200 East; Center Street to 300 South
Logan City, Utah

Noise Assessment Report
February, 2009
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Introduction
This report summarizes the environmental noise impact and mitigation analysis performed by J-U-B Engineers, Inc. (JUB) as part of the environmental review process of the proposed 200 East project improvements in Logan City, Utah. The analysis included measurements of existing sound levels at representative sensitive receiving locations in areas that would be affected by traffic related to the proposed project and noise impact and mitigation modeling based on expected 2030 traffic conditions. This report is summarized in the environmental impact statement for this project.

Project Description
The proposed improvement will require reconstructing 200 East south of Center Street to connect the roadway to the Center Street Intersection. The intersection will also be reconstructed to accommodate a traffic signal. Additional improvements include constructing a pedestrian under-crossing between Merlin Olsen Central Park and Pioneer Parkway (Figure 4.1 – Roadway and Intersection Improvements). Furthermore, this improvement will require widening the roadway from 45 feet to 60 feet, to provide a consistent cross-section along 200 East. Currently, the roadway cross-section of 200 East between 200 South and 300 South is significantly narrower than the width of 200 East between 100 South and 200 South. Widening will occur on the east side of 200 East, requiring acquisition of property and right of way.

The design alternatives evaluated in the noise impact analysis include the No Build and Build Alternatives for the signalized intersection at 300 South/200 East and Center Street/200 East intersections. Each alternative is described briefly below.

No Build
Under the No Build Intersection Alternative no improvements would be made to the existing 200 East and Center Street Intersection. Only routine maintenance would occur at the intersection. Analysis of a No Build Alternative is required as per the guidelines in the Federal Highway Administration (FHWA) technical Advisory T6640.8A and in the Utah Department of Transportation Environmental Process Manual of Instruction.

Build Alternative 2A - Signalized Intersection at Center Street/200 East
Build Alternative 2A includes transportation improvements along 200 East from Center Street to 300 South. These improvements include connecting 200 East south of Center Street, constructing a signalized intersection at 200 East and Center Street, improving the 200 East and 200 South intersection, improving the 200 East and 300 South intersection by adding turn-lanes, and widening 200 East from 200 South to 300 South to an 88-foot cross-section consistent with Logan City’s standards for a major collector

Build Alternative 2A was identified as the Preferred Alternative by UDOT and Logan City because it meets all elements of the project’s Purpose and Need. The Preferred Alternative includes the following elements:
• Construction of a new intersection at Center Street and 200 East, including a connection of 200 East to the south of Center Street. A signalized intersection at 200 East and Center Street would include one through travel-lane for all approach directions, center turn lanes, right turn lanes, and designated pedestrian crosswalks.
• A pedestrian under-crossing would be constructed under 200 East between Merlin Olsen Central Park and Pioneer Parkway. A second pedestrian under-crossing would be constructed under Center Street between Boulevard Street and Merlin Olsen Central Park.
• Construction of a roadway on the 200 East alignment from Center Street to 100 South. The roadway would have be constructed at an approximate 3% slope to accommodate for the notable change in elevation between Center Street and 100 South. Retaining walls would also be required for the roadway design. A fence would be constructed on the outside of the sidewalks for pedestrian safety.
• Pioneer Avenue would terminate in a cul-de-sac and access for all existing uses would be maintained.
• The 200 East roadway between 100 South and 200 South would be resurfaced and striped to establish a uniform roadway cross-section throughout the corridor. Curb and gutter would be reconstructed and storm drainage facilities would be included.
• The offset alignment at the intersection of 200 South and 200 East would be corrected by widening the southern leg to match the northern roadway width. The stop signs at the intersection would be relocated to the east and west legs of the intersection.
• 200 East would be widened from 200 South to 300 South to provide all required roadway elements to meet Logan City’s standard cross-section for a major collector and the CMPO Pedestrian and Bicycle Master Plan. The proposed roadway design includes an 11-foot center turn lane, two 11-foot travel lanes, two 11-foot parking/bike lanes, 2.5-foot curb and gutter, 8-foot park strips, 5-foot sidewalks, and 1-foot buffer past sidewalks.
• Construction of intersection improvements at 300 South and 200 East, including left turn-lanes for both eastbound travel on 300 South and southbound travel on 200 East, and a right turn-lane on westbound 300 South.

Affected Environment
Noise Level Terminology
Noise is sometimes defined as unwanted sound. This report makes no such distinction, and the terms noise and sound are used more or less synonymously. The human ear responds to a very wide range of sound intensities. The decibel (dB) scale used to describe sound is a logarithmic rating system that accounts for the large differences in audible sound intensities. This scale accounts for the human perception of a doubling of loudness as an increase of 10 dB. Therefore, a 70-dB sound level will sound twice as loud as a 60-dB sound level.

