Traffic Noise is a Health Risk

Long-term exposure to noise is linked to increased blood pressure, cardiovascular, gastrointestinal, and neurological disease, cognitive and mental health problems, and all-cause mortality. The U.S. Environmental Protection Agency Noise Effects Handbook (1985) recommends that outdoor 24-hour average noise be limited to 65 A-weighted decibels (dBA) in residential areas. People living near busy roads may be exposed to this level of daily noise. Outside of occupational settings, Americans are most likely to be exposed to chronic, harmful noise levels from transportation.

How Noise Barriers Work

The Massachusetts Department of Transportation will construct noise barriers on limited-access highways when average noise during the loudest hour of the day exceeds 70 dBA at residences or 75 dBA at parks, schools, hospitals, and other uses of concern.

Topography Matters. Walls and berms can reduce highway noise by 5 to 10 dBA, to a safer level, by blocking line-of-sight propagation of sound waves. They are not effective if the receivers (homes and other buildings, parks and other spaces) are significantly higher or lower than the roadway.

Barriers must extend horizontally beyond the receptor they are protecting, 4 times the distance between the receptor and the travel lane. Therefore barriers work best on limited-access highways not interrupted by intersections or topography.

Neighborhoods near exit ramps cannot usually be protected by barriers—in spite of the fact that much of highway-related traffic noise originates from accelerating and decelerating traffic on exit ramps and their intersections with local roads.

Residential and Recreational Population Density

Block residential density within 100 meters of the selected highways was calculated, with additional weighting for recreation places (parks and play areas) in that zone. These should be evaluated for noise protection including noise barriers.

19 schools, hospitals and long-term care facilities, and 296 other public and institutional facilities identified by Land Use code, are within 100 meters of the selected highways. These should be evaluated for noise protection including noise barriers.

Best Barrier Sites Based on Population Density

Rural town centers are usually affected to a greater degree by noise than urban centers due to lower population density. Urban areas with high density and large populations are more likely to receive complaints of noise. Therefore barriers work best on access highways, and other than limited-access highways, do not mitigate traffic noise into rural areas.

Best Barrier Sites Based on Community Health

Most unhealthy chronic traffic noise is not within 100 meters of a limited-access highway, and therefore cannot be mitigated by noise barriers. In new development, we can avoid exposing large populations to road noise through better land use planning and zoning.

Ranking Potential Noise Barrier Sites for Public Health Impact

The expected length of life for a child born in a census tract is used as a measure of neighborhood health, and vulnerability to transportation noise. Low-life-expectancy tracts tend to cluster in densely populated urban areas and economically depressed areas.

Noise Beyond the Highway

Most unhealthy chronic traffic noise is not within 100 meters of a limited-access highway, and therefore cannot be mitigated by noise barriers. In new development, we can avoid exposing large populations to road noise through better land use planning and zoning.

Topographic site selection includes consideration of slope, distance from curving and accelerations, existing and proposed levels of highway noise, and other factors not related to proximity.

The minimum distance between the barrier and the roadway is 25 feet in all cases to allow clearance for features such as signs, guardrails, and emergency access routes. The maximum height of a barrier is limited to 20 feet to avoid blocking visibility and to assure that noise barriers are visible to drivers, pedestrians, and cyclists.

Residential and school sound insulation programs are effective in reducing aviation and traffic-related noise and air pollution, indoors where people spend up to 90% of their time. Insulation also reduces heating and cooling costs, improves comfort, and protects vulnerable people during extreme heat and cold. Insulation with ventilation means residents can keep windows closed in warm months, shutting out noise and pollution.

Map Projections and References

Map Projection: NAD83 State Plane Massachusetts Mainland FIPS 2011

Data sources: MassDOT; U.S. Environmental Protection Agency “Noise, A Health Problem”; FHWA-USDOT Transportation Statistics, National Road and Aviation Noise Map, U.S. Centers for Disease Control and Prevention, Small Area Life Expectancy Project.

Martha Orndorff
May 3, 2019
CEEE-107 Spring 2019

Tufts University

Hearing the Highway

Suitable Sites for Noise Barriers in Massachusetts

Traffic noise is a health risk, and noise barriers may extend up to 90 meters. Benefits include reduced noise, improved comfort, and reduced cooling costs. Noise barriers on flat terrain are usually 60 meters, and they run through heavily populated areas, as they have high noise impact up to 100 meters from travel lanes.

Route 295 in Medford, Medford/Somerville, and the area Regional Highways that were inserted into older urban neighborhoods are areas of noise exposure in Massachusetts.

Route 19 Schools, hospitals, and other uses) are significantly lower. Neighbors near exit ramps cannot usually be protected by barriers—in spite of the fact that much of highway-related traffic noise originates from accelerating and decelerating traffic on exit ramps and their intersections with local roads.

MassDOT also considers project feasibility, cost, and community acceptance of noise barrier locations. Google Streetview was used to screen out sites with complex ramp configurations, unsuitable topography, insufficient right of way, and existing protective barriers.

This screening found that when population and public health impacts are given priority, many of the best sites for highway noise barriers are found in densely settled older cities. These are also likely to be areas where the community health, measured by life expectancy, is poorer.