

would be required only for the aerial alignment. For the aerial alignment, in order to accommodate the aerial guideway, the roadway would need to be widened at several locations along Imperial Highway in order to maintain the existing number of travel lanes.

- **Parking**

Based on the estimated parking demand, a total of 750 parking spaces should be provided on-site at the Norwalk Transportation Center to prevent spill over of parking onto adjacent streets. If the 750 spaces are not provided, a preferential parking plan should be established in the vicinity of the Norwalk Transportation Center station to eliminate spill over parking on residential streets, if the residents of the area perceive a significant problem with the availability of on-street parking.

3.11 NOISE AND VIBRATION

3.11.1 Environmental Setting

Existing Noise Environment

The existing noise levels in the project corridor have been documented through a noise survey. Measurements were performed at four locations shown in Figure 3-28. At each location, community noise levels were continuously monitored for a 24-hour period. Table 3-22 summarizes the measurement locations and overall results. The hourly measurement results and plots of the hourly L_{eq} 's are given for each site in Appendix A of the Noise and Vibration Study.

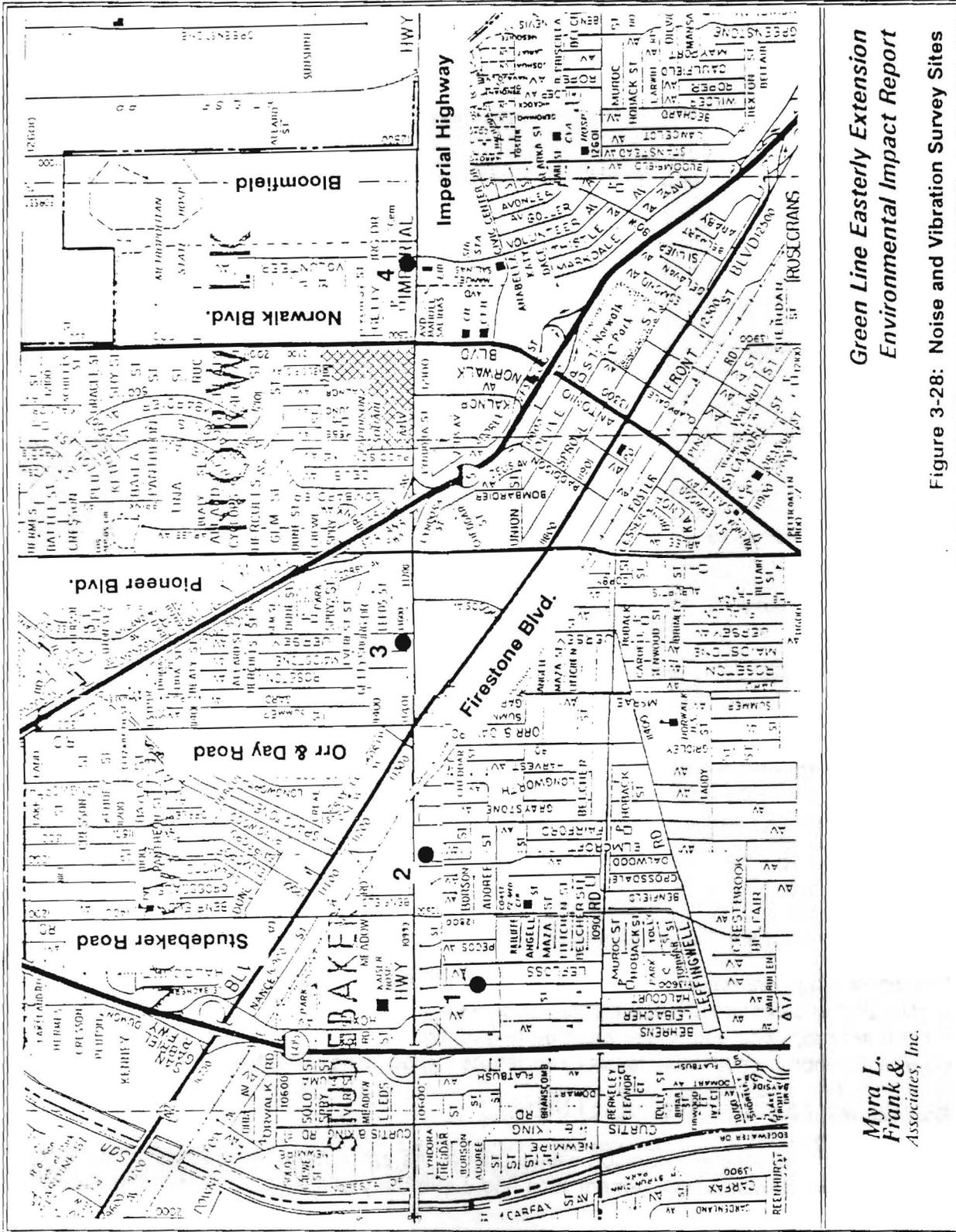
Each of the noise measurement locations are generally representative of other similar community areas in the study area. The measurements are important since they have been generalized to apply to all noise sensitive receptors in the corridor for estimating the change in CNEL that would be caused by the trains and determining impact. Following is a brief discussion of each site:

Site 1: End of Le Floss near start of extension. Somewhat removed from heavy traffic on Imperial Highway and Studebaker, this site is considered representative of the western and eastern ends where the track is not in the median of Imperial Highway.

Site 2: Lyndora Street in backyard facing Imperial. Six foot wall along Imperial. This site is typical of many residences along Imperial Highway that have some sort of obstruction that acts as at least a partial acoustical barrier.

Site 3. Jersey and Imperial Highway, direct view of Imperial Highway. This site represents the residences and commercial establishments that are somewhat set back from Imperial but without any acoustical protection from traffic noise on Imperial.

Site 4. Volunteer and Imperial across street from library. Direct view of Imperial Highway. This site is similar to Site 3 but closer to Imperial Highway. It is representative of buildings right on Imperial Highway.



**Green Line Easterly Extension
Environmental Impact Report**

Figure 3-28: Noise and Vibration Survey Sites

**Myra L.
Frank &
Associates, Inc.**

Table 3-22: Noise Survey Measurement Sites & Summary Results

MEASUREMENT SITE	START TIME AND DATE	DISTANCE, FT		MEAS. CNEL (dBA)
		FROM IMPERIAL HIGHWAY	FROM NEAR TRACK CL	
1. End of Le Floss, in front yard	17:00 6/16/92	800	80	64
2. Lyndora St. in backyard facing Imperial Hwy. Six ft masonry wall between Imp. Hwy and microphone.	15:00 6/15/92	25	70	65
3. Jersey & Imperial Hwy. At setback line from Imperial with direct line of site of Imperial Hwy traffic.	16:00 6/16/92	75	105	71
4. Volunteer & Imperial Hwy. Northeast corner of intersection. In backyard at house setback line from Imperial. Clear view of traffic on Imperial Hwy.	16:00 6/15/92	25	60	71

Source: Harris Miller Miller & Hanson, 1992.

The noise measurements show diurnal variations that are typical of urban and suburban areas. Noise levels are fairly constant from about 6 AM to 8 PM, dropping to a minimum between midnight and 4 AM. After 4 AM sound levels start to rise again, reaching daytime levels between 6 and 7 AM. The principal existing noise source in the study area is traffic on Imperial Highway.

In generalizing the measurement results for evaluating potential impact, the analysis has underestimated existing noise levels instead of overestimating, thereby ensuring conservative that the impact projection estimates would be conservative. Table 3-23 contains a summary of the generalized community noise levels used for the impact assessment.

Existing Ground-Borne Vibration and Noise

Measurements of ambient vibration were made at the same general locations as the ambient noise measurements. Measurement sites and a summary of the results is given in Table 3-24.

Table 3-23: Generalized Community Noise Levels

LOCATIONS	NOISE LEVEL USED IN ASSESSMENT	COMMENTS
Areas at west and east end where alignment is not in median of Imperial Highway	CNEL = 62 dBAC	This is 2 dBA lower than the measured level at the end of Le Floss.
Residential areas along Imperial Highway	CNEL = 65 dBA	Existing noise levels are higher than this for most residences facing Imperial Highway. This level is representative of residences partially shielded from Imperial Highway noise.
Commercial and institutional buildings along Imperial Highway	$L_{eq}(\text{day}) = 67 \text{ dBA}$	Change in daytime L_{eq} is used to evaluate noise impact for institutions where occupants are not more sensitive to nighttime noise

Source: Harris Miller Miller & Hanson

High sensitivity accelerometers mounted in the vertical direction on steel stakes driven either into the ground or sidewalks were used to measure the vibration. Acceleration signals were recorded on a portable FM tape recorder. Recordings of at least 20 minutes in duration were made at each site. The field tape recordings were subsequently analyzed in the HMMH laboratory to obtain a strip chart record of root-mean-square (rms) vibration velocity level in decibels. A one second rms time constant was used.

