

---

# **HIGHWAY NOISE POLICY AND ABATEMENT GUIDELINES**



PREPARED IN COOPERATION WITH:

State of Hawaii, Department of Transportation, Highways Division  
and U.S. Department of Transportation, Federal Highway Administration



Honolulu, Hawaii

August 2011

---

## Table of Contents

|   |    |
|---|----|
| 1. INTRODUCTION.....  | 1  |
| 2. PURPOSE AND APPLICABILITY OF POLICY.....                                 | 2  |
| 3. DEFINITIONS .....  | 3  |
| 4. TRAFFIC NOISE PREDICTION .....   | 6  |
| 5. ANALYSIS OF TRAFFIC NOISE IMPACTS.....                                   | 8  |
| 5.1 Identification of Traffic Noise Impacts.....                            | 8  |
| 5.2 Noise Abatement Criteria (NAC) – Activity Categories and Criteria ..... | 9  |
| 5.3 Identifying Impacted Receptors.....                                     | 11 |
| 5.4 Determining Existing or Current Year Noise Levels .....                 | 12 |
| 6. ANALYSIS OF NOISE ABATEMENT MEASURES .....                               | 13 |
| 6.1 Consideration of Noise Abatement Measures.....                          | 13 |
| 6.2 Noise Abatement for Non-Residential Receptors.....                      | 14 |
| 6.3 Feasibility of Noise Abatement .....                                    | 15 |
| 6.4 Reasonableness of Noise Abatement .....                                 | 15 |
| 6.5 Documentation of Noise Study Results .....                              | 16 |
| 6.6 Design Build Requirements.....  | 17 |
| 6.7 Third Party Funding.....  | 17 |
| 6.8 Cost Averaging Noise Abatement Measures .....                           | 17 |
| 6.9 Collection and Reporting of Constructed Noise Barrier Data .....        | 17 |
| 7. FEDERAL PARTICIPATION .....  | 18 |
| 8. PUBLIC PARTICIPATION AND INFORMATION FOR LOCAL OFFICIALS .....           | 18 |
| 9. CONSTRUCTION NOISE .....   | 19 |
| 10. REGULATIONS AND GUIDANCE REPORTS.....                                   | 20 |
| 10.1 FHWA Highway Noise Regulations and Resources .....                     | 20 |
| 10.2 HDOT Program for Existing Highways (Not Subject to FHWA Approval)..... | 20 |
| 10.3 HDOT Guidance for Highway Noise Complaints .....                       | 21 |
| 10.4 HDOT Guidance for Highway Noise Analysis .....                         | 25 |
| 10.5 TNM 2.5 Highway Noise Analysis.....                                    | 30 |

## 1. INTRODUCTION

This document contains HDOT's noise policy on highway traffic noise and construction noise. This policy describes the HDOT's implementation of the requirements of the Federal Highway Administration (FHWA) Noise Standard in 23 Code of Federal Regulations (CFR) Part 772 (see Section 10.1). This policy was developed by HDOT and by FHWA.

The level of highway traffic noise primarily depends on three factors: 1) The volume of the traffic, 2) The speed of the traffic, and 3) The number of trucks in the flow of the traffic. Generally, heavier traffic volumes, higher speeds, and greater number of trucks increase the loudness of highway traffic noise. Vehicle noise is primarily a combination of noise produced by the engine, drivetrain, exhaust, and tires.

For the purpose of highway traffic noise analyses, motor vehicles are grouped into five categories: 1) Automobiles - vehicles with two axles and four tires; 2) Medium trucks - all cargo vehicles with two axles and six tires; 3) Heavy trucks - all cargo vehicles with three or more axles; 4) Buses - all vehicles designed to carry more than nine passengers; and 5) Motorcycles – all vehicles with two or three tires and an open-air driver/passenger compartment.

Noise is unwanted sound. The vibration of sound pressure waves in the air produces sound. Sound pressure levels used to measure the intensity of sound are described in terms of decibels. The decibel (dB) is a logarithmic unit, which expresses the ratio of the measured sound pressure level to a standard reference level. Sound is composed of various frequencies, but the human ear does not respond to all frequencies. Frequencies to which the human ear does not respond are filtered out when measuring highway traffic noise levels. Sound level meters are usually equipped with weighting circuits, which filter out selected frequencies. The A-scale on a sound level meter best approximates the frequency response of the human ear. Sound pressure levels measured on the A-scale of a sound meter are abbreviated dB(A).

The most common descriptor of environmental noise in the U.S. is the equivalent (energy average) sound level. The equivalent sound level is the steady state, A-weighted sound level which contains the same amount of acoustic energy as the actual time varying, A-weighted sound level over a specified period of time. If the time period is one hour, the descriptor is the hourly equivalent sound level,  $L_{eq}(h)$ , which is widely used as a descriptor of highway traffic noise. An additional descriptor, which is sometimes used, is the  $L_{10}$ . This is the A-weighted sound level that is exceeded 10% of the time.

Decibels are logarithmic units therefore cannot be added arithmetically. The sound pressure level from two equal sources is 3 dB(A) greater than the sound pressure level of just one source. So, two trucks producing 90 dB(A) each combine to produce 93 dB(A), not 180 dB(A). In other words, a doubling of the noise source produces only a 3 dB(A) increase in the sound pressure level. Studies have shown that this increase is barely perceptible by the human ear. However, studies show that a 5dB(A) increase is a readily perceptible change.

This policy contains the highway agency's policy on how highway traffic noise impacts are defined, how noise abatement is evaluated, and how noise abatement decisions are made. In addition to defining traffic noise impacts, the FHWA Noise Standard requires that noise abatement measures be considered when traffic noise impacts are identified for Type I Federal projects. Noise abatement measures that are found to be feasible and reasonable must be constructed for Type I projects. Feasible and reasonable noise abatement measures are eligible for Federal-aid participation at the same ratio or percentage as other eligible project costs.

## **2. PURPOSE AND APPLICABILITY OF POLICY**

This policy provides procedures for noise studies and noise abatement measures to help protect the public's health, welfare and livability, to supply noise abatement criteria, and to establish requirements for information to be given to local officials for use in the planning and design of highways approved pursuant to title 23 U.S.C.

The highway traffic noise prediction requirements, noise analyses, noise abatement criteria, and requirements for informing local officials in this regulation constitute the noise standards mandated by 23 U.S.C. 109(1). All highway projects which are developed in conformance with this regulation shall be deemed to be in accordance with the FHWA noise standards.

The applicability of this policy of HDOT is defined by the following clauses:

- (a) This policy applies to all Federal or Federal-aid Highway Projects authorized under title 23 U.S.C. Therefore, this policy applies to any highway project or multimodal project that: Requires FHWA approval regardless of funding sources, or is funded with Federal-aid highway funds.
- (b) The HDOT developed this noise policy with FHWA approval and shall apply this policy uniformly and consistently statewide.
- (c) This policy applies to all Type I projects.

(d) The development and implementation of Type II projects are not mandatory requirements of section 109(i) of title 23 U.S.C.

(e) HDOT does not participate in a Type II program.

(f) HDOT is not required to complete a noise analysis or consider abatement measures for a Type III project.

In addition to Federal projects, this policy shall also apply to other State-funded projects that involve: (1) Construction of a highway on new alignment; or (2) A significant change in the horizontal or vertical alignment of an existing highway; or (3) Adding new through lanes to an existing highway. The requirements of this policy apply uniformly and consistently to all projects throughout the State that fall into one of the three categories specified above.

### **3. DEFINITIONS**

*Abatement.* Measures used to reduce traffic noise levels. Under normal circumstances, abatement measures will be implemented only where noise reduction will be more than 5 dB(A).

*Adverse Effects.* (Environmental Justice.) The totality of significant individual or cumulative human health or environmental effects, including interrelated social and economic effects, which may include noise. Effects: (a) Predominately borne by a minority population and/or a low-income population; or, (b) Will be suffered by the minority population and/or low-income population and is appreciably more severe or greater in magnitude than the adverse effect that will be suffered by the non-minority population. (U.S. DOT Order 5610.2)

*Benefited Receptor.* The recipient of an abatement measure that receives a noise reduction of no less than 5 dB(A).