People generally cannot detect sound level differences (increases or decreases) of 1 dB in a given noise source. Although differences of 2 or 3 dB can be detected under ideal laboratory situations, they are difficult to discern in an active outdoor noise environment. A 5-dB change in a given noise source or environment would be likely to be perceived by most people under normal listening conditions.
When addressing the effects of noise on people, it is necessary to consider the frequency response of the human ear, or those frequencies that people hear best. Sound measuring instruments are therefore often designed to "weight" sounds based on the way people hear. The frequency-weighting most often used to evaluate environmental noise is A-weighting, and measurements from instruments using this system are reported in "A-weighted decibels" or dBA. All sound levels discussed in this evaluation are reported in A-weighted decibels.

For a given noise source, factors affecting the sound transmission from the source, which affect the potential noise impact, include distance from the source, frequency of the sound, absorbency of the ground surface, the presence or absence of obstructions and their absorbency or reflectivity, and the duration of the sound. The degree of impact on humans also depends on who is listening and on existing sound levels. Typical sound levels of some familiar noise sources and activities are presented in Table 1-2.

Because the dBA scale used to describe noise is logarithmic, a doubling of a traffic noise source (i.e., twice as much traffic on a road) produces a 3 dBA increase in overall roadway noise. Overall sound levels due to "line" sources such as roads decrease with distance from the road at a rate of 3 dBA per doubling of the distance from the road. Sound levels from discrete events or "point" sources, such as from a single vehicle's brake screech or tire squeal, decrease 6 dBA per doubling of the distance from the event. Conversely, moving half the distance closer to a road increases sound levels by 3 dBA and 6 dBA for roadway and point sources, respectively.

Federal regulatory agencies often use the equivalent sound level (Leq) to evaluate noise impacts. The Leq is the level of a constant sound that has the same sound energy as the actual, fluctuating sound. As such, the Leq can be considered an energy-average sound level. But this metric should not be confused with an arithmetic average which tends to de-emphasize high and low values, because the Leq gives most weight to the highest sound levels because they contain the most sound energy. The Leq noise metric also has been found to be highly correlated to community response to noise, and is often the metric calculated by noise models to assess potential impacts and the need for mitigation.

In discussing sound level measurements and predictions, it is important to identify the time period being considered, because most sound-energy criteria address sound levels over some time period. In this way, noise criteria address both the intensity and the duration of sounds. Equivalent sound levels discussed in this analysis are for a one-hour period during midday or peak period traffic.
Noise Regulation Overview

FHWA/UDOT Noise Impact and Abatement Policies

The Federal Highway Administration (FHWA) identified noise criteria and established procedures for evaluating road improvement projects in its Federal-Aid Highway Manual (U.S. Department of Transportation, 1982). These criteria and procedures are now codified in federal rules in 23 CFR 772. The FHWA defines a traffic noise impact as a measured or predicted traffic noise level approaching or substantially exceeding the federal noise abatement criteria, but leaves the definition of "approaching" and "substantially exceeding" to the states. The Utah Department of Transportation (UDOT) defines "approaching" the FHWA limits as sound levels within 2 dBA of a criterion level and defines "substantially exceeding" existing noise levels as an increase of 10 dBA or more. The UDOT abatement criteria can be found in Table 1-3.
Because the proposed project is subject to state and federal review, the federal noise limits and noise impact criteria listed above apply to the proposed project. These limits and the related state noise impact and mitigation policies and guidelines provide a set of tools with which to objectively assess the relative magnitude and potential impacts of traffic noise levels. Applying UDOT policy also provides a means to evaluate potential mitigation measures using standard principles of barrier effectiveness and cost/benefit analysis.

<table>
<thead>
<tr>
<th>LAND USE CATEGORY</th>
<th>FHWA Hourly Leq (dBA)</th>
<th>UDOT Hourly Leq (dBA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) Land 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.</td>
<td>57</td>
<td>56</td>
</tr>
<tr>
<td>(B) Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.</td>
<td>67</td>
<td>66</td>
</tr>
<tr>
<td>(C) Developed lands, properties, or activities not included in the above categories.</td>
<td>72</td>
<td>71</td>
</tr>
<tr>
<td>(D) Undeveloped lands</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>(E) Interior of residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.</td>
<td>52</td>
<td>51</td>
</tr>
</tbody>
</table>

