Environmental Justice Analysis of Minority and Low-Income Populations Adjacent to Goods Movement Corridors in Southern California

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ABSTRACT

Southern California is the largest international trade gateway in the U.S., and the region also generates enormous local and domestic goods movement activity. Given the expected growth in international trade and domestic goods movement in the future, significant growth in truck volumes and rail traffic are anticipated in the region to facilitate reliable goods movement and to support economic growth. As goods movement is a major contributor to local and regional environmental issues, such as air pollution and health risk, it is a regional priority not only to mitigate the environmental impacts of the goods movement system, but also to ensure that there is equity in distribution of environmental benefits and burdens from federally funded goods movement programs and projects pursuant to Title VI of the Civil Rights Act.

Therefore, in order to prevent disproportionately high and adverse environmental effects and health risks on minority and low-income populations from the goods movement system, the Southern California Association of Governments conducted Environmental Justice analyses for the goods movement system included in the Regional Transportation Plan. The objective of this paper is to identify minority and low-income populations, to analyze their spatial distributions along major truck corridors and freight rail corridors, and to address the Environmental Justice implications of the goods movement system in Southern California.

INTRODUCTION

The Southern California Association of Governments (SCAG) is the designated metropolitan planning organization (MPO) under federal law, responsible for developing and adopting a long-range Regional Transportation Plan (RTP) every four years which serves as a basis for transportation decision-making in the region (SCAG Region). As a federally funded government agency, SCAG is responsible for implementing Title VI of the Civil Right Act of 1964, which states that "no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance." And, by Executive Order 12898 from 1994, Title VI was further amplified by providing that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." And, Orders on Environment Justice by U.S. Department of Transportation (DOT) in 1997 and Federal Highway Administration (FHWA) in 1998 which were issued in support of Executive Order 12898 *(1)*. SCAG is determined and committed to developing long range plans that will improve, correct or mitigate any disproportionate impacts to our Environmental Justice Population Groups.

In compliance with federal and state requirements and guidelines on Environmental Justice, SCAG has been integrating the principles of Title VI to address Environmental Justice in preparation for its RTPs. On April 4, 2012, SCAG adopted the 2012-2035 Regional Transportation Plan/Sustainable Communities Strategy (2012-2035 RTP/SCS) containing a regional commitment to reduce emissions from transportation sources pursuant to Senate Bill (SB) 375 through which the California Air Resources Board (CARB) set per capita targets for reduction in greenhouse gas (GHG) emissions—8 percent in 2020 and 13 percent in 2035 from 2005 levels. In preparation for the 2012-2035 RTP/SCS, SCAG conducted Environmental Justice analyses to assess the impacts of programs and projects included in the 2012-2035 RTP/SCS on minority and low-income populations (herein called "Environmental Justice population groups").

Amongst transportation programs and projects of the 2012-2035 RTP/SCS, one of the key strategies is the development of a freight transportation system to maintain economic growth in the region, to sustain quality of life and to meet federal air quality requirements *(2)*. The goods movement system in Southern California consists of two major user markets—domestic/regional/local trade and international trade. The SCAG Region is the largest international trade gateway in the U.S. The Ports of Los Angeles and Long Beach, rank first and second largest among container port facilities in the U.S., respectively, and together they rank as third largest container port complex in the world *(3)*. The Ports of Los Angeles and Long Beach together shared over 31 percent of total container volume in the U.S. in 2009; and, it is forecasted that the total container volumes for the ports will gain market share rising to 37 percent of total U.S. volume by 2030 *(3)*. While the region is a major international gateway, a dominant goods movement activity generated in the SCAG Region is the local, regional and domestic trade system. The intra-regional goods movement forms more than 85 percent of truck trips *(2)*. The rail system supports domestic goods movement by providing a critical connection between the nation's largest port complex and the rest of the nation. In 2010, goods movement-dependent industries, such as manufacturing, wholesale, retail sales, construction and warehousing, contributed $253 billion to the regional gross domestic product (GDP) *(2)*. Given the economic growth of the SCAG Region and the recovery and expansion of international trade in the national economy, it is imperative that regional goods movement infrastructure continue to serve market demand and to facilitate the enormous economic growth in the region.