*Common Noise Environment.* A group of receptors within the same Activity Category in Table 1 that are exposed to similar noise sources and levels; traffic volumes, traffic mix, and speed; and topographic features. Generally, common noise environments occur between two secondary noise sources, such as interchanges, intersections and cross-roads.

*Date of Public Knowledge.* The date of approval of the Categorical Exclusion (CE), the Finding of No Significant Impact (FONSI), or the Record of Decision (ROD), as defined in 23 CFR part 771.

*Decibel (dB).* See definition on page 2.

*Design Year.* The future year used to estimate the probable traffic volume for which a highway is designed.

*Environmental Justice.* The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

*Existing Noise Levels.* The worst noise hour resulting from the combination of natural and mechanical sources and human activity usually present in a particular area.

*Feasibility.* The combination of acoustical and engineering factors considered in the evaluation of a noise abatement measure.

*Impacted Receptor.* A receptor is considered to be impacted by the effects of highway noise if the predicted noise levels approach or exceed specific absolute noise levels or when the predicted traffic noise levels substantially exceed the existing noise levels. See section 5.3 for specific limits.

$L_{10}$ . The sound level that is exceeded 10% of the time (the 90<sup>th</sup> percentile) for the period under consideration, with  $L_{10}(h)$  being the hourly value of  $L_{10}$ .

$L_{eq}$ . The equivalent steady-state sound level which in a stated period of time contains the same acoustic energy as the time varying sound level during the same time period, with  $L_{eq}(h)$  being the hourly value of  $L_{eq}$ .

*NAC.* Noise Abatement Criteria are shown on Table 1 in Section 5.2.

*Multifamily Dwelling.* A residential structure containing more than one residence. Each residence in a multifamily dwelling shall be counted as one receptor when determining impacted and benefited receptors.

*Noise Barrier.* A physical obstruction that is constructed between the highway noise source and the noise sensitive receptor(s) that lowers the noise level, including stand alone noise walls, noise berms (earth or other material), and combination berm/wall systems.

*Noise Reduction Design Goal.* The optimum desired dB(A) noise reduction determined from calculating the difference between future build noise levels with abatement, to future build noise levels without abatement. HDOT shall achieve a noise reduction design goal of 7 dB(A) for 75% of benefiting front-row receptors along the subject project.

*Permitted.* A definite commitment to develop land with an approved specific design of land use activities as evidenced by the issuance of a building permit.

*Property Owner.* An individual or group of individuals that holds a title, deed, or other legal documentation of ownership of a property or a residence.

*Reasonableness.* The combination of social, economic, and environmental factors considered in the evaluation of a noise abatement measure.

*Receptor.* A discrete or representative location of a noise sensitive area(s), for any of the land uses listed in Table 1. The typical receptor is the first floor dwelling unit in any type of housing. Receptor as defined here is the same as TNM version 2.5 *receiver*, as in the following sentence excerpted from TNM 2.5 User Guide: "TNM computes highway traffic noise at nearby receivers and aids in the design of highway noise barriers." See Section 6.2 for a receptor definition for non-residential land uses.

*Residence.* A dwelling unit. Either a single family residence or each dwelling unit in a multifamily dwelling.

*Statement of Likelihood.* A statement provided in the environmental clearance document based on the feasibility and reasonableness analysis completed at the time the environmental document is being approved.

*Substantial Construction.* The granting of a building permit, prior to right-of-way acquisition or construction approval for the highway.

*Substantial Noise Increase.* An increase in noise levels of 15 dB(A) or more in the design year over the existing noise level.

*Traffic Noise Impact.* Design year build condition noise levels that approach or exceed the NAC listed in Table 1 for the future build condition; or design year build condition noise levels that create a 15 dB(A) noise increase over existing noise levels.

*Type I Project.* This is defined as a highway project with one of the following characteristics:

- (1) The construction of a highway on new location; or,
- (2) The physical alteration of an existing highway where there is either:
  - (i) Substantial Horizontal Alteration. A project that halves the distance between the traffic noise source and the closest receptor between the existing condition to the future build condition; or,
  - (ii) Substantial Vertical Alteration. A project that removes shielding therefore exposing the line-of-sight between the receptor and the traffic noise source. This is done by either altering the vertical alignment of the highway or by altering the topography between the highway traffic noise source and the receptor; or,
- (3) The addition of a through-traffic lane(s). This includes the addition of a through-traffic lane that functions as a HOV lane, High-Occupancy Toll (HOT) lane, bus lane, or truck climbing lane; or,
- (4) The addition of an auxiliary lane, except for when the auxiliary lane is a turn lane; or,
- (5) The addition or relocation of interchange lanes or ramps added to a quadrant to complete an existing partial interchange; or,
- (6) Restriping existing pavement for the purpose of adding a through-traffic lane or an auxiliary lane; or,
- (7) The addition of a new or substantial alteration of a weigh station, rest stop, ride-share lot or toll plaza.

If a project is determined to be a Type I project under this definition then the entire project area as defined in the environmental document is a Type I project.

*Type II Project.* A Federal or Federal aid highway project for noise abatement on an existing highway. This HDOT policy does not include a Type II program but includes a section providing relevant guidance for addressing highway noise issues on existing highways (Section 10.3).

*Type III Project.* A Federal or Federal aid highway project that does not meet the classifications of a Type I or Type II project. Type III projects do not require a noise analysis.

#### **4. TRAFFIC NOISE PREDICTION**

This section pertains to the modeling of highway sections for the purpose of predicting noise levels and the resultant noise levels should specific abatement is installed.

All highway noise analysis conducted by or for HDOT must use the FHWA Traffic Noise Model (TNM); see updates at <http://www.fhwa.dot.gov/environment/noise/index.htm>. HDOT shall adopt the newest version of TNM, as applicable, within one year of its release by the FHWA.

All highway noise analysis conducted by or for HDOT must use “average pavement type.”

Noise contour lines may be used for project alternative screening or for land use planning to comply with § 772.17 of this part, but shall not be used for determining highway traffic noise impacts.

In predicting noise levels and assessing noise impacts, traffic characteristics that would yield the worst traffic noise impact for the design year shall be used. This typically means that TNM analysis should be conducted for the hour before or after the peak period so that not only traffic volume is high but also level of service conditions are at C or D (highway speeds are over 35 mph and expressway speeds are over 45 mph.) In addition, if complaints indicate night time annoyance, supplemental analysis for the 9 to 10 PM time period along with prevailing speeds for that period should be conducted.

Noise analysis conducted by or for HDOT must use the TNM version current at the time of the study and utilize the data and settings stated below, or justify variances to them.

- Traffic volume selection: Traffic data used for existing and design year noise predictions should represent the Design Hour Volume (DHV) or the peak truck traffic hour or the maximum hourly under Level of Service “C”, whichever creates the highest noise level.
- Receptor Locations: A receptor location is the designated area highway noise is measured or modeled. HDOT defines receptor location as the area between the right-of-way line and the side of a building fronting the highway where frequent human activity occurs, such as a patio, pool, or play area in the yard of a home. When analyzing areas with multi-family dwelling units (e.g., apartments, condominiums), an exterior area, such as a patio, playground, or picnic area between the highway and the side of the building fronting the highway should be chosen. If there isn't a ground level exterior area, a balcony or deck location for analysis should be chosen. If there are no “exterior areas of frequent human use,” the analysis should be done using interior noise abatement criteria for activity category D, which as shown in Table 1 on page 11 does not include residences. When analyzing areas with multi-family dwelling units, all dwelling units predicted to experience highway traffic noise impacts should be identified. However, multi-family dwellings can be represented by one receptor in TNM to expedite the modeling process. Also a cluster of detached or attached homes can be modeled as one receptor in TNM. However, in the Reasonableness Analysis, the full number of receptors represented by one TNM receptor

must be used. TNM limitations for predicting noise levels should be stated along with the results, as applicable to the TNM version utilized.

