Solutions……Solutions……..Solutions……Solutions

HOW TO CUT……

Noise disturbs millions of people. Low-income households can be hardest hit: typically, they find it harder to influence those in authority; they tend to spend more time in their neighbourhoods; they have less opportunity to move home.

The utterly frustrating thing is there are viable solutions to most noise problems. This short report focuses on these solutions.

Solutions……Solutions……..Solutions……Solutions

Contents

The Problem in a Nutshell

Noise impacts millions of people in the UK and many more across the world. And yet it remains the forgotten pollutant. It is not the subject of international conferences attracting prime ministers and presidents. It has never really excited the green movement. It is too often dismissed as simply a local issue.

It may come as surprise but noise has regularly topped the list of complaints in Rio de Janeiro. Despite its poverty, crime and shanty towns, it is noise which can account for more than 60% of all public complaints in the Brazilian city (1). And Rio is not untypical. Noise is a problem that is widespread and worldwide.

Although noise, particularly aircraft noise, can and does impact on all sectors of society, it tends to be people on low incomes who are disproportionately affected

A study showed that, while just 7% of people living in a detached house or bungalow are annoyed by noise from their neighbours, this rises to 23% of those living in a medium/high rise flat (2). I don't want to overplay this because you can be seriously disturbed by noise whatever your circumstances but, as a general rule, the wealthier you are the more you are likely to have the self-confidence, time, resources and opportunities to do something about it.

If noise impacted Belgravia the way it does Bermondsey, I suspect there would be more urgency to tackle it (3)

SOUND FACTS

11% of people in the UK are extremely disturbed by neighbour noise, with 54% bothered to some extent (4)

8% of people are extremely disturbed by traffic noise, with 55% bothered to some extent (4)

4% of people are extremely disturbed by aircraft noise, with 31% bothered to some extent (4)

17% of people say piped music is the thing they most detested about modern life (5)

Each year one in six people in the UK move house because of noise (6)

The World Health Organisation has found wind turbine noise can cause real annoyance (7)

Underwater noise has doubled each decade during the past 50 years (8)

Traffic Noise

With the right measures in place, annoyance caused by traffic noise could be cut by 70% (9).

Lower speeds

- Cutting the urban speed limit from 30mph to 20mph could reduce traffic noise by more than 50% (10).
- Cutting the motorway speed limit from 70mph to 60 mph could cut noise by more than 25% (10).

Quieter Road Surfaces

- The use of quieter road surfaces could halve the noise from traffic. Quieter road surfaces like porous asphalt cost more than traditional road surfaces but are 3-10 times more cost-effective than mitigation measures such as home insulation or the construction of noise barriers (11).

Noise Barriers

- These can be expensive but are essential at noise hot spots. At their best, they can cut noise by 75%.

Electric Vehicles

- Greater use of electric and hybrid vehicles will cut noise. However, they come with two important caveats. First, tyre noise will still be present – this means that electric vehicles will only cut car noise up to speeds of about 35mph; above that tyre noise dominates. Second, it remains uncertain how much noise will be deliberately added to electric vehicles – and the tone of it - so people can hear them coming. But, even with these caveats, electric vehicles should cut noise levels in built-up areas quite noticeably. They will not do so on many rural 'A' roads where the current speed limit is higher. In economic terms they do have an important advantage over measures like quieter road surfaces, insulation and noise barriers, in that the cost falls on the manufacturers and the users rather than on the public purse.

Traffic Reduction

- Traffic volumes affect noise. 200 vehicles passing in one hour sound half as loud as 2000. So volumes need to fall fairly significantly to have a noticeable effect. But a cut in traffic even by a small amount could improve noise levels by reducing the overall number of noise events. However, even here, speed reduction is crucial. Traffic noise will not fall automatically with a drop in vehicles numbers if it simply allows the remaining traffic to speed up.

Reduction in traffic volumes	Reduction in noise (LAeq)
10%	0.5 decibels
20%	1.0 decibels
30%	1.6 decibels
40%	2.2 decibels
50%	3.0 decibels
75%	6.0 decibels

This assumes no changes in speed, traffic composition or driving patterns (Source: Ellebjerg 2008a: 11, Table 2.1)

Traffic Mix

- Traffic mix is an important factor in both overall noise and noise peaks. Heavy vehicles, mopeds and motorcycles are disproportionately noisy. At 30 km/h (19mph) one heavy vehicle can emit as much noise as 15 cars. However, light vehicles dominate traffic noise because they account for most of the traffic. Even on roads where there is a greater percentage of heavy traffic, cars will still usually dominate noise levels because of their higher speeds (Ellebjerg 2008a).

