

Arizona Department of Transportation

Instruction on Determination on Existing Noise levels and Noise Measurement Data Form

November 29, 2017

INSTRUCTIONS ON DETERMINATION OF EXISTING NOISE LEVELS

GENERAL INFORMATION

The methodology used for the highway noise level measurement is to comply with procedures specified in Section 4 - *Existing-Noise Measurements in the Vicinity of Highways* - of the FHWA document [FHWA-PD-96-046/DOT-VNTPC-FHWA-96-5](#), *Measurement of Highway-Related Noise* (FHWA, 1996), or any other subsequently FHWA-approved methodology.

Measurements are to be taken under meteorologically acceptable conditions, with winds less than 12 mph and dry pavement. All measurement equipment shall have a valid calibration certificate at the time of measurements.

In general for all Activity Categories, existing noise levels should be established by:

- field measurements alone during *worst noise hour*, or
- field measurements in combination with FHWA TNM model, and if necessary other noise prediction models depending on the existence of the background noise sources.

Field measurements are required, as existing background noise is usually a composite from many sources, and noise prediction models are applicable only to noise originating from a specific source. If it is clear that existing noise levels at locations of interest are predominantly due to a highway, then the existing noise levels may be calculated using the validated FHWA highway traffic noise prediction model.

For the purpose of validation of the FHWA TNM, the noise level measurements taken must be representative of free-flow conditions, without traffic controls, away from sound reflective objects (warehouses, parked trucks, privacy walls etc.), without being influenced by other noise sources (aircrafts, lawn mowers, engines running, running water, loud insects, birds, animals), and with a clear view to the roadway.

When and where possible, it is recommended to take two noise measurements simultaneously, with sound level meters placed on the same line perpendicular to the highway, the farther being approximately within 400 ft from the highway, while the other placed half the distance.

Suggested periods for measuring traffic noise levels is 6:00-10:30 AM, and 15:30-18:00, excluding holidays, weekends, preferably on Tuesdays, Wednesdays, or Thursdays.

Any noise source contributing to the noise levels at the location, other than observed traffic noise, must be identified and captured in TNM model for that particular modeled receiver.

RESOURCES

For multimodal projects, or when a background noise source is from adjoining FTA or FRA facility, one may use the following resources:

- [FHWA Traffic Noise Model \(TNM2.5\)](#)

For ADOT managed infrastructure, ample traffic information is available on [Transportation Data Management System](#) (Figure 1). Following the steps from 1 to 6 one may access to continuous traffic monitoring data that may provide answers on traffic patterns to determine the “noisiest hour”.

- [Federal Transit Administration Noise Impact Assessment Spreadsheet, version 7/3/2007](#), [Federal Transit Administration General Transit Noise Assessment – CREATE Freight Noise and Vibration Model](#).

The methodology to be used for railroad noise level measurement and computation is to be in line with the procedures specified in Section 6 - *Detailed Noise Analysis*, 6.6.2 - *Noise Exposure Measurements* and 6.6.3 - *Noise Exposure Computations from Partial Measurements*, of the document [FTA-VA-90-1003-06 - Transit Noise and Vibration Impact Assessment](#).

Horn noise resources and modeling details may be found [here](#). Note that calculator requires registration and login. ADOT EP Noise may assist with using these models should it be required.

- Aircraft-related noise resources may be found [here](#). ADOT EP Noise may assist with determination of applicability should it be required.

Please do not hesitate to contact [ADOT EP Noise staff](#) for any advice or clarification needed.

