Urban Transportation Reform for Improved Health Equity in L.A. County Introduction

Los Angeles is the second-most populous city in the United States with nearly 4 million inhabitants. When considering the four additional counties (Orange, Riverside, Ventura, San Bernardino) that make up Greater Los Angeles (GLA), the estimated population increases to 18.1 million residents (Pitt, Los Angeles, California Population 2022). Los Angeles City which resides in the county with the same name, is by far the most populous of the 88 cities that make up the county. Despite the allusion that the Western United States developed last, Los Angeles (city) was founded in 1781, prior to the establishment of Washington, D.C. Its immoral reputation preceded it and was plagued by natural disasters that swept it away in two floods before the city was settled on higher ground for a third and final time. Since then, Los Angeles has changed significantly, becoming a major port for the nation's economy and an epicenter of diversity that Los Angeles Mayor Eric Garcetti refers to as "our great strength" ("Confessions of a Pothole Politician"). Similarly, to Mayor Garcetti's outlook, the allure of Los Angeles epitomizes the American Dream, with automobile transportation, single-family homes, and the residence of some of the most wealthy and famous people in the world (Pitt). However, the glamour of Los Angeles is not distributed equally among residents, as segregation based on Garcetti's great racial and economic plurality is starkly apparent. The 88 cities that makeup Los Angeles County differ significantly in demographic makeup and health outcomes seen through neighborhood divisions. Most prominently, Black residents score the lowest between racial groups (Asian, Black, Latino, White) on the Health Index developed by Los Angeles Urban League and United Way of Greater Los Angeles and have death rates higher than other racial groups, representative of the racial disparities in region in need of multisectoral attention (Nichols).

Two of the famously less favorable characteristics of GLA are the horrible public transportation access and the notorious smog spread over the five counties. These two aspects of life in GLA are inseparable, as existing transportation, personal and commercial, contributes to the air pollution. Transportation also has other impacts on health outcomes aside from the hazy skyline. Convenient and affordable public transportation can improve mental and physical health while increasing access to healthy food, medical care, and employment. For Los Angeles County residents that rely on public transportation, improving the systems of mass transit would expand opportunities for health and well-being that are otherwise unachievable without access to a car. In the United States women, young adults, Black workers, low-income workers, elderly adults, and people with disabilities

disproportionally rely on public transportation, making mass transit improvement an issue of social, economic, political, and health equity (Public Transportation in the US).

Partnering transportation redesign projects with community health data while accounting for potential health impacts allows for transportation infrastructure to be planned in a matter that upholds racial and socioeconomic justice initiatives. This has the potential to strengthen the GLA area by improving regional health and reducing longstanding inequities. As a result, urban transportation as a lens to improve community health poses a complex challenge in need of cross-sector collaboration to unite residents, government (state and municipal), and non-governmental organization in providing reliable, safe, affordable, and effective transportation options to improve well-being.

Greater Los Angeles Transportation History

Originally, Los Angeles had a robust public transportation infrastructure through the Red and Yellow Streetcar system. The goal of the network was to allow for single-family homes to exist simultaneously with access to economic opportunities in the city center. On the 1000 miles of tracks, residents commuted to the city center, the beach, and the mountains. Automobiles disrupted the established system that began to lose popularity during the middle of the 20th century, measured through decreased ridership and voter apprehension to continue to support the system. Eventually, the network met its demise in 1961 and bus transportation replaced it as the most common form of public transit (Elkind).

