



INAPPROPRIATE USE OF TRAIN HORNS IN RAIL CORRIDORS WITHIN MELBOURNE



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Executive Summary

- a) The 2015 State Budget announced that trains would run 24 hours a day during weekends. As a result, residents living adjacent to train tracks will experience significant sleep disturbance and associated health problems as train horns are sounded through the night.
- b) Despite assurances from the current government before the election that it would consider introducing night curfews to abate noise from running trains throughout the night, the Minister has gone back on this promise. This flies in the face of overseas experience, in which horn use has been limited at night to protect the health and welfare of residents.
- c) Even before the 24-hour weekend service is introduced, local communities adjacent to train lines have had to endure levels of unreasonable and sometimes harmful levels of noise later at night and into the early hours of the morning.
- d) Train operators are exempt from legislation that protects Victorians against nuisance or harmful noise. Thus, people living next to train lines are treated differently from the rest of the community, in that they have no legal recourse when subjected to excessive train noise, even when it affects their health and wellbeing.
- e) Current operating procedures for train horns only considers safety, and ignores the high cost to the health and welfare of people living near train lines. There is a need to redress this gross imbalance.
- f) Train horn noise affects a swath of local residents living within 200 metres of metropolitan train lines. It affects an estimated 280,000 people. As Melbourne undergoes urban consolidation around existing transport corridors, more residents will be exposed to train noise.
- g) Local residents are exposed to noise from train horns that can peak from 45 – 60 dBA at night. While noise from train horns is short and intermittent, it can cause:
 - Sleep disturbance;
 - Cardiovascular problems;
 - Quality of life to suffer; and
 - Children’s school performance to drop
- h) Assurances from a number of ministers over the past five years, that they had instructed Metro to minimise night-time noise, have not been honoured.

- i) Because there are no rules governing unnecessary and excessive use of train horns, Metro refuses to actively investigate complaints of unnecessary or overuse of train horns. Moreover, the Public Transport Ombudsman had no jurisdiction in this area. Not surprisingly, many local residents no longer bother complaining, and, as a result, complaint statistics are a gross underestimate of the level of dissatisfaction in the community.
- j) Overuse reduces the effectiveness of horns as a warning of danger, and this report identifies opportunities to reduce noise along rail corridors without compromising safety.
- k) Local government have not been consulted on the issue of train noise along exiting train corridors, even though it has a significant impact on their ability to discharge their responsibilities to their communities. For example, it reduces their capacity to optimise the effectiveness of their urban consolidation programs along train corridors, as they need to take into account environmental factors, such as noise on the amenity of people who will occupy new dwellings. In addition, councils are unable to protect their residents' welfare from nuisance noise.

Unless the State government acts on abating noise from running trains all night, local government may need to further limit development along train corridors.

- l) The State government refuses to make public rules that apply to train horn use and reports of the risks that train noise poses to human health and welfare.

Tasks

Investigate the legislation, policy and practices associated with the use of train horns in the Melbourne Metropolitan.

Describe the impact of noise pollution on residents living adjacent or near train lines.

Identify opportunities to reduce the impact of train horns in ways that do not compromise safety.

The Author

Background

Dr Harry Blutstein worked with Victorian Environment Protection Authority for 27 years, leaving the organisation in 2002. During that time, he managed the noise laboratory, noise policy and enforcement, among other duties. Between 1996 and 2002, he held the positions of Director of Scientific Services and Director of Sustainable Development.

He has also held positions as director of Envirolinx and Environmental Services Australia, and was on the international board of The Natural Step. He has also acted as an advisor to the US EPA and the United Nations Environment Programme and has been a member of the National Roundtable on Business Sustainability.

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Integrating Sustainability

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Rail Network

1. Melbourne's train network services a population of 4,350,000 people who live in the Greater Melbourne metropolitan area.¹
2. The length of rail lines in Melbourne's transport network is 464 kilometres, consisting of seventeen routes that radiate out from the city.²
3. According to the Australian Bureau of Statistics, the major growth areas are in the outer suburbs like South Morang, Epping, Cranbourne and Craigieburn, as well as inner suburbs where urban consolidation has increased population density.³ These trends have influenced transport planning, with new services promised for the outer suburbs in high growth areas, while the frequency and capacity of the network is also being expanded to match increasing demand.
4. The network is managed by the Public Transport Victoria (formerly Department of Transport) and the network is operated by Metro Trains Melbourne, a consortium of UGL Rail, MTR Corporation and John Holland, under a franchise agreement with Victorian government. The agreement commenced on 30 November 2009 for an initial period of eight years, with an option for up to an additional seven years.
5. Metro operates suburban trains and is also responsible for maintaining the rail tracks, signalling, electrical overhead system, and the stations on the suburban electrified rail system. It also operates the Metropolitan Train Control Centre (Metrol) and is responsible for all train movements on the suburban electrified network.
6. Around ten years ago, new types of rolling stock incorporated train horns that are louder than those of older trains. As a result, there was a significant increase in noise experienced by residents.
7. Responsibility for crossings is shared between local municipalities and VicRoads. There are 172 level crossings in the Metropolitan area. These are protected by active warning systems linked to the arrival of a train, principally: flashing lights, audible warnings and automatic boom gates. In addition, trains use horns to warn motorists, cyclists, pedestrians and commuters of oncoming trains.

¹ Population data is an estimate for June 2013 from the Australian Bureau of Statistics report "3218.0 - Regional Population Growth, Australia, 2012-13."

² The main lines are Alamein, Belgrave, Craigieburn, Cranbourne, South Morang, Frankston, Glen Waverley, Hurstbridge, Lilydale, Pakenham, Sandringham, Stony Point, Sunbury, Upfield, Werribee and Williamstown and one special events train line runs to Flemington Racecourse.

³ Australian Bureau of Statistics report "3218.0 - Regional Population Growth, Australia, 2012-13."