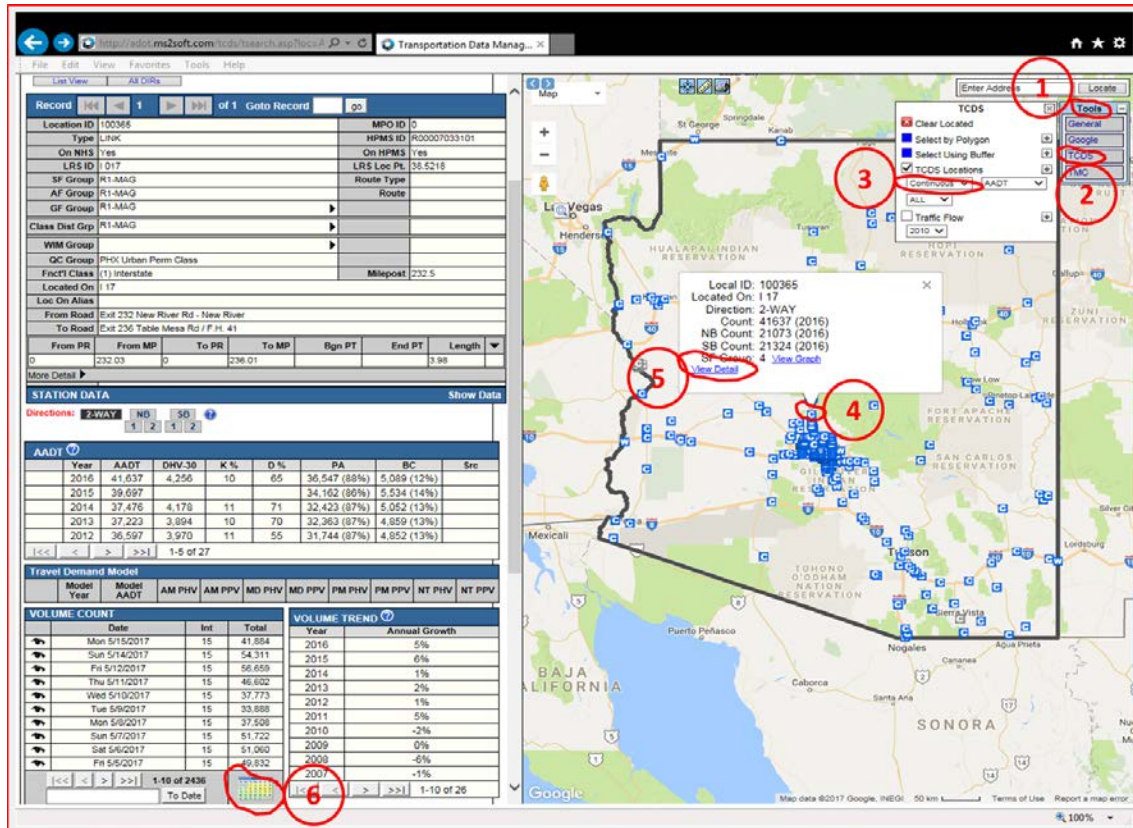


Figure 1 - Transportation Data Management System - ADOT

PROCEDURAL RECOMMENDATIONS

The noise measurement should yield the worst hourly noise level generated from representative noise sources for that area. The period with the highest sound levels may not be at the peak traffic hour but instead, during some period when traffic volumes are lower but the truck mix or vehicle speeds are higher.

It is critical to understand that the FHWA NAC focuses on noise levels where highway traffic noise could potentially interfere with speech communication in exterior areas. Therefore, in properly determining existing noise conditions following factors are essential for consideration.

1. The location is a representative area of frequent human use.
2. The time of measurements at the location coincides with frequent human use common occurrence.
3. The worst noise hours of both highway and alternative noise source is captured, and

- The worst noise hours of both highway and alternative noise source at the time when frequent human use commonly occurs is captured.

The noise levels at any particular location may be affected by an alternate noise source such as other roadways/streets, railroads, and industrial facilities. Figure 2, note that receiver 1 is likely mostly influenced by noise source 4, while receiver 2 is likely mostly influenced by noise sources 1, 2 and 3. In this particular situation, it is hard to determine the contribution of respective noise sources without modeling every noise source-roadway.



Figure 2 - Alternative noise sources

In TNM 2.5, it is suggested to single out roadway and remove all traffic from other roadways-noise sources, while in TNM 3.0 it is possible to identify contribution of individual roads and road segments, Figure 3. Once sound levels are calculated for all, or active, modeled receivers, one may go to *Reports, Sound level diagnosis for rad segments*, and find a page with the observed receiver.