Given the amount of noise caused by light vans and lorries, as well as the growth in home deliveries due to the Internet, the growth in cargo bikes could play an important role in noise reduction.

The Role of Road User Charging

If the number of cars and lorries on the roads fell, there would be a reduction in noise. But the opposite has been taking place. Between 1994 and 2019 all motor traffic increased by 36% (lorries up by 12%; cars and taxis up by 29%; and vans by 106%). The challenge now is to reverse that trend. I believe road user charging is an essential building block to making that happen.

Road user charging will cut traffic levels (13) but can it be fair?

The award-winning journalist Janice Turner wrote in her Times column (22/10/20):

"Drivers will refuse to pay to collect tiles from B & Q or take their old mum to Tescos…businesses will revolt."

Introduced tomorrow, it would hit a lot of people very hard: low-income and disabled drivers; carers; owners of delivery vans and many small businesses; even a lot of families on average incomes, given the high cost of public transport.

Road user charging must not destroy livelihoods

It is easy for those of us who care about noise to dream of the role road user charging could have in creating quieter streets and more liveable neighbourhoods. But if it targets the less well-off and destroys livelihoods, it becomes yet another idea promoted by the better-off – which includes most NGOs and many pressure groups – at the expense of those struggling to make ends meet.

In its early stages it should be framed by carers who need their cars, by small business people who need their vans, by mums on outlying estates who rely on shared taxis, by shift workers and by disabled people. The usual process should be subverted.

I am serious in arguing this. It is not to exclude professionals and other interests – it would be impracticable to do so - but, far too often, the experts have come with their plans and the campaign groups with their pet policies and, except for a bit of statutory consultation, expected the people to fit around them. I'm arguing that it should start with the people, and with the people who might be most affected. Subverting the usual process gives us the best chance of getting the fairest scheme.

What other measures are needed to be put in place to make road-user charging effective and fair?

Imagine this scenario
Public transport is very cheap so most people would be spending less on transport than they do today. Car use would fall. Congestion on the roads would be eased, saving people who need cars and vans time and money. Conditions for walking and cycling would improve. Is this an impossible dream? I don't think so.

1. Re-allocation of road space

A sensible reallocation of road space from cars and lorries to more sustainable modes of transport would assist pedestrians, cyclists, buses, taxis and trams and would encourage more use of these modes. But banning cars on streets should be the exception; not the norm. A city without cars will not function; in the same way that a city with too many cars does not function.

2. Quality conditions for walking and cycling.

There is scope for modal switch. About half the journeys we make are under two miles and 75% less than five miles. But let's be realistic. Not everybody will choose to cycle. Good bus services are essential to reducing car use of these shorter journeys.

3. The embrace of new technology.

The UK is beginning to buzz with exciting new vehicles: cargo bikes, e-scooters, e-bikes and pedicabs. Cargo bikes have the potential to cut van traffic. Research by the consultancy WSP has found that up to 14% of vans could be replaced by cycle freight in London by 2025. Electric bikes, too, have a lot of potential. A recent report from the Urban Transport Group found 100 million car and taxi trips in the city regions could be replaced by e-bikes each year (12). There are also increasing opportunities to make use of shared transport.

4. Convenient, accessible and affordable public transport.

Cheaper fares are essential for road user charging to work fairly. But they don't require massive public subsidy.

Cheap fares can be financed in a number of ways:

- By using some of the money raised from road user charging;
- By imposing a transport tax on big employers (as places like Paris already do), on the basis that their employees benefit from cheap fares;
- By introducing a small annual transport levy on our rates.

5. A comprehensive transport and planning network in place

London has such a network. A lot of UK cities don't, although a number are developing one. The network would need to include planning and housing policies that were not based around the car and, if necessary, work-place parking charges.

What about car-ownership? Once people own a car, they tend to want to use it. Not just because of its perceived convenience but also to get a return on their investment. Good alternatives in themselves do not seem to be enough to persuade many out of their cars. Road user charging may tip that balance.

Road user charging may well be inevitable. As electric vehicles become commonplace, fuel duty will begin to dry up. The Treasury will need an alternative source of revenue.

Now is the time to start to put together a scheme that works for everybody.