Safety of Vehicle Drivers and Pedestrians

8. Collisions between road vehicles and trains at railway level crossings account for only a small percent of all road casualties. Nevertheless, these accidents are three times more likely to involve fatalities when compared to all other types of road accidents.⁴ On the other hand, the risk of serious injury traveling in a car, based on kilometres travelled, is more than ten times as high compared with passengers travelling by rail.⁵
9. The most common circumstances of injury involves car occupants injured in a collision with a train (42.3%) and pedestrians injured in a collision with a train (29.6%).⁶
10. Train drivers, passengers, bystanders and emergency personnel who witness the accident are often distressed by what they see, and may even suffer post-traumatic stress disorder.
11. To reduce accidents, all crossings feature warning signage and automatic warning systems - flashing lights, boom gates, bells – that are activated by an approaching train.

There are a number of people who ignore these stationary signals and cross anyway. Train horns address this behaviour by providing another layer of warnings, alerting motorists, pedestrians, cyclists and commuters that a train is about to pass.

12. *National Railway Code of Practice* determines the volume of train horns. The specification for the high (Main) horn is 130 dBA at one metre and a minimum of 88 dBA at 200 metres, while the low horn level is between 85 and 90 dBA at 100 metres.⁷

The specification for the high horn at 200 metres indicates that it was designed to be used to give a warning at a distance, so that approaching vehicles and pedestrians know that a train is about to pass a crossing, several seconds before the train arrives.

13. Transport Safety Victoria remit includes regulating railway safety. It monitors Metro's approach risk management and compliance with transport safety legislation. It also investigates and reports on transport safety matters, and advises the Minister for Public Transport on train safety issues.

⁴ Afxentis, D. "Urban railway level crossings: Civil engineering working paper." Monash University, 1994.

⁵ AIHW: Henley G and Harrison JE 2009. "Serious injury due to transport accidents involving a railway train, Australia 2002–03 to 2006–07". Australian Institute of Health and Welfare Injury research and statistics series no. 54.

⁶ AIHW: Henley G and Harrison JE 2009. "Serious injury due to transport accidents involving a railway train, Australia 2002–03 to 2006–07". Australian Institute of Health and Welfare Injury research and statistics series No. 54.

⁷ These specifications were cited in a letter from Angela Marotta (Metro) to Harry Blutstein, dated 20 July 2010.

Legislation, Policy and Operational Procedures

14. The relevant laws are the *Transport Act 1983*, *Transport (Rail Safety) Act 1996* and the *Transport (Rail Safety) Regulations 1998*.

Section 251B of the *Transport Act 1983* exempts passenger rail operations from liability and prosecution for nuisance in relation to noise under the *Environment Protection Act 1970* or the *Local Government Act 1989*.

There is ample evidence (which is presented in the next section of this report) that shows that noise from train horns can severely affect health and welfare, with the most egregious being sleep deprivation. This makes a nonsense of the exemption contained in Section 251B that states that “noise emanating from rolling stock ... does not constitute a nuisance.” By any objective measure, noise does constitute a “nuisance,” as defined by section 58 of the Victorian *Public Health and Wellbeing Act 2008*. It singles out noise that is “liable to be, dangerous to health or offensive,” while “offense means annoying or injurious to personal comfort.”⁸

This exemption provides Metro with protection from nuisance actions being brought under common law, and prevents the EPA and local government officers from investigating or taking enforcement action against Metro for excessive or unnecessary use of train horns.

This exception prevents local government from fulfilling one of its objectives under the *Local Government Act*, which is “to improve the overall quality of life of people in the local community.”⁹

15. With no legislative restraints on the use of train horns, Metro feels under no obligation to minimise unnecessary or excessive horn use, or rigorously investigate complaints of unreasonable noise. In practice, such complaints are referred to the Metro’s Train Driver Manager, who files complaints without following them up with drivers. Not surprisingly, most people have stopped complaining to Metro about train noise, and, as result, complaint statistics on this issue are grossly underestimated.

In addition, the Public Transport Ombudsman (PTO) is unable to compel Metro to take noise complaints seriously. Instead, the PTO tries to mediate disputes, as it explains in an information sheet released in 2013. “While PTO is not able to determine the reasonableness of noise emissions under Franchise Agreements, practical reductions in noise emission may be gained through the independent investigation of complaints and negotiations between our office, consumers and the operator.”¹⁰ Unfortunately, the PTO has had little or no success in convincing Metro that it has a problem with the way drivers use the horn or with its handling of complaints.

⁸ *Public Health and Wellbeing Act 2008* (Vic)

⁹ *Local Government Act 1989*, section 3C(c).

¹⁰ Public Transport Ombudsman, *Noise Complaints PTO Approach 3*, December 2013.

16. In August 2012, the government released its *Draft Passenger Rail Infrastructure Policy*. This policy only applies when statutory approvals are required for either changes in land use near an existing or future rail corridor, or planned changes to passenger rail infrastructure. It does not apply to established residential areas adjacent to train lines.

This policy therefore establishes two classes of residents. Those who live adjacent to new rail corridors will be given a higher level of protection against train noise than those who live along existing lines.

17. Metro has refused to release its *Book of Rules and Operating Procedures*, which govern horn use, arguing that it is not a public document.¹¹ As a result, the public are not in a position to know whether or not the horns are being used within the rules. Nevertheless, from correspondence with Metro it is possible to identify occasions when the driver sounds the horn. They are:

- When a train approaches or leaves a station;
- When a train approaches a road level crossing or pedestrian crossing;
- When two trains approach one another;
- If the driver's view is obscured;
- When an express train passes through a station;
- When employees are working near the line; and
- When the driver perceives any possible danger.