- Modeling multiple lanes: TNM allows and recommends traffic to be modeled lane-by-lane, the centerline of each lane being associated with a different source-to-receptor distance. Therefore for TNM noise analysis volume data on a lane by lane basis should be collected.
- Roadway Shoulders: Shoulders should be modeled as a roadway with no traffic. The width of the shoulder in the field should be used.
- Ground Terrain: Changes on ground features such as walls, berms, hills, valleys, should be represented by the terrain lines in TNM. Typically zero to three terrain lines is enough to represent terrain features in all situations. Existing walls may be modeled as fixed height walls and an average height should be used for locations where the height varies. Similarly, ground zones different from the default ground surface may be modeled as separate ground zones. The minimum size of such zones; should be at least 75 ft. wide.
- Medians: The minimum recommended width of the median for TNM modeling is 10 ft. Medians with paved surface and width greater than 10 ft. could be modeled as a roadway with zero traffic.
- Tree Zone: The minimum size of a tree zone for modeling is 15 ft. in height and 50 ft. in width.

## **5. ANALYSIS OF TRAFFIC NOISE IMPACTS**

### **5.1 Identification of Traffic Noise Impacts**

All highway noise analysis conducted by or for HDOT shall:

- (a) Determine traffic noise levels by field measurements for projects on new alignments.
- (b) Predict existing and design year traffic noise levels for projects on existing alignments.
- (c) Give primary consideration to exterior areas where frequent human use occurs.
- (d) Be completed for: (1) Each alternative under detailed study; (2) Each Activity Category of the NAC as explained in Section 5.2 and listed in Table 1.
- (e) Include the following:

- (e1) Identification of existing activities, developed lands, and undeveloped lands, which may be affected by noise from the highway.
- (e2) Validation of predicted noise levels through comparison between measured and predicted levels for projects on new or existing alignments.
- (e3) Measurement of noise levels by using an ANSI S1.4-1983 Type II or better integrating sound level meter.
- (e4) Identification of project limits to determine all traffic noise impacts for the design year for the build alternative.

(f) Use the **HDOT's approach level which is defined as 1 dB(A) less than the NAC** for Activity Categories A to E listed in Table 1.

(g) Use the **HDOT's substantial noise increase which is defined to be equal to 15 dB(A) over existing noise levels**. The substantial noise increase criterion is independent of the absolute noise level.

The following sections in the chapter provide detailed definitions on activity categories and their NAC, procedure to define and count receptors affected by highway noise and procedures for assessing existing or current noise levels.

## **5.2 Noise Abatement Criteria (NAC) – Activity Categories and Criteria**

*Activity Category A.* This activity category includes the exterior impact criteria for 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 for the area to continue to serve its intended purpose. The HDOT shall submit justifications to the FHWA on a case-by-case basis for approval of an Activity Category A designation.

*Activity Category B.* This activity category includes the exterior impact criteria for single-family and multifamily residences.

*Activity Category C.* This activity category includes the exterior impact criteria for a variety of land use facilities.

Determination of cost effectiveness is somewhat problematic for nonresidential land uses because it is difficult to determine the number of impacted receptors. HDOT adopts a standard practice for analyzing these facilities and identifies an equivalent number of receptors. For land uses in

Category C the HDOT uses the representative lot size of residential development and divides the impacted Category C area by the representative lot size. The typical urban and rural lot sizes in Hawaii are 4,200 ft<sup>2</sup> and 9,200 ft<sup>2</sup>, respectively<sup>1</sup>. Noise modeling predicts noise impacts from the project to a distance of 250 ft.

Example: A proposed highway runs by a park in an urban area for a length of 2,258 ft. The park has a total impacted area of 2,258 x 250 = 564,500 ft<sup>2</sup>. The impacted area is divided by the typical urban lot size of 4,200 ft<sup>2</sup> resulting in 134.4 receptors. In this case, the equivalent number of receptors is 134.

*Activity Category D.* This activity category includes the interior impact criteria for certain land use facilities listed in Activity Category C that may have interior uses.

The HDOT shall conduct an indoor analysis after a determination is made that exterior abatement measures will not be feasible and reasonable. An indoor analysis shall only be done after exhausting all outdoor analysis options. In situations where no exterior activities are to be affected by the traffic noise, or where the exterior activities are far from or physically shielded from the roadway in a manner that prevents an impact on exterior activities, the HDOT shall use Activity Category D as the basis of determining noise impacts.

For Category D the receptor assessment is performed using the same method and values as for Category C.

*Activity Category E.* This activity category includes the exterior impact criteria for developed lands that are less sensitive to highway noise. For Category E the receptor assessment is performed using the same method and values as for Category C.

*Activity Category F.* This activity category includes developed lands that are not sensitive to highway traffic noise. There are no impact criteria for the land use facilities in this activity category and no analysis of noise impacts is required.

*Activity Category G.* This activity includes undeveloped lands. Analysis by or for HDOT shall:

- (i) Determine whether the undeveloped land is permitted for development. The milestone and its associated date for acknowledging when undeveloped land is considered permitted

---

<sup>1</sup> Estimated using the Land Use and Structural Characteristics of Oahu (Table 6.02) reported in the 2009 State of Hawaii Data Book (<http://hawaii.gov/dbedt/info/economic/databook/db2009/>).

shall be the date of issuance of a building permit by the local jurisdiction or by the appropriate governing entity.

(ii) Assign the land to the appropriate Activity Category and analyze it in the same manner as developed lands in that Activity Category, if undeveloped land is determined to be permitted.

(iii) Determine noise levels in accordance with 772.17(a) and document the results in the project's environmental clearance documents and noise analysis documents, if undeveloped land is not permitted for development by the date of public knowledge.<sup>2</sup>

**TABLE 1 TO PART 772—NOISE ABATEMENT CRITERIA**  
[Hourly A-Weighted Sound Level, decibels (dB(A))<sup>1</sup>]

| Activity category    | Activity Leq(h) | Criteria <sup>2</sup> L10(h) | Evaluation location | Activity description  |
|----------------------|-----------------|------------------------------|---------------------|---|
| A .....              | 57              | 60                           | 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 <sup>3</sup> ..... | 67              | 70                           | Exterior .....      | Residential.  |
| C <sup>3</sup> ..... | 67              | 70                           | Exterior .....      | Active sport areas, amphitheatres, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings. |
| D .....              | 52              | 55                           | Interior .....      | Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.  |
| E <sup>3</sup> ..... | 72              | 75                           | Exterior .....      | Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A–D or F.  |
| F .....              | .....           | .....                        | .....               | Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.  |
| G .....              | .....           | .....                        | .....               | Undeveloped lands that are not permitted.   |

<sup>1</sup> Either Leq(h) or L10(h) (but not both) may be used on a project.  
<sup>2</sup> The Leq(h) and L10(h) Activity Criteria values are for impact determination only, and are not design standards for noise abatement measures.  
<sup>3</sup> Includes undeveloped lands permitted for this activity category.

### 5.3 Identifying Impacted Receptors

Receptors are discrete points within a noise model that represent noise sensitive locations. An individual receptor may represent multiple individuals. The number of receptors should include all dwelling units, e.g., owner-occupied, rental units, mobile homes, etc.

For multi dwelling structures such as duplexes, apartments, or condominium complexes along the front row, each dwelling unit is considered a receptor.

<sup>2</sup> Federal participation in noise abatement measures will not be considered for lands that are not permitted by the date of public knowledge.

A noise impact occurs at a receptor when the predicted noise levels approach or exceed specific absolute noise levels or when the predicted traffic noise levels substantially exceed the existing noise levels.

An area comprising a 500 ft. wide swath centered along the highway centerline should be delineated as the noise sensitive region for TNM modeling. Noise Abatement Criteria (NAC) per FHWA activity categories (Table 1), are different for different classes of receptors. Existing noise sensitive locations in the vicinity of freeway limits may be identified from land use maps, aerial photographs, and site inspection.

The estimated noise levels of each class of representative receptors are compared with the NAC. Noise impact occurs when either of the following criteria are met:

1. **Absolute criteria:** The predicted noise levels at a receptor's location approaches, equals or exceeds the NAC. Approach is defined as 1 dB(A) below NAC.
2. **Relative Criteria:** The predicted noise levels substantially exceeds the existing noise level at a location of receptor even though the predicted noise level does not approach, equal or exceed the NAC. In this policy "substantially exceed" is defined as more than 15 dB(A) to retain consistency with HDOT's previous highway noise policy.