As truck and rail volumes are expected to continue to increase, it is critical to develop strategies to relieve increasing environmental concerns in the SCAG Region as well as improving regional goods movement infrastructure to accommodate economic and transportation growth. Heavy-duty trucks and freight rail are usually powered by diesel fuel and they are major sources of NO_X, and $PM_{2.5}$ emissions, which contribute to community health risks, including respiratory illnesses and asthma. The goods movement system is also a major source of CO_2 emissions, the most significant GHG which causes global

climate change. Therefore, it is essential to reduce the impacts of the regional goods movement system on the environment and public health as well as to improve its infrastructure. In order to achieve this goal, the 2012-2035 RTP/SCS includes strategies to address community health concerns and environmental issues while facilitating technology development that contributes to economic growth. The concerns expressed through public outreach to the communities is that the projects included in SCAG's long range plan not be primarily located in low income areas or areas with high concentration of minority or foreign born population. To address these concerns, SCAG has developed strategies which include a near term approach supporting the deployment of commercially available lower-emission freight system and the long term approach implementing zero- and near-zero emission freight system *(2)*. Air quality in the SCAG Region is expected to improve significantly due to reductions in emissions in the future given the implementation of the strategies recommended in the 2012-2035 RTP/SCS.

However, there are areas with concentration of minority and low-income populations (herein called "Environmental Justice areas") where the SCAG Region needs to improve in terms of the potential disproportionately high and adverse human health or environmental effects on Environmental Justice population groups. For example, it was observed that the distributional impact of $PM_{2.5}$ in the Environmental Justice areas exceeds the regional average *(2)*. In this regards, SCAG analyzed the impacts of programs and projects of the 2012-2035 RTP/SCS on Environmental Justice population groups. As a part of SCAG's Environmental Justice analyses, this paper focuses on identifying the Environmental Justice population groups, examining spatial distributions of each group along major truck and freight rail corridors, estimating emission intensity along major truck corridors, and discussing the Environmental Justice concerns and issues from the goods movement system in the SCAG Region.

Literature Review: Environmental Impacts of Goods Movement System on Nearby Communities

Several studies have already evaluated the environmental impacts of the goods movement system, especially diesel trucks and freight rail activities, on nearby communities. Some studies analyzed the environmental impacts of heavy-duty diesel truck operations on near-roadway communities and its environmental justice implications *(4, 5, 6)*. The studies discussed Environmental Justice concerns about the concentration of heavy-duty truck-related environmental impacts on minority and low-income communities adjacent to freight truck corridors, such as cancer risk, air pollution, noise, traffic safety and congestion issues. Other studies examined the impact of truck and rail freight movement on air quality and GHG emissions. Though freight rail impacts accounts for only a small portion of goods movement emissions, the studies indicated that the concentration of environmental impacts along the freight rail facilities raises local-level Environmental Justice questions *(7, 8)*. These local level Environmental Justice questions reflect a need to develop strategies to improve the transportation system while not building projects or developing strategies that adversely affect minority and low-income communities. The studies also expected that PM and NOx emissions contributions from freight rail movement will be growing significantly in the future, raising concerns about equity in the distribution of benefits of and burdens from freight rail operations *(7, 8)*.

METHODOLOGY

The approach for the spatial distribution analysis of Environmental Justice population groups consists of three steps. First, the Environmental Justice population groups were identified according to Executive Order 12898 and the Orders on Environmental Justice by DOT and FHWA. Second, an appropriate criteria for buffer distance from major truck and freight rail corridors was determined, based on guidance and recommendations from various organizations. Third, using the selected distance criteria, the spatial analysis of Environmental Justice population groups was conducted by using an area-weighted interpolation method. As discussed earlier, though the contribution of freight rail emissions are not significant in the SCAG Region—5 percent and 4 percent of regional goods movement related to NOx and PM emissions, respectively *(2)*, concentrations of emissions from rail activities can cause localized concentrations, especially given the expected growth in goods movement. In this regard, this research performed analyses of socioeconomic indicator distributions from major truck and freight rail corridors,

separately. In addition to distribution analysis of Environmental Justice population groups, this paper compared the projected growth changes of Environmental Justice population groups between areas adjacent to major truck corridors and areas adjacent to freight rail corridors to examine socioeconomic characteristics of each area. Also, this paper conducted a comparative analysis of emission intensity between areas in proximity to major truck corridors and freeways in the SCAG Region to understand the environmental impacts from freight truck operations on the Environmental Justice population groups living in proximity to major truck corridors.

