

Traffic Noise – Recommended Text

Example 1: Analysis Not Required	2
Example 2: Noise Analysis	3
Example 3: Typical Analysis -- Impact with No Feasible & Reasonable Abatement	6
Example 4: Typical Analysis -- Impact with Feasible & Reasonable Abatement	10
Example 5: Atypical Analysis – Low Volume Highways	15
Example 6: Atypical Analysis -- All Undeveloped Land	18
Example 7: Combined Analysis -- Developed (no impact) and Undeveloped Land	21
Example 8: Analysis Reevaluation	25
Example 9: Abbreviated Analysis	26

Example 1: Analysis Not Required

The proposed project would not be on new location, would not substantially alter either the horizontal or vertical alignment, and would not increase the number of through-traffic lanes; therefore, a traffic noise analysis is not required by TxDOT's (FHWA approved) "Guidelines for Analysis and Abatement of Highway Traffic Noise."

Noise associated with the construction of the project is difficult to predict. Heavy machinery, the major source of noise in construction, is constantly moving in unpredictable patterns. However, construction normally occurs during daylight hours when occasional loud noises are more tolerable. No extended disruption of normal activities is expected. Provisions will be included in the plans and specifications that require the contractor to make every reasonable effort to minimize construction noise through abatement measures such as work-hour controls and proper maintenance of muffler systems.

Example 2: Noise Analysis

This analysis was accomplished in accordance with TxDOT's (FHWA approved) Guidelines for Analysis and Abatement of Highway Traffic Noise.

Sound from highway traffic is generated primarily from a vehicle's tires, engine and exhaust. It is commonly measured in decibels and is expressed as "dB."

Sound occurs over a wide range of frequencies. However, not all frequencies are detectable by the human ear; therefore, an adjustment is made to the high and low frequencies to approximate the way an average person hears traffic sounds. This adjustment is called A-weighting and is expressed as "dBA."

Also, because traffic sound levels are never constant due to the changing number, type and speed of vehicles, a single value is used to represent the average or equivalent sound level and is expressed as "Leq."

COMMON SOUND/NOISE LEVELS		
Outdoor	dBA	Indoor
Pneumatic hammer	100	Subway Train
Gas lawn mower at 3 feet		
	90	Food blender at 3 feet
Downtown (large city)	80	Garbage disposal at 3 feet
Lawn mower at 100 feet	70	Vacuum cleaner at 10 feet
		Normal speech at 3 feet
Air conditioning unit	60	Clothes dryer at 3 feet
Babbling brook		Large business office
Quiet urban (daytime)	50	Dishwasher (next room)
Quiet urban (nighttime)	40	Library

The traffic noise analysis typically includes the following elements:

- Identification of land use activity areas that might be impacted by traffic noise.
- Determination of existing noise levels.
- Prediction of future noise levels.

- Identification of possible noise impacts.
- Consideration and evaluation of measures to reduce noise impacts.

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 would occur.

FHWA NOISE ABATEMENT CRITERIA		
Activity Category	dBA Leq	Description of Land Use Activity Areas
A	57 (exterior)	Lands on which serenity and quiet are of extra-ordinary 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.

NOTE: primary consideration is given to exterior areas (Category A, B or C) where frequent human activity occurs. However, interior areas (Category E) are used if exterior areas are physically shielded from the roadway, or if there is little or no human activity in exterior areas adjacent to the roadway.

A noise impact would occur when either the absolute or relative criterion is met:

Absolute criterion: the predicted noise level at a receiver approaches, equals or exceeds the NAC. "Approach" is defined as one dBA below the NAC. For example: a noise impact would occur at a Category B residence if the noise level is predicted to be 66 dBA or above.

Relative criterion: the predicted noise level substantially exceeds the existing noise level at a receiver even though the predicted noise level does not approach, equal or exceed the NAC. "Substantially exceeds" is defined as more than 10 dBA. For example: a noise impact would occur at a Category B residence if the existing level is 54 dBA and the predicted level is 65 dBA (11 dBA increase).

When a traffic noise impact occurs, noise abatement measures must be considered. A noise abatement measure is any positive action taken to reduce the impact of traffic noise on an activity area.

