

UNITED STATES DISTRICT COURT  
FOR THE WESTERN DISTRICT OF TEXAS  
AUSTIN DIVISION

SHUDDE FATH, SAVE BARTON CREEK §  
ASSOCIATION, FRIENDS OF THE §  
WILDFLOWER CENTER, CAROLE KEETON, §  
FRANK CLOUD COOKSEY, SUSAN AND §  
JERRY JEFF WALKER, DR. LAURIE §  
DRIES, SAVE OUR SPRINGS ALLIANCE, §  
INC., MOPAC CORRIDOR NEIGHBORS §  
ALLIANCE, THE FRIENDSHIP ALLIANCE §  
OF NORTHERN HAYS COUNTY, INC., and §  
CLEAN WATER ACTION, §  
*Plaintiffs,* §

v. §

No. 1:16-cv-234

TEXAS DEPARTMENT OF TRANSPORTATION §  
and CENTRAL TEXAS REGIONAL MOBILITY §  
AUTHORITY, §  
*Defendants.* §

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**DECLARATION OF TODD BUSCH**

1. My name is Todd Busch. I am over 18 years of age, of sound mind, and capable of making this declaration. The facts stated in this declaration are within my personal knowledge and are true and correct.

2. I am a Senior Project Engineer in the Emissions Reduction and Compliance group of Pinchin Ltd., specializing in acoustics, noise, and vibration. I am a professional engineer licensed to practice in the State of California. I have been involved for over 21 years with projects involving highway noise and barriers since first studying the topics as part of a graduate thesis program at the University of British Columbia, Vancouver, Canada.

3. I am a Board Certified Member of the Institute of Noise Control Engineers USA and have both academic and applied professional knowledge of outdoor sound propagation, noise-

barrier performance, and regulations pertaining to highway noise. I have undertaken studies of highway noise in California, Texas, Ohio and New York within both the context of litigation and as an expert assisting clients whose projects are expected to be environmentally compliant with regulation. These studies have required noise measurements, predictive modeling of noise levels, validation and calibration of calculations, analysis, development of noise abatement/mitigation, and reporting in conformity to accepted document standards.

4. The statements set out below and in the attached report, express my conclusions and opinions and are within my field of professional expertise and experience.

5. I have reviewed both the environmental assessment for the MoPac Intersections and the environmental impact statement for the State Highway 45 Southwest projects. I have furthermore reviewed the contents of technical studies prepared by TxDOT as part of the preparation of these environmental documents and am familiar with both Federal regulation and State guideline documents of relevance to the processes involved.

6. In my opinion there are notable deficiencies for these two projects under study and the associated environmental documents due to their incompleteness, inherent inaccuracy, inconsistency with external guideline documents, internal inconsistencies, and failure to adhere to best practices for measurement and analysis of highway noise.

7. TxDOT/FHWA make use of a noise-impact criterion that allows for noise levels that are inconsistent with US EPA findings about what is requisite to protect public health and welfare. The standards used by TxDOT are, potentially, allowing for noise levels that are up to 21 decibels (dB) higher than recommended by the EPA. A 21 dB logarithmic difference corresponds, mathematically, to a situation where there is approximately 125 times more sound being allowed for than is considered safe by the US EPA for the long-term exposure of people to

noise. See U.S. Environmental Protection Agency, Report 550/9-74-004, “Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety”, March 1974.

8. TxDOT incorrectly asserts that there is no “constructive use” of the property of the Lady Bird Johnson Wildflower Center in terms of Section 4(f) encroachment.

9. TxDOT/FHWA do not adequately address existing and future noise impacts to the property of the Lady Bird Johnson Wildflower Center by failing to apply an NAC Category A criterion, which are, “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.”

10. TxDOT fails to adequately document the reasonable cost-effectiveness of noise abatement by utilizing a cost basis of \$25,000 per benefitted noise receptor that has not been updated since 1999.

11. TxDOT admits to the inaccuracies associated with assuming an “average” pavement for calculation of noise emissions using the FHWA TNM calculation model but uses this assumption anyway.

12. TxDOT does not validate the calculated existing noise levels through comparisons to measured noise levels with documented traffic and meteorological conditions. Furthermore, TxDOT does not properly calibrate the calculated future noise levels with reference to the arithmetic differences between calculated and measured, existing noise levels.

13. TxDOT indicates that a PFC pavement will be used for the SH 45 Southwest project, with lower noise emissions that have been documented through research sponsored by TxDOT.

Nonetheless, TxDOT knowingly introduces inaccuracies to a state-funded project through the assumed requirement that an “average” pavement type be assumed.

14. TxDOT relies upon sponsored research reports to claim that endangered species such as the golden-cheeked warbler will not be impacted by the SH 45 Southwest project. However, this sponsored research does not include measurements of a noise level that are applicable to the golden-cheeked warbler and that match the future environmental conditions associated with the construction and traffic-operation of the project.