#### 5.4 Determining Existing or Current Year Noise Levels

Existing and current year noise levels may be determined either by TNM modeling or by a properly conducted field study. The field survey method is recommended but not required. The project-specific environmental requirement shall determine the required method for determining existing or current noise levels by a subject highway facility. New alignment projects require a field study to determine existing noise levels.

Field measurements shall be consistent with the guidelines contained in FHWA Measurement of Highway - Related Noise (May 1996)<sup>3</sup>. Noise measurements are required to be done with a sound meter (ANSI S1.4-1983 Type II or better.) Field measurements are usually taken:

- 1) When the highest noise levels are expected. The period with the highest levels may not be at the peak traffic hour, but a period when traffic volumes may be lower but the overall percentage of trucks or vehicle speeds are higher.

---

<sup>3</sup> <http://www.fhwa.dot.gov/environment/noise/measurement/measure.cfm>

- 2) At Level of Service conditions of "C" at which traffic flows at an average speed that is near, at or above the posted speed limit.
- 3) When the roadway pavement is dry.
- 4) When the wind speed is less than 12 mph.
- 5) For at least one hour.

## **6. ANALYSIS OF NOISE ABATEMENT MEASURES**

Locations that are determined to be impacted by traffic noise levels will be considered for traffic noise abatement. Abatement measures must be reasonable and feasible. The FHWA will not approve project plans and specifications unless feasible and reasonable noise abatement measures are incorporated into the plans and specifications to reduce the noise impact on existing activities, developed lands, or undeveloped lands for which development is permitted.

Feasibility deals primarily with engineering considerations, whereas reasonableness uses cost-effectiveness criteria to arrive at a decision. This section describes the required considerations that should be included into the feasibility and reasonableness criteria for approving noise project plans and noise abatement measure specifications.

When traffic noise impacts are identified, noise abatement shall be considered and evaluated for feasibility and reasonableness. The HDOT shall determine and analyze alternative noise abatement measures to abate identified impacts by giving weight to the benefits and costs of abatement and the overall social, economic, and environmental effects by using feasible and reasonable noise abatement measures for decision making.

In abating traffic noise impacts, the HDOT shall give primary consideration to exterior areas where frequent human use occurs.

### **6.1 Consideration of Noise Abatement Measures**

Where abatement is warranted on the basis of NAC, the following types of abatement must be considered:

- Construction of noise barriers.

Where abatement is warranted on the basis of NAC, the following types of abatement may be considered:

- Traffic management measures.
- Alteration of project alignment (including horizontal and vertical realignment of a roadway).
- Noise compatible land use planning for consideration of undeveloped land along the project right of way that is not permitted – not eligible for federal aid.
- Insulation of public use or non-profit institutional structures (e.g., hospitals, churches, schools and other category D uses as in Table 1).

FHWA does not allow the use of pavement type or surface texture as a noise abatement measure. HDOT may conduct quiet pavement research and receive FHWA approval to implement a Quiet Pavement Program.

Planting of vegetation or landscaping is not an acceptable Federal-aid noise abatement measure because only dense stands of evergreen vegetation at least 100 ft. deep will reduce noise levels. A 200-ft. width of dense vegetation can reduce noise by 10 dB(A). It is usually impossible, however, to plant enough vegetation along a road to achieve such reductions.

The local planning and zoning authorities are responsible for the compatibility between highway and residential developments, and for noise evaluation and control prior to developments. Proper zoning can reduce or eliminate the undesirable effects of highway traffic noise by encouraging the development of less noise-sensitive land uses (e.g., commercial or industrial uses) next to a highway or by promoting the use of open space to minimize noise impacts. The acquisition of undeveloped/unimproved land to act as a noise buffer is eligible for federal funding for Type I projects.

Examination and evaluation of feasible and reasonable noise abatement measures for reducing the traffic noise impacts shall be conducted based on the method in Sections 6.3, 6.4 and the guidelines in Section 10.5.

## **6.2 Noise Abatement for Non-Residential Receptors**

Reasonableness as estimated in Section 6.4 of this policy can also be calculated for exterior nonresidential land uses in Table 1 (e.g., churches, schools, hospitals). The same base allowance,

adjustments, and modifications as for residential are used in determining the reasonableness allowance, except that the number of equivalent receptors is used instead of the number of residential units. The standard HDOT standard of practice for non-residential uses is specified for Activity Categories C, D and E (see page 9 to 11) and applies to this section as well.

### 6.3 Feasibility of Noise Abatement

Feasibility of the potential installation of noise barriers for noise abatement is defined as follows:

- (i) Achievement of at least a 5 dB(A) highway traffic noise reduction for two thirds of impacted receptors along the subject Type I highway project; and
- (ii) Determination that it is possible to design and construct the barrier after considering issues relating to safety, barrier height, topography, drainage, utilities, and maintenance, maintenance access to adjacent properties, and access to adjacent properties (i.e., arterial widening projects).

Both acoustic and engineering concerns may render a proposed noise barrier construction project infeasible. The AASHTO Green Book is the required basis for site design.

### 6.4 Reasonableness of Noise Abatement

Reasonableness of the potential installation of noise barriers for noise abatement is defined as follows:

- (i) **Consideration of the viewpoints of the property owners and residents of the benefited receptors.** The HDOT shall solicit the viewpoints of all of the benefited receptors and obtain enough responses to document a decision on either desiring or not desiring the noise abatement measure. A noise abatement measure shall be constructed or implemented only if at least two thirds of the land owners and residents of impacted receptor units approve of the measure. This percentage will be determined from the responses received from a mail-back or telephone questionnaire survey. The survey results to determine approval or disapproval shall be deemed reliable if at least one quarter of the deployed surveys were completed.
- (ii) **Cost effectiveness of the highway traffic noise abatement measures.** Abatement costing up to \$60,000 per benefitted receptor is deemed to be reasonable for cost. Each dwelling unit or equivalent receptor that experience the minimum benefit of 5 dBA reduction shall be counted as one benefited receptor. (Note that dwelling units, not

- people, are to be counted). HDOT shall review and update the allowable cost for abatement every five years.
- (iii) **Noise reduction design goals for highway traffic noise abatement measures.** For Type I projects HDOT shall achieve a noise reduction design goal of 7 dB(A) for 75% of the benefiting front-row receptors along the subject project.
  - (iv) The above three reasonableness factors must collectively be achieved in order for a noise abatement measure to be deemed reasonable.

### 6.5 Documentation of Noise Study Results

Before adoption of a CE, FONSI, or ROD, the HDOT shall identify:

- (1) Noise abatement measures which are feasible and reasonable, and which are likely to be incorporated in the project; and,
- (2) Noise impacts for which no noise abatement measures are feasible and reasonable.

Documentation of highway traffic noise abatement: The environmental document shall identify locations where noise impacts are predicted to occur, where noise abatement is feasible and reasonable, and locations with impacts that have no feasible or reasonable noise abatement alternative. For environmental clearance, this analysis shall be completed to the extent that design information on the alternative(s) under study in the environmental document is available at the time the environmental clearance document is completed.

A statement of likelihood shall be included in the environmental document since feasibility and reasonableness determinations may change due to changes in project design after approval of the environmental document. The statement of likelihood shall include the preliminary location and physical description of noise abatement measures determined feasible and reasonable in the preliminary analysis. The statement of likelihood shall also indicate that final recommendations on the construction of abatement measure(s) are determined during the completion of the project's final design and the public involvement processes.

An Environmental Justice analysis in the environmental document should include information on the noise impacts on minority and low-income populations. The environmental document should also include measures to avoid, minimize, or mitigate disproportionately high and adverse effects on minority and low-income populations' health or environment (noise impacts included) and involve Environmental Justice populations in the evaluation of the project and its alternatives.