The FHWA traffic noise modeling (TNM) software was used to calculate existing and predicted traffic noise levels at receiver locations (Table XX and Figure X) that represent the land use activity areas adjacent to the proposed project that might be impacted by traffic noise and potentially benefit from feasible and reasonable noise abatement. TNM primarily considers the number, type and speed of vehicles; highway alignment and grade; cuts, fills and natural berms; surrounding terrain features; and the locations of activity areas likely to be impacted by the associated traffic noise.

TABLE XX: TRAFFIC NOISE LEVELS (dBA Leq)						
Receiver	NAC Category	NAC Level	Existing	Predicted 20XX	Change (+/-)	Noise Impact
R1 (one-word description)						
R2						
R3						
R4						
R5						
R6						
R7						
etc.						

As indicated in Table XX, the proposed project would not result in a traffic noise impact.

Noise associated with the construction of the project is difficult to predict. Heavy machinery, the major source of noise in construction, is constantly moving in unpredictable patterns. However, construction normally occurs during daylight hours when occasional loud noises are more tolerable. None of the receivers is expected to be exposed to construction noise for a long duration; therefore, any extended disruption of normal activities is not expected. Provisions will be included in the plans and specifications that require the contractor to make every reasonable effort to minimize construction noise through abatement measures such as work-hour controls and proper maintenance of muffler systems.

A copy of this traffic noise analysis will be made available to local officials to ensure, to the maximum extent possible, future developments are planned, designed and programmed in a manner that would avoid traffic noise impacts. 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.

Example 3: Typical Analysis -- Impact with No Feasible & Reasonable Abatement

This analysis was accomplished in accordance with TxDOT's (FHWA approved) Guidelines for Analysis and Abatement of Highway Traffic Noise.

Sound from highway traffic is generated primarily from a vehicle's tires, engine and exhaust. It is commonly measured in decibels and is expressed as "dB."

Sound occurs over a wide range of frequencies. However, not all frequencies are detectable by the human ear; therefore, an adjustment is made to the high and low frequencies to approximate the way an average person hears traffic sounds. This adjustment is called A-weighting and is expressed as "dBA."

Also, because traffic sound levels are never constant due to the changing number, type and speed of vehicles, a single value is used to represent the average or equivalent sound level and is expressed as "Leq."

COMMON SOUND/NOISE LEVELS		
Outdoor	dBA	Indoor
Pneumatic hammer	100	Subway Train
Gas lawn mower at 3 feet		
	90	Food blender at 3 feet
Downtown (large city)	80	Garbage disposal at 3 feet
Lawn mower at 100 feet	70	Vacuum cleaner at 10 feet
		Normal speech at 3 feet
Air conditioning unit	60	Clothes dryer at 3 feet
Babbling brook		Large business office
Quiet urban (daytime)	50	Dishwasher (next room)
Quiet urban (nighttime)	40	Library

The traffic noise analysis typically includes the following elements:

- Identification of land use activity areas that might be impacted by traffic noise.
- Determination of existing noise levels.

- Prediction of future noise levels.
- Identification of possible noise impacts.
- Consideration and evaluation of measures to reduce noise impacts.

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 would occur.

FHWA NOISE ABATEMENT CRITERIA		
Activity Category	dBA Leq	Description of Land Use Activity Areas
A	57 (exterior)	Lands on which serenity and quiet are of extra-ordinary 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.

NOTE: primary consideration is given to exterior areas (Category A, B or C) where frequent human activity occurs. However, interior areas (Category E) are used if exterior areas are physically shielded from the roadway, or if there is little or no human activity in exterior areas adjacent to the roadway.

A noise impact would occur when either the absolute or relative criterion is met:

Absolute criterion: the predicted noise level at a receiver approaches, equals or exceeds the NAC. "Approach" is defined as one dBA below the NAC. For example: a noise impact would occur at a Category B residence if the noise level is predicted to be 66 dBA or above.

Relative criterion: the predicted noise level substantially exceeds the existing noise level at a receiver even though the predicted noise level does not approach, equal or exceed the NAC. "Substantially exceeds" is defined as more than 10 dBA. For example: a noise impact would occur at a Category B residence if the existing level is 54 dBA and the predicted level is 65 dBA (11 dBA increase).