Low Traffic Neighbourhoods (LTNs)

In my view LTNs, areas where roads are closed to through traffic, are not the answer to cutting noise on the worst-affected roads. Noise falls within the LTNs but levels can increase on the adjacent boundary and main roads. Many of these roads, most of them residential, have seen an increase in traffic since the recent spate of LTNs was introduced.

Unlike older LTNs, which tended to cover just better-off areas, many of more recent ones include poor places as well as rich ones but there are real equity concerns around their impact on boundary and main roads. In London, where the bulk of the research has been carried out, 8.5% of the population lives on main roads; that is, about 720,000 people.

LTNs create quieter neighbourhoods but often at the expense of more traffic on adjacent roads

Environmental Injustice

Many of us spend a lot of time on main roads: at work; at school; shopping and socialising; waiting for buses; meeting friends; simply walking. Poor & BAME communities are most likely to do so. Little money, and very often no car, means they leave their own neighbourhoods less often than wealthier people do. It is interesting that the residents of main roads are rising up, really for the first time in decades, and saying 'enough is enough', with many of campaigns being led by members of the BAME communities.

Poor & BAME communities are most likely to live, walk, wait for buses, learn & play on the 'main' roads where levels of traffic, noise and pollution are highest

Many of the recent LTNs were put in with the best of intentions, with councillors looking for ways to improve the environment for their residents. Some of the councils are now considering plans to tame the traffic on the main and boundary roads. But it is a post-code lottery, with main/boundary road residents fearful they will be left with the spillover traffic for ever.

Main roads are already the noisiest and most polluted. There are strong health and equity arguments to tame traffic on these roads first. LTNs are doing the opposite. Without real efforts to tackle main and boundary road traffic, LTNs simply worsen the noise problems on the roads where noise is at its worst.

Aircraft Noise

When aircraft noise disturbs, it can really disturb.

The World Health Organisation has found people start to get annoyed by aircraft noise at lower levels than either road or rail noise. This is partly down to the high-level of low-frequency present in aircraft noise. https://www.euro.who.int/__data/assets/pdf_file/0008/383921/noise-guidelines-eng.pdf

The latest official figures show that over 2.5 million people in the UK are extremely disturbed by aircraft noise, with 31% of the population bothered to some extent (4). Of course not everybody is disturbed by noise from planes flying over them. The statistics show that, even at high noise volumes, a lot of people are not worried but, nevertheless, the numbers disturbed remain high.

If you are driven to despair by the noise, you can become very angry with the airport. But that anger can blind us to the good aviation can and does do.

Not 'anti-aviation' but 'anti-noise'

Aircraft are the work-horses of the globalised economy which has over the last few decades facilitated the trade which has lifted millions of people out of poverty.

Warren East, the chief executive of Rolls Royce, put it like this:

> ***"For thousands of years, the exchange of culture, ideas, goods and services has been the powerhouse of human progress. Aviation has accelerated that exchange across continents, making a huge contribution to humanity and the global economy. International trade is responsible for much of the development and prosperity of the modern world".*** Daily Telegraph (4/2/20)

I believe he is correct. I cannot agree with the 'degrowth' philosophy that some aviation campaigners put forward. In my view, it will bring a halt to the growing prosperity across the globe. Aviation – and the growth of aviation – has a key role to play in enabling that prosperity. This is not to say that it would not be better if a lot of shorter journeys could be made by rail or to argue aviation shouldn't pay more tax. It should. It is under-taxed. It pays no tax on airline fuel and there is no VAT on tickets.

We mustn't kill off aviation. The focus should be on dealing with its downsides.

So, how to we deal with aircraft noise?

1. Research and development into quieter aircraft

Aircraft are a lot less noisy than they were 40 years ago. But in the coming years an annual reduction of only 0.1% is expected in noise from aircraft coming on-stream. The technology is not on the horizon for planes to get significantly quieter anytime soon. Meaningful resources need to be put into research and development into quieter planes by both the industry and governments.

2. Build new airports well away from centres of population

It is interesting there are few noise complaints about the main airports in the Scandinavian countries. They are located well outside the towns and cities. It is not always possible to relocate existing airports but there are lessons here for the emerging economies as they build new airports.

3. Encourage quieter alternatives to air travel where feasible

Aviation does long-distance journeys well but, if rail became more viable for shorter journeys, it opens up the possibility of managing or even reducing flight numbers over many communities (which is what they want above all else).

