4.5 NOISE AND VIBRATION

This section provides an overview of noise and vibration and evaluates the construction and operational impacts associated with *Mobility Plan 2035* (MP 2035 or the proposed project). Topics addressed include pedestrian, vehicle, transit, and bicycle enhancements.

The section is organized as follows:

- **Regulatory Framework** describes the pertinent federal, state, and local laws and guidelines.
- **Existing Setting** provides a general summary and overview of the exiting noise and vibration environment
- **Thresholds of Significance** lists the thresholds used in identifying significant impacts.
- **Impacts** discusses the methodology used to assess impacts, including an overall discussion of methodology and assumptions, followed by a listing of thresholds and how the MP 2035 is expected to perform for each of them.
- **Mitigation Measures** are identified as necessary and feasible to reduce identified significant adverse impacts.
- **Significance of Impacts after Mitigation** identifies residual impacts after application of mitigation measures.

The following provides background information on the noise and vibration levels discussed in this section.

Noise Characteristics and Effects

Characteristics of Sound. Sound is technically described in terms of the loudness (amplitude) and frequency (pitch) of the sound. The standard unit of measurement for sound is the decibel (dB). The human ear is not equally sensitive to sound at all frequencies. The "A-weighted scale," abbreviated dBA, reflects the normal hearing sensitivity range of the human ear. On this scale, the range of human hearing extends from approximately 3 to 140 dBA. **Figure 4.5-1** provides examples of A-weighted noise levels from common sounds.

Noise Definitions. This noise analysis discusses sound levels in terms of Community Noise Equivalent Level (CNEL) and Equivalent Noise Level (L_{eq}).

Community Noise Equivalent Level. CNEL is an average sound level during a 24-hour period. CNEL is a noise measurement scale, which accounts for noise source, distance, single event duration, single event occurrence, frequency, and time of day. Human reaction to sound between 7:00 p.m. and 10:00 p.m. is as if the sound were actually 5 dBA higher than if it occurred from 7:00 a.m. to 7:00 p.m. From 10:00 p.m. to 7:00 a.m., humans perceive sound as if it were 10 dBA higher due to the lower background level. Hence, the CNEL is obtained by adding an additional 5 dBA to sound levels in the evening from 7:00 p.m. to 10:00 p.m. and 10 dBA to sound levels in the night from 10:00 p.m. to 7:00 a.m. Because CNEL accounts for human sensitivity to sound, the CNEL 24-hour figure is always a higher number than the actual 24-hour average.

Equivalent Noise Level. L_{eq} is the average noise level on an energy basis for any specific time period. The L_{eq} for one hour is the energy average noise level during the hour. The average noise level is based on the energy content (acoustic energy) of the sound. L_{eq} can be thought of as the level of a continuous noise which has the same energy content as the fluctuating noise level. The equivalent noise level is expressed in units of dBA.