## **6.6 Design Build Requirements**

For design-build projects, the preliminary technical noise study shall document all considered and proposed noise abatement measures for inclusion in the NEPA document. Final design of design-build noise abatement measures shall be based on the preliminary noise abatement design developed in the technical noise analysis. Noise abatement measures shall be considered, developed, and constructed in accordance with this standard and in conformance with the provisions of 40 CFR 1506.5(c) and 23 CFR 636.109.

## **6.7 Third Party Funding**

Third party funding is not allowed on a Federal or Federal-aid Type I project if the noise abatement measure would require the additional funding from the third party to be considered feasible and/or reasonable. Third party funding is acceptable on a Federal or Federal-aid highway Type I project to make functional enhancements, such as absorptive treatment and access doors or aesthetic enhancements, to a noise abatement measure already determined feasible and reasonable.

## **6.8 Cost Averaging Noise Abatement Measures**

HDOT shall not use cost averaging.

## **6.9 Collection and Reporting of Constructed Noise Barrier Data**

The HDOT shall maintain an inventory of all constructed noise abatement measures. The inventory shall include the following parameters: type of abatement; cost (overall cost, unit cost per/sq. ft.); average height; length; area; location (state, county, city, route); year of construction; average insertion loss/noise reduction as reported by the model in the noise analysis; NAC category(s) protected; material(s) used (precast concrete, berm, block, cast in place concrete, brick, metal, wood, fiberglass, combination, plastic (transparent, opaque, other); features (absorptive, reflective, surface texture); foundation (ground mounted, on structure); project type (Type I, II, or III and optional project types such as State funded, county funded, tollway/turnpike funded, other, unknown).

## **7. FEDERAL PARTICIPATION**

Federal financial participation may be considered for highway Type I projects in Hawaii as follows:

(a) Federal funds may be used for noise abatement measures when: (1) Traffic noise impacts have been identified; and (2) Abatement measures have been determined to be feasible and reasonable pursuant to § 772.13(d).

(b) Noise Abatement Measures. The following noise abatement measures may be considered for incorporation into a Type I project to reduce traffic noise impacts. The costs of such measures may be included in Federal aid participating project costs with the Federal share being the same as that for the system on which the project is located.

- (1) Construction of noise barriers, including acquisition of property rights, either within or outside the highway right-of-way. Landscaping is not a viable noise abatement measure.
- (2) Traffic management measures including, but not limited to, traffic control devices and signing for prohibition of certain vehicle types, time-use restrictions for certain vehicle types, modified speed limits, and exclusive lane designations.
- (3) Alteration of horizontal and vertical alignments.
- (4) Acquisition of real property or interests therein (predominantly unimproved property) to serve as a buffer zone to preempt development which would be adversely impacted by traffic noise. This measure may be included in Type I projects only.
- (5) Noise insulation of Activity Category D land use facilities listed in Table 1. Post-installation maintenance and operational costs for noise insulation are not eligible for Federal aid funding.

## **8. PUBLIC PARTICIPATION AND INFORMATION FOR LOCAL OFFICIALS**

Affected property owners will be notified that a noise abatement measure is being considered for incorporation into a highway project when sufficient information is available to adequately define the overall dimensions and location of the associated noise abatement measure. Informal procedures such as surveys or an open house shall be used to gather input from impacted residents. On Oahu, presentation(s) at a regularly scheduled meeting of affected Neighborhood Board(s) shall be made.

Upon reception of highway related noise complaints, HDOT shall investigate citizen complaints based on the guidelines and survey form in Section 10.4.

HDOT shall furnish the results of all highway traffic noise analyses to local government officials and shall encourage local communities and developers to practice noise compatible development. Local coordination will specifically be accomplished through the distribution of highway project environmental documents and noise study reports. Guidance for report preparation is in Section 10.2.

HDOT utilizes the date of development as one of the factors in determining the reasonableness of a Type I noise abatement measure. To minimize future traffic noise impacts on currently undeveloped lands of Type I projects, HDOT shall inform local officials within whose jurisdiction the highway project is located of:

- (1) Noise compatible planning concepts;
- (2) The best estimation of the future design year noise levels at various distances from the edge of the nearest travel lane of the highway improvement where the future noise levels meet the HDOT definition of "approach" for undeveloped lands or properties within the project limits. HDOT shall identify the distance to the exterior noise abatement criteria in Table 1.
- (3) Non-eligibility for Federal-aid participation for a Type II project as described in § 772.15(b).

## **9. CONSTRUCTION NOISE**

The construction of Type I projects may generate annoyance due to construction noise, therefore HDOT shall:

- (a) Identify land uses or activities that may be affected by noise from construction of the project. The identification is to be performed during the project development studies.
- (b) Determine the measures that are needed in the plans and specifications to minimize or eliminate adverse construction noise impacts to the community. This determination will include a weighing of the benefits achieved and the overall adverse social, economic, and environmental effects and costs of the abatement measures.
- (c) Incorporate the needed abatement measures in the plans and specifications.

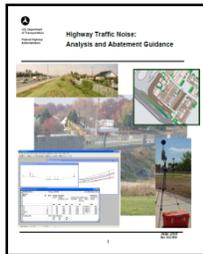
## 10. REGULATIONS AND GUIDANCE REPORTS

Fundamental regulations and important guidance documents are included below.

### 10.1 FHWA Highway Noise Regulations and Resources



<http://edocket.access.gpo.gov/2010/pdf/2010-15848.pdf>



[http://www.fhwa.dot.gov/environment/noise/regulations\\_and\\_guidance/analysis\\_and\\_abatement\\_guidance/guidancedoc.pdf](http://www.fhwa.dot.gov/environment/noise/regulations_and_guidance/analysis_and_abatement_guidance/guidancedoc.pdf)



FHWA Highway Traffic Noise Website, including TNM  
<http://www.fhwa.dot.gov/environment/noise/>

### 10.2 HDOT Program for Existing Highways (Not Subject to FHWA Approval)

The HDOT has not developed a Type II Policy. A process for the case-by-case treatment of highway noise issues on existing highways is described in section 10.4.

If HDOT develops a Type II Program, it would need to include a priority system to rank the projects in the program. This priority system shall be submitted to and approved by FHWA before Federal-aid funds can be used for projects in the program. HDOT is required to re-analyze the priority system on a regular basis, not to exceed five (5) years.

If HDOT develops a Type II Program, a proactive and ongoing public involvement program should be implemented to engage the Environmental Justice populations, seek input on potential noise impact and abatement issues, and provide information on traffic noise abatement proposals. Special efforts may need to be made to ensure that minority and low-income populations are aware of the public involvement process and are able to participate. Strategies include increased outreach and reaching Environmental Justice communities, which may include conducting noise workshops to inform the public about a noise abatement proposal and/or to solicit public opinion regarding a noise abatement proposal, as necessary.

When examining the reasonableness of multiple abatement projects for existing highways:

- (a) HDOT shall give a higher priority to residential areas where high absolute traffic noise levels are expected to occur, e.g., greater than 70 dB(A), or where large increases over existing noise levels are anticipated, e.g., greater than a 10 dB(A) increase. Emphasis should be given to night time noise between 9:00 PM and 10:00 PM.
- (b) HDOT shall give a lower priority to residential areas that have developed along an existing highway without proper consideration of traffic noise impacts by the local community or the developer.

### **10.3 HDOT Guidance for Highway Noise Complaints**

There are conditions under which complaints may warrant a noise investigation. If the condition holds, then the investigation will determine if noise analysis is required. The results of the noise analysis will indicate the preferred abatement, if abatement is necessary.

The first step is to determine what public agency can best address the noise complaint. If a complaint is determined to be a long-term highway traffic noise disturbance from a state highway, then HDOT shall conduct an investigation if the receptor from which the complaint was filed was in existence prior to the date when the highway in question was built or expanded.

**On Oahu**, HDOT shall present the results of its preliminary investigation to the pertinent Neighborhood Board (NB) within six (6) months from the reception of the complaint along with a

recommendation for noise analysis or not. The simple majority of NB quorum during a regular meeting must approve of the HDOT recommendation.

**On Neighbor Islands**, HDOT shall present the results of its preliminary investigation to a community meeting in the affected area within six (6) months from the reception of the complaint. Community input shall be used to determine conducting of noise analysis or not.