4. Share the noise around

Except for areas under the final approach to a runway, it is possible to use the new satellite-based technology to create rotating flight paths to give residents a break from the noise each day. In my experience, communities are much less interested in how many runways an airport has than in how many planes fly over their homes. These days it is the volume of aircraft passing overhead rather than the noise of each plane that is the biggest cause of disturbance.

5. Impose a numbers cap or a noise cap

The industry favours a noise cap because it can incentivise airlines to use less noisy planes. Communities like a cap on the number of flights. If a cap (on noise or numbers) is imposed, it would be most effective as a cap over particular communities, not one covering the airport as a whole, for what is critical to people is the impact on their community.

6. Limit night flights

The European Union published a report which showed that, world-wide, most night flights are operated for the convenience of the airlines, rather than because they are essential (22). Night flying should become the exception.

7. Provide generous compensation and mitigation

Communities under flight paths should expect money to pay for effective sound insulation measures. People who lose their homes or who see them devalued in price should be properly compensated. Wherever a new airport is built people who lose their homes or land should be generously compensated.

8. Ensure best operational procedures are followed

The steepness of the descent or ascent is important for communities as are measures such as the point aircraft coming into land lower their landing gear.

These measures would quite noticeably lower the impact of noise without harming an important industry.

Ground to Air

Here's a prediction. Over the next decade our streets will become quieter but our skies will get noisier.

Quieter Streets

There is a range of measures, likely to be put in place, which will cut traffic noise:

- Electric cars will reduce noise at speeds of under about 35mph. Above that, there will be little difference as tyre noise predominates.
- 20mph speed limits are becoming the norm in many towns and cities. The basic rule of thumb is the lower the speed, the lower the noise levels.
- More journeys will be done by bicycle and probably on foot as well.
- Cargo bikes will be used a lot more for deliveries.
- Road user charging is likely to be introduced in several cities. That will cut traffic levels, particularly if some of the money raised is put into lowering the fares.

These measures will cut noise from traffic in cities and towns. We may see fewer of them in rural areas.

Noisier Skies

There are new developments which could increase noise in the air:

- Conventional aircraft may become a little less noisy but, post the pandemic recovery, this could well be offset by an overall increase in the number of aircraft.
- Flying taxis could be taking people to the races at Ascot or a business conference in Brighton.
- Drones might be delivering your neighbour's pizza.
- Helicopters are likely to be still buzzing around.

Innovation helps drive an economy. But, unchecked, innovations can do damage. The drone is doing wonders delivering goods and medicines in the difficult terrain of Africa or Asia but let Deliveroo deliver our pizzas. Crack open the champagne on the train to Ascot. No need to show off by landing in a flying taxi. You might frighten the horses!

Blue-skies thinking and good regulation are needed about campaigns to counter the new noise in the air.

Rail Noise

Rail noise disturbs far fewer people than noise from aircraft or motor vehicles. But it does remain a problem. Noise from freight and high-speed trains can be a particular concern.

Most of the noise from trains comes from the wheels rolling over the rails. It is the roughness of the rails and the wheels which causes the noise. The more roughness there is, the more disturbing the noise. The roughness is caused by wear and tear. A European Commission study found that roughness may cause noise levels to rise by up to 5dB(A) (14).

Solutions

The noise from rails can be cut by 'polishing' which reduces the roughness of the rails and wheels.

The vibrations which cause noise can be minimised with rail dampers, which are lengths of elastic material fixed to the rails.

But the big gains can come from cutting the noise of the wheels by replacing the brake pads used. A change from cast iron to composite material (the so-called K and LL blocks) could cut the noise by as much as 50% (15). It would also reduce the vibration from freight trains, which is the source of much disturbance.

There is little difficulty in fitting new vehicles with the new technology. The problem is the cost of retro-fitting existing stock. There are, for example, over 600,000 freight wagons, and many more passenger carriages, in use in the European Union (AEA Technology). According to the International Union of Railways it would cost around 2-3 billion euros to retrofit them (16). The savings, though, would be considerable. The Dutch infrastructure company, ProRail, has calculated that the retrofitting of rolling stock with quiet brakes would result in cost savings of 500 million to 1 billion euros in the Netherlands alone (17). Much of these savings would come from the reduced need for noise walls and the insulation of neighbouring buildings.

