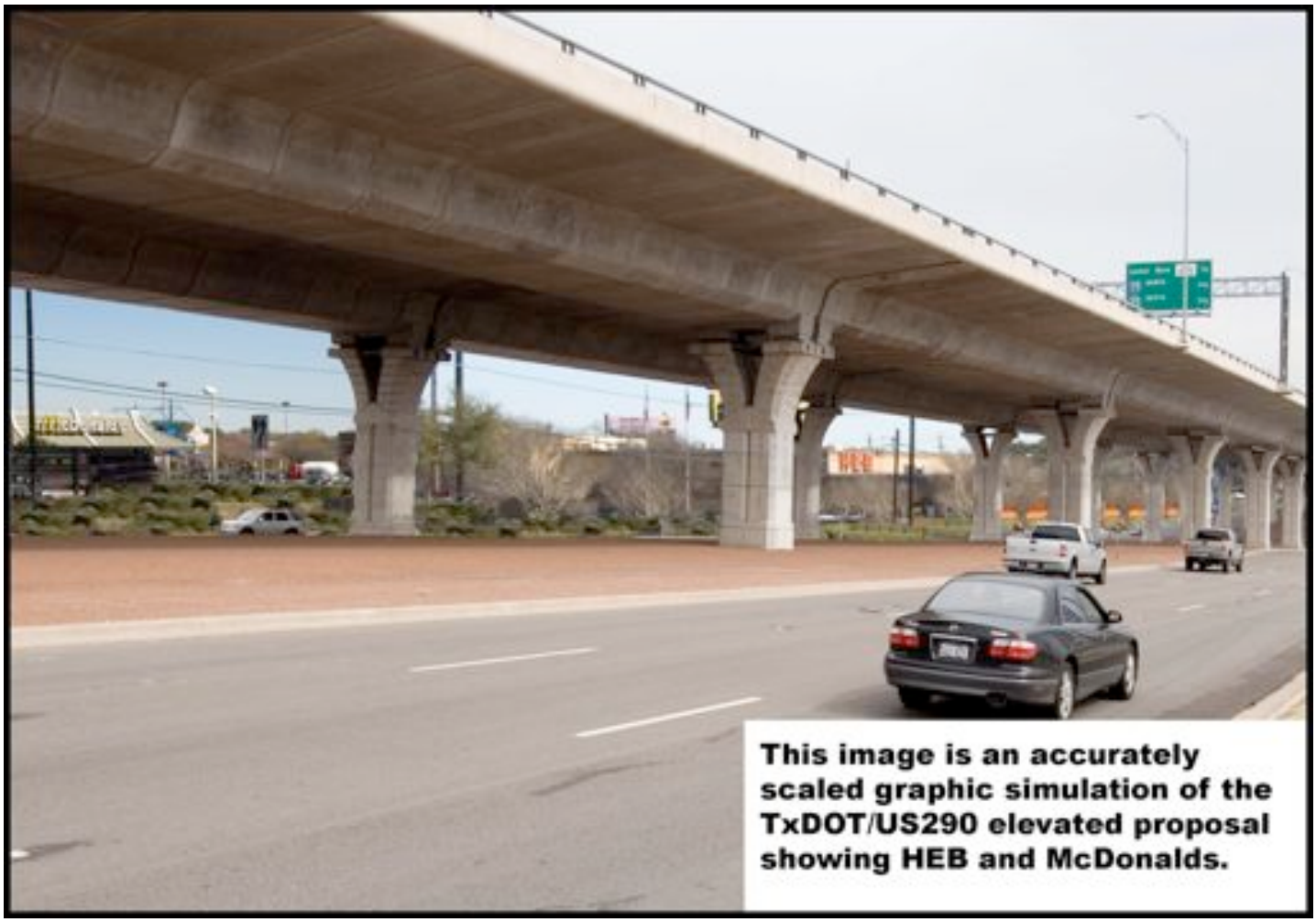
Fix290 Noise Report

Analysis of Future Highway Noise in Oak Hill
for the
TxDOT Hwy 290/71 Interchange Project



Prepared for Fix290.org

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MESA ENGINEERING
Oak Hill, Texas

Table of Contents

Overview

This document discusses increases in noise levels involved with the construction of the Texas Department of Transportation (TxDOT) project known as the Highway 290/71 Interchange Project. The Fix290 concept for Oak Hill consists of a "ground-level" parkway and is supported by more than 2300 petition signers. TxDOT's plans for the project are for 12 lanes of pavement with 6 lanes of elevated tollway. Highway 290 and 71 are currently both four-lane roadways.

This study makes two analyses. The first calculates noise levels today, for an elevated project and for a ground level parkway. The results of these calculations match the measured noise levels fairly well. The second part of the study compares current noise levels at the Mopac/290 interchange with today's noise levels in Oak Hill. Measured noise levels from the Mopac/290 interchange are used as a proxy to show what the future levels of noise near the Oak Hill "Y" interchange might be—following construction of a new roadway there.

This second part of the study conservatively demonstrates the increase in noise levels that can be expected in Oak Hill from the construction of an elevated highway system similar to the existing Mopac/290 interchange. The reason this part of the study is conservative is that the current traffic volume at the Mopac/290 interchange is only 100,000 vehicles per day. The Capital Area Metropolitan Planning Organization (CAMPO) 2030 Plan allows for 157,500 vehicles per day at the Oak Hill "Y" in the year 2030. This is nearly half again as much traffic than is currently represented by the measurements at Mopac/290. The Oak Hill noise levels will be correspondingly higher if the 157,500 vehicle per day level is actually achieved.

