plazas have been proposed at various locations along the proposed N2 Wild Coast Toll Road Project. Neither the Noise Control Regulations, nor SANS 10328 contain procedures to assess the impact of noise emanating from toll plazas. In this investigation the assessment of noise from the proposed toll plaza locations, and the associated noise mitigation recommendations, have been based on the results of detailed investigations conducted at typical toll plazas in South Africa (Jongens Keet Associates, May 2002) and procedures recommended by the World Health Organization [WHO, 4].

The existing $L_{Req,d}$ on land flanking the alternative R102 route, such as Kingsway, is unacceptably high. Although the predicted increase in $L_{Req,d}$ over the subsequent 10 and 15 years is barely significant, with or without tolling of the N2, any increase will exacerbate an already unacceptably high exposure to road traffic noise on residential land in this suburb. As a consequence of inadequate planning, technical noise mitigation alternatives cannot be practically implemented on residential land directly flanking the R102. It is thus recommended that serious consideration be given to attracting through-traffic away from the R102 onto the N2. This would imply that the section of the N2 Highway skirting the residential suburbs south of Durban <u>not</u> be tolled.

The intensity of impact of noise during construction of new roads through rural areas is expected to range between very high on land within approximately 150 m of construction work to medium at approximately 400 m distance. In order to minimise the significance of the impact it is recommended that machinery with the lowest noise emission be used and that a well planned and co-ordinated “fast track” procedure is implemented to complete the total construction process in any area in the shortest possible time.

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SANS 10103	The measurement and rating of environmental noise with respect to annoyance and to speech communication.
SANS 10210	Calculating and predicting road traffic noise
SANS 10357	The calculation of sound propagation by the Concawe method.

APPENDIX A

Glossary of terms used in the measurement and assessment of Sound

This Appendix contains terms defined in SANS 10328 and SANS 10103. Their meanings are in certain instances loosely described to facilitate understanding.

Ambient noise
The totally encompassing sound in a given situation at a given time, and is usually composed of sound from many sources, both near and far including noise from the source(s) under investigation.

dB
Abbreviation of the **decibel**. It denotes the human's subjective response to the change in amplitude ("loudness") of sound pressure variations on a logarithmic scale as opposed to a linear scale.

A-weighted sound pressure level (sound level), L_{pA} or L_A (in dBA)
The sound pressure level, in decibels, relative to a reference sound pressure, and incorporating an electrical filter network (A-weighting circuit) in the measuring instrument corresponding with the human ear's different sensitivity to sound at different frequencies.

Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$ (dBA)
The term "equivalent continuous" may be understood to mean the "average" A-weighted sound level measured continuously, or calculated, over a time interval T.

Equivalent continuous rating level, $L_{Req,T}$ (dBA)
The equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$, measured or calculated during a specified time interval T, to which is added adjustments for tonal character, impulsiveness of the sound and the time of day. An adjustment of 5 dB is added for any tonal character, if present, plus a further 5 dB if the noise is also of an impulsive nature. Where neither is present, the $L_{Req,T}$ is equal to the $L_{Aeq,T}$.

Reference time interval
The time interval to which an equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$, or rating level of noise, $L_{Req,T}$, is referred. Unless otherwise indicated, the reference time interval is interpreted as follows:

–	Day-time:	06:00 to 22:00hrs	T=16 hours	when $L_{Req,T}$ is denoted $L_{Req,d}$
–	Night-time:	22:00 to 06:00hrs	T=8 hours	when $L_{Req,T}$ is denoted $L_{Req,n}$

Equivalent continuous day/night rating level, $L_{R,dn}$
$L_{Req,d}$ combined (on an energy basis) with ($L_{Req,n}$ + 10 dB). The reference time interval, T = 24 hours. 10 dB is added to $L_{Req,n}$ because of the greater sensitivity to noise during night time.

Residual noise
The ambient noise that remains at a given position in a given situation when one or more specific noises (usually those under investigation) are suppressed.

APPENDIX B PEER REVIEW REPORT

The reviewer is thanked for his valuable input.

François Malherbe

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CCA Environmental
Attention: Mr. Fuad Fredericks
PO Box 10145
Caledon Square
7905

2 April 2008

Dear Mr. Fredericks

PEER REVIEW OF SPECIALIST NOISE STUDY
ENVIRONMENTAL IMPACT ASSESSMENT OF THE PROPOSED N2 WILD COAST TOLL HIGHWAY

1. GENERAL REMARKS ON THE APPROACH OF THE STUDY

The task of presenting a noise study for a stretch of road 560 km long is a formidable one A balance has to be found between presenting enough detail on the one hand without loosing the overview of the project. The approach chosen by the consultant was to provide detailed calculation results, presented as contours of noise levels along sections 5 and 6 of the proposed highway east of Lusikisiki. The assumption was then made that since the topography is similar to that of the other sections these results could be extrapolated to the other sections of the project. A further assumption that this approach implies is that the same traffic flow conditions apply to sections 1 to 6 of the project. As far as could be ascertained this assumption is nowhere clearly stated in the report, neither are the assumed traffic flow conditions.

For normal traffic flow conditions the contours of high impact, i.e. indicating a resulting noise level of 65 dBA or higher, are located in close proximity to the road. Therefore,

whereas some accuracy is lost in this approach of extrapolating results in the general sense, the assessment of the noise impact in terms of the requirements of the Noise Regulations will remain relatively unaffected by the specific topography of the area.

Therefore, I am reasonably satisfied that the general approach to the noise study is a valid one for sections 1 to 6 of the project.

