Noise

This chapter discusses noise impacts based on past noise modeling performed in the region and on other relevant noise-related information. It focuses on transportation-related noise sources as well as ambient noise characteristics under different development patterns. It then analyzes the potential noise impacts under each of the growth distribution alternatives.

5.14.1 Affected Environment

A. BACKGROUND

The human ear can perceive a range of noise levels. The range of perceptible magnitudes is so large that noise levels are generally expressed on a logarithmic scale in units called decibels (dB). Noise levels are affected by a number of variables, including elevation, terrain, distance from the source and weather. A break in the line of sight between a source and receiver (e.g., buildings, hilly terrain) generally reduces sound levels by 5 dBA.[1] In addition, noise levels decrease with distance from a noise source. The change in noise level depends on the type of terrain (hard or soft), as well as the type of source (e.g., roadway, transit center). Weather conditions alter both noise levels and the transmission of noise from a source to where it is received. The human ear perceives changes in sound levels more effectively than absolute sound levels. While a 3 dB increase is barely perceptible to the human ear, a 5 dB increase sounds as if the noise is about one and one-half times as loud. A 10 dB increase is perceived as a doubling in noise level to most listeners.

At high intensities, environmental noise directly affects human health by causing hearing loss. Although the science is currently inconclusive, noise is also suspected of causing and aggravating other health problems. Environmental noise affects general human welfare by interfering with thought, sleep, and conversation. According to the Environmental Protection Agency, environmental sound levels below 55 dBA L_{dn}[2] should protect human health and welfare with a margin of safety for areas with outdoor uses. However, this level is not a standard. Rather, it identifies a safe level of noise exposure without consideration of other factors, such as cost of mitigation (EPA, 1974). Environmental sound levels in most urban environments are greater than 55 dBA L_{dn}. Sound levels typical of various environments are shown in Figure 5-14-1.

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[1] The human ear can best perceive frequencies or pitches between 1,000 and 5,000 hertz (Hz). Environmental sounds consist of many frequencies. Frequency weighting combines all of the frequencies into one sound level that simulates how an average person hears sounds. The commonly used frequency weighting for environmental sounds is A-weighted decibels (dBA).

[2] Ldn, or the day/night noise level, describes the daily noise environment, with an added penalty for higher noise levels at night.

FIGURE 5-14-1: TABLE OF TYPICAL OUTDOOR SOUND LEVELS IN VARIOUS ENVIRONMENTS

Description of Environment	L_{dn} (dBA)
City (Downtown Major Metropolis)	75 – 80
Very Noisy Urban	70
Noisy Urban	65
Urban	60
Suburban	55
Small Town and Quiet Suburban	45 – 50

Source: Environmental Protection Agency, 1974

In addition to its effects on humans, noise can also affect wildlife (for more information see *Chapter 5.5 – Ecosystems*). While research on the impacts of noise on ecosystems has produced a range of theories and results, most experts agree that noise can affect wildlife behaviorally and physiologically. If noise is a constant stress, it can exhaust wildlife, affecting reproductive success and the likelihood of survival. Projecting actual consequences of noise on wildlife is difficult, however, because responses will vary between species (Radle, 2006).

B. REGULATORY SETTING

Federal and state noise regulations and guidance provide a framework for evaluating noise impacts from transportation sources. The Federal Transit Administration, Federal Highway Administration, and Federal Aviation Administration each have established noise exposure measurement procedures (both modeling and monitoring) and noise impact criteria. The Federal Transit Administration's criteria apply to federally funded transit projects and vary depending on project type. For fixed guideway and transit facilities, Federal Transit Administration project exposure criteria apply. The Federal Highway Administration regulates noise associated with busways, access ramps, and other projects connected to roadway systems. The Federal Aviation Administration primarily regulates airport land use, aircraft noise, but also provides assistance to airport operators in developing and implementing noise abatement and compatibility programs.

Noise Criteria for Transit Projects

Under Federal Transit Administration transit criteria, a noise impact occurs when a proposed project would cause $L_{eq}(h)$[3] or Ldn noise levels to increase overall noise between 1 and 10 dBA, depending on the existing noise level and land use (FTA, 1995). In general, the greater the existing noise level, the less a project may increase the overall noise level. Land uses sensitive to noise are divided into three categories (see Figure 5-14-2). Other uses, such as retail and industrial, are generally not considered noise-sensitive.