The downfall of early 20th century public transportation is attributed to the emphasis on highways construction and car transportation in the 1950s and 60s. Through the Federal Aid Highway Act of 1956 and the transition to suburban living. Car transportation on the federally prioritized national highway networks became the norm in many urban areas (Public Transportation in US). Mayor Eric Garcetti described this period of novel highways transportation as "[working] for a long time. It was 20 minutes anywhere; we were building the future" ("Season 9, Episode 1"). Across the country, this vision of the future was far from an equitable plan for all Americans as highway construction often cut through low-income and Black neighborhoods while claiming to be effective means of clearing "blighted" areas, establishing physical structures symbolic of racialized intracity divisions (Popovich, et al.). In the late 1950s and throughout the 1960s, urban dwellers protested the construction of the "eyesores" which cut through parklands in addition to Black communities, echoing the recognizable American hegemony of racial oppression and disregard for the natural environment. In origin, the highways are symbolic of the mid-century legacy of reliance on cars, racial tensions, and lack of foresight on environmental and health impacts.

Many anticipated a shift of funding back to urban mass transportation when President Nixon signed the Federal-Aid Highway Act in 1973. The goal was to balance transportation between highways and other forms with the environment, safety, energy, and communities in mind. It aimed to achieve this goal through adding an addition \$3 billion in funding for the Urban Mass Transit Administration (which would become the current Federal Transit Administration) and allowing states to us "highway right-of-way for publicly owned mass transit facilities...without repaying Federal-aid funds used to acquire the property" (Weingroff). Overall, it expanded the funding for mass transit construction, allowing urban areas to use revenue from the Highway Trust Fund for projects other than highways which had been the exclusive use of the fund in years prior.

Despite changes in federal legislation, Los Angeles voters rejected sales tax measures to fund public transit initiatives in 1968 and 1974, approving a similar measure in 1980 to fund rail, bus, and road improvements through sales tax. This measure ushered in the construction of the first rail line in 1985 and slowly expanded over the next two decades. Contrary the first two propositions, sales tax measures in the late 2000s to present day have seen more support from voters and rail expansion is now a top priority of the Los Angeles Mayor's Office (Elkind).

Current Challenges to Los Angeles County Health and Transportation

On a citywide level, Los Angeles County has the worst ozone pollution air quality in the United States, and all five counties in GLA received F grades for particle and ozone pollution. The extremely unhealthy conditions that the Lung Association reported for Los Angeles are attributed to wildfires, the Port of Los Angeles and Long Beach, and personal transportation. The Port of Los Angeles and Long Beach, which is responsible for approximately 40% of US imports, is faced with moving goods from the port to regional warehouses which then transports goods to the rest of the country. The primary means of moving these goods to the warehouses is trucks, noisy heavy-duty vehicles emitting massive amounts of pollution, a symbol of American economic reliance on fossil fuels ("Season 9, Episode 1," Hayes). Los Angeles County Public Health Office uses the U.S. Environmental Protection Agency's (U.S. EPA) Air Quality Index (AQI) to distinguish between the six levels of health concern for air pollution. Air quality between 101 and 150 is categorized as unhealthy for sensitive groups and given examples are children, older adults, and those with heart and lung disease (Air Pollution in Los Angeles County). In 2021, Los Angeles experienced 70 days with "Unhealthy Air for Sensitive Groups" and 26 "Unhealthy Air" days (Annual Air Quality Los Angeles County).

In addition to air pollution, noise pollution can disrupt sleep and diminish quality of life, leading to high blood pressure, speech interference, hearing loss, and decreased productivity. The effects of noise pollution were federally recognized when the United States Environmental Protection Agency established the Office of Noise Abatement and Control in 1972 as part of the Clean Air Act. Nine years later, the office was closed under the official statement that state and local government was responsible for addressing noise issues, concordant with Reagan ideals of government deregulation and budget cuts (Clean Air Act Title IV – Noise Pollution). Highways are a common source of noise, illustrating an additional impact of highway traffic on health.

A major challenge to the expansion of mass transportation in GLA is the sheer size of the region. Despite the massive geographic spread, analysis of urban sprawl developed at NYU, Los Angeles was the least sprawling metropolitan area in the United States. Despite Los Angeles reliance on auto transport and massive coverage, which are common characteristics of urban sprawl, it's ranking is attributed to the lack of low-density developments (Florida). Somewhat ironically, spread of the area is attributed to the streetcar system of the early 1900s which allowed for cluster around streetcar routes, but as time continued, the areas between streetcar suburbs were filled and the streetcars disappeared, leaving the large high-density region seen today (Elkind).