15. TxDOT does not evaluate the deleterious effects of short-term construction noise on wildlife, including endangered species.

16. TxDOT does not evaluate the deleterious effects of long-term operational traffic noise on wildlife, including endangered species.

17. TxDOT does not appear to have considered alternatives to concrete as a material to construct a noise barrier that could deliver abatement at a lesser cost.

18. TxDOT does not disclose the underlying values assigned to calculation parameters within the FHWA TNM model, including, but not limited to: volumes by vehicle type, percentages of each vehicle type, and assumed speeds of each vehicle type.

19. TxDOT does not disclose noise measurement results over the course of a 24-hr day, or longer, to document diurnal variations of noise level and the hour during which worst-hour noise levels occurred.

20. TxDOT does not provide an indication of what third-party reference standards were used to provide guidance conducting noise measurements.

21. TxDOT’s own analysis indicates that a “finding of no significant impact” for noise impacts on the Wildflower Center and adjacent neighborhoods from the MoPac X project cannot

be supported. Further, the methodologies reported, and lack of disclosure of key information, indicates that TxDOT analysis is not reliable in terms of forecasting actual impacts. The lack of adequate disclosure and the inherent inaccuracy of the calculation procedures, as admitted by TxDOT within the environmental documents, makes the document fundamentally unreliable.

22. The basis for the above statements setting out my professional observations and conclusions on the TxDot analyses of potential noise impacts are explained more fully in the attached report, which was written by me, and which is incorporated herein for all purposes.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on this 6 day of February 2017.

A handwritten signature in black ink that reads "Todd Busch". The signature is written in a cursive style with a large initial 'T' and 'B'.

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Todd Busch



**FINAL**

# **Expert Report on Noise**

MoPac (State Loop 1) Intersections and State Highway (SH) 45  
Southwest Projects  
Austin District, Texas

Prepared for:

## **Save Our Springs Alliance**

905 W Oltorf Street, Suite A  
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Attn: Lauren Ice  
Staff Attorney

February 3, 2017

Pinchin File: 118180



**Issued to:** Save Our Springs Alliance  
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## EXECUTIVE SUMMARY

Pinchin Ltd. (Pinchin) was retained by Save Our Springs Alliance (the Client) to prepare an expert review of noise for the MoPac (State Loop 1) Intersections and State Highway (SH) 45 Southwest Projects located in Austin, Texas. The two projects in question are referred to within this document as MoPac X and SH 45 Southwest. This report has been prepared in the context of litigation undertaken by the Client against the Texas Department of Transportation (TxDOT) and the Central Texas Regional Mobility Authority (CTRMA) over the environmental processes and findings for two closely related projects.

This expert review is based on documents provided by the Client for the following issues.

- Noise criteria that are used to determine environmental impacts.
- External consistency with applicable laws and regulations at the Federal and State levels.
- Internal consistency within the technical reports and environmental studies.
- Accuracy of quantitative reporting of noise levels.
- Completeness in terms of adhering to applicable laws and regulations.
- Conformity to best practices for environmental assessment and study of highway noise levels, impacts, and mitigation/abatement.

The following concluding observations derive from the text within this report and are provided in point form:

- TxDOT/FHWA make use of a noise-impact criterion that allows for noise levels that are inconsistent with US EPA findings about what is requisite to protect public health and welfare. The standards used by TxDOT are, potentially, allowing for noise levels that are up to 21 dB higher than recommended by the EPA.
- TxDOT incorrectly asserts that there is no “constructive use” of the property of the Lady Bird Johnson Wildflower Center in terms of Section 4(f) encroachment.
- TxDOT/FHWA do not adequately address existing and future noise impacts to the property of the Lady Bird Johnson Wildflower Center by failing to apply an NAC Category A criterion, which are, “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.”
- TxDOT fails to adequately document the reasonable cost-effectiveness of noise abatement by utilizing a cost basis of \$25,000 per benefitted noise receptor that has not been updated since 1999.



- TxDOT admits to the inaccuracies associated with assuming an “average” pavement for calculation of noise emissions using the FHWA TNM calculation model but uses this assumption anyway.
- TxDOT does not validate the calculated existing noise levels through comparisons to measured noise levels with documented traffic and meteorological conditions. Furthermore, TxDOT does not properly calibrate the calculated future noise levels with reference to the arithmetic differences between calculated and measured, existing noise levels.
- TxDOT indicates that a PFC pavement will be used for the SH 45 Southwest project, with lower noise emissions that have been documented through research sponsored by TxDOT. Nonetheless, TxDOT knowingly introduces inaccuracies to a state-funded project through the assumed requirement that an “average” pavement type be assumed.
- TxDOT relies upon sponsored research reports to claim that endangered species such as the golden-cheeked warbler will not be impacted by the SH 45 Southwest project. However, this sponsored research does not include measurements of a noise level that are applicable to the golden-cheeked warbler and that match the future environmental conditions associated with the construction and traffic-operation of the project.
- TxDOT does not evaluate the deleterious effects of short-term construction noise on wildlife, including endangered species.
- TxDOT does not evaluate the deleterious effects of long-term operational traffic noise on wildlife, including endangered species.
- TxDOT does not appear to have considered alternatives to concrete as a material to construct a noise barrier that could deliver abatement at a lesser cost.
- TxDOT does not disclose the underlying values assigned to calculation parameters within the FHWA TNM model, including, but not limited to: volumes by vehicle type, percentages of each vehicle type, and assumed speeds of each vehicle type.
- TxDOT does not disclose noise measurement results over the course of a 24-hr day, or longer, to document diurnal variations of noise level and the hour during which worst-hour noise levels occurred.
- TxDOT does not provide an indication of what third-party reference standards were used to provide guidance conducting noise measurements.
- TxDOT’s own analysis indicates that a “finding of noise significant impact” for noise impacts on the Wildflower Center and adjacent neighborhoods from the MoPac X project