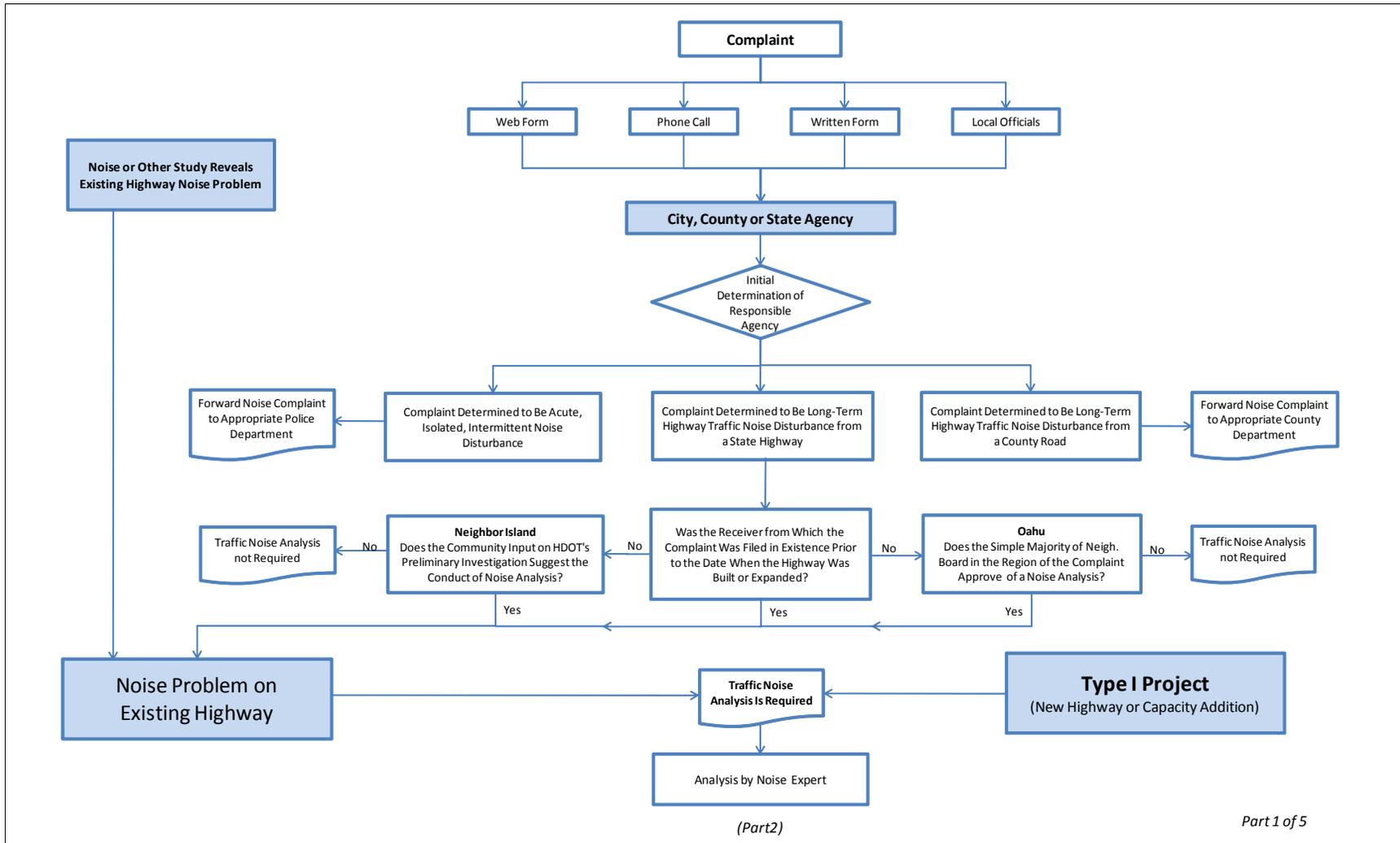


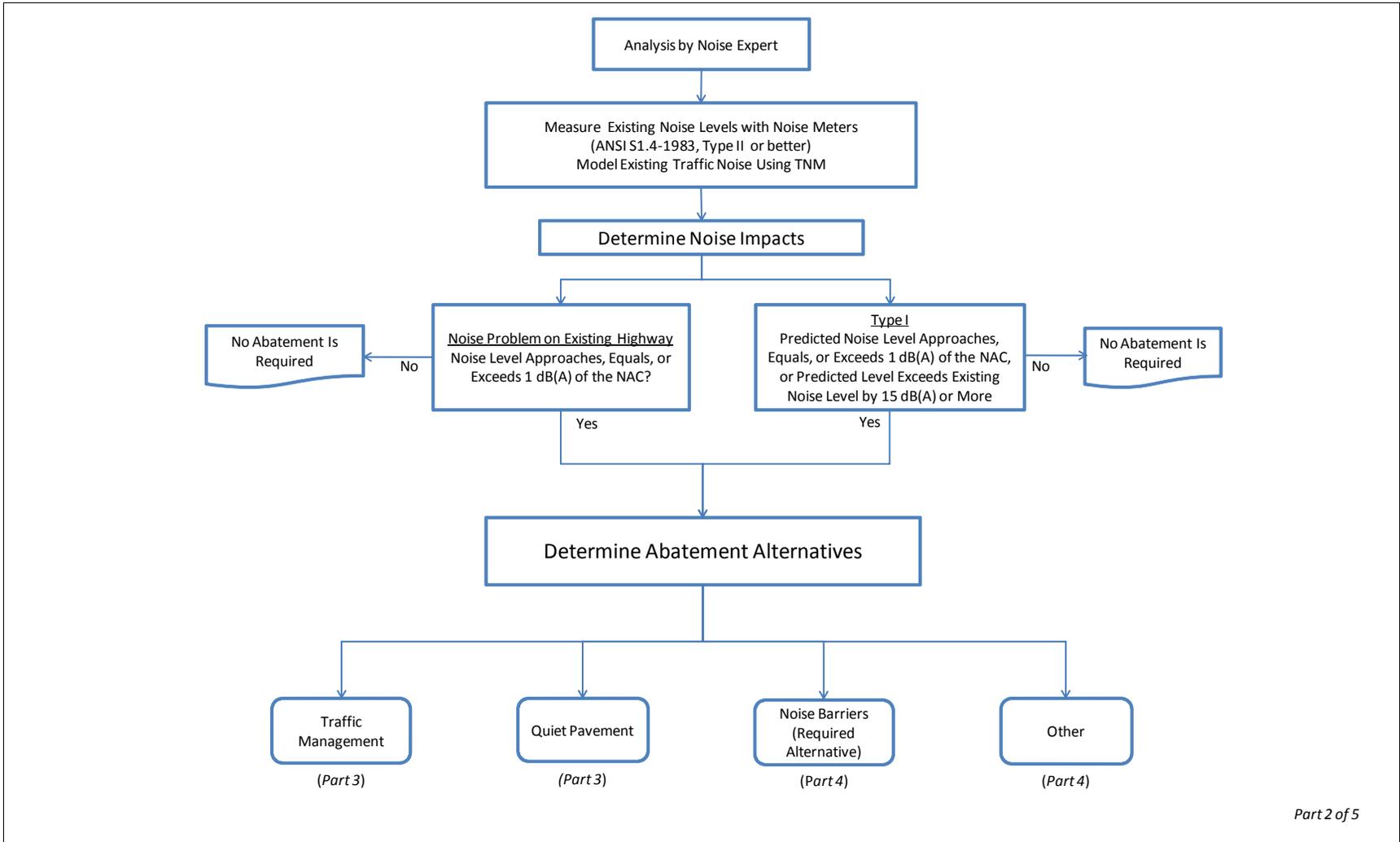
| Description  |                                      |   |  |
|--|--------------------------------------|---|--|
| 2. Is the complaint due to noise from loud motorcycles, heavy vehicle brakes, racing cars, or helicopters?                                   |                                      | <input type="checkbox"/> Yes                        | <input type="checkbox"/> No                              |
| 3. Is the complaint due to nearby road construction noise?   |                                      | <input type="checkbox"/> Yes                        | <input type="checkbox"/> No                              |
| a. If yes, then on what road is the construction going on?   |                                      |   |  |
| 4. Is the complaint due to highway or road traffic noise?  |                                      | <input type="checkbox"/> Yes                        | <input type="checkbox"/> No                              |
| a. If yes, what road is causing the noise?   |                                      |   |  |
| <p><i>Please describe below, the noise disturbance you are experiencing.</i></p> <p>Description:</p><br><br><br><br><br><br><br><br><br><br> |                                      |   |  |
| 5. What time of day do you experience <b>the most</b> noise disturbance?   |                                      | <i>Check all that apply</i>                         |  |
| <input type="checkbox"/> Midnight -3 AM  | <input type="checkbox"/> 3 AM – 6 AM | <input type="checkbox"/> 6 AM-9 AM                  | <input type="checkbox"/> 9 AM-Noon                       |
| <input type="checkbox"/> Noon-3 PM   | <input type="checkbox"/> 3 PM-6 PM   | <input type="checkbox"/> 6 PM-9 PM                  | <input type="checkbox"/> 9 PM-Midnight                   |
| 6. How long has the noise disturbance bothered you?  |                                      |   |  |
| House/Building Description – <i>if applicable</i>  |                                      |   |  |
| 7. Year building was constructed   |                                      | 8. Is building air conditioned?                     | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 9. Number of stories   |                                      | 10. Number of bedrooms                              |  |
| 11. Type of building: wood, brick, etc.  |                                      | 12. Number of bedrooms with windows facing the road |  |

