



# memorandum

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from Michael Mulbarger and Mark Johnson  
subject Traffic Noise Technical Memorandum (Revised), Mercer West Two-way Conversion Project

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## Acronyms and Abbreviations

WSDOT	Washington State Department of Transportation
NAC	Noise Abatement Criteria
FHWA	Federal Highway Administration
TNM	Traffic Noise Model

## Introduction

This technical memorandum presents the results of traffic noise modeling for the proposed project.

## Proposed Project

The City of Seattle, Washington, in cooperation with the Federal Highway Administration, proposes to make improvements to the Mercer Corridor, which includes Mercer and Roy Streets and adjoining cross streets, in the Uptown neighborhood of Seattle. The Mercer West Two-way Conversion Project will complete the City’s vision for a direct, two-way connection between I-5 and Elliott Avenue West.

The project area covered in this analysis includes Mercer Street and West Mercer Street from Fifth Avenue North to Fifth Avenue West and Roy Street and West Roy Street from Aurora Avenue North to Fifth Avenue West (Exhibit 2-1 attached). The purpose of the project is to improve local safety, access, and circulation within the Uptown neighborhood for motorized vehicles, bicycles and pedestrians, and to provide for more direct movement of traffic and freight through the corridor.

Currently, from Fifth Avenue North to First Avenue North, Mercer Street is a one-way principal arterial with four eastbound lanes, operating as a couplet with Roy Street. Roy Street is a principal arterial with two westbound lanes from Fifth Avenue North to First Avenue North and three westbound lanes from First Avenue North to Queen Anne Avenue North. West of First Avenue North, Mercer Street, which becomes West Mercer Street at Queen Anne Avenue North, is a two-way street. West of Queen Anne Avenue North, West Roy Street is a two-way street. Roy Street is also a two-way street to the east of Fifth Avenue North.

The project would modify channelization and signals to replace the existing Mercer/Roy couplet with a two-way Mercer Street, which would eliminate the extra turns required to travel from east to west through this area and reduce vehicle and pedestrian conflicts. The project would also convert Roy Street to a two-way street with bicycle lanes between Fifth Avenue North and Queen Anne Avenue North.

### ***Mercer Street/West Mercer Street Improvements***

Mercer Street would operate as a two-way street, with two lanes in each direction. This would be accomplished by restriping lanes, adding appropriate signs and signals, and modifying an existing curb bulb to provide room for two lanes in each direction. Other changes would include left-turn lanes at some intersections and modifications to parking. Curb ramps would be installed at locations where they are missing to comply with American with Disability Act (ADA) requirements (Exhibits 2-2 and 2-3 attached). Curb bulb modification and ADA improvements could lead to minimal storm drainage improvements as required by governing codes. All changes to Mercer Street between Fourth Avenue North and Queen Anne Avenue North would be within the existing street width and right-of-way. Minimal changes could be made to sidewalks, street trees, or planting strips. Right-of-way will be required along the south side of Mercer Street in the block between Fourth Avenue North and Fifth Avenue North to widen Mercer Street and transition to the future widened, six-lane Mercer Street Underpass east of Fifth Avenue North (part of the Alaskan Way Viaduct Replacement Project).

West of Queen Anne Avenue North, West Mercer Street would remain a two-way street, and minimal changes could be made to sidewalks, parking, street trees, or planting strips. Pedestrian crossing enhancements, such as curb bulbs or a median refuge, would be constructed on West Mercer Street at Fourth Avenue West or Fifth Avenue West, maintaining the existing one lane in each direction on West Mercer Street.

### ***Roy Street Improvements***

The one-way portion of Roy Street between Fifth Avenue North and Queen Anne Avenue North would be converted to two-way operation, reconfigured to have one travel lane in each direction, bike lanes, and parking on one side of the street. This would be accomplished by restriping lanes and adding appropriate signs and signals. The existing sidewalks would remain. The project also includes an option to convert Queen Anne Avenue North and/or First Avenue North to two-way operation between Mercer and Roy streets. Bicycle sharrows or other bicycle pavement markings would be added to West Roy Street between Queen Anne Avenue North and Fifth Avenue West.

In the block between Taylor Avenue North and Fifth Avenue North, curbs and parking would be modified within the existing right-of-way to add a westbound bicycle lane and eastbound bicycle sharrows connecting to existing bicycle facilities on Taylor Avenue North. Curb ramps would be added and modified at the intersection of Roy Street and Taylor Avenue North.