A-Weighted Decibel Scale

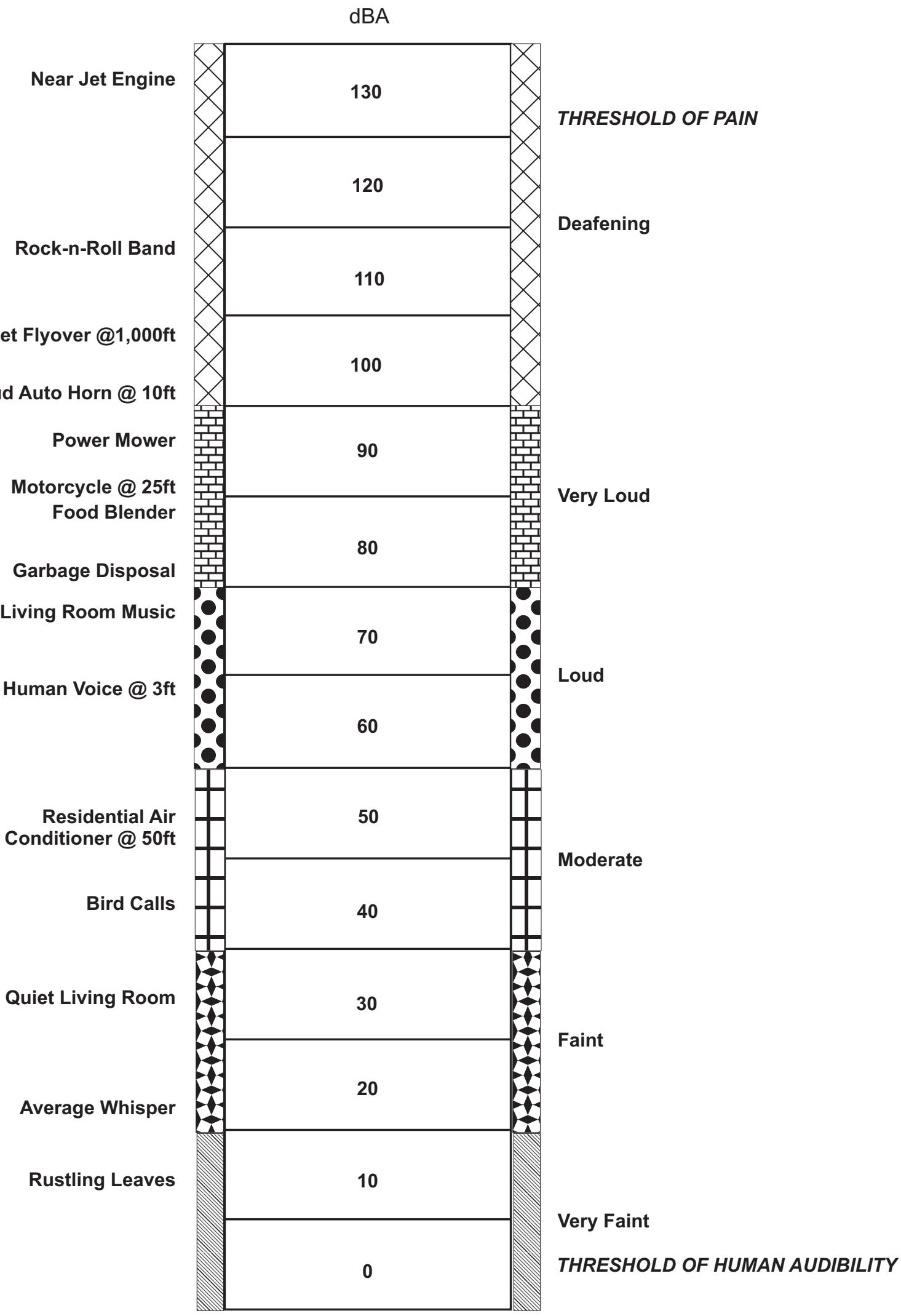

FIGURE 4.5-1

SOURCE: Cowan, James P., Handbook of Environmental Acoustics.

Effects of Noise. Noise is generally defined as unwanted sound. The degree to which noise can impact the human environment range from levels that interfere with speech and sleep (annoyance and nuisance) to levels that cause adverse health effects (hearing loss and psychological effects). Human response to noise is subjective and can vary greatly from person to person. Factors that influence individual response include the intensity, frequency, and pattern of noise, the amount of background noise present before the intruding noise, and the nature of work or human activity that is exposed to the noise source.

Audible Noise Changes. Studies have shown that the smallest perceptible change in sound level for a person with normal hearing sensitivity is approximately 3 dBA. A change of at least 5 dBA would be noticeable and would likely evoke a community reaction. A 10-dBA increase is subjectively heard as a doubling in loudness and would cause a community response.

Noise levels decrease as the distance from the noise source to the receiver increases. Noise generated by a stationary noise source, or "point source," will decrease by approximately 6 dBA over hard surfaces (e.g., reflective surfaces such as parking lots or smooth bodies of water) and 7.5 dBA over soft surfaces (e.g., absorptive surfaces such as soft dirt, grass, or scattered bushes and trees) for each doubling of the distance. For example, if a noise source produces a noise level of 89 dBA at a reference distance of 50 feet, then the noise level would be 83 dBA at a distance of 100 feet from the noise source, 77 dBA at a distance of 200 feet, and so on. Noise generated by a mobile source will decrease by approximately 3 dBA over hard surfaces and 4.8 dBA over soft surfaces for each doubling of the distance.