Identifying Environmental Justice Population Groups

To assess the issue of potential disproportionate distribution of environmental impacts on Environmental Justice population groups from goods movement system, it is necessary to identify minority and low-income populations. Executive Order 12898 and the Orders on Environmental Justice by DOT and FHWA define "minority" as a person who is Black, Hispanic or Latino, Asian American, American Indian, Alaskan Native, Native Hawaiian and Other Pacific Islander. SCAG analyzed the ethnic/racial groups by transportation analysis zones (TAZ) (11,000+ zones equivalent to census block groups), based on the SCAG's growth forecast.

SCAG's Growth Forecast Development

The SCAG's growth forecast for different levels of geography is developed using the top-down approach with a strong emphasis of local input process. The following is a summary of how SCAG developed TAZ population and household forecasts with additional socioeconomic attributes *(9)*.

SCAG projects region/county population and households using the cohort-component model and the headship rate method. The model computes population at a future point in time by adding to the existing population the number of group quarters population, births, and persons moving into the region during a projection period, and by subtracting the number of deaths and the number of persons moving out of the region. The projected households at a future point in time are computed by multiplying the projected residential population by projected headship rates. Headship rate is the proportion of a population cohort that forms the household. Age-gender-racial/ethnic specific household formation level is applied to the projected population to estimate households. Demographic and economic assumptions play a decisive role in determining the size of population in the future. Population size is projected by identifying the demographic rates (e.g., fertility rate, survival rate, migration rate) of the population cohort. Household formation behavior reflecting the assimilation pattern determines the future households.

The city population and household forecast is initially derived by multiplying the 2008 RTP jurisdiction's share of the county growth delta during the forecast horizon by the updated county household growth delta during the same period. The jurisdiction's relative growth pattern in the 2008 RTP growth forecast remained constant. The jurisdictional level household size and the group quarters population from the recent estimates of California Department of Finance are incorporated into the new database. TAZ population and household forecasts are derived using the housing unit (HU) method, as used in the city forecasts. The first step of the housing unit method is to project housing units at the TAZ level. Since SCAG focuses on the household forecast, SCAG derives the initial TAZ household forecasts by reflecting growth patterns incorporated in the 2008 RTP forecasts, recent estimates and trends, and updated city household forecasts. The TAZ household forecast is converted into population by using the group quarters population plus the product of households and average persons per household (PPH). The average number of persons per household is projected using the recent estimates and trends, and is constrained by the updated city PPH. Group quarters population is projected using the TAZ's share of the city population from the 2000 Census and 2008 DOF, which is assumed to remain constant during the projection horizon. Local input plays an important role in developing an accurate growth forecast for 2012–2035 RTP/SCS. Although the local input is an on-going process, SCAG updated the preliminary population and household forecasts using local input from local jurisdictions for at least three times during the development of the growth forecast.

Population and household forecasts are further disaggregated into necessary socioeconomic attributes (e.g., age, race/ethnicity, income quintiles, etc.), as required in the environmental justice analysis. The additional attribute variables are called secondary variables. These secondary variables at the TAZ level are estimated using the Small Area Secondary Variables Allocation Model (SASVAM) *(10)*. SASVAM generally relies on the probabilistic choice model, which reflects the temporal change of the socioeconomic attributes of TAZs. The SASVAM results are controlled to the county level forecasts including the results of the cohort-component model, the trend extrapolation, or the statistical method. For example, TAZ household forecasts by race/ethnicity are derived by using SASVAM and controlled for the county household forecasts by race and ethnicity *(11)*. The household forecasts by race and ethnicity is further disaggregated into quintiles of household income. The iterative proportional fitting method is used to update income quintiles consistent with the TAZ household forecasts by race/ethnicity.