There are no established Leq levels for undeveloped land.
Existing Sound Levels

Existing sound levels were measured at six noise sensitive receiver locations (Figure 1-1) within the study area, during the afternoon peak hours of August 21, 2008 (afternoon peak hours are between approximately 4 p.m. and 6 p.m.). Time periods for the traffic counts were chosen to represent typical weekday PM peak traffic conditions. These sound level measurements (SLMs) are used to characterize the existing acoustic environment and to provide a baseline from which to assess future changes in traffic noise. The measurements were taken using Extech 407780 sound level meters. The meters are Type I sound level meters with levels of accuracy about ± 1 dBA. The meters had been factory certified within the previous 12 months and were field calibrated immediately prior to the measurements. The microphones of the meters were fitted with wind screens and were set approximately 5 feet above the ground (at a typical listening height). Each short-term sound level measurement lasted 10 minutes, during which time visible traffic sources were counted and categorized. Categories of vehicles counted included autos, medium trucks, heavy trucks, buses, and motorcycles.

There are residential receivers along both sides of 200 East. Two parks located on 200 East are between 100 East and Center Street. Pioneer Parkway is located on the west of 200 East and occupies 3.4 acres of the southeast corner of this block. Merlin Olsen Central Park is located on the east of 200 East and occupies the entire block. The areas between 100 South and 300 South contain residential uses on both sides of 200 East with several mature street trees within the existing park strip. Terrain throughout this area is relatively flat with receivers located at grade with the proposed roadway improvements. Table 1-4 identifies the existing noise measurements.

<table>
<thead>
<tr>
<th>SML Location</th>
<th>Date/Day</th>
<th>Leq</th>
<th>Land Use Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>SML1</td>
<td>Thursday, 08/21/08</td>
<td>62.3</td>
<td>B</td>
</tr>
<tr>
<td>SML2</td>
<td>Thursday, 08/21/08</td>
<td>62.8</td>
<td>B</td>
</tr>
<tr>
<td>SML3</td>
<td>Thursday, 08/21/08</td>
<td>54.3</td>
<td>B</td>
</tr>
<tr>
<td>SML4</td>
<td>Thursday, 08/21/08</td>
<td>51.7</td>
<td>B</td>
</tr>
<tr>
<td>SML5</td>
<td>Thursday, 08/21/08</td>
<td>53.3</td>
<td>B</td>
</tr>
<tr>
<td>SML6</td>
<td>Thursday, 08/21/08</td>
<td>65.0</td>
<td>D</td>
</tr>
</tbody>
</table>

SML = Sound Measurement Location
Figure 1-1 Sound Level Measurement Locations
Potential Environmental Noise Impacts

Noise Modeling Description
Potential p.m. peak-hour traffic noise levels were calculated for traffic conditions expected in the year 2030 for No Build, and the proposed 200 East extension. These calculations were performed using the FHWA Traffic Noise Model (TNM) version 2.5 (FHWA 2004) to calculate noise levels at nearby receptors and to examine the potential noise-reducing benefits of noise barriers. TNM considers traffic volumes, composition, travel speed, terrain, and the presence or absence of obstructions like buildings or noise barriers to calculate hourly Leqs from traffic sources.

Both intersections; 300 South/200 East and Center Street/200 East were evaluated for the 2030 conditions without the 200 East extension and 2030 conditions with the 200 East extension with traffic signals at 300 South/200 East and Center Street/200 East. The data was derived from roadway plans, aerial photos, and from observations during a site visit. The modeling included directional presentations of roadway segments, lawn zones, parks and residential buildings which can be represented as barriers.

In most situations, TNM’s performance can be evaluated by comparing measured traffic noise levels with the levels predicted by the model based on the traffic conditions observed during the measurements (including vehicle counts, classifications, estimated travel speeds, and all terrain and building features from the existing environment). In some situations, extraneous noise sources such as aircraft or nearby voices were included in the measurement. In these cases, JUB noted the time and duration of such events, and then corrected the measurements using spreadsheet calculations. For each receiver where calibration was possible, the calculated and measured sound levels agreed within ±2 dBA, indicating the model is accurately representing the project area.

Noise Sensitive Areas and Terrain Features
The study area is primarily comprised of residential and recreational receivers along 200 East. No commercial receivers exist in the study area. The residential areas exist on both sides of the 200 East and are potentially affected by traffic noise from the 200 East extension and widening which in some cases will replace the existing lawn with roadway improvements.

The elevation at Center Street/200 East is approximately 20 to 25 feet higher than the intersection at 200 East/100 South. The area between 100 South and Center Street contains two parks on both sides of 200 East with numerous mature trees throughout both parks. The area between 200 South and 300 South contains residential uses on both sides of 200 East with mature street trees within the existing park strip. No significant elevation change occurs between these two intersections.