cannot be supported. Further, the methodologies reported, and lack of disclosure of key information, indicates that TxDOT analysis is not reliable in terms of forecasting actual impacts.



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**APPENDICES**

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## 1.0 INTRODUCTION AND SCOPE

Pinchin Ltd. (Pinchin) was retained by Save Our Springs Alliance (the Client) to prepare an expert review of noise for the MoPac (State Loop 1) Intersections and State Highway (SH) 45 Southwest Projects located in Austin, Texas. The two projects in question are referred to within this document as MoPac X and SH 45 Southwest. This report has been prepared in the context of litigation undertaken by the Client against the Texas Department of Transportation (TxDOT) and the Central Texas Regional Mobility Authority (CTRMA) over the environmental processes and findings for two closely related projects.

This expert review is based on documents provided by the Client for the following issues.

- External consistency with applicable laws and regulations at the Federal and State levels.
- Internal consistency within the technical reports and environmental studies.
- Accuracy of qualitative interpretations of laws and regulations along with quantitative reporting of noise levels.
- Endangered species are discussed in terms of conformance to applicable laws along with a review of relevant scientific information.
- Completeness in terms of adhering to applicable laws and regulations.
- Conformity to best practices for environmental assessment and study of highway noise levels, impacts, and mitigation/abatement.

## 2.0 NOISE CRITERIA

The applicable regulatory guidelines for receptors of noise in vicinity to these two projects are described within both TxDOT guidance documents [10.1a, 10.2a] and Federal Highway Administration (FHWA) regulations [10.3a] and are shown for reference within Table 1 of this report. An “approach level” of 1 dBA has been defined by TxDOT. This approach towards the absolute noise abatement criteria (NAC) within Table 1 of this report to be treated as an approach or exceed value for Activity Category B Residential of 66 dBA or higher, instead of 67 dBA or higher, during the worst-hour of a typical day in order for a receptor to be deemed impacted by project noise.

### 2.1 U.S. Environmental Protection Agency Findings

Pinchin introduces the “Levels” document produced by the U.S. Environmental Protection Agency (EPA) in 1974 [10.3.b]. The findings of this report [10.3.b, page 3] are summarized below within Table 2 of this report. The EPA makes use of an Leq(24), which represents the sound energy averaged over a 24-hr period and a day-night noise level, and an Ldn, which represents the Leq over a 24-hr day with a 10-dB



positive weighting applied to nighttime noise levels. Nighttime being those hours from 10 PM to 7 AM of the same 24-hr day.

A comparison of the EPA “Levels” document findings to the NAC applied by the FHWA and TxDOT suggests the following:

- The US EPA suggests that an Leq(24) of up to 70 dBA is needed to avoid long-term issues with hearing loss.
- The FHWA/TxDOT NAC approach or exceed method for determining noise impacts does not guarantee, even with noise abatement, that the noise environment with a project will be quiet enough so as to avoid long-term hearing loss.
- The US EPA suggests that an Ldn of up to 55 dBA corresponds to an environment for outdoor interference and annoyance that is requisite to the public health and welfare. Under conditions where the traffic is relatively constant throughout a 24-hr day, this could correspond to a situation where the worst-hour noise level is as low as 45 dBA.
- For Activity Category B Residential, a worst-hour Leq(h) of 66 dBA or higher determines that a noise impact occurs at a noise receptor of interest.
- The FHWA/TxDOT criteria for residential noise receptors are, thus, on the order of 21 dB higher than recommended by the US EPA. A 21 dB logarithmic difference corresponds, mathematically, to a situation where there is approximately 125 times more sound being allowed for than is considered safe by the US EPA for the long-term exposure of people to noise. Greater multipliers are possible even with noise abatement in place since the NAC are only used to represent noise impacts and are not used as design objectives for determining the required performance of noise abatement measures.
- For engineering purposes, each 10 dB change of noise level, higher or lower, corresponds to a doubling or halving of the perceived loudness. This can be extrapolated such that a 20 dB relative increase corresponds to a perceived factor of four increase of the perceived loudness.
- Based on this information and comparisons, Pinchin suggests that the NAC being applied by FHWA/TxDOT are inconsistent, due to the excessive allowance for noise levels relative to EPA recommendations, with preserving a noise environment for people that is requisite to protect public health and welfare.