When a traffic noise impact occurs, noise abatement measures must be considered. A noise

abatement measure is any positive action taken to reduce the impact of traffic noise on an activity area.

The FHWA traffic noise modeling (TNM) software was used to calculate existing and predicted traffic noise levels at receiver locations (Table XX and Figure X) that represent the land use activity areas adjacent to the proposed project that might be impacted by traffic noise and potentially benefit from feasible and reasonable noise abatement. TNM primarily considers the number, type and speed of vehicles; highway alignment and grade; cuts, fills and natural berms; surrounding terrain features; and the locations of activity areas likely to be impacted by the associated traffic noise.

TABLE XX: TRAFFIC NOISE LEVELS (dBA Leq)						
Receiver	NAC Category	NAC Level	Existing	Predicted 20XX	Change (+/-)	Noise Impact
R1 (one-word description)						
R2						
R3						
R4						
R5						
R6						
R7						
etc.						

As indicated in Table XX, the proposed project would result in a traffic noise impact and the following noise abatement measures were considered: traffic management, alteration of horizontal and/or vertical alignments, acquisition of undeveloped property to act as a buffer zone and the construction of noise barriers.

Before any abatement measure can be proposed for incorporation into the project, it must be both feasible and reasonable. In order to be "feasible," the abatement measure must be able to reduce the noise level at an impacted receiver by at least five dBA; and to be "reasonable," it must not exceed the cost-effectiveness criterion of \$25,000 for each receiver that would benefit by a reduction of at least five dBA.

Traffic management: altering the flow of traffic for the purpose of lowering noise levels would degrade the designed effectiveness/functionality of the proposed project. Substantial speed reductions would be required to lower noise levels by a readily perceptible amount and would be detrimental to the efficient movement of traffic. Other measures such as time or use restrictions for certain vehicles are not allowed on state highways.

Alteration of horizontal and/or vertical alignments: a major realignment (more than double the

existing distance from roadway to receiver) would be required to achieve the minimum required reduction in noise and, therefore, would not be feasible when considering the stated purpose and need for the proposed project as well as the other associated environmental issues.

Buffer zone: the acquisition of undeveloped property to act as a buffer zone is designed to avoid rather than abate traffic noise impacts and, therefore, is not feasible.

Noise barriers: this is the most commonly used noise abatement measure. Noise barriers were evaluated for each of the impacted receiver locations with the following results:

R3-R8: these receivers represent a total of 5 residences with driveways facing the roadway. A continuous noise barrier would restrict access to these residences. Gaps in a noise barrier would satisfy access requirements but the resulting non-continuous barrier segments would not be sufficient to achieve the minimum, feasible reduction of 5 dBA.

R11, R15, and R18: these receivers are retail businesses. Noise barriers would have a detrimental affect on these receivers by restricting views and access by potential customers.

R13 and R20: these receivers are separate, individual residences. Noise barriers that would achieve the minimum feasible reduction of 5 dBA at each of these receivers would exceed the reasonable, cost-effectiveness criterion of \$25,000.

None of the above abatement measures would be both feasible and reasonable; therefore, no noise abatement measures are proposed for this project.

Noise associated with the construction of the project is difficult to predict. Heavy machinery, the major source of noise in construction, is constantly moving in unpredictable patterns. However, construction normally occurs during daylight hours when occasional loud noises are more tolerable. None of the receivers is expected to be exposed to construction noise for a long duration; therefore, any extended disruption of normal activities is not expected. Provisions will be included in the plans and specifications that require the contractor to make every reasonable effort to minimize construction noise through abatement measures such as work-hour controls and proper maintenance of muffler systems.

A copy of this traffic noise analysis will be made available to local officials to ensure, to the maximum extent possible, future developments are planned, designed and programmed in a manner that would avoid traffic noise impacts. 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.

Example 4: Typical Analysis -- Impact with Feasible & Reasonable Abatement

This analysis was accomplished in accordance with TxDOT's (FHWA approved) Guidelines for Analysis and Abatement of Highway Traffic Noise.

Sound from highway traffic is generated primarily from a vehicle's tires, engine and exhaust. It is commonly measured in decibels and is expressed as "dB."