Summary

Using conservative estimates, Oak Hill can easily expect to experience large increases in ambient noise levels due to the planned US 290/ SH 71 project. Construction of an elevated roadway system would more than double existing noise levels. Obviously, any increase in traffic will increase noise levels. However, the ground level Fix290 concept will effectively transmit approximately 50% less noise energy into the community compared to an elevated road design. Moreover, this sound impact will be far easier to mitigate than TxDOT's elevated design.

The noise levels in Oak Hill today, with 59,000 vehicles per day traffic volume on parts of US 290, are already above the levels allowed by almost every single health and safety agency and organization in the US, and likewise by most of the international health and safety organizations worldwide. Future noise levels will be impacted by an increase of 167 percent in traffic volume. That is, noise levels in Oak Hill will be affected by more than one and a half times more vehicles than are present today.

Unexpected Results

The work leading up to this paper revealed an unexpectedly bad effect of the proposed highway improvements. The cover picture of this report shows an elevated roadway and is meant to remind us that elevation allows noise to travel much further. The unexpected results are that this image also shows how ***any*** elevated roadway improvements to SH 71 in downtown Oak Hill will have extreme impacts on the landscape of this tiny community. "Any" roadway improvements include the parkway concept that Fix290 advocates. Why is this?

To remove traffic signals on SH 71, that is, to allow for a direct connection between HWY 71 and 290, the road will have to be elevated between the two shopping centers in downtown Oak Hill. There is not enough room to design the roadway any other way. The superimposed image on the report cover shows what this will look like and is true to scale. Looking carefully at the image shows the Oak Hill HEB and McDonald's in the background.

The elevated direct connection will be taller than any structure in the area. And as the remainder of this report indicates, after the roadway is constructed, noise levels adjacent to that road segment will be more than twice as loud as they are today. This is very bad news for the anticipated Town Center redevelopment. Noise levels will make pedestrian conversations difficult at best – an attribute of a town center that is not at all conducive to community life.

An alternative does exist to prevent an overpass between the shopping centers from being built. One of the main selling points of the Southwest Parkway, which is historically underutilized, was to serve as a "traffic relief valve" for Oak Hill and southwest Austin. Long overdue roadway and signage improvements at the SW Parkway/SH 71 intersection would decrease traffic pressure at the "Y." This action would preclude the construction of an elevated overpass between the two shopping center tracts.

Background to This Study

A decibel (db) is a unit of sound measurement and was named after Alexander Graham Bell. Decibels are not like most linear measurement scales that we as a society are accustomed to. Temperature (degrees Fahrenheit or Celsius) and weight (pounds, kilos, etc.) are two of the most common linear scales. Sound is not measured the same way.

Sound is measured with a base 10 log scale. This means that a 3 dB change has twice the sound energy, a 10 dB change is ten times larger, a 20 dB change is a hundred times larger, a 30 dB change is a thousand times larger and so on. It is also referred to as an exponential scale. To complicate things further, sound *is perceived* linearly, only on a skewed scale. A 10 dB change is double the loudness, a 20 dB change is four times as loud, a 30 dB change is eight times as loud, etc.

The following table is provided to give some sort of reference to these discussions:

One 60-watt light bulb	13 dB
A pin drop	15 dB
Wilderness	30 dB
Quiet home, Library	40 dB
Quiet street	43 dB
Normal conversation	60 dB
Loud singing (3 feet)	75 dB
Automobile (25 feet)	80 dB
8-hour day ear plug required level	85 dB
65 mph diesel truck (300 feet)	90 dB
Subway (inside)	94 dB
65 mph diesel truck (30 feet)	100 dB
Power mower (3 feet)	107 dB
Pneumatic riveter (3 feet)	115 dB
Rock and Roll Live, Loud	115 dB
Chainsaw (3 feet)	117 dB
Threshold of Pain	120 dB
Loudest Scream	128 dB

Federal Traffic Noise Standards

The Federal Highway Administration says a "noise impact" occurs when either: "the projected traffic noise levels substantially exceed the existing noise levels in an area" or traffic noise levels "approach or exceed" certain established "Noise Abatement Criteria" (NAC). According to TxDOT's "Guidelines for Analysis and Abatement of Highway Traffic Noise,"

"The FHWA has established the following Noise Abatement Criteria (NAC) for various land use activity areas that are used as one of two means to determine when a traffic noise impact will occur."

FHWA NOISE ABATEMENT CRITERIA (NAC)		
Activity Category	**dBA Leq**	**Description of Land Use Activity Areas**
A	**57 (exterior)**	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	**67 (exterior)**	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries and hospitals.
C	**72 (exterior)**	Developed lands, properties or activities not included in categories A or B above.
D	**--**	Undeveloped lands.
E	**52 (interior)**	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums.

Comparison to Fix290 Concept

Fix290 advocates building the road on the ground. By elevating the roadway, the noise source is much more efficient at projecting sound into the distance - like an air raid siren.

An elevated highway allows more of the sound energy to be emitted continuously, without interruption or the absorption affects of objects in the noise path. Objects such as buildings and plants both reflect and absorb sound energy. These objects dampen sound sources close to the ground so that much less of the sound energy escapes into the surrounding area.

This study used a noise model to approximate noise levels from different highway characteristics: Existing Conditions, Ground Level Parkway and Elevated Tollway. Design characteristics are footnoted beneath the results table. All of the calculations were the same except for noise source elevation and number of vehicles per hour. The results show conclusively that an elevated roadway is 3 dB louder than a ground level roadway. This is twice the noise energy and 50 percent louder than the ground level roadway.

