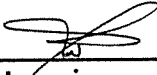





ARIZONA DEPARTMENT OF TRANSPORTATION

NOISE ABATEMENT POLICY

FINAL VERSION 11-29-2005

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ARIZONA DEPARTMENT OF TRANSPORTATION NOISE ABATEMENT POLICY

I. INTRODUCTION

The Arizona Department of Transportation (ADOT) will use the following guidelines to determine the need, feasibility, and reasonability of noise abatement or reduction measures on all roadway projects. This policy is based on the accepted practices and procedures used by federal and state transportation agencies to assess highway-related noise levels. ADOT's Environmental & Enhancement Group (EEG) will implement the policy.

II. DEFINITIONS

- A. **Abatement** – A reduction in sound levels (degree of sound intensity).
- B. **Barrier** – A natural or man-made object that interrupts the path of sound. A barrier could be a wall, an earth berm, or a combination of both.
- C. **Benefited Developed Property** – A developed property that receives at least a 5 dBA reduction in the predicted traffic noise level because of noise abatement measures. The legal property owner of the benefited developed property, or the owner's designated representative, shall be referred to as a "benefited customer" in this document. For multi-family, developed properties (such as apartments, condominiums, or manufactured home developments), each individual dwelling unit receiving at least a 5 dBA reduction will be considered a benefited customer. This definition applies to all FHWA Activity Categories listed in Table 1.
- D. **CFR** – The Code of Federal Regulations.
- E. **Decibel (dB)** – A unit for measuring sound levels. Traffic noise level measurements are rounded to the nearest whole number prior to impact determination and presentation in project reports.
- F. **dBA** – Sound levels are typically measured using a statistically weighted scale. There are three weighted scales: A, B, and C. Because the A scale most closely represents the range of human hearing, units of measurement for highway sound levels will use the A-weighted scale and be designated with dBA.
- G. **Date of Public Knowledge** – The signatory date of the final environmental document prepared in accordance with the National Environmental Policy Act (NEPA) and approved by FHWA. Approval documents consist of Categorical Exclusions (CE), a Finding of No Significant Impact (FONSI) for Environmental

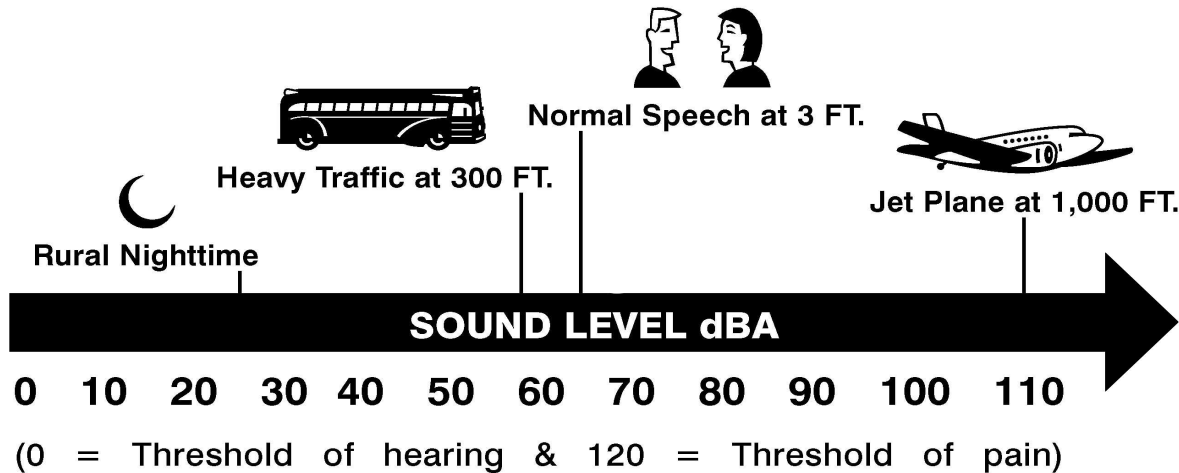
Assessments, or a Record of Decision (ROD) for Environmental Impact Statements.