FIGURE 5-14-2: FEDERAL TRANSIT ADMINISTRATION-ESTABLISHED NOISE-SENSITIVE LAND USES

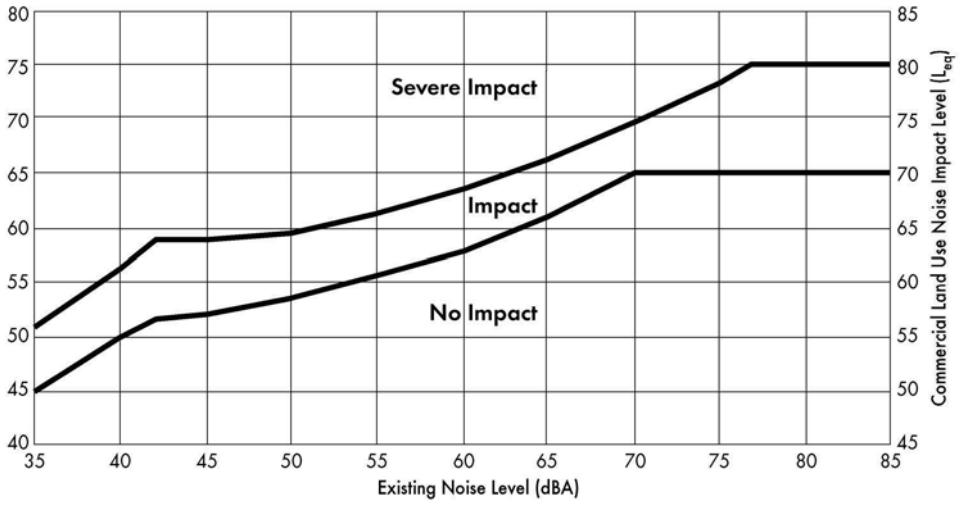
Land Use Category	Description
1	Most sensitive areas where quiet is essential (e.g., outdoor amphitheaters)
2	Places where people sleep (e.g., homes, apartments, hotels, hospitals)
3	Least sensitive areas (e.g., schools, libraries, medical offices, concert halls)

Source: Federal Transit Administration, 1995

Noise impact levels, as defined by the Federal Transit Administration, are presented in Figure 5-14-3. These noise exposure levels include only noise generated by a specific project and not other noise sources that contribute to the overall noise level in the project area. In urban areas with existing L_{dn} noise levels ranging from 60 to 75 dBA, noise impacts from light rail lines would occur at noise-sensitive locations (such as residences) within 50 to 100 feet of the tracks, depending on local conditions. In suburban areas with existing L_{dn} noise levels of 50 to 60 dBA, noise impacts would occur within approximately 100 to 150 feet of park-and-ride lots. Impacts would occur within approximately 25 to 50 feet of commuter rail lines with one commuter train per hour.

[3] L_{eq}, or the equivalent sound level, is a common descriptor for environmental noise is the equivalent sound level. L_{eq} is a sum of all sounds over a given period of time. L_{eq} measured over a 1-hour period is the hourly L_{eq}, denoted $L_{eq}(h)$.

FIGURE 5-14-3: PROJECT IMPACT CRITERIA FOR TRANSIT PROJECTS



Source: Federal Transit Administration, 1995

Noise Criteria for Roadway Projects

For roadway projects, noise impacts occur when predicted traffic noise levels approach or exceed the Federal Highway Administration's noise abatement criteria or substantially exceed existing noise levels (23 Code of Federal Register, Part 772.5). The Federal Highway Administration noise abatement criteria specify different $L_{eq}(h)$ noise levels for different land use categories (Figure 5-14-4). For receptors where serenity and quiet are of extraordinary significance, such as National Parks and National Monuments, the noise criterion is 57 dBA. For residences, parks, schools, churches, and similar areas, the noise criterion is 67 dBA. Mitigation is considered when the noise abatement criteria are approached or exceeded.