Social Demographic Indicators for Environmental Justice Population Groups

Social demographic indicators were selected based on the Environmental Justice Strategic Enforcement Assessment Tool (EJSEAT), a tool for the EPA Office of Enforcement and Compliance Assurance (OECA) to identify areas with potentially disproportionately high and adverse environmental and public health burdens *(12)*. Also, 'low-income' population was defined as a person whose median household income is at or below the Department of Health and Human Services (HHS) poverty guidelines. The poverty threshold for the SCAG Region is based on regional average household size for the census year; for example, for a regional mean of 2.98 persons (rounded to 3) per household, the threshold would consist of the sum of the value for the first person plus two additional people *(2)*. The household counts in each income range are then used to determine the number and percentage of households in each census tract below the poverty level which is a family of three earning less than $17,374 in 2010 *(13)*. In addition, SCAG analyzed income quintile and the ethnic distribution within each income quintile by processing the 2005-09 ACS data. The following is the list of the socioeconomic indicators SCAG used as a reference population group in the Environmental Justice analyses and also the list of regional income quintiles based on the household income data:

Ethnic/Racial/Other Indicators:

- White (Non-Hispanic), Hispanic (Latino), African-American, American Indian, Asian/Pacific Islander, Other Racial Categories
- Disabled/Mobility Limited, Age 65 and Above, Age 5 and Below

Income Indicators:

- Below Poverty Level
- Income Quintile 1 ($0 to $24,581), Income Quintile 2 ($24,582 to $46,436), Income Quintile 3 ($46,437 to $73,554), Income Quintile 4 ($73,555 to $99,999), Income Quintile 5 ($100,000 and Higher)

The EPA Environmental Justice guidance (the Guidance) explains that minority population is concentrated if the percentage of the minority population and the low-income population of the affected area is "meaningfully greater" than the percentage of the minority population and low-income population in the general population of the region *(14)*. In order to assess the concentration of the Environmental Justice population groups, a comparative analysis was conducted on the percentage of the Environmental Justice population groups between areas adjacent to the goods movement system, including major truck and freight rail corridors, and the regional average.

Determining Distance Criteria for Freight Transportation System

To assess the distribution of the Environmental Justice population groups along major truck and freight rail corridors, it is necessary to consider appropriate distance criteria for the environmental impacts extent. In order to determine suitable distance criteria, SCAG referred to guidance and recommendations

from various organizations, such as the California Air Resources Board (CARB) and Southern California Air Quality Management District (SCAQMD). CARB recommends avoiding siting new sensitive land uses within 500 feet (150 meters) between a freeway and high-traffic roads in its Air Quality and Land Use Handbook (the Handbook). The Handbook also recommends avoiding sensitive land uses within 1,000 feet (300 meters) of busy distribution centers and major service and maintenance rail yards *(15)*. SCAQMD's Health Risk Assessment Guidance establishes a minimum buffer of 1,000 feet between truck traffic and sensitive receptor locations to reduce exposure from idling *(16)*. In addition, a California Office of Environmental Health Hazard Assessment (OEHHA)'s study found that places within 500 feet of main city streets, highways, and freeways generally have higher traffic pollutant levels *(17)*. Based on the guidance and recommendations, SCAG used 500 foot and 1,000 foot buffers to test if there is a statistical difference between two buffers in assessing the spatial distribution of the Environmental Justice population groups. The test showed there is no significant difference in terms of the Environmental Justice population group distribution between the two buffers. In this regards, SCAG used 500 foot buffer only to assess the spatial distribution of the Environmental Justice population groups for this research.

Spatial Analysis of Distribution of Environmental Justice Population Groups

To analyze the spatial distribution of Environmental Justice population groups, a residential area-weighted interpolation method was used. The residential area-weighted interpolation method assumes that the population is distributed equally within residential areas of a TAZ, and it calculates population based on the area ratio of the residential areas of a TAZ interested with 500 foot buffer to the entire residential areas of a TAZ. For example, if a TAZ has 1,000 non-Hispanic Asian population and 25% of total residential area of the TAZ is intersected with 500 feet buffer from major truck corridors, then it is estimated that 250 out of the TAZ's total non-Hispanic Asian population reside within 500 feet from major truck corridors. To evaluate the spatial concentration of Environmental Justice population groups along major truck and freight rail corridors, the percentage of each socioeconomic indicator within 500 foot buffer were estimated and then compared with the regional average.