Additionally, Covid-19 complicates public transportation initiatives. The communities that rely on public transportation are also at increased risk for severe health complications from Covid-19 namely elderly people and people with disabilities. The health order by Los Angeles County announced on 21 April 2022 that mask requirements would continue for another 30 days on public transportation, airports, and other transportation hubs despite the abandonment of nationwide mask mandate on public transportation (Fuller). While some forms of public transportation provide air filtration others lack proper ventilation. To ensure that public transportation users are adequately protected leaving transportation mask mandates in place would be an appropriate course of action. Additionally, continuing mask mandates could prevent the spread of other viral and bacterial infections. Elderly people and people with disabilities rely on public transportation at increased rates therefore continuing mask mandates on public transportation would increase safety and health equity as these populations would not be placed at a heightened risk of disease during necessary public transportation use. Continuing the established mask mandates would be a simple, low cost means of ensuring vulnerable populations have equal opportunity and risk when using public transportation.

Despite efforts to reform transportation toward a greener, healthier alternative in Los Angeles, significant opposition is anticipated from organizations that advocate for and benefit from automobile transportation like the Automobile Club of Southern California. In 2018, there was a campaign to reverse state fuel tax and vehicle fees backed by the primary (false) argument that the state was spending revenues inappropriately. Revenue diversion from gas tax money to public transit was approved in Proposition 5 in 1974 by California voters. The primary goal of the legislation was to lessen environmental impact of transit projects. Proponents of Proposition 6 seeking to reverse the previous legislation argue that roads, rather than public transportation infrastructure should be the recipients of state funding, and the general sentiment is that there is no responsibility to address impending threats of climate change, an outlook that could have detrimental effects on the health of Californians (The Times Editorial Board). It is reasonable to believe that Californians who supported Proposition 6 will carry their pro-car ideology to oppose reforms to GLA transportation for reasons including that it "does not work for [their] hair and heels" (The Times Editorial Board).

Systems Thinking and Complexity

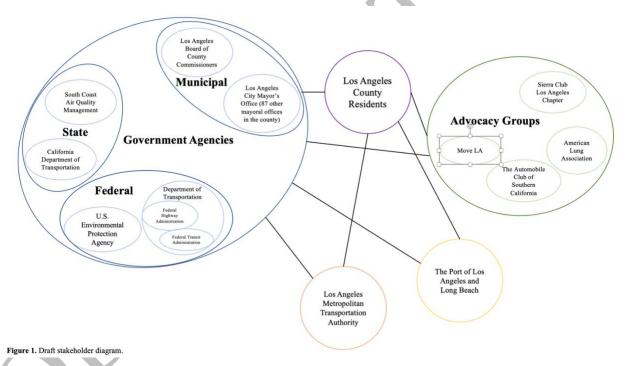
A system entails a set of components that interact while changing and learning, stretching across disciplines. When combined with complexity theory, these components interact over time, creating feedback loops and the behavior of the system cannot be explained through the individual parts, rather behaviors are dictated by the relationships between the individual factors (Ompad & Tozan). A complex challenge entails a situation in which little agreement is found on the definition and solutions present an array of possibilities, each with trade-offs (Complex or 'Wicked Issues'). The challenge involves multiple causes and stakeholders which "are in flux and interact over time" (Ompad & Tozan). The current state of Los Angeles transportation is a complex challenge due to its origin through a history of multisectoral mismanagement of city planning rooted in political, economic, and racist motivations. Many recognize the negative environmental and human health consequences of the vehicle reliant region, but stakeholders lack agreement on the definition of the problem and the potential solutions, creating friction between political leaders and citizens.