It is uncommon for ground-borne vibration to be perceptible to humans except near sources such as heavy construction equipment or steel-wheel rail systems. Vibration from normal street traffic, even buses and heavy trucks, does not usually reach levels perceptible to humans unless one is within about 25 feet of the road or there is a bump or other road irregularity causing higher than normal vibration. As a reference point, using the decibel scale with a reference of $1 \mu\text{in./sec}$, 65 dB is the approximate threshold of human perception of vibration, 70 dB is the point vibration starts to become noticeable, 75 dB inside residences is about the point where people get annoyed if the vibration is a common occurrence, and vibration amplitudes of 80 dB inside residences would annoy many people even if it occurs only 20 to 30 times per day. Levels up to the 95 to 100 dB range are necessary before even minor cosmetic damage to buildings, such as hairline cracks in plaster, are possible.

Table 3-24: Ambient Vibration Test Sites and Summary Results

MEASUREMENT SITE	START TIME AND DATE ⁽¹⁾	DISTANCE FROM IMPERIAL HIGHWAY (FT)	MEASURED VIBRATION VELOCITY LEVELS (dB RE 10 ⁻⁶ IN./SEC)		
			PEAK	TYP. PEAK	TYP. TRAFFIC
1. End of Le Floss	14:55 6/17/92	800	64	57-61	55
2. Southwest corner of Fairford and Imperial Highway	15:50 6/17/92	45	75	71-74	63-65
3. Northwest corner of Imperial Hwy and Jersey St.	17:30 6/16/92	80	73	65-70	62-65
4. Southwest corner of Volunteer and Imperial Highway (at northeast corner of library)	18:30 6/16/92	80	73	60-63	55-58
- Blue Line trains, above subway under Flower Street ⁽²⁾	6/16/92	25	60 (25 mph trains)		
Notes: (1) All ambient vibration measurements were 20 minutes long. (2) A total of five trains were measured at speeds of approximately 25 mph.					

Source: Harris Miller Miller & Hanson, 1992.

The charts of vibration velocity level were evaluated to obtain typical levels caused by traffic on Imperial Highway, typical levels caused by trucks or buses on Imperial Highway, and the absolute maximum level during the 20-minute measurement period. These levels, shown in Table 3-24, indicate that vibration from typical traffic is virtually always below the threshold of human perception, but occasional peaks caused by trucks or buses exceed 70 dB, which is into the range perceptible to the typical human. At Site 1, which is 800 feet from Imperial Highway, the measured vibration levels were always below the perceptible range.

In addition to the ambient vibration measurements, the vibration caused by Blue Line trains operating in the Flower Street tunnel was measured. Measurements were made at the ground surface above the subway with the accelerometer located a horizontal distance of 25 feet from the near track centerline. This measurement was used as a reference point for the projections of ground-borne vibration since the Green Line vehicles are expected to have similar ground-borne vibration characteristics as the Blue Line vehicles. The average maximum level from five train passbys was 60 dB, which is well below the threshold of human perception. However, the train speeds in the Flower Street subway average only about 25 mph. Approximately 8 dB should be added to scale this number to 65 mph, the expected maximum speed on the Green Line extension.

3.11.2 Impact Criteria

Airborne Noise

Noise impact for this project has been evaluated using the existing Federal Transit Administration (FTA), formerly the Urban Mass Transportation Administration (UMTA), criteria, although it is expected that FTA would soon adopt new noise standards. A preliminary review of the impact assessment with the existing impact criteria and the proposed new impact criteria indicates that the two sets of criteria result in approximately equivalent degrees of impact. Table 3-25 summarizes the present FTA impact criteria as defined in "Guidelines for Preparing Environmental Impact Assessments," UMTA Circular UMTA C 5620.1 (Ref. 1).

Table 3-25: Federal Transit Administration Noise Impact Criteria

IMPACT CATEGORY	CONDITIONS*
Generally Not Significant	1. No noise-sensitive sites in project area.
	2. Increase of 3 dBA or less at noise sensitive sites and project does not result in violations of noise ordinances or standards.
Possibly Significant <i>(Marginal Impact)</i>	Increases in noise levels no greater than 5 dBA.
Generally Significant <i>(Significant Impact)</i>	1. Project would cause noise standards or ordinances to be exceeded.
	2. Project would cause 6 to 10 dBA increase in noise levels in built-up areas.
	3. Project would cause increase in noise levels of 10 dBA or more.
<p>Note:</p> <p>The circular states that an L_{eq} measure should be used to characterize the noise conditions. In this study, CNEL has been used to characterize noise in residential communities and daytime L_{eq} has been used for areas that are not particularly sensitive to nighttime noise. CNEL is a representation of total acoustic energy over a 24-hour period with adjustments during the nighttime hours (10 pm to 7 am) and evening hours (7 pm to 10 pm) to account for many people being particularly sensitive to noise during these periods.</p>	

Source: Harris Miller Miller & Hanson, Inc., 1992.

The impact identified using the present FTA criteria is consistent with the guidelines included in the noise and vibration sections of the American Public Transit Association (APTA) noise and vibration guidelines (Ref. 3) and the design goals used for the Los Angeles-Long Beach Blue Line (Ref. 4). For clarity, in the remainder of the report the two levels of significant impact are referred to as marginal impact and significant impact, as indicated in the table.

Ground-Borne Vibration and Noise

Since there are no existing FTA criteria for acceptable levels of ground-borne vibration or ground-borne noise, the proposed FTA criteria shown in Table 3-26 are used for this project. These criteria are based on previous standards, criteria, and design goals including, ANSI S3.29 (Ref. 2), the noise and vibration guidelines of the American Public Transit Association (Ref. 3) and design goals used for previous LACTC rail projects (Ref. 4). Similar limits have been used on previous LACTC projects as well.

Table 3-26: Impact Criteria for Ground-Borne Vibration and Noise

LAND USE CATEGORY	RMS GROUND-BORNE VIBRATION		GROUND-BORNE NOISE
	DECIBELS RELATIVE TO 1 MIN./SEC	IN./SEC	
Category 1: Buildings where low ambient vibration is essential for interior operations. The limits are based on acceptable vibration for moderately vibration sensitive equipment such as optical microscopes or electron microscopes with vibration isolation bases.	65 dB	0.0018	--
Category 2: Residences and buildings where people normally sleep.	72 dB	0.004	35 dBA
Category 3: Institutional such as schools and offices with primarily daytime use.	75 dB	0.0056	40 dBA

Source: Harris Miller Miller & Hanson, Inc., 1992.

There are some buildings, such as concert halls, TV studios, churches, and theaters, that can be very sensitive to vibration and noise but do not fit into any of the three categories. Because of the sensitivity of these buildings, they usually warrant special attention during the environmental assessment of a transit project. Table 3-27 gives limits for acceptable ground-borne vibration and noise for various types of special buildings.

3.11.3 Projection Models

Construction Noise and Vibration

Construction noise varies greatly, depending on the construction process, type and condition of equipment used, and layout of the construction site. Many of these factors are traditionally left to the contractor's discretion, which makes it difficult to accurately estimate levels of

Table 3-27: Vibration and Noise Criteria for Special Buildings

TYPE OF BUILDING OR ROOM	RMS GROUND-BORNE VIBRATION		GROUND-BORNE NOISE
	DECIBELS RELATIVE TO 1 MIN./SEC	IN./SEC	
Concert Halls	65 dB	0.0018	25 dBA
TV Studios	65 dB	0.0018	25 dBA
Recording Studios	65 dB	0.0018	25 dBA
Auditoriums	72 dB	0.004	30 dBA
Churches	72 dB	0.004	35 dBA
Theaters	72 dB	0.004	35 dBA

Source: Harris Miller Miller & Hanson, Inc., 1992.

construction noise. Overall, construction noise levels are governed primarily by the noisiest pieces of equipment, and the dominant source of noise from most construction equipment is the engine, which is usually a diesel, often without sufficient muffling. For special construction processes such as impact pile driving and pavement breaking, noise generated by the actual process dominates.

Projection of construction noise requires developing a construction scenario of the equipment to be used and the average utilization factors or duty cycles (i.e., the percentage of time during operating hours that the equipment operates under full power during each phase). Using typical sound emission characteristics, it is then possible to estimate L_{eq} or CNEL at various distances from the construction site. Table 3-28 below provides a typical equipment scenario for the excavation phase, including full-power equipment noise emission levels at 50 feet, assumed duty cycles, and the resulting workday L_{eq} for this phase of construction. The estimate assumes a 12-hour daytime workday.

Noise from Train Operations

The basis for projections of airborne noise from trains operating on the aerial structure is the noise emission limits included in the specification for the Green Line vehicle and standard formulas to project the maximum level (L_{max}) at other distances and to estimate L_{eq} , given information about L_{max} and train speed. The noise limits included in the specification are a maximum level of 77 dBA at a distance of 50 feet from the train with the train operating on tangent tie and ballast track at a speed of 40 mph. A 2 dBA adjustment has been made to allow for modest noise level increases due to normal wear on the wheels and rails and a 3 dBA adjustment has been made to account for noise levels being higher when trains are on aerial structures. The final reference level used was 82 dBA at 50 mph 50 feet from the centerline of the near track.