Sound occurs over a wide range of frequencies. However, not all frequencies are detectable by the human ear; therefore, an adjustment is made to the high and low frequencies to approximate the way an average person hears traffic sounds. This adjustment is called A-weighting and is expressed as "dBA."

Also, because traffic sound levels are never constant due to the changing number, type and speed of vehicles, a single value is used to represent the average or equivalent sound level and is expressed as "Leq."

COMMON SOUND/NOISE LEVELS		
Outdoor	dBA	Indoor
Pneumatic hammer	100	Subway Train
Gas lawn mower at 3 feet		
	90	Food blender at 3 feet
Downtown (large city)	80	Garbage disposal at 3 feet
Lawn mower at 100 feet	70	Vacuum cleaner at 10 feet
		Normal speech at 3 feet
Air conditioning unit	60	Clothes dryer at 3 feet
Babbling brook		Large business office
Quiet urban (daytime)	50	Dishwasher (next room)
Quiet urban (nighttime)	40	Library

The traffic noise analysis typically includes the following elements:

- Identification of land use activity areas that might be impacted by traffic noise.
- Determination of existing noise levels.

- Prediction of future noise levels.
- Identification of possible noise impacts.
- Consideration and evaluation of measures to reduce noise impacts.

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 would occur.

FHWA NOISE ABATEMENT CRITERIA		
Activity Category	dBA Leq	Description of Land Use Activity Areas
A	57 (exterior)	Lands on which serenity and quiet are of extra-ordinary 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.

NOTE: primary consideration is given to exterior areas (Category A, B or C) where frequent human activity occurs. However, interior areas (Category E) are used if exterior areas are physically shielded from the roadway, or if there is little or no human activity in exterior areas adjacent to the roadway.

A noise impact would occur when either the absolute or relative criterion is met:

Absolute criterion: the predicted noise level at a receiver approaches, equals or exceeds the NAC. "Approach" is defined as one dBA below the NAC. For example: a noise impact would occur at a Category B residence if the noise level is predicted to be 66 dBA or above.

Relative criterion: the predicted noise level substantially exceeds the existing noise level at a receiver even though the predicted noise level does not approach, equal or exceed the NAC. "Substantially exceeds" is defined as more than 10 dBA. For example: a noise impact would occur at a Category B residence if the existing level is 54 dBA and the predicted level is 65 dBA (11 dBA increase).

When a traffic noise impact occurs, noise abatement measures must be considered. A noise

abatement measure is any positive action taken to reduce the impact of traffic noise on an activity area.

The FHWA traffic noise modeling (TNM) software was used to calculate existing and predicted traffic noise levels at receiver locations (Table XX and Figure X) that represent the land use activity areas adjacent to the proposed project that might be impacted by traffic noise and potentially benefit from feasible and reasonable noise abatement. TNM primarily considers the number, type and speed of vehicles; highway alignment and grade; cuts, fills and natural berms; surrounding terrain features; and the locations of activity areas likely to be impacted by the associated traffic noise.

TABLE XX: TRAFFIC NOISE LEVELS (dBA Leq)						
Receiver	NAC Category	NAC Level	Existing	Predicted 20XX	Change (+/-)	Noise Impact
R1 (one-word description)						
R2						
R3						
R4						
R5						
R6						
R7						
etc.						

As indicated in Table XX, the proposed project would result in a traffic noise impact and the following noise abatement measures were considered: traffic management, alteration of horizontal and/or vertical alignments, acquisition of undeveloped property to act as a buffer zone and the construction of noise barriers.

Before a noise abatement measure can be proposed for incorporated into the project, it must be both feasible and reasonable. In order to be "feasible," it must be able to reduce the predicted noise level at an impacted receiver by at least five dBA; and to be "reasonable," it must not exceed the cost-effectiveness criterion of \$25,000 for each receiver that would benefit by a reduction of at least five dBA in the predicted noise level.

Traffic management: altering the flow of traffic for the purpose of lowering noise levels would degrade the designed effectiveness/functionality of the proposed project. Substantial speed reductions would be required to lower noise levels by a readily perceptible amount and would be detrimental to the efficient movement of traffic.

Alteration of horizontal and/or vertical alignments: a major realignment (more than double the existing distance from roadway to receiver) would be required to achieve the minimum required

reduction in noise and, therefore, would not be feasible when considering the stated purpose and need for the proposed project as well as the other associated environmental issues.

