Appendix I:

Noise and Air Impact Analysis

MARCH 2019

LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

STATE PROJECT NO. H.001271/FEDERAL AID PROJECT NO. H001271

TRAFFIC NOISE ANALYSIS

CANE RIVER BRIDGE
CHURCH STREET
ROUTE LA 1-X
ENVIRONMENTAL ASSESSMENT

NATCHITOCHES PARISH, LOUISIANA

Prepared By:
Providence Engineering and Design, LLC
1201 Main Street
Baton Rouge, Louisiana 70802
(225) 766-7400
www.providenceeng.com

Project Number 1200-001-000

ACRONYMS AND ABBREVIATIONS

ADOT	Arizona Department of Transportation
ANSI	American National Standards Institute
CFR	Code of Federal Regulations
CL	Centerline
dB	Decibel
dBA	A-Weighted Decibels
EB	Eastbound
FHWA	Federal Highway Administration
ft	Feet
LADOTD	Louisiana Department of Transportation and Development
Leq	Equivalent Steady-State Sound Level
Leq(h)	Hourly Equivalent Steady-State Sound Level
LAeq(1h)	Hourly Equivalent A-Weighted Sound Level
mph	Miles Per Hour
N/A	Not Applicable
NAC	Noise Abatement Criteria
NB	Northbound
NCHRP	National Cooperative Highway Research Program
NM	Noise Meter Location
ROW	Right-of-Way
SB	Southbound
SI	Substantial Increase
SL	Sound Level
SLM	Sound Level Meter
sq ft	Square feet
TNM	Traffic Noise Model
TNM 2.5	Traffic Noise Model v.2.5
TXDOT	Texas Department of Transportation
US DOT	United States Department of Transportation
WB	Westbound
%	Percent

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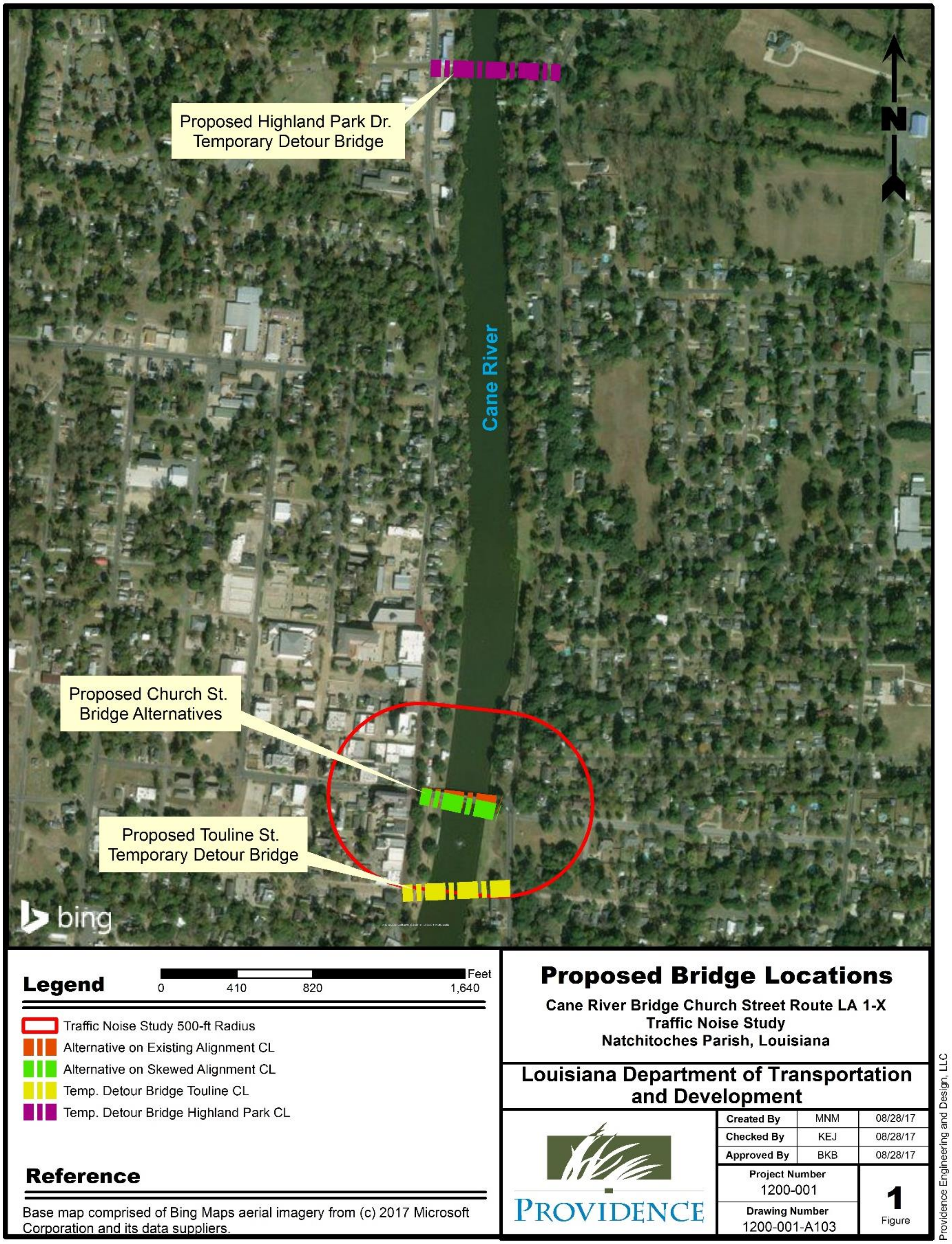
1.0 INTRODUCTION

On behalf of the Louisiana Department of Transportation and Development (LADOTD), Providence Engineering and Design, LLC (Providence) conducted a highway traffic noise analysis for the proposed bridge replacement of the Cane River Bridge at Church Street on LA 1-X in the city of Natchitoches, Natchitoches Parish, Louisiana. This traffic noise analysis will determine noise impacts associated with the Build Alternatives, and, if impacts are identified, noise abatement will be considered and evaluated for both feasibility and reasonableness. This noise analysis was prepared in accordance with the requirements of the Federal Highway Administration (FHWA) noise standards, Procedure for Abatement of Highway Traffic and Construction Noise [23 Code of Federal Regulations (CFR) Part 772] and state requirements. The LADOTD's Highway Traffic Noise Policy (dated July 2011) provides information on how highway traffic noises are defined, how noise abatement is evaluated, and how noise abatement decisions are made in Louisiana. This report documents the methodology and results of the Cane River Bridge traffic noise analysis in accordance with FHWA and the LADOTD requirements.

1.1 Project Description

The existing bridge on Church Street is classified as a Minor Arterial roadway with a posted speed of 25 miles per hour (mph). The existing bridge is a two-lane concrete deck girder bridge constructed during the 1930s. The bridge is located within the Natchitoches Historic Landmark District, but has been determined ineligible for the National Register of Historic Places and is not a contributing element to the District. Signalized intersections exist at the bridge termini; east at Williams Avenue and west at Front Street. The proposed project involves the replacement of the Cane River Bridge at Church Street to address structural and functional deficiencies as well as the widening of the bridge to resolve traffic congestion, increase capacity, and improve the level of service presently and in the future. One of the proposed Build Alternatives will be a Minor Arterial with a posted speed of 25 mph on the existing alignment. The second Build Alternative will have a posted speed of 25 mph on a skewed alignment to meet the signal at Williams Avenue and St. Clair Avenue. These Build Alternatives propose a three-lane undivided roadway including two, 12-foot-wide travel lanes (one eastbound and one westbound), 14-foot-wide center turning lane, four-foot-wide outside shoulders, two six-foot-wide sidewalks, and two 1.58-foot-wide barriers. **Figure 1** depicts the locations for the Build Alternatives. The bridge centerlines (CL) were provided by the bridge consultants, Huval and Associates, Inc.

FIGURE 1: PROPOSED BRIDGE LOCATIONS



1.2 Noise Background

According to FHWA's *Highway Traffic Noise: Analysis and Abatement Guidance*, sound occurs when an object moves and the movement causes vibrations of the molecules in the air to move in waves. We hear what we call sound when the vibration reaches our ears. Sound from highway traffic is generated primarily from a vehicle's tires, engine, and exhaust. Sound pressure levels used to measure the intensity of sound are described in terms of decibels (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-weighted decibels (dBA). **Table 1** shows the noise levels for common indoor and outdoor sounds. 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 steady-state sound level (Leq).

TABLE 1: COMMON SOUND AND NOISE LEVELS

TABLE 1
COMMON SOUND AND NOISE LEVELS

Outdoor	dBA	Indoor
Jet flyover at 1,000 feet	110	Rock band at 15 feet
		Baby Crying
Leaf Blower	100	Subway
Gas Weed Eater		Fire Alarms
Riding Lawn Mower	90	Food blender at 3 feet
Gas Edger		Crowded Restaurant
Police Whistle	80	Garbage disposal at 3 feet
Air Conditioner Compressor		Shouting at 3 feet
Gas lawn mower at 100 feet	70	Vacuum cleaner at 10 feet
		Normal speech at 3-5 feet
Heavy traffic at 300 feet	60	Clothes dryer at 3 feet
Babbling Brook		Large business office
Quiet urban (daytime)	50	Refrigerator
Quiet urban (nighttime)	40	Quiet office, Library
Wilderness	30	Bedroom at night
Quite rural (nighttime)	20	Whisper
	10	Threshold of hearing

Source: Common Indoor and Outdoor Noise Levels flier, Arizona Department of Transportation, December 2008 and Table 4 Common Sound/Noise Levels, Texas Department of Transportation *Guideline for Analysis and Abatement of Roadway Traffic Noise*, April 2011.

The FHWA has established noise abatement criteria (NAC) for various land use activity categories that can be used to determine when a traffic noise impact would be expected to occur. Traffic noise impacts occur when either the absolute or relative criterion is met:

- Absolute criterion: Under this criterion, a noise impact occurs when the predicted noise level approaches, equals, or exceeds the FHWA NAC. This is also referred to as a sound level (SL) impact.
- Relative criterion: Under this criterion, a noise impact occurs when the predicted noise level is a substantial increase over the existing level even if it does not approach, equal, or exceed the FHWA NAC. This is also referred to as substantial increase (SI) impact.

The LADOTD's noise policy defines traffic noise levels as "approaching" when the noise level is a least 1 dBA below the FHWA NAC. The policy also states that a 10 dBA increase over existing levels is a substantial increase. **Table 2** includes the activity categories and their respective hourly equivalent steady-state sound level [Leq(h)] value, per FHWA and the LADOTD guidelines.

TABLE 2: NOISE ABATEMENT CRITERIA HOURLY dBA

Activity Category	FHWA Leq(h)	Evaluation Location	Activity Description	LADOTD Leq(h)
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.	56
B	67	Exterior	Residential (includes undeveloped lands permitted for residential).	66
C	67	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 nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings. Includes undeveloped lands permitted for these activities.	66
D	52	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.	51
E	72	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A–D or F. Includes undeveloped lands permitted for these activities.	71
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.	-

Source: Highway Traffic Noise Policy, LADOTD, 2011

2.0 TRAFFIC NOISE ANALYSIS

According to the LADOTD's noise policy, highway traffic noise analysis includes the following:

- 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 noise abatement measures to reduce noise impacts

2.1 Land Use Identification

A land use analysis of the project area was conducted to locate all noise-sensitive land uses within the logical termini of the project, including Section 4(f) properties, and to determine their location relative to the Build Alternatives. The model limits reach 500 feet west of the Church Street intersection with Front Street and 500 feet east of the Church Street intersection with Williams Avenue. The northern and southern limits of the noise study area each reach 500 feet from the Church Street bridge. The land use analysis of the project area was determined through review of available mapping and aerial photographs of the area and adjusted to reflect field confirmation. NAC Categories B, C, and E were identified adjacent to the Build Alternatives. **Table 3** and **Figure 2** identify the various land use activity areas and provide additional details including the NAC activity categories and criteria for each area. These land use areas share a common noise environment. A common noise environment is a group of receptors within the same NAC category that are exposed to similar noise sources, traffic volumes, traffic mix, speed, and topographic features.

TABLE 3: LAND USE ACTIVITY AREAS

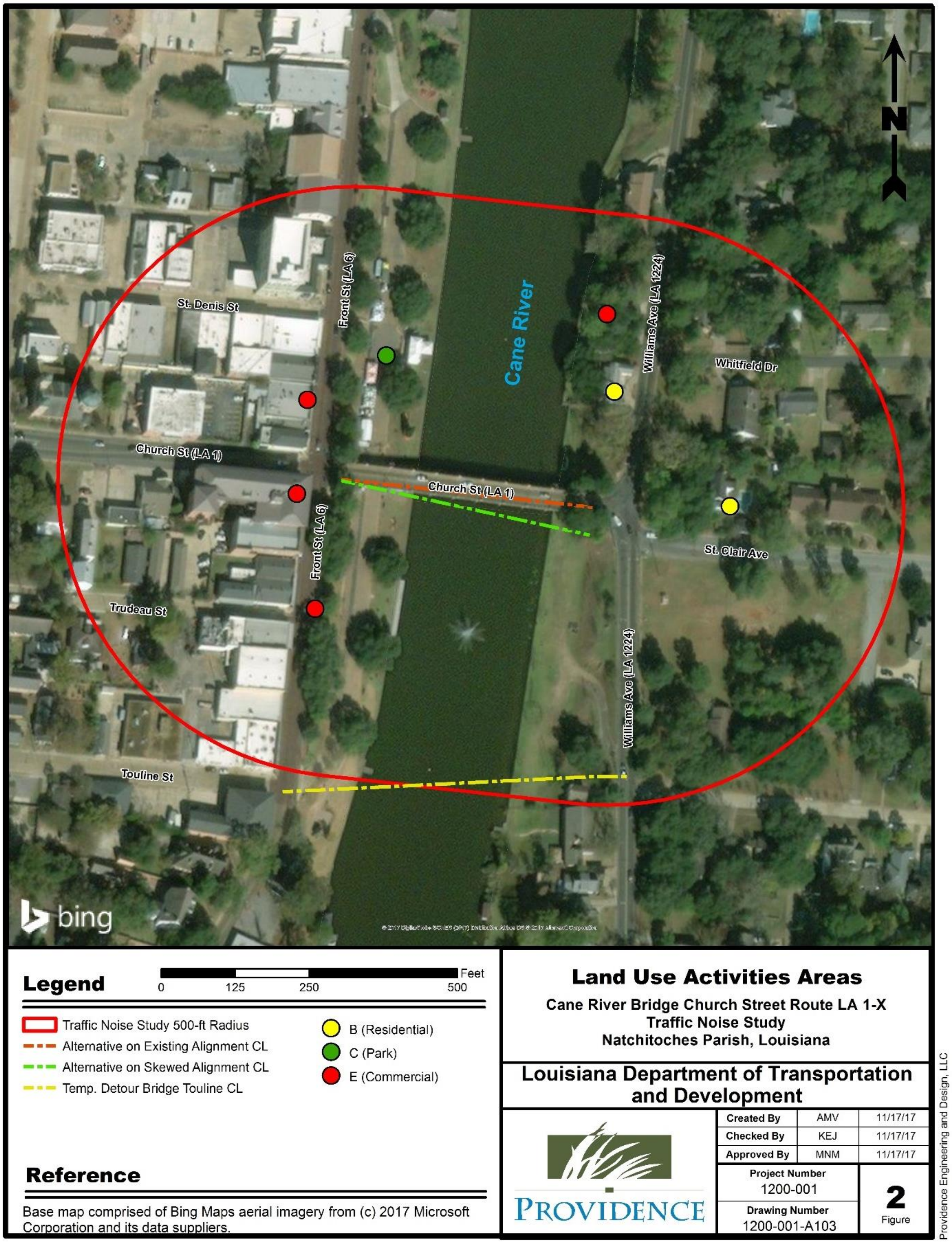
Map ID	Description	Activity Category [2]	DOTD Leq(h)
	Residential	B	66
	Park	C	66
	Commercial [1]	E	71

NOTES:
1. Commercial properties are only considered to be Activity Category E if an outside area of frequent human use is present. 2. Activity Categories are defined in Table 2.

Map ID	Description	Activity Category [2]	DOTD Leq(h)
(yellow)	Residential	B	66
(green)	Park	C	66
(red)	Commercial [1]	E	71

NOTES:
1. Commercial properties are only considered to be Activity Category E if an outside area of frequent human use is present.
2. Activity Categories are defined in Table 2.

FIGURE 2: LAND USE ACTIVITY AREAS



A majority of the modeled receptors consist of Category B residential receptors, primarily multi-family dwelling units. These complexes include Nakatosh Condominiums and other apartments located above the shops on Front Street. On the east bank of the river are several single-family residences.

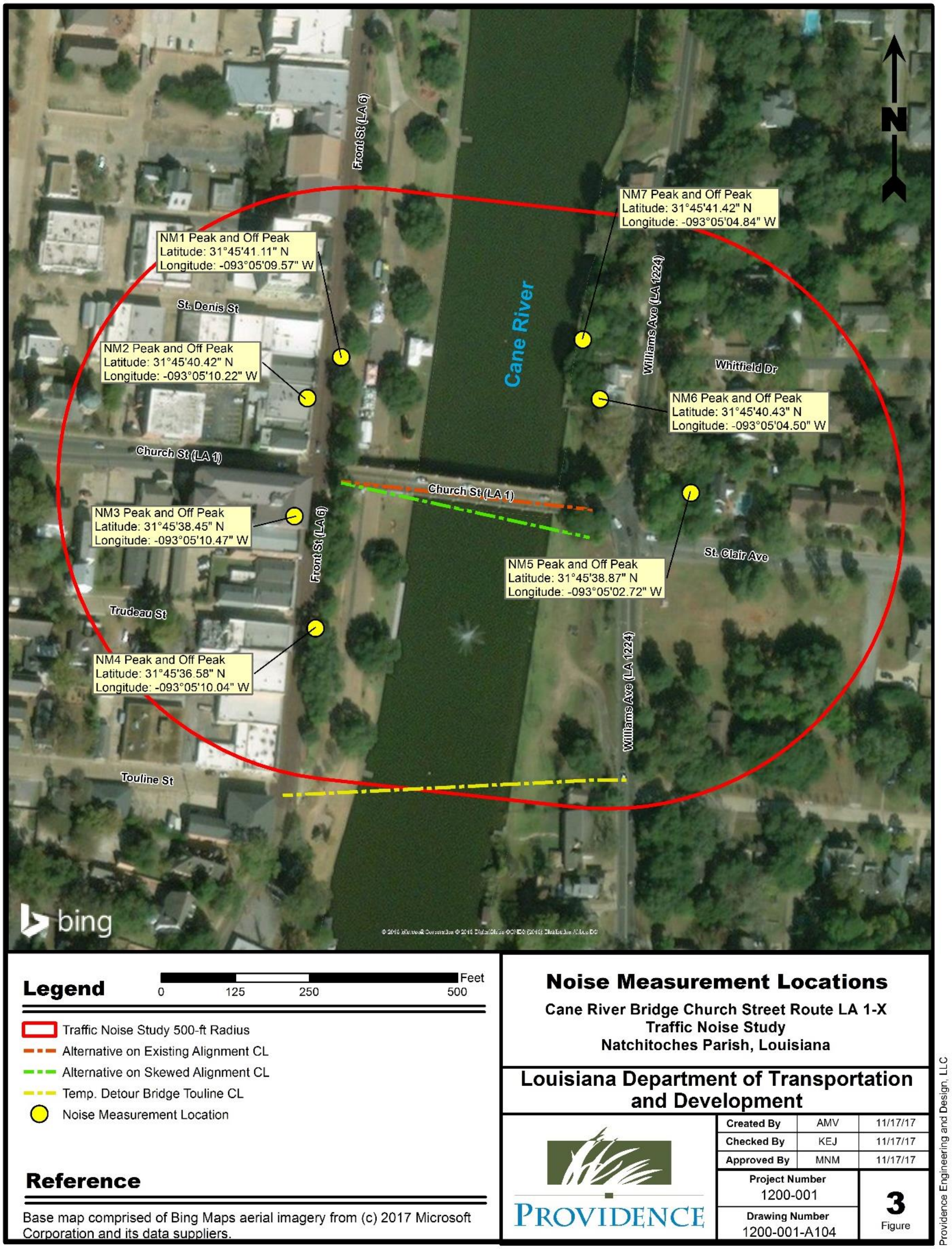
There are several Category C receptors including the Fleur de Lis Stage, amphitheater area and several outdoor seating areas lining the western bank of the Cane River along Front Street. The Immaculate Conception Church has a patio/courtyard area that is included in the noise study area.

A commercial property (hotel, motel, office, restaurant/bar, *etc.*) is only considered Category E if exterior areas of frequent human use are present. During field investigations, 25 Category E receptors were identified that will require further analysis. Five are dining establishments that contain outdoor seating areas including Mama's Oyster House, Merci Beaucoup Restaurant, The Landing Restaurant and Bar, and Front Street Market. Fifteen are shops with benches on Front Street which allow shoppers to rest and admire the scenery of historic downtown Natchitoches. These businesses include Brenda's Clothing & Accessories, All Tangled Up, Hello Dolly, Merci Beaucoup Gift Shop, Barber Shop, Razzle Dazzle Unique Boutique, Natchitoches Art Guild & Gallery, Rocking Horse Toy Store, Plantation Treasures, Mary Lou's Flowers, Tres Bien Antiques, and other gift shops. The Exchange Bank & Trust has an outside patio and ATM area. The other Category E receptors are outside patio areas of hotels such as the Church Street Inn, Andre's Riverview, and Log Cabin Guest House.

2.2 Determination of Existing Noise Levels

Field measurements of actual noise levels are used to validate the traffic noise model (TNM) predictions. Seven potential noise measurement sites were identified and submitted to LADOTD for review and approval prior to undertaking noise measurements. These sites represented the Categories B, C, and E receptors discussed in **Section 2.1**. **Figure 3** illustrates the seven noise measurement locations for both the peak and off-peak measurements.

FIGURE 3: NOISE MEASUREMENT LOCATIONS



Field measurements were collected on October 4, 2017 and October 5, 2017 by Providence personnel between approximately 7:00 AM and 6:00 PM. These measurement locations were typically in the front or side yards of sensitive receptors, whichever was located between the noise source and the receptor. Measurements were collected using an American National Standards Institute (ANSI) Type 2 Larson Davis SoundTrack LxT2 sound level meter (SLM) at the seven measurement locations. The SLM was calibrated at the beginning of the trip and rechecked before each measurement. The time of day, meteorological conditions, calibration results, and any unusual ambient noise sources experienced during each measurement period were recorded. Approximate 20-minute intervals were used during peak times and off-peak times, to ensure adequate data was collected. Traffic counts were taken at each location during the measurement intervals for automobiles, medium trucks, heavy trucks, buses, and motorcycles. The traffic values were converted to an hourly value for TNM input during the validation effort. Field data sheets, vehicle count logs, and site photographs for each location are provided as **Appendix A-1**, **Appendix A-2**, and **Appendix A-3**, respectively. The existing levels for the seven measurement locations are further discussed in the following section.

2.3 Prediction of Existing and Future Noise Levels

In accordance with current FHWA noise regulations, the TNM Version 2.5 (TNM 2.5) computer program was used to predict the noise levels associated with the proposed project.