FIGURE 5-14-4: FEDERAL HIGHWAY ADMINISTRATION'S NOISE ABATEMENT CRITERIA

Activity Category	$L_{eq}(h)$	Description of Activity Category
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A or B.
D	— — — —	Undeveloped lands.
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Source: 23 Code of Federal Register Part 772

Noise Criteria for Airports

The Federal Aviation Administration is primarily responsible for the regulation of aircraft noise, although the agency also supports state and local efforts to ensure compatible land use near airports. Airport operators develop noise exposure maps to describe how airport operations will affect the compatibility of land uses in the area (14 Code of Federal Register, Part 150). According to the Federal Aviation Administration regulations, residential and recreational land uses are generally compatible with noise levels below 65 dB L_{dn}. Most commercial and industrial land uses are compatible with noise levels up to 70 dB L_{dn}, although few land uses are recommended over 70 dB L_{dn} without mitigation. For land uses with existing exposure levels over 65 dB L_{dn}, the Federal Aviation Administration considers an increase of 1.5 dB L_{dn} to be significant (Port of Seattle, 2002). If any change in airport operations would cause a

substantial new noncompatible use or significantly reduce noise over existing incompatible land uses in an area depicted on the noise exposure map, the airport must submit a revised map (14 Code of Federal Register, Part 150). Airports who have submitted acceptable noise maps may develop and submit for Federal Aviation Administration approval a noise compatibility program (14 Code of Federal Register Part 150.23). The purpose of such programs is to identify existing and future airport noise, reduce noise impacts in surrounding communities, and reduce or eliminate present or future noncompatible land uses in the area. After Federal Aviation Administration approval of an airport's noise compatibility program, the airport is eligible to receive Part 150 noise funds to help implement the program.

State Noise Criteria

The Washington State Department of Ecology (Ecology) regulates noise levels at property lines adjacent to a noise source (WAC Chapter 173-60). Although traffic and transit noise is exempt from property line noise limits, the limits apply to construction noise during certain hours and to other operations such as park-and-ride lots. Figure 5-14-5 illustrates the level of allowable noise, based on the land use of the noise source and the receiving property, or the Environmental Designation of Noise Abatement (EDNA). Most jurisdictions in the Puget Sound region have adopted the Ecology property line limits with minor changes, such as lower limits in residential areas during nighttime hours. Aircraft in flight are exempt from the provisions of WAC 173-60. In addition, aircraft engine testing and maintenance are exempt from the provisions between 7:00 a.m. and 10:00 p.m.

FIGURE 5-14-5: MAXIMUM PERMISSIBLE NOISE LEVELS BY ENVIRONMENTAL DESIGNATION (DBA)

EDNA of Noise Source	EDNA of Receiving Property Residential	EDNA of Receiving Property Commercial	EDNA of Receiving Property Industrial
Residential	55	57	60
Commercial	57	60	65
Industrial	60	65	70

Source: Washington Administrative Code, 1989

C. EXISTING CONDITIONS

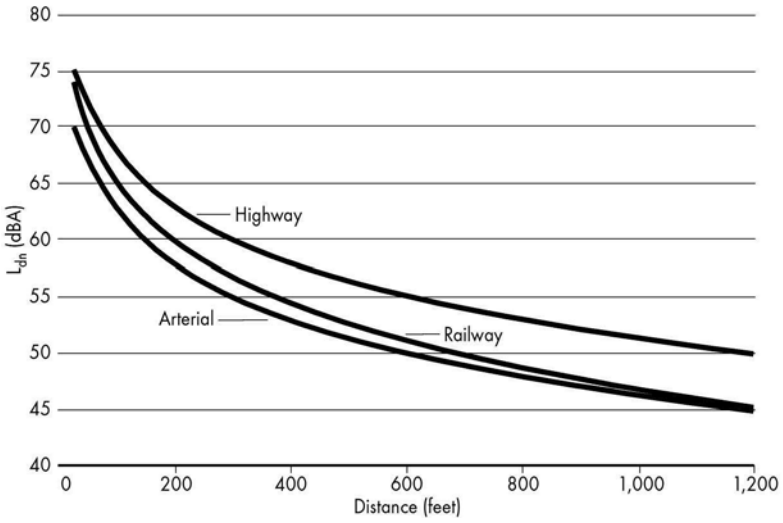
Background environmental sound levels vary widely in different environments. The Environmental Protection Agency evaluated L_{dn} sound levels at population centers of various densities and developed qualitative descriptions of the sound environments (Figure 5-14-1).