The model also shows that future noise levels with either alternative are 7db to 10 db louder, or up to twice as loud as current conditions. However, the parkway impacts are both less severe, and easier to mitigate, as we shall see in a later section.

The following table shows the results of a noise model used to calculate noise levels from different highway characteristics:

Results Table for Noise Calculation Model

Distance from road centerline [feet]	Existing Road (dB)	Ground Level Parkway (dB)	Future Elevated Tollway (dB)
100	64	***71***	***73***
200	59	***66***	***70***
300	56	64	***67***
400	54	62	***65***
500	53	61	64
600	52	59	63
700	51	58	62
800	50	58	61
900	49	57	60
1000	49	56	59
1500	46	54	56
2000	44	51	54
2500	42	50	52

Bolded values exceed the Federal Highway Administration Noise Abatement Criteria for "B" Activities: "Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals." Existing traffic – 59,000 vehicles per day, future traffic – 157,500 vehicles per day, as per TxDOT 5 County Traffic counts and CAMPO 2030 traffic projections. Day night split – 85/15%, Trucks 5%, area impervious cover – 50%, average traffic speed existing40 mph, future 65 mph.

The Federal Highway Administration rules trigger mandatory noise abatement for increases of 10 dB or greater above existing conditions. As can be seen from the above table, this mandatory abatement level is met in nearly all instances.

The ones instance where this criteria is not met is within the 100 foot distance from the mainlanes. This distance falls within the 'noise shadow' of the elevated roadway—a narrow band where the elevation of the noise source actually decreases the amount of noise energy transmitted to a site (sound passes overhead). This zone is usually no more than 300 feet wide, which is also reflected in the results shown in the table.

Direct Comparison of Existing Noise Levels At the Mopac/290 Interchange

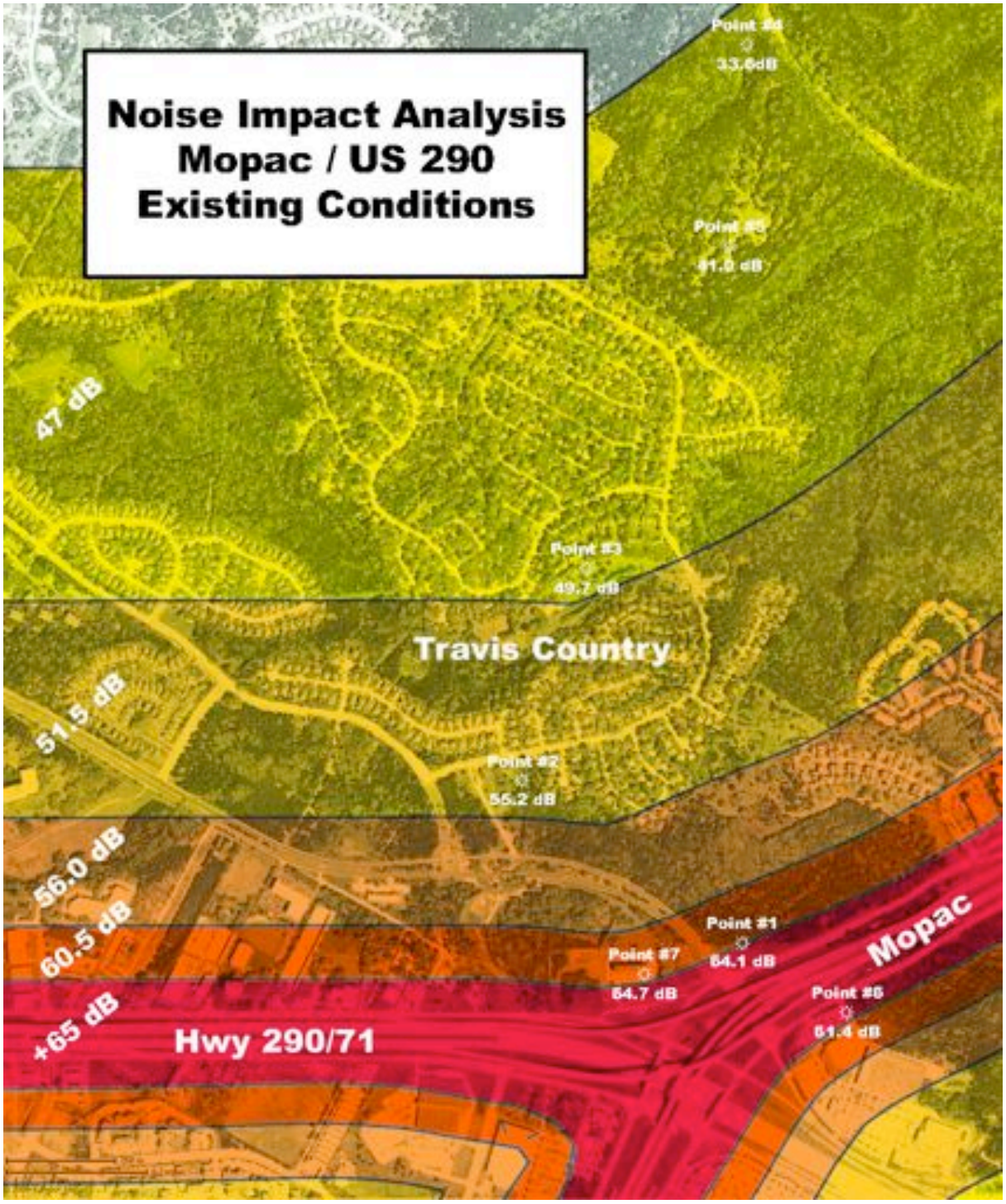
To compare noise levels at the Mopac/290 interchange with the "Y" intersection in Oak Hill, a number of measurements were made with an OSHA approved noise level meter using standard noise measurement engineering techniques. These measurements were then plotted on aerial photography and lines of equal loudness were interpreted.