## 2.2 Lady Bird Johnson Wildflower Center

Within the “Traffic Noise Technical Memorandum” [10.1.c, page 4] for the MoPac (State Loop 1) Intersections project, the Lady Bird Johnson Wildflower Center (“Center”) is classified as being an NAC Category C property with an allowable worst-hour noise level of up to 67 dBA (66 dBA with the 1 dB “approach” standard applied) to avoid being considered impacted by the project. Arguably, this is an incorrect classification, notwithstanding the claim by TxDOT [10.1.g, page 12] that the Center is effectively a Section 4(f) property and, therefore, according to FHWA/TxDOT reasoning should be classified as an NAC Category C property (see Table 1 of this report). Pinchin recommends that the property be reclassified as an NAC Category A property, while still retaining the characteristics of Section 4(f) lands, for the purposes of environmental noise study, since it appears to meet the description provided by the FHWA/TxDOT for such a classification. Namely, from Table 1 of this report, “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.”

Furthermore, TxDOT claims [10.1.g, page 13] that “The noise impacts to the Wildflower Center would not be considered a constructive use of a Section 4(f) property because, (1) the affected park activities, features or attributes do not meet the definition of being “noise-sensitive facilities” and (2) because the proposed noise barrier would reduce the noise level at these locations beyond the existing conditions.”

Pinchin suggests that the Lady Bird Johnson Wildflower Center most certainly merits being considered among those that are “noise-sensitive facilities.”

According to the FHWA [10.3.c], “The FHWA Division Office or Federal Lands Division Office is responsible for making most decisions related to Section 4(f) compliance at the project level after consulting with the appropriate officials with jurisdiction (note: some states have assumed responsibility for Section 4(f) compliance per 23 USC 326 and 327). These decisions include whether Section 4(f) applies to a property, whether a use will occur, whether a de minimis impact determination may be made, assessment of each alternative's impacts to Section 4(f) properties, and determining whether the law allows the selection of a particular alternative. In the cases where it appears that there will be a constructive use, the FHWA Division Office may only make a Section 4(f) decision with prior concurrence from FHWA Headquarters.” Texas is among those states that have assumed responsibility for Section 4(f) compliance [10.3.c]. Pinchin suggests that a “de minimus” noise impact can be achieved by seeking to reduce noise levels to those associated with NAC Category A property instead of assuming an NAC Category C usage [10.3.d, page 12].



### **3.0 EXTERNAL CONSISTENCY**

This section addresses the external consistency of the project's environmental documents with applicable laws and regulations at the Federal and State levels.

#### **3.1 Reasonable Cost Effectiveness of Noise Abatement**

TxDOT's "Guideline" [10.1a, 10.2a, page 11] makes use of a measure of the cost effectiveness of proposed noise abatement of \$25,000 per "benefitted receptor," which refers to a receptor of noise where the noise abatement achieves adequate reductions of noise level relative to the unabated, future condition. This practice is consistent with FHWA regulation [10.3a] within Section 772.13 (d) (2) (ii). As noted within the "Guideline," this data is derived from a TxDOT study, completed in year 1999, where \$25,000 is the "median value for all states [10.3.e, page 5]. The value of this cost-effectiveness has not been subsequently updated by TxDOT within the intervening 17 years, despite FHWA requirements for Federal-funded projects that such a cost-effectiveness measure be "[reanalyzed] ... on a regular interval, not to exceed 5 years" (see Section 772.13 (d) (2) (ii)). Due to the limited scope of application of FHWA regulation [10.3a], such a cost-effectiveness measure need not apply to a state-funded project with a state environmental impact statement. Furthermore, there is no immediate evidence that TxDOT has explored new technologies for noise barriers that might deliver abatement at a lower cost than previously determined in year 1999 [10.3.e].

#### **3.2 Predictions using "Average" Pavement**

TxDOT relies upon a calculation model for predicting noise levels at noise receptors of interest, as follows: "The most current version of the FHWA [Traffic Noise Model] TNM computer model must be used in the noise analysis, and if appropriate, should be validated [for the existing condition] with noise measurements taken at noise receptors" [10.1.a, 10.2.a, page 23]. This stipulation about the calculation model to be used is consistent with FHWA regulation Section 772.9 (a) [10.3.a]; although the FHWA does allow for the use of, "... any other model determined by the FHWA to be consistent with the methodology of the FHWA TNM." For projects subject to FHWA regulation, see Section 772.9 (b), such as those that are Federal-funded, the calculation model is to be configured such that "Average pavement type shall be used in the FHWA TNM for future noise-level prediction unless a highway agency substantiates the use of a different pavement type for approval by the FHWA," [10.3.a].