Generally, noise is most audible where there is a direct line-of-sight.[1] Barriers, such as walls, berms, or buildings, that break the line-of-sight between the source and the receiver greatly reduce noise levels from the source since sound can only reach the receiver by bending over the top of the barrier. Sound barriers can reduce sound levels by up to 20 dBA. However, if a barrier is not high or long enough to break the line-of-sight from the source to the receiver, its effectiveness is greatly reduced.

Vibration Characteristics and Effects

Characteristics of Vibration. Vibration is an oscillatory motion through a solid medium in which the motion's amplitude can be described in terms of displacement, velocity, or acceleration. Vibration can be a serious concern, causing buildings to shake and rumbling sounds to be heard. In contrast to noise, vibration is not a common environmental problem. It is unusual for vibration from sources such as buses and trucks to be perceptible, even in locations close to major roads. Some common sources of vibration are trains, buses on rough roads, and construction activities, such as blasting, pile driving, and heavy earth-moving equipment.

Vibration Definitions. There are several different methods that are used to quantify vibration. The peak particle velocity (PPV) is most frequently used to describe vibration impacts to buildings and is usually measured in inches per second. The PPV is defined as the maximum instantaneous peak of the vibration signal. The root mean square (RMS) amplitude is most frequently used to describe the effect of vibration on the human body. The RMS amplitude is defined as the average of the squared amplitude of the signal. Decibel notation (Vdb) is commonly used to measure RMS. The decibel notation acts to compress the range of numbers required to describe vibration.[2]

Effects of Vibration. High levels of vibration may cause physical personal injury or damage to buildings. In addition, ground-borne vibration levels rarely affect human health. Instead, most people consider ground-borne vibration to be an annoyance that can affect concentration or disturb sleep. High levels of ground-borne vibration can damage fragile buildings or interfere with equipment that is highly sensitive to ground-borne vibration (e.g., electron microscopes).

[1]Line-of-sight is an unobstructed visual path between the noise source and the noise receptor.
[2]City of Los Angeles, *City of Los Angeles CEQA Thresholds Guide*, 2006.

REGULATORY FRAMEWORK

Noise Regulations

Los Angeles Municipal Code (LAMC). The City of Los Angeles has established policies and regulations concerning the generation and control of noise that could adversely affect its citizens and noise sensitive land uses. Regarding construction, Section 41.40 (Noise Due to Construction, Excavation Work – When Prohibited) of LAMC indicates that no construction or repair work shall be performed between the hours of 9:00 p.m. and 7:00 a.m., since such activities would generate loud noises and disturb persons occupying sleeping quarters in any adjacent dwelling, hotel, apartment or other place of residence. No person, other than an individual home owner engaged in the repair or construction of his/her single-family dwelling, shall perform any construction or repair work of any kind or perform such work within 500 feet of land so occupied before 8:00 a.m. or after 6:00 p.m. on any Saturday or on a federal holiday, or at any time on Sunday. Under certain conditions, the City may grant a waiver to allow limited construction activities to occur outside of the limits described above.

Section 112.05 (Maximum Noise Level of Powered Equipment or Powered Hand Tools) of the LAMC also specifies the maximum noise level of powered equipment or powered hand tools. Any powered equipment or hand tool that produces a maximum noise level exceeding 75 dBA at a distance of 50 feet is prohibited. However, this noise limitation does not apply where compliance is technically infeasible. Technically infeasible means the above noise limitation cannot be met despite the use of mufflers, shields, sound barriers and/or any other noise reduction device or techniques during the operation of equipment.

Noise Element of the General Plan. The Noise Element of the General Plan guides the development of noise regulations.[3] It addresses noise mitigation regulations, strategies and programs and delineates federal, State and city jurisdiction relative to rail, automotive, aircraft and nuisance noise. Programs included in the Noise Element that are relevant to the proposed project include:

- Continue to encourage the California Department of Transportation (Caltrans), the Los Angeles County Metropolitan Transportation Authority (Metro), or their successors, and other responsible agencies, to plan and construct transportation systems so as to reduce potential noise impacts on adjacent land uses, consistent with the standards and guidelines contained in the noise element.
- Continue to enforce, as applicable, federal, State, and city regulations intended to abate or eliminate disturbances of the peace and other intrusive noise.
- **City of Los Angeles California Environmental Quality Act (CEQA) Thresholds Guide**. The City of Los Angeles has published CEQA significance thresholds to be used in noise analyses.[4] The City of Los Angeles CEQA Thresholds Guide includes a community noise exposure table that addressed land use consistency (**Table 4.5-1)**. Specific significance thresholds are discussed below and include thresholds for construction and operational noise levels.