The public health, economic, social, and political aspects of transportation infrastructure in Los Angeles contribute to the complexity of the challenge of reforming existing systems and establishing new ones to increase access. Although California state law supports funding mass transit infrastructure, some Californians fail to agree that there is a need for such reform, contributing to the idea that there is not agreement on the definition of the problem whether that be climate change or the impacts of cars on human health. Secondly, there are multiple factors contributing to the historical context that developed the current challenge (e.g. institutionalized racism, destruction of prior public transportation systems) and multiple causes that contribute to the continuation of urban health impacts due to public transit (e.g. lack of sufficient funding, economic reliance on the Port of Los Angeles and Long Beach). Additionally, efforts to improve urban health are happening simultaneously in multiple sectors which complicates the ability to gauge impact and necessitates cross-sector collaboration and communication. There are a wide array of possible solutions and

trade-offs that offer potential benefits to improving health, while this paper only proposes some based upon research of similar efforts worldwide.

Stakeholder Identification and Mapping

As systems operate through evolving relationships between components, stakeholders in the transportation infrastructure of GLA can be viewed as these components in these systems. Stakeholders in the GLA transportation network are the people, populations, and institutions that are impacted by changes in the system and the interactions between stakeholders in-turn alter the system. While Greater Los Angeles Area residents are obvious stakeholders in improving transportation access in Los Angeles, methods of facilitating cross-sector collaboration opportunities include identifying institutional stakeholders and mapping stakeholder relationships. Figure 1. Illustrates a draft of institutional stakeholders including government agencies, advocacy groups, and private institutions that have a direct relationship with transportation infrastructure in GLA.



Due to the multitude of cities which make up the GLA, collaboration across city and county governments are necessary to address transportation access and health equity challenges. After identifying critical aspects of complex challenges related to health equity and transportation access in the GLA, methods will include identifying opportunities for cross-sector collaboration and proposing resolutions to parts of the complex challenges observed. In the resolution of these challenges the County has the potential to serve as a liaison between city governments to facilitate transportation initiatives that span across city borders.

The Port of Los Angeles and Long Beach which moves about one fifth of all US import/export traffic, is also a stakeholder in improving the transportation systems in Los Angeles ("Season 9, Episode 1"). The primary means of moving goods from the ports is trucks, which utilize freeways. With more congestion on the freeways, more gas is used, and more money is spent, which ultimately results in productivity and money lost. Recent global supply chain difficulties prompted by Covid-19 delayed goods across America and the scale of the Los Angeles/Long Beach port, it is difficult to argue that every American consumer, at least in the Western Continental United States, is not a stakeholder in Los Angeles transportation. The massive economic impact of the Port and the built transportation infrastructure makes the California state government and federal government stakeholders as well in transforming Los Angeles transportation regarding highways.

The Sierra Club Angeles Chapter, in particular the Transportation Committee, is a potential influential stakeholder in supporting the environmental sustainability and community input on transformation of GLA public transportation. The chapter's current initiatives campaign to support county legislation to expand transit, prevent new highway construction, support urban infill development to reduce driving necessity, and adapt to clean freight from the ports (Transportation Committee).

Cross-Sector Collaboration Models

Los Angeles mass transportation, especially when accounting for reversing historical injustices, does not have the potential to be resolved through a single sector. For this reason, crosssector collaboration is required. Cross-sector collaboration entails incorporating governments, nongovernmental organizations, and citizens to resolve complex challenges, or aspects of complex challenges, in ways that could not be achieved without such collaboration (Kritz). Mayor Eric Garcetti approach echoes sentiments of cross-sector collaboration through aiming to build communities that allow residents to walk to necessary resources. These community building initiatives must occur simultaneously with rail transit projects, one of the mayor's primary platforms, to provide resources to communities while areas undergo the long process of becoming 'walkable.'