Selected Receivers		Total L _{Aeq}	Important Roadways		Important Segments		Partial L _{Aeq}
Name	No.	dBA	Name	Name	No.	dBA	
School_1_playground	1	55.1	I-10_NB_Frontage 1	Point-3	4	16.3	
			I-10_NB_Frontage 1	Point-36	5	31.0	
			I-10_NB_Frontage 1	Point-37	6	25.2	
			I-10_NB_Frontage 1	Point-38	7	30.7	
			I-10_NB_Frontage 1	Point-39	8	42.1	
			I-10_NB_Frontage 1	Point-5	9	17.4	

Figure 3 - Road segment contribution to a particular receiver

As shown on Figure 4, in case of a school, playgrounds, central field and sports terrains may be identified as areas of frequent human use. Noise measurements need to be taken with and without students using facilities, and with or without alternative noise source, such as train passing; noise levels obtained in this way should be compared and $L_{eq(h)}$ determined. In this case, it is essential to capture noise induced by railroad traffic, and it can be done by FTA modeling, once the FTA model is properly calibrated (by using values of sound level readings with and without train passing at receiver ¥₁). Please use ADOT Noise Abatement Requirements for determining number of receptors represented by each individual receiver.



Figure 4 - Placement of receivers when there is school

The alternative noise source may be expected based on the purpose and location of the observed facility. Aircraft noise is usually representative near airports, noise from barking dogs is usually representative near kennels, ambulance or police sirens is usually representative near hospitals or police stations, truck noise near truck weighting stations-warehouses with reversing vehicles such as forklift operations.

Measurements are made to represent an hourly equivalent sound level, $L_{eq(h)}$. For statistical accuracy, typically measurement periods of 10-15 minutes may be used to represent the $L_{eq(h)}$. This is acceptable if nothing unusual is expected to occur during the noisiest hour. Measurements along low-volume highways may require longer measurement periods (e.g., 30-60 minutes) to attain desirable statistical accuracy.

Measurements are to be made with noise meters of sufficient accuracy to yield valid data for the particular project. Procedures should be followed consistently. Traffic conditions, climatic conditions, and land uses at the time of measurement should be noted.

Please ensure that any alternative noise source is considered when noise abatement measures are assessed for consideration of reasonableness criterion of meeting the noise reduction design goal.

INSTRUCTIONS ON USING NOISE MEASUREMENT DATA FORM

PURPOSE OF THE NOISE MEASUREMENT

In addition to the FHWA Noise Abatement Criteria (NAC), there are three options:

1. Noise inquiry, in support of dealing with concerns from public
2. TNM validation, for the purpose of validation of traffic noise model and ground type determination
3. Existing conditions, taken in support of noise analysis determination of noise levels in project area

Required Actions: Please **select** one that is applicable. Please **select** applicable FHWA NAC.

PROJECT DETAILS

It gives basic information of the project the noise measurement is being taken in relation to, and closer geographical location.

Required Actions:

1. **Enter Envoy number.** Envoy number is automatically generated once ADOT Communications receives a noise related inquiry from public. For the process flow in case of receiving noise inquiry please refer to appropriate *Standard Operating Procedure – EP Noise*.
2. **TracksID - Enter ADOT’s Tracks number** associated with the project.
3. **Project title - Provide project description** ensuring it matches the title used in other environmental documents. In case of noise inquiry, **enter** name and surname of the inquirer.
4. **Date - Insert the date** of noise measurements in format **mm/dd/yyyy**.
5. **Route – Insert the route** ensuring it matches the title used in other environmental documents. Mile Post 1 and 2: **Insert Mile Post 1** for the beginning and **Mile Post 2** for the end of the highway closest to the noise measurement location. (156, 157 or 234, 235)
6. **County: Select** from drop-down menu the County the noise measurement location administratively belongs to. **Address: Insert** the address of the location, or the nearest address if known.

GEO-REFERENCE

This is required to accurately identify the location of noise measurement that will be later referred to in noise measurement database and represented in a GIS map – noise levels layer. One of the easiest ways is to go to the location using free service maps, such as Google maps for example, a right click on a map of the location, select “What’s here?” (Figure 1) and a window will pop-up with GPS coordinates.