Buffer zone: the acquisition of undeveloped property to act as a buffer zone is designed to avoid rather than abate traffic noise impacts and, therefore, is not feasible.

Noise barriers: this is the most commonly used noise abatement measure. Noise barriers were evaluated for each of the impacted receiver locations with the following results:

Noise barriers would not be feasible and reasonable for any of the following impacted receivers and, therefore, are not proposed for incorporation into the project:

R3-R8: these receivers represent a total of 5 residences with driveways facing the roadway. A continuous noise barrier would restrict access to these residences. Gaps in a noise barrier would satisfy access requirements but the resulting non-continuous barrier segments would not be sufficient to achieve the minimum, feasible reduction of 5 dBA.

R11, R15, and R18: these receivers are retail businesses. Noise barriers would have a detrimental affect on these receivers by restricting views and access by potential customers.

R13 and R20: these receivers are separate, individual residences. Noise barriers that would achieve the minimum feasible reduction of 5 dBA at each of these receivers would exceed the reasonable, cost-effectiveness criterion of \$25,000.

Noise barriers would be feasible and reasonable for the following impacted receivers and, therefore, are proposed for incorporation into the project:

R25-R28: these receivers represent a total of 16 residences. Based on preliminary calculations, a noise barrier 1929 feet in length and 10 feet in height would reduce noise levels by at least 5 dBA for 14 benefited receivers at a total cost of \$347,220 or \$24,801 for each benefited receiver.

Optional Table for multiple barriers (in lieu of text)

TABLE XX: NOISE BARRIER PROPOSAL						
Barrier	Representative Receivers	Total # Benefited	Length (feet)	Height (feet)	Total Cost	\$/Benefited Receiver
1	R-25 thru R-28	14	1929	10	\$347,220	\$24,801
2						
3						
4						

Any subsequent project design changes may require a reevaluation of this noise barrier proposal. The final decision to construct the proposed noise barrier would not be made until after the

completion of the project design, utility evaluation and polling of adjacent property owners.

Noise associated with the construction of the project is difficult to predict. Heavy machinery, the major source of noise in construction, is constantly moving in unpredictable patterns. However, construction normally occurs during daylight hours when occasional loud noises are more tolerable. None of the receivers is expected to be exposed to construction noise for a long duration; therefore, any extended disruption of normal activities is not expected. Provisions will be included in the plans and specifications that require the contractor to make every reasonable effort to minimize construction noise through abatement measures such as work-hour controls and proper maintenance of muffler systems.

A copy of this traffic noise analysis will be made available to local officials to ensure, to the maximum extent possible, future developments are planned, designed and programmed in a manner that would avoid traffic noise impacts. 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.

Example 5: Atypical Analysis – Low Volume Highways

This analysis was accomplished in accordance with TxDOT's (FHWA approved) Guidelines for Analysis and Abatement of Highway Traffic Noise.

Sound from highway traffic is generated primarily from a vehicle's tires, engine and exhaust. It is commonly measured in decibels and is expressed as "dB."

Sound occurs over a wide range of frequencies. However, not all frequencies are detectable by the human ear; therefore, an adjustment is made to the high and low frequencies to approximate the way an average person hears traffic sounds. This adjustment is called A-weighting and is expressed as "dBA."

Also, because traffic sound levels are never constant due to the changing number, type and speed of vehicles, a single value is used to represent the average or equivalent sound level and is expressed as "Leq."

COMMON SOUND/NOISE LEVELS		
Outdoor	dBA	Indoor
Pneumatic hammer	100	Subway Train
Gas lawn mower at 3 feet		
	90	Food blender at 3 feet
Downtown (large city)	80	Garbage disposal at 3 feet
Lawn mower at 100 feet	70	Vacuum cleaner at 10 feet
		Normal speech at 3 feet
Air conditioning unit	60	Clothes dryer at 3 feet
Babbling brook		Large business office
Quiet urban (daytime)	50	Dishwasher (next room)
Quiet urban (nighttime)	40	Library

The traffic noise analysis typically includes the following elements:

- Identification of land use activity areas that might be impacted by traffic noise.
- Determination of existing noise levels.