2.3.1 Model Validation

Prior to using the TNM 2.5 for prediction, the model must be validated. The model validation compares the noise levels measured in the field to the noise level predicted by the model. As long as the model results are within 3 dBA of the field measured noise levels, no further action is needed and the TNM 2.5 can be used for predicting existing and future traffic noise levels.

The validation run was set up using the existing roadway parameters, traffic counts collected during the field measurements, and the observed or posted speeds. The posted speed limits for the entirety of the Cane River Bridge project area is 25 mph. The posted speed limits for side streets modeled are as follows:

- Williams Avenue at 25 mph
- St. Clair Avenue at 25 mph
- Front Street at 25 mph

There was an error in data collection during the first two minutes for Noise Meter Location (NM) 1 Peak, the SLM data included the calibration in its measurements. NM 1 Peak data had to be recalculated due to non-representative and disruptive localized noise sources during Minute 3 and Minute 9. The Leq for NM 2 Off-Peak had to be recalculated due to non-representative and disruptive localized noise sources during Minutes 4, 10, 16 and 19. The Leq for NM 3 Off-Peak had to be recalculated due to non-representative and disruptive localized noise sources during Minute 17. The Leq for NM 4 Off-Peak had to be recalculated due to calibration in Minute 1 and non-representative and disruptive localized noise sources during Minute 19. The Leq for NM 5 Peak had to be recalculated due to non-representative and disruptive localized noise sources during Minutes 3 and 18. A summary of the traffic data used, sound level meter measurement history, Leq calculation tables, TNM traffic input tables, TNM sound level results tables and TNM plan views for the validation runs are provided in **Appendix B**. **Table 4** summarizes the field measurements compared to the TNM predicted values. Fourteen validation models were used to represent the Peak and Off-Peak measurements for the seven noise measurement locations. All but three models validated.

TABLE 4: VALIDATION RESULTS

Site	Time Period	Description	Measured Leq (dBA)	Predicted Leq (dBA)	Difference (dBA)
1	Peak	Amphitheater	65.8	64.1	1.7
1	Off-Peak	Amphitheater	66.1	64.4	1.7
2	Peak	Mama's Oyster House	67.7	65.9	1.8
2	Off-Peak	Mama's Oyster House	67.0	63.7	3.3
3	Peak	Front St. Market	67.2	67.2	0.0
3	Off-Peak	Front St. Market	67.8	67.0	0.8
4	Peak	Front St. Benches	65.6	59.8	5.8
4	Off-Peak	Front St. Benches	63.6	61.7	1.9
5	Peak	White House	55.8	58.6	-2.8
5	Off-Peak	White House	57.0	59.2	-2.2
6	Peak	Riverside House	56.3	58.7	-2.4
6	Off-Peak	Riverside House	58.3	56.6	1.7
7	Peak	Andre's River House	54.4	53.1	1.3
7	Off-Peak	Andre's River House	56.5	53.0	3.5

The model predicted value for NM 2 Off-Peak was 3.3 dBA lower than that measured in the field. Similarly, the model predicted value for NM 4 Peak was 5.8 dBA lower than that measured in the field. NM 7 Off-Peak was 3.5 dBA lower than that measured in the field. TNM 2.5 does not incorporate the effects of atmospheric conditions, including wind speed and direction, when predicting noise levels. During the off-peak measurements at the NM 2 and NM 7 locations, southerly winds of five to ten mph with gusts measured up to 14 mph were observed. The measurement locations were approximately 100 feet and 300 feet on the north side from the traffic noise source. During the peak measurement at the NM 4 location, ten mph easterly winds were observed. This NM 4 location was approximately 200 feet south of the traffic noise source and 250 feet due west of a fountain located in the center of Cane River. This wind direction places the noise measurement locations downwind from the primary noise source, which is likely to carry road noise to the receiver. The National Cooperative Highway Research Program (NCHRP) issued additional guidance in 2014 related to the atmospheric effects on highway traffic noise levels, specifically wind and temperature gradients. Their sound models studied the effects of different meteorological conditions at various receiver distances and heights. Several runs were used to include various factors such as wind direction (upwind versus downwind), wind speeds, barrier presence, and ground type (hard versus soft). The results were presented in tabular format. **Table 5** summarizes the findings for the following conditions: soft ground, no barrier, and regular mix of automobiles and trucks.

TABLE 5: DIFFERENCE IN SOUND LEVELS RELATIVE TO CALM / NEUTRAL ATMOSPHERIC CONDITIONS

Receiver Distance (feet)	Receiver Height (feet)	Sound-Level Difference in Decibels (dB)	
		Moderate Downwind (5.6 mph)	Strong Downwind (11.2 mph)
50	5	3	4
100	5	4	8
200	5	8	12
400	5	12	14
800	5	14	15
1,600	5	15	16

Source: NCHRP. Report 791: Supplemental Guidance on the Application of FHWA's Traffic Noise Model. National Academy of Sciences, 2014. "Table 14: Differences in Sound Levels Relative to Calm/Natural Conditions: Automobiles and Trucks, Soft Ground, without Noise Barrier".

Sound levels could have been increased based on the receiver distance and wind speeds observed during the off-peak conditions of NM 2 in the range of 4 to 8 dB. This range is in line with the 3.3 dBA increase in the field measurements over the predicted model. The range of 8 to 12 dB was expected for the receiver distance and wind speeds observed during the off-peak conditions of NM 7 which is more than the 3.5 dBA increase in the field measurements. Lastly the 5.8 dBA increase measured at NM 4 peak conditions is most likely due to the noise generated by the fountain in Cane River as a noise source which is why it is less than the 8 to 12 dB sound level difference to be expected if it were produced from a traffic noise source. There are too many variables along the propagation path to expect consistent agreement between the field measurement and model at this receiver distance and in the wind conditions. Another circumstance to note is that Front Street is paved with brick pavers which create louder tire noise from passing vehicles. Aside from the fountain located in Cane River, there were on-going construction activities at the park located on the western bank of the Cane River. These construction activities were noted on the field summary sheets and required several One-Minute Calculations for Leq to subtract a minute from the noise study due to non-typical noises observed.

The model validated for the other eleven runs including the NM 2 peak location, the NM 4 off-peak location, and the NM 7 peak location. Therefore, the model is considered valid for use in predicting the existing and future build noise levels. A summary of the traffic data used, SLM measurement history, One-Minute Calculations for Leq, TNM sound-level traffic input tables, TNM sound-level result tables, and TNM plan views for the validation runs are provided in **Appendix B-1**, **Appendix B-2**, **Appendix B-3**, **Appendix B-4**, **Appendix B-5**, and **Appendix B-6**, respectively.

2.3.2 Traffic Predictions

Traffic data used to predict the existing and future noise levels was prepared by Cobb, Fendley & Associates, Inc. (CobbFendley). Traffic data provided by CobbFendley included the AM and PM peak volumes for the following conditions: 2017 existing year, 2018 construction year, 2038 design year no-build, and the 2038 design year build for the Build Alternatives (see **Appendix C-1**). According to the traffic study, the AM and PM peak hour volumes were determined to be from 7:00 AM to 9:00 AM, and from 3:45 PM to 5:45 PM. CobbFendley provided 7-day, 24-hour class counts for each of the 13 vehicle classes along Church Street eastbound and westbound. The data provided a 24-hour count for each vehicle class beginning on Friday, May 5, 2017 at 3:00 PM. For the intersecting side streets, CobbFendley provided 48-hour traffic counts for each of the 13 vehicle classes beginning on Wednesday, May 17, 2017 at 12:00 AM. All the intersection data was provided as two separate counts for AM and PM values. These percentages were used for the existing, design year no-build, and design year build peak and off-peak models. Once the percentages were applied to the hourly volume, the numbers were rounded for each category. In some instances, the total for each category may be off one vehicle from the hourly value. The vehicle classification percentages used and the detailed counts used to calculate the percentages are included as **Appendix C-2**. A summary of the percentages used in the model is included as **Table 6**.

TABLE 6: VEHICLE CLASSIFICATION PERCENTAGES

Roadway Segment	Automobiles	Medium Trucks	Heavy Trucks	Buses	Motorcycles
Church St Bridge EB	91.3%	6.7%	1.0%	0.2%	0.8%
Church St Bridge WB	88.5%	8.2%	1.7%	0.3%	1.3%
Church St road EB	91.4%	6.6%	1.0%	0.5%	0.6%
Church St road WB	80.1%	15.1%	2.6%	1.6%	0.6%
Front St NB (S)	84.5%	13.9%	0.7%	0.7%	0.2%
Front St SB (S)	92.5%	5.9%	0.7%	0.3%	0.6%
Front St NB (N)	89.1%	6.3%	1.2%	0.4%	3.0%
Front St SB (N)	90.0%	6.4%	1.5%	0.2%	2.0%
Williams Ave NB (S)	83.3%	4.2%	10.7%	0.4%	1.4%
Williams Ave SB (S)	86.6%	5.1%	7.4%	0.6%	0.2%
Williams Ave NB (N)	86.2%	6.7%	6.3%	0.7%	0.2%
Williams Ave SB (N)	76.6%	14.7%	7.3%	1.2%	0.3%
St Clair St EB	91.6%	6.0%	1.6%	0.5%	0.3%
St Clair St WB	89.5%	7.1%	2.6%	0.3%	0.5%

NOTES:
1. These percentages are based on traffic counts collected by CobbFendley in 2017. A detailed description of how these values were calculated is included in **Section 2.3.2**.

Once the traffic was determined for each segment, the vehicle class percentages in **Table 6** were then applied to generate the TNM traffic input values for automobiles, medium trucks, heavy trucks, buses, and motorcycles (see **Appendix C-4**).

2.3.3 Model Setup

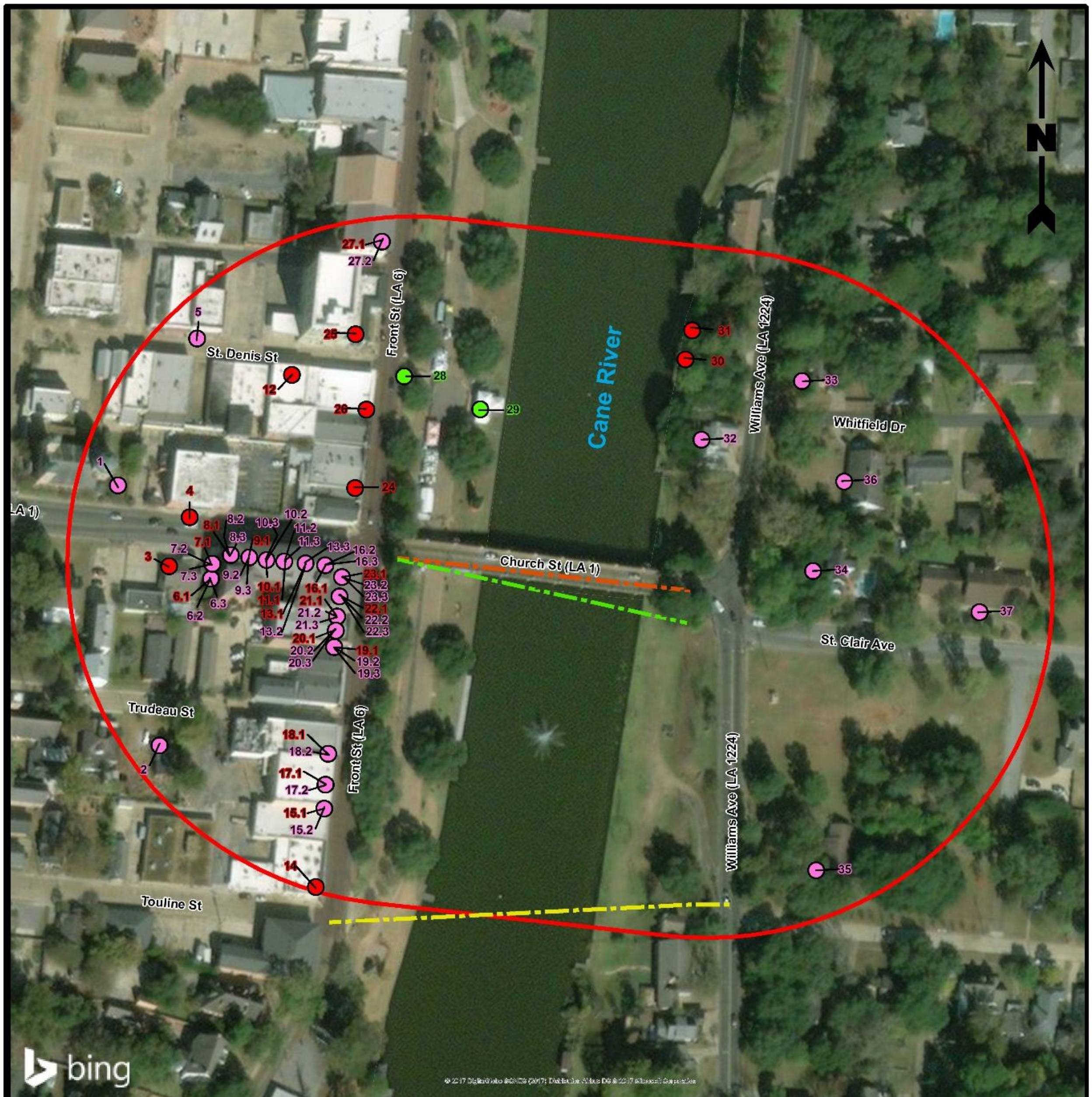
Models were used to predict noise levels for the existing year (2017), design year (2038) no-build, design year (2038) existing alignment build, and design year (2038) skewed alignment build conditions. Model limits extend along Church Street and terminate before the Second Street intersection on the western end and the Williams Avenue intersection on the eastern end. Intersecting side streets within the model limits (Front Street, Williams Avenue and St. Clair Avenue) are included in the noise models along with their respective existing and predicted traffic values. For Church Street, one roadway was modeled in each direction of travel for all four model conditions.

The proposed speed for the Build Alternatives will remain 25 mph along Church Street. Therefore, the current posted speed limits (see **Section 2.3.1**) were used for all four model conditions. Flow control devices were used in all four conditions to reflect the signalized intersections of Front Street and Williams Avenue and unsignalized intersection at St. Clair Avenue. These flow control devices account for the acceleration of vehicles as they leave these signalized intersections. The surface of Front Street is brick and mortar which is unaccounted for in the TNM 2.5 model software. According to FHWA policy only average pavement surfaces are modeled.

Several multi-family complexes are located along the project area. In accordance with LADOTD and FHWA policies, each individual unit was counted as a single receptor. For multi-floor units, a receiver was used to represent each unit. Any receiver names containing a decimal represents complexes with multiple levels. The number after the decimal represents the floor on which the unit is located. For example, 19.3 represents a receiver on the third floor. The receiver height within the model was adjusted ten feet per floor. A total of 67 noise sensitive receptors were identified within 500 feet of the Build Alternatives that might be impacted by traffic noise and could potentially benefit from noise abatement measures. These receivers were included in all four model conditions. The term receiver is used when discussing the TNM points that represent these 67 existing receptors (see **Figure 4** at the end of this section).

Other modeling elements including building barriers, ground zones, and terrain lines are described in this section. Several large buildings throughout the project area were modeled as barriers and assigned an appropriate height based on street view observations. First row receptors were carefully placed in the model to ensure they were not included behind the building barriers. Since Church Street is a bridge spanning the Cane River, four terrain lines were modeled to represent the river bank bottom and river bank top on the north and south sides of the bridge. A ground zone representing the water of Cane River was bounded by the bottom terrain lines representing the river bank. The TNM sound-level input tables for all existing receivers, future receivers, and each of the modeled elements discussed in this section are included as **Appendix D**.

FIGURE 4: TNM EXISTING RECEIVER LOCATIONS



Legend

Scale: 0 125 250 500 Feet

- Traffic Noise Study 500-ft Radius
- Alternative on Existing Alignment CL
- Alternative on Skewed Alignment CL
- Temp. Detour Bridge Touline CL
- B (Residential)
- E (Commercial)
- C (Recreational)

Reference

Base map comprised of Bing Maps aerial imagery from (c) 2017 Microsoft Corporation and its data suppliers.

Existing Receiver Locations

Cane River Bridge Church Street Route LA 1-X
Traffic Noise Study
Natchitoches Parish, Louisiana

Louisiana Department of Transportation and Development

PROVIDENCE

Created By	AMV	11/17/17
Checked By	KEJ	11/17/17
Approved By	MNM	11/17/17

Project Number 1200-001

Drawing Number 1200-001-A105

4 Figure

Providence Engineering and Design, LLC

A total of eight TNM models were used to determine the sound levels at each receiver including an AM and PM value for the following conditions: 2017 Existing Conditions, 2038 No-Build Alternative, 2038 Build Alternative on Existing Alignment, and 2038 Build Alternative on Skewed Alignment. The worst predicted hourly equivalent sound level at each receiver was obtained by using the higher of the AM and PM values (see **Table 7**). The TNM sound-level input traffic tables, TNM predicted sound-level results, and TNM plan views for the four model conditions including AM/PM are included as **Appendices E**, **F**, and **G**, respectively.

TABLE 7: WORST-CASE NOISE LEVEL DETERMINATIONS

Receiver	2017 Existing Conditions			2038 No-Build Alternative			2038 Existing Alignment Build Alternative			2038 Skewed Alignment Build Alternative		
	AM LAeq1h (dBA)	PM LAeq1h (dBA)	Level Used (dBA)	AM LAeq1h (dBA)	PM LAeq1h (dBA)	Level Used (dBA)	AM LAeq1h (dBA)	PM LAeq1h (dBA)	Level Used (dBA)	AM LAeq1h (dBA)	PM LAeq1h (dBA)	Level Used (dBA)
R1	65.6	65.8	65.8	65.8	66.1	66.1	65.8	66.1	66.1	65.8	66.1	66.1
R2	49.0	49.2	49.2	49.2	49.4	49.4	49.2	49.4	49.4	49.3	49.5	49.5
R3	67.0	67.2	67.2	67.3	67.5	67.5	67.3	67.5	67.5	67.3	67.5	67.5
R4	71.1	71.1	71.1	71.3	71.4	71.4	71.4	71.4	71.4	71.3	71.4	71.4
R5	49.5	49.8	49.8	49.7	50.0	50.0	49.7	50.0	50.0	49.8	50.0	50.0
R6.1	63.5	63.7	63.7	63.8	64.0	64.0	63.8	64.0	64.0	63.8	64.0	64.0
R6.2	63.5	63.7	63.7	63.8	64.0	64.0	63.8	64.0	64.0	63.8	64.0	64.0
R6.3	63.4	63.6	63.6	63.7	63.9	63.9	63.7	63.9	63.9	63.7	63.9	63.9
R7.1	66.1	66.3	66.3	66.3	66.5	66.5	66.3	66.5	66.5	66.3	66.5	66.5
R7.2	65.9	66.0	66.0	66.1	66.3	66.3	66.1	66.3	66.3	66.1	66.3	66.3
R7.3	65.7	65.9	65.9	65.9	66.1	66.1	65.9	66.1	66.1	65.9	66.1	66.1
R8.1	71.1	71.1	71.1	71.3	71.4	71.4	71.3	71.4	71.4	71.3	71.4	71.4
R8.2	70.6	70.7	70.7	70.8	70.9	70.9	70.9	70.9	70.9	70.8	70.9	70.9
R8.3	70.4	70.4	70.4	70.6	70.7	70.7	70.6	70.7	70.7	70.6	70.7	70.7
R9.1	71.2	71.2	71.2	71.5	71.5	71.5	71.5	71.5	71.5	71.4	71.5	71.5
R9.2	70.8	70.8	70.8	71	71.1	71.1	71.1	71.1	71.1	71.0	71.0	71.0
R9.3	70.6	70.6	70.6	70.8	70.8	70.8	70.8	70.9	70.9	70.8	70.8	70.8
R10.1	71.4	71.4	71.4	71.6	71.7	71.7	71.7	71.7	71.7	71.6	71.6	71.6
R10.2	71.0	71.0	71.0	71.2	71.3	71.3	71.3	71.3	71.3	71.2	71.2	71.2
R10.3	70.8	70.8	70.8	71	71.1	71.1	71.1	71.1	71.1	71.0	71.1	71.1
R11.1	71.7	71.7	71.7	72	72	72.0	72.1	72.1	72.1	72	72.0	72.0
R11.2	71.3	71.3	71.3	71.6	71.6	71.6	71.1	71.7	71.7	71.6	71.6	71.6
R11.3	71.1	71.1	71.1	71.4	71.4	71.4	71.4	71.5	71.5	71.3	71.4	71.4
R12	47.2	48.5	48.5	47.4	48.7	48.7	47.4	48.7	48.7	47.3	48.6	48.6
R13.1	72.3	72.3	72.3	72.5	72.6	72.6	72.7	72.8	72.8	72.5	72.6	72.6
R13.2	71.9	71.9	71.9	72.1	72.2	72.2	72.3	72.3	72.3	72.1	72.2	72.2
R13.3	71.6	71.6	71.6	71.8	71.9	71.9	72.0	72.1	72.1	71.9	71.9	71.9
R14	60.9	62.4	62.4	61.2	62.7	62.7	61.2	62.7	62.7	61.2	62.7	62.7

Receiver	2017 Existing Conditions			2038 No-Build Alternative			2038 Existing Alignment Build Alternative			2038 Skewed Alignment Build Alternative		
	AM LAeq1h (dBA)	PM LAeq1h (dBA)	Level Used (dBA)	AM LAeq1h (dBA)	PM LAeq1h (dBA)	Level Used (dBA)	AM LAeq1h (dBA)	PM LAeq1h (dBA)	Level Used (dBA)	AM LAeq1h (dBA)	PM LAeq1h (dBA)	Level Used (dBA)
R15.1	62.8	64.5	64.5	63.2	64.9	64.9	63.2	65.0	65.0	63.2	65.0	65.0
R15.2	62.6	64.2	64.2	62.9	64.6	64.6	63.1	64.7	64.7	63.2	64.8	64.8
R16.1	73.0	73.2	73.2	73.3	73.4	73.4	73.5	73.7	73.7	73.1	73.3	73.3
R16.2	72.6	72.7	72.7	72.8	73	73.0	73.1	73.3	73.3	72.7	72.8	72.8
R16.3	72.5	72.6	72.6	72.7	72.8	72.8	72.9	73.1	73.1	72.5	72.7	72.7
R17.1	63.1	64.8	64.8	63.5	65.3	65.3	63.5	65.3	65.3	63.6	65.3	65.3
R17.2	63.0	64.5	64.5	63.3	65.0	65.0	63.5	65.0	65.0	63.5	65.1	65.1
R18.1	63.4	65.1	65.1	63.7	65.5	65.5	63.8	65.5	65.5	63.8	65.6	65.6
R18.2	63.4	64.9	64.9	63.7	65.3	65.3	63.8	65.4	65.4	63.9	65.5	65.5
R19.1	65.8	67.5	67.5	66.1	67.8	67.8	66.2	67.8	67.8	66.3	67.9	67.9
R19.2	66.0	67.4	67.4	66.2	67.7	67.7	66.2	67.7	67.7	66.3	67.7	67.7
R19.3	65.9	67.3	67.3	66.1	67.6	67.6	66.1	67.6	67.6	66.1	67.6	67.6
R20.1	66.6	68.1	68.1	66.9	68.4	68.4	66.9	68.4	68.4	66.9	68.4	68.4
R20.2	66.6	68.0	68.0	66.9	68.3	68.3	66.9	68.3	68.3	66.9	68.3	68.3
R20.3	66.4	67.8	67.8	66.7	68.1	68.1	66.8	68.1	68.1	66.8	68.2	68.2
R21.1	67.5	68.9	68.9	67.7	69.1	69.1	67.5	68.9	68.9	67.5	69	69.0
R21.2	67.4	68.7	68.7	67.7	69	69.0	67.5	68.8	68.8	67.5	68.8	68.8
R21.3	67.2	68.5	68.5	67.4	68.8	68.8	67.3	68.6	68.6	67.3	68.6	68.6
R22.1	68.8	70.0	70.0	69	70.3	70.3	69.0	70.2	70.2	69.0	70.2	70.2
R22.2	68.7	69.9	69.9	68.9	70.2	70.2	68.9	70.1	70.1	68.9	70.1	70.1
R22.3	68.5	69.7	69.7	68.7	70	70.0	68.8	69.9	69.9	68.7	69.9	69.9
R23.1	70.8	71.9	71.9	71.1	72.1	72.1	71.3	72.3	72.3	71.2	72.2	72.2
R23.2	70.6	71.7	71.7	70.9	71.9	71.9	71.0	72.1	72.1	70.9	72	72.0
R23.3	70.5	71.5	71.5	70.7	71.8	71.8	71.0	72.0	72.0	70.9	71.9	71.9
R24	69.4	70.8	70.8	69.6	70.9	70.9	69.5	70.9	70.9	69.5	70.9	70.9
R25	60.5	62.0	62.0	60.7	62.1	62.1	60.7	62.2	62.2	60.7	62.2	62.2
R26	66.8	68.3	68.3	67.0	68.5	68.5	67.0	68.5	68.5	67.1	68.5	68.5
R27.1	64.0	65.4	65.4	64.2	65.5	65.5	64.2	65.5	65.5	64.2	65.5	65.5
R27.2	63.6	64.9	64.9	63.7	65	65.0	63.8	65.1	65.1	63.8	65.1	65.1
R28	63.1	64.6	64.6	63.3	64.8	64.8	63.4	65.0	65.0	63.4	64.8	64.8