High Speed Rail

There are particular problems with high speed trains. Not, though, when they are travelling at lower speeds, i.e. not much faster than conventional trains. At those speeds they are likely to make less noise than the conventional ones because they will be fitted with all the latest noise-reducing features. The problem arises at speeds of more than 250/300 kilometres per hour. That is where aerodynamic noise starts to kick in in a big way. Travel at these speeds can also generate ground vibrations, similar to the sonic boom associated with supersonic aircraft. And there is the problem of brake screech as the trains slow down or come to a halt.

There is a lot of technical work being done to examine ways of reducing the noise and vibration from high-speed trains but there is no escaping the fact that they are noisy. If a high-speed line is built, tunnels, noise barriers and insulation programmes need to be integral to the proposal. Also a cap should be imposed on the number of trains that will be operated: it would be very difficult, in noise terms, to justify a frequent high-speed service on any line.

The overall conclusion must be that there is a lot which can be done to reduce rail noise significantly but that some of the problems associated with freight and high-speed trains may prove more intractable.

Shipping Noise

The natural sounds of the ocean are magnificent in their range, beautiful in their delivery and stunningly varied. But these sounds are in danger of being overwhelmed by human noises and vibrations as never before. It is whales and dolphins which can be especially badly affected. With limited sight and smell, sound is all-important for them. Since they often communicate over long distances, their chain of communication is particularly vulnerable to human-induced noise. A particular problem arises if mammals are communicating at the same low-frequencies as 'man-made' noise.

Although sonar testing and pile driving cause noise problems in the ocean, shipping is the main culprit

Although sonar testing and pile driving cause real noise problems, the main culprit is shipping. Roughly 80% of international trade goods are transported by ships. Over 100,000 large commercial vessels are criss-crossing the world's oceans. The numbers continue to grow. They are clearly important for international trade which has contributed to the reduction in global poverty in recent decades. But they create a lot of noise.

There are two key factors generating the noise:

One is the speed at which the ships are travelling. It is estimated a 10% reduction in speed would cut global underwater noise from shipping by between 40% and 50% (18). It would also tackle CO_2 from shipping – which is a real problem – by around 13%. The International Maritime Organization (IMO) in April 2018 committed to reduce the total annual greenhouse case emissions by at least 50% by 2050 compared to 2008, with the aim of phasing them out entirely. One element of the strategy is to consider and analyze the use of speed optimization and speed reduction, taking into account the impact on safety, distance travelled, the market, trade and on shipping's capability to serve remote geographic areas.

A 10% reduction in speed would cut global underwater noise from shipping by between 40% and 50% and CO2 by 13%

The second is the propellers. As the blades turn, they create thousands of tiny bubbles, a process known as 'cavitation'. It is the sound of these bubbles bursting that causes the noise. Ship engines are a distant secondary contributor. The shipping industry has been slow to act. It would be in its interest to do so since reducing cavitation noise will cut fuel costs. The industry is supportive of improved design standards for new ships being mandatory but is reluctant to retrofit existing ships.

The industry is doing a lot more to tackle noise than it was but hasn't committed to the same sort of clear target it has done with climate emissions. It will undoubtedly weigh up the economic impacts of the different measures to cut noise and climate emissions but it has become clear in recent years it is beginning to sail in a different, quieter direction. However, the journey has only begun.

- For more information on the topic of underwater noise check out the Jonas Project: http://www.jonasproject.eu/oceannoise/

Wind Farm Noise

Across the world, communities complain of noise from wind turbines. The evidence suggests that the low-frequency component in wind turbine noise plus the flickering of the blades can have a destabilizing impact on people's health.

Solutions:

While not 'loud' in the conventional sense, the noise from wind turbines can be particularly disturbing due to the high-level of low-frequency contained in the noise. This, together with the flickering of the blades, can be destabilizing.