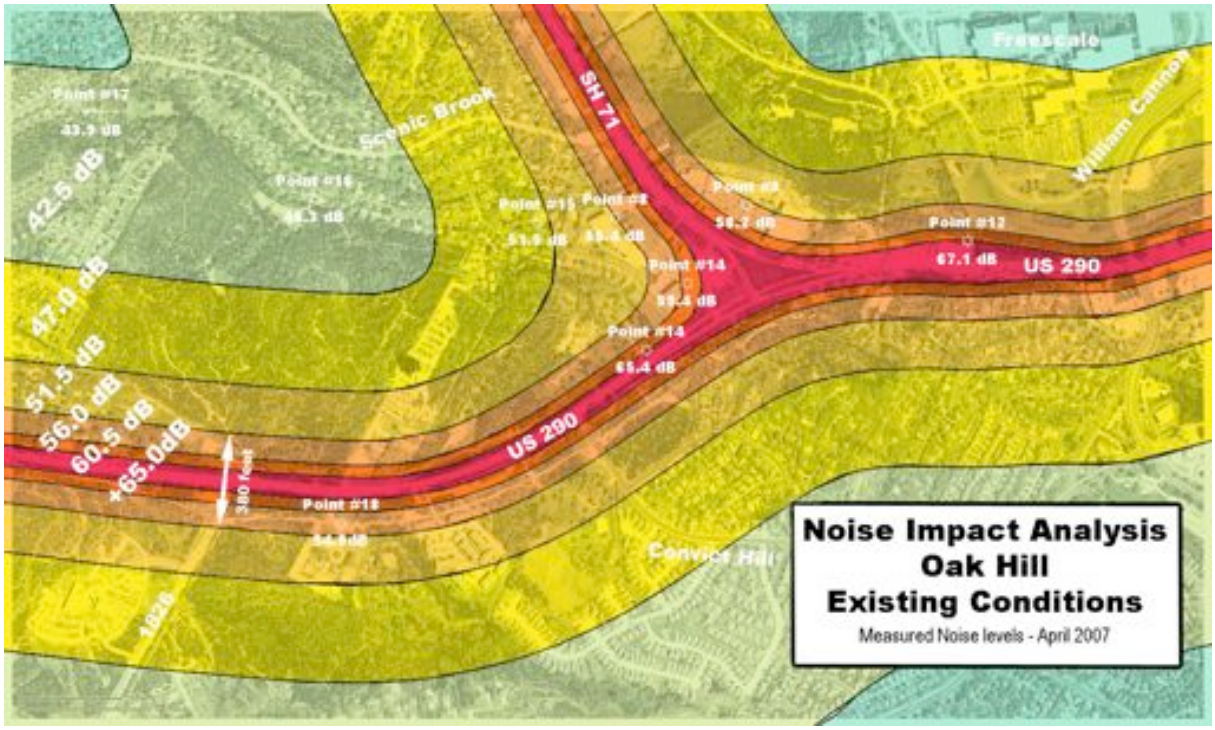
The primary tool thus derived is shown below as the image entitled *"Noise Impact Analysis, Existing Conditions, Mopac/US290."*

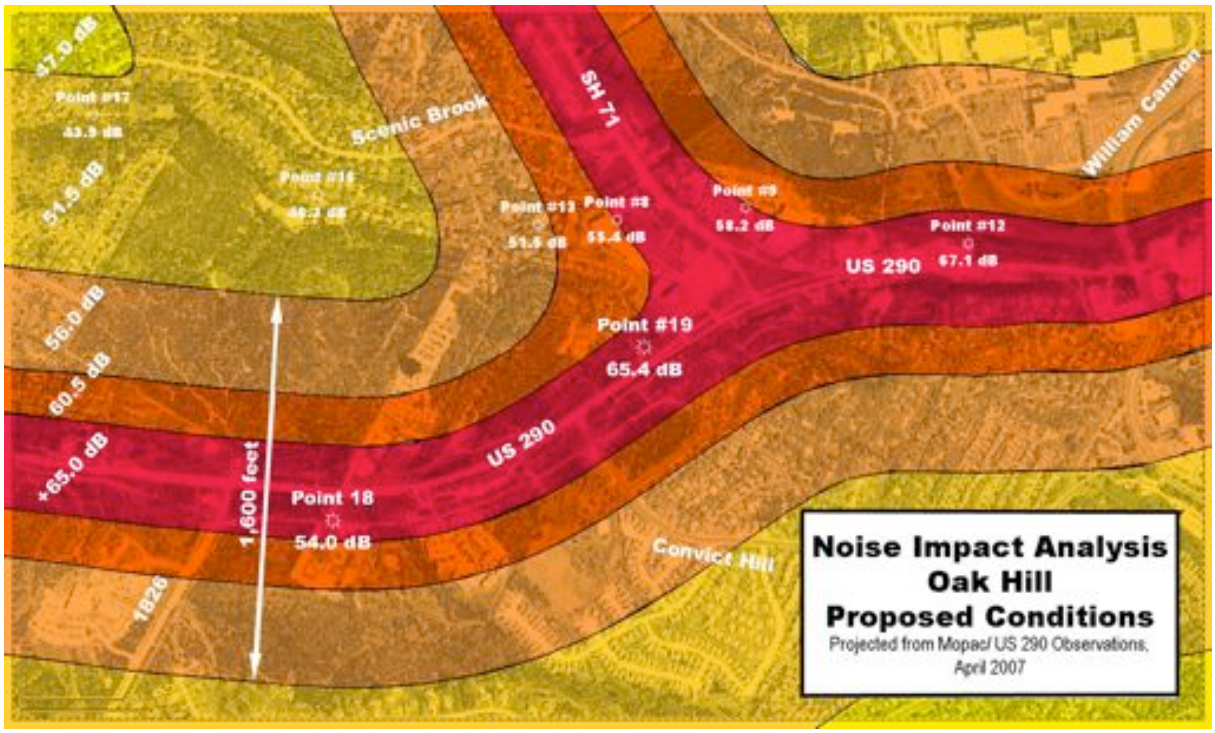
A second "tool" was developed with measurements of existing noise levels at the US290/SH71 intersection at the "Y" in Oak Hill. This tool is entitled *"Noise Impact Analysis, Oak Hill, Existing Conditions"*.