- H. **Date of public knowledge (State Projects)** – The signatory date of the final environmental document prepared in accordance with the ADOT Action Plan and approved by ADOT.
- I. **Design Year** – The future year used to estimate the probable traffic volume for which a highway is designed. Normally, traffic estimates are projected 20 years into the future from the estimated start date of construction.
- J. **Existing Sound Level** – The current noise level, made up of all natural and man-made noises normally present within a particular area. The existing sound level provides a reference point for determining noise impacts when transportation improvements or new highways are being considered.
- K. **Impacted Developed Property** – A developed property where projected noise levels in areas of frequent human activity exceed ADOT’s approach threshold for the appropriate FHWA Activity Category summarized in Table 1. The legal owner of the impacted developed property, or the owner’s designated representative, shall be referred to as an “impacted customer” in this document. For multi-family, developed properties (such as apartments, condominiums, or manufactured home developments), each individual dwelling unit exceeding ADOT’s approach threshold will qualify as an impacted customer. ADOT will consider noise abatement for all impacted developed properties.
- L. **Insertion Loss** – A term used in noise analysis describing the projected noise reduction that results when a noise barrier is placed between a noise source and a receiver.
- M. **Level Of Service (LOS)** – A term that describes the relationship between traffic volume and traffic speed, consisting of six levels. In general, traffic speed is limited by traffic volume. For example, Level Of Service A describes light volume traffic traveling at uninterrupted, posted speeds. Level Of Service F describes high volume traffic traveling at restricted speeds (gridlock). Level Of Service C describes a condition where the maximum traffic volume moves at the posted speed limit.
- N. **L_{eq}** – The steady state sound level, L_{eq}, is calculated as the average sound energy level and is the measurement used to determine noise impacts. When it is measured hourly and the A-weighted scale is used, it is abbreviated as L_{Aeq1h}.
- O. **Noise Abatement Criteria (NAC)** – The FHWA has established criteria, based on land use, that identify when a noise impact will likely occur. The FHWA criteria are shown in Table 1.

- P. **Noise Receiver** – The technical term used in noise modeling to describe the location of a potential noise impact.
- Q. **Planned, Designed and Programmed** – A property is considered to be “planned, designed, and programmed” if a construction permit has been obtained. ADOT considers a permit to construct subsurface utilities as the construction permit. For multiple-phase developments, each phase will be considered a separate development.
- R. **Predicted Noise Level** – The noise level determined for the worst traffic noise conditions likely to occur on a regular basis for existing and future conditions. As of October 14, 2004, the Traffic Noise Model (TNM) is the model approved by FHWA for predicting existing and future noise levels on new transportation projects. After consultation with ADOT’s EEG, predicted noise levels may be adjusted (*i.e.*, calibrated) based on measurements made at selected reference locations in accordance with the procedures found in FHWA-PD-96-046/DOT-VNTSC-96-5, “Measurements of Highway-Related Noise”, May 1996. This reference is available at www.azdot.gov/Highways/EEG/noise.asp.
- S. **Section 4(f) Resource** – According to federal regulation, it is a significant publicly-owned public park, recreation area, or wildlife and waterfowl refuge, or any significant historic site, and is a protected resource.
- T. **Traffic Noise Threshold** – ADOT defines an impact when predicted noise levels approach the Noise Abatement Criteria (NAC) or when predicted traffic noise levels substantially exceed existing noise levels. The threshold is a noise level less than the NAC and is utilized by ADOT as a level at which noise abatement is examined and considered.
- U. **Type I Project** – Construction of a highway at a new location, or the physical alteration of an existing highway that significantly changes the horizontal or vertical alignment or increases the number of continuous travel lanes.
- V. **Type II or Retrofit Project** – A highway project proposed strictly for noise abatement on an existing highway. The cut-off date for mandatory FHWA approval of Type II projects was November 28, 1995. ADOT does not have a Type II program.
- W. **Worst Traffic Noise Condition** – Predicted noise levels are calculated for the peak noise hour, which is usually the peak traffic hour, or when volumes are heaviest but speeds are not significantly impeded. ADOT considers Level Of Service C traffic traveling in both directions at the posted speed limit, or the maximum speed in accordance with the noise model, to be the worst traffic noise condition.