Receiver	2017 Existing Conditions			2038 No-Build Alternative			2038 Existing Alignment Build Alternative			2038 Skewed Alignment Build Alternative		
	AM LAeq1h (dBA)	PM LAeq1h (dBA)	Level Used (dBA)	AM LAeq1h (dBA)	PM LAeq1h (dBA)	Level Used (dBA)	AM LAeq1h (dBA)	PM LAeq1h (dBA)	Level Used (dBA)	AM LAeq1h (dBA)	PM LAeq1h (dBA)	Level Used (dBA)
R29	59.2	59.9	59.9	59.4	60.1	60.1	59.2	60.0	60.0	59.1	59.8	59.8
R30	59.0	59.2	59.2	59.2	59.4	59.4	59.4	59.6	59.6	59.1	59.2	59.2
R31	58.5	58.6	58.6	58.7	58.8	58.8	58.9	59.1	59.1	58.6	58.7	58.7
R32	64.5	64.5	64.5	64.7	64.7	64.7	65.1	65.1	65.1	64.5	64.5	64.5
R33	64.7	64.6	64.7	64.9	64.8	64.9	64.9	64.9	64.9	64.5	64.3	64.5
R34	65.0	65.2	65.2	65.3	65.6	65.6	65.5	65.8	65.8	64.8	65.0	65.0
R35	60.2	60.8	60.8	60.5	61.1	61.1	60.5	61.1	61.1	61.2	61.8	61.8
R36	61.0	61.2	61.2	61.3	61.5	61.5	61.7	61.9	61.9	60.9	61.1	61.1
R37	58.4	58.7	58.7	58.5	58.9	58.9	58.5	58.8	58.8	58.6	59	59.0

NOTES:

1. Models were run for both AM/PM time periods, and the highest predicted hourly equivalent sound level was selected for use in the analysis.

2.4 Determination of Traffic Noise Impacts

As discussed in **Section 2.1**, traffic noise impacts occur when the future noise levels approach or exceed the FHWA NAC or when the future noise levels exceed the existing noise levels by 10 dBA. The predicted noise levels from **Table 7** were used to predict traffic noise impacts for the Design Year No-Build and Build Alternatives. A summary of the TNM predicted levels and impact type, if any, is shown in **Table 8**. The No-Build conditions resulted in a sound level noise impact to 35 of the 67 receivers modeled (see **Figure 5a** at the end of this section). All but eight of the impacted receivers represent residential (Category B) receptors. The eight commercial receptors represent Church Street Inn (Receiver 4), Merci Beaucoup Gift Shop (Receiver 8.1 and 9.1), The Breakfast Nook (Receiver 10.1), Brenda’s Clothing & Accessories (Receiver 11.1 and 13.1), and Front Street Market (Receiver 16.1 and 23.1). All impacts were sound level impacts that resulted from the predicted noise reaching the NAC of 66 dBA for Category B and 71 dBA for Category C.

The same 67 receivers were modeled for the two 2038 Build Alternative conditions. Sound level impacts occurred for 35 receivers, the same receivers impacted in the No-Build 2038 conditions. **Figure 5b** and **Figure 5c** at the end of this section illustrates the impacted build receivers.

TABLE 8: TNM PREDICTED NOISE LEVELS

Receiver	NAC Category (1)	DOTD NAC (dBA)	Existing Year (2017)	Design Year (2038)								
				No-Build			Existing Alignment Build			Skewed Alignment Build		
			LAeq1h (dBA)	LAeq1h (dBA)	Increase over Existing (dBA)	Impact Type (2)	LAeq1h (dBA)	Increase over Existing (dBA)	Impact Type (2)	LAeq1h (dBA)	Increase over Existing (dBA)	Impact Type (2)
R1	C	66	65.8	66.1	0.3	SL	66.1	0.3	SL	66.1	0.3	SL
R2	B	66	49.2	49.4	0.2	-	49.4	0.2	-	49.5	0.3	-
R3	E	71	67.2	67.5	0.3	-	67.5	0.3	-	67.5	0.3	-
R4	E	71	71.1	71.4	0.3	SL	71.4	0.3	SL	71.4	0.3	SL
R5	E	71	49.8	50.0	0.2	-	50.0	0.2	-	50.0	0.2	-
R6.1	E	71	63.7	64.0	0.3	-	64.0	0.3	-	64.0	0.3	-
R6.2	B	66	63.7	64.0	0.3	-	64.0	0.3	-	64.0	0.3	-
R6.3	B	66	63.6	63.9	0.3	-	63.9	0.3	-	63.9	0.3	-
R7.1	E	71	66.3	66.5	0.2	-	66.5	0.2	-	66.5	0.2	-
R7.2	B	66	66.0	66.3	0.3	SL	66.3	0.3	SL	66.3	0.3	SL
R7.3	B	66	65.9	66.1	0.2	SL	66.1	0.2	SL	66.1	0.2	SL
R8.1	E	71	71.1	71.4	0.3	SL	71.4	0.3	SL	71.4	0.3	SL
R8.2	B	66	70.7	70.9	0.2	SL	70.9	0.2	SL	70.9	0.2	SL
R8.3	B	66	70.4	70.7	0.3	SL	70.7	0.3	SL	70.7	0.3	SL
R9.1	E	71	71.2	71.5	0.3	SL	71.5	0.3	SL	71.5	0.3	SL
R9.2	B	66	70.8	71.1	0.3	SL	71.1	0.3	SL	71.0	0.2	SL
R9.3	B	66	70.6	70.8	0.2	SL	70.9	0.3	SL	70.8	0.2	SL
R10.1	E	71	71.4	71.7	0.3	SL	71.7	0.3	SL	71.6	0.2	SL
R10.2	B	66	71.0	71.3	0.3	SL	71.3	0.3	SL	71.2	0.2	SL
R10.3	B	66	70.8	71.1	0.3	SL	71.1	0.3	SL	71.1	0.3	SL
R11.1	E	71	71.7	72.0	0.3	SL	72.1	0.4	SL	72.0	0.3	SL
R11.2	B	66	71.3	71.6	0.3	SL	71.7	0.4	SL	71.6	0.3	SL
R11.3	B	66	71.1	71.4	0.3	SL	71.5	0.4	SL	71.4	0.3	SL
R12	E	71	48.5	48.7	0.2	-	48.7	0.2	-	48.6	0.1	-
R13.1	E	71	72.3	72.6	0.3	SL	72.8	0.5	SL	72.6	0.3	SL
R13.2	B	66	71.9	72.2	0.3	SL	72.3	0.4	SL	72.2	0.3	SL
R13.3	B	66	71.6	71.9	0.3	SL	72.1	0.5	SL	71.9	0.3	SL

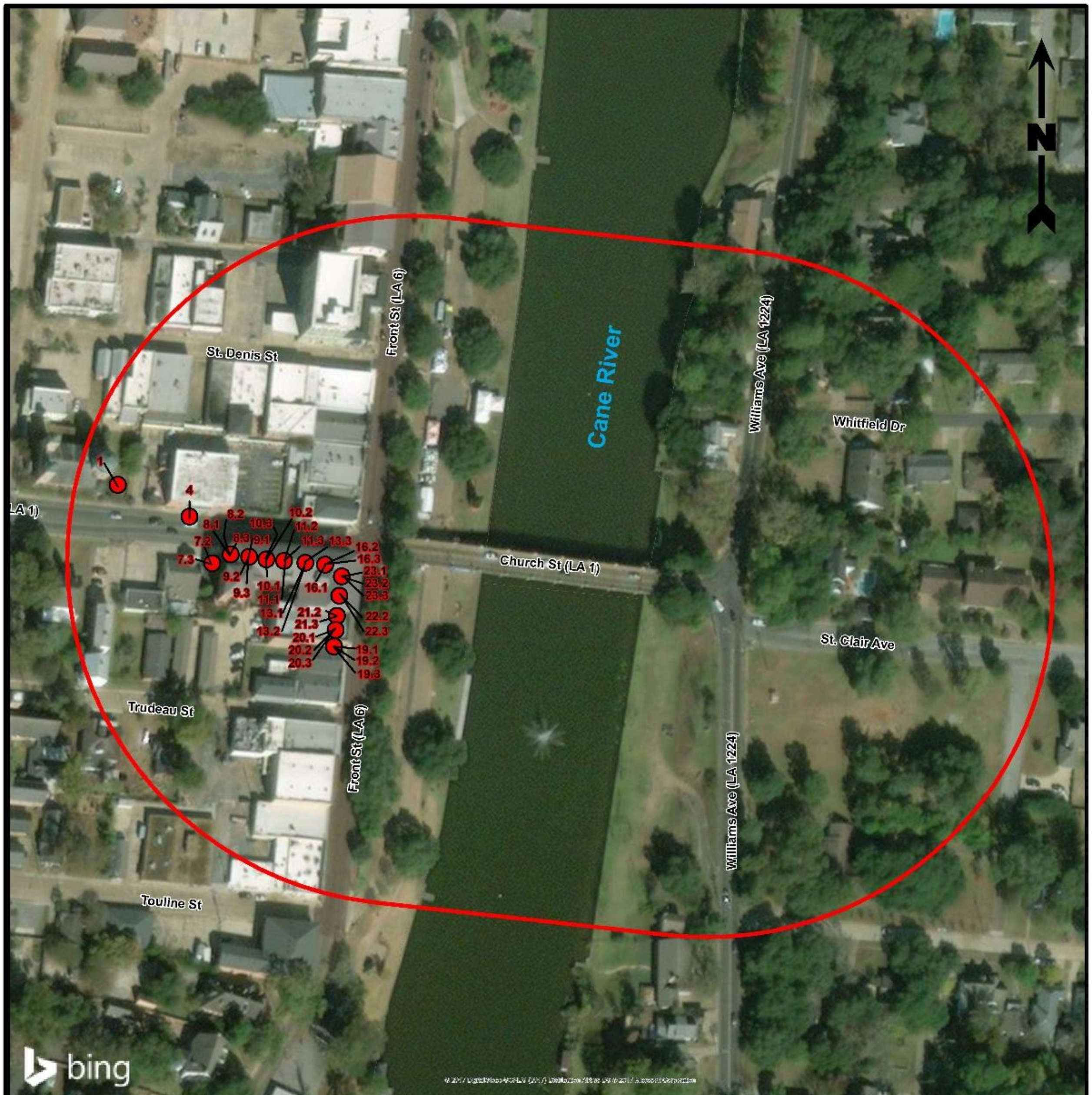
Receiver	NAC Category (1)	DOTD NAC (dBA)	Existing Year (2017)	Design Year (2038)								
				No-Build			Existing Alignment Build			Skewed Alignment Build		
			LAeq1h (dBA)	LAeq1h (dBA)	Increase over Existing (dBA)	Impact Type (2)	LAeq1h (dBA)	Increase over Existing (dBA)	Impact Type (2)	LAeq1h (dBA)	Increase over Existing (dBA)	Impact Type (2)
R14	E	71	62.4	62.7	0.3	-	62.7	0.3	-	62.7	0.3	-
R15.1	E	71	64.5	64.9	0.4	-	65.0	0.5	-	65.0	0.5	-
R15.2	B	66	64.2	64.6	0.4	-	64.7	0.5	-	64.8	0.6	-
R16.1	E	71	73.2	73.4	0.2	SL	73.7	0.5	SL	73.3	0.1	SL
R16.2	B	66	72.7	73.0	0.3	SL	73.3	0.6	SL	72.8	0.1	SL
R16.3	B	66	72.6	72.8	0.2	SL	73.1	0.5	SL	72.7	0.1	SL
R17.1	E	71	64.8	65.3	0.5	-	65.3	0.5	-	65.3	0.5	-
R17.2	B	66	64.5	65.0	0.5	-	65.0	0.5	-	65.1	0.6	-
R18.1	E	71	65.1	65.5	0.4	-	65.5	0.4	-	65.6	0.5	-
R18.2	B	66	64.9	65.3	0.4	-	65.4	0.5	-	65.5	0.6	-
R19.1	B	66	67.5	67.8	0.3	SL	67.8	0.3	SL	67.9	0.4	SL
R19.2	B	66	67.4	67.7	0.3	SL	67.7	0.3	SL	67.7	0.3	SL
R19.3	B	66	67.3	67.6	0.3	SL	67.6	0.3	SL	67.6	0.3	SL
R20.1	B	66	68.1	68.4	0.3	SL	68.4	0.3	SL	68.4	0.3	SL
R20.2	B	66	68.0	68.3	0.3	SL	68.3	0.3	SL	68.3	0.3	SL
R20.3	B	66	67.8	68.1	0.3	SL	68.1	0.3	SL	68.2	0.4	SL
R21.1	E	71	68.9	69.1	0.2	-	68.9	0.0	-	69.0	0.1	-
R21.2	B	66	68.7	69.0	0.3	SL	68.8	0.1	SL	68.8	0.1	SL
R21.3	B	66	68.5	68.8	0.3	SL	68.6	0.1	SL	68.6	0.1	SL
R22.1	E	71	70.0	70.3	0.3	-	70.2	0.2	-	70.2	0.2	-
R22.2	B	66	69.9	70.2	0.3	SL	70.1	0.2	SL	70.1	0.2	SL
R22.3	B	66	69.7	70.0	0.3	SL	69.9	0.2	SL	69.9	0.2	SL
R23.1	E	71	71.9	72.1	0.2	SL	72.3	0.4	SL	72.2	0.3	SL
R23.2	B	66	71.7	71.9	0.2	SL	72.1	0.4	SL	72.0	0.3	SL
R23.3	B	66	71.5	71.8	0.3	SL	72.0	0.5	SL	71.9	0.4	SL
R24	E	71	70.8	70.9	0.1	-	70.9	0.1	-	70.9	0.1	-
R25	E	71	62.0	62.1	0.1	-	62.2	0.2	-	62.2	0.2	-
R26	E	71	68.3	68.5	0.2	-	68.5	0.2	-	68.5	0.2	-

Receiver	NAC Category (1)	DOTD NAC (dBA)	Existing Year (2017)	Design Year (2038)								
				No-Build			Existing Alignment Build			Skewed Alignment Build		
			LAeq1h (dBA)	LAeq1h (dBA)	Increase over Existing (dBA)	Impact Type (2)	LAeq1h (dBA)	Increase over Existing (dBA)	Impact Type (2)	LAeq1h (dBA)	Increase over Existing (dBA)	Impact Type (2)
R27.1	E	71	65.4	65.5	0.1	-	65.5	0.1	-	65.5	0.1	-
R27.2	B	66	64.9	65.0	0.1	-	65.1	0.2	-	65.1	0.2	-
R28	C	66	64.6	64.8	0.2	-	65.0	0.4	-	64.8	0.2	-
R29	C	66	59.9	60.1	0.2	-	60.0	0.1	-	59.8	-0.1	-
R30	E	71	59.2	59.4	0.2	-	59.6	0.4	-	59.2	0.0	-
R31	E	71	58.6	58.8	0.2	-	59.1	0.5	-	58.7	0.1	-
R32	B	66	64.5	64.7	0.2	-	65.1	0.6	-	64.5	0.0	-
R33	B	66	64.7	64.9	0.2	-	64.9	0.2	-	64.5	-0.2	-
R34	B	66	65.2	65.6	0.4	-	65.8	0.6	-	65.0	-0.2	-
R35	B	66	60.8	61.1	0.3	-	61.1	0.3	-	61.8	1.0	-
R36	B	66	61.2	61.5	0.3	-	61.9	0.7	-	61.1	-0.1	-
R37	B	66	58.7	58.9	0.2	-	58.8	0.1	-	59.0	0.3	-

NOTES:

1. NAC Categories are defined in Table 2.
2. Impact types include SL or SI.

FIGURE 5a: 2038 NO-BUILD IMPACTED RECEIVERS



Legend

0 125 250 500 Feet

Traffic Noise Study 500-ft Radius

No-Build Impacted Receivers

Reference

Base map comprised of Bing Maps aerial imagery from (c) 2017 Microsoft Corporation and its data suppliers.

2038 No-Build Impacted Receivers

Cane River Bridge Church Street Route LA 1-X
Traffic Noise Study
Natchitoches Parish, Louisiana

Louisiana Department of Transportation and Development

PROVIDENCE

Created By	AMV	11/21/17
Checked By	KEJ	11/21/17
Approved By	MNM	11/21/17

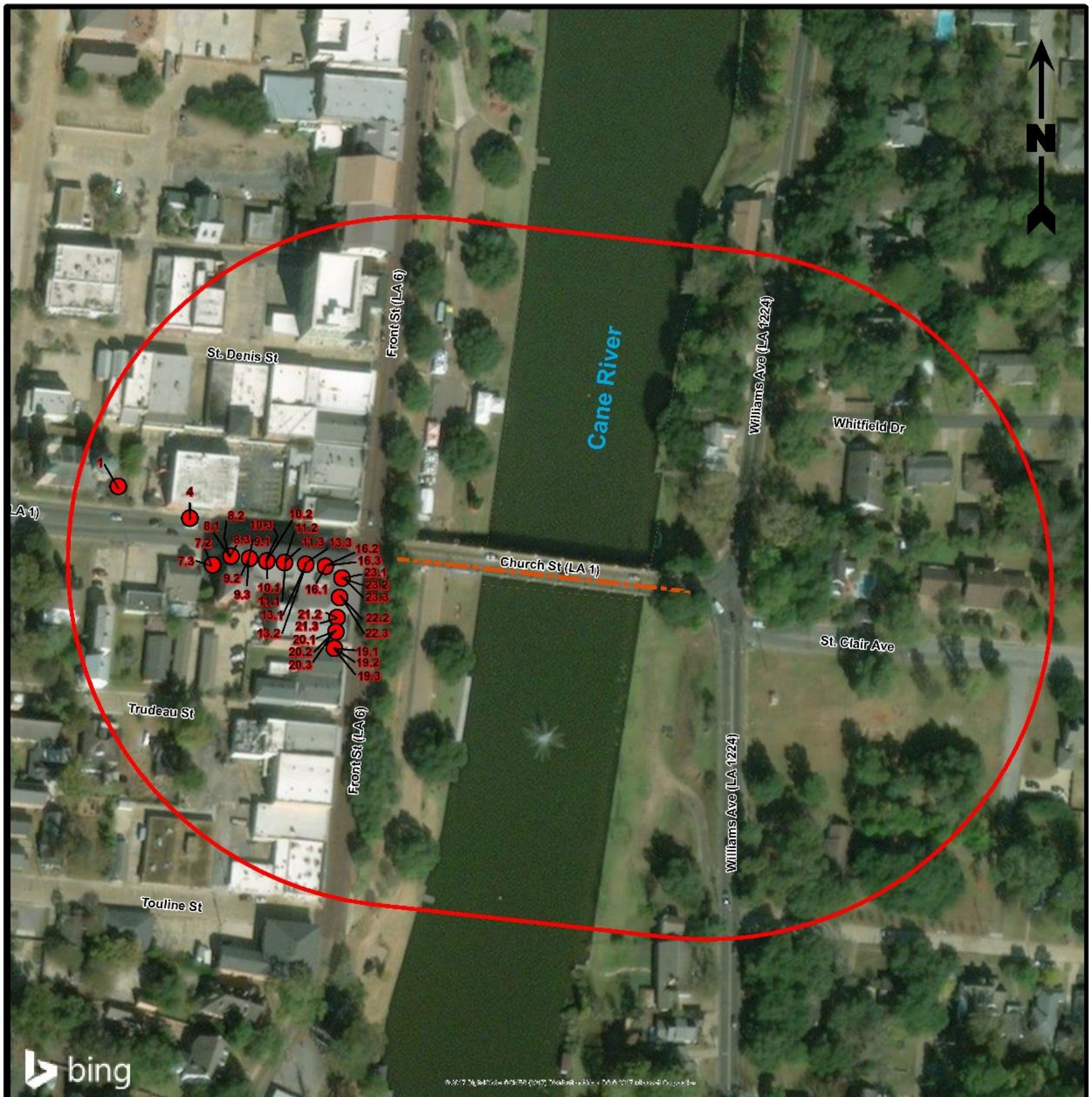
Project Number 1200-001

Drawing Number 1200-001-A106

5a Figure

Providence Engineering and Design, LLC

FIGURE 5b: 2038 EXISTING ALIGNMENT BUILD IMPACTED RECEIVERS



Legend

0 125 250 500 Feet

- Traffic Noise Study 500-ft Radius
- Alternative on Existing Alignment CL
- Impacted Receivers

Reference

Base map comprised of Bing Maps aerial imagery from (c) 2017 Microsoft Corporation and its data suppliers.