Bicycle lanes would be added to Fifth Avenue North between Mercer and Roy streets to connect the bicycle lanes on Roy Street to the bicycle path on Mercer Street that is part of the separate Mercer Underpass improvements. In addition, a later phase of the project may include installing a two-way, separated bicycle path on the west side of Fifth Avenue North between Mercer Street and Harrison Street. The bicycle path would require approximately 12 feet of right-of-way along the west side of Fifth Avenue North starting from a point mid-way between Mercer Street and Republican Street to Harrison Street. Other options under consideration for this segment of Fifth Avenue North include bicycle lanes or sharrows.

## Affected Environment

The proposed Mercer West Two-way Conversion Project is located in the Uptown neighborhood, to the north of downtown Seattle. The project area is a mixed commercial, residential, and entertainment district that includes retail businesses, professional offices, apartments, and the Seattle Center, which includes theaters, open space and other recreational uses.

## Regulatory Context

Washington State Department of Transportation (WSDOT) has established noise abatement criteria (NAC) for transportation noise in accordance with Federal Highway Administration (FHWA) requirements. The WSDOT noise criteria are applicable to all roadway projects in Washington State, including projects on local roads where the project proponent is a local jurisdiction like the City of Seattle. The NAC are provided in Table 1 below.

**Table 1  
FHWA NOISE ABATEMENT CRITERIA**

Activity Category	Activity Leq(h) <sup>1</sup> FHWA	Evaluation Location	Description of Activity Category
A	57	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B <sup>2</sup>	67	Exterior	Residential
C <sup>2</sup>	67	Exterior	Active sports 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, recreational areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
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.
E <sup>2</sup>	72	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	–	–	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	–	–	Undeveloped lands that are not permitted.

(Based on Table 1 of 23 CFR Part 772)

<sup>1</sup> The Leq(h) Activity Criteria values are for impact determination only, and are not design standards for noise abatement measures.

<sup>2</sup> Includes undeveloped lands permitted for this activity category.

The land uses adjacent to the project corridor include primarily a mixture of residential and commercial uses that can be categorized in Activity Categories B, C and E in Table 1 above.

The prediction of future traffic noise levels with the roadway improvements was performed using the FHWA’s computer model for highway traffic noise prediction and analysis – the Traffic Noise Model (TNM-Version 2.5). The TNM predicts sound energy, in one-third octave bands, between highways and nearby receivers taking the intervening ground’s acoustical characteristics/topography and rows of buildings into account. Default settings for meteorological conditions were used in the TNM: 50% relative humidity and a temperature of 68° F. The design year, peak hour traffic data used on the analysis varies by roadway segment along the project corridor, and is provided in Table 2 below.

**TABLE 2  
TRAFFIC DATA**

Roadway	Roadway Segment	Direction	TNM Input				Speed (mph)
			Cars	Medium Trucks	Heavy Trucks	Buses	
Mercer Street	Elliott Ave. to Queen Anne Ave. N	Peak	609	3	26	12	30
		Off-Peak	502	3	21	10	30
	Queen Anne Ave. to 1 <sup>st</sup> Ave. N	Peak	505	2	5	2	30
		Off-Peak	449	2	4	2	30
	1 <sup>st</sup> Ave. N to 5 <sup>th</sup> Ave. N	Peak	473	14	5	1	30
		Off-Peak	348	11	4	1	30
Roy Street	Queen Anne Ave. to 1 <sup>st</sup> Ave. N	Peak	662	20	7	1	30
		Off-Peak	178	5	2	0	30
	1 <sup>st</sup> Ave. N to 5 <sup>th</sup> Ave. N	Peak	235	7	2	0	30
		Off-Peak	166	5	2	0	30

SOURCE: DKS Associates, Inc. 2010

### Project Operation Effects

The WSDOT has determined that a traffic noise impact occurs when predicted future traffic noise levels approach or exceed the NAC for a given “Activity Category” as defined in Table 1 above. WSDOT defines the term “approach” to mean within 1 dBA of the NAC (i.e. for a Activity Category “B” Land Use (residence) the NAC criteria is 67 dBA, and an approach of the NAC would occur at 66 dBA).