Table 3-28: Typical Equipment List

EQUIPMENT ITEM	SOUND LEVEL AT 50 Ft. (dBA)	EQUIPMENT UTILIZATION FACTOR (%)	L _{eq} (dBA)
Air Compressor	69	200	72
Backhoe	85	40	81
Crane, Derrick	88	10	78
Dozer	87	40	83
Generator	78	80	77
Loader	84	40	80
Pump	76	80	75
Rock Drill	98	4	84
Shovel	82	40	78
Truck	88	16	80
Total Workday L_{eq} at 50 feet			90

Source: Harris Miller Miller & Hanson, 1992.

3.11.4 Impacts

This section summarizes the evaluation of potential noise and vibration impact of the Metro Green Line Extension. Two extension alignments have been evaluated, one aerial structure and one subway. Both alignments run from the existing terminus just east of I-605, curve northeast to Imperial Highway and run along Imperial Highway to a proposed intermodal transfer station at the Santa Fe tracks.

This assessment has looked at both airborne noise and ground-borne vibration and noise. Airborne noise is noise that travels the normal airborne path between the source and the receiver. This is an important factor for the aerial structure alignment but is not a factor for the subway alignment. Ground-borne vibration is caused by the steel wheels rolling on steel rails which creates vibration energy that propagates through the to the foundations of nearby buildings. The vibration then propagates throughout the remainder of the building. In extreme cases, the vibration can cause building damage. For modern transit systems, ground-borne vibration amplitudes are almost never sufficient to cause even minor cosmetic building damage such as hairline cracks in plaster. The real concern is human annoyance either from perceptible vibration, audible noise, or rattling of windows, pictures on walls or items on shelves. Audible noise can be caused by the vibration of room surfaces which radiate sound. In a sense, the room surfaces act like a large loudspeaker. Ground-borne noise usually is a low-frequency rumble. It is only experienced inside buildings and is not an outdoor phenomena.

Ground-borne vibration and noise are not expected to be a factor for the aerial alignment. The vibration path from the rail, through the aerial structure and support columns to the ground, usually results in sufficient attenuation that the vibration should be within acceptable limits even a few feet from the columns.

The noise and vibration assessment has included a survey of existing noise and vibration in the corridor, projections of airborne noise and ground-borne vibration and noise at sensitive receptors along the corridor, and for any receptors where the noise or vibration impact criteria are exceeded, recommendation of suitable mitigation measures. The evaluation of noise impact is based on the present Federal Transit Administration (FTA) guidelines. Impact of ground-borne vibration and noise is based on the design goals included in the American Public Transit Administration (APTA) rapid transit design guidelines and impact limits commonly used on transit projects.

Following is a summary of the assumptions that have been used in developing the impact assessment:

1. The vehicle is assumed to have similar noise and vibration emission characteristics as the vehicles in use on the Blue Line operating between Los Angeles and Long Beach.
2. Because there are no at-grade street crossings, it is assumed that there would be no need for warning horns, bells, or whistles.
3. The maximum train speed would be 45 mph on curves and 65 mph on straight sections.
4. Existing noise levels expressed in terms of Community Noise Equivalent Level (CNEL) are 62 dBA in neighborhoods not directly fronting on Imperial Highway and 65 dBA for neighborhoods on Imperial Highway. These levels are based on generalization of the the noise survey results. The level for neighborhoods along Imperial Highway assumes the equivalent of a 6-foot wall between street traffic and noise sensitive receivers. This assumption underestimates existing noise levels for areas where residences are directly exposed to noise from Imperial Highway traffic.
5. A sound barrier along the aerial structure would reduce levels of train noise by 7 dBA. This can be achieved by a wall extending 3.5 to 4 feet above the top-of-rail.

The projections of airborne noise and ground-borne vibration and noise have been based on measurements that have been performed at existing transit properties, including the Blue Line running from Long Beach to Los Angeles and standard mathematical models. The models have been previously verified through measurements.

Airborne noise projections basically assume that Green Line vehicles would meet noise specifications used for Blue Line vehicles. The basic limit in the Blue Line specifications is a maximum of 77 dBA at a distance of 50 feet from the track with the vehicle operating on tie and ballast tangent track at 40 mph. This base level has been increased by 2 dBA to allow for moderate noise increases because of normal wear of the wheels and rails and an additional 3 dBA to account for operation on an aerial structure.

The projections of ground-borne vibration and noise are based on a wide range of measurements that have been performed at existing transit facilities. They include two levels, one that is based on the high range of all measurement data and the second that is representative of the average measured vibration levels. As a check of the projections, one measurement of the vibration created by Blue Line trains in the Flower Street subway was performed. The average measured maximum vibration velocity level at this point is approximately 8 dB lower than the projections. This suggests that vibration levels along the Green Line may be lower than projected, but does not represent sufficient data to modify the projections. It does reaffirm the desirability of a more detailed vibration assessment in the final design phase which includes vibration propagation testing in the study area. It is probable that more detailed assessment during the final design would considerably reduce the extent of vibration mitigation that is required.

Table 3-29 and Table 3-30 summarize the results of the noise and vibration assessment for the Green Line extension. Table 3-29 shows the number of noise and vibration sensitive receptors affected by the two alignments with and without mitigation. Following is a discussion of the impacts for each alignment.

Aerial Alignment

Without mitigation, the aerial alignment is projected to create noise levels exceeding the impact limits at a number of single- and multi-family buildings, several motels and the library. Most of the affected buildings are within the significant impact zone.

Subway Alignment

As indicated above, because this study has used conservative projections of ground-borne vibration and noise, the amount of projected impact from ground-borne vibration may be considerably reduced after more detailed studies in the final design stage of this project. The projected ground-borne vibration and noise levels at many of the buildings included in the Table 3-29 counts are only slightly over the impact criteria. Either more detailed studies or more accurate estimates of train speed may remove many from the impact zone.

3.11.5 Mitigation Measures

Aerial Alignment

Almost all of the potential noise impact can be eliminated with sound barriers at the edge of the aerial structure. The minimum lengths of sound barrier are approximately 5,500 feet on the north side and 9,000 feet on the south side. In several cases it may be desirable for aesthetic reasons to connect short sections of barrier and make the barrier more continuous. In contrast to the typical freeway barrier that is 12 to 15 feet high, an effective aerial structure barrier does not need to extend more than 3.5 to 4 feet above the top-of-rail. This is because the noise source is down low near the wheel-rail interface and the barriers are located close to the noise source. As long as the barriers are constructed of a material with a minimum surface density of 4 lb/sq-ft and there are no holes or gaps in the barrier to act as sound leaks, the barriers should provide the 7 dBA attenuation assumed in the analysis.

Table 3-29: Airborne Noise and Ground-Borne Vibration Impact

ALIGNMENT	LAND USE	AIRBORNE NOISE		GROUND-BORNE VIBRATION
		MARGINAL IMPACT	SIGNIFICANT IMPACT	
1. Aerial No mitigation	Single Family	39	102	--
	Multi-Family	9	11	--
	Motel/Hotel	0	3	--
	Library	0	1	--
2. Subway No mitigation	Single Family	--	--	33
	Multi-Family	--	--	9
	Motel/Hotel	--	--	3
	Library	--	--	0
1. Aerial With mitigation	Single Family	5	0	--
	Multi-Family	0	0	--
	Motel/Hotel	0	0	--
	Library	0	0	--
2. Subway With mitigation	Single Family	--	--	0
	Multi-Family	--	--	0
	Motel/Hotel	--	--	0
	Library	--	--	0

Source: Harris Miller Miller & Hanson, Inc., 1992.

Table 3-30: Summary of Noise and Vibration Mitigation Measures

ALIGNMENT	NOISE OR VIBRATION SOURCE	EXTENT	MITIGATION MEASURE
1. Aerial	Construction	-	Contract specifications with noise and vibration limits Noise and vibration monitoring during construction
	Airborne Noise	5500 ft WB 9300 ft EB	Sound barrier walls
	Ground-Borne Vibration and Noise	-	None required
2. Subway	Construction	-	Contract specifications with noise and vibration limits Noise and vibration monitoring during construction
	Airborne Noise	0 ft	None required
	Ground-Borne Vibration and Noise	500 ft 4500 ft	Floating slab trackbed Special track fasteners, resiliently supported ties, ballast mats, reduced speed

Source: Harris Miller Miller & Hanson, Inc., 1992.

Subway Alignment

At the western end, where the subway is directly under a number of buildings, impact from ground-borne vibration and noise is clear. In this area, ensuring that trains do not create unacceptable levels probably would require at least 500 feet of floating slab track support system, or other appropriate measures. For the remainder of the route, ground-borne vibration and noise impact can be controlled through more moderate means. The possibilities to consider include:

- Speed reductions. Reducing speed by 30 percent would provide an average of 3 dB attenuation. This mitigation would not be preferred for operational reasons.
- Special track fasteners. Special high resilience direct fixation track fasteners can provide about 5 dB attenuation.
- Resiliently supported ties. Resiliently supported ties usually consist of double-block ties that sit in a rubber boot in a depression in the invert. Available data indicates they can be very effective at controlling low-frequency ground-borne vibration.

- Ballast mats. If ballasted track is used in the subway (which is not likely), ballast mats can provide 5 to 10 dB attenuation. A ballast mat consists of special mats, typically made of rubber, that is placed on the invert under the ballast.