A third tool was developed to show what the "Y" in Oak Hill would look like if the existing Mopac/290 interchange sound levels were superimposed over the "Y" (entitled *"Noise Impact Analysis, Oak Hill, Proposed Conditions"*.

These three images are shown below. Measurement points are marked as point #1, Point #2, etc. Each band of color represents a 4.5 dB increment of loudness, the outside edge of the band being the level indicated. Example, the outside edge of the bright red band is 65 dB. Noise levels inside of the red band are all greater than 65 dB.


Noise Impact Analysis
Mopac / US 290
Existing Conditions
Point #4
33.6dB
Point #5
61.0 dB
47 dB
Point #3
49.2 dB
Travis Country
51.5 dB
Point #2
55.2 dB
56.0 dB
60.5 dB
+65 dB
Hwy 290/71
Point #1
64.1 dB
Point #7
64.7 dB
Mopac
Point #6
61.4 dB


Freescale
Scenic Brook
SH 71
William Cannon
Point #17
43.9 dB
42.5 dB
Point #16
47.0 dB
Point #13
51.6 dB
Point #8
55.4 dB
Point #9
58.2 dB
Point #12
67.1 dB
US 290
Point #14
55.4 dB
51.5 dB
56.0 dB
60.5 dB
+65.0dB
380 feet
Point #18
54.0dB
Convict Hill
1826
Noise Impact Analysis
Oak Hill
Existing Conditions
Measured Noise levels - April 2007


47.0 dB
Point #17
43.9 dB
Scenic Brook
SH 71
William Cannon
51.5 dB
Point #16
Point #13
51.6 dB
Point #8
55.4 dB
Point #9
58.2 dB
Point #12
67.1 dB
US 290
56.0 dB
Point #19
65.4 dB
60.5 dB
+65.0 dB
1,600 feet
US 290
Point 18
54.0 dB
Convict Hill
1826
Noise Impact Analysis
Oak Hill
Proposed Conditions
Projected from Mopac/ US 290 Observations,
April 2007

Summary of Noise Tools

After superimposing the 100,000 vehicle per day noise levels derived from the Mopac/290 interchange onto the Oak Hill downtown area, it became obvious the significant impact that an elevated roadway of this magnitude (12 lanes) would have on such a small community. The area experiencing greater than 56 dB, the level which most airports around the world consider an impact, would grow from 380 feet to 1600 feet from the roadway. This is an increase of 321 percent, or more than three times as great of an area.

When the full impact of the 157,500 vehicles per day is considered, increases in noise levels will be above the 10 dB limit that the Federal Highway Administration (FHWA) imposes for allowable, unmitigated increases in noise.

Future Noise Levels

Because this study examines noise levels based on a current traffic volume of approximately 100,000 vehicles per day at the Mopac/290 interchange, Oak Hill's noise level will actually be considerably higher

If official estimates by TxDOT and CAMPO are accurate, local traffic in Oak Hill will increase from 59,000 vehicles per day to approximately 157,500 vehicles per day by the year 2030. This is a 167 percent increase, far more than double the current traffic volume.

This study compared the measured noise impact of 100,000 vehicles per day traffic at Mopac/290 to existing conditions at 290/71. This 100,000 vehicle count is roughly an increase of 50 percent of the traffic volume over current conditions in Oak Hill. Noise calculations show that a doubling of the source noise increases the noise volume by 3dB (decibels), or about 100 percent. Therefore a source increase of half would increase the noise level by about 30 percent (noise measurements in dB are logarithmic).

So, ultimate noise levels in 2030 in the Oak Hill community will be, on average, 30 percent higher than are depicted in the noise comparison tools – which more than doubles current levels of noise in the community.

Effects of Increased Traffic Noise

> **Residential Property Values:** There is a demonstrated 0.4 percent decrease in the value of a housing unit for each of one decibel over a threshold value of 55 dB. (Haling, et al, Transportation Research Board)

Considering the values shown in the graphic entitled “Noise Impact Analysis, Oak Hill, Proposed Conditions” are conservative by 1.5 dB, several hundred residences will be impacted by sound levels greater than 55 dB. The worst will see sound level increases to greater than 66.5 dB. Considering an average of greater than a 10 dB increase in sound levels, each residential home will see a decrease in value of four percent from noise alone.