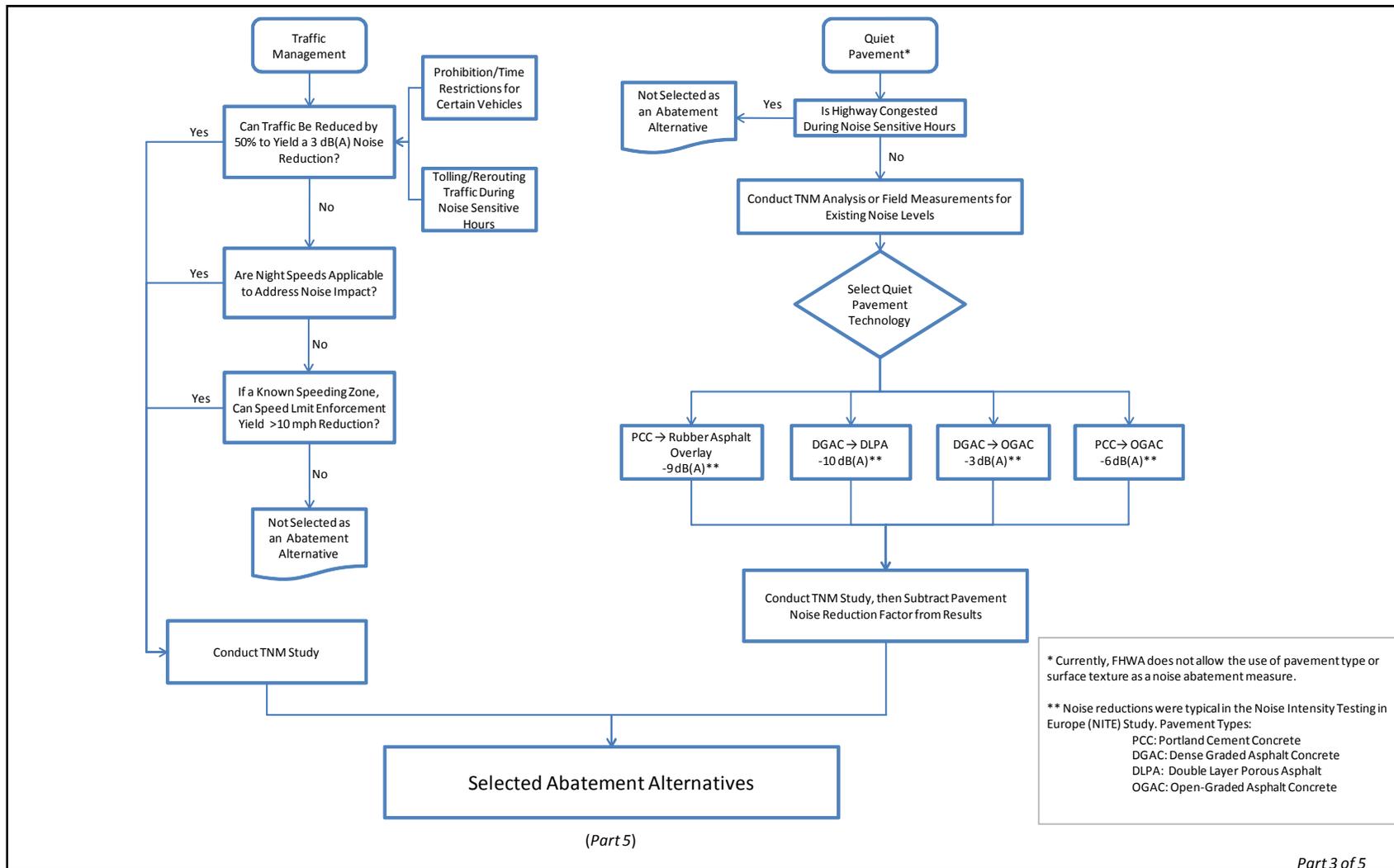
|  |  |                              |   |
|--|--|------------------------------|---|
| 13. Type of windows  |  |                              |   |
| 14. When did you move to this location?  |  |                              |   |
| Websites to use if complaint filer does not know when his/her home was constructed or building materials used:<br>www.honolulupropertytax.com   www.kauaipropertytax.com   www.hawaiipropertytax.com   www.mauipropertytax.com |  |                              |   |
| <b>Internal Processing</b>   |  |                              |   |
| <b>Determining Responsible Agency</b>  |  |                              |   |
| If the concerned citizen answered yes to question 2, forward to local police department.   |  |                              |   |
| If the concerned citizen answered yes to question 3, forward to HDOT Construction and Maintenance Branch or County Department of Public Works.   |  |                              |   |
| If the concerned citizen answered yes to question 4, and the roadway in question is a state highway, then begin noise abatement inquiry, otherwise forward to appropriate agency.  |  |                              |   |
| Responsible Agency:  |  |                              |   |
| <input type="checkbox"/>   | Honolulu Department of Transportation Services | <input type="checkbox"/>     | Hawaii County Department of Public Works – Traffic Division |
| <input type="checkbox"/>   | Honolulu Police Department                     | <input type="checkbox"/>     | Hawaii County Police Department                             |
| <input type="checkbox"/>   | Hawaii State Department of Transportation      | <input type="checkbox"/>     | Other:  |
| <input type="checkbox"/>   |  | <input type="checkbox"/>     | Maui County Department of Transportation                    |
| <input type="checkbox"/>   |  | <input type="checkbox"/>     | Maui County Police Department                               |
| <input type="checkbox"/>   |  | <input type="checkbox"/>     | Kauai County Department of Public Works                     |
| <input type="checkbox"/>   |  | <input type="checkbox"/>     | Kauai County Police Department                              |
| <b>Preliminary Investigation and Data</b>  |  |                              |   |
| Area of study – Highway and mile post  |  |                              |   |
| Posted speed limit   |  | AADT                         |   |
| Number of lanes  |  | Peak Hour Volume             |   |
| <b>Determining Need for Traffic Noise Analysis</b>   |  |                              |   |
| For an Oahu complaint: Does the corresponding Neighborhood Board approve of a Traffic Noise Investigation of this complaint?   |  | <input type="checkbox"/> Yes | <input type="checkbox"/> No                                 |
| If yes, traffic noise analysis is required. If no, traffic noise analysis is not required and no further investigation of this complaint is needed.  |  |                              |   |
| For a neighbor island complaint: Does feedback obtained from a relevant community meeting in the affected area suggest that this is a highway noise problem?   |  | <input type="checkbox"/> Yes | <input type="checkbox"/> No                                 |
| If yes, traffic noise analysis is required. If no, traffic noise analysis is not required at this time   |  |                              |   |
| <b>Action Taken</b>  |  |                              |   |
| Investigator:  |  | Date                         |   |