The noise emissions within the FHWA TNM are a function of pavement type (Portland cement concrete (PCC), dense-grade asphalt concrete (DGAC), open-grade asphalt concrete (OGAC)); and vehicle type (automobiles, medium trucks, heavy trucks, buses, motorcycles); along with traffic volumes for each vehicle type, speed for each vehicle type, and roadway gradient [10.3.f]. The "average" pavement type is





determined from the noise emission data for PCC and DGAC pavements only and is, therefore, potentially compromised for the accuracy of the assumed noise emissions relative to PCC, DGAC, OGAC and other pavement types.

The issue of modeling accuracy due to variations of assumed pavement type is discussed further below. Furthermore, the issue of model validation using measurements for comparison to predicted noise levels is explored in greater detail below.

#### **4.0 INTERNAL CONSISTENCY**

This section addresses the internal consistency of the environmental studies and associated technical reports for both projects. Additional issues are discussed that introduce further topics for discussion under the topic of accuracy.

##### **4.1 MoPac (State Loop 1) Intersections**

The Environmental Assessment (EA) for the MoPac (State Loop 1) Intersections project states that, “The [existing] pavement section consists of asphalt, with intermittent curb and gutter” [10.1.g, page 2]. There is no “statement of likelihood” (see [10.1.a, 10.2.a, page 13]) within either the EA or supporting technical noise memorandum [10.1.c] about the pavement type that is expected to be incorporated into the project. As noted above, pavement type is a parameter that affects the noise emissions of a modeled roadway within the TNM. For a project where there are pre-existing roadways with a known pavement, model validation is also stipulated by both FHWA Section 772.11 (d) (2) [10.3.a] and TxDOT [10.1.a, 10.2.a, page 23] regulations.

##### **4.2 SH 45 Southwest**

The Environmental Impact Statement (EIS) for SH 45 Southwest [10.2.d, page 130] states that, “Although the use of different pavement types is not an approved noise mitigation measure, the use of [Permeable Friction Course] PFC pavement on this project is likely to result in lower noise levels than those projected by the [TNM] model results.” For this project, there is, therefore, a commitment to using a pavement type with lower noise emissions than results from the use of the “average” pavement type in the TNM. This confirms that TxDOT has conducted an analysis for this project where, by their own admission, the predicted noise levels for future conditions are inherently inaccurate. The issue of modeling accuracy is discussed in more detail below.

#### **5.0 ACCURACY**

This section considers the accuracy of quantitative reporting of noise levels. The topics discussed below focus on model validation and variations of noise emissions with pavement type.



## 5.1 Model Validation

TxDOT failed to validate the accuracy of their FHWA TNM predictions of noise levels relative to the existing noise levels that were measured at various receptor sites. As noted above, both TxDOT guidance documents [10.1.a, 10.2.a, page 23] require model validation, which in practice consists of a comparison of measurements at noise receptors of interest to predicted results using a calculation model. This expectation is also conveyed within FHWA regulation [10.3.a] Section 772.11 (d) (2) which states, “For projects on new or existing alignments, validate predicted noise level through comparison between measured and predicted noise level.”

As noted above, the FHWA TNM requires the assignment of values for a number of model parameters, including, but not limited to: pavement type, vehicle type, traffic volumes for each vehicle type, speed for each vehicle type, and roadway gradient. In cases where the existing noise level from a roadway is subject to direct measurement, it is also necessary to collect information about the actual operations of vehicles on the roadway during that time frame in order to allow for the calculation model to be configured correctly and see the model validated. TxDOT has failed to undertake such a model validation for either of the projects in question, which is an obvious possibility towards improved accuracy in the case of the existing MoPac (State Loop 1) Intersections project.

The process of validation involves a comparison, which in practice also requires an accept/reject threshold for the allowable arithmetic difference between the measured and calculated noise levels. An example would be +/- 2 dB tolerance whereby differences of this amount or less can suggest that the calculated noise level be utilized to indicate the worst-hour noise level in preference to the measured noise level; or vice versa. Additionally, when the arithmetic difference exceeds this allowable tolerance, protocol could indicate that the calculated noise level be adjusted to match the measured noise level and that this adjustment serves as a model calibration factor which should be utilized for subsequent calculations of the future, predicted noise level due to a project. None of this type of validation and/or calibration has been undertaken by TxDOT.

## 5.2 Pavement Noise Emissions

For calculations using the FHWA TNM TxDOT utilized the assumed noise emissions an “average” pavement type, which is not really even a pavement type but is, rather, the average of PCC pavement, which is relatively louder, and DGAC pavement, which is relatively quieter [10.3.f]. As discussed above, this assumption is required by FHWA regulation but need not apply to State-funded projects. For the latter case, TxDOT has chosen to make this assumption for both projects in question despite the omission of such an explicit requirement within State policy [10.1.a, 10.2.a]. Furthermore, TxDOT itself has sponsored research studies to document the noise emissions from PFC pavements and these studies report the



significance of their application to modeling using the FHWA TNM [10.3.g]. Within the Conclusions and Recommendations of this report [10.3.g, page 128] the authors found that, for PFC, that, “The “Average” pavement option in TNM overpredicts noise levels by almost 5 dBA, while the “OGAC” pavement option overpredicts noise levels by about 3 dBA, on average. These numbers imply that the “Average” option is not the best alternative for calculations corresponding to PFC pavements.” For Federal-funded projects, TxDOT could take steps to substantiate the use of a different pavement type by the FHWA. For State-funded projects, there would appear to be no impediment to the use of noise emissions for a given pavement type by TxDOT when the modeled result will be more accurate predictions of noise levels.