Since the project would alter existing traffic patterns in the area, and traffic volumes are naturally predicted to increase over time, noise level contours were developed for the project corridor. These contours depict the distance, measured in feet from the improved roadway’s centerline where an approach (within 1 dBA) of the NAC is predicted to occur for a given land use (see Table 1 above) during the design year of the proposed improvements. Table 3 lists the distance of the applicable noise contour from the roadway centerline, and the corresponding contours are shown on Exhibits 2-2, 2-3, and 2-4. All distances are for the future build, design year condition (2030), which includes completion of the Alaskan Way Viaduct Replacement Project. It was determined through this noise contour analysis that some land uses in the westernmost portion of the study area could potentially be impacted by traffic noise (i.e. the noise contour distance extends past a noise sensitive site – the site is “within” the contour); therefore, additional detailed traffic noise modeling and analysis was warranted at the locations identified on Exhibit 2-4.

**TABLE 3  
NOISE CONTOUR DISTANCES**

Roadway Segment	Distance (feet)*
<b>West Mercer Place between Elliott Avenue West and Queen Anne Avenue</b>	<b>50.0</b>
<b>Mercer Street between Queen Anne Avenue and 1<sup>st</sup> Avenue North</b>	<b>&lt;25.0</b>
<b>Mercer Street between 1<sup>st</sup> Avenue North and 5<sup>th</sup> Avenue North</b>	<b>32.0</b>
<b>Roy Street between Queen Anne Avenue and 4<sup>th</sup> Avenue North</b>	<b>35.0</b>
<b>Roy Street between 4<sup>th</sup> Avenue North and Aurora Avenue</b>	<b>&lt;25.0</b>

\* Distances shown are referenced from the centerline of the roadway, and do not include any reduction in noise levels that may occur due to shielding from existing structures.

SOURCE: ESA 2011

As shown in Table 3, the maximum distance from the roadway centerline that an exterior traffic noise impact is predicted to occur at a residential or recreational area is 50 feet for the segment of West Mercer Place from Elliott Avenue West to Queen Anne Avenue. It should be noted that there are no capacity improvements planned for this area, and the potential increase in traffic noise is directly related to a forecast future increase in motor vehicle traffic resulting from general population growth and the completion of the bored tunnel portion of the Alaskan Way Viaduct Replacement Project. From Queen Anne Avenue to the east, including the improvements along Roy Street, the noise contour distance ranges from less than 25 feet to 35 feet from the roadway centerline. In most cases this distance would not extend much further than the sidewalk/building facades on either side of the roadway. This is due to the low volume of traffic and low speeds along the project corridor.

The contour distances described above were generated for Activity Category B and C land uses as detailed in Table 1. There is also an Activity Category (E) for land uses (restaurants, bars, hotels, etc) that exist along the project corridor as well. However, the NAC for Category "E" Land Uses is 72.0 dBA (an approach of this criterion occurs at 71 dBA, and as such would determine an impact). A review of the noise contours already predicted and provided in Table 3 revealed that a 71.0 dBA noise contour would not extend beyond the right-of-way for the proposed improvements. As such, no traffic noise impacts for Activity Category E Land Uses are expected to occur.

Since the results of the noise contour analysis indicate that some noise sensitive land uses (residences along West Mercer Place north of Elliott Avenue West) may be inside the 50' noise contour distance, additional detailed computer modeling was conducted using the TNM to determine if any of the residences would be impacted by traffic noise.

Future Build Alternative peak-hour traffic noise levels were predicted at twenty-two (22) residential locations along West Mercer Place and West Mercer Street, between Elliott Avenue West and Third Avenue West. The site locations are provided on Exhibit 2-4. Table 4 summarizes modeled future no-build (2030) and future build noise levels at those noise- sensitive sites. In the no-build condition, the NAC for Activity Category B is approached or exceeded at 17 of the 22 residences modeled, with traffic noise levels predicted to range from 63.2 to 69.1 dBA. In the build condition, the NAC for Activity Category B is approached or exceeded for the same 17 residences modeled, with traffic noise levels predicted to range from 63.3 to 69.2 dBA. When compared to the no-build condition, traffic noise levels under the future build condition are predicted to increase by 0.1 to 0.3 dBA. As previously stated, differences in noise levels of less than 3 dBA are not considered readily perceptible by the human ear, therefore these increases would not be considered perceptible.