[3]City of Los Angeles, *Noise Element of the Los Angeles City General Plan*, February 3, 1999.
[4]City of Los Angeles, *City of Los Angeles CEQA Thresholds Guide*, 2006.

TABLE 4.5-1: GUIDELINES FOR NOISE COMPATIBLE LAND USE

Land Use Category	Community Noise Exposure (dBA, CNEL)						
	55	60	65	70	75	80	
Residential - Low Density Single-Family, Duplex, Mobile Homes							
Residential - Multi-Family							
Transient Lodging - Motels Hotels							
Schools, Libraries, Churches, Hospitals, Nursing Homes							
Auditoriums, Concert Halls, Amphitheaters							
Sports Arena, Outdoor Spectator Sports							
Playgrounds, Neighborhood Parks							
Golf Courses, Riding Stables, Water Recreation, Cemeteries							
Office Buildings, Business Commercial and Professional							
Industrial, Manufacturing, Utilities, Agriculture							

Normally Acceptable - Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction without any special noise insulation requirements.

Conditionally Acceptable - New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply system or air conditioning will normally suffice.

Normally Unacceptable - New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

Clearly Unacceptable - New construction or development should generally not be undertaken.

SOURCE: California Office of Noise Control, Department of Health Services.

EXISTING SETTING

Existing Noise Levels. The LAMC, Section 111.03 (Minimum Ambient Noise Level) has set forth the presumed ambient noise levels for various land uses (**Table 4.5-2**). The daytime and nighttime ambient noise levels for residential areas are presumed to be 50 and 40 dBA, respectively. However, urban areas typically experience ambient noise levels higher than the conservative levels presented in the table.

TABLE 4.5-2: PRESUMED EXISTING AMBIENT NOISE LEVEL

Zone		dBA Daytime (7:00 a.m. to 10:00 p.m.)	dBA Nighttime (10:00 p.m. to 7:00 a.m.)
Residential	A1, A2, RA, RE, RS, RD, RW1, RW2, R1, R2, R3, R4, and R5	50	40
Commercial	P, PB, CR, C1, C1.5, C2, C4, C5, and CM	60	55
Manufacturing	M1, MR1, and MR2	60	55
Heavy Manufacturing	M2 and M3	65	65

SOURCE: LAMC, Section 111.03.

Existing Vibration Levels. The vibration environment is dominated by vehicular movement. Heavy trucks can generate vibrations that vary depending on vehicle type, weight, and pavement conditions. As trucks typically operate on major streets, existing vibration in the project area is largely related to truck traffic on the surrounding roadway network.

Sensitive Receptors

Some land uses are considered more sensitive to changes in noise and vibration levels than others, depending on the population groups and the activities involved. Noise- and vibration-sensitive land uses are locations where people reside or where the presence of unwanted sound could adversely affect the use of the land. Residences, schools, hospitals, guest lodging, libraries, and some passive recreation areas would each be considered noise- and vibration-sensitive and may warrant unique measures for protection from intruding noise.

The proposed project is an element of the General Plan that would guide mobility policies, programs, and projects in the City of Los Angeles through 2035. The types of mobility improvements under consideration would occur throughout the urbanized area of the City of Los Angeles. Land uses within the City include all of noise- and vibration-sensitive land uses discussed above.

THRESHOLDS OF SIGNIFICANCE

In accordance with Appendix G of the State CEQA Guidelines, the proposed project would have a significant impact related to noise if it would:

- Expose persons or generate noise in levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;
- Expose people to or generate excessive vibration or groundborne noise levels;
- Result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project; and/or
- Result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

Noise

The City of Los Angeles has established significance thresholds in its *CEQA Thresholds Guide*. The following specific significance thresholds are relevant to the proposed project.

Construction. The proposed project would have a significant impact related to construction activity if:

- Construction activities lasting more than one day would exceed existing ambient noise levels by 10 dBA or more at a noise sensitive use;
- Construction activities lasting more than ten days in a three-month period would exceed existing ambient noise levels by 5 dBA or more at a noise sensitive use; and/or
- Construction activities would exceed the ambient noise level by 5 dBA at a noise sensitive use between the hours of 9:00 p.m. and 7:00 a.m. Monday through Friday, before 8:00 a.m. or after 6:00 p.m. on Saturday, or anytime on Sunday.