These rules provide drivers with no guidance on how to avoid unnecessary use of the horn, particularly at night when horn noise is likely to disturb sleep. This is not surprising, as the standard operating procedures for horn use have been developed by safety experts who have little knowledge of noise management and do not fully appreciate the impact of unreasonable noise on human health and amenity. Furthermore, these guidelines were produced with no public input. As a result, the guidelines lack any credible provisions to abate noise.

18. Trains are fitted with horns at two levels (high and low).¹² See point 12 for the specifications of these two horns.
19. The standard operating procedures for horn use only specify particular circumstances under which a horn is sounded, and leaves it to drivers to determine whether to use the high or low horn. The approach taken by drivers is inconsistent. Some drivers sounded the high horn on almost all occasions, including at night and early morning. Others are more aware that horns disturb local

¹¹ Letter from Angela Marotta (Metro) to Harry Blutstein dated 20 July 2010.

¹² Metro uses the terms 'Main horn' and 'Low Horn,' but for the purposes of this report high and low horns will be used throughout.

residents who are still asleep, and do not use the horn if they can avoid it.

20. Under its franchise agreement, Metro is required to undertake a risk assessment in accordance with AS/NZS 4360, which requires it to address “human risk factors.” Metro has refused to release its risk assessments because its reports are “not public documents.”¹³ This argument does not hold up, as local residents have a right to know the risks they have been exposed to from train noise. Moreover, until this risk assessment is released to the public, a suspicion remains that the health and welfare risks of horn noise have not been rigorously assessed.
21. On a number of occasions various ministers have provided insubstantial assurances that they will instruct Metro to reduce the impact of train noise. For example, on 7 September 2010 the Minister of Public Transport, Martin Pakula, offered the following assurance:

Train operators and rail industry regulators are mindful of the impact that train operations can have on people living in close proximity to railway environs. In this regard, drivers are periodically instructed to be mindful of their operating environment and to ensure that trains operate in a manner that minimises noises, particularly in built up areas.¹⁴

Soon after this assurance was provided, there was a noticeable improvement, and horns were seldom heard in the early mornings or late at night. But after about twelve months, the incidences of unnecessary horn use gradually increased. Today, there are very few cases when drivers do not sound the horn on multiple occasions, and often use the high horn.

It is clear that once public pressure ceases, such political assurances are forgotten.

Impacts of Horn Noise

22. On average, trains generally start running at around 5 am (although some as early as 4:17 am) and finish at around 2 am (although some run as late as 2:14 am). Generally, those running to the outer suburbs are most affected by the early starts and late completions to services (eg Lilydale, Cranbourne and Frankston lines).
23. During peak periods, trains run between every 8 and 24 minutes depending on the line. At night this frequency is reduced to 30 minutes along most lines. Depending on the location of a resident with relation to stations and crossings, and the timetable, it is possible to hear up to ten soundings of a horn over a period of four minutes during peak periods, and at night there can be ten soundings every 15 minutes.¹⁵ In practice, the frequency is usually less. Nevertheless soundings of just once or

¹³ Letter from Angela Marotta to Harry Blutstein, dated 20 July 2010.

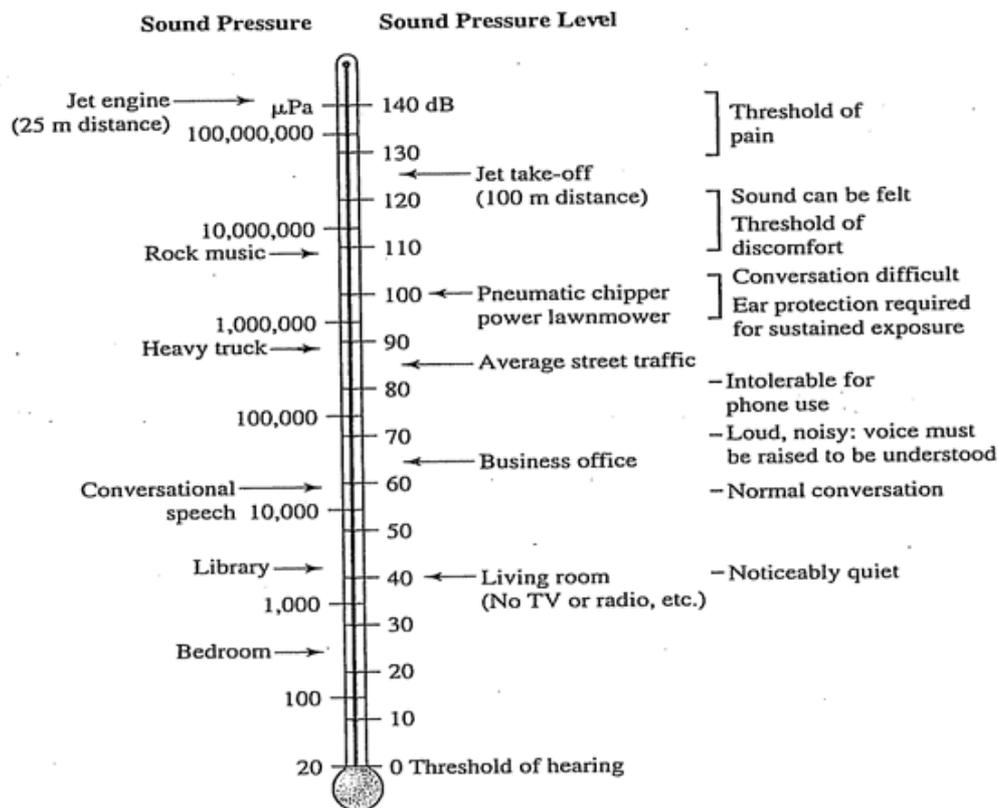
¹⁴ Letter from The Hon Martin Pakula to Harry Blutstein, dated 7 September 2010.

¹⁵ This assumes that the two trains cross and that pedestrian and road crossings are adjacent to a station.

twice over a short period late at night can still disturb sleep patterns.