TABLE 4  
PREDICTED BUILD ALTERNATIVE TRAFFIC NOISE LEVELS

Site ID	# of Units	Land Use	Future No-Build	Future Build	Increase from No-Build to Build
1	1	Res.	68.4	68.7	0.3
2	1	Res.	63.2	63.3	0.1
3A	1	Res.	65.2	65.3	0.1
3B	1	Res.	65.3	65.4	0.1
3C	1	Res.	64.9	65.0	0.1
4A	1	Res.	67.2	67.5	0.3
4B	1	Res.	67.3	67.5	0.2
4C	1	Res.	66.9	67.1	0.2
5A	1	Res.	65.5	65.8	0.3
5B	1	Res.	66.6	66.8	0.2
6A	1	Res.	68.7	68.8	0.1
6B	1	Res.	68.1	68.3	0.2
6C	1	Res.	67.7	67.9	0.2
7A	1	Res.	67.8	68.0	0.2
7B	1	Res.	67.4	67.6	0.2
7C	1	Res.	67.1	67.3	0.2
8A	1	Res.	68.9	69.1	0.2
8B	1	Res.	68.5	68.7	0.2
8C	1	Res.	68.3	68.4	0.1
9A	1	Res.	69.1	69.2	0.1
9B	1	Res.	68.7	68.9	0.2
9C	1	Res.	68.4	68.6	0.2

SOURCE: ESA 2011. The letters A, B, and C following a Site ID indicate first, second, and third floor residences, respectively. The locations of the modeled sites are provided on Exhibit 2-4.

**Mitigation**

Because the project would not have perceptible impacts on noise levels, no mitigation is proposed.

**References**

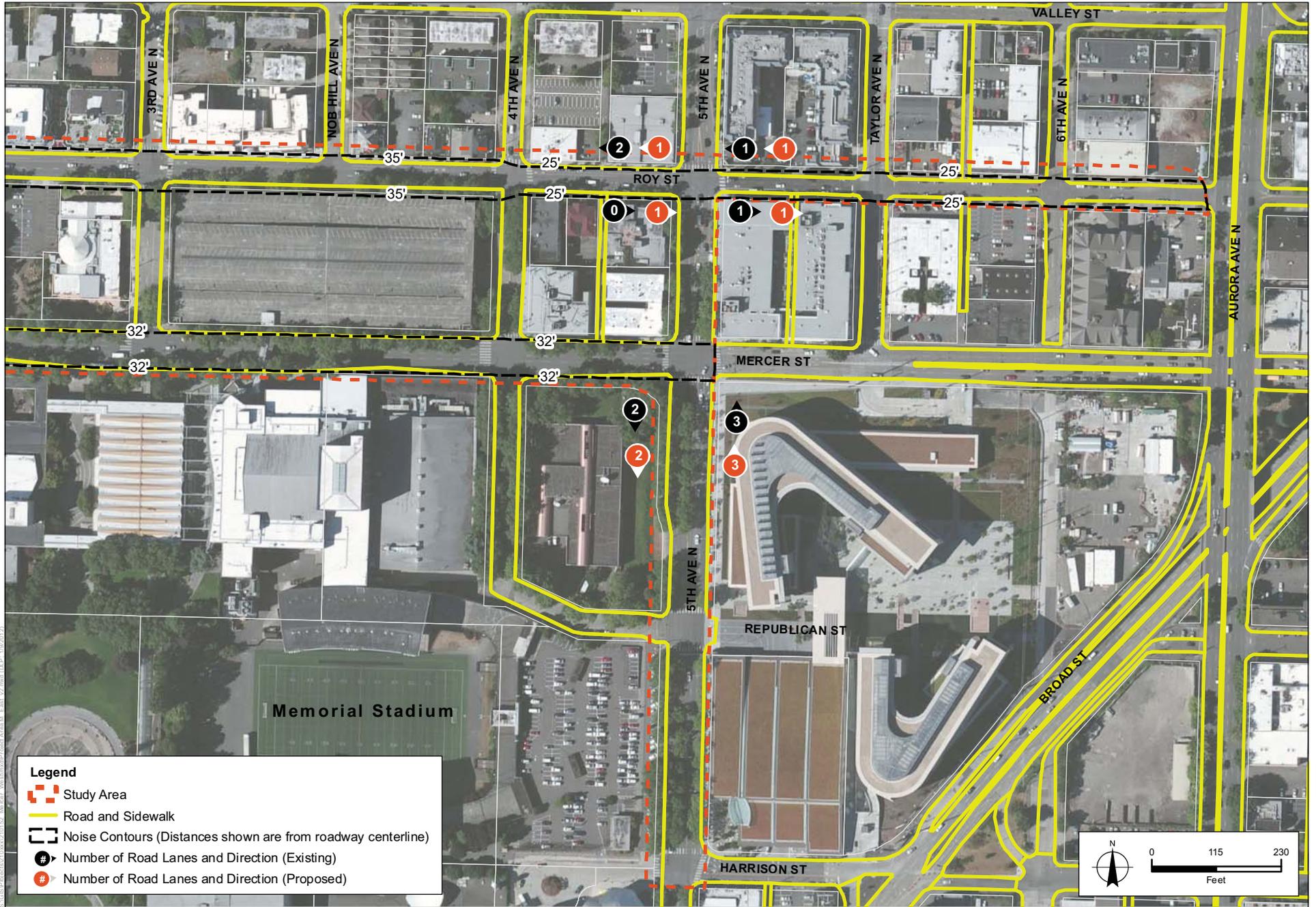
Washington State Department of Transportation (WSDOT). Environmental Procedures Manual. 2011.