The actual attenuation achieved with special track fasteners, resiliently supported ties, or ballast mats strongly depends on the spectrum of the ground-borne vibration. Vibration mitigation measures should be carefully evaluated during the design phase to select the most cost effective measure.

3.12 AIR QUALITY

The purpose of this section is to discuss the potential impacts of the proposed project on regional and local air quality, during both construction and operation. These potential impacts are measured against the current state of air quality in the study area. Where necessary, mitigation measures are proposed to reduce the impacts created by the project.

3.12.1 Regulatory Authority

The California Air Resources Board (ARB) is the state agency responsible for coordinating both the state and federal air pollution control programs. Enforcement of standards and permitting of new stationary pollution sources within the SCAB are performed by the South Coast Air Quality Management District (SCAQMD). In March 1989, SCAQMD adopted an Air Quality Management Plan (AQMP) in order to attain air quality standards established by the U.S. Environmental Protection Agency (EPA) under the provisions of the Clean Air Act (CAA). The plan is subject to approval by EPA, and it was adopted by the California Air Resources Board (ARB) later in 1989. A Draft 1991 AQMP revision was adopted by the SCAQMD in July 1991. The plan is designed to bring the SCAB into compliance with federal and state air quality standards. Southern California Association of Governments (SCAG) is responsible for developing regional plans for the transportation management, growth, and land use portions of the AQMP. Approval of the 1991 AQMP is still pending from the ARB and EPA.

The California Clean Air Act, effective January 1, 1989, divides the non-attainment areas into three categories with progressively stringent requirements: moderate, serious, and severe. The South Coast Air Basin is a severe non-attainment area for ozone, carbon monoxide, and nitrogen dioxide. The basin is nearing attainment for sulfates and has met attainment goals for lead and sulfur dioxide. The California Clean Air Act does not address PM_{10} . According to the California Clean Air Act, air quality management districts containing severe non-attainment pollutants are required to include specified emission reduction strategies to meet milestones in implementing emission controls into regional air quality management plans.

The 1989 AQMP established air pollution control strategies to bring the South Coast Air Basin into compliance with all federal and California air quality standards. The attainment strategy identified in the AQMP consists of three tiers:

- Tier I identifies control measures that can be adopted within the next five years through technological applications and management practices that are currently available.

- Tier II measures include the use of existing technologies as well as future technologies that require advancements expected to occur in the near future.
- Tier III programs are designed to bring about technological breakthroughs to further reduce emissions of reactive organic gases.

As a result of the passage of the California Clean Air Act, the 1989 AQMP was required to be amended to develop new strategies for the South Coast Air Basin to reach the attainment of state as well as federal air quality standards. The revised 1991 AQMP, in addition to developing strategies to achieve state standards, also reflects updated data for the South Coast Air Basin and recognizes air pollutant emissions reduction achievements. The 1991 AQMP requires ozone, carbon monoxide, and nitrogen dioxide levels to be reduced by 25 percent by the end of 1992, by 40 percent by the end of 1997, and by 50 percent by the end of the year 2000.

Local jurisdictions are required to come into conformity with the 1991 AQMP by adopting an Air Quality Element as part of each city's general plan. Each city's Air Quality Element must contain the transportation, land use and energy conservation control measures recommended in the 1991 AQMP.

Air Quality Ambient Standards For Criteria Pollutants

Federal and state legislation have established ambient air quality standards to protect public health. NAAQS is the National Ambient Air Quality Standards and CAAQS stands for California Ambient Air Quality Standards for pollutants shown in Table 3-31. The state standards are generally more stringent than the corresponding federal standards. The SCAB region currently exceeds federal and state standards for five criteria pollutants.

3.12.2 Major Pollutants and Associated Health Effects

Both the federal and state governments have set health-based ambient air quality standards for the following six pollutants: sulfur dioxide (SO₂), lead (Pb), ozone (O₃), nitrogen dioxide (NO₂), carbon monoxide (CO), and fine particulates of less than 10 microns in size (PM₁₀). The SCAB currently complies with the standards for both sulfur dioxide and lead but exceeds the standards for the remaining four pollutants, as discussed previously. In addition, California has set standards for ethylene, hydrogen sulfide, sulfates, visibility and vinyl chloride. All but sulfates and visibility are controlled through permit requirements. Sulfates and visibility are addressed through control programs for the four pollutants discussed below.

- Carbon Monoxide

Carbon monoxide is formed by the incomplete combustion of fossil fuels and is produced almost entirely by automobiles. Exposure to carbon monoxide can cause dizziness and fatigue and can impair central nervous system function. The number of days exceeding the carbon monoxide standards decreased substantially by the mid-1980s; however, since that time, there has been an increase in exceedances, which is probably due to increased vehicular travel. In 1990, Los Angeles County exceeded the federal carbon monoxide standard more than any other area of the United States.

Table 3-31: Federal and State Air Quality Standards

POLLUTANT	AVERAGING PERIOD	CALIFORNIA STANDARD ¹	FEDERAL STANDARD ²	
			PRIMARY ³	SECONDARY ⁴
Ozone	1 Hour	0.09 parts per million (ppm)	0.12 ppm	Same as primary
Carbon Monoxide	1 Hour	20 ppm	35 ppm	Same as primary
	8 Hours	9.0 ppm	9.0 ppm	
Nitrogen Dioxide	1 Hour	0.25 ppm	No Standard (NS)	NS
	Annual	NS	0.053 ppm	Same as primary
Sulfur Dioxide	1 Hour	0.25 ppm	NS	NS
	3 Hours	NS	NS	1300 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$)
	24 Hours	0.05 ppm	$365 \mu\text{g}/\text{m}^3$	NS
	Annual	NS	$80 \mu\text{g}/\text{m}^3$	NS
Suspended Particulate (PM_{10})	24 Hours	$50 \mu\text{g}/\text{m}^3$	$150 \mu\text{g}/\text{m}^3$	Same as primary
	Annual Arithmetic Mean	NS	$50 \mu\text{g}/\text{m}^3$	
	Annual Geometric Mean	$30 \mu\text{g}/\text{m}^3$	NS	NS
Lead	30 days	$1.5 \mu\text{g}/\text{m}^3$	NS	NS
	Calendar Quarter	NS	$1.5 \mu\text{g}/\text{m}^3$	Same as primary
Sulfates	24 Hours	$25 \mu\text{g}/\text{m}^3$	NS	NS
Hydrogen Sulfide	1 Hour	0.03 ppm	NS	NS
Vinyl Chloride	24 Hours	0.010 ppm	NS	NS
Visibility ⁵	8 Hours	Reduce visibility below 10 miles	NS	NS

Notes:

- California standards for ozone, carbon monoxide, sulfur dioxide (1-hour), nitrogen dioxide, suspended particulate matter - PM_{10} , and visibility are values that are not to be exceeded. The sulfur dioxide (24-hour), sulfates, lead, hydrogen sulfide, and vinyl chloride standards are not to be equaled or exceeded.
- Federal standards, other than ozone and those based on annual averages, are not to be exceeded more than once a year. The ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above the standard is equal to or less than one.
- National Primary Standards: the levels of air quality necessary to protect the public health with an adequate margin of safety.
- National Secondary Standards: the levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.
- This standard is intended to limit the frequency and severity of visibility impairment due to regional haze and is equivalent to a 10-mile nominal visual range when relative humidity is less than 70%.

Source: California Air Resources Board air Quality Data - General Summary, 1989.

- Nitrogen Dioxide

Nitrogen dioxide and nitric oxide are formed as a result of fuel combustion under high temperature or pressure. These compounds are referred to together as nitrogen oxides or NO_x . Nitrogen dioxide contributes to other pollution problems, including concentration of ozone, fine particulate matter, poor visibility and acid deposition. It decreases lung function and may reduce resistance to infection. By 1990, the federal standard had been exceeded in only one location in Los Angeles County, and the highest concentration was four percent greater than the federal standard. Los Angeles is the only county in the United States that does not meet the federal standard.

- Ozone

Ozone is formed by photochemical reactions between NO_x and reactive organic gases (ROG). Reactive organic gases are formed from the combustion of fuels and the evaporation of organic solvents. Elevated ozone concentrations result in reduced lung function, particularly during vigorous physical activity. This health problem is particularly acute in children. Ozone levels in the SCAB exceed the federal standard far more frequently than anywhere else in the country.

- PM_{10}

PM_{10} refers to small suspended particles that are 10 microns or less in diameter. Nitrates and sulfates, as well as dust particles, are major components. These small particles can be directly emitted as a by-product of fuel combustion, through abrasion such as wear on tires or brake linings or through wind erosion of soil. They can also be formed in the atmosphere through chemical reactions. These particles may carry carcinogens and other toxic compounds which adhere to the particle surfaces and can enter the lungs. In 1989, state PM_{10} standards were exceeded in all areas, frequently by a wide margin. The less stringent federal PM_{10} standards were also exceeded in many areas.

Sources of Pollution

At the present time, mobile sources account for approximately 98 percent of carbon monoxide production in the SCAB. On-road mobile sources (primarily autos and trucks) account for nearly all of this production. The remainder is attributable to stationary sources. Daily production of carbon monoxide in the SCAB in 1987 was 4,987 tons.