Operational. The proposed project would have a significant impact related to operational activity if:

- Ambient noise level measured at the property line of affected uses increases by 3 decibels CNEL to or within the "normally unacceptable" or "clearly unacceptable" categories, as shown in **Table 4.5-1**, or any 5 dBA or more increase in noise level.

Vibration

There are no adopted City standards for vibration. Based on Federal Transit Administration (FTA) guidelines, the proposed project would have a significant impact related to vibration if:

- Vibration levels would exceed the damage criteria listed in **Table 4.5-3**.

TABLE 4.5-3: VIBRATION DAMAGE CRITERIA

Building Category	PPV (Inches Per Second)
I. Reinforced-concrete, steel, or timber (no plaster)	0.5
II. Engineered concrete and masonry (no plaster)	0.3
III. Non-engineered timber and masonry buildings	0.2
IV. Buildings extremely susceptible to vibration damage	0.12

SOURCE: FTA, *Transit Noise and Vibration Impact Assessment*, May 2006.

IMPACTS

CONSTRUCTION

The proposed project is an element of the General Plan that would guide mobility policies, programs, and projects in the City of Los Angeles through 2035. The proposed project is developed to the concept level of detail and specific roadway designs for planned improvements are not yet available. Program implementation is in large part contingent upon the availability of adequate funding. Funding is likely to change over time due to economic conditions and to fluctuations in the priorities of federal, state and regional funding agencies as well as the City budget. None of the improvements included can be implemented unless specific funding is made available. In order to assist the City in prioritizing annual transportation related funding the various departments including, planning, transportation and public works will collectively prepare for Council a sub-set of programs to be implemented in each forthcoming budget cycle. Therefore, there is no construction schedule or phasing.

Noise

Construction activity would result in temporary increases in ambient noise levels on an intermittent basis. Noise levels would fluctuate depending on the construction phase, equipment type and duration of use, distance between the noise source and receptor, and presence or absence of noise attenuation barriers. Typical noise levels are listed in **Table 4.5-4** for noise levels at distances of 50 and 100 feet from the construction noise source.

TABLE 4.5-4: MAXIMUM NOISE LEVELS OF COMMON CONSTRUCTION MACHINES

	Noise Level (dBA)		
Noise Source	**50 Feet /a/**	**100 Feet /a/**	**400 Feet /a/**
Trucks	89	83	71
Roller	74	68	56

/a/ Assumes a 6-dBA drop-off rate for noise generated by a "point source" and traveling over hard surfaces. Actual measured noise levels of the equipment listed in this table were taken at distances of 10 and 30 feet from the noise source.
SOURCE: USEPA, *Noise from Construction Equipment and Operations, Building Equipment and Home Appliances*, PB 206717, 1971.

Construction activity associated with the *MP 2035*'s Enhanced Networks would mainly include reconfiguration of roadway striping and would not include excavation or construction. Limited heavy-duty equipment is anticipated to construct the proposed enhancements (e.g., small loaders for sidewalk widening or asphalt pacing equipment). **Table 4.5-5** shows the treatments associated with each Enhanced Network and associated degree of construction noise. Many of the treatments would have minimal, or no, construction noise. Striping activities could result in infrequent periods of high noise, this noise would not be sustained and would occur only during the temporary construction period. No pile driving or other construction activity that would generate very high noise would occur. Construction activity would comply with Section 41.40 of the LAMC, which regulates the hours of construction activities, and restricts construction activity to between 7:00 a.m. and 9:00 p.m. In addition, construction activities within 500 feet of residential areas would not occur before 8:00 a.m. or after 6:00 p.m., unless otherwise approved by the City.