III. TYPICAL NOISE LEVELS

Noise is measured in decibels (dB), and is perceived differently by every individual. The chart below indicates common indoor and outdoor noise levels.



IV. DETERMINATION OF NOISE IMPACT

The determination of a noise impact is based on the FHWA regulations. However, the FHWA regulations allow some flexibility for each state to determine noise impacts. Both the federal criteria and the state interpretation of those criteria are presented in this section. These criteria are used to determine when a noise impact occurs or will occur.

A. Federal Highway Administration Noise Abatement Criteria

The FHWA has issued regulations for noise evaluation in Title 23, Code of Federal Regulations, Part 772 (23 CFR 772), **Procedures for Abatement of Highway Traffic Noise and Construction Noise**. The main objectives of 23 CFR 772 are "to provide procedures for noise studies and noise abatement measures, to help protect the public health and welfare, 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, United States Code (U.S.C.)." The regulations require the consideration of noise abatement measures when traffic noise impacts are identified. Noise abatement measures must be feasible and reasonable to be incorporated into a transportation project (as described in Sections V and VI).

FHWA has developed specific noise abatement criteria. These criteria are depicted in Table 1. According to the FHWA regulations, a traffic noise impact occurs when the predicted traffic noise level approaches or exceeds the Noise Abatement Criteria (NAC) for the specified land use. In addition, an impact occurs when the predicted traffic noise level substantially exceeds the existing noise level. FHWA allows each individual state to define the levels at which the noise "approaches" the criteria and when it

“substantially exceeds” the existing noise level. ADOT’s interpretation of these terms is presented below.

TABLE 1
Noise Abatement Criteria (NAC)
“A”-Weighted Sound Level in Decibels (dBA)

Activity Category	L _{Aeq1h}	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, cemeteries and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	--	Undeveloped lands.
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums.
Source: 23 CFR 772		

B. Arizona Department of Transportation Criteria

The FHWA regulations allow each state some flexibility in determining noise impact. ADOT has established the following thresholds for noise impact based on the FHWA regulations:

i. FHWA: The predicted traffic noise level approaches or exceeds the noise abatement criteria (NAC), as shown in Table 1.

ADOT defines this threshold as 3 dBA below the NAC for Categories B and E and 1 dBA below the NAC for Categories A and C. For example, the approach threshold for Category B is 64 dBA.

In determining and reducing traffic noise impacts, exterior areas are given primary consideration. ADOT generally will consider abatement only where frequent human use occurs and a reduced noise level would be of benefit.

ii. FHWA: The predicted traffic noise level substantially exceeds the existing noise level.

ADOT defines "substantial" in this context as 15 dBA or greater. Noise abatement will be considered for all substantially impacted developed properties. However, when projected unmitigated design year exterior noise levels for a substantially impacted developed properties are equal to or less than 57 dBA, abatement measures generally are not feasible or reasonable.

All noise monitoring shall be done in accordance with the procedures found in Section 4 of FHWA-PD-96-046/DOT-VNTSC-96-5, Measurements of Highway-Related Noise, May 1996.

C. Timing of New Development Near Highways

A noise-sensitive development (including residences, schools, churches, hospitals, and libraries) will be analyzed for traffic noise if the development is planned, designed, and programmed. A development is planned, designed, and programmed if the local jurisdiction has issued a construction permit prior to the Date of Public Knowledge.

For Federal-aid projects, the Date of Public Knowledge is defined as the date the environmental document for a transportation project is approved, specifically the date when the CE, FONSI, or ROD is approved.

For state funded projects, the date of public knowledge is defined as the date the environmental document for a transportation project is approved.

ADOT is responsible for analyzing changes in traffic noise impacts prior to the Date of Public Knowledge. ADOT is not responsible for providing noise abatement for new developments adjacent to the proposed transportation project after the Date of Public Knowledge.