24. Assuming that noise levels above 45 dBA are likely to disturb sleep, then train noise will impact a swath of at least 200 metres, which will have an adverse impact on 280,000 people. (See point 34 for noise standards in Australia and elsewhere)
25. It is difficult to quantify the noise experienced by individuals, because noise levels are influenced by geography, the position of intervening buildings, and the construction materials of houses (including the orientation of windows), among other factors. The impact on each individual also varies, with some people being more sensitive than others, so that people exposed to similar noise levels may manifest different physiological and psychological responses to that noise.

Nevertheless, depending on the distance between where a horn is sounded and the location of resident houses, it is possible for people to be exposed to noise levels between 50 – 70 dBA within 200 metres of when a horn is sounded, which, as can be seen from the figure below, is highly intrusive when compared with other human activities.



Noise is measured on a log scale, which means that for every 10 dBA increase in noise level is perceived as a subjective doubling in loudness while an increase of 20 dBA will be four times as loud.

26. One of the reasons for the introduction of the high horn was that, increasingly, cars are equipped with radios and air conditioning. As a result, for the high horn to be effective, one study showed that the horn needed to deliver 109 dBA of sound at a distance.¹⁶ It concluded that this level was above the threshold of pain. The study's authors went on to say that: "In high speed encounters, present horns cannot reliably warn motorists early enough. A horn with enough output to be totally effective would be an unacceptable nuisance."¹⁷ Another expert in the field came to a similar conclusion, stating that: "A train whistle with sufficient output to overcome the known constraints would result in noise-induced hearing loss either to locomotive engine-drivers or to members of those local communities that abut the crossing. This would be an unacceptable nuisance."¹⁸ Despite such studies, conventional wisdom continued to place reliance on ever louder horns and more frequent use of horns.
27. A number of health studies that have addressed the impact of train noise are discussed next.
28. The high horn is often used within metres of people waiting at crossings or on a platform, including infants and small children who could suffer irreversible noise-induced hearing loss.¹⁹
29. One of the major problems that arise from horn use is sleep disturbance. At night, when background noise is low, even a small number of high peak noise events, such as train horns, will affect sleep as trains run well into the night and start again early in the morning. This situation will be aggravated when trains run 24 hours a day at weekends.
30. Meta-analysis of community attitudinal surveys found that train noise is ranked among the most significant causes of community dissatisfaction. According to this report, approximately 10 percent of respondents reported being highly annoyed when exposed to noise levels in excess of at 60 L_{dn} ²⁰ while at 85 L_{dn} , the proportion of those who are highly annoyed increases to approximately 70 percent (see figure below).²¹ It should be noted that this study did not consider short intrusive noise, such as noise created by train horns, when the level of annoyance is likely to be much higher.

¹⁶ The current Australian standard of 130 dBA is four times greater than the 109 dBA suggested here.

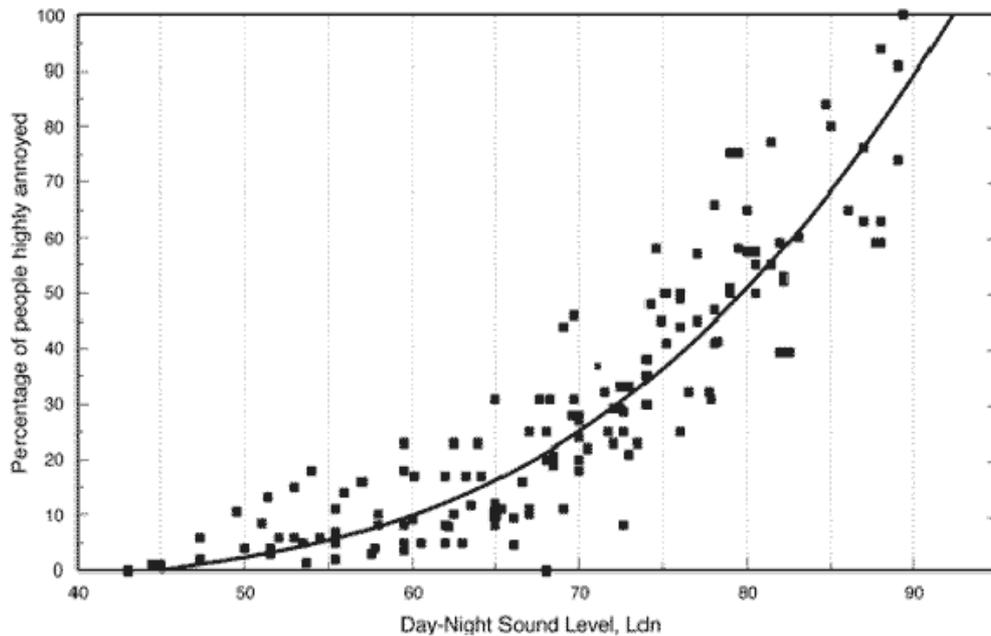
¹⁷ Aurelius, J.P. and Korobow, N. (1971) *The Visibility and Audibility of Trains Approaching Rail-Highway Grade Crossings*, Report FRA-RP-71-1. Federal Railroad Administration, US Department of Transportation. Washington, DC.

¹⁸ Wigglesworth, E.C. (1976) *Human factors in road-rail crossing accidents*. Ministry of Transport, Victoria, p 134.

¹⁹ Brookhouser, Patrick E., Don W. Worthington, and William J. Kelly. "Noise-induced hearing loss in children." *The Laryngoscope* 102.6 (1992): 645-655.

²⁰ Environmental noise assessments are measured as the day-night sound level (L_{dn}). L_{dn} provides an accurate measure of the overall "noise climate" of an area. Rather than representing the moment to moment variation in sound levels, L_{dn} describes the cumulative effect of all noise sources over a longer period of time.