## **6.0 ENDANGERED SPECIES**

This section discusses how endangered species are considered within the EIS for SH 45 Southwest [10.2.d] in terms of conformance to applicable laws along with a review of relevant scientific information. The discussion distinguishes between noise associated with both short-term construction and long-term operation of the project as they pertain to the golden-cheeked warbler which has habitat along the transportation corridor for the SH 45 Southwest project. The golden cheek warbler is listed by the U.S. Fish & Wildlife Service [10.3.h] as an endangered species [10.3.i].

Lackey [10.3.j], with sponsorship from TxDOT, has studied the impact of construction noise on reproductive success and territory selection of golden-cheeked warblers along Highway 83 in Real County, Texas. As noted on page 2, “The golden-cheeked warbler (*Dendroica chrysoparia*), the focal species for my research, was placed on the federal endangered species list in 1990 due to habitat destruction and fragmentation. As urbanization increases, roads are being built and modified throughout the golden-cheeked warbler’s range.” From the abstract on page iv, “Results suggest that construction noise does not appear to affect behavior or reproductive success of golden-cheeked warblers.” However, upon closer review, there is no information about the measured noise levels to document the environmental conditions in proximity to the birds under study. Furthermore, from page 58:

- “[The] study sites were located in rural counties with vehicle loads of <2,000 vehicles/day. Previous studies reporting negative effects road noise on songbird populations have been located near roads with 10,000–60,000 vehicles/day and have shown biological effects from 40 m to 3 km away from roadways ....”
- “Given the difference in vehicle loads, it is conceivable that golden-cheeked warblers may react differently to road noise in louder areas with higher traffic volume than warblers in rural areas.”

CALTRANS has produced a technical memorandum that reviews the known effects of both traffic noise and road construction noise on birds [10.3.k]. The memorandum covers bird hearing and communication



within the highway operational noise and construction noise environment. From the abstract of the memorandum, “The following topics are discussed: stress and physiological effects, acoustic overexposure, masking, dynamic behavioral and population effects, extrapolation of data from humans and birds to other species.” From page 3 of the memorandum, “... construction or traffic noise that adds significantly to natural ambient noise has the possibility of producing a suite of significant short- and long-term behavioral and physiological changes in birds. These may include changes in foraging location and behavior; interference with acoustic communicate between conspecifics; failure to recognize other important biological signals, such as sounds of predators and/or prey; decreasing hearing sensitivity temporarily or permanently; and/or increasing stress and altering steroid hormone levels. Any of these effects could have long-term consequences and enduring impacts that include interference with breeding by individuals and populations, thereby threatening the survival of individuals or species.” TxDOT failed to refer to the CALTRANS memorandum and the plethora of supporting scientific literature that would have adequately addressed the topic of construction noise in this case.

## **6.1 Short-Term Construction**

TxDOT does not consider construction noise as a potential environmental impact to wildlife within either the EA for MoPac (State Loop 1) Intersections or the EIS for SH 45 Southwest. Construction noise is generally more substantial in terms of the levels and amplitudes, respectively, than would be noise from long-term operation. As such, there is no analysis of potential impacts or mitigation to protect species like birds from the disruptive effects of construction activity. Within the context of SH 45 Southwest, the golden-cheeked warbler is an endangered species and would, presumably, be the subject of reasonable scrutiny over the topic of construction noise.

## **6.2 Long-Term Operation**

TxDOT does not have a reasonable basis for claiming that, “... no impacts to the Golden-cheeked Warbler are expected from the proposed [SH 45 Southwest] project” [10.2.d, page 284]. This is due to the inadequacy of one of the studies that is used to substantiate this claim. Namely, “Studies suggest that road construction noise and road noise have no effect on Golden-cheeked Warbler pairing success, territory placement, or productivity (Lackey et al. 2011 [10.3.] ...).” The studies undertaken to support this claim by TxDOT in question, discussed above in terms of a source of the research, a Master of Science thesis, did not conduct measurements during the research program to document the noise levels being experienced by the golden-cheeked warblers under study. Furthermore, also discussed above, the studies noted that the results are for a relatively low traffic volume road that is not comparable to future SH 45 Southwest operating conditions.



## **7.0 COMPLETENESS**

This section addresses the completeness of the environmental studies for both projects in terms of adherence to applicable laws and regulations. The comments below apply to the environmental studies for both of the projects under review.