Slightly more than one half of the reactive organic gases produced in the SCAB come from mobile sources, and nearly all of this is attributable to on-road vehicles. The balance is produced in nearly equal amounts by residential, commercial/service industry sources, and the industrial/manufacturing sector. Daily production of reactive organic gases in the SCAB in 1987 was 1,375 tons.

Mobile sources account for 76 percent of daily nitrogen oxide production in the SCAB. Of this, 72 percent is attributable to on-road vehicles. Fuel combustion accounts for 91 percent of all stationary source contributions. In 1987, 1,208 tons of nitrogen oxides were produced daily in the SCAB.

In 1987, 1,075 tons per day of particulate matter (PM₁₀) were produced in the SCAB. Stationary sources accounted for about 94 percent of the total.

3.12.3 Environmental Setting

South Coast Air Basin

The proposed project is located within the South Coast Air Basin (SCAB). The SCAB consists of the non desert portions of Los Angeles, Riverside, and San Bernardino counties and all of Orange County, covering a total of 6,600 square miles of area. Los Angeles County comprises approximately 40 percent of the basin (2,400 square miles). The SCAB is bounded on the west by the Pacific Ocean, on the north and east by the San Gabriel, San Bernardino, and San Jacinto mountains, and on the south by the San Diego County line.

Climate

The location of Southern California, at the edge of the Pacific High Pressure Area, makes the weather pattern very stable. It is a coastal plain with connecting broad valleys and low hills. Southern California has a Mediterranean climate characterized by warm dry summers and mild winters. On most days the net wind flow is from west to east. This produces the effect of having pollutant source areas near the coast affecting receptor areas inland to the east, and this source-receptor relationship is further compounded by the population density and the majority of industries, commerce, streets and freeways that are located in the principal source areas in the western portion of the basin.

Temperatures in the basin are generally mild, increasing inland from the coast. Average annual high and low temperatures measured near the project sites were 74 and 53° F, respectively, over the last 30 years of record (SCAQMD, 1980).

Most of the rainfall occurs between November and April, averaging approximately 15 inches per year over the last 40 years. Total recorded rainfall varied from 5 to 33 inches per year in this period (*Los Angeles Times*, July 1992).

Among the four counties of the SCAB region, Los Angeles County ambient pollution concentrations are the highest. In winter months, air quality degradation is mainly due to carbon monoxide and nitrogen dioxide emissions from mobile sources, because these pollutants remain in the air for a longer period of time. In summer, air quality problems result from the formation of photochemical smog as hydrocarbons and nitrogen dioxide react under strong sunlight. Los Angeles County has been designated as a non-attainment area by the U.S. EPA under provisions of the CAA for ozone, carbon monoxide, nitrogen dioxide and total suspended particulates. Los Angeles County is designated an attainment area for sulfur dioxide.

Project Area Air Quality and Meteorological Conditions

The SCAQMD has subdivided the region into 22 air monitoring areas. Each of these areas has an air monitoring station. The project is located in the South East Los Angeles County, Region no. 5 monitoring area. The monitoring station for this area is located at 14427 Leffingwell Road, Whittier, approximately 5 miles northeast of project site. Another near by receptor station is

located in Pico Rivera at 3713-B San Gabriel River Parkway, approximately 5 miles north of project site, in an adjacent region. These stations monitor ozone, ROG, CO, NO₂, and PM₁₀. Data for 1989, 1990, and 1991 are given in Table 3-32 and Table 3-33.

- Recorded Air Quality at the Whittier Monitoring Station:

In the past three years, as indicated in Table 3-32, federal and state 1-hour and 8-hour standards for CO were not exceeded in this region. For nitrogen dioxide in year 1989 state 1-hour standards of 0.25 ppm were exceeded for one day. Federal standards were not exceeded in these years. Ozone 1-hour state standards of 0.09 ppm were exceeded in all three years for 70 days in 1989 and 59 days in 1991. Federal 1-hour standards of 0.12 ppm were exceeded for 23 days in 1991. Sulfur dioxide standards for either federal or state were not exceeded during the 1989-1991 period. Suspended particulates and lead and sulfates were not measured in those years.

- Recorded Air Quality at the Pico Rivera Monitoring Station:

In the past three years, as indicated on Table 3-33, the state 1-hour carbon monoxide standard of 20 ppm was not exceeded. The 8-hour standard of 9.1 ppm was exceeded for three days in 1989 and one day in 1990 and 1991. The federal 1-hour standard of 35 ppm was not exceeded during the last three years. The state's 1-hour maximum concentration for nitrogen dioxide was exceeded for two days in 1989 and 1990. Only in 1989 was the federal standard of $[[\%]]$ above standard exceeded by 2.2 percent. The federal standard for ozone was exceeded in all three years by 61 days in 1989 and 48 days in 1991. The state standard of 0.09 ppm for 1-hour was exceeded for 108 days in 1989 and 86 days in 1991. State and federal standards for Sulfur dioxide were not exceeded in 1989 and 1990. SO₂ was not measured in 1992. Suspended particulates and lead have not been measured in three years. One Sulfate sample exceeded in 1989.

3.12.4 Construction Emissions

There are two alignments to this project: aerial and subway. Construction characteristics would vary in between the two. Information on the type and quantity of construction equipment in use was obtained from Gannett Fleming. Table 3-34 shows the estimated usage. Emission factors were taken from the SCAQMD's *Draft CEQA Air Quality Handbook* (1992). Each piece of equipment is assumed to be diesel powered and in operation for the maximum number of hours during the day for worst case analysis. In the following section worst case criteria pollutant emissions in a day are compared with SCAQMD thresholds of significance.

Aerial Alignment

The aerial alignment would be constructed in several different phases. The first task would involve the widening of Imperial Highway. The second task would involve the relocation of all the overhead and subterranean utility lines that pass through the middle of Imperial Highway. The final phase would involve the construction of the aerial guideway. The aerial alignment would produce fewer criteria emissions than the subway alignment (see next section). The impact areas would change as construction proceeds to different locations. Table 3-35 shows the level of pollutant production during various phases of aerial construction. Nitrogen oxides

Table 3-32: Whittier Monitoring Station Exceedances

(STANDARD OR MEASUREMENT)	1989	1990	1991
CARBON MONOXIDE			
Federal: (1 Hour)	0	0	0
(8 Hour)	0	0	0
State: (1 Hour)	0	0	0
(8 Hour)	0	0	0
OZONE			
Federal: (1 Hour)	37	21	23
State: (1 Hour)	70	47	59
NITROGEN DIOXIDE			
Federal: (% above std.) ²	0	0	0
State: (1 Hour)	1	0	0
SULFUR DIOXIDE			
Federal: (24 Hour)	0	0	0
State: (24 Hour)	0	0	0
VISIBILITY			
State: (Los Angeles International Airport)	150	154	159
SUSPENDED PARTICULATE (PM₁₀)			
Federal: (24 Hour)	NM	NM	NM
State: (24 Hour)	NM	NM	NM
LEAD			
Federal: (Quarters exceeding std.)	NM	NM	NM
State: (Months exceeding std.)	NM	NM	NM
SULFATE			
State: (No. of samples exceeding std.)	NM	NM	NM
Notes:			
¹ The Whittier monitoring station is located at 14427 Leffingwell Rd. ² The federal standard is an annual arithmetic mean value greater than 0.053 parts per million. NM Pollutant not monitored at this station.			

Source: South Coast Air Quality Management District - Air Quality Data Sheets, 1989-1991.

Table 3-33: Pico Rivera Station Exceedances

(STANDARD OR MEASUREMENT)		1989	1990	1991
CARBON MONOXIDE				
Federal:	(1 Hour)	0	0	0
	(8 Hour)	1	1	0
State:	(1 Hour)	0	0	0
	(8 Hour)	2	1	1
OZONE				
Federal:	(1 Hour)	61	43	48
State:	(1 Hour)	108	85	86
NITROGEN DIOXIDE				
Federal:	(% above std.) ²	2.2	0	0
State:	(1 Hour)	2	2	0
SULFUR DIOXIDE				
Federal:	(24 Hour)	0	0*	NM
State:	(24 Hour)	0	0*	NM
VISIBILITY				
State:	(William J. Fox Airport, Lancaster)	NM	14	9
SUSPENDED PARTICULATE (PM₁₀)				
Federal:	(24 Hour)	NM	NM	NM
State:	(24 Hour)	NM	NM	NM
LEAD				
Federal:	(Quarters exceeding std.)	0	0	0
State:	(Months exceeding std.)	0	0	0
SULFATE				
State:	(No. of samples exceeding std.)	1	0	0
Notes:				
¹ The Pico Rivera monitoring station is located at 3713-B San Gabriel River Parkway. ² The federal standard is an annual arithmetic mean value greater than 0.053 parts per million. * Less than 12 full months of data. May not be representative NM Pollutant not monitored at this station.				

Source: SCAQMD -Air Quality Data Sheets, 1989-1991.

