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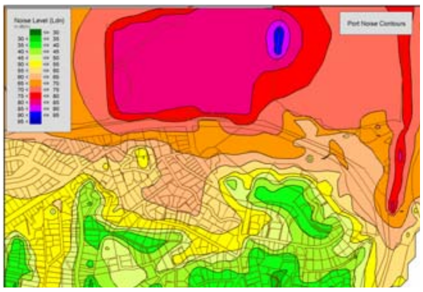


PREDICTING AND MODELLING PORT NOISE

Keith Ballagh, Marshall Day Acoustics, Auckland

NOTES TO ACCOMPANY THE PRESENTATION MADE AT COASTS & PORTS AUSTRALASIAN CONFERENCE 2003

Port Noise can be predicted accurately provided the necessary inputs are known. The three main inputs are:

- source sound levels;
- ground contours;
- operational information.

The principal noise sources are ships, straddle carriers, cranes, fork lifts, refrigerated containers, trucks and trains, and log handling equipment such as log grabbers.

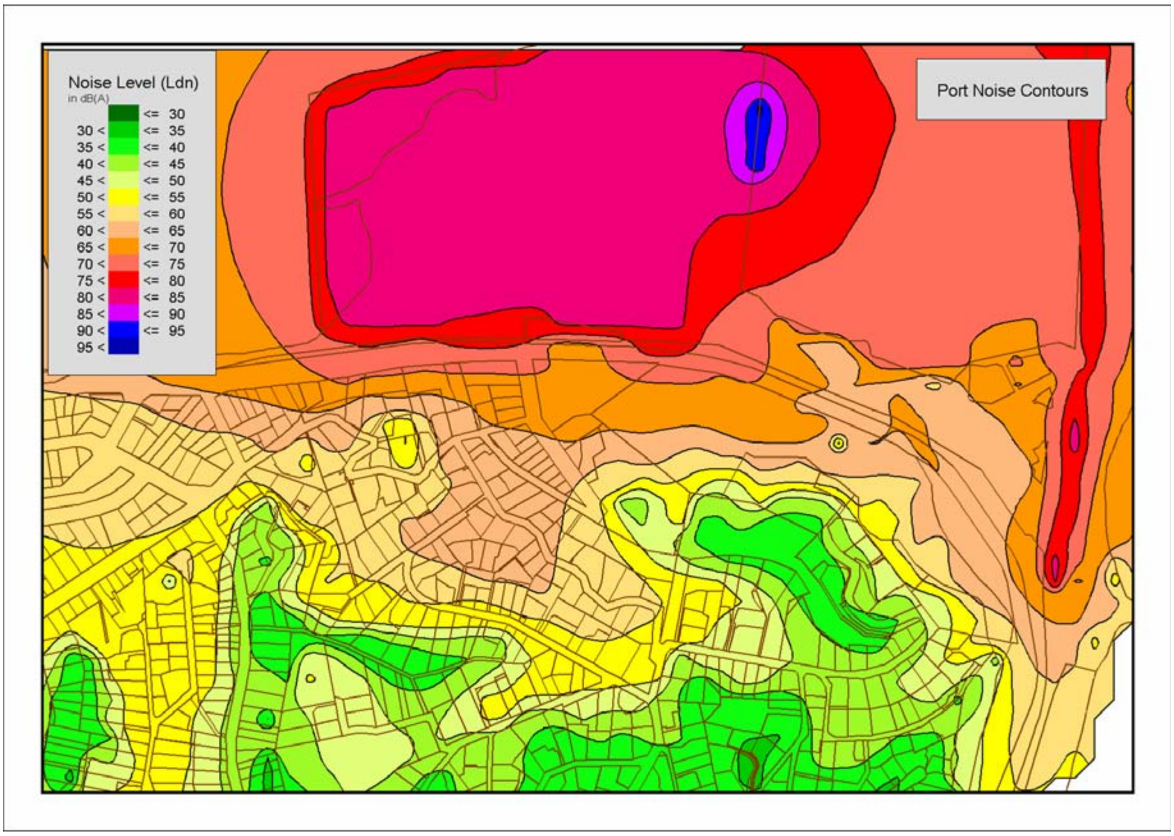
Each of these can be measured under normal working conditions to establish the sound power level of the source, and from this the sound level at different distances can be calculated. The ground topography must be accurately known since sound propagation is strongly affected by the ground contours between source and receiver, and Ports by their very nature tend to be surrounded by hilly terrain. Usually ground contours at 2 metre intervals can be obtained and would be sufficiently precise.