Although a number of human activities contribute to noise exposure levels, transportation sources are the largest contributor to ambient noise in urban and suburban areas. Noise levels from transportation sources vary with the volume, speed, and type of vehicle. Typically, an increase in any of these factors increases traffic noise levels.

Roadway Noise

Noise from mobile sources consists of noises from the engine, tires, and exhaust. Heavy trucks are significant contributors to overall traffic noise levels. The exhaust and mechanical systems, increased tire to pavement contact, and poor aerodynamic design of heavy vehicles contribute to higher traffic noise levels. Roadways with greater amounts of truck traffic will have higher noise levels than roadways without truck traffic. Ambient noise levels can generally be estimated based on distance to transportation sources. Typical L_{dn} noise levels, as a function of distance from highways, arterials, and rail lines, are shown in Figure 5-14-6.

FIGURE 5-14-6: TYPICAL L^{DN} NOISE LEVELS NEAR TRANSPORTATION FACILITIES



Source: Federal Transit Administration, 1995

Noise levels measured in the Puget Sound region tend to be consistent with the values in Figure 5-14-6 and Figure 5-14-7. For example, Seattle urban area noise levels were documented in the Central Link Environmental Impact Statement to range from 61 to 76 dBA L_{dn} (Sound Transit, 1999).

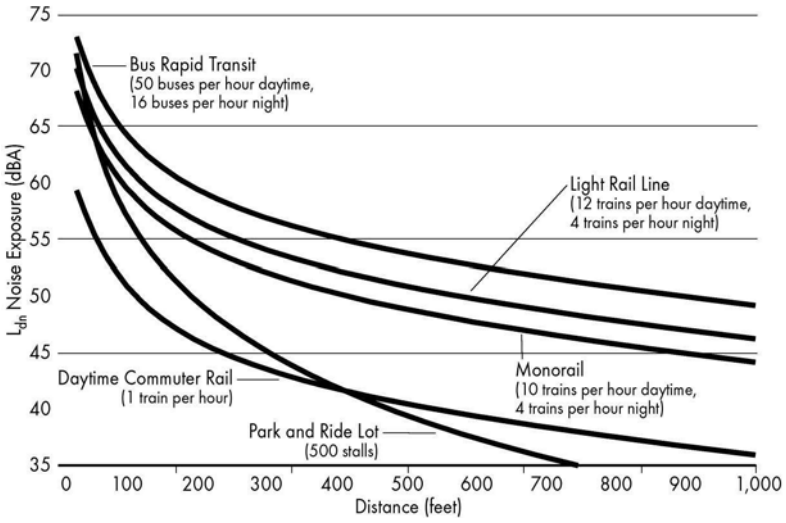
Railway Noise

Measurements taken in residential areas for the Interstate 405 Corridor Program Environmental Impact Statement along the Burlington Northern Santa Fe rail line on the east side of Lake Washington ranged from 56 to 68 dBA L_{dn} (WSDOT, 2002).

Transit Noise

Existing transit noise sources in the Puget Sound region include buses, light rail, and commuter rail. Typical L_{dn} noise exposure levels from transit vary based on the mode or facility. For example, typical noise levels for a commuter rail system operating one train per hour during the day at 50 mph would be approximately 55 dBA at 50 feet from the track. If trains idle for long periods of time at stations, the L_{dn} exposure levels in the vicinity of the stations would increase. Noise exposure levels from a 500-stall surface-level park-and-ride lot operating with 10 buses per hour during the day would be about 64 dBA at 50 feet from the lot. Noise levels associated with transit also vary by vehicle size and engine type. Electric and gasoline buses, for example, are quieter than diesel buses. On heavily traveled roadways, the contribution of bus noise to total traffic noise is generally very limited.