- Prediction of future noise levels.
- Identification of possible noise impacts.
- Consideration and evaluation of measures to reduce noise impacts.

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 would occur.

FHWA NOISE ABATEMENT CRITERIA		
Activity Category	dBA Leq	Description of Land Use Activity Areas
A	57 (exterior)	Lands on which serenity and quiet are of extra-ordinary 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.

NOTE: primary consideration is given to exterior areas (Category A, B or C) where frequent human activity occurs. However, interior areas (Category E) are used if exterior areas are physically shielded from the roadway, or if there is little or no human activity in exterior areas adjacent to the roadway.

A noise impact would occur when either the absolute or relative criterion is met:

Absolute criterion: the predicted noise level at a receiver approaches, equals or exceeds the NAC. "Approach" is defined as one dBA below the NAC. For example: a noise impact would occur at a Category B residence if the noise level is predicted to be 66 dBA or above.

Relative criterion: the predicted noise level substantially exceeds the existing noise level at a receiver even though the predicted noise level does not approach, equal or exceed the NAC. "Substantially exceeds" is defined as more than 10 dBA. For example: a noise impact would occur at a Category B residence if the existing level is 54 dBA and the predicted level is 65 dBA (11 dBA increase).

When a traffic noise impact occurs, noise abatement measures must be considered. A noise

abatement measure is any positive action taken to reduce the impact of traffic noise on an activity area.

The FHWA traffic noise modeling software was used to calculate existing and predicted noise levels at a representative worst case location on the right of way. The predicted noise level of XX dBA exceeded the existing level of XX dBA by only X dBA and the NAC for Category B was not approached, equaled or exceeded. Therefore, the project would not result in a traffic noise impact outside the right of way.

Noise associated with the construction of the project is difficult to predict. Heavy machinery, the major source of noise in construction, is constantly moving in unpredictable patterns. However, construction normally occurs during daylight hours when occasional loud noises are more tolerable. None of the receivers is expected to be exposed to construction noise for a long duration; therefore, any extended disruption of normal activities is not expected. Provisions will be included in the plans and specifications that require the contractor to make every reasonable effort to minimize construction noise through abatement measures such as work-hour controls and proper maintenance of muffler systems.

A copy of this traffic noise analysis will be made available to local officials to assist in future land use planning.

Example 6: Atypical Analysis -- All Undeveloped Land

This analysis was accomplished in accordance with TxDOT's (FHWA approved) Guidelines for Analysis and Abatement of Highway Traffic Noise.

Sound from highway traffic is generated primarily from a vehicle's tires, engine and exhaust. It is commonly measured in decibels and is expressed as "dB."

Sound occurs over a wide range of frequencies. However, not all frequencies are detectable by the human ear; therefore, an adjustment is made to the high and low frequencies to approximate the way an average person hears traffic sounds. This adjustment is called A-weighting and is expressed as "dBA."

Also, because traffic sound levels are never constant due to the changing number, type and speed of vehicles, a single value is used to represent the average or equivalent sound level and is expressed as "Leq."

COMMON SOUND/NOISE LEVELS		
Outdoor	dBA	Indoor
Pneumatic hammer	100	Subway Train
Gas lawn mower at 3 feet		
	90	Food blender at 3 feet
Downtown (large city)	80	Garbage disposal at 3 feet
Lawn mower at 100 feet	70	Vacuum cleaner at 10 feet
		Normal speech at 3 feet
Air conditioning unit	60	Clothes dryer at 3 feet
Babbling brook		Large business office
Quiet urban (daytime)	50	Dishwasher (next room)
Quiet urban (nighttime)	40	Library

The traffic noise analysis typically includes the following elements:

- Identification of land use activity areas that might be impacted by traffic noise.
- Determination of existing noise levels.

- Prediction of future noise levels.
- Identification of possible noise impacts.
- Consideration and evaluation of measures to reduce noise impacts.

The FHWA has established the following Noise Abatement Criteria (NAC) for various land use activity areas.

FHWA NOISE ABATEMENT CRITERIA		
Activity Category	dBA Leq	Description of Land Use Activity Areas
A	57 (exterior)	Lands on which serenity and quiet are of extra-ordinary 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.