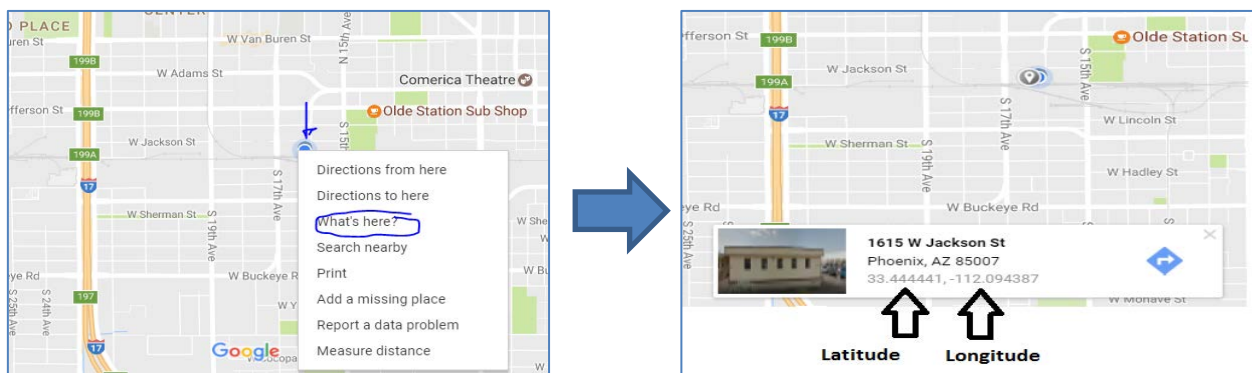


Figure 5 - GPS coordinates determination

Required Action: Insert Latitude, Longitude, in the format shown on Figure 1 and Altitude.

EQUIPMENT AND ATMOSPHERIC CONDITIONS

This section provides information on the equipment used and prevailing atmospheric conditions. Please ensure that the atmospheric conditions are in line with ADOT Noise Abatement Requirements, and Instructions on Noise Measurement Activities.

Required Actions:

1. Sound level meter - **Insert** the appropriate **title** of the instrument used for this particular measurement.
2. Calibration valid - **Insert the date** the **calibration** is valid to. (*It must have valid Calibration Certificate*).
3. Temperature, Humidity, Wind – **insert** the prevailing conditions of the noise measurements. (Please make sure wind speed is less than 12 mph in course of noise measurement).
4. Clouds – **select** from drop-down menu the applicable.
5. Sample start – **insert** the **time** of the first noise measurement sample in format 16:00 (4 PM => 16:00)
6. Duration – **insert** the **average duration** of measurements. Please ensure the duration is not less than 10 min per sample.

VEHICLE SPEED, VOLUMES AND MIX

For TNM model validation, it is essential that the hourly values of vehicle volumes and mix are accurately captured in course of noise measurement. The hourly vehicle volumes and mix are to be entered in TNM model, and after the model is run, the noise levels must be within 3 dB(A) of the respective noise measurement taken for validation purposes. One may want to check the observed data for accuracy against [ADOT TDMS](#).

Required Action: Insert Speed, the hourly value of Vehicles total, and percentage per respective vehicle category.

SOUND LEVEL RESULTS

In line with ADOT Noise Abatement Requirements, three measurements are to be taken at the same location, to determine and represent A-weighted hourly value of L_{eq} , or $L_{eq(h)}$. When determining the $L_{eq(h)}$ please ensure it is represented by a simple average value of three measurements taken at the location.

If there was a major interference (that was not present in course of other noise measurements), that value is not to be included in calculation, and should be marked. If two values are with interference, noise measurement will not be considered as valid for noise analysis and it should be repeated.

Please ensure that the total duration of all noise measurements combined is not less than 45 minutes.

Required Actions:

1. **Insert** the L_{eq1-3} values; **check** if there was interference.
2. **Calculate** and **insert** L_{eqh} .
3. **Select** ground type from drop-down menu.

BACKGROUND NOISE DESCRIPTION

Any observation relevant to the noise measurement, please insert in background noise description. Background noise source may be a railroad traffic, another arterial street, truck parking lot, industrial facility such as metal processing plant or construction facility, and school-playground noise.

Required Action: Insert concise description of any background noise observed

AERIAL IMAGE AND SENDING FORM

Although it is self-explanatory, one may take a photo of the location by a tablet and save on the spot, and inserted by clicking on the image holder. Once completed form may be sent by pressing the send button image, which opens up email command, immediately from the location.

By using this template, the time required for filling and manipulation of the form may be reduced.