FIGURE 5-14-7: TYPICAL L^{DN} NOISE LEVELS NEAR TRANSIT FACILITIES



Source: Parsons Brinckerhoff, 2005

Airport Noise

Aircraft noise is a contributor to noise exposure levels in the Puget Sound region. Noise levels from individual aircraft events can range from 53 to 78 L_{max}[4] dBA depending on the type of aircraft, height above the ground, and other factors (Port of Seattle, 2002). The Puget Sound region is home to several airports, and Seattle-Tacoma International Airport (Sea-Tac) is the region's primary commercial and international service airport. Five other airfields serve as general aviation and reliever airports. In addition, there are 23 other general aviation airports throughout the region. Aircraft produce noise while on the ground and flying over populated areas, as well as during takeoff and landing.

In 2002 the Federal Aviation Administration approved the Seattle-Tacoma International Airport FAR Part 150 Study Update. The study identifies areas affected by existing and forecast future airport noise, and outlines a comprehensive program for reducing noise impacts in the communities around the airport (Burien, Des Moines, Kent, Normandy Park, Federal Way, Tukwila, SeaTac, and areas of unincorporated King County). The Port is now implementing the Noise Study recommendations using Federal Aviation Administration Part 150 funds and airport funds.

In 1996 the Puget Sound Regional Council adopted Resolution A-96-02, which amended the Metropolitan Transportation Plan, adding plans for a third runway at Seattle-Tacoma International Airport. . The Resolution included 31 action steps (conditions) to address noise impacts in the communities around Sea-Tac Airport. . As of March 2006, 21 action steps were complete and 10 were underway. . Updating the Sea-Tac FAR Part 150 Study (completed in 2002) was among the required action steps. . The Resolution also required the Port of Seattle to work with the Highline School District to implement a program to reduce airport noise impacts in schools throughout the district. . This program (known as "Sound Environment for Education") is funded by the Federal Aviation Administration, the Port, the State of Washington, and the Highline School District. . Implementation is currently underway. .

A Part 150 Noise Study and Airport Noise Compatibility Program for King County International Airport (Boeing Field) was completed in 2004, and is being implemented. . This program is helping to reduce the impacts of airport noise in the areas around Boeing Field.

At Snohomish County Airport (Paine Field) the most recent airport master plan was completed in 2002 and included preparation of an official FAR Part 150 Noise Exposure Map. . The noise analysis shows significant existing and forecast (2008) aircraft noise (above 65 L_{dn}) is mostly contained within the airport boundary. Therefore no FAR Part 150 Noise Compatibility Program was done.

[4] L_{max} is the highest noise level that occurs during a given measurement period.

The region's 25 other airports generate aircraft noise, but similar to the Paine Field situation, most aircraft noise occurs within airport properties.

5.14.2 Analysis of Alternatives (Long-Term Impacts)

Urbanization affects noise exposure levels by changing the physical environment, such as replacing vegetation with paved surfaces and buildings. Noise decreases with distance from the noise source, and vegetation absorbs noise more effectively than hard terrain. Urbanization also increases the number of noise sources in an area, such as lawn mowers, vehicles on streets and highways, railroads, and aircraft in flight. Population density, therefore, is highly correlated with noise exposure. As an area grows, construction and maintenance operations increase, emergency vehicles are more prevalent, and more people are concentrated in areas with more noise sources. As cities and regions grow under each of the alternatives, the number of noise sources could increase. The extent of the perceptible change in sound levels, however, will depend on where and how the growth occurs, and on any potential mitigation measures employed.

Generally, increased population and employment in rural areas has the potential to result in low-density growth patterns. While noise sources may increase, the receptors could likely be spread out over a large area and are unlikely to perceive a noticeable change in sound levels. . Unincorporated urban growth areas present a wide variety of growth patterns, from completely undeveloped to more mature urban areas. . New residents in presently undeveloped areas of the urban growth area may be exposed to lower levels of ambient noise, similar to those in rural areas. . Potential exposure in presently developed areas could be more similar to that in metropolitan or core cities, where noise levels are already high, and changes in noise levels associated with significant growth may only be slightly perceivable.

A. IMPACTS COMMON TO ALL ALTERNATIVES

Alternative plans for urbanization differ in where uses and activities are concentrated and how people and goods move between areas. For example, concentrating growth in an area could likely increase traffic and associated noise levels on nearby roads. The effect of transportation-generated noise depends on the proximity of noise-sensitive land uses to the noise source.