2038 Existing Alignment Impacted Receivers

Cane River Bridge Church Street Route LA 1-X
Traffic Noise Study
Natchitoches Parish, Louisiana

Louisiana Department of Transportation and Development

PROVIDENCE

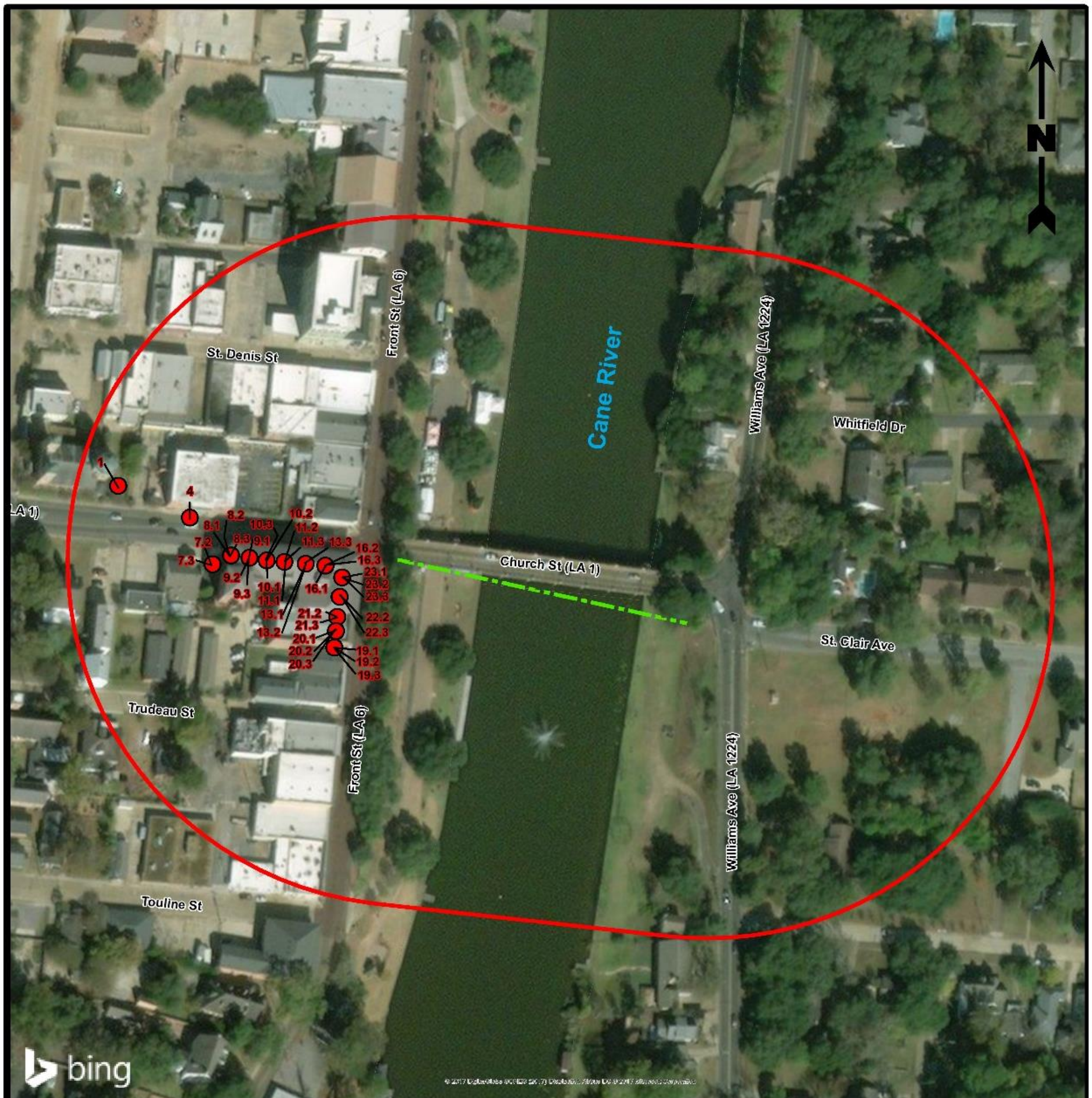
Revised By	AMV	11/21/17
Checked By	KEJ	11/21/17
Approved By	MNM	11/21/17

Project Number 1200-001

Drawing Number 1200-001-A107

5b Figure

FIGURE 5c: 2038 SKEWED ALIGNMENT BUILD IMPACTED RECEIVERS



Legend

Feet: 0 125 250 500

- Traffic Noise Study 500-ft Radius
- Alternative on Skewed Alignment CL
- Impacted Receivers

Reference

Base map comprised of Bing Maps aerial imagery from (c) 2017 Microsoft Corporation and its data suppliers.

2038 Skewed Alignment
Impacted Receivers

Cane River Bridge Church Street Route LA 1-X
Traffic Noise Study
Natchitoches Parish, Louisiana

Louisiana Department of Transportation and Development

PROVIDENCE

Revised By	AMV	11/21/17
Checked By	KEJ	11/21/17
Approved By	MNM	11/21/17

Project Number: 1200-001

Drawing Number: 1200-001-A108

5c Figure

Providence Engineering and Design, LLC

2.5 Evaluation of Noise Abatement

Noise abatement measures must be considered when a traffic noise impact occurs. A noise abatement measure is any positive action taken to reduce the impact of traffic noise on an activity area. Noise abatement shall be considered and evaluated for both feasibility and reasonableness when traffic noise impacts are identified, according to FHWA guidance and the LADOTD policy. This information is assessed to determine if the abatement goals can be achieved and, if so, if the abatement measures can be physically implemented. As discussed in **Section 2.4**, noise abatement measures were evaluated for the 35 impacted receptors for the 2038 Build Alternatives.

2.5.1 Traffic Management Measures

Controlling traffic can sometimes reduce highway traffic noise levels. Signs for prohibition or time restrictions of certain vehicle types would not be feasible since Church Street (LA 1-X) serves as an urban principal arterial. *No Engine Brake* signs could also reduce noise levels near flow control devices. Of the 35 impacted receptors, 34 are located near the signalized intersection of Church Street and Front Street. These receptors could potentially benefit from the use of *No Engine Brake* signs.

Modified speed limits could also result in a reduction of highway traffic noise. A model was created using the 2038 Build Alternative on Existing Alignment PM traffic volumes, the 35 impacted receivers, and a reduction in the speed limit along the Church Street Bridge from 25 mph to 20 mph. The PM peak model was used because it was selected as the worst-case noise level 99 percent of the time (see **Table 7**). All of the 35 impacted receptors remained impacted with the posted speed of 20 mph. An additional noise reduction model was run reducing the speed limit within the project area to 15 mph along the Church Street Bridge. Again, all of the 35 impacted receptors remained impacted with the posted speed of 15 mph. A similar reaction happened when the 2038 Build Alternative on Skewed Alignment PM model was tested for speed reductions. A summary of the speed reduction analysis for both Build Alternatives is shown in **Tables 9a** and **9b**. The TNM predicted sound-level result tables for both speed reduction models are included as **Appendix H**.

The final determination regarding *No Engine Brake* signs and the posted speed will be determined during final design.

TABLE 9a: SPEED REDUCTION ANALYSIS

Impacted Receivers	2038 Existing Alignment PM LAeq1h (dBA)	20 mph Speed Abatement LAeq1h (dBA)	Still Impacted	15 mph Speed Abatement LAeq1h (dBA)	Still Impacted
R1	66.1	66.1	Yes	66.1	Yes
R4	71.4	71.4	Yes	71.4	Yes
R7.2	66.3	66.3	Yes	66.3	Yes
R7.3	66.1	66.1	Yes	66.1	Yes
R8.1	71.4	71.4	Yes	71.4	Yes
R8.2	70.9	70.9	Yes	70.9	Yes
R8.3	70.7	70.7	Yes	70.7	Yes
R9.1	71.5	71.5	Yes	71.5	Yes
R9.2	71.0	71.1	Yes	71.1	Yes
R9.3	70.8	70.9	Yes	70.9	Yes
R10.1	71.7	71.7	Yes	71.7	Yes
R10.2	71.3	71.3	Yes	71.3	Yes
R10.3	71.1	71.1	Yes	71.1	Yes
R11.1	72.0	72.1	Yes	72.1	Yes
R11.2	71.7	71.7	Yes	71.7	Yes
R11.3	71.4	71.4	Yes	71.4	Yes
R13.1	72.8	72.7	Yes	72.7	Yes
R13.2	72.3	72.3	Yes	72.3	Yes
R13.3	72.1	72.1	Yes	72.0	Yes
R16.1	73.7	73.6	Yes	73.7	Yes
R16.2	73.3	73.3	Yes	73.2	Yes
R16.3	73.1	73.1	Yes	73.0	Yes
R19.1	67.8	67.8	Yes	67.7	Yes
R19.2	67.7	67.6	Yes	67.5	Yes
R19.3	67.6	67.5	Yes	67.4	Yes
R20.1	68.4	68.3	Yes	68.2	Yes
R20.2	68.3	68.2	Yes	68.1	Yes
R20.3	68.1	68.1	Yes	68.0	Yes
R21.2	68.9	68.8	Yes	68.7	Yes
R21.3	68.7	68.6	Yes	68.5	Yes
R22.2	70.1	70.1	Yes	70.0	Yes
R22.3	69.9	69.9	Yes	69.8	Yes
R23.1	72.1	72.3	Yes	72.2	Yes
R23.2	71.9	72	Yes	72	Yes
R23.3	71.8	71.9	Yes	71.9	Yes

TABLE 9b: SPEED REDUCTION ANALYSIS

Impacted Receivers	2038 Skewed Alignment PM LAeq1h (dBA)	20 mph Speed Abatement LAeq1h (dBA)	Still Impacted	15 mph Speed Abatement LAeq1h (dBA)	Still Impacted
R1	66.1	66.1	Yes	66.1	Yes
R4	71.4	71.4	Yes	71.4	Yes
R7.2	66.3	66.3	Yes	66.3	Yes
R7.3	66.1	66.1	Yes	66.1	Yes
R8.1	71.4	71.4	Yes	71.4	Yes
R8.2	70.9	70.9	Yes	70.9	Yes
R8.3	70.7	70.6	Yes	70.7	Yes
R9.1	71.5	71.5	Yes	71.5	Yes
R9.2	71.0	71.0	Yes	71.0	Yes
R9.3	70.8	70.8	Yes	70.8	Yes
R10.1	71.6	71.6	Yes	71.6	Yes
R10.2	71.2	71.2	Yes	71.2	Yes
R10.3	71.1	71.1	Yes	71	Yes
R11.1	72.0	72.0	Yes	72.0	Yes
R11.2	71.6	71.6	Yes	71.6	Yes
R11.3	71.4	71.4	Yes	71.4	Yes
R13.1	72.6	72.6	Yes	72.6	Yes
R13.2	72.2	72.2	Yes	72.2	Yes
R13.3	71.9	71.9	Yes	71.9	Yes
R16.1	73.3	73.3	Yes	73.4	Yes
R16.2	72.8	72.8	Yes	73	Yes
R16.3	72.7	72.7	Yes	72.8	Yes
R19.1	67.9	67.8	Yes	67.7	Yes
R19.2	67.7	67.7	Yes	67.5	Yes
R19.3	67.6	67.5	Yes	67.4	Yes
R20.1	68.4	68.3	Yes	68.3	Yes
R20.2	68.3	68.2	Yes	68.1	Yes
R20.3	68.2	68.1	Yes	68.0	Yes
R21.2	69.0	68.8	Yes	68.7	Yes
R21.3	68.7	68.6	Yes	68.5	Yes
R22.2	70.1	70.1	Yes	70.0	Yes
R22.3	69.9	69.9	Yes	69.8	Yes
R23.1	72.1	72.2	Yes	72.2	Yes
R23.2	71.9	71.9	Yes	71.9	Yes
R23.3	71.8	71.9	Yes	71.8	Yes

2.5.2 Alteration of Horizontal and Vertical Alignments

A reduction in noise levels may be gained by suppressing a roadway vertical alignment to create a natural berm or by shifting the horizontal alignment away from the noise sensitive receptor (FHWA, 2011). The proposed roadway will be constructed at-grade to blend with the existing environment and lessen visual impacts. Due to the number of residential and commercial structures located along the east side and west side, the potential corridor space is limited and will not allow for further shifting of the horizontal alignment. Additionally, both Build Alternatives consist of widening the existing bridge facility; therefore, it would not be feasible to alter the horizontal or vertical alignment to abate traffic noise impacts.

2.5.3 Acquisition of Property Rights

One abatement measure is the acquisition of property to serve as a buffer zone to prevent development that would be adversely impacted by traffic noise. "The potential use of buffer zones applies to predominantly unimproved property; not to purchase homes or developed property to create a noise buffer zone" (FHWA, 2011). In this case, the impacted receptors represent the first row of structures. For this project, it would not be feasible to acquire property rights to serve as a buffer zone for these receptors.

2.5.4 Noise Insulation of Public Use or Nonprofit Institutional Structures

A reduction of highway traffic noise may be gained by insulating buildings. "Highway agencies may only consider noise insulation for public use or nonprofit institutional structures, *e.g.*, places of worship, schools, hospitals, libraries, *etc*. Public use or nonprofit institutional structures is defined as a facility that is open for public use, owned by the public, or that a nonprofit organization owns the facility" (FHWA, 2011). No public use or nonprofit institutional structures are located near the proposed project; therefore, the insulation of buildings was not considered as a noise abatement measure.

2.5.5 Construction of Noise Barriers

The last noise abatement measure considered was construction of noise barriers. Noise barriers are typically a solid wall-like structure located between the noise source and the impacted receptor to reduce noise levels. The LADOTD's noise policy establishes the criteria for determining a noise barrier's feasibility and reasonableness. For feasibility, a noise barrier must result in at least a 5 dBA reduction in highway traffic noise for 75 percent of the first row impacted receptors to be considered feasible. Other feasibility factors include access to adjacent properties, barrier height, safety, topography, utilities, drainage, and maintenance of the abatement measure.

The reasonableness of any abatement measure is determined if the following three criteria are met:

- At least one receptor receives an 8 dBA noise reduction
- The cost estimate is equal to or less than $35,000 per benefited receptor (a receptor that receives at least a 5 dBA noise reduction, regardless of whether or not the receptor was impacted)
- No relevant objections are made during initial public involvement or if during follow-up solicitation with benefited receptors, 50 percent or more of the responses are positive

Noise barriers were initially considered for all 35 impacted receptors for the Existing Alignment and Skewed Alignment Build Alternatives (see **Tables 10a** and **10b**). A noise barrier would not be feasible for all receptors along Front Street due to the recurring breaks that would be required to maintain property and side street access to these receptors. A noise barrier analysis in TNM 2.5 was conducted for the 35 impacted receivers that represent residential and commercial receptors. The noise barrier analysis considered four potential barrier locations along the bridge on Church Street (see **Figures 6a** and **6b** at the end of this section).

TABLE 10a: BARRIER CONSIDERATION FOR BUILD IMPACTED RECEPTORS

Receptor Name	Barriers Considered
R1	Barrier Analysis 1 & 2
R4	Barrier Analysis 1 & 2
R7.2	Barrier Analysis 1 & 2
R7.3	Barrier Analysis 1 & 2
R8.1	Barrier Analysis 1 & 2
R8.2	Barrier Analysis 1 & 2
R8.3	Barrier Analysis 1 & 2
R9.1	Barrier Analysis 1 & 2
R9.2	Barrier Analysis 1 & 2
R9.3	Barrier Analysis 1 & 2
R10.1	Barrier Analysis 1 & 2
R10.2	Barrier Analysis 1 & 2
R10.3	Barrier Analysis 1 & 2
R11.1	Barrier Analysis 1 & 2
R11.2	Barrier Analysis 1 & 2
R11.3	Barrier Analysis 1 & 2
R13.1	Barrier Analysis 1 & 2
R13.2	Barrier Analysis 1 & 2
R13.3	Barrier Analysis 1 & 2
R16.1	Barrier Analysis 1 & 2
R16.2	Barrier Analysis 1 & 2
R16.3	Barrier Analysis 1 & 2
R19.1	Barrier Analysis 1 & 2
R19.2	Barrier Analysis 1 & 2
R19.3	Barrier Analysis 1 & 2
R20.1	Barrier Analysis 1 & 2
R20.2	Barrier Analysis 1 & 2
R20.3	Barrier Analysis 1 & 2
R21.2	Barrier Analysis 1 & 2
R21.3	Barrier Analysis 1 & 2
R22.2	Barrier Analysis 1 & 2
R22.3	Barrier Analysis 1 & 2
R23.1	Barrier Analysis 1 & 2
R23.2	Barrier Analysis 1 & 2
R23.3	Barrier Analysis 1 & 2

TABLE 10b: BARRIER CONSIDERATION FOR BUILD IMPACTED RECEPTORS

Receptor Name	Barriers Considered
R1	Barrier Analysis 3 & 4
R4	Barrier Analysis 3 & 4
R7.2	Barrier Analysis 3 & 4
R7.3	Barrier Analysis 3 & 4
R8.1	Barrier Analysis 3 & 4
R8.2	Barrier Analysis 3 & 4
R8.3	Barrier Analysis 3 & 4
R9.1	Barrier Analysis 3 & 4
R9.2	Barrier Analysis 3 & 4
R9.3	Barrier Analysis 3 & 4
R10.1	Barrier Analysis 3 & 4
R10.2	Barrier Analysis 3 & 4
R10.3	Barrier Analysis 3 & 4
R11.1	Barrier Analysis 3 & 4
R11.2	Barrier Analysis 3 & 4
R11.3	Barrier Analysis 3 & 4
R13.1	Barrier Analysis 3 & 4
R13.2	Barrier Analysis 3 & 4
R13.3	Barrier Analysis 3 & 4
R16.1	Barrier Analysis 3 & 4
R16.2	Barrier Analysis 3 & 4
R16.3	Barrier Analysis 3 & 4
R19.1	Barrier Analysis 3 & 4
R19.2	Barrier Analysis 3 & 4
R19.3	Barrier Analysis 3 & 4
R20.1	Barrier Analysis 3 & 4
R20.2	Barrier Analysis 3 & 4
R20.3	Barrier Analysis 3 & 4
R21.2	Barrier Analysis 3 & 4
R21.3	Barrier Analysis 3 & 4
R22.2	Barrier Analysis 3 & 4
R22.3	Barrier Analysis 3 & 4
R23.1	Barrier Analysis 3 & 4
R23.2	Barrier Analysis 3 & 4
R23.3	Barrier Analysis 3 & 4

For each of the four barrier analyses, the initial barrier length was determined by evaluating the length of the new Church Street Bridge and would allow for continued access on adjacent streets and driveways. The barrier height was initially modeled at 14 feet on structure to determine if the first reasonableness criteria (an 8 dBA reduction at one receptor) could be met at the maximum height and length. If it could not be met, no further analysis was conducted. If it could be met, then the height and length would be adjusted to try and achieve the reasonableness cost criteria (less than $35,000 per benefited receptor), as well as the feasibility criteria of at least a 5 dBA reduction for the first row of impacted receivers. The rest of this section discusses the details for each barrier analysis, and a summary is included as **Table 11**.

TABLE 11: BARRIER RESULTS

Barrier	Height (ft)	Length (ft)	Area (sq ft)	5 dBA Reduction Receptor	8 dBA Reduction Receptor	Unit Cost (1)	Total Cost	Cost Per Benefitted Receptor
1	14	479	6,706	0	0	$43	$288,358	N/A (2)
2	14	471	6,594	0	0	$43	$283,542	N/A (2)
3	14	489	6,846	0	0	$43	$294,378	N/A (2)
4	14	482	6,748	0	0	$43	$290,164	N/A (2)

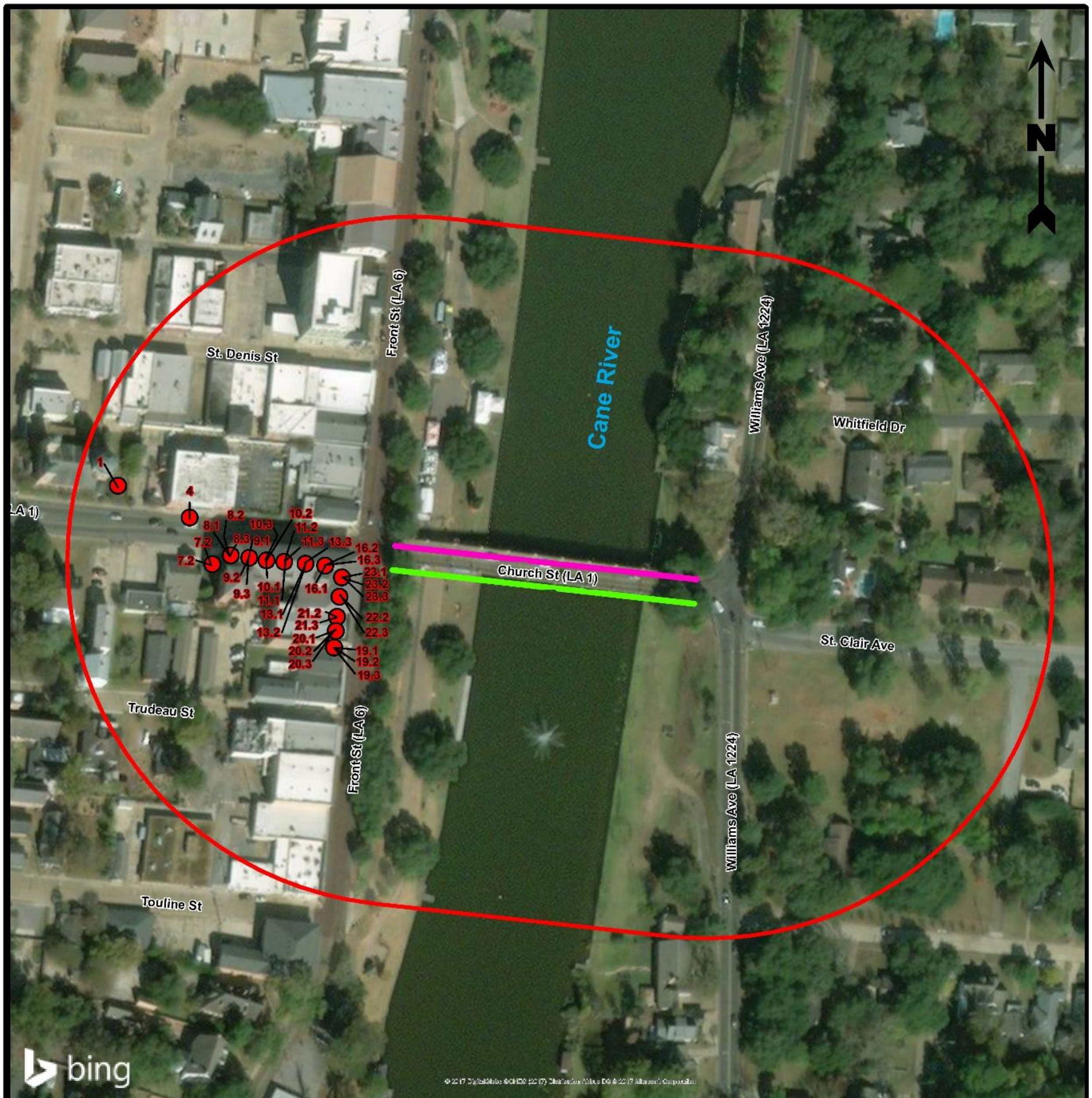
NOTES:
1. The unit cost was obtained from the LADOTD 2016 noise barrier estimated construction costs, which was found on the LADOTD Noise Compatibility webpage.
2. There were no benefitted receptors at the maximum 14-foot modeled barrier height. Therefore, the cost per benefitted receptor could not be determined.