TABLE 4.5-5: TREATMENT LEVEL AND CONSTRUCTION NOISE INTENSITY

Enhanced Network	Treatment Level	Assumptions	Construction Intensity
Pedestrian-Enhanced Network	N/A	Infrastructure (e.g., way-finding, street trees, and lighting)	Low
		Bulb-outs and sidewalk widening	Medium
Bicycle-Enhanced Network	Moderate	Remove one vehicular travel lane per direction to accommodate a buffered bicycle lane	Low
	Comprehensive	Remove one vehicular travel lane per direction to accommodate a cycle track	Low
Transit-Enhanced Network	Moderate	No change to lane configuration	None
		Double frequency of bus service	None
	Moderate Plus	Convert one vehicular travel lane per direction to a bus only lane during peak periods	Low
		Double frequency of bus service	None
	Comprehensive	Convert one vehicular travel lane per direction to a bus only lane for the full day	Low
		Double frequency of bus service	None
Vehicle-Enhanced Network	Moderate	Increase vehicle travel speeds by 10 percent	None
		Add one vehicular travel lane per direction if all-day parking is available –OR– convert one off-peak parking lane per direction to a full-time vehicular travel lane	Low
	Comprehensive	Increase vehicle travel speeds by 10 percent	None
		Add one vehicular travel lane per direction if all-day parking is available –OR– convert one off-peak parking lane per direction to a full-time vehicular travel lane	Low
		Increase effective vehicular capacity by 10 percent	None

SOURCE: Fehr & Peers, 2013.

Treatments would occur within existing right-of-ways and, as discussed above, would not involve intense construction activity. It anticipated that project-related construction noise would be the same within each APC. It is possible that construction activities lasting more than one day would exceed existing ambient noise levels by 10 dBA or more at any one noise sensitive use as construction proceeds along a transportation corridor; it is not anticipated that construction activities lasting more than ten days in a three-month period would exceed existing ambient noise levels by 5 dBA or more at any one noise sensitive use, and/or it is not anticipated that construction activities would exceed the ambient noise level by 5 dBA at any one noise sensitive use between the hours of 9:00 p.m. and 7:00 a.m. Monday through Friday, before 8:00 a.m. or after 6:00 p.m. on Saturday, or anytime on Sunday. Therefore, without mitigation, the proposed project would result in a significant impact related to construction noise.

Vibration

As discussed above, it is anticipated that the construction activity would typically require small loaders and similar construction equipment. **Table 4.5-6** shows construction equipment vibration levels based on various reference distances. Construction vibration is a localized event and is typically only perceptible to a receptor that is in close proximity to the vibration source. Construction vibration levels associated with small loaders and bulldozers would not be expected to exceed the FTA criteria of 0.2 inches per second for non-engineered timber and masonry buildings (typical of residential buildings and institutional buildings). Specific designs for roadway changes were not available when this analysis was completed. It is possible that larger pieces of construction equipment (e.g., graders) could be used during construction activity. Large bulldozers would generate a vibration level of approximately 0.2 inches per second at 15 feet. At 15 feet or less, vibration levels could exceed the FTA criteria of 0.2 inches per second. Therefore, without mitigation, the proposed project would result in a significant impact related to construction vibration.

TABLE 4.5-6: VIBRATION VELOCITIES FOR CONSTRUCTION EQUIPMENT

Equipment	PPV at 15 feet (Inches/Second) /a/	PPV at 25 feet (Inches/Second) /a/	PPV at 50 feet (Inches/Second) /a/	PPV at 100 feet (Inches/Second) /a/
Small Bulldozer	0.003	0.003	0.0001	0.0004
Large Bulldozer	0.191	0.089	0.031	0.011

/a/ Non-engineered timber and masonry buildings can be exposed to ground-borne vibration levels of 0.2 inches per second without experiencing structural damage.
SOURCE: FTA, *Transit Noise and Vibration Impact Assessment*, May 2006.

OPERATION

Noise

Pedestrian-Enhanced Network (PEN). Treatments associated with the PEN include infrastructure improvements within the sidewalk and street right-of-way as well as pedestrian signal timing infrastructure improvements. Pedestrian Enhancements typically include way-finding, street trees, pedestrian-scaled street lighting, enhanced crosswalks at all legs of the intersection, automatic pedestrian signals, reduced crossing length (e.g., bulb-outs, median pedestrian refuges), wider sidewalks (less than 15 feet, where feasible), and specialty paving and seating areas where special maintenance funding exists. The example PEN improvements described above would not increase vehicles speeds and associated noise levels. The improvements could reduce speeds and potentially increase congestion. However, reduced vehicle speeds and increased traffic congestion result in decreased noise levels. Therefore, the proposed project would result in a less-than-significant impact related to the PEN.