Table 3-34: Construction Equipment

EQUIPMENT BY PHASE**	SUBWAY ALTERNATIVE		AERIAL ALTERNATIVE	
	# Used	Time (hr/day)	# Used	Time (hr/day)
STREET WIDENING				
Concrete Saws	NA	NA	4	8
Rollers	NA	NA	2	8
Asphalt Pavers	NA	NA	2	8
Tract/Loader/Backhoe	NA	NA	2	8
Concrete Pavers	NA	NA	1	8
Trucks ^a	NA	NA	2	8
RELOCATION OF UTILITY LINES				
Bore/Drill Rig	NA	NA	3	8
Trencher	NA	NA	2	8
Trucks ^a	NA	NA	3	8
DEMOLITION				
Crawler Cranes	1	8	2	8
Crawler Dozer (Gals)	NA	NA	1	8
Generator Sets	NA	NA	6	8
Rubber Tired Loaders	NA	NA	2	8
Tractors/Loaders	2	8	NA	NA
Trucks ^a	4	8	8	8
EXCAVATION				
Crawler Dozer (Gals)	1	8	NA	NA
Drill Rig	2	8	NA	NA
Pumps	4	8	NA	NA
Rubber Tired Loaders	2	8	NA	NA
Generators	4	8	NA	NA
Excavators	1	8	1	8
Tunnel Boring Machine	1	16	NA	NA
Trucks ^a	30	8	2	8
CONSTRUCTION				
Drill Rig	NA	NA	3	8
Pile Drilling Auger	NA	NA	1	8
Cement/Mortar Mixer	18	8	12	8
Crawler Cranes	1	8	2	8
Generators	4	8	6	8
Plate Compactor	2	8	2	8
Welders	6	8	4	8
Trucks ^a	30	8	8	8
Notes: * Type of equipment, number used and operating times provided by Gannett Fleming, Los Angeles. ** Emission factors obtained from SCAQMD's Draft CEQA Air Quality Handbook, May 1992. ^a Off-highway truck emission factors for diesel-powered construction equipment assumed. NA Not Applicable.				

Source: Myra L. Frank & Associates, Inc., 1992.

are predicted to exceed the SCAQMD established threshold during all but the excavation phase. Carbon monoxide production would not exceed the threshold but would be the highest during the construction phase (323 pounds per day). No other criteria pollutants are likely to exceed the threshold during any construction phase.

Table 3-35: Construction Emissions - Aerial Alternative

POLLUTANTS (Pound per Day)	ROG	CO	NOx	PM10	SOx
SCAQMD THRESHOLD CRITERIA	75	550	100	150	150
CONSTRUCTION PHASES					
Street Widening	58	107	164	18	20
Exceeds Criteria	No	No	Yes	No	No
Relocation of Utility Lines	24	151	210	24	18
Exceeds Criteria	No	No	Yes	No	No
Demolition	27	118	268	25	24
Exceeds Criteria	No	No	Yes	No	No
Excavation	5	26	57	6	5
Exceeds Criteria	No	No	No	No	No
Construction	71	323	424	42	37
Exceeds Criteria	No	No	Yes	No	No
Note: Emission factors obtained from SCAQMD's Draft CEQA Air Quality Handbook, May 1992.					

Source: Myra L. Frank & Associates, Inc., 1992.

Subway Alignment

The subway alignment would mostly affect areas in the vicinity of the two ends of the Green Line Extension. Approximately 30 trucks per day, and heavy equipment used to excavate a tunnel, would be major sources of criteria pollutants. Table 3-36 shows total emissions generated during each major phase of construction. Nitrogen Oxides are predicted to exceed the SCAQMD threshold of significance in each phase, with a maximum of 947 pounds per day during the excavation period. Reactive Organic Gases are expected to exceed the threshold by 19 pounds per day during the excavation phase. No other criteria pollutants are predicted to have a significant impact on air quality during construction of the subway. Anticipated CO emissions would not cause a major impact on air quality during the subway construction period.

Table 3-36: Construction Emissions - Subway Alternative

POLLUTANTS (Pounds per Day)	ROG	CO	NOx	PM10	SOx
SCAQMD THRESHOLD CRITERIA	75	550	100	150	150
CONSTRUCTION PHASES					
Demolition	16	73	152	14	13
Exceeds Criteria	No	No	Yes	No	No
Excavation	94	489	947	93	85
Exceeds Criteria	Yes	No	Yes	No	No
Construction	71	355	739	68	68
Exceeds Criteria	No	No	Yes	No	No
Note: Emission factors obtained from SCAQMD's Draft CEQA Air Quality Handbook, May 1992.					

Source: Myra L. Frank & Associates, Inc., 1992.

3.12.5 Operational Criteria Emissions

The proposed project is expected to increase commuter mobility by public transport thereby reducing the production of pollution. No significant land use changes or new developments are anticipated as a result of this project.

The Green Line Easterly Extension is not expected to generate significant mobile emissions from project-related traffic except at the two intersections closest to the end stations. The intersections of Studebaker Road and Imperial Highway and Bloomfield and Imperial Highway are likely to be the intersections most affected by project-related traffic. Data on existing and future conditions with project traffic volumes at major intersections, Level of Service (LOS) and Average Daily Trips (ADT) along Imperial Highway were provided by Meyer, Mohaddes Associates. Table 3-37 shows AM Peak LOS and PM Peak LOS at each major intersection. Regional ambient growth of 20 percent was assumed in order to project future traffic volumes.

Mobile Source Criteria Emissions

Mobile source criteria emissions were calculated using a methodology prescribed in the SCAQMD's *Draft CEQA Air Quality Handbook* (1992). Project Average Daily Trips (ADT) were converted into VMT and multiplied by the emission factor for each criteria pollutant. Daily mobile source criteria pollutants were predicted for three conditions: existing, future without the project and future with the project. They are recorded in Table 3-38. The proposed project is expected to reduce future traffic volume by approximately 1000 vehicles per day on Imperial Highway. SCAQMD threshold criteria for Reactive Organic Gases (ROG), Carbon Monoxide (CO) and Nitrogen Oxides (NOx) are predicted to exceed the criteria in the year 2010. Particulate Matter (PM₁₀) and Sulfur Oxide (SOx) emissions are not expected to exceed SCAQMD criteria. It is

Table 3-37: Level of Service (LOS) at Major Intersections

INTERSECTIONS	EXISTING		FUTURE W/O PROJECT		FUTURE WITH PROJECT	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Studebaker Road/Imperial Hwy.	B	E	F	F	F	F
Firestone Blvd./Imperial Hwy.	C	C	E	F	E	E
Pioneer Blvd./Imperial Hwy.	C	E	F	F	F	E
Norwalk Blvd./Imperial Hwy.	F	F	F	F	F	F
Bloomfield Ave./Imperial Hwy.	D	D	E	F	E	E

Source: Meyer, Mohaddes Associates, Inc., 1992.

important to note that a substantial decrease in all pollutants would occur between 1992 and 2010 as a result of improved technology. The proposed project would result in further reduction beyond the No Project condition because it would divert some auto trips to transit.

Regional Effects

The Green Line Easterly Extension would operate on electric power. The expected fleet size of 24 cars includes 18 peak hour, 12 base hour and 6 spare (maintenance and operation) cars. The train size would normally be one car in length. Total projected average annual miles would be 2,600,000 miles (7,123.28 miles per day). Week day average miles would be 2,069,000 miles. Cumulative peak hour average miles are projected to be 1,259,000 miles. Each train is estimated to consume approximately 6 Kwh/car mile. Information on vehicle miles traveled was obtained from Daniel, Mann, Johnson, & Mendenhall (DMJM), Los Angeles. ICF Kaiser Engineers (Kaiser), Los Angeles, provided information on Kwh/Car mile electric consumption. Los Angeles Department of Water and Power (LADWP) and Southern California Edison (SCE) would supply required power for the operation of this project.

Table 3-38: Daily Mobile Source Emissions

	ROG	CO	NOx	PM ₁₀	SOx
1. Existing (1992)					
East of I-5	207	4,418	813	100	0.19
West of I-5	190	4,066	748	92	0.17
Total	397	8,484	1,561	192	0.36
2. Future Without Project (Year 2010)					
East of I-5	41	824	257	48	0.02
West of I-5	44	900	280	53	0.03
Total	85	1,724	537	101	0.05
3. Future With Project (Year 2010)					
East of I-5	41	820	255	48	0.02
West of I-5	44	887	276	52	0.03
Total	85	1,707	531	100	0.05
Net Reduction (1-3)	312	6,777	1,030	92	0.31
Net Reduction (2-3)	0	17	6	1	0.00
SCAQMD Threshold Criteria	75	550	100	150	150
<p>Notes: Daily mobile emissions are based on methodology adopted by SCAQMD <u>Draft CEQA Air Quality Handbook</u> (Daily Emissions = VMT * Emission factor for each criteria pollutant).</p> <p>This table reflects emissions at locations along Imperial Highway (pounds per day).</p>					

Source: Myra L. Frank & Associates, Inc., 1992.

The electricity produced to meet the added demand by the project would have associated emissions. Table 3-39 shows anticipated amount of criteria pollutants generated from the power plants. Emission factors were obtained from SCAQMD's *Draft CEQA Air Quality Handbook* (1992). No significant air quality impact is anticipated. None of the criteria pollutant emissions would exceed AQMD significance thresholds. The project site would not be affected by any of these pollutants generated from power plants.