Due to the logarithmic nature of the decibel scale, increases in traffic volumes do not cause proportional increases in noise levels. A doubling of traffic, for example, would result in only a 3 dB increase in noise levels. Traffic would need to triple to result in a readily perceivable (5 dB) noise increase (CDOT 2004). For this analysis, noise impacts were analyzed based on changes in vehicle trips compared to existing conditions and to a comparison of transportation benchmarks in 2040 for the various alternatives. Although this approach does not reveal all areas that would experience noise impacts, it identifies locations where traffic noise would noticeably increase and compares the alternatives to one another. . Areas that experience substantial increases in travel demand may require additional transportation capacity in the future. Transit and roadway enhancements would produce localized noise impacts in the project corridor. Impacts resulting from additional transportation facilities would be similar to those depicted in Figures 5-14-6 and 5-14-7 shown on previous pages.

B. ANALYSIS OF EACH ALTERNATIVE

Preferred Growth Alternative

Under the Preferred Growth Alternative, growth would be focused in metropolitan cities, core cities, and larger cities. As compared to current plans (Growth Targets Extended), the densities associated with this growth pattern would result in fewer vehicle trips in the region, and fewer vehicle trips within urbanized areas. On average, the number of trips would not double, and therefore would not yield a readily perceivable increase in noise levels. Outside of the metropolitan, core and larger cities, the Preferred Growth Alternative would result in less noise increase as compared to the Growth Target Extended alternative.

Even though the increases are less than current plans, because a substantial amount of growth under the Preferred Growth Alternative would be within urban areas, most investments in transportation capacity would likely be to the existing infrastructure. In the case of transportation, improved transit headways and additional road capacity can cause slight increases in noise levels. As density increases in metropolitan and core cities, however, other noise sources (such as ambulances) could likely contribute to rising noise levels in those areas.

Growth Targets Extended Alternative

Growth Targets Extended would extend currently adopted plans and targets to the year 2040. Growth under Growth Targets Extended would be more evenly distributed among geographies than under existing conditions. Half of the population growth would be distributed between metropolitan cities and the unincorporated urban growth area, while the majority of employment growth would occur in metropolitan cities and core cities. Because much of the projected population growth in the unincorporated urban growth area would not be highly dense urbanized growth, it is unlikely to result in readily perceivable increases in noise levels. Under Growth Targets Extended, daily vehicle trips in some metropolitan cities could double, but on average traffic would increase only 60 percent. Similarly, vehicle trips in core cities are projected to increase 75 percent on average. As mentioned above, traffic would need to triple to cause a perceivable change in noise levels.

In comparison to the other alternatives, the most population growth in rural areas is expected under Growth Targets Extended. Regionally significant habitat areas occur at the greatest density in rural areas. Noise impacts on wildlife would therefore be possible as rural areas and adjacent resource lands are potentially developed and noise levels increase (see *Chapter 5.5 – Ecosystems*).

Metropolitan Cities Alternative

Under the Metropolitan Cities Alternative, growth would be focused in metropolitan cities and core cities. Although the densities associated with this growth pattern would result in the fewest vehicle trips in the region, it would cause the greatest increase in vehicle trips within urbanized areas. On average, vehicle trips in metropolitan cities would double, though select cities could experience a tripling in daily trips. Similarly, a few core cities may see increases in vehicle trips over 200 percent. On average, however, the number of trips would double, not yielding a readily perceivable increase in noise levels. Outside of the metropolitan and core cities, the Metropolitan Cities Alternative would result in the least increase in noise compared to the other alternatives.

Because a substantial amount of growth under the Metropolitan Cities Alternative would be within urban areas, most investments in transportation capacity would likely be to the existing infrastructure. In the case of transportation, improved transit headways and additional road capacity can cause slight increases in noise levels. As density increases in metropolitan and core cities, however, other noise sources (such as ambulances) could likely contribute to rising noise levels in those areas.