The operational data must be predicted for future uses of the Port since the intended life of the Port Noise boundaries is the life of the plan, i.e. about 10 years. This is extremely difficult to do, but unless a reasonable estimate is made the noise boundaries will be in the incorrect location. The critical factor is the "busy five day" scenario. The Port Company attempts to predict the number of ships that might visit in its busiest five days, the volume of cargo (eg the number of containers that would be handled) and hence the number of straddle carriers and forklifts that would be in operation, and the number of trucks and trains required to move that volume of cargo to and from the Port.

Once all the input data is assembled it is entered into noise prediction software such as SoundPLAN. This then predicts the noise over the area of interest and calculates the noise contours, and in particular, the L_{dn} 55 dBA and L_{dn} 65 dBA contours. The prediction software calculates the noise from each source to a grid of receiver points, typically spaced 10 metres apart, for each hour of the day, taking into account the fact that many of the sources move over a wide area. The noise levels at night (10.00pm – 7.00am) are penalised with a 10 dB weighting as required by the L_{dn} measure.

Usually a number of different scenario will be run to determine the worse case operating conditions as it is not always obvious what combinations of ships or cargo will produce the worst five day noise contours. A typical example of noise contours is shown in Figure 1.

Figure 1— Example of Port Noise Contours



EXAMPLES OF IMPLEMENTATION

Port Chalmers

Port Otago has had problems with noise for a number of years, and there have been a number of Court cases over the last 10 years concerning noise at Port Chalmers.

When the District Plan was prepared in 1997 the Port Noise Standard had not been finished and so in the draft plan the City Council retained the previous approach of attempting to limit noise levels with a typical industrial noise control. The Port submitted on this draft plan, requesting that an approach based on the current draft of the Port Noise Standard be used. Noise contours were prepared based on the Port Company's projections of future growth, and noise boundaries based on these contours were included in the revised Plan. This revised Plan was appealed and the reference has been heard earlier this year with a decision not yet released. It is interesting, however, to note that the Port Company took a quite different approach at the hearing. Having previously advocated the use of the Port Noise Standard it now requested the use of a noise management plan which would require it to operate at less than L_{dn} 65 dBA at any dwelling. It if could not, then it would be obliged to make an offer to either purchase the dwelling or to acoustically treat the dwelling to achieve an internal noise level of L_{dn} 45 dBA.

One of the main reasons for the Port moving to the noise management plan approach was that it found that developments at the Port had rendered the noise boundaries out of date within a very short time. In particular, the arrival of the so called supership (a container vessel carrying over 4,000 containers) as part of its trade. These superships were about 10 dBA noisier than the noisiest previous ship and pushed the noise contours well outside the noise boundaries that were supposed to last 10 years or more. The process of applying for a Plan change had such long time scales that it was considered impractical to react to changes in trade with the required speed by applying for a plan change to move the noise boundaries.