For the section in the vicinity of Umbogintwini detailed calculation results are provided (section 4.11.8 of the report) but only for a relatively small distance along the highway. The results are again extrapolated to the other parts of the section, including that containing the highly affected school in Athlone Park. No reasons for providing only this small a section of calculated results is given and, in my opinion, a detailed analysis over a longer distance of the proposed toll highway would have better illustrated the deductions and assessments made. However, the report does recommend that the final mitigation measures along this section would need to be determined at the detailed design stage. Therefore, I am satisfied that the conclusions drawn on the limited analysis are meaningful and correct for the purpose of this study.

2. COMPLIANCE WITH THE TERMS OF REFERENCE

The submitted report was studied in detail and in my opinion the Terms of Reference have in essence been complied with.

3. CONSIDERATION GIVEN TO THE LEGAL, POLICY AND PLANNING CONTEXT OF THE PROJECT

The legal, policy and planning context in terms of the noise aspects of the project are discussed in great detail in section 2 of the report under the heading 'Identification of Risk Sources'. I would have preferred if the legal and related aspects of the report would have been discussed under their own heading.

4. STUDY APPROACH, TECHNICAL CONTENT AND ASSESSMENT METHODOLOGY OF THE STUDY

As discussed in section 1 of this review report, I am satisfied that the study approach is credible. The calculation methodology that was used is as prescribed by SANS 10328, i.e. in accordance with SANS 10210, and is, therefore, technically correct. Considerable effort is invested in explaining the mechanisms of road traffic noise and the special case of noise generated by the use of toll plazas. The criterion according to which the assessment is carried out is described in detail in section 3 of the report.

Therefore, I am satisfied that the technical content and assessment methodology of the report are credible.

5. ADEQUACY OF THE INFORMATION USED

Apart from traffic flow for section 7 near Umbogintwini and the provision of some topographical images, there is no specific listing of the input data used in the calculation of the results. Therefore, it is difficult to assess whether all the information used in the study was adequate or not. However, judging by the quality of the results provided, adequate information was available for the calculations to be performed in a credible way.

6. SIGNIFICANCE RATINGS OF POTENTIAL IMPACTS

In my opinion the significance ratings given to the potential impacts are reasonable and reliable and in line with general good practice, as described in SANS 10103.

7. RECOMMENDATIONS OF THE STUDY

The recommendations of the study centre on the application of noise mitigation measures. These are well motivated. The one recommendation that will be seen as controversial is that the section of the N2 Highway skirting the residential suburbs south of Durban not be tolled, so as not to increase road traffic noise levels on the alternative route. However, although controversial, the recommendation is well motivated, and I would support it.

8. ALTERNATIVE VIEWPOINTS OF THE REVIEWER

The reviewer has found no alternative viewpoints to the issues presented in the report.

9. KEY UNCERTAINTIES OR RISKS AND/OR ASSUMPTIONS

It is my considered opinion that the key uncertainties or risks have been sufficiently highlighted in the report. As far as the assumptions are concerned the fact that the same traffic flow conditions are assumed for sections 1 to 6 of the project should be clearly stated. Furthermore, a listing of the information/data that was available for the calculations should also be provided.

F Ie R Malherbe Pr Eng

Comments and Response Table on report of peer reviewer F. Malherbe

Reviewer's comments	Response
1. General Remarks "The approach chosen by the consultant was to provide detailed calculation results, presented as contours of noise levels along sections 5 and 6 of the proposed highway east of Lusikisiki. The assumption was then made that since the topography is similar to that of the other sections these results could be extrapolated to the other sections. A further assumption that this approach implies is that the same traffic flow conditions apply to sections 1 to 6 of the project" "…detailed calculation results are provided (section 4.11.8 of the report) but only for a relatively small distance along the highway."	**3.1.2** of the report described the sections of the route included in the study. For clarification the following sentence has been included, "The potential noise impact of the proposed new road through the Greenfields, sections 5 and 6, is included in this investigation." **Heading 4** of the report indeed stated, in error: " ..Sections 1 through 6.." This has been corrected to read ".. Sections 5 and 6 .." with additional clarification in the first sentence of that paragraph. **4.11.8 through 4.11.10** The topography along the Section of the route is undulating and variable. The portion studied in detail contained much of the variables characteristic of the land along the route. Viz. influence of differences in elevation relative to the

	road on the exposure to road traffic noise on either side of the road without and with alternative mitigation procedures. It was considered that for the purposes of a noise impact study the fundamental issues had been addressed, namely, the presence of an existing noise impact and alternative ways of mitigating the noise – in principle. Extending this to the whole Section would burden the reader with excessive and unnecessary detail that would in all likelihood be modified during the detail design stage of the road. The actual choice of practical mitigation procedures will be site dependent. This includes the proximity of residences/noise sensitive land to the road; the relative elevation that would determine the required height of a noise barrier; the land available to implement the mitigation measure; etc. This clarification has been included in 4.11.10.
3. Consideration given to the legal, policy and planning context of the project "I would have preferred if the legal and related aspects of the report would have been discussed under their own heading	The author agrees. In the original report it was indeed contained under a separate heading. However, it was an explicit requirement by the compilers of the present EIA report that it be changed to the present form.
5. Adequacy of the information used … There is no specific listing of the input data used in the calculation of the results.	Only peak traffic flow data was received from the traffic engineers. The midday hourly traffic flow (refer to 4.1) and mean speed was subsequently verbally obtained for the relevant sections from the traffic engineers. These appear in all the noise contour Figures.