**Attachments**

- Exhibit 2-1. Project Vicinity
- Exhibit 2-2. Project Area East
- Exhibit 2-3. Project Area West and Central
- Exhibit 2-4. Modeled Noise Sensitive Sites

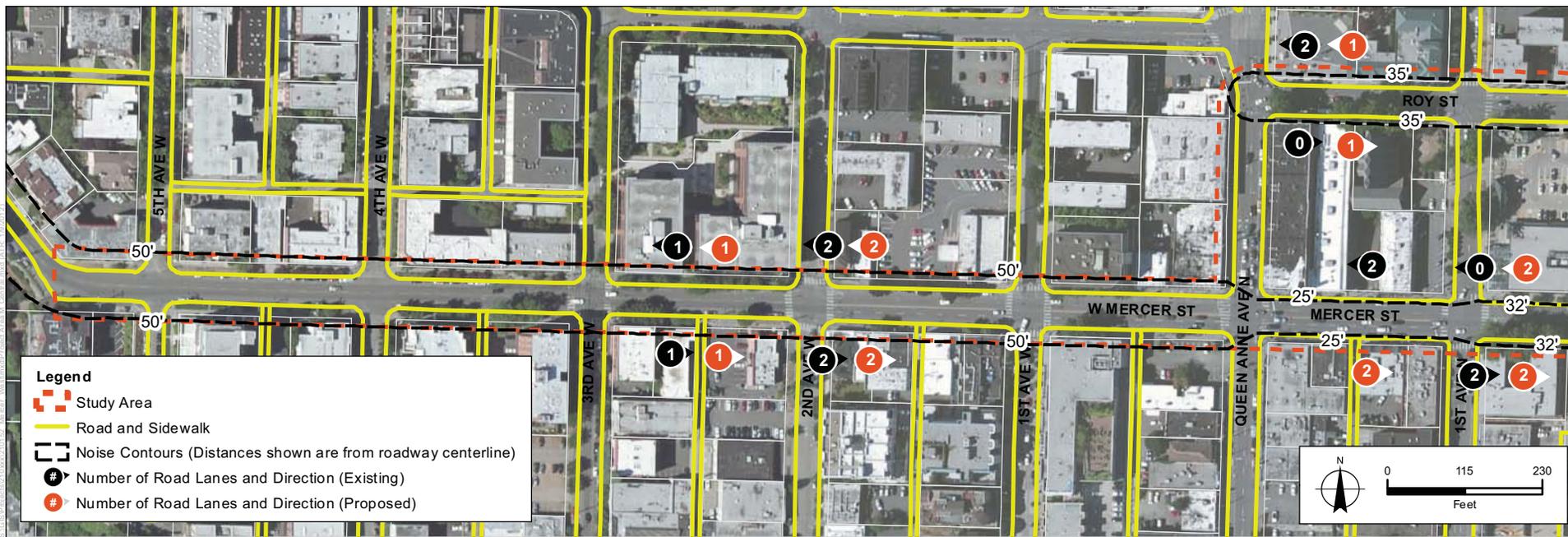


SOURCE: City of Seattle, 2009; NAIP (USDA), 2009 (Aerial)



SOURCE: City of Seattle, 2009; NAIP (USDA), 2009 (Aerial)

Mercer West Corridor, 210152  
**Exhibit 2-2**  
 Project Area  
 Seattle, Washington