Estimation of Emission Intensity along Major Truck Corridors

In addition, air pollutant emission intensity analysis was conducted for communities in proximity to major truck corridors to assess environmental impacts of freight truck operations on the Environmental Justice population groups living in proximity to major truck corridors. Emission intensity analysis is based on running emission estimates from SCAG's emission impact study for air pollutants, including reactive organic gases (ROG), carbon monoxide (CO), carbon dioxide (CO2), oxides of nitrogen (NO_X), sulfur dioxide (SO2), particulate matter (PM2.5) *(2)*. Emissions were estimated for the year 2008 at the TAZ level. To estimate emission intensity, TAZs located within 500 feet from major truck corridors were selected, and total emissions of each emission factor were estimated by aggregating emissions within the selected TAZs. Then, the total emissions were normalized by total acreage of the selected TAZs. To compare the emission intensity of TAZs along major truck corridors with the regional level, the same methodology was used to estimate emission intensity of TAZs along freeways in the SCAG Region. The emission data used in the research includes emissions from both passenger car and truck movement. In this vein, to better assess the impacts of freight movement separately from passenger cars, SCAG estimated the vehicle-miles traveled (VMT) for truck movement on the major truck corridors, and then, compared it with the truck VMT for the rest of freeways in the SCAG Region.

ANALYSIS RESULTS

Distribution of Environmental Justice Population Groups along Major Truck and Freight Rail Corridors

Table 1 presents the socioeconomic indicators within 500 feet from major truck and freight rail corridors in 2008 and 2035. As shown in the table, the share of most Environmental Justice population groups living in proximity to major truck and freight rail corridors is higher than regional average both in 2008

and 2035. The table also presents the share of five income quintile households and the ethnic distribution within each income quintile within TAZs in proximity to major truck and freight rail corridors. It was observed that the share of lower income quintile households and minority populations is higher in TAZs in proximity to major truck corridors than the regional average. These observations imply that truck and rail-related environmental burdens could be higher for the minority and low-income communities than the regional average. However, further analysis is needed to verify this observation.

Projected Growth Changes of Environmental Justice Population Groups

In addition to the spatial distribution analyses of Environmental Justice population groups along major truck and freight rail corridors, the historical growth changes of each Environmental Justice population group and its share change from 2008 to 2035 were estimated. Table 2 summarizes the projected growth and share changes within TAZs in proximity to major truck and freight rail corridors. The share of minority population is expected to increase by approximately 7.7 percent in areas adjacent to major truck corridors while the share of minority population in areas adjacent to freight rail corridors is expected to increase by approximately 10.4 percent. The growth rates in elderly, young children and disabled population are projected to be relatively higher in areas adjacent to freight rail corridors than areas adjacent to major truck corridors, while both areas show similar share changes. And, the growth rate and share change in households below poverty level are projected to be relatively higher in areas adjacent to freight rail corridors. In general, compared with TAZs within 500 feet from major truck corridors, TAZs within 500 feet from freight rail corridors are expected to have higher growth rates of Environmental Justice population groups, indicating that concentration of the Environmental Justice population groups could be relatively higher in areas adjacent to freight rail corridors than areas adjacent to major truck corridors.

Emission Intensity Distribution along Major Truck Corridors

Table 3 summarizes the emission intensity estimates for ROG, CO, CO_2, NOX, SO_2, $PM_{2.5}$ within TAZs in proximity to major truck corridors for the year 2008. It compares the emission intensity of areas within 500 feet from major truck corridors with areas within 500 feet from freeways in the SCAG Region. Column (c) of Table 3 represents the percentage increase/decrease of emission intensity within areas along major truck corridors, compared with the regional level. Higher emission intensity was observed within areas along major truck corridors than the regional level in every emission factor. It was estimated that areas in proximity to major truck corridors show approximately 20 percent of CO and CO_2 emission intensity and over 30 percent of $PM_{2.5}$ emission intensity more than the regional level.

The emission data used in the research includes emissions from both passenger car and truck movement. In order to better assess the impacts of truck movement separately from passenger cars, SCAG estimated the vehicle-miles traveled (VMT) for truck movement for the major truck corridors, and then, compared it with the rest of freeways in the SCAG Region. Table 4 summarizes the total and truck VMTs for major truck corridors and for the rest of freeways in the SCAG Region in 2008. As shown in the table, it is estimated that 12.6% of total VMT for major truck corridors is truck VMT while only 7% of total VMT for the rest of freeways in the SCAG Region is truck VMT. And, it is also estimated that truck VMT for major truck corridors accounts for approximately 63% of total truck VMT of the SCAG Region while the length of major truck corridors accounts for 26% of total length of freeways in the SCAG Region. These observations suggest that there is a high concentration of truck movements on major truck corridors, compared with the rest of freeways in the SCAG Region. Therefore, given the results from Tables 3 and 4, it is implied that there could be more adverse environmental impacts on areas along freight truck corridors resulting from the significant amount of truck movements. Considering the concentration of the Environmental Justice population groups along major truck corridors, the results indicate that there could be potential disproportionate environmental impacts from truck movement on the Environmental Justice population groups living in proximity to major truck corridors.