²¹ Finegold, L.S., C.S. Harris, and H.E. von Gierke. 1994. "Community Annoyance and Sleep Disturbance: Updated Criteria for Assessing the Impact of General Transportation Noise on People," *Noise Control Engineering Journal*, Vol. 42, No. 1, pp. 25-30.



31. A 2006 survey of residents living adjacent to rail lines, commissioned by the Rail Safety & Standards Board, found that train horns caused people to suffer significant sleep deprivation, which was aggravated when new, louder horns were introduced. This report, however, found that returning to using quieter horns did not increase safety risks.²²
32. According to an article published in the *Southern Medical Journal* by Lisa Goines, and Dr Louis Hagler:

The primary sleep disturbances are difficulty falling asleep, frequent awakenings, waking too early, and alterations in sleep stages and depth, especially a reduction in REM sleep. Apart from various effects on sleep itself, noise during sleep causes increased blood pressure, increased heart rate, increased pulse amplitude, vasoconstriction, changes in respiration, cardiac arrhythmias, and increased body movement. For each of these, the threshold and response relationships may be different. Some of these effects (waking, for example) diminish with repeated exposure; others, particularly cardiovascular responses, do not. Secondary effects (so-called after effects) measured the following day include fatigue, depressed mood and well-being, and decreased performance. Decreased alertness leading to accidents, injuries, and death has also been attributed to lack of sleep and disrupted circadian rhythms. Long-term psychosocial effects have been related to nocturnal noise.²³

²² Rail Safety & Standards Board (2006) *Research into the effectiveness of train horns at crossings and their impact on neighbours, to support industry consideration on potential solutions to the noise problem*, R&D Programme: Research Brief T668, T680 and T681.

²³ Goines, Lisa, and Louis Hagler. "Noise pollution: A modern plague." *Southern medical journal*, 100.3 (2007): 287-294. Citations within this quote have been omitted.

33. A UK survey of 612 people living near a train line in Lingfield, Horsham and Canterbury found that sleep loss was a serious and commonly reported problem. Residents described how they were woken up by train horns and were unable to get back to sleep. They “lie awake, waiting for the next horn noise, tired and angry.”²⁴

34. The World Health Organization *Night Noise Guidelines for Europe* identified vulnerable groups.

Children are considered to be at risk, even though they have a higher wakening threshold than adults, because they spend more time in bed. Because sleep becomes more fragmented in the elderly, they are more vulnerable to night-time noise. Pregnant women and the sick are also at greater risk. Finally, shift workers are at risk because their circadian rhythms are stressed.²⁵

35. There are no residential noise standards in Victoria. However standards elsewhere are based on the need to protect sleep at night.

In ACT, the standard is 45 dBA during the day and 35 dBA at night. In Queensland, the long-term exposure level is set at 45 dBA L_{eq} (8 hours) at night, outside a habitable room of a dwelling, and the short-term exposure level of 50 dBA to 55 dBA L_{eq} , measured as the highest 15 minute level during the evening or night outside a dwelling. In SA, noise in residential areas should not exceed 52 dBA between 7am and 10 pm, and 45 dBA between 10 pm and 7 am. World Health Organisation Guidelines on community noise found that sleep is disturbed by noise levels outside a bedroom exceeding 45 $LA_{eq,8h}$ (night), and that the average level at night should be 30 LA_{max} .²⁶ For a sleeping area in a motel or inner suburb residence, Australian Standard (AS 2107) recommends a satisfactory sound level of 30dBA L_{eq} and a maximum level of 35dBA L_{eq} .²⁷

None of these standards comprehensively address loud short term noise events, like train horns, but are based on average sound levels over much longer periods of time. To some extent, this drawback was addressed by the Australian enHealth Council, which concluded that “for good sleep over 8 hours the indoor sound pressure level measured as a maximum instantaneous value should not exceed approximately 45 dBA LA_{max} more than 10 or 15 times per night.”²⁸

Based on the current practices in the use of horns in Victoria, most of these standards would be breached at night.

²⁴ Rail Safety & Standards Board (2006) “Understanding the problems that train horn noise causes to neighbours - Impact survey overview,” Report T681.

²⁵ Hurtley, Charlotte, ed. *Night noise guidelines for Europe*. WHO Regional Office Europe, (2009), p xii.

²⁶ Berglund, Birgitta, Thomas Lindvall, and Dietrich H. Schwela. "Guidelines for community noise." *Guidelines for community noise*. OMS, 1999.

²⁷ Australian Standard 2107 (2000), “Acoustics – Recommended design sound levels and reverberation times for building interiors”

²⁸ EnHealth Council. "The health effects of environmental noise: Other than hearing loss." *Australia: Commonwealth of Australia, Department of Health and Ageing, Publication 3311* (2004), p 29.

36. Australian research found that the maximum noise level inside a bedroom of short duration transient events should not exceed 45 dBA LA_{max} for nil sleep disturbance.²⁹
37. While not solely attributable to train noise, an Australian study estimated that the direct and indirect economic cost of sleep disorders is \$4.5 billion.³⁰
38. A recent study of transportation noise found that it not only adversely effects sleep, but it also affects the heart rate during sleep, and may be linked to cardiovascular disease.³¹
39. Melbourne is currently undergoing significant urban consolidation around existing railway corridors. This will result in more residents being exposed to train noise, as medium to high density housing is built adjacent to railway lines.

Overuse of train horns can add costs to new developments for expensive soundproofing. For people in existing dwellings, retrofitting double-glazed windows can cost between \$10,000 and \$20,000, while those living in weatherboard and brick veneer house find that such sound proofing is usually only partially effective in cutting out the noise from horns.

40. It has been argued that people who live near railway lines understand that their amenity will be affected by train noise, and have bought in at a discounted price, which takes account of this noise.

Since around 2001, the level of noise has been ramping up, first with the introduction of high horns and now with the operations of train 24 hours a day. These are additional imposts on the health of residents and the government has a responsibility of treating everyone equally. Governments have not used the same argument for people living tollways and freeways, were sound barriers have been erected, and governments should be equally willing to protect the health of local residents adjacent to railway lines.