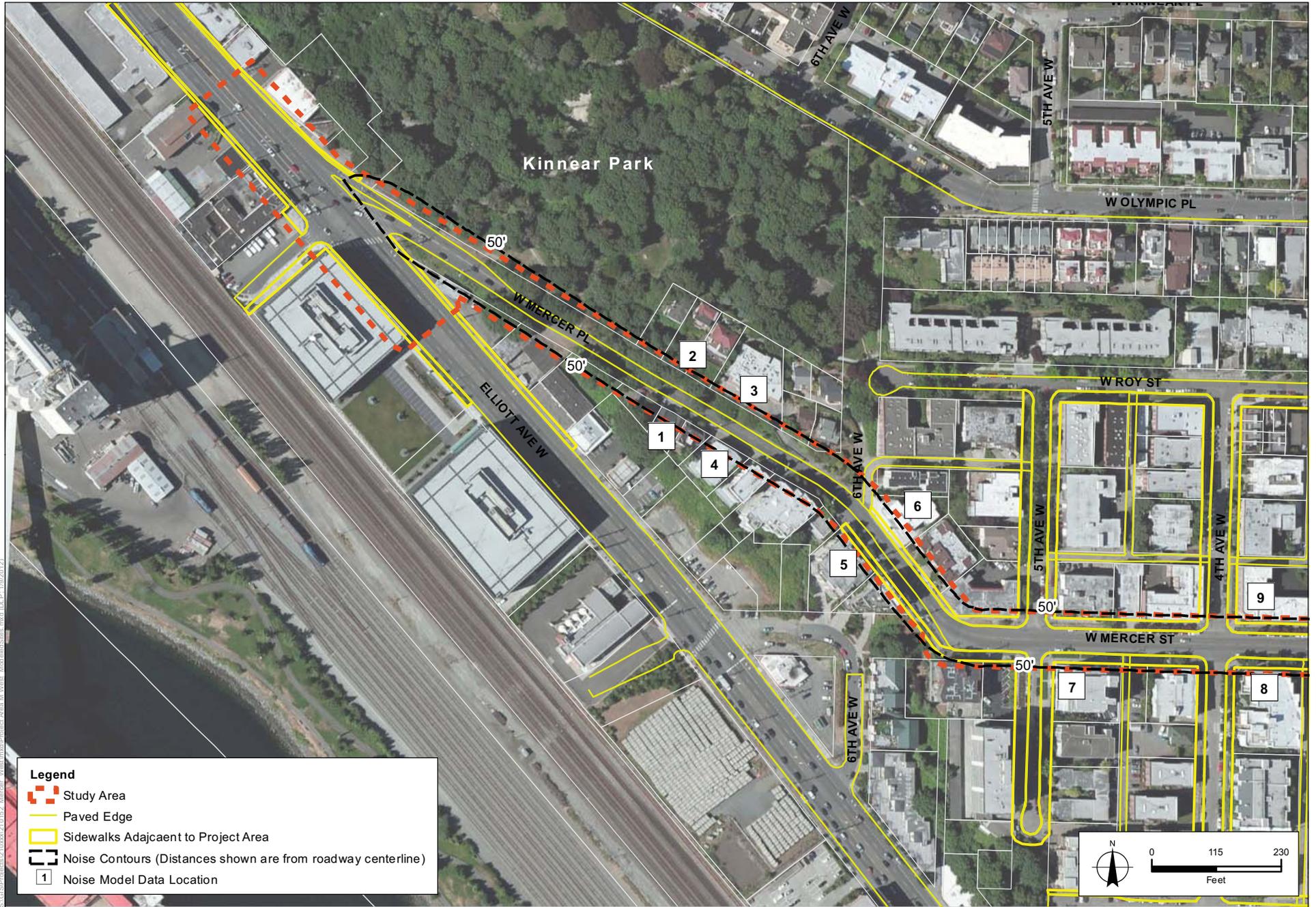


**Legend**

- Study Area
- Road and Sidewalk
- Noise Contours (Distances shown are from roadway centerline)
- Number of Road Lanes and Direction (Existing)
- Number of Road Lanes and Direction (Proposed)



SOURCE: City of Seattle, 2009; NAIP (USDA), 2009 (Aerial)



S:\GIS\Projects\211000\2110152\_Mercer\_West\Map\Project\_Area\_M\_Visual\_ModelableSites.mxd (DL: P: 1/9/2012)

SOURCE: City of Seattle, 2009; NAIP (USDA), 2009 (Aerial)

Mercer West Corridor, 210152  
**Exhibit 2-4**  
 Modeled Noise Sensitive Sites  
 Seattle, Washington