Barrier 1 and Barrier 2 were modeled in the 2038 Build Alternative on Existing Alignment to abate noise impacts for 35 impacted receivers (see **Table 10a**). The lengths of these barriers were restricted to 471 feet due to the length of the Church Street bridge structure and sight lines to existing intersections. Of the 35 impacted receptors, all but two (Receptors 1 and 4) are first-row impacted receptors. In order to achieve a 5 dBA reduction at 75 percent of the first-row receptors, 27 would have to achieve 5 dBA reduction. No barrier could achieve this noise reduction; therefore, the noise barrier is not considered acoustically feasible. No receptor received an 8 dBA reduction in highway traffic noise to meet the first criteria of reasonableness. Based on the first reasonableness criteria, the barriers are considered not reasonable.

Barrier 3 and Barrier 4 were modeled in the 2038 Build Alternative on Skewed Alignment to abate noise impacts for 35 build impacted receptors (see **Table 10b**). These barriers were limited to 482 feet in length due to the length of the Church Street Bridge structure and sight lines to existing intersections. Even at the maximum barrier height of 14 feet, none of the receptors near the proposed barriers achieved an 8 dBA noise reduction; therefore, no further analyses were conducted for Barrier 3 and Barrier 4.

Data related to the barrier analysis model including TNM sound-level results tables, plan views, and LADOTD worksheets for feasibility and reasonableness for the four analyzed barriers are included as **Appendix I-1**, **Appendix I-2**, and **Appendix I-3**, respectively.

FIGURE 6a: NOISE BARRIER ANALYSIS



Legend

Feet: 0 125 250 500

- Traffic Noise Study 500-ft Radius
- Existing Alignment Impacted Receivers
- Barrier 1
- Barrier 2

Reference

Base map comprised of Bing Maps aerial imagery from (c) 2017 Microsoft Corporation and its data suppliers.

2038 Existing Alignment
Noise Barrier Analysis
Cane River Bridge Church Street Route LA 1-X
Traffic Noise Study
Natchitoches Parish, Louisiana

Louisiana Department of Transportation and Development

PROVIDENCE

Revised By	AMV	11/21/17
Checked By	KEJ	11/21/17
Approved By	MNM	11/21/17

Project Number 1200-001

Drawing Number 1200-001-A111

6a Figure

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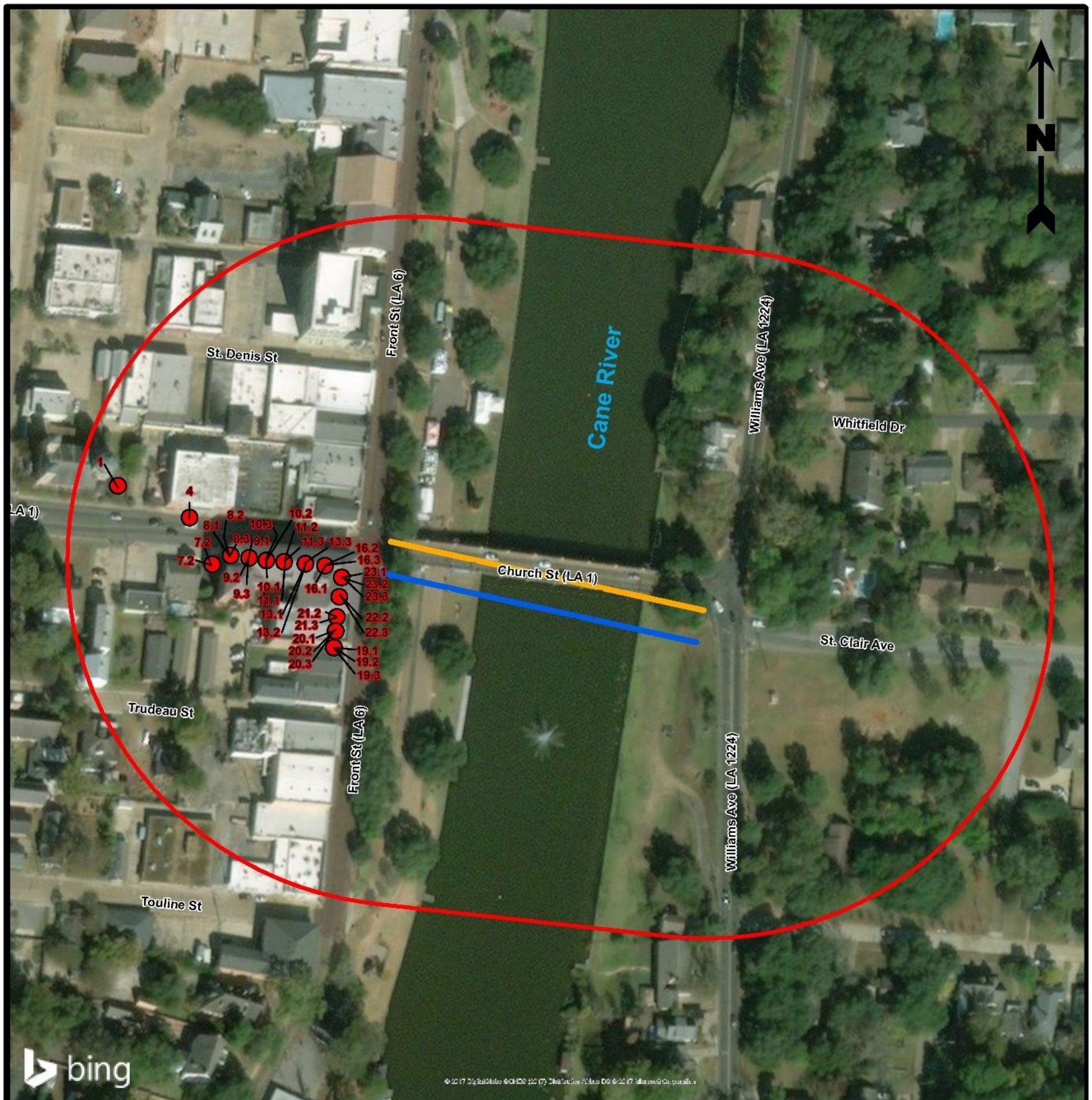
FIGURE 6b: NOISE BARRIER ANALYSIS



Legend

0 125 250 500 Feet

- Traffic Noise Study 500-ft Radius
- Skewed Alignment Impacted Receivers
- Barrier 3
- Barrier 4

Reference

Base map comprised of Bing Maps aerial imagery from (c) 2017 Microsoft Corporation and its data suppliers.

2038 Skewed Alignment
Noise Barrier Analysis
Cane River Bridge Church Street Route LA 1-X
Traffic Noise Study
Natchitoches Parish, Louisiana

Louisiana Department of Transportation and Development

PROVIDENCE

Revised By	AMV	11/21/17
Checked By	KEJ	11/21/17
Approved By	MNM	11/21/17

Project Number 1200-001
Drawing Number 1200-001-A112
6b Figure

Providence Engineering and Design, LLC

3.0 INFORMATION FOR LOCAL OFFICIALS

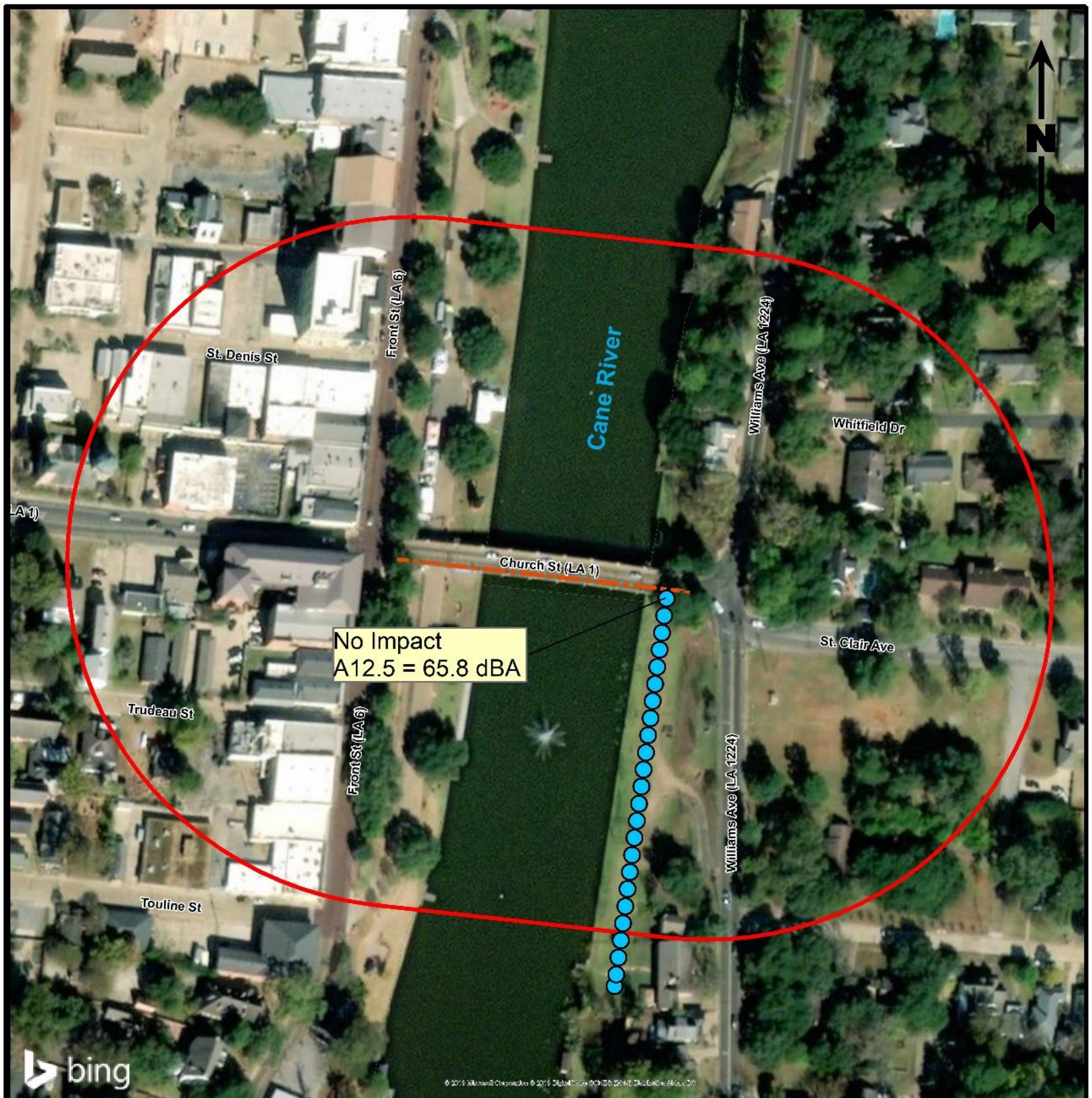
The LADOTD noise policy requires an estimation of future noise levels for undeveloped lands in the immediate vicinity of the project. This information is useful for local officials to limit future land development that will be compatible with anticipated highway noise levels. The PM 2038 predicted noise levels were used to determine a potential area of impact for existing undeveloped lands. There are no undeveloped areas along the Cane River Bridge study area. The land along the banks of the Cane River are owned by the City of Natchitoches and are currently cleared and used mostly as recreational facilities. For the purpose of local officials' information, the undeveloped area south of the Church Street bridge along the east bank of the Cane River was used for this study. Receivers were modeled beginning at the proposed right-of-way (ROW) line and were then placed every 25 feet from the ROW out to a distance of 300 feet to determine the approximate distance where a noise impact can be expected to occur. This area and modeled receivers are illustrated on **Figures 7a** and **7b** at the end of this section.

Area A is located on undeveloped land on the south side of Church Street Bridge on the east bank of the Cane River using the 2038 Build Alternative on Existing Alignment. For this area, no residences (Category B), public use areas (Category C), or commercial structures with exterior use (Category E) would be impacted, since the noise levels within 12.5 feet of the proposed ROW do not exceed the impact criteria of 66 dBA or 72 dBA respectively.

Area B is located on undeveloped land on the south side of Church Street Bridge on the east bank of the Cane River using the 2038 Build Alternative on Skewed Alignment. For this area, no residences (Category B), public use areas (Category C), or commercial structures with exterior use (Category E) would be impacted, since the noise levels within 12.5 feet of the proposed ROW do not exceed the impact criteria of 66 dBA or 72 dBA respectively.

Data related to the local officials' noise model including receiver input table, sound-level results table, and plan views are included as **Appendix J-1**, **Appendix J-2**, and **Appendix J-3**, respectively. A copy of the environmental document that includes this noise analysis will be provided to local officials upon approval.

FIGURE 7a: INFORMATION FOR LOCAL OFFICIALS – AREA A



Legend

Feet 0 125 250 500

- Traffic Noise Study 500-ft Radius
- Alternative on Existing Alignment CL
- Area A Receivers

Reference

Base map comprised of Bing Maps aerial imagery from (c) 2017 Microsoft Corporation and its data suppliers.

Local Officials Area A

Cane River Bridge Church Street Route LA 1-X
Traffic Noise Study
Natchitoches Parish, Louisiana

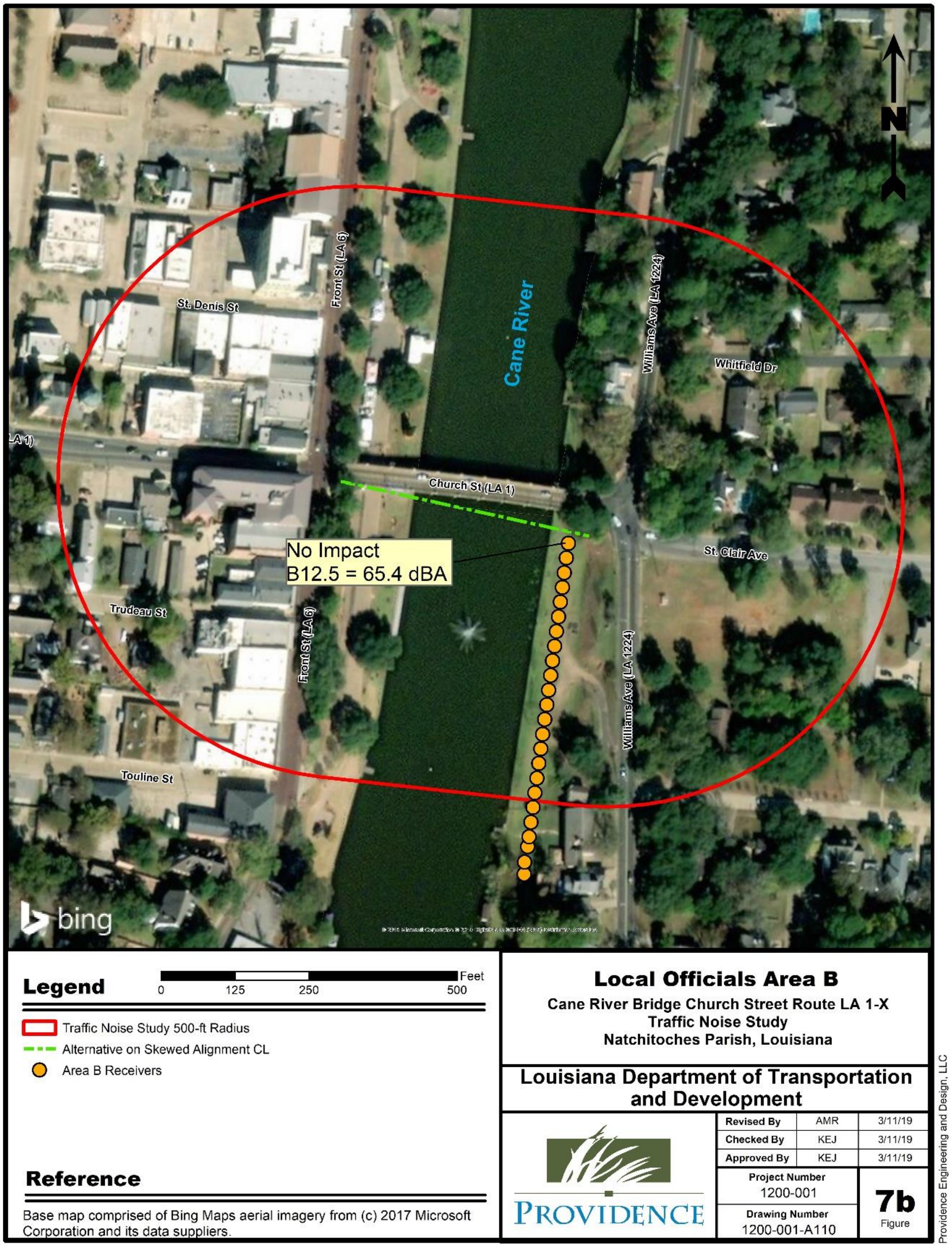
Louisiana Department of Transportation and Development

PROVIDENCE

Revised By	AMR	3/11/19
Checked By	KEJ	3/11/19
Approved By	KEJ	3/11/19
Project Number 1200-001	7a Figure	
Drawing Number 1200-001-A109		

Providence Engineering and Design, LLC

FIGURE 7b: INFORMATION FOR LOCAL OFFICIALS – AREA B



4.0 CONSTRUCTION NOISE

Receptors located within the vicinity of the proposed reconstruction of the Church Street Bridge over Cane River are likely to experience temporary increases in noise related to construction activities. It is difficult to predict levels of construction noise at a particular receptor or group of receptors. Heavy machinery, the major source of noise in construction, is constantly moving in unpredictable patterns. Construction normally occurs during daylight hours when people tolerate occasional loud noises. The contractor should operate, whenever possible, between the hours of 7:00 AM and 5:00 PM. The duration for individual receptors should be short. Therefore, there are no anticipated disruptions of normal activities. However, the project plans and specifications will include provisions requiring the contractor to make every reasonable effort to minimize construction noise through noise abatement measures, such as ensuring all construction equipment is properly muffled and all motor panels are shut during operation. The City, Parish, or LADOTD contractors and developers shall comply with local construction noise ordinances, and all construction equipment will be required to comply with Occupational Safety and Health Administration regulations as they apply to employee safety.

5.0 TEMPORARY DETOUR BRIDGES

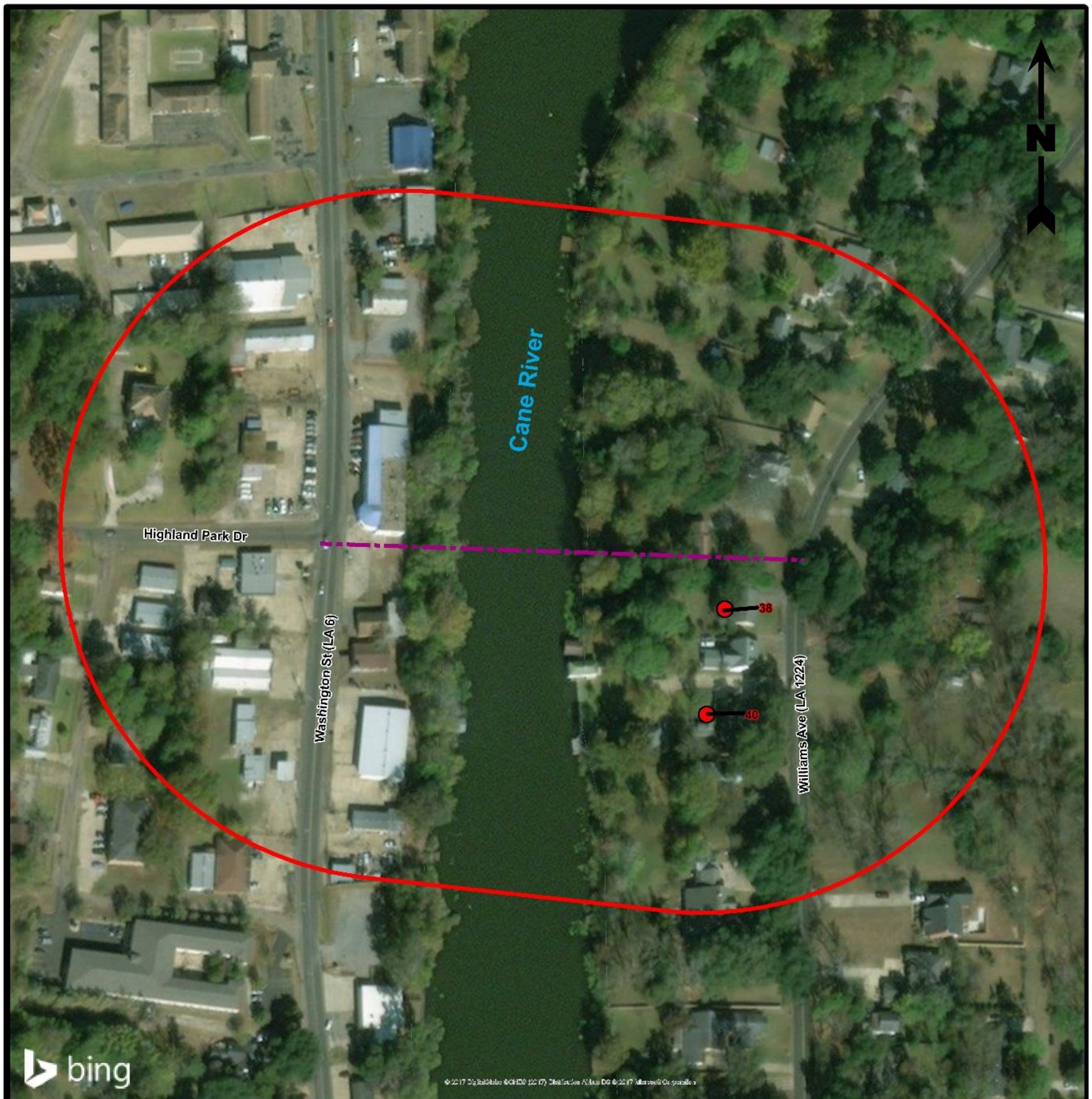
As part of the construction plan, two temporary bridge locations have been proposed as detour routes while the Church Street Bridge is being constructed. One such location is a temporary bridge at Highland Park Drive, which is one mile north of Church Street in a mainly residential area. Another temporary bridge location is Touline Street, which is 500 feet south of Church Street in a commercial and residential area similar to that of Church Street. Due to public feedback during the Solicitation of Views process regarding this temporary structure proposed at Highland Park Drive, Providence has decided in coordination with C.H. Fenstermaker & Associates, LLC and LADOTD to conduct a noise analysis for these two temporary bridge locations.

CobbFendley provided traffic volumes for the 2018 Construction Year with the assumption that all traffic flow on the Church Street Bridge will follow the detour to the temporary bridge location. The vehicle classification percentages used and the detailed counts used to calculate the percentages are included as **Appendix K-1**. A summary of the percentages used in the model is included as **Table 6**. Once the traffic was determined for each segment, the vehicle class percentages in **Table 6** were then applied to generate the TNM traffic input values for automobiles, medium trucks, heavy trucks, buses, and motorcycles.

Two models were created for each temporary bridge location. One model showing the 2017 Existing Year conditions and one model showing the 2018 Construction Year Conditions. Receivers were added to the original 67 modeled receivers to include residential and commercial receivers near the temporary bridge locations. The temporary bridge location at Highland Park Drive has 13 residential receivers and one commercial receiver. The temporary bridge location at Touline Street has 17 residential receivers and three commercial receivers. All receivers and other modeling elements in TNM 2.5 can be seen in **Appendix K-2** and **Appendix K-5**.