Best practices

41. The policies and practices that govern the use of train horns only consider risks from accidents between trains and pedestrians, or people in vehicles. Accidents are acute incidents that are intense and immediate, and have attracted the most attention. These risks need to be balanced against the chronic problems of sleep disturbance, which also affects the health of a large number of people.

²⁹ Bullen, R., A. Hede, and T. Williams. "Sleep disturbance due to environmental noise: a proposed assessment index." *Acoustics Australia*, 24.3 (1996).

³⁰ Hillman, D., Murphy, A., Antic, R., and Pezzullo, L (2006). "The economic cost of sleep disorders." *Sleep*, 29(3) 299-305.

³¹ Croy, Ilona, Michael G. Smith, and Kerstin Persson Waye. "Effects of train noise and vibration on human heart rate during sleep: an experimental study." *BMJ open* 3.5 (2013): e002655.

According to research conducted by the UK Rail Safety & Standards Board, health costs outweigh the safety benefits.³²

42. Current practices place an unfair burden on homeowners, in terms of impact on their health, sleep loss and enjoyment of their properties. This inequity will be addressed in the following best practices.

The best practices identified in this section do not compromise safety but in some cases enhance it. These best practices are built around the following tenets:

- Horns are not the only solution, and in some cases not the best solution to address what is, in essence, a behavioural problem of risk-takers crossing a train line when active signals warn of an approaching train.
- Overuse and unnecessary use can reduce the effectiveness of the horn, as people become insensitive to the frequent blaring of horns. It should be used sparingly to provide sufficient warning that a train is about to pass through the crossing.
- A number of current practices are out-of-date, redundant and should be done away with.
- There is an overreliance on horns, and more effective means are now available to address the aberrant behaviour of risk-takers.
- The most cost effective best practices have been identified, after considering the full costs to both the train operator, in terms of works and training, and the public, in terms of their health and welfare.

43. Introduce curfews or quiet zones between 10 pm and 6 am.

Rationale:

A number of countries have decided that night curfews (or “quiet zones”) do not compromise safety, provided drivers retain the ability to use the horn in emergency situations.

When Canada introduced quiet zones in 1999, municipal authorities were allowed to set train anti-whistling periods between 10 pm and 6 am, subject to a safety audit and the installation of automatic gates.³³

In the US, Federal Railway Administration allow for the establishment of “Quiet Zones” where

³² Rail Safety & Standards Board (2006) “Research into the effectiveness of train horns at crossings and their impact on neighbours, to support industry consideration on potential solutions to the noise problem,” R&D Programme: Research Brief T668, T680 and T681.

³³ Transport Canada Guideline No.1: Procedure and Conditions for Eliminating Whistling at Public Crossings.

railroad horns are not sounded on public highway-rail grade crossings.³⁴ A quiet zone has to be at least half mile in length, and only applies to soundings of train horns across railroad crossings, although drivers can still sound the horn when they perceive an immediate danger. By October 2014, there were 614 quiet zones across the US network.³⁵ An evaluation of quiet zones in the US found that there is “no statistically significant difference in the number of accidents before and after the establishment of Quiet Zones.”³⁶

In 2007, the UK Rail Safety & Standards Board started to implement night time quiet period, between 11 pm and 7 am, when trains no longer routinely sound their horns at whistle boards. Drivers will only sound the horn if they see people on or near the track.³⁷

44. While the feasibility of quiet zones and curfews are being examined, there is no reason why train drivers should not immediately stop using the high horn between 10 pm and 6 am, except when necessary to address an immediate risk to life or limb.

Rationale:

At night, ambient noise is significantly lower than it is during the day by about 10 dBA (or half). Therefore the low horn will have the same impact as the high horn does during the day.

In addition, safety risks are much lower at night, because there is little traffic on the road, almost no pedestrians, and few people waiting on suburban platforms. Therefore, in most situations, no horn needs to be sounded once the train driver has conducted a simple visual check to ensure that there are no hazards ahead. This would further reduce noise impacts. The exceptions are when an imminent threat exists, or in the case of busy stations, like Box Hill, Clifton Hill and Caulfield, or when trains approach major roads.

According to the Australian Rail Track Corporation, between 75 – 94 percent of level crossing accidents occur during daylight hours.³⁸

In 2014, TasRail in Tasmania decided to only use the “low-note” horn between the hours of 10 pm

³⁴ The Federal Railroad Administration (FRA) “Use of Locomotive Train Horns at Highway-Rail Grade Crossings” was passed June 24, 2005 and allows localities the opportunity to establish quiet zones in railroad-highway grade crossings.

³⁵ Federal Railway Administration, “Quiet Zone Locations by City and State,” October 15, 2014.

³⁶ Ron Ries “Analysis of Safety at Quiet Zones.” Presentation at the 2014 Global Level Crossing Safety & Trespass Prevention Symposium.

³⁷ Rail Safety & Standards Board “Reducing the negative impact of train horns.” See <http://www.rssb.co.uk/about-rssb/case-studies/reducing-the-negative-impact-of-train-horns> (accessed 10 May 2015).

³⁸ Australian Government, *Response to the House of Representatives Committee report Level Crossing Safety! an update to the 2004 Train Illumination Report*, July 2009. See p. 7.

and 6 am.³⁹

In 2007, the UK Rail Safety & Standards Board instructed drivers to only use the low tone from the two tone horn at whistle boards.⁴⁰ After retrofitting quieter horns, an assessment found that this did not lead to a significant change in risk levels.⁴¹

45. Only use the high horn to provide warnings at a distance from a crossing, which should be marked by whistle boards.⁴²

Rationale:

The effectiveness of a horn depends on consistency, so that the public see that there is a predictable time interval before the train traverses a crossing.