The Texas A&M Real Estate Center says that the median home value in Austin in 2007 is $182,000. (The average value is $246,000 – a median assumption is more realistic for the central Oak Hill community and is more conservative than the $246,000 average price.) The four percent decrease in home value due to noise is equal to $7,280.

Proposed Town Center: A new pedestrian-friendly, mixed use “town center” was named as a consistent priority for residents during the recent Oak Hill Neighborhood Plan process. The draft neighborhood plan is now nearing completion and formal adoption by the City of Austin. In addition to the challenges of automobile access from a tolled, elevated facility, the visual blight and barrier effects of a high-speed roadway already tend to discourage pedestrian activity at the town center. Future sound levels exceeding the volume of normal conversation would further repress the planned vitality of the center as a “people place.”

“Double-Decking” Worse for Noise: A “double-deck” design would amplify noise more, worsening the problem. Such a design was first considered and rejected in the 1988 EIS. A ‘tuck-under’ two level design was proposed again by a 1996 task force convened by CAMPO’s predecessor agency. Recently, a retired TxDOT engineer proposed this same basic scheme once more.

According to a Texas Transportation Institute study undertaken for TxDOT: "When noise is a major consideration, designs that place traffic under an elevated roadway… should be avoided. The noise from the lower level of traffic is reflected from the underside of the elevated section back toward the ground, off the R.O.W. This noise adds to the direct line of sight noise to produce an amplification." (Zimmer et al, 1997)

Highly Annoyed Neighbors: A study in 1978 by T.J. Schultz showed that noise levels above 65 dB had a peculiar affect on 15% of a population. This affect is described as “highly annoyed”. The paper by Dr. Schultz is one of the leading methods for determining the mental impacts of noise in transportation projects, and was originally based on 400 individuals. It is also important to note that simple annoyance starts at 42 dB. And it is also interesting to note that normal conversation is rated at about 60 dB.

A Comparison of Allowable FHWA and TxDOT Noise Levels and World Practices

The FHWA and TxDOT have some of the least stringent noise standards in the world. In the US, the Environmental Protection Agency, Federal Energy Regulatory Commission, Federal Transit Authority, Federal Railroad Commission, Surface Transportation Board, National Research Council, and American National Standards Institute all uphold more stringent noise standards. As stated previously, TxDOT's noise standard is 67 dB.

Noise Standards – National and International

World Health Organization	50db DNL: Maximum to prevent serious annoyance 55db DNL: Serious Annoyance and unhealthy environment
EPA	45db DNL: Quiet suburban or rural community 55db DNL: level required to protect health and welfare
Federal Energy Regulatory Commission	55db DNL: Maximum limit for noise in residential environment
Federal Transit Administration	50db DNL: Impact for an existing 40db DNL environment
Federal Railroad Administration	50db DNL: Impact for an existing 40db DNL environment
Surface Transportation Board	50db DNL: Impact for an existing 40db DNL environment
National Research Council	40db DNL: Full environmental review required for existing 45db DNL environment 55db DNL: Serious noise impact
American National Standards Institute (ANSI)	55db DNL: Significant impact
European Country (EC) Regulations	45db DNL: No new residential construction permitted in some countries
World Bank	55db DNL: Noise limit for any new development

Reference: Save Our Heritage – Citizen Advocates, Protecting National Heritage sites, Concord MA, http://www.saveourheritage.com/

Comparison to Airport Noise Regulations

The US Federal Aviation Administration (FAA) also has one of the least stringent noise regulations in the world. The FAA has issued the following guidelines as part of its Airport Noise Compatibility Program, found in Part 150 of the Federal Aviation Regulations:

> *Maximum noise level for residential areas adjacent to FAA airports will be: 65 dB DNL (day/night level). This criteria imposes a penalty of 10dB on nighttime noise, which decreases the allowable noise levels.*

TxDOT uses 67 dB Leq as their maximum allowable noise level. Leq is the straight average noise level (equivalent level). In general, the 67 dB Leq is considered to be louder than the same 67 dB DNL measurement.

This criterion also imposes a 10 dB penalty on nighttime noise basically allowing only 55 db of noise at night.

So with the increase in traffic associated with the new elevated roadway, scores of residences and many commercial properties will be subject to noise levels greater than living in the flight approach of a major airport.

A Review of TxDOT's 2003 Noise Study of the US290/SH71 Interchange Project

In June 2003, TxDOT published a study of noise impacts to Oak Hill from the project. This document was submitted to FHWA for approval to discharge TxDOT's obligations under federal law. One glaring problem is that no sites adjacent to or along SH 71 are examined, even though 1.1 miles of the project occur there, including all of the elevated "direct connectors" (flyover bridges) planned for the "Y" interchange. Some properties in the area "inside the Y" could suffer noise impacts from both roadways.

Also, it must be remembered that even following Federal Highway Administration (FHWA) criteria, TxDOT allows some of the highest, if not *the* highest (loudest) noise limits in the world.

The following summarizes numerous identified flaws and questions related to this study:

1. **Impossible finding:** No change or a reduction in noise levels for ten of thirty-eight receptors, in spite of a large projected growth in traffic [Tables 3 through 7]. As indicated in this study, instead hundreds of dwellings are very likely to be affected.

2. **Unlikely finding:** Only seven of the thirty-five developed receptors report a "noise impact" along with the large projected traffic increase [Tables 3 through 7]. As the above real-life example of the Mopac/290 intersection illustrates, this is a highly unlikely outcome.