Local government coordination will be accomplished through the distribution of highway project environmental documents and technical noise studies. Upon request, ADOT will furnish the results of highway traffic noise analyses to local government officials. ADOT encourages local communities and developers to practice noise compatible development.

D. Consideration of Noise Abatement

ADOT considers noise abatement when traffic noise impacts are identified. ADOT sets the following goals when considering noise abatement:

- Reduce noise levels to 64 dBA or less.
- Effective aesthetic and architectural integration into the community.
- Keeping the public informed and soliciting public preferences.
- Careful attention to neighborhood issues like fire access, security, visibility, and drainage.
- Careful attention to driver safety, including line of sight and emergency vehicle access.

ADOT evaluates the feasibility and reasonability of implementing noise abatement when impacted customers are identified. As stated in the FHWA regulations and this policy, noise abatement measures must be feasible and reasonable. "Feasible" deals primarily with engineering considerations (e.g., can a barrier be built given the topography of the

location; can a substantial noise reduction be achieved given certain access, drainage, snow, safety, or maintenance requirements; are other noise sources present in the area, etc.). “Reasonable” implies that common sense and good judgment are applied in arriving at a decision. Some specific considerations for feasibility and reasonability are presented in the next two sections.

V. FEASIBILITY OF NOISE ABATEMENT

When noise abatement measures are considered, feasibility criteria shall include, but not be limited to, the following:

A. Amount Of Noise Reduction

Noise barriers should be designed to reduce projected unmitigated noise levels by at least 5 dBA and reduce noise to levels at or below the appropriate ADOT approach threshold, where feasible. For example, if the projected unmitigated noise level of a residential property (Activity Category B) is 72 dBA, the proposed barrier should be designed to reduce the overall noise level to at or below ADOT’s approach threshold of 64 dBA, resulting in a barrier design that reduces noise levels by 9 dBA.

It is often possible to reduce noise levels to less than the ADOT approach threshold, but it is not always feasible to achieve an overall noise reduction of 5 dBA. For these exceptional cases, ADOT will consider constructing noise barriers that provide partial abatement, *i.e.* reduction in noise levels of 3 or 4 dBA. For example, if the projected unmitigated noise level of a residential property (Activity Category B) is 67 dBA, the proposed barrier should be designed to reduce the noise level to 62 dBA and achieve an overall noise level reduction of at least 5 dBA. However, if due to constructability constraints the proposed noise barrier reduces projected noise levels by 4 dBA, resulting in an overall noise level of 63 dBA, ADOT will consider building the noise barrier as opposed to rejecting this option because it does not meet the 5 dBA noise level reduction criteria. ADOT will not consider constructing a noise barrier that reduces projected noise levels by 3 or 4 dBA and results in a projected mitigated noise level exceeding 64 dBA or that reduces projected noise levels by less than 3 dBA.

B. Barrier Height

ADOT considers the design of each proposed noise barrier on an individual basis when determining barrier height. The designed height of any proposed barrier may be adjusted, based on barrier location, impacted customer input, and/or the reasonable and feasible criteria. Due to cost, aesthetics, and constructability, ADOT generally will not construct noise barriers higher than 20 feet.

C. Breaks In Barrier

Breaks or openings in noise barriers, such as for side-street access, driveways, or drainage, allow noise to travel through the barrier and reduce the effectiveness of the noise barrier. ADOT discourages placing breaks or openings in barriers. Noise barriers should be designed and located in such a manner that does not require any breaks or openings in the barrier. In some cases, breaks in barriers can be accommodated with offset, overlapping barriers.

D. Other Noise Sources Present

In some instances, the noise level at a particular location may be affected by a noise source other than the nearby highway. Other noise sources include urban streets, railroads, industrial facilities, and airplane flight paths. In such locations, a noise barrier for the proposed transportation project may not be feasible, since a substantial noise reduction cannot be achieved due to other noise sources.

E. Safety

Noise barriers will not be constructed in such a way as to create a potential safety hazard.