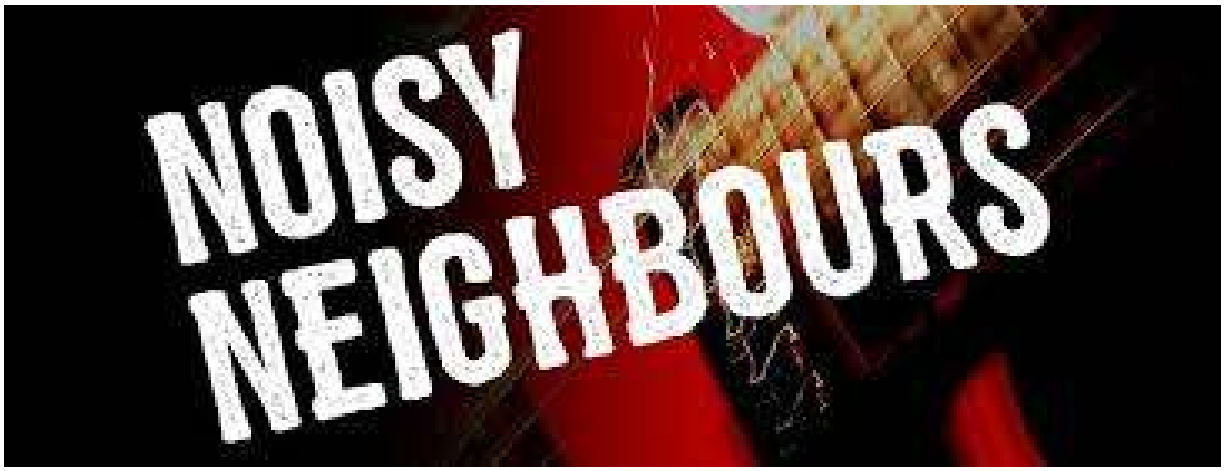
• **Use accurate noise guidelines.**

• **No turbines within at least one mile of residential properties.** This is the distance recommended by the French Academy of Medicine. The terrain of course will influence how far the noise carries so, if there is nothing to block the noise, the distance should be greater.

• **Close down turbines which cause disturbance.** It is not acceptable to expect people to put up with destabilizing and disturbing noise for decades.

And promote energy sources which do not cause the noise problems that wind does. That is, potentially all other sources: for details, see our report http://www.ukna.org.uk/uploads/4/1/4/5/41458009/noise_audit.pdf

Neighbour Noise



Complaints about noisy neighbours, already high, increased significantly during lockdown. There is legislation in place to deal with neighbour noise. The challenge is for the police and local authorities to find the resources and the will-power to use it effectively.

Key legislation:

Environmental Protection Act 1990 - *https://www.legislation.gov.uk/ukpga/1990/43/contents*

Noise Act 1996 - *https://www.legislation.gov.uk/ukpga/1996/37/contents*

The Anti-Social Behaviour, Crime and Policing Act 2014 - *https://www.legislation.gov.uk/ukpga/2014/12/contents/enacted*

Solutions:

Crack down on noise offenders

• This has been made a lot simpler by the 2014 Anti-Social Behavior legislation which allows noise offenders to be prosecuted more easily and quickly (19). It is time to get consistently tough on noise offenders. Sometimes a warning will suffice but the authorities should not hesitate to use their powers to confiscate their equipment or evict them, if required. Do whatever is needed to sort out the noise problem for the victim.

Give residents the right of appeal

• When local authorities fail to crack down on noise offenders, there is little redress for noise sufferers. They can go to court (usually too expensive) or the Ombudsman (whose remit is often too narrow to deal with many of these cases). An Independent Appeals Panel needs to be set up.

Improve insulation of properties

• Poor sound insulation is one of the hidden scandals of our housing crisis. Exact figures are hard to come by but research done over 10 years ago estimated at least 2.5 million people lived in homes with poor sound insulation (2). This will have increased in recent years with the growth of the private rented sector. A nationwide programme to properly insulate all the UK's homes would run into billions but doing nothing is not an option. The worst affected should be done first as part of a 10 year programme to install effective sound insulation in all homes.

Just 7% of people living in a detached house or bungalow are annoyed by noise from their neighbours. This rises to 23% of those living in a medium/high rise flat.

Community Noise

Many argue that our towns, cities, parks, shops, restaurants and hospitals are noisier than ever before. It need not be like this. Existing or new legislation should be used to:

Noisy Neighbourhoods

- clampdown on 'boom' cars, noisy motor bikes and stereo systems blaring from cars
- restrict the playing of amplified music on streets where people work, shop or live
- enforce by-laws that forbid the playing of music in public parks
- limit the number of music events allowed in any one park or open space in a year; impose and enforce tough conditions when they are permitted
- close down premises which continue to present a noise problem in a community
- restrict fireworks to a limited number of public displays each year; ban the sale of fireworks to the public; promote the use of laser display
- bring in tight restrictions on the use of leaf blowers

Noisy Trains, Buses and Tubes

- cut the number of announcements to the barest minimum: those required by law to assist visually impaired people and those essential for safety and disruption
- reduce the loudness of the announcements;
- get tough with people playing music on public transport

Piped Music

Regulate piped music and televisions in hospitals and nursing homes. No patient should unwillingly be subjected to piped music or televisions in hospitals or nursing homes. Separate television rooms and headphones for people who want to listen to television or music in wards should be the norm, and also for outpatients.