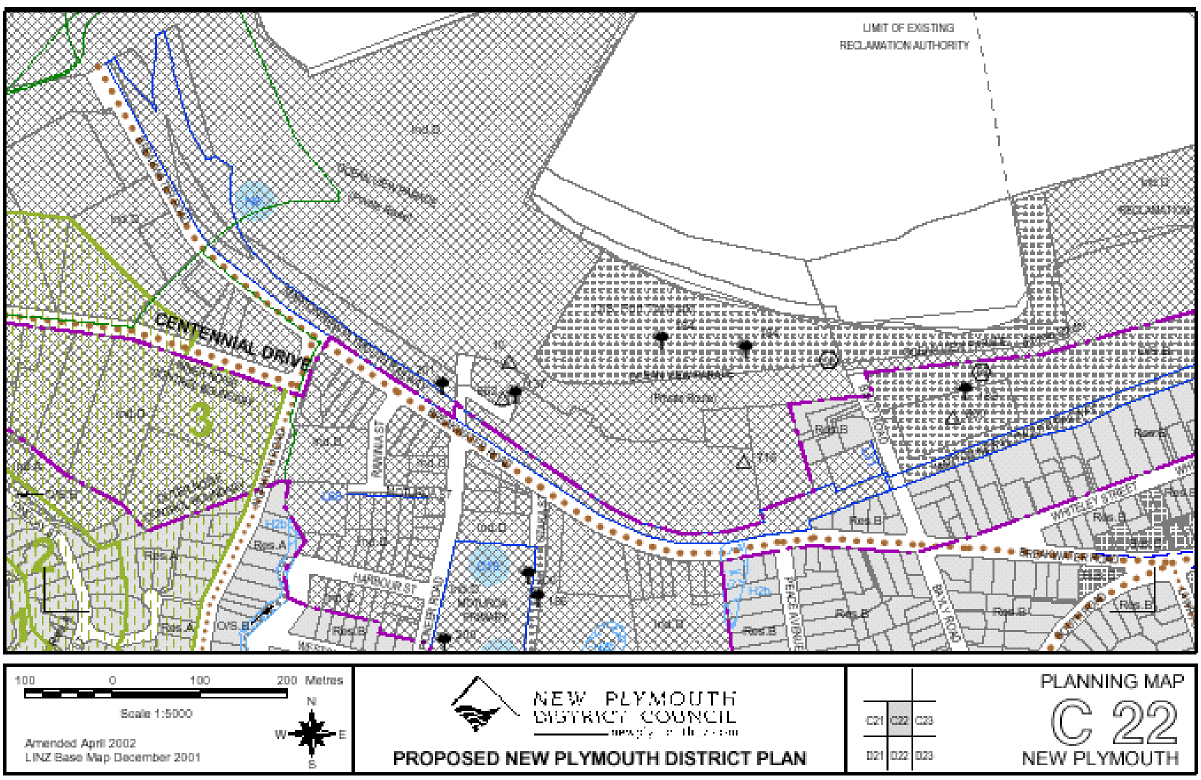
New Plymouth

The port at New Plymouth, operated by Westgate Transport, is well separated from residential areas and has not had significant problems with noise over the years. The planning situation has some similarities with Port Otago in that the Draft District Plan was prepared before the Port Noise Standard was finally published and so the City Council included the Port in the general industrial noise controls. Westgate submitted on the draft, requesting that the general principles of the draft Port Noise Standard be included in the District Plan, and developed a noise model of the Port Operations to predict noise contours from which inner and outer noise boundaries were developed.

This approach was adopted by the Hearings Committee and was not appealed. Thus, the operative plan includes an inner and outer noise boundary, with land use controls in the area between the two boundaries.

The Port must operate in compliance with a 5 day rolling L_{dn} of 65 dBA at the inner control boundary, and also meet short-term noise limits which are almost identical to the Port Noise Standard. A section of their plan map C22 is included as Figure 2.

Figure 2 -
Planning Map C22 showing location of Inner and Outer Noise Control Boundaries



Auckland

The main port at Auckland is relatively well situated with about 500 metres and a major road between themselves and the nearest residential area. When the Auckland City District Plan was being developed the Port Noise Standard was only just being started and so it was not used in the Draft Plan and a more conventional L_{10} control as used with a night-time limit of 50 dBA at the nearest residential zoned land. The reverse sensitivity issue has been dealt with by requiring specific acoustic design of new apartment developments north of Quay Street.

CONCLUSIONS

From an acoustic consultant's perspective the Port Noise Standard has been relatively successful, ironically being more successful at ports that do not have significant noise problems. The Standard allows the port some flexibility to create noise that would otherwise fall outside the normal industrial noise limits, while still placing controls on its noise. As ports have moved towards 24 hour, 7 day operations this flexibility has been essential. The incorporation of noise boundaries in District Plans has also signalled to local communities the areas where port noise will affect the amenity and provided some protection to ports from reverse sensitivity issues. As coastal properties have been more and more prized this protection is becoming of the utmost importance.

However, the Standard has been found to be inflexible in critical cases where the conflict between port and community is the most difficult. Primarily, this is because of the very dynamic changes in the transport industry, in which the types of cargoes, and the ships they travel in, change with lightning speed (in comparison to the glacial time scale of the Resource Management processes). This creates difficulties where noise boundaries have been fixed on operational assumptions that prove to be incorrect.

The Port Noise Standard has proved to be a valuable tool in managing conflicts between ports and communities, and without it we would undoubtedly be faced with a whole lot of District Plans that were unrealistic in trying to control port noise. However it would appear to be worthwhile to review the Standard in the near future, once District Plans controlling the main ports have been fully operative for 2 to 3 years. In this way the Standard could be ready for the next round of District Plan reviews. The main area of improvement would be a way of dealing with rapid change in port operations that occur.