### **7.1 Alternative Noise Barrier Materials**

TxDOT does not appear to have investigated the possibility of using materials other than concrete for the estimation of the assumed cost of noise barriers [10.3.e]. Alternative materials in use include wood, polymers, and even earth berms. All of these conceivably can provide the required noise-control performance that concrete achieves at a lower unit cost. The consideration of such alternative materials using realistic unit costs could allow for the construction of more noise barriers in order to abate impacts.

### **7.2 FHWA TNM Model Parameters**

TxDOT fails to document the most-basic information about the assumed operating parameters for vehicles on existing and/or future highways to support calculations of the worst-hour noise level. This includes volumes by vehicle type, percentages of each vehicle type, and assumed speeds of each vehicle type. As such, the projects do not achieve a suitable standard for disclosure.

### **7.3 Worst-Hour Noise Measurements**

TxDOT fails to report noise levels over the course of a 24-hr day for each hour in order to document the diurnal variations of hourly noise levels. This information would reveal the times of day when worst-hour noise levels occur and allow for calculation of supplemental measures of exposure, such as the day-night noise level, Ldn. As such, the projects do not achieve a suitable standard for disclosure.

## **8.0 BEST PRACTICES**

This section addresses the conformity of the environmental studies to best practices for environmental assessment and study of highway noise levels, impacts, and mitigation/abatement.

TxDOT indicates that noise measurements were taken but does not provide an indication as to whether or not they were conducted in accordance to a referenceable set of procedures, such as those promulgated by the FHWA [10.3.m]. The FHWA provides guidance for the recommended practice for performing existing noise measurements in the vicinity of a highway. TxDOT provides no information about the who, what, where, when, why or how of noise measurement procedures and does not document basic information related to the atmospheric conditions at the time of measurement. As such, the projects do not achieve a suitable standard for disclosure.



## 9.0 CONCLUSIONS

The following concluding observations derive from the text above and are provided in point form:

- TxDOT/FHWA make use of a noise-impact criterion that allows for noise levels that are inconsistent with US EPA findings about what is requisite to protect public health and welfare. The standards used by TxDOT are, potentially, allowing for noise levels that are up to 21 dB higher than recommended by the EPA.
- TxDOT incorrectly asserts that there is no “constructive use” of the property of the Lady Bird Johnson Wildflower Center in terms of Section 4(f) encroachment.
- TxDOT/FHWA do not adequately address existing and future noise impacts to the property of the Lady Bird Johnson Wildflower Center by failing to apply an NAC Category A criterion, which are, “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.”
- TxDOT fails to adequately document the reasonable cost-effectiveness of noise abatement by utilizing a cost basis of \$25,000 per benefitted noise receptor that has not been updated since 1999.
- TxDOT admits to the inaccuracies associated with assuming an “average” pavement for calculation of noise emissions using the FHWA TNM calculation model but uses this assumption anyway.
- TxDOT does not validate the calculated existing noise levels through comparisons to measured noise levels with documented traffic and meteorological conditions. Furthermore, TxDOT does not properly calibrate the calculated future noise levels with reference to the arithmetic differences between calculated and measured, existing noise levels.
- TxDOT indicates that a PFC pavement will be used for the SH 45 Southwest project, with lower noise emissions that have been documented through research sponsored by TxDOT. Nonetheless, TxDOT knowingly introduces inaccuracies to a state-funded project through the assumed requirement that an “average” pavement type be assumed.
- TxDOT relies upon sponsored research reports to claim that endangered species such as the golden-cheeked warbler will not be impacted by the SH 45 Southwest project. However, this sponsored research does not include measurements of a noise level that are applicable to the golden-cheeked warbler and that match the future environmental conditions associated with the construction and traffic-operation of the project.



- TxDOT does not evaluate the deleterious effects of short-term construction noise on wildlife, including endangered species.
- TxDOT does not evaluate the deleterious effects of long-term operational traffic noise on wildlife, including endangered species.
- TxDOT does not appear to have considered alternatives to concrete as a material to construct a noise barrier that could deliver abatement at a lesser cost.
- TxDOT does not disclose the underlying values assigned to calculation parameters within the FHWA TNM model, including, but not limited to: volumes by vehicle type, percentages of each vehicle type, and assumed speeds of each vehicle type.
- TxDOT does not disclose noise measurement results over the course of a 24-hr day, or longer, to document diurnal variations of noise level and the hour during which worst-hour noise levels occurred.
- TxDOT does not provide an indication of what third-party reference standards were used to provide guidance conducting noise measurements.
- TxDOT's own analysis indicates that a "finding of noise significant impact" for noise impacts on the Wildflower Center and adjacent neighborhoods from the MoPac X project cannot be supported. Further, the methodologies reported, and lack of disclosure of key information, indicates that TxDOT analysis is not reliable in terms of forecasting actual impacts.