Workers in shops, restaurants and elsewhere are often bombarded by piped music that is sometimes loud and often very repetitive. Such inescapable forced music is particularly stress-inducing. Legislation is needed to give workers the right not to have to listen to it in the same way that non-smokers have gained the right not to have to breathe others' smoke.

Provide tax-breaks for 'muzac-free' shopping malls. Shopping malls are in many ways like a public street. Particularly in many of the UK's smaller towns and cities, it is difficult to get what you want without visiting the mall meaning you have little choice but to listen to the music.

Heat Pumps

Air source heat pumps can be noisy....in our desire for net zero, it is essential that adverse noise impacts are not a consequence. Stephen Turner, President of the Institute of Acoustics:

The Government plans to ban the installation of natural gas boilers in new homes from 2025 and has a stated 'ambition' to phase them out altogether in the following decade.

Their main replacement is likely to be heat pumps. These are like air conditioners which pump out heat. And most of them are situated outside. There are significant noise concerns.

We simply cannot risk installing heat pumps in properties until we are certain they will not cause noise problems

Thomas Lefevre, the director of Etude, which was commissioned by the Greater London Authority to study heat pumps (20), said, "The noise coming out is not huge, but it is not negligible. People who say they will not introduce any noise risk at all are wrong."

A report by the European Heath Pump Association admitted that the fan noise is a key problem. Mike Stigwood, the director of the consultancy MAS Environmental told the journal Noise Bulletin (21) that the tonal and low-frequency noise from noise pumps would be a problem.

Those on lowest incomes living in multi-occupancy properties and flats are likely to be worst hit

Where they are located is also important. In flats the choice of location can be very limited indeed. There is an expectation that the technology might improve as the mass market justifies and stimulates investment in quieter pumps but we simply cannot risk installing heat pumps in properties until we are certain they will not cause noise problems. Otherwise their constant low-frequency noise will create untold misery. And those on lowest incomes living in multi-occupancy properties and flats are likely to be worst hit. It is essential that the Government carries out an urgent noise audit of heat pumps. At present it looks impossible for them to be installed without causing widespread noise problems.

Solutions:

- The Government carries out an urgent noise audit of heat pumps
- Halt the installation of heat pumps until any noise problems have been overcome.

It is critical the country does not rush into the installation of heat pumps in the way hasty permission was given to build onshore wind turbines in the late 2000s, with adverse noise impacts.

Conclusions

Road Traffic noise can be reduced considerably. Lower speeds, quieter roads surfaces, noise barriers, and electric vehicles, plus investment in public transport (with lower fares), active travel and measures, such as road user charging, reallocation of road space and tighter parking restrictions, to cut traffic volumes are all possible without damaging the economy.

Aircraft noise presents more of a problem. First-rate operational practices will cut noise; some modal shift to rail for short distance journeys can reduce flight numbers; but progress towards significantly quieter planes is slow, not helped by the fact that the current emphasis is on designing aircraft with lower emissions.

Rail noise on conventional trains can be cut through a variety of technical measures. Noise from freight and high-speed trains will continue to cause some problems. If a high-speed line is built, tunnels, noise barriers and insulation programmes need to be integral to the proposal and a cap imposed on the number of trains that will be operated.

Shipping noise can be reduced markedly through cutting the speed of ships, together with measures to deal with cavitation from the propellers.

Wind farm noise can be tackled through imposing a strict distance of how far the turbines can be from the nearest property, plus investment in other quieter forms of energy. Existing turbines which disturb people should be shut down.

Neighbour noise can be tackled by using existing legislation to crack down on offenders, giving noise complainants a right of appeal and embarking on a nationwide programme of sound insulation.

Community noise, which includes piped music, fireworks, leaf blowers, public transport announcements, boom cars and amplified music in public places, is not an intractable problem if the political will is there to act.

A Noise Audit should be mandatory for all new inventions such as heat pumps, drones and flying taxis. Noise regulations should be in place before they are permitted.

Overall Conclusion: Many of the world's problems are difficult to solve. Noise is not one of them. Reducing the noise of aircraft will continue to be challenging but generally noise is not a problem without a solution.

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