F. Line-Of-Sight Check

ADOT recommends any proposed noise barrier break the line-of-sight between the noise source and the impacted customer location, since noise barriers are more effective when traffic is not visible to the impacted customer.

G. Section 4(f) Properties

For properties subject to Section 4(f) protection, impacts must be evaluated by FHWA on a case-by-case basis to determine if there is a “substantial impairment” to the intended use of the property. Section 4(f) protections do not apply to state-funded projects.

VI. REASONABILITY OF NOISE ABATEMENT

When noise abatement measures are considered, reasonability criteria shall include, but not be limited to, the following:

A. Maximum Cost Of Abatement

The maximum recommended cost of abatement is \$43,000 (2005 dollars) per benefited developed property. Benefited residential developed properties include all single-family dwellings (*i.e.*, apartments, manufactured homes, condominiums, detached homes), whether occupied by the owner or a renter, that receive a 5 dBA

noise reduction from proposed mitigation measures. For benefited developed properties such as parks, schools, hospitals, and churches, noise abatement will be considered on a case by case basis, as specified in ADOT's noise guidelines.

B. Local Funding Participation

When a noise barrier has been proposed for a transportation project, local jurisdictions can contribute additional funds to add aesthetic treatments, enhance the design, increase height, or incorporate additional features.

C. Isolated Developed Properties

Generally, it will not be reasonable to provide abatement for isolated developed properties. Noise mitigation will be considered only if barrier costs meet the criteria presented in Sub-Section A under Section VI.

D. Height Restrictions By Local Jurisdictions

Zoning laws or ordinances passed by local jurisdictions may restrict heights of walls or barriers. ADOT will not construct a noise barrier that fails to meet the noise reduction requirements presented in Section V, Subsection A, if a local jurisdiction will not grant a variance to laws or ordinances governing height restrictions. In these cases, noise concerns and noise mitigation associated with roadway improvements completed by ADOT become the responsibility of the local jurisdiction.

E. Multi-story Buildings

ADOT will provide noise abatement for the first story of an eligible multi-story structure if the feasible and reasonable criteria identified in this policy are met. ADOT will also evaluate the feasibility and reasonability of providing noise abatement for second and higher floors. Cost effectiveness criteria, maximum height limitations, and the absence of exterior activity areas are factors that may affect the feasibility and reasonability of noise abatement for upper floors.

F. Line-Of-Sight Check

ADOT recommends any proposed noise barrier break the line-of-sight between the noise source and the impacted customer location, since noise barriers are more effective when traffic is not visible to the impacted customer.

G. Aesthetic Value

Noise barriers designed for roadway projects are frequently discontinuous due to parameters such as roadway geometry, length of project, topography, and location or size of residential subdivisions. It is sometimes beneficial to eliminate gaps

between proposed noise barriers for aesthetic value if the gaps are “limited”, meaning the gap is a few hundred feet wide. In addition, closing the gap can result in reduced barrier heights of the original unconnected barriers when the insertion loss of a continuous barrier is compared to the insertion loss of higher barriers with limited gaps. ADOT’s Environmental and Enhancement Group (EEG) considers aesthetic value and cost effectiveness of closing barrier gaps when evaluating noise barrier recommendations.

The above listing is not intended to be all encompassing. Other factors may be considered in determining the feasibility and reasonability of proposed abatement measures.

VII. PREFERENCES OF IMPACTED CUSTOMERS

Noise barriers will be constructed unless the majority of impacted customers are opposed to their construction. Opposition to barrier construction shall be documented in writing, such as formal surveys or petitions, and shall be compiled by the local jurisdiction, landowner association, neighborhood representative, or ADOT.

The preferences of impacted customers will be considered regarding the heights of proposed noise barriers. If the majority of impacted customers object to the proposed barrier height recommended by ADOT, the barrier may be constructed at a lower height under certain conditions. The impacted customers shall be informed of the design height of the proposed noise barrier recommended by the noise analysis. If impacted customers request a lower noise barrier, the shorter height wall may be constructed.

To evaluate the preferences of impacted customers, an impacted customer that receives a 3 or 4 dBA reduction in projected noise level is designated as a partially benefited customer.