In terms of long-term cross-sector collaboration opportunities, a proposed course of action for GLA highways is to remove sections and replace with community driven projects that have the potential to heal landscapes divided by highways. Opportunities for cross-sector collaboration can be modeled after two projects in other U.S. cities (Rochester and San Francisco) that removed sections of highway to improve community health and well-being.

In Rochester the eastern section of the sunken Inner Loop Highway was filled in to be replaced with a smaller pedestrian friendly road and the reclaimed land was used for the construction of apartments. Many residents in the Rochester area are pleased to see the freeway, described unfavorably as a "moat," removed, but feelings are mixed because of concerns about being pushed out through gentrification as the area improves. As a result, community members organized meetings to involve residents in the planning process, helping the city address concerns (Popovich, et al.). In Los Angeles County, the cities differ greatly in racial and financial makeup, these gentrification concerns are directly applicable as Los Angeles aims to make areas more accessible through public transportation therefore making them more favorable for prospective residents. Using existing community meetings and organizations in GLA would allow for projects like the Rochester Inner Loop freeway to take place in GLA.

Similarly, Seoul, Korea saw success following the removal of a congested, elevated freeway in the downtown area of the city. The freeway in Seoul harbored many of the same characteristics as Los Angeles freeways: commuter reliance, pollution, and traffic congestion. Political buy in was essential to the plan as the Mayor Lee Myung-bak made it an essential part of his campaign platform. While success was measured through modeling to gauge reductions in travel times, the mayor also created a public engagement team to address concerns of residents, identifying an opportunity for collaboration between citizens, the government, and designers. The result is a revitalized business district and reappearance of a buried river into a public greenspace for residents in the place of the former freeway. Additionally, the rerouting of previous vehicles and increase in transit allowed for a reduction in travel times to downtown Seoul shown through modeling. The success of the project has provoked other Korean regions and cities to pursue similar initiatives and serves as model for the benefits of replacing freeways with usable greenspace (Rao).

The Presidio Parkway project in San Francisco, which was completed this year, can be used as a model for cross-sector collaboration between city officials, the county transportation authority, the state department of transportation, and private organizations. Through the project a small segment of San Francisco's elevated highway system near the Golden Gate Bridge was reformed to include tunnels with a park allowing pedestrians, bikers, and wildlife to pass over safely, in addition to improving safety for drivers. The project connected San Francisco Board of Supervisors, San Francisco County Transportation Authority, Caltrans, Sierra Club, and private urban designers to collaborate on the project with the aim of improving public safety. The result was a safer, more environmentally friendly, and publicly usable space. Cross-sector collaboration allowed the project to proceed through bringing together authorities that built community support, funded, and ensured feasibility of the project (Chappell & Woolsey).

Ensuring Progressive Impacts

Since 1974, the state government has allowed for fuel excise tax revenue to be spending mass transportation systems, but recent legislation has allowed for sales tax measures to fund transportation (The Times Editorial Board). Gas taxes are a potential means of using taxes to progressive fund public transportation. Those with access to vehicles would contribute more to fund public transportation initiatives instead of who rely on public transportation to access work, school, and healthcare, predominantly low-income individual and people of color (Wach & Taylor). Additionally, gas taxes could act as a financial incentive for those with vehicles to use public transportation. Therefore, increasing ridership and contributing to revenue raising through an increased number of fares collected without placing a disproportionate burden on those who rely on mass transportation.

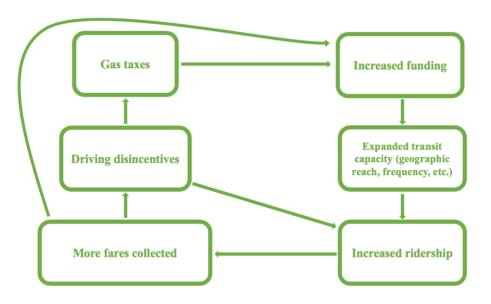


Figure 2. Theoretical transportation funding feedback loop.