Overuse and inconsistent application of horns means that vehicle drivers and pedestrians become desensitised to it and after a while don't notice the horn. Once drivers and pedestrians have lost confidence in the predictability of the warning system, they are more likely to engage in risky behaviour.

Overuse of horns, such as when trains approach or leave a platform, or when two trains cross (see the next point) is counterproductive.

During the day, the high horn should only be used at a distance, to provide sufficient warning to vehicle drivers, cyclists, and pedestrians that a train is approaching. The key is that the time interval is consistent, which will increase its effectiveness as a warning. Consistency can be improved by putting greater reliance on whistle boards, which provide drivers with a reminder of when to sound the horn.

46. Discontinue to practice of sounding the horn when trains approach and leave a station or when trains approach one another. The horn should still be allowed to use when a driver is faced with an imminent risk.

³⁹ TasRail "Tasrail Introduces Changes to its Level Crossing Warning Regime," media release dated June 27, 2014. Access at <http://www.tasrail.com.au/media-releases/2014/06/27/tasrail-introduces-changes-to-its-level-crossing-warning-regime/> (Accessed on 9 May 2015).

⁴⁰ Rail Safety and Standards Board (2009) "Train horn noise", accessed from <http://www.rssb.co.uk/standards-and-the-rail-industry/train-horn-noise> on October 23, 2014.

⁴¹ Rail Safety & Standards Board (2006) "Research into the safety benefits provided by train horns at level crossings," Report T668.

⁴² Whistle boards are signs marking a location where a train driver is required to sound the horn. It is unclear whether the Melbourne metropolitan rail network has many whistle boards installed. If not, then the network needs to be upgraded and these considered by be best practice.

Rationale:

Less is better, and auditory warnings should be kept to a single purpose. Overuse devalues the effectiveness that a warning horn offers, as it no longer provides a reliable indication to people at crossings when to expect a train to pass (see previous point).

One area in which horns are overused is when they are sounded as a train arrives at and departs from a platform. This practice does not add to safety, because there are now a number of other safety measures in place that make such horn use redundant. They are:

- Pre-arrival announcements, warning commuters that a train is about to arrive;
- Automatic doors and sound warnings that operate as doors close;
- The platforms are well-lit, allowing train drivers to see along the length of a platform, and, even on curved platforms, video screens provide drivers with excellent visibility;
- PSOs on duty at night ensure passengers getting on and off trains do so safely.
- Early in the morning and late at night, when there are few or no passengers on suburban platforms, there is no reason for using the warning horn.

The other example of overuse is when the horn is sounded by two trains approaching one another, regardless whether they are near a crossing or not. This practice may be a leftover from when trains had openable windows, so the horn would warn anyone with their arm or head out the window to watch out for the passing train.

No risk management reports were found in the literature that justified the use of warning horn on trains approaching, or leaving a platform, or when two trains pass one another.

47. The most cost effective means of improving safety are programs that discourage risk-taking behaviour. They include:

- Install red-light cameras and CCTV on high risk crossings, where vehicles and pedestrians frequently ignore warning signals. Also increase police blitzes and prosecute offenders.⁴³
- Implement public awareness campaigns.
- Implement the Dedicated Short Range Communication (DSRC) system, which provides vehicle drivers with a 360 degree level of awareness of the surrounding traffic situation.
- Place greater reliance on visual warnings, such as on-train, front-mounted warning lights and ditch lights, activated on time-to-crossing.

⁴³ A trial is underway at Laverton, which is being undertaken by the Australian Centre for Rail Innovation .The trial is an initiative of the Victorian Railway Crossing Safety Steering Committee, and is being funded jointly by the Victorian Government and the Australian Rail Track Corporation.

- Augment auxiliary lighting on trains to improve train conspicuity.
- Install crossing obstruction detectors.
- Install red, yellow and green traffic signals at high-risk crossings.
- Install stationary horns mounted at the grade crossing, which are activated by the same mechanisms that trigger the active warning system, so that they provide a timely warning of oncoming trains. As the stationary horns direct sound down the roadway rather than down the track, they do not need to be as loud as train-mounted horns, and are able to deliver a more effective warning to oncoming road vehicles.⁴⁴
- Ensure that vegetation does not limit visibility of crossings, and that street lighting around crossings is adequate.

Rationale:

When boom gates are down, lights flashing and bells ringing, pedestrians, cyclists and motorists have a clear warning of an oncoming train. Some make a deliberate choice to ignore these warnings, risking their own safety and that of those on the train. These risk-takers often are fully aware that they are racing to beat an oncoming train, and doing so in defiance of the law. Moreover, the use of the horn is unlikely to do little to modify their behaviour, particularly when horn use is inconsistent and overused, desensitizing them to the sound of such warnings. Such dangerous behaviour is usually motivated by frustration and impatience when delayed by approaching trains,⁴⁵ which is likely to be heightened during rush hour.⁴⁶ Others try to beat trains for the thrill associated with risk-taking.⁴⁷ Whatever the circumstance of such aberrant behaviour, these law-breakers are comforted by the knowledge that their chances of being caught and fined are minimal.

This behaviour is compounded by the prevalence of vehicle sound proofing, air conditioning, and entertainment systems. Helmet-wearing motor cyclists may also have difficulty hearing audible signals and train horns. During his keynote address at the Seventh International Symposium on Railroad-Highway Grade Crossing Research and Safety in 2002, Sir Ninian Stephen pointed out that relying on auditory signals can only result in an “arms race,” which is likely to prove futile. As a result, greater emphasis should be given to visual warning signals and local controls that warn of an approaching train.⁴⁸ For these reasons, audible signals at crossings are probably less effective now

⁴⁴ Roop, S., “A Safety Evaluation of the RCL Automated Horn System,” Texas Transportation Institute, College Station, May, 2000.