The preference of impacted customers will be weighted as follows:

- Impacted customers receiving a 5 dBA reduction or more in projected noise levels shall receive three points
- Impacted customers receiving a 4 dBA reduction in projected noise levels shall receive two points
- Impacted customers receiving a 3 dBA reduction in projected noise levels shall receive one point

If a dispute over barrier preferences develops between the owner of an impacted property and the legal occupant of the impacted property, the preferences of the property owner will take precedence.

The definition of a partially benefited customer shall be used only for assigning points to impacted customers participating in the preferences evaluation and shall not apply to the cost per benefited customer evaluation discussed in Section VI, Subsection A.

The preferences of impacted customers will be considered for noise abatement, if options are available within the scope of the project. Only impacted customers responding to the request to evaluate preference will be counted in the point tally. However, additional efforts will be employed to contact non-responsive impacted customers, including mailings, telephone calls, and in-person interviews.

It will be ADOT's responsibility to ensure reasonable efforts are made to contact impacted customers and evaluate their preferences. ADOT will evaluate the preferences of impacted customers when at least 50% of the responses plus 1 additional response are received. ADOT will consider customer preferences that modify the noise barrier as originally presented based on the majority of points tallied. ADOT encourages participation by the local jurisdictions in the process to contact impacted customers and evaluate their preferences.

VIII. EXTENUATING CIRCUMSTANCES

Extenuating circumstances may exist where unique or unusual conditions warrant special consideration of traffic noise impacts and/or implementation of noise abatement measures. Extenuating circumstances could involve:

- Areas extremely sensitive to noise
- Areas where severe traffic noise impacts are anticipated
- Areas containing Section 4(f) resources
- Locations that are difficult or impractical to mitigate with barriers
- Local and regional weather conditions

Extenuating circumstances will be considered on an individual project basis.

Normal variations in weather and traffic patterns can result in field noise measurements that exceed ADOT's target noise level for abatement at a given location, at a given time. ADOT cannot warranty or guarantee that a specific level of noise abatement can be achieved at all locations at all times.

After construction of a highway project, if based on customer concerns the need arises to revisit the noise analysis and mitigation provisions due to deficiencies in the technical noise study, there will be a three-year time period for additional mitigation under the Type I program. The three-year time period will begin upon ADOT's formal acceptance