As expected for both temporary bridge locations during the 2018 Construction Year an increase in traffic noise was experienced by some receivers. Two residential receivers (Receivers 38 and 40) on the eastern bank of Cane River at the Highland Park Drive temporary bridge experienced sound level impacts. Nine residential receivers (Receivers 35, 50.2, 51.2, 52.2, 53.2, 56.2, 62, 63, and 64) were impacted at the Touline Street temporary bridge. These impacted receivers can be seen in **Figures 8a** and **8b**. All traffic volumes, TNM 2.5 model element input tables, TNM 2.5 plan views and TNM 2.5 sound level results are included in **Appendix K**.

FIGURE 8a: 2018 HIGHLAND PARK DRIVE BRIDGE IMPACTED RECEIVERS



Legend

Feet: 0 125 250 500

- Traffic Noise Study 500-ft Radius
- Temp. Detour Bridge Highland Park CL
- Highland Park Dr Bridge Impacted Receivers

Reference

Base map comprised of Bing Maps aerial imagery from (c) 2017 Microsoft Corporation and its data suppliers.

2018 Highland Park Dr Bridge Impacted Receivers

Cane River Bridge Church Street Route LA 1-X
Traffic Noise Study
Natchitoches Parish, Louisiana

Louisiana Department of Transportation and Development

PROVIDENCE

Created By	AMV	11/21/17
Checked By	KEJ	11/21/17
Approved By	MNM	11/21/17

Project Number: 1200-001
Drawing Number: 1200-001-A114
Figure: 8a

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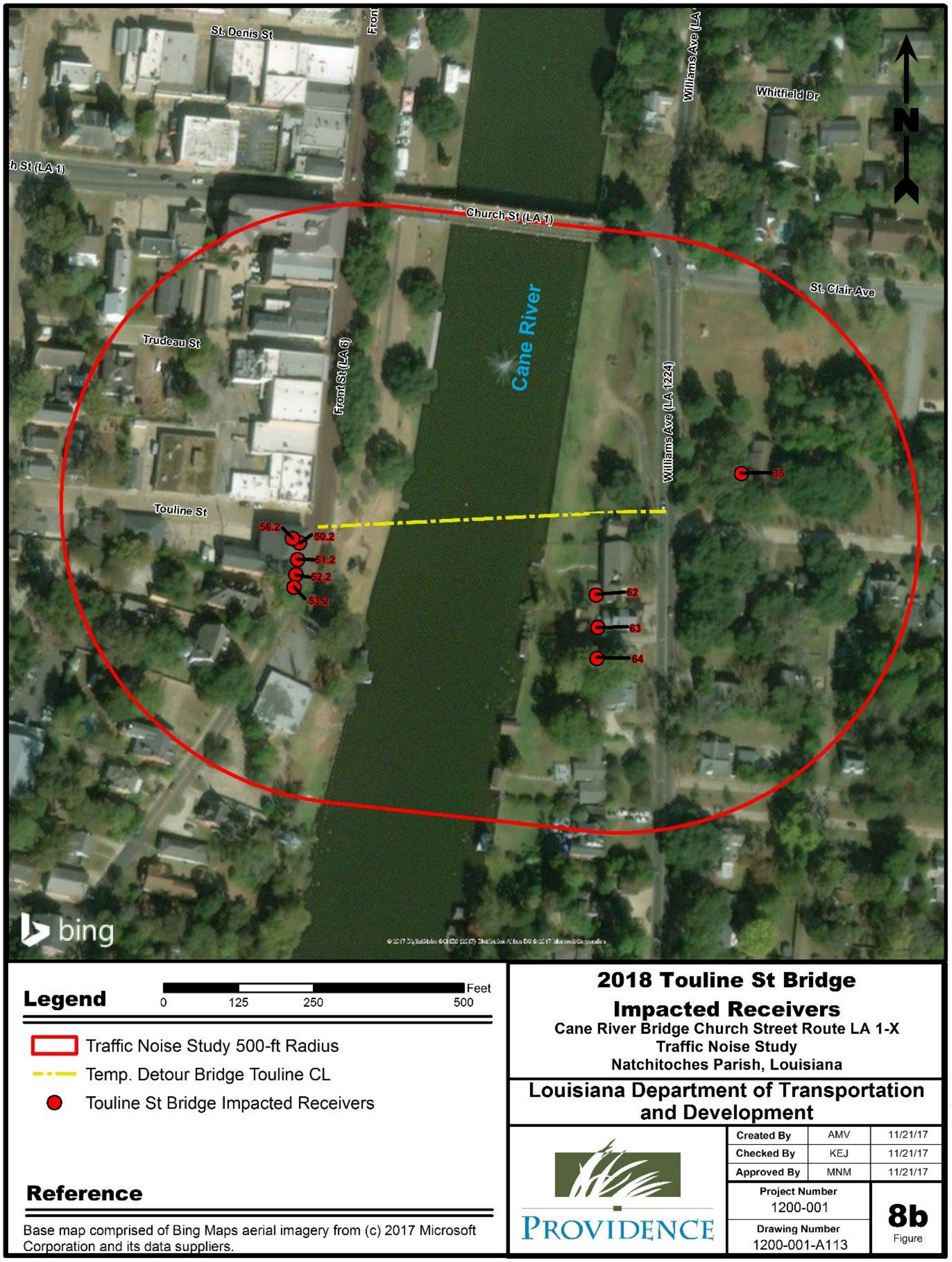
FIGURE 8b: 2018 TOULINE STREET BRIDGE IMPACTED RECEIVERS



6.0 NOISE ANALYSIS SUMMARY

The following provides a summary of the results of the traffic noise analysis for the proposed widening of the Church Street Bridge over Cane River. Of the 67 receptors modeled, 35 experience a noise impact during the Design Year (2038) Build Alternatives. Noise abatement measures were considered for these impacted receptors. Noise abatement such as alteration of horizontal or vertical alignments and acquisition of property rights to serve as a buffer zone were determined to not be feasible or reasonable. Additionally, no Category D receivers experience internal noise impacts; therefore, noise insulation was not considered as a noise abatement measure.

Traffic management measures such as *No Engine Brake* signs could be beneficial, since some of the impacted receptors are located near the signalized intersection of Church Street and Front Street. However, modified speed limits reducing the Church Street bridge to 15 mph proved ineffective in abating the impact to the impacted receptors in the PM build models.

Noise barriers were considered for all impacted receptors. A noise barrier analysis in TNM 2.5 was conducted for the 35 impacted receivers representing residential and commercial receptors. Construction of two noise barriers on the Church Street bridge structure was analyzed for these receptors. None of the barriers met the feasibility and reasonableness criteria.

Temporary bridges will be a part of the construction phase of the Church Street Bridge project. The two possible detour locations are north at Highland Park Drive or south at Touline Street, both of which are residential areas with no existing bridges. A traffic noise analysis was conducted for the two temporary bridges. Of the 14 receivers at Highland Park Drive only two experienced noise impacts during the Construction Year 2018. Of the 20 receivers at Touline Street only nine experienced noise impacts during the Construction Year 2018. No noise abatement measures were considered for these impacted receivers.

It is important to note that during Stage 1 Planning/Environmental, the noise analysis identifies noise abatement measures that are likely to be incorporated into the project's design. The final determination of any proposed noise abatement measure(s) will be made during the design stage. If during design, conditions substantially change that impact the implementation of proposed barriers, the City will reevaluate the reasonableness of the barrier. Only barriers determined to be both reasonable and feasible will be incorporated into the project and constructed.

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JANUARY 2018

LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

STATE PROJECT NO. H.001271/FEDERAL AID PROJECT NO. H001271

AIR QUALITY IMPACT ASSESSMENT REPORT

CANE RIVER BRIDGE CHURCH STREET ROUTE LA 1-X ENVIRONMENTAL ASSESSMENT

NATCHITOCHES PARISH, LOUISIANA

Prepared By:
Providence Engineering and Design, LLC
1201 Main Street
Baton Rouge, Louisiana 70802
(225) 766-7400
www.providenceeng.com

Project Number 1200-001-000

ACRONYMS AND ABBREVIATIONS

°F	Degrees Fahrenheit
AADT	Annual Average Daily Traffic
ADT	Average Daily Traffic
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CO_2	Carbon Dioxide
EA	Environmental Assessment
EIS	Environmental Impact Statement
FHWA	Federal Highway Administration
GHG	Greenhouse Gases
HEI	Health Effects Institute
IRIS	Integrated Risk Information System
LADOTD	Louisiana Department of Transportation and Development
LDEQ	Louisiana Department of Environmental Quality
LOS	Level of Service
MOVES2014a	Motor Vehicle Emissions Simulator Model 2014a
mph	Miles Per Hour
MSATs	Mobile Source Air Toxics
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
O_3	Ozone
PM	Particulate Matter
PM_{10}	PM with an aerodynamic diameter of 10 microns or less
$PM_{2.5}$	PM with an aerodynamic diameter of 2.5 microns or less
Pb	Lead
ppb	Parts per Billion
ppm	Parts per Million
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
ug/m^3	Micrograms per Cubic Meter
USEPA	United States Environmental Protection Agency
VMT	Vehicle Miles Traveled
vpd	Vehicles per Day
VOC	Volatile Organic Compound

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1.0 INTRODUCTION

The Louisiana Department of Transportation and Development (LADOTD) is proposing to replace the Cane River Bridge at Church Street on Route LA 1-X in the city of Natchitoches, Natchitoches Parish, Louisiana. **Figure 1** is a vicinity map showing the proposed project location.

The proposed project involves the replacement of the current bridge to address structural and functional deficiencies as well as the widening of the Cane River Bridge at Church Street to resolve traffic congestion, increase capacity, and improve the level of service (LOS). The existing bridge is a two-lane concrete deck girder bridge constructed in the 1930s. While the bridge is within the Natchitoches Historic Landmark District, it has been determined ineligible for the National Register of Historic Places and is not a contributing element to the District.

Traffic data collection and studies were conducted in 2017 and included 7-day, 24-hour class counts for each of the 13 vehicle classes along Church Street eastbound and westbound. Additionally, data was used to determine AM and PM peak volumes for the existing year (2017), construction year (2018), design year (2038) no-build, and the design year (2038) build for the two build alternatives.

The existing Cane River Bridge has a posted speed limit of 25 miles per hour (mph) and is classified as a Minor Arterial roadway. Both replacement structures are proposed to be a three-lane concrete deck girder bridge and be Minor Arterial roadways with a posted speed of 25 mph. Build Alternative 1 proposes to replace the bridge on its existing alignment. Build Alternative 2 proposes to replace the existing bridge on a slightly skewed alignment to allow the new bridge to align with the Williams Avenue and St. Clair Avenue intersection; the existing bridge is only accessible from Williams Avenue. To ferry traffic during construction, there are two potential locations for temporary bridges: Highland Park Drive to the north and Touline Street to the south of the existing bridge. **Figure 2** shows the locations of the proposed Build Alternatives and detour routes.

This air quality impact assessment report summarizes the results of the air quality assessment for the two build alternatives proposed for the replacement of the Church Street Cane River Bridge as well as the temporary bridges and the No-Build Alternative.

FIGURE 1: PROJECT STUDY AREA

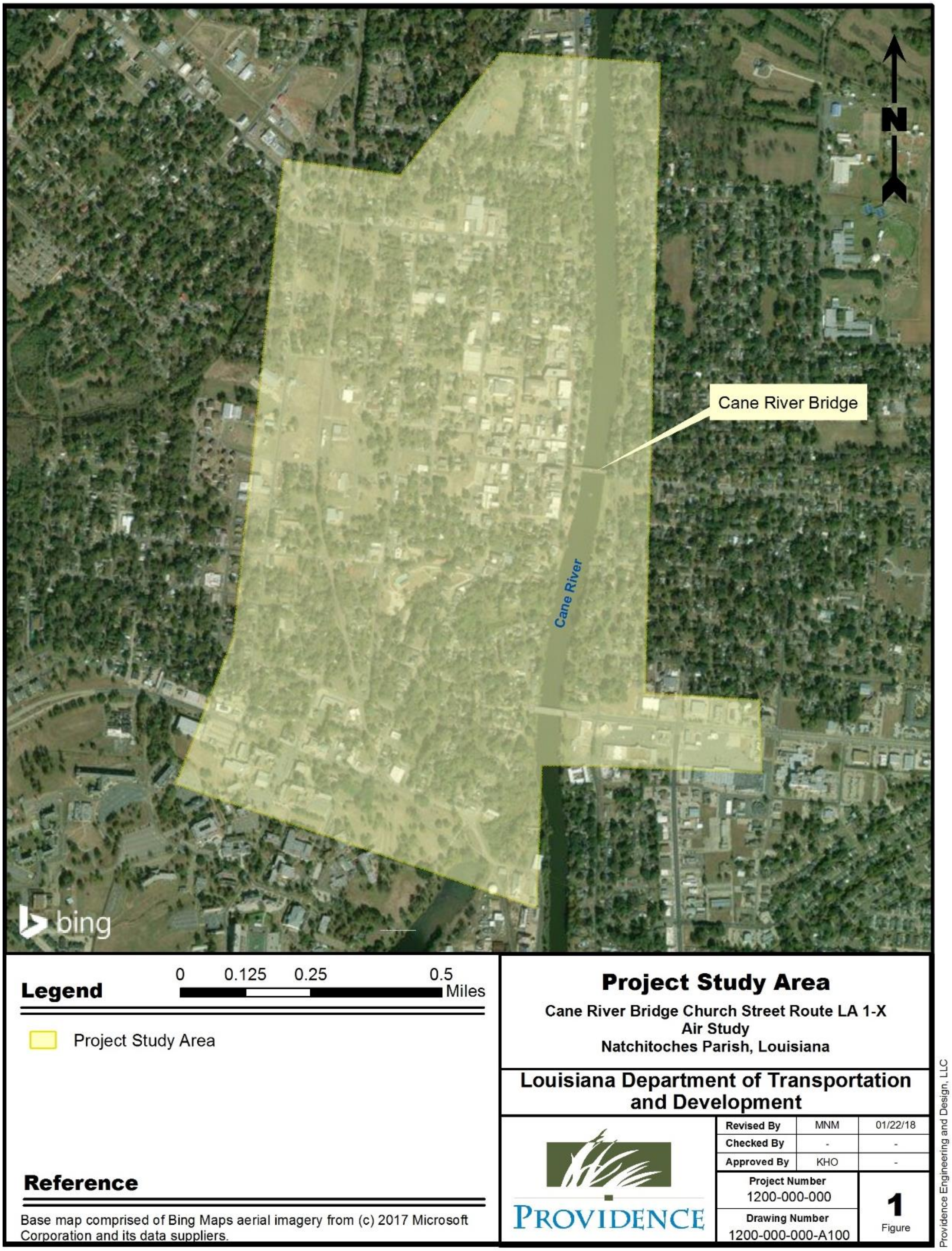
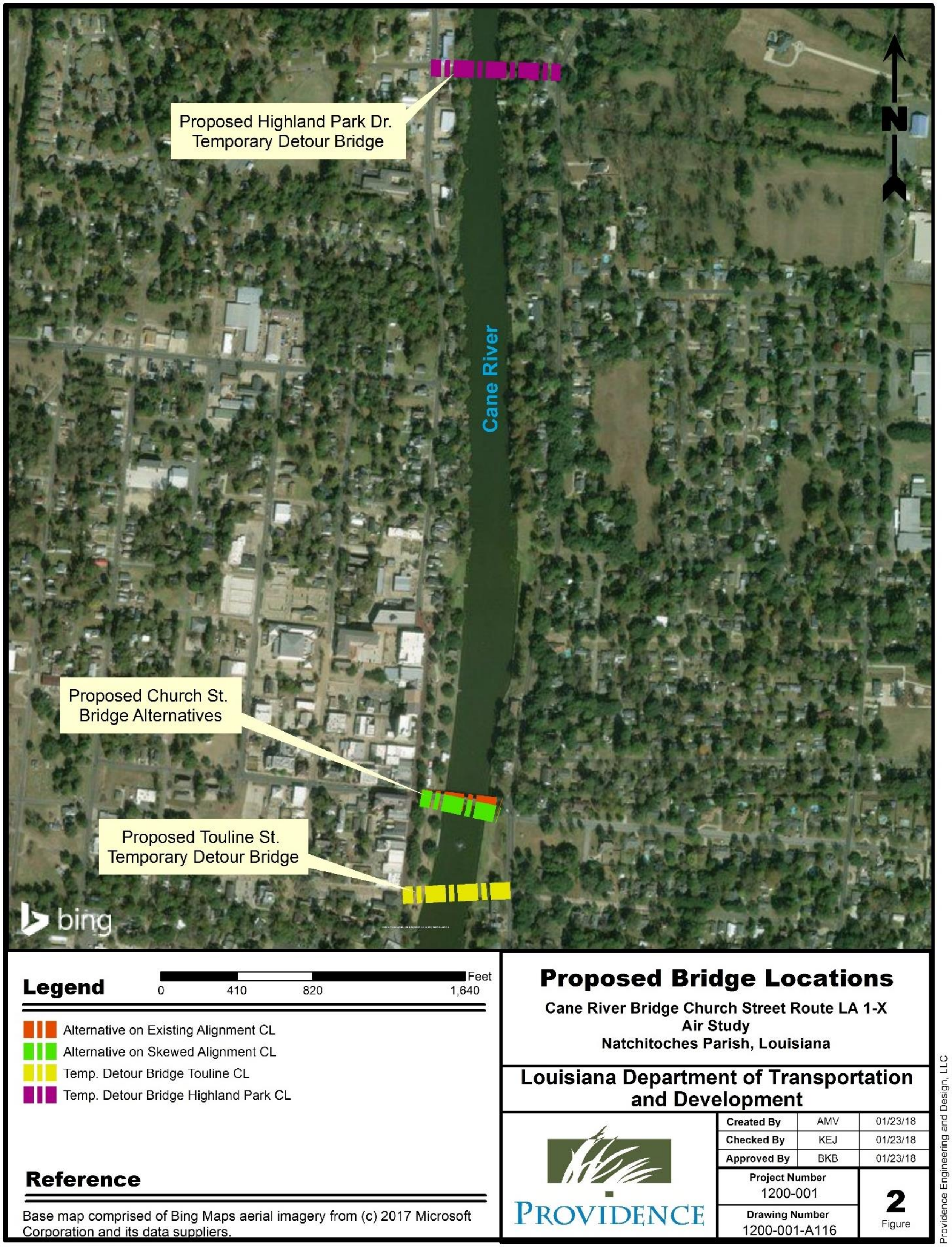


FIGURE 2: PROPOSED BRIDGE LOCATIONS



2.0 EXISTING CONDITIONS

The existing roadway is a Minor Arterial two-lane concrete deck girder bridge. Signalized intersections exist at the bridge termini; east at Williams Avenue and west at Front Street.

Traffic volume data on the existing bridge were collected in May 2017. Based on the data, the total average daily traffic (ADT) (east and westbound) on the bridge was 11,885 vehicles per day (vpd). The projected count for the design year 2038 was calculated to be of 12,509 vpd. The design year count included a growth rate of .25% added to peak hour volumes.

Traffic volumes were projected for 2018 and the 2038 design year. **Table 1** represents the base and projected maximum traffic volumes during peak hour in the study area.

TABLE 1: CURRENT AND PROJECTED PEAK HOUR TRAFFIC VOLUMES

LOCATION	Existing Conditions (2017)	Construction (2018)	Design Year (2038)
Church Street Bridge EB	607	609	639
Church Street Bridge WB	510	511	538
Church Street EB	426	427	449
Church Street WB	314	315	331
Williams Avenue NB (St. Clair to LA 1)	315	316	332
Williams Avenue SB (St. Clair to LA 1)	464	465	488
Williams Avenue NB (Stephens and St. Clair)	273	274	288
Williams Avenue SB (Stephens and St. Clair)	451	452	475
Front Street NB (North of LA 1)	381	381	401
Front Street SB (North of LA 1)	306	307	322
Front Street NB (South of LA 1)	170	170	179
Front Street SB (South of LA 1)	158	159	167
St. Clair Avenue EB	78	78	82
St. Clair Avenue WB	39	39	41

Source: CobbFendley Technical Memorandum, October 2017.

3.0 DESCRIPTION OF PROPOSED FACILITY

A total of three alternatives are being considered for the proposed action. These alternatives include the No-Build Alternative and two Build Alternatives. In addition to these, two Detour Alternatives are being considered for the construction of the proposed action. A description of each alternative is provided below.

3.1 No-Build Alternative

The No-Build Alterative would not replace the bridge and would maintain the current roadway alignment and traffic capacity. The No-Build Alternative would involve taking no action to address traffic congestion as identified in the project need. Routine maintenance would not widen or otherwise increase capacity or improve the access requirements of the existing roadway network.

3.2 Build Alternative 1

Build Alternative 1 involves replacing the existing bridge on existing alignment with another concrete deck girder bridge classified as a Minor Arterial with a 25 mph posted speed limit. The bridge includes two, 12-foot-wide travel lanes (one eastbound and one westbound), one, 14-foot-wide center turning lane, four-foot-wide outside shoulders, two, six-foot-wide sidewalks, and 1.58-foot-wide bridge railings. This Build Alternative is shown in **Figure 3**.

3.3 Build Alternative 2

Build Alternative 2 involves replacing the existing bridge with another concrete deck girder bridge classified as a Minor Arterial with a 25 mph posted speed limit. The bridge includes two, 12-foot-wide travel lanes (one eastbound and one westbound), one, 14-foot-wide center turning lane, four-foot-wide outside shoulders, two, six-foot-wide sidewalks, and 1.58-foot-wide bridge railings. This alternative bridge will have a skewed alignment with the east termination of the bridge aligning with the intersection of Williams Avenue and St. Clair Avenue. This Build Alternative is shown in **Figure 4**.

3.4 Detour Alternative 1

Detour Alternative 1 involves constructing a temporary bridge crossing north of the project location at Highland Park Drive to Williams Avenue. The crossing will be a prefabricated Acrow bridge truss classified as a Minor Arterial with a 25 mph posted speed limit. The bridge includes two, 12-foot-wide travel lanes (one eastbound and one westbound). This Detour Alternative is shown in **Figure 5**.

3.5 Detour Alternative 2

Detour Alternative 2 involves constructing a temporary bridge crossing south of the project location at Touline Street to Williams Avenue. The crossing will be a prefabricated Acrow bridge truss classified as a Minor Arterial with a 25 mph posted speed limit. The bridge includes two, 12-foot-wide travel lanes (one eastbound and one westbound). This Detour Alternative is shown in **Figure 6**.