3.12.6 Carbon Monoxide Concentrations

Approved ARB and SCAQMD regulatory air dispersion models and methodologies were adopted to estimate pollutant impacts from mobile source emissions. Project carbon monoxide emissions from electricity use would occur outside the study area and therefore would not contribute to local concentration. The CALINE4 source model was used to estimate local CO impacts from mobile sources. CALINE4 is a Gaussian plume dispersion model developed by the California Department of Transportation (DOT) to predict air pollutant concentrations near line sources. Worst-case meteorological conditions were used to predict 1-hour average pollutant concentrations from CO emissions associated with mobile sources. These parameters included a wind speed of 0.5 meters per second, "G" stability (very stable), and model-determined worst case wind direction.

Table 3-39: Regional "Burden" Analysis

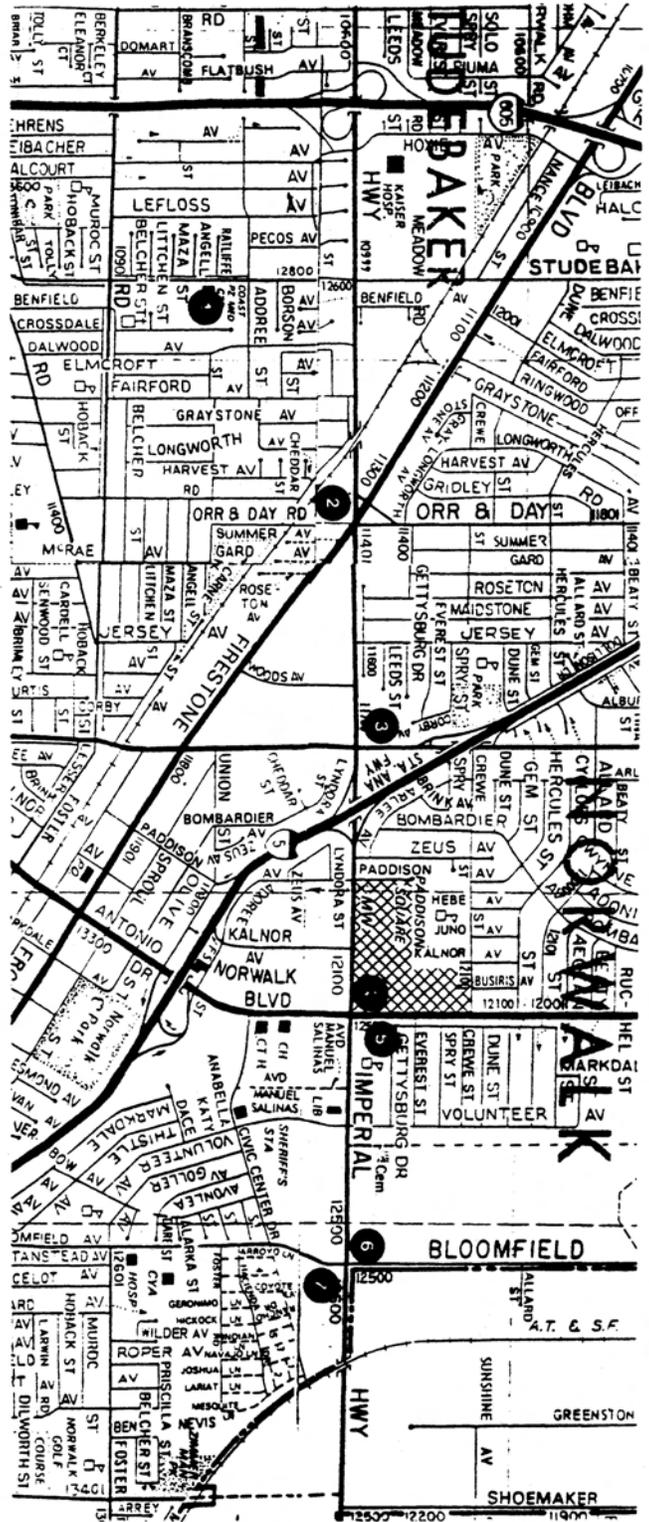
POLLUTANTS	POUNDS PER DAY
Reactive Organic Gas (ROG)	0.42
Carbon Monoxide (CO)	8.54
Nitrogen Oxides (NOx)	49.14
Sulfur Oxides (SOx)	5.12
Note: Emission factors obtained from AQMD's Draft CEQA Handbook, 1992.	

Source: Myra L. Frank & Associates, Inc., 1992.

Sensitive Receptors

Some land use types are considered more sensitive to air pollution than others, due to the types of population groups or activities involved. Seven such receptors were identified (Figure 3-29). Sensitive locations along the project segment were selected as follows:

- Receptor 1. Medical building on Studebaker Road south of Imperial Highway.
- Receptor 2. Church on Imperial Highway and Orr and Day road intersection (south west corner).
- Receptor 3. Gas station at Pioneer and Imperial Highway (northwest corner).
- Receptor 4. Bus stop at Norwalk and Imperial (Paddison Square Shopping Mall, northwest corner).
- Receptor 5. McDonald's Restaurant (across Paddison Square on Norwalk Boulevard, 200 ft. north of Imperial Highway).
- Receptor 6. Office building at Bloomfield and Imperial (northwest corner).
- Receptor 7. Gas station at Bloomfield and Imperial (southeast corner).



Source: Myra L. Frank & Associates, Inc., 1992.

*Myra L.
Frank &
Associates, Inc.*

*Metro Green Line Easterly Extension
Environmental Impact Report*

Figure 3-29: Location of Sensitive Receptors

Carbon Monoxide Concentration "Hot Spots"

Estimated CO concentrations at the receptors are presented in Table 3-40. The results indicate that in the year 1992, at six of the seven receptor locations CO concentration levels were higher than the state 1-hour standard of 20 ppm. The federal 1-hour standard of 35 ppm was not exceeded at any location. In the year 2010 (future without project), one of the seven locations is predicted to exceed the state 1-hour standard. None of the locations is predicted to exceed state or federal standards for the future, with project alternative.

Table 3-40: 1-Hour Carbon Monoxide Concentration Levels at Sensitive Receptors

SENSITIVE RECEPTORS	EXISTING (YEAR 1992)		NO BUILT (YEAR 2010)		FUTURE WITH PROJECT (YEAR 2010)	
	1-Hour	8-Hour	1-Hour	8-Hour	1-Hour	8-Hour
Receptor 1	19.80	10.97	14.52	8.05	14.60	8.11
Receptor 2	23.60	13.06	16.23	8.99	15.70	8.71
Receptor 3	26.30	14.45	18.14	10.03	17.40	9.65
Receptor 4	27.70	15.31	20.61	11.41	18.22	10.09
Receptor 5	19.80	10.97	16.30	9.00	15.11	8.38
Receptor 6	21.80	12.07	16.20	8.99	16.20	8.99
Receptor 7	20.80	11.52	17.61	9.76	15.54	8.64
No. of Receptors Exceeding State Standard [> =20 ppm for 1-Hour and > =9 ppm for 8-Hour]	6	7	1	3	0	2
Note: Ambient level: 1-hour: 12.4 and 8-hour: 6.9 at Whittier monitoring station.						

Source: Myra L. Frank & Associates, Inc., 1992.

The persistence factor method was used to calculate the 8-hour concentration level. Persistence factor is a ratio of 1-hour to 8-hour ambient levels. This method has a recognized tendency to over predict actual 8-hour concentrations since peak 1-hour traffic volumes are assumed to exist for eight hours. State 8-hour standard is predicted to exceed at two locations in 2010. Whereas for the "no-build" (2010) alternative three locations are predicted to exceed the standard. As compared with existing conditions, the proposed project would have a beneficial effect on carbon monoxide concentration. It would result in a reduction in the number of locations exceeding the 1-hour standard and it would result in reduced amounts for the 8-hour standard at each location.

Carbon Monoxide Conformity

SCAG's Draft CO Conformity Guideline states that transportation projects conform if: (1) It is included in a Regional Transportation Plan and a Traffic Improvement Program found to conform and (2) it can reasonably be demonstrated that the project, when taken as a whole, would reduce or eliminate the number and severity of violations of the federal carbon monoxide standards in the area substantially affected by the project. A more specific statement of the CO conformity guideline requirements as they relate to the proposed project is presented below:

- For areas in which there would be no carbon monoxide violations in the "no-build" scenario, the project conforms only if there would be no violations in the "build" scenario.
- For areas in which there would be carbon monoxide violations in the "no-build" scenario, the project conforms if the "build" scenario shows a reduction in the number and severity of CO violations in the area substantially affected by the project.

The "area substantially affected by the project" includes both (a) the vicinity of the project in which receptors are located which could be affected by vehicles using the project, and (b) other affected streets and arterials on which traffic could be expected to change significantly as a result of the proposed project.