Larger Cities Alternative

Under this alternative, about 60 percent of growth would be focused in core and larger cities, with another 20 percent in metropolitan cities. Vehicle trips in metropolitan cities vary greatly under the Larger Cities Alternative, actually decreasing in some areas while more than doubling in others. On average, vehicle trips would increase by approximately 40 percent in metropolitan cities. In core cities, vehicle trips would double on average, but are estimated to triple in a few locations. Unlike the Metropolitan Cities Alternative, more growth would be dispersed to larger cities, where increased traffic could likely be expected. Most of the regional growth under the Larger Cities Alternative, however, would be near existing transportation infrastructure. No new transportation-related sources are likely to be created. Other new noise sources related to increased urbanization, however, can be expected in core and large cities.

Smaller Cities Alternative

This alternative would disperse growth throughout the urban growth area, with the most growth focused in small cities and the unincorporated urban growth area of any of the alternatives. Compared to existing conditions, traffic volumes regionwide are estimated to increase more under the Smaller Cities Alternative than any other alternative. Traffic within metropolitan and core cities are estimated to increase only 3 percent and 34 percent, respectively. Traffic-related noise levels are therefore unlikely to increase in metropolitan and core cities under the Smaller Cities Alternative.

In the remainder of the region, vehicle trips are estimated to almost double. Travel under the Smaller Cities Alternative is estimated to be widely dispersed throughout the region. While average noise levels in currently rural areas could likely increase, dense urbanized growth — and therefore a perceptible change in sound levels — is unlikely. As growth spreads across the region, areas may find a need for added capacity in the form of new or expanded transportation facilities. New facilities could likely cause some noise impacts for nearby land uses (see Figures 5-14-6 and 5-14-7).

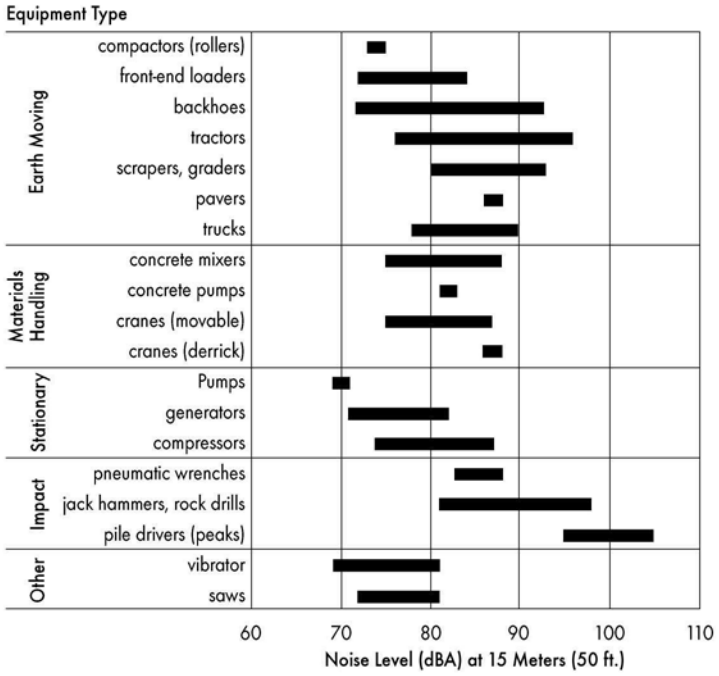
Similar to Growth Targets Extended, 10 percent of growth would occur in rural areas under the Smaller Cities Alternative. As described in that alternative, while impacts to human populations are anticipated to be minimal, impacts on wildlife may occur as rural areas and adjacent resource lands are potentially developed and noise levels increase.

5.14.3 Cumulative Effects

Each of the alternatives would result in construction activity in various areas throughout the region, and construction in all alternatives would be likely throughout the time period to 2040. Noise during construction could be bothersome to nearby residents and businesses. Construction would vary widely in hours of operation and noise impacts, depending on the size and type of project. Specific impacts would be analyzed and addressed during future project-level planning and environmental review of individual projects.

The predominant source of noise at most construction sites is the internal combustion engine. Earthmoving equipment, material-handling equipment, and stationary equipment are all engine-powered. Sound levels associated with mobile equipment vary in a cyclic fashion, while sound levels from stationary equipment (e.g., pumps, generators, and compressors) are fairly constant. Trucks are prevalent during most phases of construction and are not confined to the project site. Noise from trucks, therefore, tends to affect more receptors. Other noise sources include pneumatic, hydraulic, or electric impact equipment and tools such as pile drivers.