FIGURE 3: BUILD ALTERNATIVE 1 (EXISTING ALIGNMENT)

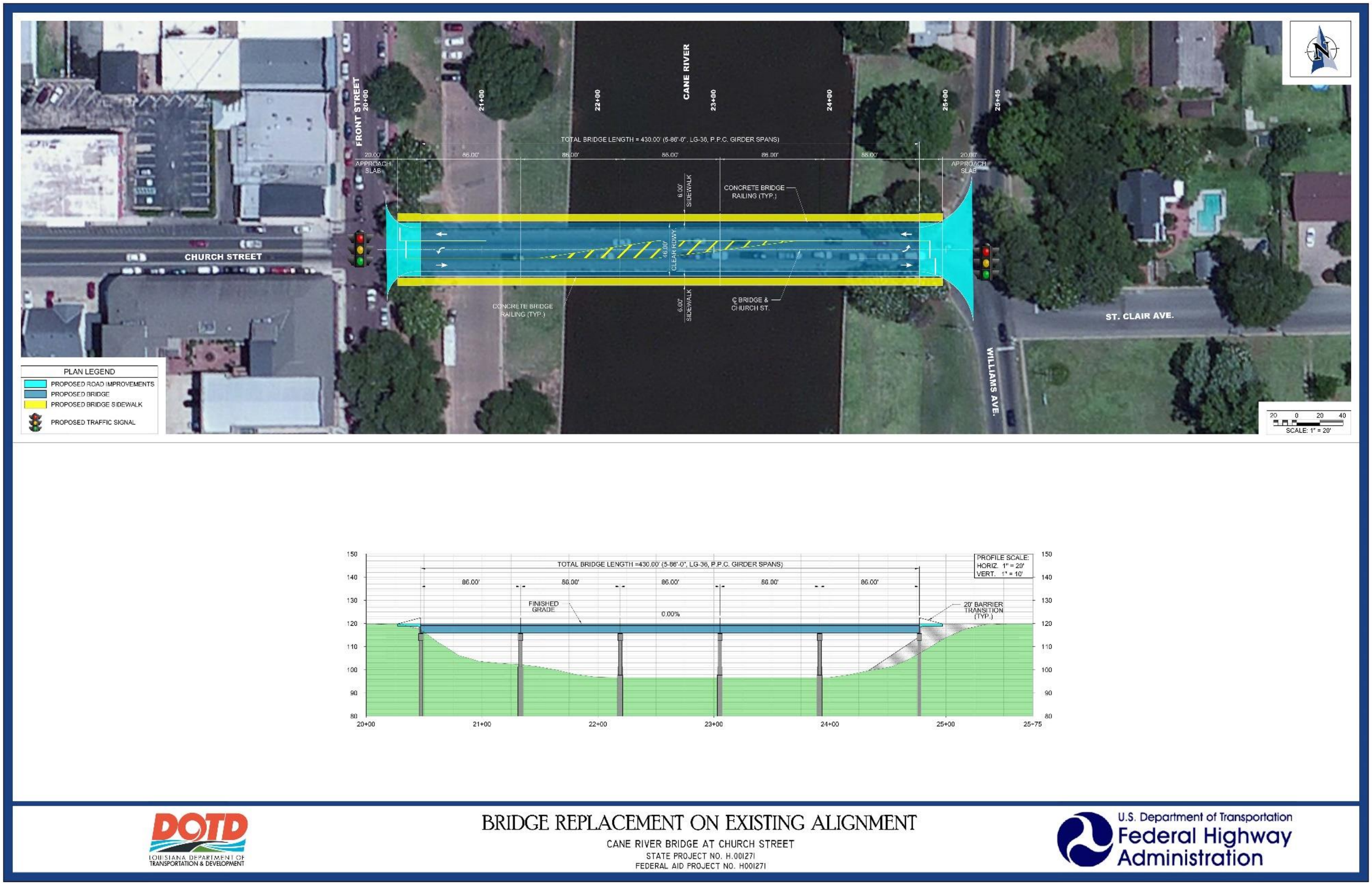


FIGURE 4: BUILD ALTERNATIVE 2 (SKEWED ALIGNMENT)

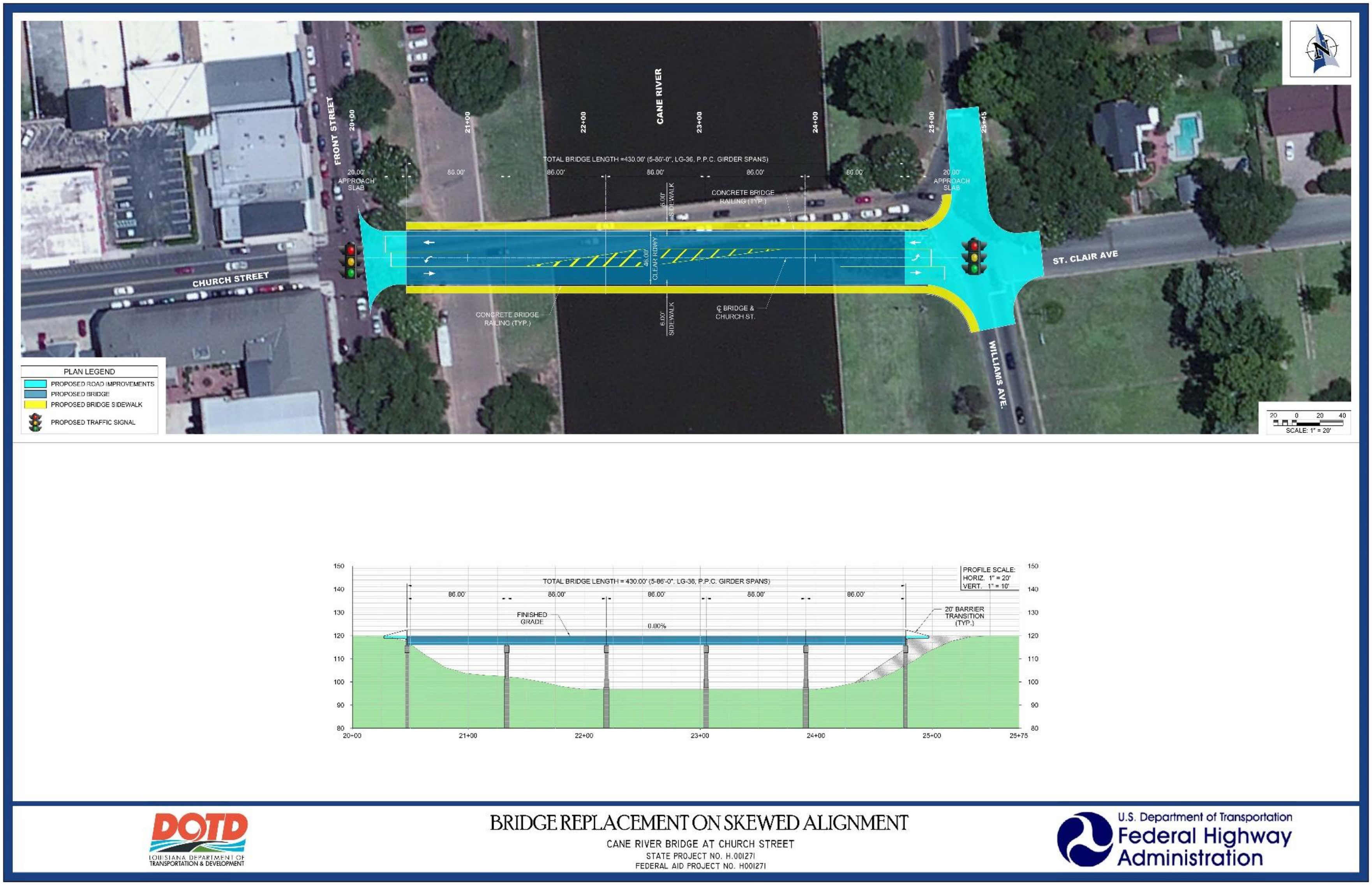
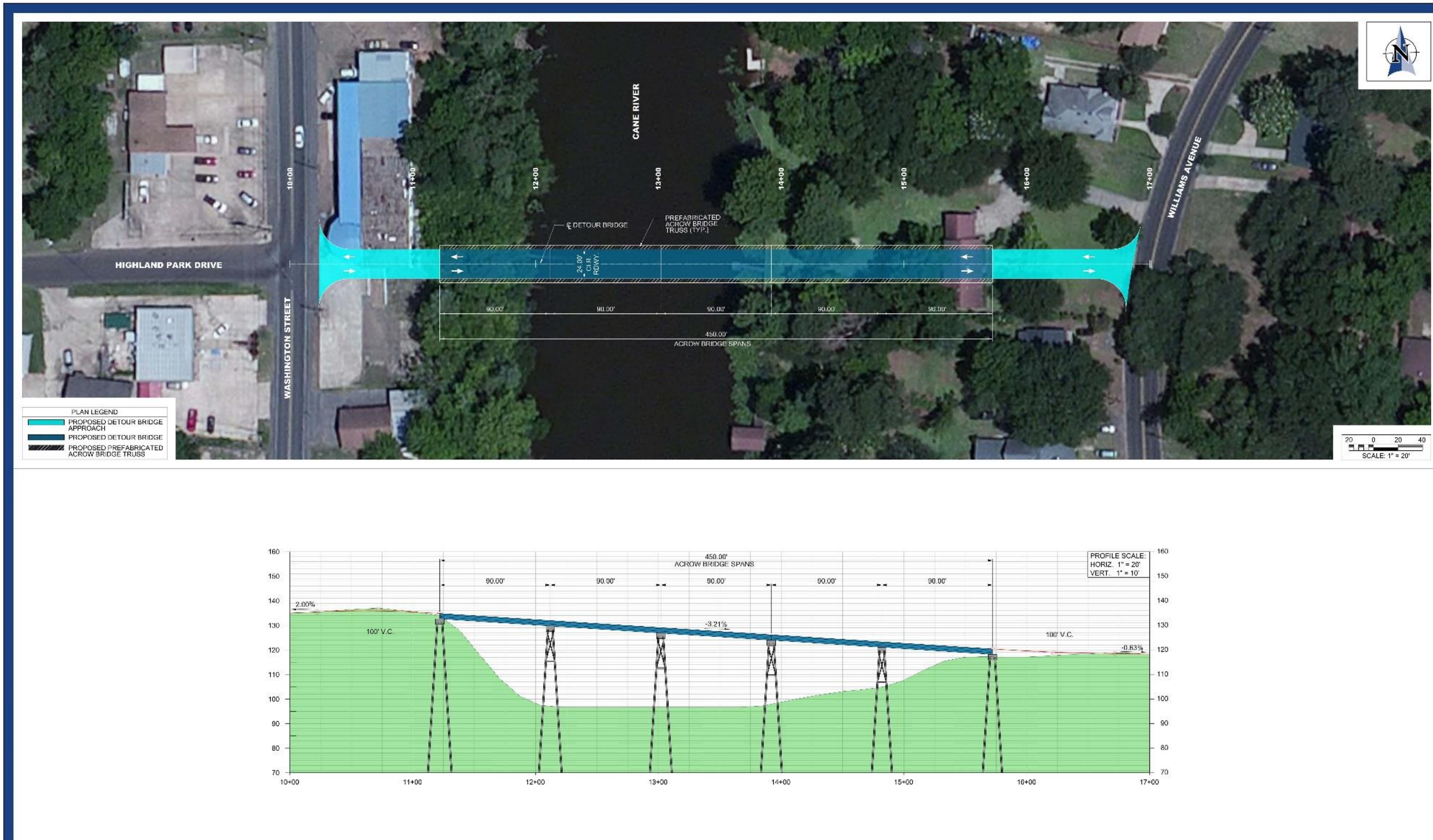


FIGURE 5 : DETOUR ALTERNATIVE 1 (HIGHLAND)



TEMPORARY BRIDGE CROSSING AT HIGHLAND PARK DR. TO WILLIAMS AVE.

CANE RIVER BRIDGE AT CHURCH STREET

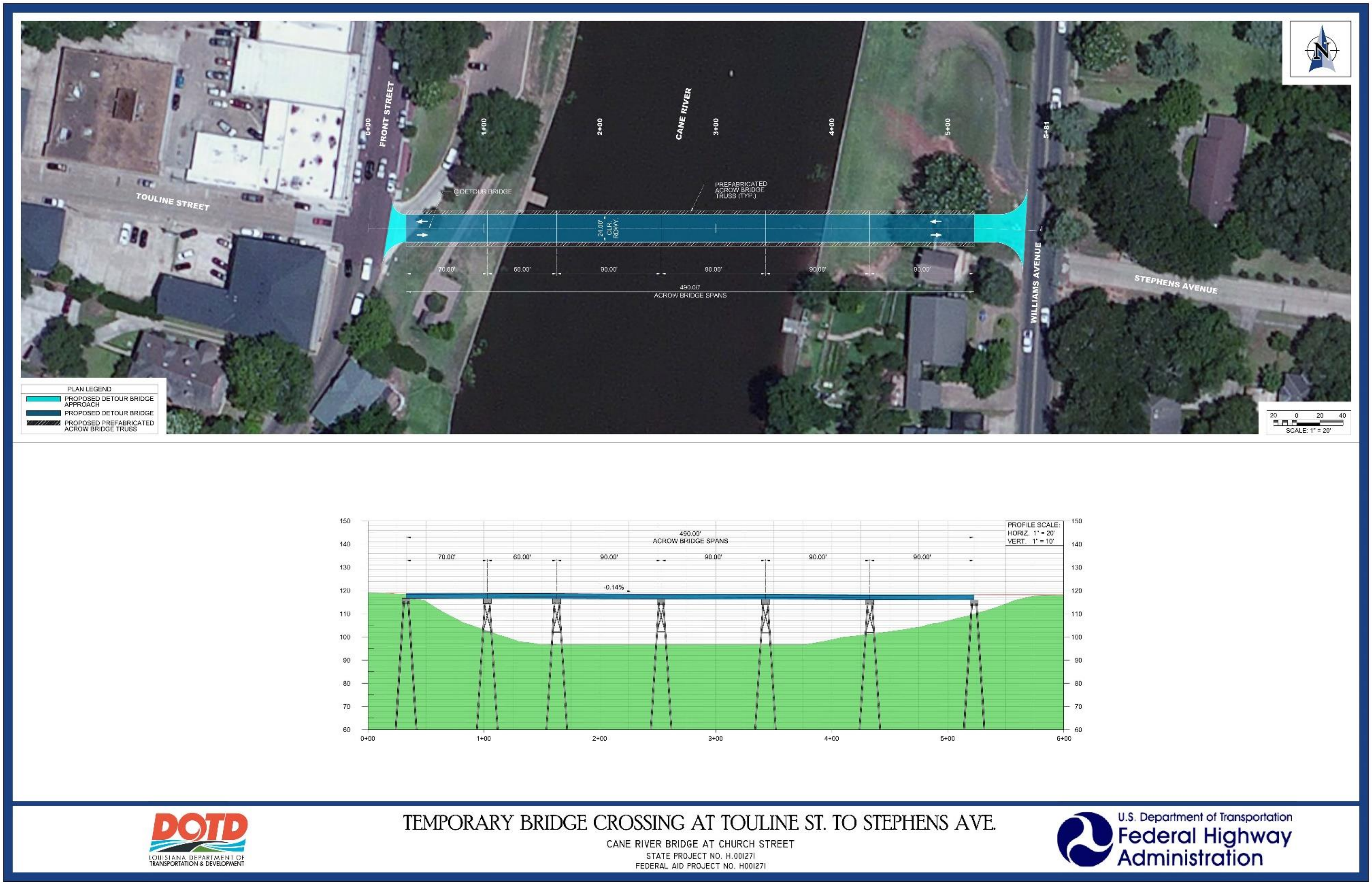
STATE PROJECT NO. H.001271

FEDERAL AID PROJECT NO. H001271

LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

U.S. Department of Transportation Federal Highway Administration

FIGURE 6: DETOUR ALTERNATIVE 2 (TOULINE)



4.0 EXISTING AIR QUALITY AND REGULATORY SETTING

Section 4.0 is an overview of air quality standards and the regulatory setting; existing air quality and National Ambient Air Quality Standard (NAAQS) compliance; regional attainment and the attainment status for the area potentially affected by the proposed project; transportation conformity requirements; and mobile source air toxics (MSATs).

4.1 Air Quality Standards and Regulatory Setting

The Clean Air Act (CAA) requires the United States Environment Protection Agency (USEPA) to set NAAQS (40 Code of Federal Regulations [CFR] part 50) for pollutants considered harmful to public health and the environment. Primary standards provide public health protection, including protecting the health of sensitive populations such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

In compliance with the requirements of the CAA of 1970 and the Clean Air Act Amendments (CAAA) of 1977 and 1990, the USEPA promulgated and adopted the NAAQS to protect public health, safety, and welfare from known or anticipated effects of six criteria pollutants. The six criteria pollutants are ozone (O_3); carbon monoxide (CO); nitrogen dioxide (NO_2); sulfur dioxide (SO_2); particulate matter (PM) with an aerodynamic diameter of 10 microns or less (PM_{10}) and 2.5 microns or less ($PM_{2.5}$); and lead (Pb). The NAAQS define the allowable concentrations of pollutants that may be reached but not exceeded during a given period. The purpose of these standards is primarily to protect human health and secondarily, human welfare with a reasonable margin of safety. The CAA requires that all states attain compliance through adherence to the NAAQS, as demonstrated by the comparison of measured pollutant concentrations with the NAAQS.

The NAAQS are typically measured in units of micrograms per cubic meter ($\mu g/m^3$), parts per million (ppm), or parts per billion (ppb). The NAAQS primary and secondary standards are shown in **Table 2**.

TABLE 2: NAAQS

Pollutant	Averaging Period	Threshold for Standard	Primary NAAQS	Secondary NAAQS
CO	1-hr	Not to be exceeded more than once per calendar year.	35 ppm	None
	8-hr	Not to be exceeded more than once per calendar year.	9 ppm	None
Pb [1]	Rolling 3-Month Average	Not to be at or above this level.	0.15 µg/m^3	0.15 µg/m^3
NO_2 [2]	1-hr	The three-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed this level.	100 ppb	None
	Annual	Annual mean.	53 ppb	53 ppb
PM_{10}	24-hr	Not to be exceeded more than once per year on average over three years.	150 µg/m^3	150 µg/m^3
$PM_{2.5}$	24-hr	The three-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed this level.	35 µg/m^3	35 µg/m^3
	Annual	The three-year average of the weighted annual mean concentrations from single or multiple community-oriented monitors is not to exceed this level.	12 µg/m^3	15 µg/m^3
O_3 [3]	8-hr (2008 std)	The annual fourth-highest daily maximum 8-hour concentration averaged over three years at each monitor within an area must not exceed this level.	0.070 ppm	0.070 ppm
SO_2 [4]	1-hr	The three-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed this level.	75 ppb	None
	3-hr	Not to be exceeded more than once per year.	None	0.5 ppm

Source: USEPA 2016

(1) In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 µg/m3 as a calendar quarter average) also remain in effect.

(2) The level of the annual NO_2 standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.

(3) Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O_3 standards additionally remain in effect in some areas. Revocation of the previous (2008) O_3 standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.

(4) The previous SO_2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas:
(a) any area for which it is not yet one year since the effective date of designation under the current (2010) standards, and
(b) any area for which implementation plans providing for attainment of the current (2010) standard have not been submitted and approved and which is designated nonattainment under the previous SO_2 standards or is not meeting the requirements of a State Implementation Plan (SIP) call under the previous SO_2 standards (40 CFR 50.4(3)), A SIP call is an USEPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the require NAAQS.

4.2 Regional Air Quality and Local Monitoring Data

Outdoor air quality in a given location is described by the concentration of various pollutants in the atmosphere. Air quality is a function of several factors, including the quantity and dispersion rates of pollutants in the region, temperature, the presence or absence of meteorological inversions, and topographic features of the region.

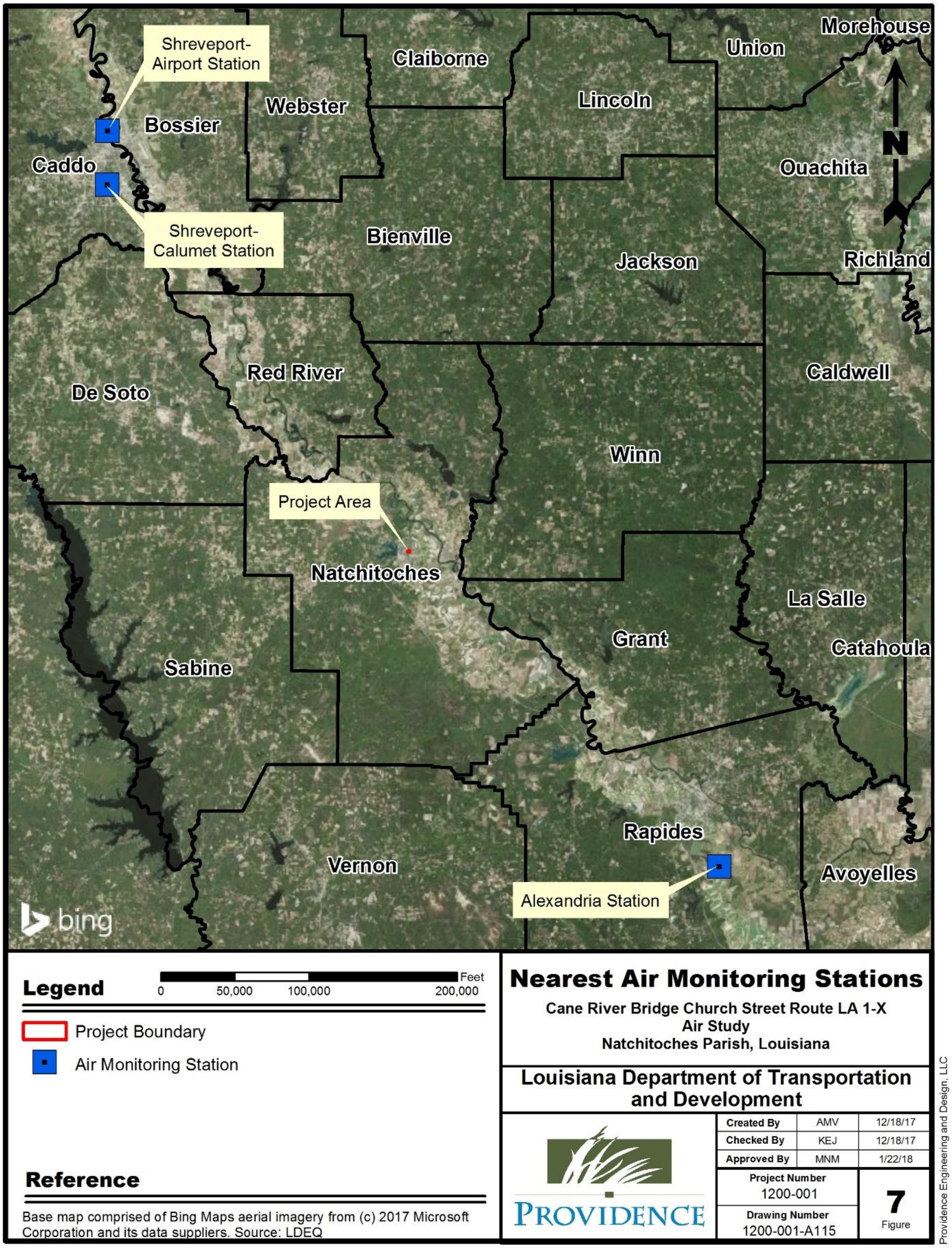
Natchitoches Parish is in northwest Louisiana and generally supports a warm, humid subtropical climate. Average temperatures range from 51 degrees Fahrenheit (°F) in the winter months to 82°F in the summer. Average annual precipitation is 50 inches. Prevailing winds are from the south and are generally calm during the summer into fall.

The USEPA has delegated authority for monitoring and enforcing air quality regulations in Louisiana to the Louisiana Department of Environmental Quality (LDEQ) Assessment Division. The LDEQ may adopt other, more stringent, air quality standards than those of the USEPA. However, the LDEQ observes the same air quality standards as the USEPA.