NOTE: primary consideration is given to exterior areas (Category A, B or C) where frequent human activity occurs. However, interior areas (Category E) are used if exterior areas are physically shielded from the roadway, or if there is little or no human activity in exterior areas adjacent to the roadway.

All land use activity areas adjacent to the project are currently undeveloped land. Also, no new development is currently planned, designed or programmed in these areas. Therefore, the project would not result in any noise impacts. However, to avoid noise impacts that may result from future development of properties adjacent to the project, local officials responsible for land use control programs should ensure, to the maximum extent possible, no new activities are planned or constructed along or within the following predicted (20XX) noise impact contours.

LAND USE	IMPACT CONTOUR	DISTANCE from RIGHT of WAY
Category B	66 dBA	XX feet

A copy of this traffic noise analysis will be made available to local officials to assist in future land use planning. 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.

Example 7: Combined Analysis -- Developed (no impact) and Undeveloped Land

This analysis was accomplished in accordance with TxDOT's (FHWA approved) Guidelines for Analysis and Abatement of Highway Traffic Noise.

Sound from highway traffic is generated primarily from a vehicle's tires, engine and exhaust. It is commonly measured in decibels and is expressed as "dB."

Sound occurs over a wide range of frequencies. However, not all frequencies are detectable by the human ear; therefore, an adjustment is made to the high and low frequencies to approximate the way an average person hears traffic sounds. This adjustment is called A-weighting and is expressed as "dBA."

Also, because traffic sound levels are never constant due to the changing number, type and speed of vehicles, a single value is used to represent the average or equivalent sound level and is expressed as "Leq."

COMMON SOUND/NOISE LEVELS		
Outdoor	dBA	Indoor
Pneumatic hammer	100	Subway Train
Gas lawn mower at 3 feet		
	90	Food blender at 3 feet
Downtown (large city)	80	Garbage disposal at 3 feet
Lawn mower at 100 feet	70	Vacuum cleaner at 10 feet
		Normal speech at 3 feet
Air conditioning unit	60	Clothes dryer at 3 feet
Babbling brook		Large business office
Quiet urban (daytime)	50	Dishwasher (next room)
Quiet urban (nighttime)	40	Library

The traffic noise analysis typically includes the following elements:

- Identification of land use activity areas that might be impacted by traffic noise.
- Determination of existing noise levels.

- Prediction of future noise levels.
- Identification of possible noise impacts.
- Consideration and evaluation of measures to reduce noise impacts.

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 would occur.

FHWA NOISE ABATEMENT CRITERIA		
Activity Category	dBA Leq	Description of Land Use Activity Areas
A	57 (exterior)	Lands on which serenity and quiet are of extra-ordinary 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.

NOTE: primary consideration is given to exterior areas (Category A, B or C) where frequent human activity occurs. However, interior areas (Category E) are used if exterior areas are physically shielded from the roadway, or if there is little or no human activity in exterior areas adjacent to the roadway.

A noise impact would occur when either the absolute or relative criterion is met:

Absolute criterion: the predicted noise level at a receiver approaches, equals or exceeds the NAC. "Approach" is defined as one dBA below the NAC. For example: a noise impact would occur at a Category B residence if the noise level is predicted to be 66 dBA or above.

Relative criterion: the predicted noise level substantially exceeds the existing noise level at a receiver even though the predicted noise level does not approach, equal or exceed the NAC. "Substantially exceeds" is defined as more than 10 dBA. For example: a noise impact would occur at a Category B residence if the existing level is 54 dBA and the predicted level is 65 dBA (11 dBA increase).

When a traffic noise impact occurs, noise abatement measures must be considered. A noise

abatement measure is any positive action taken to reduce the impact of traffic noise on an activity area.

The FHWA traffic noise modeling (TNM) software was used to calculate existing and predicted traffic noise levels at receiver locations (Table XX and Figure X) that represent the land use activity areas adjacent to the proposed project that might be impacted by traffic noise and potentially benefit from feasible and reasonable noise abatement. TNM primarily considers the number, type and speed of vehicles; highway alignment and grade; cuts, fills and natural berms; surrounding terrain features; and the locations of activity areas likely to be impacted by the associated traffic noise.