3. **Irreproducible results:** TxDOT chooses 2021 as the reference year for projecting future noise levels. However, no specific traffic volume is reported for that year. No time of day or measurement period was stated for the noise measurements. Without these details, it is difficult to confirm or to even analyze their findings.

4. **Incomplete investigation:** "Undeveloped areas were also considered at two locations in order to determine noise impact contours for future land use planning", but these were in fact in close proximity to one another on two properties. No other undeveloped tracts were examined.

5. **Contradiction:** The undeveloped land's future noise level equals exceeds NAC of 67 dB(a) within a contour distance of 275 feet from the right-of-way [see Table 8 p10], while other existing receptors located closer to the road than 275 feet were reported as having no or smaller impacts.

6. **Inconsistent or discriminatory methodology:** Single family residences are measured as NAC category B--where the level of decibel impact is determined based on an *exterior* measurement. The future noise levels for Vineyard Hills Apartments are based on *interior* noise levels [Table 5, p 6], which conform to Category E [p 3]. This implies that apartments can be allowed higher noise levels than other residences. Oak Hill United Methodist Church noise levels are likewise projected for the interior of the building [Table 5, p 6], even though churches are listed as a Category B land use [Table 2, p 3] along with residences.

7. **Certain 'special impact' receivers ignored entirely:** Two cemeteries in the project area, including a historic one on Old Bee Cave Rd, are not listed as receptors. These should be assessed as NAC Activity Category A, "Lands on which serenity and quiet are of extraordinary significance and serve an important public need." The Freescale research and manufacturing facility in Oak Hill may also have special needs to avoid excess vibration. This factor was discussed in earlier assessments and public input sessions but was not addressed in the report.

8. **Other significant Category B receivers ignored:** These include Seton Southwest, ACC, Oak Hill Baptist, and Williamson Creek greenbelt. See description of NAC Category B above in section on “Federal Traffic Noise Standards.”

7. **Discussion of abatement measures is incomplete--doesn't consider a ground level design:** FHWA regulations require that alteration of the horizontal (width) and vertical alignment (elevation) of the roadway be considered to reduce noise. TxDOT dismisses these alternatives in two sentences as unreasonable. TxDOT needs to study the parkway as a noise abatement measure, as required by the federal rules (see letter from the Fix 290 Coalition to FHWA).

10. **Noise barrier costs not documented:** Costs are stated, without specifying the types of materials or listing a reference to document the costs. For instance, if earthen materials can be used for barrier construction, this is far less expensive than masonry or concrete. A parkway design has enough room for earthen berms.

11. **Notice inadequate:** To discharge their statutory duty to notify local officials of future noise impacts, the authors state, "On the date of approval of this document (Date of Public Knowledge), FHWA and TxDOT are no longer responsible for providing noise abatement for new development adjacent to the project." This affords no reasonable opportunity for the (allegedly) notified local officials to respond or act in advance of this declaration.

By saying the date of approval is one and the same as the date of "Public Knowledge," there is no meaningful consultation with local officials, nor any chance for them to dispute these findings, nor understand them. By the time the abatement action is known, it's already approved, therefore there's nothing more that can be done by state or federal officials to abate the project. There is no specific guidance to local officials on what they can do to respond to the inadequately documented potential impacts.

FHWA also requires that the views of the impacted residents be a major consideration in reaching a decision on the reasonableness of abatement measures to be provided. Little (if any) outreach in this area was performed. None of the required contacts with affected neighbors and property owners are documented in the 2003 Study.

12. **TxDOT threshold to determine "noise impacts" too high.** In addition to the NAC, TxDOT uses a very high definition of "substantial increase" of 10dB (doubling of the noise level) to define "noise impacts" in the study. (California uses 5dB.) Neighborhoods well outside of what TxDOT regards as affected areas would suffer much higher noise levels.

FHWA concurred with TxDOT's finding that abatement measures for this project are neither feasible nor reasonable, but still required that another noise study be undertaken should the project be built as a toll road. FHWA's reasoning is that tolling is a new condition not foreseen in the 1988 Environmental Impact Statement (EIS). Toll operation could potentially increase noise levels, due to acceleration away from tollbooth stops. Placement of tollbooths in the TxDOT plan is, unfortunately, adjacent to important affected areas.

Noise Abatement Strategies

Title 23 of the United States Code of Federal Regulations Part 772 lists six noise abatement measures that *must* be considered by TxDOT before it can proceed with the construction of new highway segments for US 290/ SH 71. Moreover, if any of the measures are found to be "reasonable and feasible," they must be implemented. According to Sec. 772.11 (b)," When noise abatement measures are being considered, every reasonable effort shall be made to obtain substantial noise reductions."

These noise abatement measures (contained in Sec. 772.13 of 23 CFR 772) are:

1. "Traffic management measures (e.g., 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).
2. **Alteration of horizontal and vertical alignments.**
3. Acquisition of property rights (either in fee or lesser interest) for construction of noise barriers.
4. Construction of noise barriers (including landscaping for aesthetic purposes) whether within or outside the highway right-of-way. Interstate construction funds may not participate in landscaping.
5. 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.
6. Noise insulation of public use or nonprofit institutional structures."

A. Ground Level Parkway

As we have seen in the preceding section "Comparison to Fix 290 Concept," a ground-level parkway will greatly reduce noise impacts relative to TxDOT's elevated designs.