Figure 1 depicts major truck corridors and freeway systems in the Los Angeles metropolitan area, and also the spatial distribution of carbon dioxide emission intensity by TAZ for the year 2008. As shown

in the map, high concentration of emissions is observed along freeways, especially along major truck corridors.

CONCLUSION

This paper presented the distribution of Environmental Justice population groups in areas adjacent to major truck and freight rail corridors. In order to assess the concentration of the Environmental Justice population groups along goods movement corridors, a comparative analysis method was conducted to examine the distribution of socioeconomic indicators between areas adjacent to major truck and freight rail corridors and the SCAG Region. Socioeconomic indicators were selected based on Environmental Justice guidelines to define Environmental Justice population groups. Then, distance criteria from major truck and freight rail corridors was determined based on guidance and recommendations from various organizations. For distribution analysis of the Environmental Justice population groups, a residential area-weighted interpolation method was used to estimate population within 500 foot buffer areas. The results of this research indicate higher concentration of the Environmental Justice population groups within areas adjacent to major truck and freight rail corridors than the regional average, implying potential disproportionately high and adverse human health or environmental effects on the Environmental Justice population groups from the goods movement system; however, further analysis is needed to verify these observations.

Also, the research compared the projected growth and share changes between areas adjacent to major truck and freight rail corridors. The results indicate that higher concentration of the Environmental Justice population groups is expected in areas adjacent to freight rail corridors. In addition, the research estimated emission intensity for emission factors within areas adjacent to major truck corridors, and then, compared it with emission intensity within areas adjacent to freeways in the SCAG Region. The results indicate that areas adjacent to major truck corridors are expected to experience more adverse environmental burdens than the regional level, raising potential Environmental Justice concerns, given the higher concentration of the Environmental Justice population groups within areas adjacent to major truck corridors.

Areas for Future Research

Considering that the goods movement system is expected to increase in the SCAG Region in the future, additional research and analysis is needed to understand the future Environmental Justice issues relevant to the goods movement system. In addition to estimation of truck-related emission intensity along major truck corridors, similar analysis is needed to estimate freight rail-related emission estimates and emission intensity distribution within areas adjacent to freight rail corridors. Also, further analysis is necessary to examine the environmental impacts of rail-related facilities in connection with ports and major rail yards in the SCAG Region, given the expected growth in international trade and domestic goods movement in the future.

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LIST OF TABLES AND FIGURES

TABLE 1 Distribution of Environmental Justice Population Groups in TAZs Adjacent to Major Truck and Freight Rail Corridors: 2008 and 2035