As described in earlier sections, the Metro Green Line Easterly Extension is predicted to reduce CO, NO_x, PM₁₀, and ROG emissions from current levels. The project's implementation would improve overall traffic flow, contribute to increased average speeds, and therefore lower emission rates on a per miles traveled basis. It would decrease traffic on Imperial Highway and other streets thereby reducing local emissions. The "no-build" scenario shows reduction in the number of "hot-spots" (CO concentration at identified locations). Therefore, the proposed project is considered to be in conformance with the guideline.

3.12.7 Mitigation Measures

Construction

Short term impacts of construction could be reduced by the following measures. These measures should be considered as conditions of project approval and could be contained in applicable contracts between the project sponsor and contractors.

Fugitive dust control programs consistent with the provisions of SCAQMD Rule 403 for grading or earthwork activities should be employed. Measures include:

- Water all active projects sites with multiple daily applications to assure proper dust control.
- Wash down the under carriage of all haul trucks leaving site.
- Utilize street sweeping equipment on all adjacent streets used by haul trucks or vehicles that have been on-site.
- Stockpiles of soil, sand and similar materials shall be covered.
- Suspend grading operations and tunnel digging during first and second stage smog alerts, and during high winds, i.e., greater than 25 miles per hour.

- Require all trucks hauling dirt, sand, soil or other loose substances and building materials to be covered, or to maintain a minimum freeboard of two feet between the top of the load and the top of the truck bed sides.
- Prohibit parking on untreated land.
- Construction equipment would be shut off to reduce idling when not in direct use.
- Low sulfur fuel should be used for construction equipment.
- Construction activity shall be discontinued during second stage alert.

Operational

Because the proposed project would have a beneficial effect on air quality, the Green Line Easterly Extension itself can be considered a mitigation measure. In addition, public education programs regarding the importance of reducing vehicle miles traveled and the related air quality impacts could be employed.

3.13 ENERGY

3.13.1 Environmental Setting

Electricity for the Green Line Easterly Extension would be supplied by Southern California Edison (SCE). Southern California Edison Company is an investor-owned, regulated utility providing electric service to a 50,000 square mile area of Central and Southern California. The company supplies electricity from nine energy sources. In the year 1987, 47 generating plants which burned oil or natural gas met about 37 percent of demand, nuclear plants generated about 20 percent of the supply, 14 percent was generated by coal powered plants, 5 percent was provided by hydro-electric sources and 24 percent was purchased from other utilities or power producers.

Fossil fuels are consumed in Southern California by on-road vehicles in the form of gasoline and diesel fuel. On road sources account for nearly all fossil fuel consumed in the South Coast Air Basin. Table 3-41 shows estimated fuel consumption in recent years and projections of those figures to the year 2010 and 2020. Projections were estimated on the basis of one percent annual growth.

Since the automobile is the dominant form of transportation, fuel economy is a critical determinant of transportation energy consumption in the region. The table shows projected increases in fuel consumption from 1980 to 2010 to 2020. An increasing number of automobile travel miles is expected to overcome the existing trend of improved fuel economy in new automobiles. Hence, in recent years fuel consumption has declined marginally. The fuel economy trend is expected to continue in future years, and with the anticipated introduction of electric automobiles, fossil fuel consumption may be reduced significantly.

Table 3-41: Estimated Fossil Fuel Consumption

	1980	2010	2020
SCAG REGION			
Gasoline	5.5 billion	7.2 billion	7.7 billion
Diesel	530 million	690 million	740 million
SOUTH COAST AIR BASIN			
Gasoline	4.9 billion	6.4 billion	6.9 billion
Diesel	470 million	610 million	660 million

Source: Alameda Corridor Draft EIR, Myra L. Frank & Associates, Inc., 1992.

3.13.2 Construction Impacts

Construction of the proposed project would result in the consumption of fossil fuels associated with the operation of construction equipment and vehicles. Table 3-42 provides estimated fuel consumption associated with construction equipment and vehicles. As compared with regional daily fuel consumption, these amounts are considered insignificant.

3.13.3 Operational Impacts

Energy consumed by the proposed project would be in the form of electricity. Each transit vehicle is expected to consume approximately 6 Kwh/car mile. This indicates that the total electric consumption during operational phase would be approximately 42,740 kilo watts per day. Typical peak hour load is anticipated to be 2,219 Kw per hour. The total yearly consumption would be approximately 15.6 mega-watts. Table 3-43 shows combined energy consumption expressed in British Thermal Units (BTUs). In 2010, with the operation of the Green Line Easterly Extension, total energy consumption is estimated to be 3.87 billion BTUs, as compared to vehicular energy consumption of 2.13 billion and 2.44 billion BTUs in 1992 and 2010 (without the project), respectively. Yearly consumption is well within the production capacity of power plants.

3.13.4 Mitigation Measures

To maximize fuel economy and conserve energy, mitigation measures indicated in the previous air quality section should be adopted. In the interest of promoting energy efficiency, the following mitigation measures are also suggested:

Construction

- Select dump sites as close as practicable to the corridor to minimize haul distance and excavation related fuel consumption.

Table 3-42: Construction Equipment Fuel Consumption

EQUIPMENT BY PHASE	SUBWAY ALTERNATIVE		AERIAL ALTERNATIVE	
	# Used	Fuel Consumption (Gal./day)	# Used	Fuel Consumption (Gal./day)
STREET WIDENING				
Concrete Saws	NA	-	4	50
Rollers	NA	-	2	40
Asphalt Pavers	NA	-	2	40
Tract/Loader/Backhoe	NA	-	2	75
Concrete Pavers	NA	-	1	75
Trucks (Hauling)	NA	-	2	50
Total	-	-	13	330
UTILITY RELOCATION				
Bore/Drill Rig	NA	-	3	120
Trencher	NA	-	2	150
Trucks	NA	-	3	75
Total	-	-	8	345
DEMOLITION				
Crawler Cranes	1	100	2	200
Crawler Dozer	NA	-	1	75
Generator Sets	NA	-	6	120
Rubber Tired Loaders	NA	-	2	60
Tractors/Loaders	2	75	NA	-
Trucks (Hauling)	4	100	8	200
Total	7	275	19	655
EXCAVATION				
Crawler Dozer	1	75	NA	-
Drill Rig	2	80	NA	-
Pumps	4	40	NA	-
Rubber Tired Loaders	2	60	NA	-
Generators	4	80	NA	-
Excavators	1	75	1	75
Tunnel Boring Machine	1	NA	NA	-
Trucks	30	750	2	50
Total	45	1,460	-	125
CONSTRUCTION				
Drill Rig	NA	-	3	120
Pile Drilling Auger	NA	-	1	75
Cement/Mortar Mixer	18	300	12	200
Crawler Cranes	1	100	2	200
Generators	4	80	6	120
Plate Compactor	2	20	2	20
Welders	6	80	4	60
Trucks	30	750	8	200
Total	61	1,030	42	995

Source: Gannett Fleming; Myra L. Frank & Associates, Inc., 1992.

Table 3-43: Estimated Overall Operating Energy Consumption

VEHICULAR ENERGY	EXISTING (Year 1992)	FUTURE W/O PROJECT (Year 2010)	FUTURE WITH PROJECT (Year 2010)
Auto - Miles¹	248,866	366,140	363,530
Fuel consumption rate ²	22.2	29.6	29.6
Gasoline Consumed ³	11,210	12,370	12,281
Truck - Miles⁴	27,652	40,682	40,392
Fuel consumption rate ²	5.6	6.6	6.6
Diesel consumed ³	4,938	6,164	6,120
TOTAL FUEL CONSUMED³	16,148	18,534	18,401
British Thermal Units (BTU)			
Gasoline	1.46 billion	1.60 billion	1.59 billion
Diesel	0.67 billion	0.84 billion	0.83 billion
VEHICULAR BTUs	2.13 billion	2.44 billion	2.42 billion
Green Line Easterly Extension BTUs			1.45 billion
TOTAL BTUs	2.13 billion	2.44 billion	3.87 billion
Notes:			
1 90 percent of total VMT. Vehicle Miles Travels (VMT) per day were converted from Average Daily Trip information provided by Meyer, Mohaddes Associates, Inc. using conversion factors from SCAQMD Draft CEQA Handbook, 1992.			
2 Miles/Gallon. Alameda Corridor, Draft EIR, Myra L. Frank Associates, 1992.			
3 Gallons per day.			
4 10 percent of total VMT.			

Source: Meyer, Mohaddes Associates, Inc.; Myra L. Frank Associates, Inc., 1992.

- Recycle asphalt taken up from roadways, if practicable and cost-effective.
- Maintain construction equipment in good working condition.
- Promote car-pooling among construction workers, perhaps involving the use of project vans.
- Schedule construction operations to result in the most efficient use of construction equipment practicable.

Operation

The daily operation of the Green Line Easterly Extension would use electric power for vehicle propulsion. Other minor use of electricity for various functions, such as signaling, station operations, etc., would occur. The following conservation measures are suggested:

- Area lighting systems should use efficient luminaires and should be designed for an efficient placement of individual fixtures.
- During final design, every aspect of station energy use would be reviewed in order to minimize heating, lighting, ventilating, air-conditioning and other energy loads. Passive solar heating and solar hot water preheating should be considered wherever feasible. Life cycle cost analysis would be conducted to determine the most beneficial energy design.