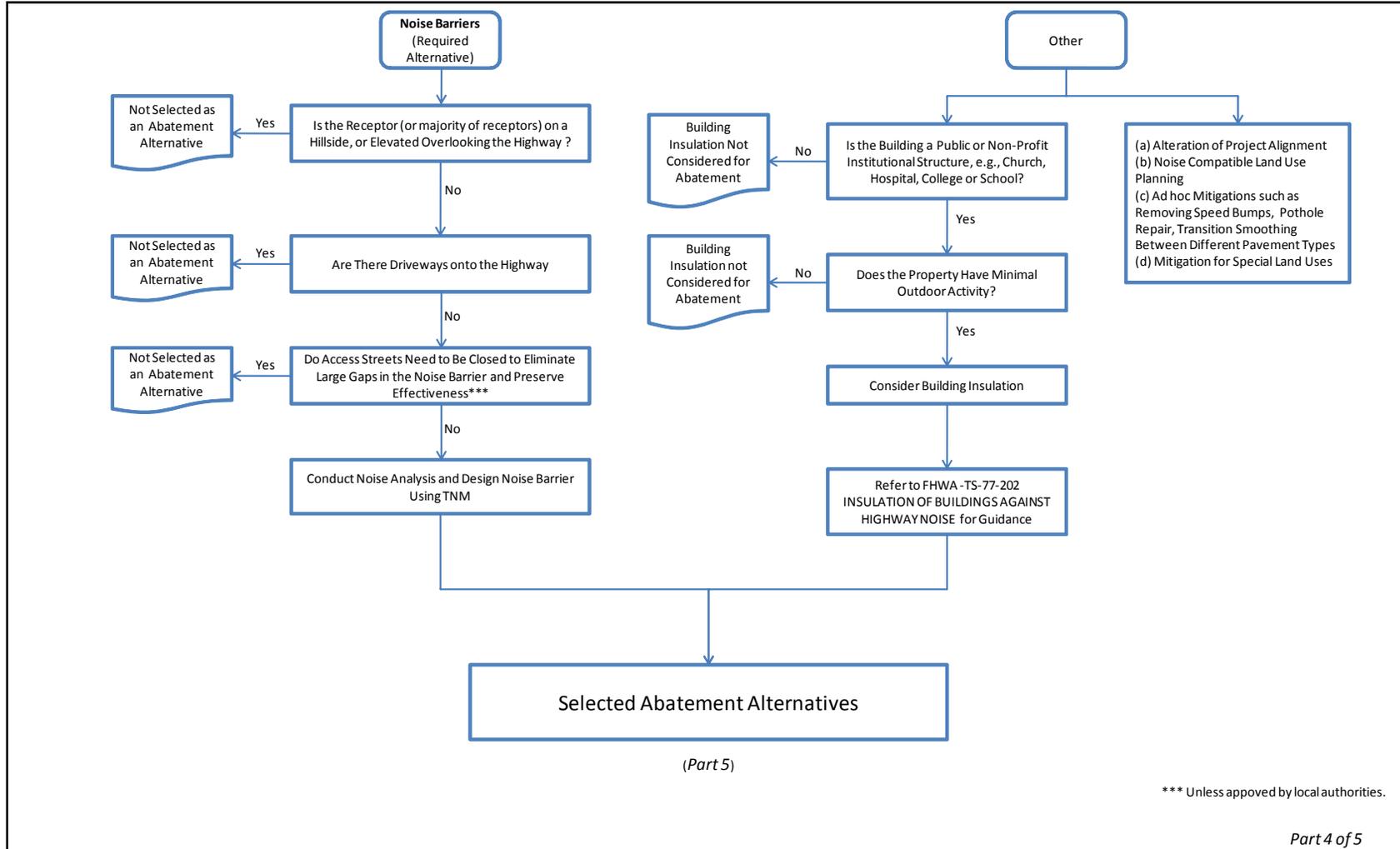
### 10.4 HDOT Guidance for Highway Noise Analysis

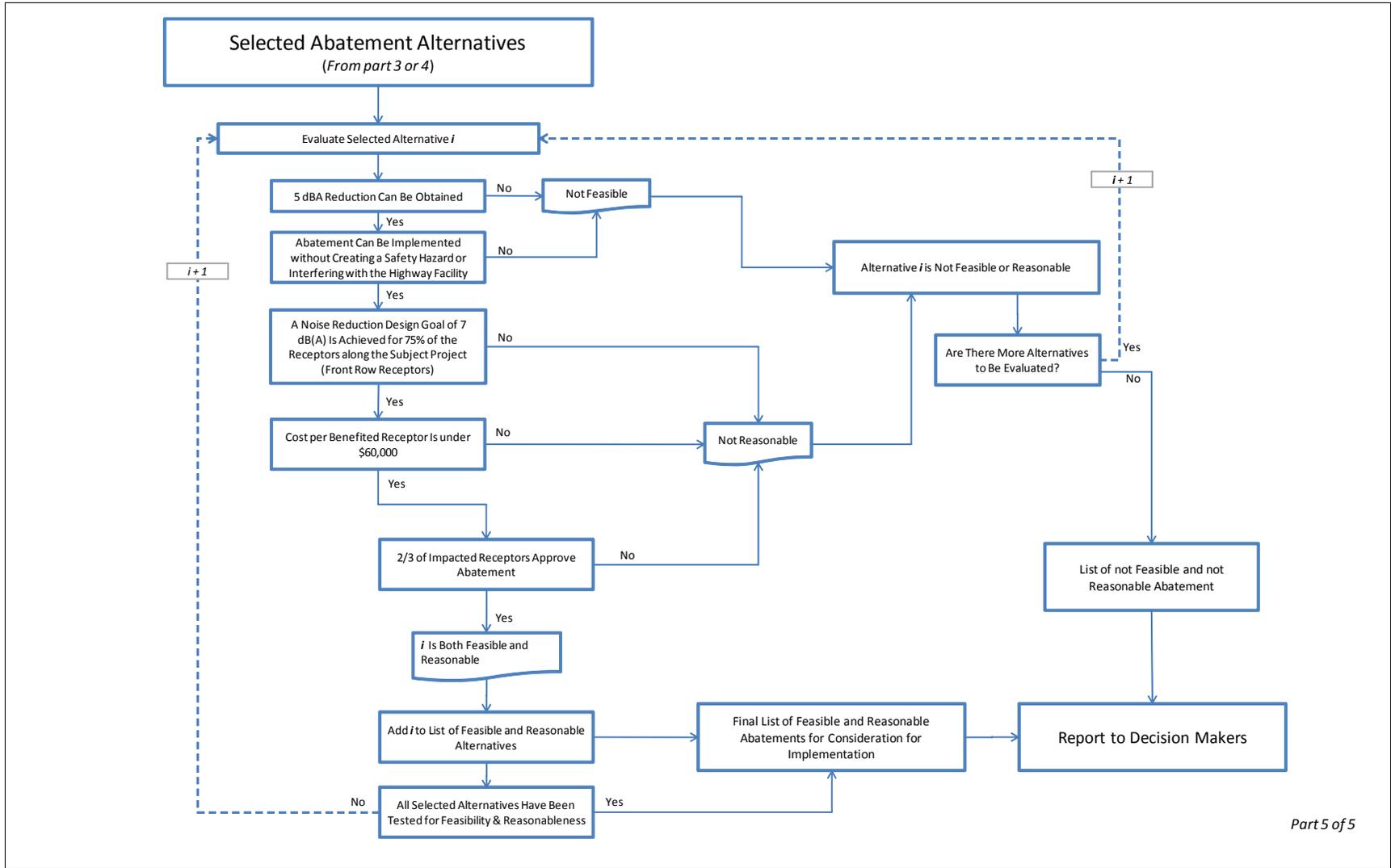
The 5-part flowchart below includes steps necessary to address highway noise issues on new, altered and existing highways.











### 10.5 TNM 2.5 Highway Noise Analysis