TABLE XX: TRAFFIC NOISE LEVELS (dBA Leq)						
Receiver	NAC Category	NAC Level	Existing	Predicted 20XX	Change (+/-)	Noise Impact
R1 (one-word description)						
R2						
R3						
R4						
R5						
R6						
R7						
etc.						

As indicated in Table XX, the proposed project would not result in a traffic noise impact.

Land use activity areas between X Street and X Avenue are currently Category D, undeveloped land. Also, no new development is currently planned, designed or programmed in these areas. There is no NAC for undeveloped land; however, to avoid noise impacts that may result from future development of properties adjacent to the project, local officials responsible for land use control programs should ensure, to the maximum extent possible, no new activities are planned or constructed along or within the following predicted (20XX) noise impact contour.

UNDEVELOPED AREA	LAND USE	IMPACT CONTOUR	DISTANCE from RIGHT of WAY
X Street to X Avenue	Category B	66 dBA	XX feet

Noise associated with the construction of the project is difficult to predict. Heavy machinery, the major source of noise in construction, is constantly moving in unpredictable patterns. However, construction normally occurs during daylight hours when occasional loud noises are more tolerable. None of the receivers is expected to be exposed to construction noise for a long

duration; therefore, any extended disruption of normal activities is not expected. Provisions will be included in the plans and specifications that require the contractor to make every reasonable effort to minimize construction noise through abatement measures such as work-hour controls and proper maintenance of muffler systems.

A copy of this traffic noise analysis will be made available to local officials to assist in future land use planning. 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.

Example 8: Analysis Reevaluation

The original traffic noise analysis concluded that no noise abatement measures would be feasible and reasonable for any of the impacted receivers. Since that time, there have been no changes that would alter this conclusion; therefore, the original traffic noise analysis remains valid.

OR

The original traffic noise analysis concluded that no noise abatement measures would be feasible and reasonable for any of the impacted receivers. The changes addressed in this reevaluation would not alter this conclusion nor result in any new impacts for which any noise abatement would be feasible and reasonable; therefore, the original traffic noise analysis remains valid.

OR

The original traffic noise analysis concluded that the proposed project would not result in any noise impacts. Since that time, there have been no changes that alter this conclusion; therefore, the original traffic noise analysis remains valid.

OR

An analysis of the land use activity areas along this portion of Loop 1 indicates that none of the receivers included in the approved FSEIS would be impacted by highway traffic noise and benefit from any feasible and reasonable noise abatement measures. Also, the minor scope of the proposed changes along this portion of Loop 1 does not warrant an analysis of any areas/receivers developed after the FSEIS was approved.

NOTE: There are several other possibilities. If there are substantial changes in the project design, OR if the original analysis did not consider the approach criterion, OR if the original analysis used L_{10} instead of L_{eq} , etc., a more in-depth or totally new analysis may be required.

Also, the original analysis should have included the following comment:

“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.”

Therefore, for a reevaluation, a new noise analysis is not required for any new development (e.g., new residential development) that occurred after the date of approval of the original document **unless** there have been substantial changes in the project design.

Example 9: Abbreviated Analysis

An analysis of the land use adjacent to the proposed project indicated there are no areas that would be impacted by highway traffic noise and benefit from any feasible and reasonable noise abatement measures.

Noise associated with the construction of the project is difficult to predict. Heavy machinery, the major source of noise in construction, is constantly moving in unpredictable patterns. However, construction normally occurs during daylight hours when occasional loud noises are more tolerable. No extended disruption of normal activities is expected. Provisions will be included in the plans and specifications that require the contractor to make every reasonable effort to minimize construction noise through abatement measures such as work-hour controls and proper maintenance of muffler systems.

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.

Notes on using the above recommended text:

1. *An abbreviated traffic noise analysis may only be used in the following situations:*
 - a. *All receivers are commercial.*
 - b. *There are few, isolated residential receivers, if it is unlikely that any receivers would be impacted and/or unlikely that any noise barriers would be feasible and reasonable.*
 - c. *Receivers are far removed from the proposed ROW.*
2. *The second paragraph on construction noise is optional.*
3. *Future noise impact contours would only be recommended for currently undeveloped areas adjacent to the project where residential development is likely to occur in the near future (at district discretion).*