	500 Feet from Major Truck Corridors				500 Feet from Freight Railroads				SCAG Region	
	2008		2035		2008		2035		2008	2035
Population	332,436		408,538		192,668		255,344			
Households	100,247		125,804		57,794		77,686			
Hispanic	186,675	56.2%	264,668	64.8%	107,969	56.0%	169,294	66.3%	44.8%	55.4%
NH White	77,135	23.2%	63,198	15.5%	55,537	28.8%	46,952	18.4%	34.4%	23.5%
NH Black	24,150	7.3%	25,902	6.3%	6,589	3.4%	9,729	3.8%	6.9%	6.1%
NH NA	1,620	0.5%	2,123	0.5%	1,113	0.6%	1,590	0.6%	0.4%	0.5%
NH Asian	37,323	11.2%	45,508	11.1%	18,347	9.5%	23,507	9.2%	11.6%	12.3%
NH Others	5,533	1.7%	7,138	1.7%	3,113	1.6%	4,273	1.7%	1.9%	2.1%
Age 65 & Above	30,433	9.2%	61,625	15.1%	17,301	9.0%	37,936	14.9%	10.4%	16.7%
Age 5 & Below	31,305	9.4%	36,165	8.9%	18,390	9.5%	22,684	8.9%	8.7%	8.2%
Disabled	30,702	9.2%	40,839	10.0%	16,445	8.5%	23,593	9.2%	8.6%	9.3%
Poverty 1*	15,708	15.7%	19,778	15.7%	8,143	14.1%	11,415	14.7%	13.8%	14.5%
Poverty 2*	9,954	9.9%	12,596	10.0%	5,434	9.4%	7,433	9.6%	8.7%	9.0%
Poverty 3*	9,448	9.4%	11,763	9.4%	5,201	9.0%	6,982	9.0%	8.3%	8.5%
Quintile 1	**21,537**	**21.5%**	**26,783**	**21.3%**	**11,352**	**19.6%**	**15,803**	**20.3%**	**21%**	**20%**
Hispanic	8,846	8.8%	16,715	13.3%	5,168	8.9%	10,658	13.7%	6.4%	10.8%
NH White	7,236	7.2%	3,374	2.7%	4,493	7.8%	2,449	3.2%	9.4%	4.2%
NH Black	2,804	2.8%	2,661	2.1%	531	0.9%	829	1.1%	2.4%	1.8%
NH NA	127	0.1%	151	0.1%	74	0.1%	122	0.2%	0.1%	0.1%
NH Asian	2,048	2.0%	3,156	2.5%	880	1.5%	1,378	1.8%	1.7%	2.4%
NH Others	475	0.5%	727	0.6%	206	0.4%	368	0.5%	0.5%	0.7%
Quintile 2	**22,532**	**22.5%**	**27,629**	**22.0%**	**12,603**	**21.8%**	**16,565**	**21.3%**	**20%**	**20%**
Hispanic	12,202	12.2%	18,317	14.6%	6,909	12.0%	11,280	14.5%	8.5%	11.5%
NH White	5,926	5.9%	3,937	3.1%	3,965	6.9%	2,911	3.7%	7.3%	4.3%
NH Black	1,927	1.9%	2,013	1.6%	491	0.9%	683	0.9%	1.6%	1.3%
NH NA	104	0.1%	143	0.1%	86	0.1%	131	0.2%	0.1%	0.1%
NH Asian	1,794	1.8%	2,435	1.9%	849	1.5%	1,112	1.4%	1.7%	1.9%
NH Others	579	0.6%	784	0.6%	303	0.5%	448	0.6%	0.6%	0.8%
Quintile 3	**21,830**	**21.8%**	**26,957**	**21.4%**	**12,687**	**22.0%**	**16,742**	**21.6%**	**20%**	**20%**
Hispanic	10,733	10.7%	16,562	13.2%	6,313	10.9%	10,473	13.5%	7.4%	10.4%
NH White	6,695	6.7%	4,792	3.8%	4,539	7.9%	3,647	4.7%	8.4%	5.1%
NH Black	1,691	1.7%	1,793	1.4%	405	0.7%	586	0.8%	1.4%	1.2%
NH NA	107	0.1%	137	0.1%	76	0.1%	117	0.2%	0.1%	0.1%
NH Asian	2,081	2.1%	2,909	2.3%	1,041	1.8%	1,421	1.8%	1.9%	2.3%
NH Others	523	0.5%	763	0.6%	313	0.5%	498	0.6%	0.6%	0.7%
Quintile 4	**19,606**	**19.6%**	**25,133**	**20.0%**	**11,938**	**20.7%**	**15,842**	**20.4%**	**20%**	**20%**
Hispanic	8,225	8.2%	13,637	10.8%	4,765	8.2%	8,600	11.1%	5.8%	8.8%
NH White	6,983	7.0%	5,422	4.3%	5,303	9.2%	4,382	5.6%	9.9%	6.4%
NH Black	1,353	1.3%	1,635	1.3%	330	0.6%	521	0.7%	1.3%	1.2%
NH NA	116	0.1%	190	0.2%	71	0.1%	106	0.1%	0.1%	0.1%
NH Asian	2,446	2.4%	3,536	2.8%	1,209	2.1%	1,843	2.4%	2.3%	2.9%
NH Others	484	0.5%	713	0.6%	260	0.4%	389	0.5%	0.5%	0.6%
Quintile 5	**14,742**	**14.7%**	**19,302**	**15.3%**	**9,215**	**15.9%**	**12,734**	**16.4%**	**20%**	**20%**
Hispanic	4,611	4.6%	9,013	7.2%	2,564	4.4%	5,578	7.2%	3.9%	7.1%
NH White	6,434	6.4%	5,099	4.1%	4,932	8.5%	4,295	5.5%	12.1%	7.9%
NH Black	1,081	1.1%	1,355	1.1%	325	0.6%	549	0.7%	1.0%	1.0%
NH NA	75	0.1%	143	0.1%	69	0.1%	111	0.1%	0.1%	0.1%
NH Asian	2,176	2.2%	3,070	2.4%	1,097	1.9%	1,777	2.3%	2.5%	3.4%
NH Others	365	0.4%	623	0.5%	227	0.4%	423	0.5%	0.4%	0.6%