Vehicle-Enhanced Network (VEN). Treatments associated with the VEN include increasing vehicle speeds by ten percent, adding vehicle lanes within the right-of-way, and increasing lane capacity by ten percent. Regarding vehicle speeds, the Caltrans has provided detailed guidance for assessing traffic noise in the

Technical Noise Supplement.[5] The guidance includes Reference Energy Emissions Levels (REMELs), which are defined as the speed-dependent energy-averaged A-weighted maximum passby noise level generated by a defined vehicle type. The noise level is presented at a distance of 50 feet from the centerline. **Table 4.5-7** shows the REMELS associated with increasing truck and auto speeds by ten percent from 40 to 44 miles per hour. Increasing vehicle speeds would increase REMELs by one to two dBA, which would be less than the 3-dBA significance threshold. Therefore, the proposed project would result in a less-than-significant impact related to increased vehicle speeds.

TABLE 4.5-7: VEHICLE SPEEDS AND NOISE LEVELS

Speed (miles per hour)	Auto REMEL (dBA)	Medium Truck REMEL (dBA)	Heavy Truck REMEL (dBA)
40	67	75	81
44	69	77	82

SOURCE: California Department of Transportation, *Technical Noise Supplement*, November 2009.

Proposed VEN treatments include adding one vehicular travel lane per direction by converting all-day parking lanes to travel lanes (if available) or converting one off-peak parking lane per direction to a full-time vehicular travel lane. These treatments would move vehicle movements closer to land uses adjacent to the right-of-way. A mobile noise analysis was completed using the Federal Highway Administration (FHWA) RD-77-108 methodology. The test case assumed that a roadway with two lanes in each direction and parking would be converted to three lanes in each direction. The analysis further assumed a speed of 35 miles per hour, 1,750 vehicles per hour for the four-lane roadway, and 2,650 vehicles per hour for six-lane roadway. The resulting analysis showed that the CNEL would increase by 2.1 dBA at land uses adjacent to the right-of-way, which would be less than the 3-dBA significance threshold. Therefore, the proposed project would result in a less-than-significant impact related to lane conversions.

The FHWA RD-77-108 methodology was also used to assess noise levels associated with increasing the effective vehicle capacity by ten percent. The test analysis assumed a four-lane roadway, a ten percent increase in volumes from 2,200 to 2,450 vehicles per peak hour, and a speed of 35 miles per hour. The resulting analysis showed that the CNEL would increase by 0.5 dBA at land uses adjacent to the right-of-way, which would be less than the 3-dBA significance threshold. Therefore, the proposed project would result in a less-than-significant impact related to increased capacity.

Transit-Enhanced Network (TEN). Treatments associated with the TEN include doubling the frequency of bus service and converting vehicle travel lanes to bus only lanes, which could increase vehicle congestion in adjacent lanes. Increased noise levels associated with doubling the frequency of bus service were assessed using the FTA Noise Impact Assessment Spreadsheet. A generic analysis was completed for doubling average daytime hourly bus events from 6 to 12 (10 minute to 5 minute headways) and doubling average nighttime hourly bus events from 3.75 to 7.5 (16 minute to 8 minute headways). The analysis further assumed bus speeds of 35 miles per hour and 50 feet from the land use to the bus lane. The resulting analysis showed that the CNEL would increase by 3.0 dBA at land uses adjacent to the right-of-way. Depending on project specifics, a bus only lane could increase noise levels by more than 3 dBA at sensitive land uses. Increased congestion in adjacent lanes would not increase noise levels as congestion decreases speeds and associated noise levels. Therefore, the proposed project would result in a significant impact related to bus lanes.

Bicycle-Enhanced Network (BEN). Treatments associated with the BEN include removing vehicle lanes for buffered bicycle lanes or cycle tracks. Lane conversions could increase vehicle delay where implemented. Traffic delay would lead to lower vehicle speeds and would not result in a distinguishable increase in ambient noise levels. For example, an automobile vehicle traveling at a speed of 35 miles per

[5]California Department of Transportation, *Technical Noise Supplement*, November 2009.

hour would generate approximately 64 dBA, whereas, an automobile traveling at a slower speed of 25 miles per hour would generate approximately 59 dBA. The 10 miles per hour speed difference would result in a 5-dBA reduction. Although not discussed above, this premise also applies to increased congestion associated with the PED and TEN. Therefore, the proposed project would result in a less-than-significant impact related to mobile noise.