⁴⁵ Witte, K and Donohue, WA. (2000). “Preventing vehicle crashes with trains at grade crossings: The risk seeker challenge”. *Accident Analysis and Prevention*, 32, 127–139.

⁴⁶ Caird, J. K., Creaser, J. I., Edwards, C. J., & Dewar, R. E. (2002). *A human factors analysis of highway-railway grade crossing accidents in Canada*. Calgary: Transportation Development Centre, Transport Canada.

⁴⁷ Witte, K and Donohue, WA. (2000). “Preventing vehicle crashes with trains at grade crossings: The risk seeker challenge”. *Accident Analysis and Prevention*, 32, 127–139.

⁴⁸ Address by the Rt. Hon. Sir Ninian Stephen to the Seventh International Symposium on Railroad-Highway Grade Crossing Research and Safety, delivered on 20 February, 2002

than in the past, a view supported by the Australian Transport Safety Bureau (ATSB).⁴⁹

Enforcement is an effective strategy in these circumstances. For example, a Canadian study found that photo/video enforcement reduced violations by between 34 to 94 percent.⁵⁰

Public awareness campaigns can also be used to modify such deliberate risk-taking behaviour. In the case of pedestrians, almost 50 percent of those surveyed at seven Melbourne crossings thought it was not illegal to cross when a train was approaching.⁵¹ A similar attitude appears to be held by vehicle drivers.⁵² Public Transport Victoria has started to tackle this problem through its "Railway Crossing Safety Awareness" campaign. In North America, the Department of Transport sponsored "Always Expect a Train" campaign in order to educate the public on the dangers of highway-rail crossings and trespassing on tracks and railroad equipment. Another campaign, called Operation Lifesaver, actively promotes safety messages aimed at reducing crossing accidents, and has achieved significant reduction of accidents.⁵³ Edwin L. Harper, President and Chief Executive Officer of the Association of American Railroads, concluded that a more effective means of improving safety was changing the attitudes and behavior of drivers, arguing that credit should be given to "programs like Operation Lifesaver, with its emphasis on the three E's - educating drivers, enforcing highway-rail grade crossing safety laws and properly engineering the crossings."⁵⁴

There are also a number of non-auditory strategies that can reduce accidents. One was identified by the House of Representatives Standing Committee on Infrastructure, Transport, Regional Development and Local Government. Its *Level Crossing Safety: Train Illumination Report* recommended better lighting on trains to improve safety. Removing vegetation that obscures the presence of oncoming trains is also worthwhile, when combined with better on-train lighting.

48. Eliminate level crossings by grade separation on main roads.

Rationale:

Once road crossings are eliminated, then there is no possibility of accidents between trains and other vehicles. The Victorian Government has committed to remove 50 of the most dangerous and

⁴⁹ Reported in "Inquiry into Improving Safety at Level Crossings," Road Safety Committee, Parliament of Victoria, December 2008, p 41.

⁵⁰ Quoted by George Rechnitzer, Shane Richardson and Tia Orton in "Literature Review on Level Crossing Safety around the world," DVExperts International Pty Ltd, 2007, p 52

⁵¹ Lloyd's Register Rail. "Study of pedestrian behaviour at public railway crossings". Public Transport Safety Victoria, 2007.

⁵² Roy Morgan Research. "National Rail Level Crossing Study". Australasian Railway Association Inc, 2008.

⁵³ Gerri L. Hall "Introducing Operation Lifesaver," Seventh International Symposium on Railroad-Highway Grade Crossing Research and Safety, 2002.

⁵⁴ "First-Half 1995 Safety Results Surpass 1994 Rail Industry Record," PR Newswire Association, October 9, 1995.

congested level crossings on the metropolitan rail network as part of *Project 10,000*, which is an excellent start.

49. Release rules and guidelines on horn use to the public.

Rationale:

Once the public are made aware of how and when horns are used, they will have a greater appreciation of the role they play in safety, and they will be able to provide constructive feedback on their day-to-day use, allowing Metro to optimise their effectiveness.

50. Release the risk assessment that addresses the impact of horns on local residents.

Rationale:

People have a right to see what risks to their health and wellbeing are caused by horn use. Such transparency should also ensure better policy making, with the risks to residents balanced with that of providing for train safety.

Recommendations

51. That codes and standards that govern the use of train horns be redrafted to take into account the health and welfare of residents living adjacent to train lines. Changes include:

- Implement a night-time curfew between 10 pm and 6 am every day of the week, except when the driver observes people at risk, near or on the tracks.
- While the curfew is being put in place, immediate action should be taken to reduce unnecessary used of horns. They include that the low horn should only be used at night, and only at a distance from high-risk crossings. Also, stop sounding the horn when trains approach and leave platforms, and when two trains cross, except when the driver observes an immediate risk to life and limb.

52. To ensure that Metro actively manage train horn use and be held to account for their performance, change contractual arrangements with Metro so that incentives (rewards and penalties) are included on responsible horn use that will fulfil the dual objective of improving safety and the health of local residents.

53. Make greater use of whistle boards to ensure that the use of warning horns is consistent. This will address the mixed messages that come from over- and erratic-use of horns, which has degraded their value.

54. A study needs to be undertaken on what impact all-night train use will have on the welfare of residents adjacent to railway lines, to determine whether further safeguards are needed.
55. Assess the best practices identified in this report and implement those that are cost effective.
56. That Metro actively investigates noise complaints, and provides feedback to drivers as part of a continuous improvement program.
57. Public Transport Victoria should expand its existing “Railway crossing safety awareness” campaign and examine other strategies to enhance safety that do not rely on auditory warnings.
58. The *Passenger Rail Infrastructure Policy* should include existing rail lines, not just apply to new developments.
59. In the public interest, the government should instruct Metro to release those parts of its *Book of Rules and Operating Procedures* that govern horn use. Metro should also release that part of its risks assessment, required under the *Rail Safety Act 2006*, which addresses “Human risk factors.”