* Poverty 1 = # of household below poverty; Poverty 2 = # of household between poverty and 1.5xP; Poverty 3 = # of household between 1.5xP and 2.0Xp

Source: Based on 2000 Census and 2005-09 ACS, processed and projected by SCAG Research and Analysis staff

TABLE 2 Projected Growth Rates and Share Change of Environmental Justice Population Groups along Major Truck and Freight Rail Corridors: From 2008 to 2035

	500 Feet from Major Truck Corridors		500 Feet from Freight Rail Corridors		SCAG Region
	Growth %	Share Change	Growth %	Share Change	Share Change
Hispanic	41.8%	8.6%	56.8%	10.3%	10.6%
NH White	-18.1%	-7.7%	-15.5%	-10.4%	-10.9%
NH Black	7.3%	-0.9%	47.6%	0.4%	-0.8%
NH NA	31.1%	0.0%	42.8%	0.0%	0.1%
NH Asian	21.9%	-0.1%	28.1%	-0.3%	0.8%
NH Others	29.0%	0.1%	37.3%	0.1%	0.2%
Age 65 & Above	102.5%	5.9%	119.3%	5.9%	6.3%
Age 5 & Below	15.5%	-0.6%	23.3%	-0.7%	-0.5%
Disabled	33.0%	0.8%	43.5%	0.7%	0.8%
Poverty 1*	25.9%	0.1%	40.2%	0.6%	0.7%
Poverty 2*	26.5%	0.1%	36.8%	0.2%	0.4%
Poverty 3*	24.5%	-0.1%	34.3%	0.0%	0.2%

* Poverty 1 = # of household below poverty; Poverty 2 = # of household between poverty and 1.5xP; Poverty 3 = # of household between 1.5xP and 2.0Xp

Source: Based on 2000 Census and 2005-09 ACS, processed and projected by SCAG Research and Analysis staff

TABLE 3 Emission Intensity Estimates for Areas Along Major Truck Corridors: 2008

Emission Factors	Emission Intensity (gram/day/acre)		Intensity Comparison* (Major Truck Corridors vs. Freeways in SCAG Region)
	500 Feet from Major Truck Corridors	500 Feet from Freeways in SCAG Region	
	(a)	(b)	(c)
Reactive Organic Gases (ROG)	4.99	4.04	23.4%
Carbon Monoxide (CO)	93.99	78.52	19.7%
Carbon Dioxide (CO_2)	11,996.31	9,997.03	20.0%
Oxides of Nitrogen (NO_X)	29.95	23.09	29.7%
Sulfur Dioxide (SO_2)	0.12	0.10	19.9%
Particulate Matter ($PM_{2.5}$)	1.12	0.85	32.6%

* Percentage increase/decrease of emission intensity within areas along major truck corridors, compared to areas along freeways in the SCAG Region. (For example, (c) was calculated by (a) minus (b) divided by (b).)
Source: SCAG Emissions Impact Study

TABLE 4 Comparison of Truck VMT for Major Truck Corridors and the Rest of Freeways in the SCAG Region: 2008

	Length (mi.)	Total VMT (thousands)	Truck VMT (thousands)	Share of Truck VMT
Major Truck Corridors	1,810 (26%)	124,940 (49%)	15,693 (63%)	12.6%
The Rest of Freeways	5,210 (74%)	131,240 (51%)	9,207 (37%)	7.0%
Freeways in SCAG Region	7,020	256,180	24,901	9.7%

Source: SCAG model data, 2012

FIGURE 1 CO_2 Emission Intensity by TAZ in the Los Angeles Metropolitan Area: 2008