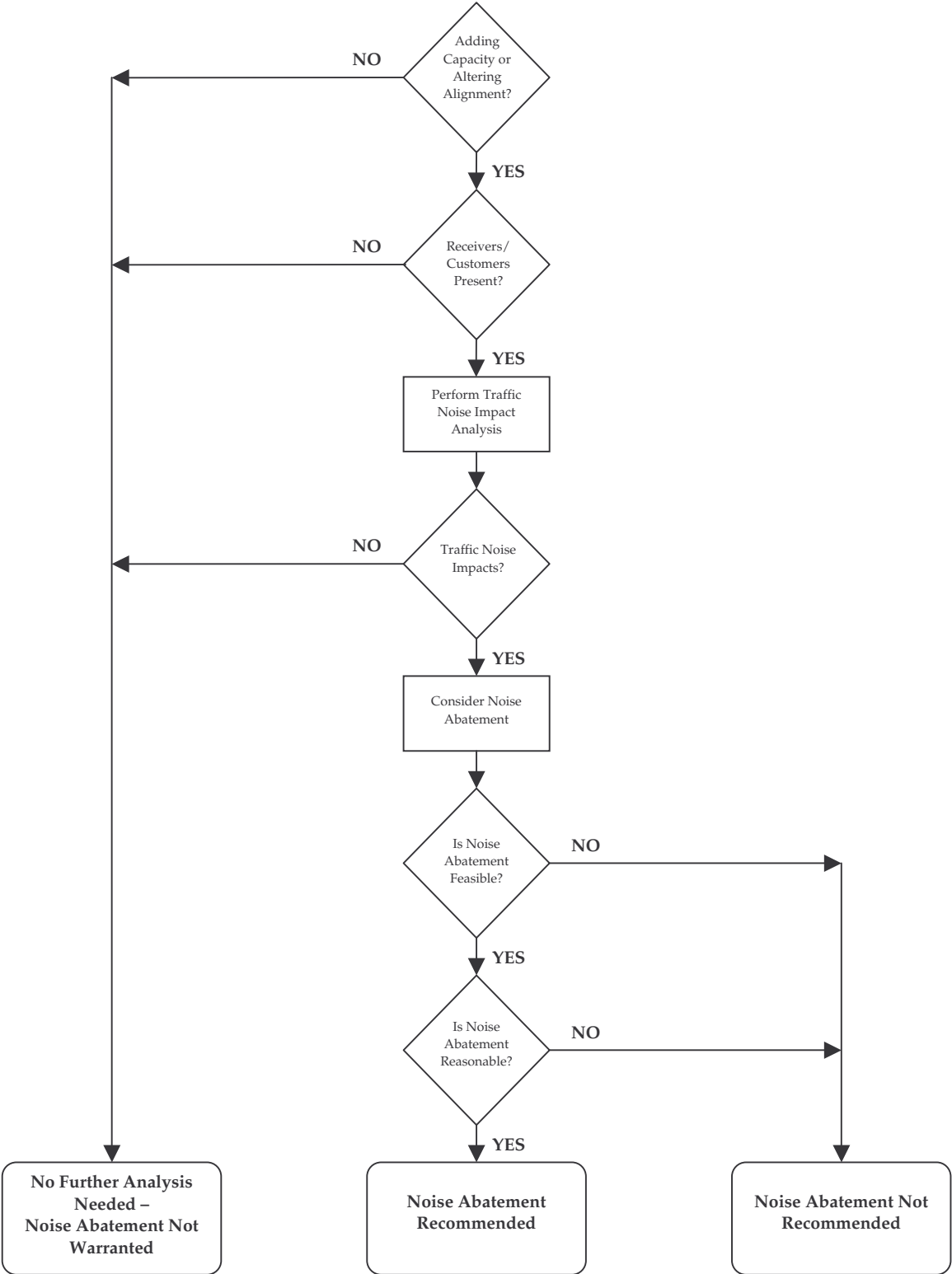
of the completed project. ADOT will evaluate customer noise concerns using noise measurements and geographic location.

IX. Quiet Pavement Pilot Program

FHWA approved the Quiet Pavement Pilot Program (QPPP) in April 2003. The QPPP is a pilot study conducted on the Maricopa County regional freeway system to evaluate the potential effectiveness of pavement types, texturing, and specifically overlaying freeways with an Asphaltic Rubber Friction Course (ARFC) as a possible noise mitigation strategy. The results of the Quiet Pavement Pilot Program could reduce future proposed barrier heights.

ADOT currently has no plans to extend the QPPP to other parts of Arizona. Future application of ARFC to federally funded roadway projects as a noise mitigation strategy may be considered for other parts of Arizona and depends on the outcome of the QPPP. ARFC may be considered as a noise mitigation strategy for state-funded roadway projects.

FLOWCHART: ADOT'S NOISE PROCESS






ARIZONA DEPARTMENT OF TRANSPORTATION

NOISE ABATEMENT POLICY

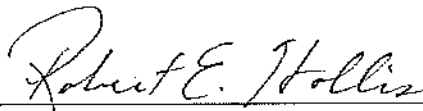
ADDENDUM, AUGUST 2007

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August, 2007 Amendment to Page 8 (Section VI, Subsection A):

A. Maximum Cost of Abatement

The maximum recommended cost of abatement is \$46,000 per benefited developed property. Benefited residential developed properties include all single-family dwellings (i.e., apartments, manufactures homes, condominiums, detached homes), whether occupied by the owner or a renter, that receive a 5 dBA noise reduction from proposed mitigation measures. For benefited developed properties such as parks, schools, hospitals, and churches, noise abatement will be considered on a case by case basis, as specified in ADOT's noise guidelines.