The removal of one or more vehicular travel lanes has the potential to change the existing noise environment by shifting the location of traffic on the roadway to adjacent parallel routes. It is anticipated that diversion would not occur on streets that operate at LOS D or better during peak periods because the average delay is not substantial. However, for the street segments where the LOS would degrade from D to E or F, some trips could divert to adjacent streets to avoid longer travel times through congested locations. Travel route changes on the City's arterial and collector roadways have been captured through the travel model's peak hour forecasts and LOS results. The extent to which trips would divert to adjacent local roadways is not reasonably foreseeable given the broad framework of MP 2035 and the Enhanced Networks, and therefore, impacts cannot be precisely determined. However, it is anticipated that increased traffic could occur on these roadways. A doubling of traffic volumes is not anticipated along the majority of roadways. However, some residential roadways have very low traffic volumes. Although mobile noise levels may increase along these segments, it is anticipated that these low-volume segments have existing noise levels within the compatibility guidelines presented in **Table 4.5-1**, above. Therefore, the proposed project would result in a less-than-significant impact related to mobile noise due to traffic diversion.

Vibration

The proposed project would not include stationary sources of vibration, such as heavy equipment operations. Operational vibration in the project vicinity would be generated by vehicular travel on the local roadways. However, project-related traffic vibration levels would not be perceptible by sensitive receptors. Therefore, the proposed project would result in a less-than-significant impact related to vibration.

MITIGATION MEASURES

CONSTRUCTION

N1 A project-specific noise analysis shall be completed, and impacts shall be mitigated, if the City determines that construction equipment would be located within 500 feet of a sensitive land use.

N2 A project-specific vibration analysis shall be completed if the City determines that construction equipment would be located within 15 feet of non-engineered timber and masonry buildings (typical of residential buildings and institutional buildings. Potential vibration impacts shall be mitigated to the greatest extent feasible.

OPERATION

As described above, the proposed project would result in a significant impact related to increased bus noise. There is no specifically planned development that is part of this proposed project. Increases in bus frequency would be implemented by the Metro. Project-level assessments will be completed by Metro, as necessary. There is no general mitigation measure within the City's purview that would eliminate this impact.

SIGNIFICANCE OF IMPACTS AFTER MITIGATION

CONSTRUCTION

Impacts related to noise and vibration were determined to be significant without mitigation. Implementation of Mitigation Measures **N1** and **N2** would ensure that detailed analyses would be completed for projects that could result in construction noise and/or vibration impacts. Impacts would be reduced to less than significant.

OPERATION

No feasible mitigation measures were identified to reduce the significant impact related to bus frequency to less than significant. Therefore, the proposed project would result in a significant and unavoidable impact related to bus noise.

CUMULATIVE IMPACTS

CONSTRUCTION

The proposed treatments are located within the City of Los Angeles. Unrelated construction activity could occur concurrently within the project area. Concurrent construction activities from nearby related projects would generate noise at each site and cumulative construction noise may exceed ambient noise and vibration levels at the nearest noise-sensitive land uses between the proposed project and the related project sites. However, similar to the proposed project, construction-related noise and vibration levels from the related projects would be intermittent, temporary, and would comply with the time restrictions and other relevant provisions in the LAMC. Therefore, the proposed project would not contribute to a cumulatively considerable impact related to construction noise and vibration.

OPERATION

The proposed project and other related development in the surrounding area would generate operational noise and vibration (i.e., off-site mobile sources) that would contribute to cumulative operational noise and vibration. The proposed project is a mix of policies and conceptual-level improvements to the transportation network. Detailed roadway designs for improvements to individual roadways or corridors are not yet available. The analysis determined that the proposed project would not result in an impact from vibration. The area-level bus analysis presented above concluded that the TEN would result in a significant impact related to increased bus noise. Increases in bus frequency would be implemented by Metro and project-level assessments will be completed by Metro, as necessary. Nonetheless, TEN-related bus noise, in combination with other local sources of noise, could increase significant cumulative noise in areas where existing ambient levels already exceed City standards. Therefore, the proposed project would contribute to a cumulatively considerable impact related to operational noise.