FIGURE 5-14-8: TYPICAL CONSTRUCTION EQUIPMENT NOISE LEVELS



Source: Parametrix, Inc.

Construction noise associated with any project would likely be intermittent, varying throughout the construction period and occurring at different locations in the project area. Noise levels would depend on the type, amount, and location of construction activities. Figure 5-14-8 represents typical maximum noise levels from construction equipment.

As Figure 5-14-8 illustrates, maximum noise levels from construction equipment could range from 69 to 106 dBA L_{max} at a distance of 50 feet. Construction noise decreases at a rate of 6 to 8 dBA for every doubling of distance from the source. Because construction equipment could idle, power off, or operate at less than full power at any given time and because construction machinery is typically used to complete short-term tasks at various locations, average Leq daytime noise levels near construction projects could be lower than the maximum noise levels shown in Figure 5-14-5.

5.14.4 Potential Mitigation Measures

Evaluation of individual project impacts and the need for mitigation measures would occur during future project-level planning and environmental review. Mitigation is generally required only where frequent human use occurs and a lower noise level would have benefits. Noise may be controlled at the receptor (e.g., increased insulation in windows, doors, and walls), at the source (e.g., quieter engines and mufflers), and along the noise path (e.g., noise walls, shielding, and increased distance). Noise mitigation at the receptor is generally not consistent with federal or state noise abatement policies.

A range of mitigation measures could be implemented as necessary to reduce noise impacts. Different methods of mitigation are appropriate for different noise sources and should be evaluated on a case-by-case basis to determine whether the approach is feasible and reasonable.

Potential mitigation measures for roadway and transit projects include:

- Acquiring land for buffer zones or for construction of noise barriers.
- Airport noise abatement and mitigation programs, and airport compatible land use programs.
- Aligning roadways or tracks further from noise-sensitive land uses.
- Designing and maintaining tracks and wheels to reduce squeal, rail corrugations, and gaps.
- Reducing engine noise by maintaining transit vehicles.
- Constructing noise barriers or berms.
- Installing noise insulation in buildings within the noise contour.
- Promoting alternative modes of transportation to reduce traffic-generated noise.
- Encouraging vehicle trip reduction.
- Requiring trucks to use designated truck routes.
- Employing traffic management measures (e.g., traffic control devices and signing for prohibition of certain vehicle types, time-use restrictions for certain vehicle types, and modified speed limits).
- Increasing vegetation and planting street trees.
- Urban design and building siting.

Noise from construction activities may be mitigated by:

- Constructing enclosures or walls to surround equipment.
- Installing mufflers or other noise-reducing devices or using quieter equipment.
- Maintaining equipment.
- Imposing time restrictions on equipment use.
- Positioning stationary equipment away from noise-sensitive receptors.

As provided for by the Federal Aviation Administration, several airports in the Puget Sound region have developed noise exposure maps and noise compatibility programs to ensure minimal noise impacts to residences adjacent to the airfields and along flight paths. The Port of Seattle has also initiated a noise remedy program that involves the insulation of schools, homes, and condominiums within Sea-Tac Airport's noise-impact boundaries. The Port is also purchasing property adjacent to the airport, installing sound insulation, and reselling it. Several regional airports have implemented noise abatement programs that restrict aircraft engine maintenance run-ups and monitor noise levels and aircraft compliance with abatement procedures. The Port also attempts to minimize noise impacts by outlining specific flight headings and altitudes. For example, flight paths over the Duwamish Industrial Area, Elliott Bay, and the Puget Sound create fewer noise impacts than flight paths over residential areas. These procedures are followed to the maximum extent possible, air traffic conditions permitting.

5.14.5 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts from noise are expected under the Preferred Growth, Growth Targets Extended, Metropolitan Cities, Larger Cities, and Smaller Cities alternatives. However, the potential mitigation measures are likely to be necessary in site-specific locations, and can likely add benefit regionwide as well. Future project-level environmental review would determine if applicable noise criteria are exceeded at specific locations. Where this occurs, potential mitigation for such impacts would be evaluated and implemented as appropriate to address the impact.