The LDEQ operates air monitoring stations throughout Louisiana. There are no air monitoring stations in Natchitoches Parish. There is only one air monitoring station in the eight parishes bordering Natchitoches Parish; it is in the City of Alexandria in Rapides Parish. The locations of the air monitoring stations in relation to the Cane River Bridge location are shown in **Figure 7.**

The nearest active LDEQ O_3 monitoring station to the proposed project is the Shreveport Airport monitoring site, which is approximately 80 miles north of the project area. Two other monitoring sites, approximately 70 miles north or south of the proposed project (Alexandria and Shreveport-Calumet), only collect $PM_{2.5}$ data.

FIGURE 7: NEAREST AIR MONITORING STATIONS



4.3 Regional Attainment Status

The USEPA designates geographic areas in a state with respect to meeting the NAAQS as attainment, nonattainment, or unclassifiable. Areas transitioning from nonattainment to attainment are termed maintenance areas. The nonattainment areas are designated based on the degree of violation of the NAAQS. For O_3, the designations are marginal, moderate, serious, severe, and extreme.

For each nonattainment area, the USEPA requires a separate local plan detailing how NAAQS levels will be met. These plans are incorporated into a State Implementation Plan (SIP) for the state. Transportation projects in nonattainment areas are coordinated with the SIP under what is called the conformity process.

The proposed project is in Natchitoches Parish, which is considered in attainment with respect to all NAAQS pollutants. On October 1, 2015, the USEPA revised the primary and secondary eight-hour NAAQS for O_3 from 0.075 ppm to 0.070 ppm, or 70 ppb. The CAA requires state designated recommendations to the USEPA within one year of NAAQS promulgation. By October 1, 2016, the governor of each state was required to recommend designations of attainment, nonattainment, or unclassifiable under the 2015 eight-hour O_3 standard for all areas of the state. The USEPA made final designations on December 20, 2017 (USEPA, 2017). Natchitoches Parish remained in attainment, as there are no major industrial facilities in the parish and the total population is relatively low when compared to other parishes.

4.4 Mobile Source Air Toxics (MSATs)

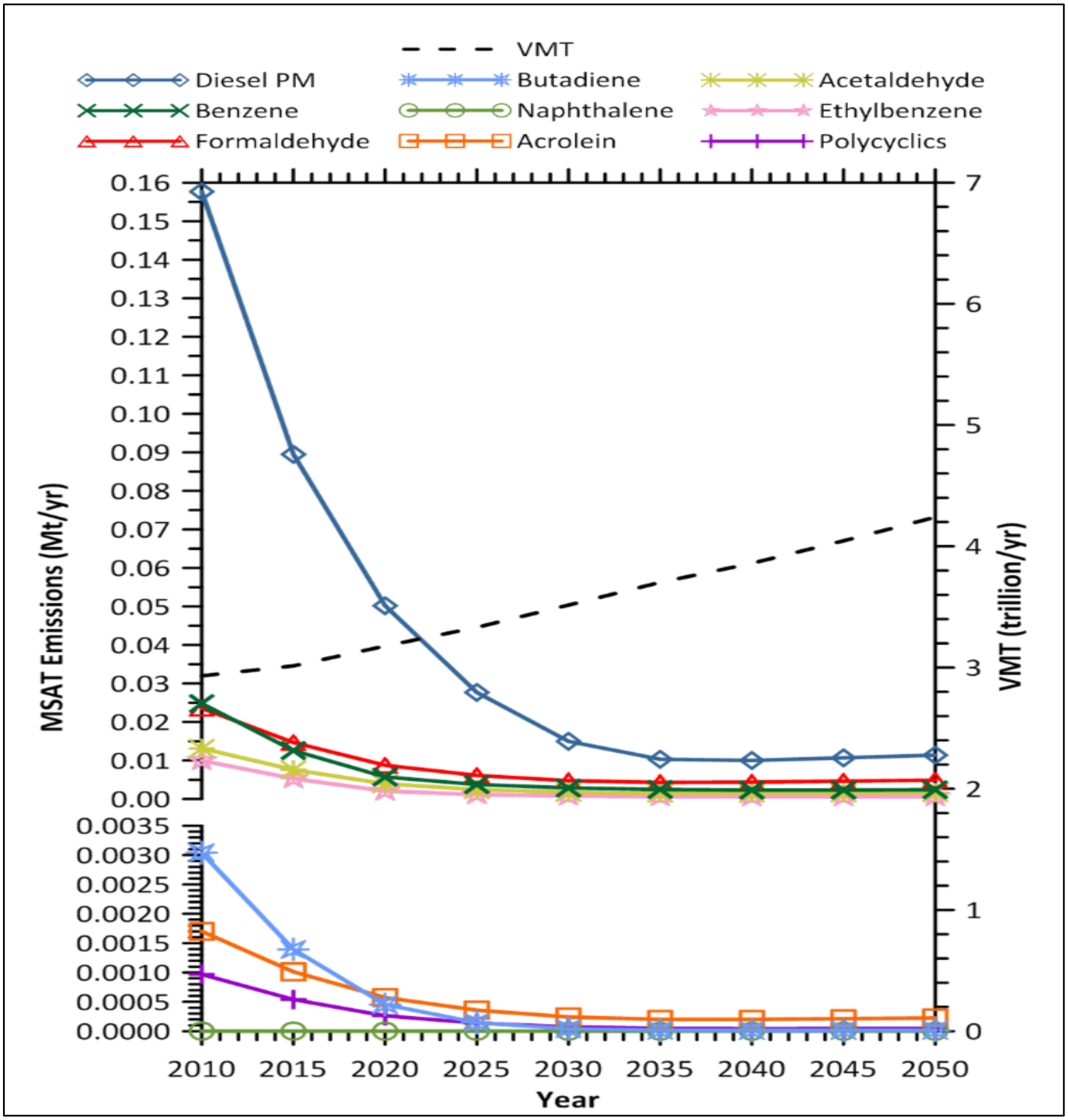
Controlling air toxic emissions became a national priority with the passage of the CAAA, whereby Congress mandated that the USEPA regulate air toxics, also known as hazardous air pollutants. This original list included 188 pollutants. The USEPA assessed this expansive list in their last rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007), identifying a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System (IRIS). The USEPA identified nine compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers or contributors and non-cancer hazard contributors from the 2011 National Air Toxics Assessment. These nine compounds, are 1,3-butadiene, acetaldehyde, acrolein, benzene, diesel PM, ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter. The Federal Highway Administration (FHWA) considers these the priority MSATs; however, the list is subject to change and may be adjusted in consideration of future USEPA rules.

Most air toxics originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners), and stationary sources (e.g., factories or refineries). The MSATs are compounds emitted from highway vehicles and non-road equipment (such as lawn mowers). Some toxic compounds are present in fuel and are emitted to the air when the fuel evaporates or passes through the engine unburned. Other toxics are emitted from the incomplete combustion of fuels or as secondary combustion products. Metal air toxics also result from engine wear or from impurities in oil or gasoline.

The 2007 USEPA MSATs rule mentioned above requires controls that will dramatically decrease MSATs emissions through cleaner fuels and cleaner engines. Based on an FHWA analysis using USEPA's Motor Vehicle Emissions Simulator 2014a model (MOVES2014a), as shown in the **Figure 8,** even if vehicle activity (vehicle-miles travelled, VMT) increases by 45 percent as assumed from 2010 to 2050, a combined reduction of 91 percent in the total annual emissions for the priority MSATs is projected for the same period.

Per the FHWA Updated Interim Guidance on Mobile Source Air Toxics Analysis in National Environmental Policy Act (NEPA) Documents, issued October 18, 2016, "Air toxics analysis is a continuing area of research. While much work has been done to assess the overall health risk of air toxics, many questions remain unanswered. In particular, the tools and techniques remain limited for assessing project-specific health outcomes as a result of lifetime MSATs exposure. These limitations impede the ability to evaluate how the potential health risks posed by MSATs exposure should be factored into project-level decision-making within the context of NEPA. Even as the science emerges, the public and other agencies expect FHWA to address MSATs impacts in its environmental documents. The FHWA, USEPA, the Health Effects Institute (HEI), and others have funded and conducted research studies to try to more clearly define potential risks from MSATs emissions associated with highway projects. The FHWA will continue to monitor the developing research in this field."

FIGURE 8: FHWA PROJECTED NATIONAL MSATS EMISSION TRENDS 2010 – 2050



Source: USEPA MOVES2014a model runs conducted by FHWA, September 2016.
Note: Trends for specific locations may be different, depending on locally derived information representing vehicle-miles travelled, vehicle speeds, vehicle mix, fuels, emission control programs, meteorology, and other factors.

5.0 AIR QUALITY IMPACT ANALYSIS

Background emissions are influenced by several factors including climate, topography, wind conditions, and the production of airborne pollutants by natural or artificial sources. Tailpipe emissions from cars and trucks produce approximately a third of the air pollution in the United States and are a major source of CO, oxides of nitrogen/nitrogen dioxide (NO_x/NO_2), and volatile organic compounds (VOCs). O_3, which is not directly emitted from automobiles (or other sources), is formed in the atmosphere by chemical reactions involving VOCs, NO_x, and sunlight. CO is the primary component of vehicle exhaust and contributes approximately 60 percent of all CO emissions in the United States. PM emissions are also important if the local environment includes a high concentration of diesel emission sources, such as heavy trucks. In addition, MSATs emissions are associated with motor vehicle sources.

This section provides results of the air quality analysis, provides an assessment of potential MSATs emissions along the project corridor, and discusses construction-related air emissions and potential mitigation activities.

5.1 O_3 and Transportation Conformity Determination

The proposed project is within an O_3 attainment area; therefore, a transportation conformity determination is not required.

5.2 CO Traffic Air Quality Analysis

CO is a product of incomplete combustion and occurs when carbon in the fuel is partially oxidized rather than fully oxidized to carbon dioxide (CO_2). CO reduces the flow of oxygen in the bloodstream and is particularly dangerous to persons with heart disease. Exposure to CO can impair visual perception, manual dexterity, learning ability, and performance of complex tasks.

Louisiana is currently in attainment statewide for CO. The traffic projections for the proposed build alternatives, as determined by the traffic study conducted by CobbFendley, indicate that average daily traffic (ADT) does not exceed 140,000 vpd. Moreover, CO analyses performed, assuming worst-case scenarios, for projects with much higher ADT to the proposed project such as the Pecue Lane/I-10 project in East Baton Rouge Parish, have shown no violations of the NAAQS. Therefore, it can be determined that the proposed project will not violate the NAAQS for CO, like similar projects modeled have previously demonstrated. Hence, air quality modeling for CO is not required.

5.3 MSATs Air Quality Analysis

The proposed project is a minor bridge replacement project that improves LOS in the project area. The traffic study indicates that the design-year AADT traffic projections within the project limits will be less than 140,000 vpd. Therefore, a qualitative MSATs analysis is required for the No-Build and the Build Alternatives.

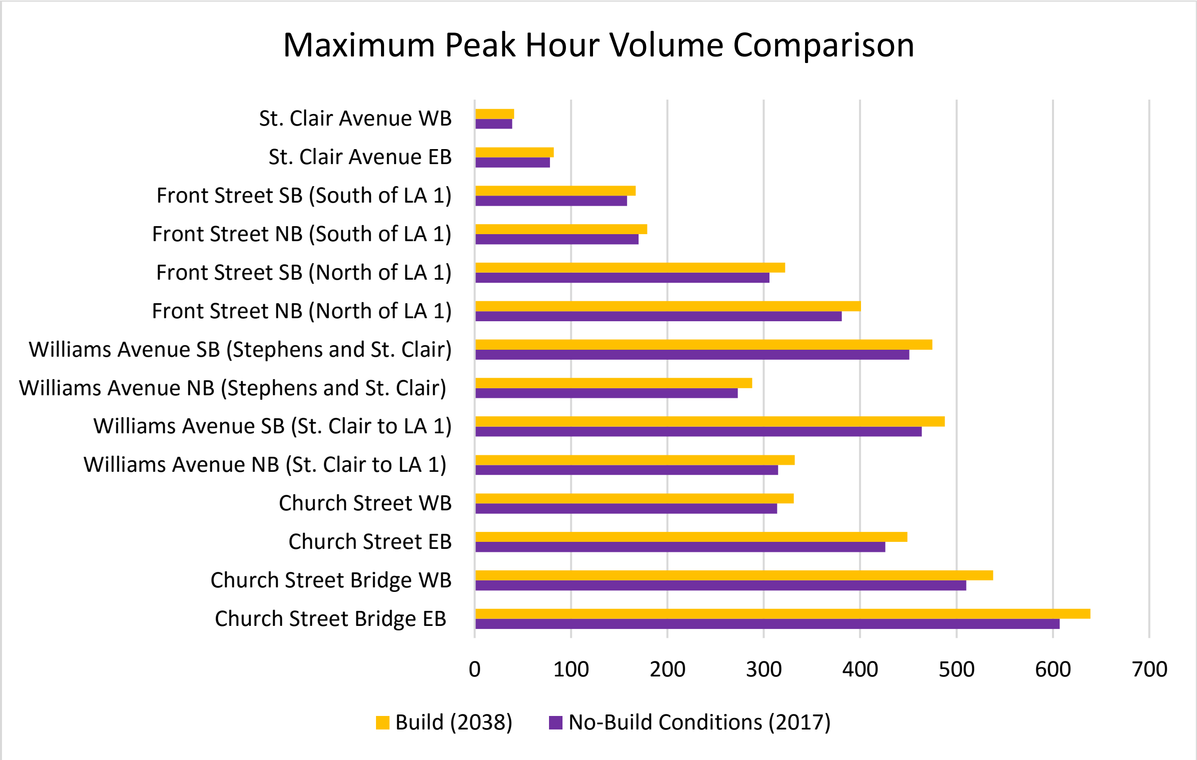
5.3.1 Project-Specific MSATs Information

A qualitative MSATs analysis provides a basis for identifying and comparing the potential differences among MSATs emissions, if any, from various alternatives of a project.

For each alternative in this document, the amount of MSATs emitted would be proportional to the vehicle miles traveled (VMT), assuming other variables such as fleet mix are the same for each alternative. The VMT estimated for the Build Alternatives are slightly higher than for the No-Build Alternative because the new structure increases the efficiency of the roadway.

Figure 9 shows a comparison of increase in traffic volume during peak hour between the Build and the No-Build Alternatives indicating the slight increase in VMT. The maximum traffic volumes at each location are taken from figures in the October 2017 memorandum.

Figure 9: BUILD VS. NO-BUILD TRAFFIC VOLUME COMPARISON



Source: CobbFendley Technical Memorandum, October 2017.

This increase in VMT means MSATs under the Build Alternative would most likely be higher than the No-Build Alternative in the general project area; however, there might also be a corresponding decrease in MSATs emissions along parallel routes.

The emissions increase is offset somewhat by lower MSATs emission rates due to increased LOS. Per the USEPA's MOVES2014a model, emissions of all priority MSATs decrease as speed increases.

Also, regardless of the alternative selected, emissions will likely be lower than present levels in the design year as a result of USEPA's national control programs that are projected to reduce annual MSATs emissions by over 90 percent between 2010 and 2050 (FHWA, 2016). Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the USEPA-projected reductions is so great (even after accounting for VMT growth) that MSATs emissions in the study area are likely to be lower in the future in nearly all cases.

In conclusion, under the Build Alternatives in the design year, it is expected there could be higher MSATs emissions within the project corridor relative to the No-Build Alternative due to increased VMT. Due to the improvement in LOS and speed in the corridor, MSATs emissions could also be reduced. There could be slightly elevated but unquantifiable changes in MSATs to residents and others in a few localized areas where VMT increases, which may be important to members of sensitive populations. However, on a regional basis, USEPA's vehicle and fuel regulations coupled with fleet turnover will cause region-wide MSATs levels to be significantly lower than today in almost all cases.

5.3.2 Incomplete or Unavailable Information for Project-Specific MSATs Health Impacts Analysis

In FHWA's view, information is incomplete or unavailable to credibly predict the project-specific health impacts due to changes in MSATs emissions associated with the proposed alternatives. The outcome of such an assessment, adverse or not, would be influenced more by the uncertainty introduced into the process through assumption and speculation rather than any genuine insight into the actual health impacts directly attributable to MSATs exposure associated with a proposed action.

The USEPA is responsible for protecting the public health and welfare from any known or anticipated effect of an air pollutant. They are the lead authority for administering the CAA and its amendments and have specific statutory obligations with respect to hazardous air pollutants and MSATs. The USEPA is in the continual process of assessing human health effects, exposures, and risks posed by air pollutants. They maintain the IRIS, which is "a compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects" (USEPA, IRIS). Each report contains assessments of non-cancerous and cancerous effects for individual compounds and quantitative estimates of risk levels from lifetime oral and inhalation exposures with uncertainty spanning perhaps an order of magnitude.

Other organizations are also active in the research and analyses of the human health effects of MSATs, including the HEI. Two HEI studies are summarized in Appendix D of FHWA's Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA Documents. Among the adverse health effects linked to MSATs compounds at high exposures are: cancer in humans in occupational settings; cancer in animals; and irritation to the respiratory tract, including the exacerbation of asthma. Less obvious is the adverse human health effects of MSATs compounds at current environmental concentrations or in the future as vehicle emissions substantially decrease (HEI, 2007).

The methodologies for forecasting health impacts include emissions modeling; dispersion modeling; exposure modeling; and final determination of health impacts. Each step in the process builds on the model predictions obtained in the previous step. All steps are encumbered by technical shortcomings or uncertain science that prevents a more complete differentiation of the MSATs health impacts among a set of project alternatives. These difficulties are magnified for lifetime (i.e. 70-year) assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over that timeframe, since such information is unavailable.

It is particularly difficult to reliably forecast 70-year lifetime MSATs concentrations and exposure near roadways to determine the portion of time that people are exposed at a specific location and to establish the extent attributable to a proposed action, especially given that some of the information needed is unavailable.

There are considerable uncertainties associated with the existing estimates of toxicity of the various MSATs, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population (HEI, 2007). As a result, there is no national consensus on air dose-response values assumed to protect the public health and welfare for MSATs compounds, and in particular for diesel PM. The USEPA and the HEI have not established a basis for quantitative risk assessment of diesel PM in background settings.

There is also the lack of a national consensus on an acceptable level of risk. The current context is the process used by the USEPA as provided by the CAA to determine whether more stringent controls are required to provide an ample margin of safety to protect public health or to prevent an adverse environmental effect for industrial sources subject to the maximum achievable control technology standards, such as benzene emissions from refineries. The decision framework is a two-step process. The first step requires USEPA to determine an acceptable level of risk due to emissions from a source, which is generally no greater than approximately 100 in one million. Additional factors are considered in the second step, the goal of which is to maximize the number of people with risks less than one in one million due to emissions from a source. The results of this statutory two-step process do not guarantee that cancer risks from exposure to air toxics are less than one in one million; in some cases, the residual risk determination could result in maximum individual cancer risks that are as high as approximately 100 in one million. In a June 2008 decision, the United States Court of Appeals for the District of Columbia Circuit upheld USEPA's approach to addressing risk in its two-step decision framework.

Information is incomplete or unavailable to establish that even the largest of highway projects would result in levels of risk greater than deemed acceptable. Because of the limitations in the methodologies for forecasting health impacts described, any predicted difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with predicting the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against project benefits, such as reducing traffic congestion, accident rates, and fatalities, plus improved access for emergency response, that are better suited for quantitative analysis.

5.3.3 Impacts of the No-Build Alternative

The No-Build Alternative would result in gradually increasing VMT as traffic volumes increase and traffic congestion worsens within the existing roadway system over time. However, MSATs emissions will likely be lower than present levels in future years as a result of USEPA's national control programs that are projected to reduce annual MSATs emissions by over 90 percent, as predicted by FHWA's latest national MSATs emission trends from 2010 to 2050 (FHWA, 2016).

5.3.4 Conclusion

A qualitative MSATs assessment has been provided relative to the various project alternatives and has acknowledged that the project's Build Alternative may result in increased exposure to MSATs emissions in certain locations. However, since concentrations and duration of exposures are uncertain, the health effects from these emissions cannot be estimated.

Air toxics analysis is a continuing area of research. The tools and techniques for assessing project-specific health outcomes as a result of lifetime MSATs exposure remain limited. These limitations impede the ability to evaluate how the potential health risks posed by MSATs exposure should be factored into project-level decision-making within the context of NEPA. The FHWA will continue to monitor the developing research in this emerging field.

5.4 Greenhouse Gas Emissions

On August 2, 2016, the Council on Environmental Quality (CEQ) issued Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas (GHG) Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews, which describes how agencies should address climate change in NEPA reviews.

The CEQ guidance applies to Environmental Assessments (EAs) and Environmental Impact Statements (EISs) and calls for an analysis of direct and indirect GHG emissions from proposed Federal agency actions. The guidance establishes that the level of analysis should be commensurate with the quantity of projected GHG emissions. It also calls for consideration of the impacts of a changing climate on the proposed action and on the affected environment.

The guidance applies to new proposed Federal agency actions where an EA or EIS commences on or after the release date of the CEQ guidance, August 2, 2016. For EAs and EISs where environmental effects analysis is not substantially complete, agencies should include a climate change analysis where practicable. The guidance does not apply retroactively to completed EAs and EISs (FHWA 2016).

On October 5, 2017, the FHWA published a notice in the Federal Register [82 FR 46427] proposing the repeal of the GHG measure.

5.5 Construction-Related Air Emissions

During the construction phase of this project, temporary increases in air pollutant emissions may occur from construction. The primary construction-related emissions are PM (fugitive dust) from site preparation which is temporary in nature (only occurring during actual construction). The potential impacts of PM emissions will be minimized by using fugitive dust control measures such as covering or treating disturbed areas with dust suppression techniques, sprinkling of water in dust prone areas, covering loaded trucks, and other dust abatement controls as appropriate.

The construction phase of this project may also generate a temporary increase in MSATs emissions during construction from equipment and related vehicles. The primary construction-related MSATs emissions are PM from site preparation and diesel PM from diesel-powered construction equipment and vehicles.

The MSATs emissions will be minimized by federal measures that require the use of low emission diesel fuel for non-road diesel construction equipment operated in

Natchitoches Parish and by provisions that would be included in the plans and specifications that require the contractor to minimize construction air quality impacts through abatement measures such as limits on construction equipment idling and other emission limitation techniques as appropriate.

Considering the temporary and transient nature of construction-related emissions, as well as the mitigation actions to be implemented, it is not anticipated that emissions from construction of this project would have any significant impact on air quality in the area.

6.0 CONCLUSIONS

Table 3 provides a summary of the results of the air quality analysis for this project. The Cane River Bridge project would not cause or exacerbate a violation of any NAAQS. There would be no adverse air quality impacts associated with the implementation of the proposed project. Therefore, no mitigation measures are proposed with respect to operational activities.

Construction has the potential to produce short-term, localized air quality impacts. Potential impacts include increased MSATs emissions from construction equipment and vehicles and temporary impacts due to fugitive dust emissions. Mitigation measures to alleviate temporary impacts from construction are described in the previous section.

TABLE 3: SUMMARY OF AIR QUALITY ANALYSIS

Analysis	Results
O^3 Conformity Determination	Not Required
CO Hotspot	Not Required
PM Hotspot	Not Required
MSATs	Low Potential Impacts
GHG Emissions	No Longer Required[1]
Construction Impacts	Temporary & Localized Minimal Impacts

[1]Federal guidance on GHG emissions measures was repealed in October 2017.

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