## 10.0 REFERENCES

### 10.1 MoPac Intersections Project (MoPac X):

- a) A0064 – TxDOT Guidelines for Analysis & Abatement of Roadway Traffic Noise (2011).
- b) A0208 – TxDOT Environmental Handbook: Traffic Noise (2015).
- c) A0235 – Traffic Noise Technical Memorandum (June 2015).
- d) A0251 – Email re Proposed Noise Barrier at Wildflower Center.
- e) A0252 – Graphic Showing Modeled Decibel Levels for Wildflower Center.
- f) A0253 – Email with Neighbors re Proposed Noise Barrier.
- g) A0265 – Final Environmental Assessment.
- h) A0270 – Traffic Noise Workshop & Meeting Summary.



## 10.2 State Highway 45 Southwest (SH 45 SW):

- a) A173 - TxDOT Guidelines for Analysis & Abatement of Roadway Traffic Noise (2011)
  - Same as MoPac X A0064.
- b) A183 - 2010\_FHWA\_Highway Traffic Noise, Analysis and Abatement Guidance - updated 2011.pdf.
- c) A288 – 2014\_CP&Y\_Reasonable Feasible Highway Traffic Noise Abatement Measure Tables SH 45SW.
- d) d.A400 – Final State Environmental Impact Statement.

## 10.3 Miscellaneous:

- a) Title 23 United States Code of Federal Regulations Section 772, “Procedures for Abatement of Highway Traffic Noise and Construction Noise”, [current as of January 13, 2017].
- b) U.S. Environmental Protection Agency, Report 550/9-74-004, “Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety”, March 1974.
- c) U.S. Department of Transportation, “Section 4(f) Tutorial”, [\[https://www.environment.fhwa.dot.gov/section4f/overview.aspx\]](https://www.environment.fhwa.dot.gov/section4f/overview.aspx). Access January 18, 2017.
- d) Texas Department of Transportation, “Environmental Handbook, US Department of Transportation Act: Section 4(f)”, May 2015.
- e) Center for Transportation Research, “Report 3965-1: Validation and Cost Effectiveness Criterion for Evaluating Noise Abatement Measures”, University of Texas at Austin, 1999.
- f) U.S. Department of Transportation, “Report No. FHWA-PD-96-010 FHWA Traffic Noise Model Revision 1, Volpe National Transportation Systems Center, April 2004.
- g) Center for Transportation Research, “Report No. FHWA/TX-10/0-5185-3 Noise Measurements of Highway Pavements in Texas”, University of Texas at Austin, April 2009, Revised October 2009.
- h) Species Profile for golden-cheeked warbler (*Dendroica chrysoparia*), [\[http://ecos.fws.gov/ecp0/profile/speciesProfile?sld=33\]](http://ecos.fws.gov/ecp0/profile/speciesProfile?sld=33). Accessed January 29, 2017.
- i) Title 16 United States Code of Federal Regulations Section 1531 et seq., “Endangered Species Act.”





**Expert Report on Noise**

MoPac (State Loop 1) Intersections and State Highway (SH) 45  
Southwest Projects, Austin District, Texas  
Save Our Springs Alliance

February 3, 2017

Pinchin File: 118180

FINAL

- j) Lackey, Melissa Anne, "Master of Science: Avian Response to Road Construction Noise with Emphasis on the Endangered Golden-Cheeked Warbler", Texas A&M University, May 2010.
- k) State of California, "Technical Memorandum for Assessment and Mitigation of the Effects of Traffic Noise and Road Construction Noise on Birds", Department of Transportation, June 2016.
- l) Lackey, M. A., M.L. Morrison, Z.G. Loman, N. Fisher, Shannon L. Farrel, B.A. Collier, et. al., "Effects of Road Construction Noise on the Endangered Golden-Cheeked Warbler", Wildlife Society Bulletin, 35(1), 15-19, 2011.
- m) U.S. Department of Transportation, "Report No. FHWA-PD-96-046 Measurement of Highway-Related Noise", Volpe National Transportation Systems Center, May 1996.

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**APPENDIX A**  
**Tables**  
**(2 Pages)**



**Table 1 to Title 23 CFR Section 772 Noise Abatement Criteria**

[Hourly A-Weighted Sound Level, decibels dBA<sup>1</sup>]

Activity Category	Activity <sup>2</sup> 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, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or non-profit 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 non-profit 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.

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



**Table 2 Summary of Noise Levels Identified by EPA as Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety**

Effect	Level	Area
Hearing loss	Leq(24) < 70 dBA	All areas.
Outdoor activity interference and annoyance	Ldn < 55 dBA	Outdoor in residential areas and farms and other outdoor areas where people spend varying amounts of time and other places in which quiet is a basis for use.
	Leq(24) < 55 dBA	Outdoor areas where people spend limited amounts of time, such as school yards, playgrounds, etc.
Indoor activity interference and annoyance	Ldn < 45 dBA	Indoor residential areas.
	Leq(24) < 45 dBA	Other indoor areas with human activities such as schools, etc.