Yet, "altering horizontal and vertical alignments" by constructing a grade-level freeway without frontage roads (a parkway) was not studied in the 2003 noise report.

Instead, TxDOT claims "Alteration of the horizontal alignment would displace existing businesses and residences and require additional right of way which would not be cost effective or reasonable." No analysis, references, documentation, or calculations are

provided in support of this statement. This single sentence is the only mention of changing horizontal alignment in the entire report.

Logically, *shrinking* the horizontal alignment of the roadway—by itself—couldn't displace *any* businesses or residences. If frontage roads were omitted from the design, only a very small number of existing businesses (five) would be landlocked, and therefore, require a property purchase and relocation. This extra cost would be more than offset by the savings in construction costs gained by omitting the frontage roads. Far from increasing costs, omitting the frontage roads would *save* money.

Researchers for TxDOT admit that shrinking horizontal alignments can reduce noise impacts: "One way noise has been reduced in the at-grade condition is to locate the right-of-way further from the people affected...noise from a spot source will be attenuated by approximately 6 dBA per doubling of distance from the source...With other reflections and diffractions, a typical value for increasing distance is a 3 to 4.5 dBA noise reduction each time distance doubles." (Zimmer et al)

TxDOT claims "Alteration of the vertical alignment would also not be cost-effective or reasonable." (Again, only a single sentence is offered in support) Yet, is well known and abundantly demonstrated that grade-level alignments are far less costly than elevated highways. Far from increasing costs, a grade-level alignment would *save* on construction costs.

B. Berms and Buffers

FHWA says, "Noise barriers are solid obstructions built between the highway and the homes along the highway. Effective noise barriers can reduce noise levels by ten to fifteen decibels, cutting the loudness of traffic noise in half."

An FHWA publication shows conclusively that earthen berms are the least expensive sound barrier to construct. According to this compilation of data from all fifty states, "Average unit costs for all years for all barrier materials range between $16-25 per square foot**,** *except for earth berms, which average only $6 per square foot* [emphasis added]." (TxDOT used $18 per square foot in their study.) Through 2004, a total of 4,281,000 square feet of earthen berm barriers have been constructed in the US. As for effectiveness, a six foot tall berm inserted between a noise source and a receptor can cut noise by 3 dB or more.

In the case of US 290 West, the right of way (ROW) for TxDOT's twelve-lane wide design is already almost entirely acquired. This ROW ranges from 350 to nearly 500 feet wide. If frontage roads were omitted from the design, much of this space could be freed up. Thus, a parkway design would allow the least expensive and most attractive type of noise barrier—a vegetated earthen berm—to be constructed.

By keeping the road at ground level as much as possible, surrounding terrain in combination with berms can be used to block noise penetration. This advantage of the

natural topographic relief would be lost with TxDOT's plan, which features nearly two miles of elevated roadway.

Using buffers, or shrinking the horizontal alignment with a parkway, also places more distance between the noise source and the receivers. For every doubling of distance between the source and receiver over grass, there is a 4.5 dB reduction. [Table 2, "Cause and Effect Relationships (dBA) in TxDOT "Noise Guidelines"] As this table explains, the effects of the different abatement measures are cumulative. If, for example, berms mimicking a depressed roadway could yield a 3 to 5 dBA reduction, this would be added to a doubling of distance over grass, for a total reduction of 7.5 to 9.5 dBA.

C. Quiet Pavements

New types of pavement demonstrate significant reductions in the noise generated by tires. While not listed as noise abatement measures in federal law, these techniques deserve careful consideration by TxDOT and FHWA.

The Arizona Department of Transportation has a "Quiet Pavement Pilot Program." Studies in Arizona of asphalt-rubber friction courses indicated a 4.5 dBA reduction in traffic noise levels versus conventional asphalt courses. The reduction in noise levels has lately been claimed to be from 6 to 9 dBA at distances from 50 to 400 feet from the highway.

For its part, TxDOT has followed the lead of ADOT with its own use of "porous friction courses" (PFCs) with rubberized asphalt, a 2-inch thick permeable pavement laid on top of a conventional concrete or asphalt surface. The US EPA reports, "Permeable friction courses laid on top of an impermeable base have been used successfully in Texas on interstates (e.g., I-35 in San Antonio) to improve traction and visibility in wet weather, as well as reduce noise." (Cambridge Systematics)

TxDOT claims the following results for this repaving of San Antonio sections of I-35:

- improved the ride quality of the existing pavement by approximately 61%
- improved the skid resistance by over 200%
- reduced the noise levels by an average of 8 to 14 decibels (dB).
- "significant reduction in major accidents"

Conclusions

"Reasonable and feasible" methods exist to reduce the impacts of traffic noise proposed for Oak Hill. Principally they involve reducing the height and width of the proposed road profile with a grade-level parkway design. Such a parkway design would actually reduce construction costs and time to completion of construction relative to TxDOT's planned tollway.

While the main point here is to note the parkway's advantages for noise abatement, there are other promising abatement methods that should also be examined. Chief among them are earthen berms and porous pavements, which may be cost-effective in these given circumstances. Cumulatively, all of these measures together may greatly offset the increases in ambient noise levels which would otherwise be anticipated for Oak Hill, given the projected increases in traffic volume and average speed for US 290/ SH 71.

Resources:

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5. “Factors that Determine the Reduction in Property Values Caused by Traffic Noise,” *Road Engineering Journal,* October 1, 1997.
6. Texas A&M Real Estate Center, “Median Home Values in Austin Texas, 2007.”
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