Noise Modeling Receptors
To evaluate front line and secondary noise receptors, 20 receptors locations were included in the TNM model representing sensitive receiving locations. TNM model runs were used in conjunction with information gathered at the sound level measurement locations to estimate existing sound levels at each of the 20 additional receptors. The model receptor locations are
illustrated in Figure 1-3. These sound levels represent PM peak-hour Leqs. Noise contours were also created to predict worse case noise levels. Figure 1-6, illustrates the future noise contours generated by implementation of the Build Alternative. The TNM model resulted in sound levels very close to measured values, within ±2 dBA or less. Therefore, no calibration of the TNM was required.

Traffic Volumes and Characteristics
Existing and future traffic sound levels were modeled using TNM and traffic data appropriate for each year and the proposed 200 East extension road considered in this analysis. The 2008 PM peak traffic volumes and noise sound level for the study area was collected at the same time in August, 2008. The data collected includes:

- Traffic volumes with turning movements for PM Peak traffic hours (4:30 pm – 5:30 pm) at the intersections of 200 East/300 South and 200 East/Center Street
- 2030 CMPO PM Volume& Daily Forecasting Maps with and without the 200 East extension

In 2030 CMPO plan, the forecasted travel demand is about 12,000 vehicles per day for Center Street and 19,000 per day for 200 East. The projected Traffic volumes are shown in Figure 1-2. Traffic volumes along each roadway were categorized as light-duty (e.g., cars), medium-duty trucks, heavy duty trucks, or buses. For existing conditions, traffic composition percentages were taken from field observations.

Figure 1-2 Forecasted Traffic Conditions (2030) with Traffic Signal
Figure 1-3 Sound Receptor Locations
Figure 1-4 Noise Contours
Impact Analysis Results Summary

Future traffic sound levels were modeled using TNM and traffic data appropriate for each year and the proposed 200 East Build Alternatives. The 2008 PM peak traffic volumes and noise sound levels for the study area were collected at the same time in August, 2008. Time periods for the traffic counts were chosen to represent typical weekday PM Peak traffic conditions. The data collected includes:

- Traffic volumes with turning movements for PM Peak traffic hours (4:30 pm – 5:30 pm) at the intersections of 200 East and 300 South and 200 East and Center Street.

Results of the TNM modeling for the 200 East Build and No Build Alternatives are shown in Table 1-5. These sound levels represent PM peak-hour Leqs. As stated previously, UDOT defines “substantially exceeding” as an increase greater than or equal to 10 dBA over existing sound levels. Modeling results are included in Appendix A of this document.

<table>
<thead>
<tr>
<th>Sound Level Location</th>
<th>2008 Modeled Sound Level</th>
<th>2030 No Build</th>
<th>Future Worse Case Noise Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>RWP1</td>
<td>56.1</td>
<td>56.1</td>
<td>56.1</td>
</tr>
<tr>
<td>RWP2</td>
<td>58.2</td>
<td>58.2</td>
<td>58.2</td>
</tr>
<tr>
<td>RWP3</td>
<td>60.2</td>
<td>60.2</td>
<td>60.2</td>
</tr>
<tr>
<td>RWP4</td>
<td>62.4</td>
<td>62.4</td>
<td>62.4</td>
</tr>
<tr>
<td>REP3</td>
<td>61.0</td>
<td>61.0</td>
<td>61.0</td>
</tr>
<tr>
<td>REP4</td>
<td>58.5</td>
<td>58.5</td>
<td>58.5</td>
</tr>
<tr>
<td>REP2</td>
<td>60.3</td>
<td>60.3</td>
<td>60.3</td>
</tr>
<tr>
<td>REP5</td>
<td>60.1</td>
<td>60.1</td>
<td>60.1</td>
</tr>
<tr>
<td>REP1</td>
<td>60.8</td>
<td>60.8</td>
<td>60.8</td>
</tr>
<tr>
<td>RER1</td>
<td>62.2</td>
<td>62.2</td>
<td>62.2</td>
</tr>
<tr>
<td>RER2</td>
<td>62.0</td>
<td>62.0</td>
<td>62.0</td>
</tr>
<tr>
<td>RER3</td>
<td>61.8</td>
<td>61.8</td>
<td>61.8</td>
</tr>
<tr>
<td>RER4</td>
<td>61.8</td>
<td>61.8</td>
<td>61.8</td>
</tr>
<tr>
<td>RER2 Row1</td>
<td>58.1</td>
<td>58.1</td>
<td>58.1</td>
</tr>
</tbody>
</table>
The modeled sound level measurement locations for both primary and secondary receivers do not exceed the 66 dBA noise contour. Furthermore, no sound levels increased greater than 10 dBA for any of the sound receptor locations identified in table 1-5. The Build Alternative will not result in a noise impact for front line or secondary receivers along 200 East.
Appendix A Modeling Information