Communities of color and low-income households must be acknowledged as the most reliant users of public transportation to access employment, education, and healthcare. While Los Angeles focuses on expanding the rail system, the smaller decrease in bus ridership (compared to rail use) in the early months of the Covid-19 pandemic showed the reliance on buses for public transportation s riders were less likely to have access to a personal automobile as an alternative. For this reason, expansion of the metro rail system in addition to bus routes should be planned to run most frequently and comprehensively in these areas (Wachs & Taylor). Additionally, expanding bus transportation is a less cost intensive means of expanding public transportation capacities while rails are being constructed, because buses operate on existing footprints of built infrastructure.

Fare collection as a means of increasing public transit fundings and supporting operational costs is a debate centered around equity and accessibility. Cities around the globe are questioning if the environmental, equity, and accessibility benefits of robust public transportation make the service a public good that should be free for use. Kansas City, Missouri, which drew less than 10% of its budget from fares, explored this through an incremental switch to free public transit. This strategy seems improbable for operating systems like BART in NorCal, which draws close to 50% of its operating budget from fares (Should Public Transit Be Free?). As reported in August by Brian Taylor, a transportation scholar at UCLA, the fare box recovery rate for the LA Metro Budget "is down in the teens," and a review of the 22-23 LA Metro Budget showed fare revenue accounted for 1.2% of the overall budget (Should Public Transit Be Free?; Linton). Additionally, Boston Mayor Michelle Wu, who is spearheading a pilot program to remove fares, credits fare elimination programs with operational savings and increased route efficiency. Similarly, Robbie Makinen, former president and CEO of Kansas City Area Transportation Authority, associates the fare disappearance with a reduction in violent incidents given the elimination of cost-related disputes onboard. Additionally, case management teams worked out of the vehicles to provide resources for residents experiencing homelessness (Should Public Transit Be Free?). Given the prevalence of unhoused residents in Los Angeles and the low proportion of the LA Metro budget that is accounted for through fares, fare elimination is a reasonable consideration to improve transportation equity in the region.

Complex Challenge Resolutions

Ambitious urban mass transit plans have lacked money in the past, but a combination of gas tax and county specific sales tax increases show potential to allow for success in building out mass transit (The Times Editorial Board). For this reason, the construction of rail systems is a beneficial long-term goal. Rail travel has obvious benefits over buses when stations are laid out effectively, immune to traffic congestion on roads, but poses a higher immediate cost. Therefore, using busses to supplement transit while Los Angeles continues to invest in effective rail transit is a potential course of action.

Secondly, Seoul and Rochester freeway removal as a model shows the potential benefits of deconstructing portions of the elevated highway network in the region. As highways age and require extensive maintenance it presents an opportunity to evaluate the value of the space and redesign areas to improve environmental sustainability, community health, and traffic patterns. Highways in Los Angeles County span across 88 cities, using this model of redoing segments of highway would allow for collaboration between cities, the county, and community organizations on a small scale and

redesign highway areas in segments. Additionally, highway removal in regions would allow for communities to replace areas with green space, community-owned businesses, and housing.

Another recommendation that has less to do with the infrastructure of transportation itself is the construction of communities that allow for people to access economic opportunities (jobs), education, nutritious food, and healthcare close to where they live. As the Covid-19 pandemic continues to alter the workforce, more research is required to understand how commuting during the typical workweek is being undergoing transformation as the companies decide when to work remotely and in person. In areas in which residents cannot work from home, particular focus should be placed on how to ensure work commutes do not disproportionally affect low-income workers.

When asked about transportation, Mayor Eric Garcetti added "We used to segregate away where we work, where we play, where we live. And now we're trying to build communities where you can actually walk" (Notes From an Imperfect Paradise), recognizing that building communities with accessible resources established within is essential to the well-being of residents. Mayor Garcetti's approach echoes similar aims seen across the country in Rochester to "make downtown a more livable place" rather than focusing on moving people in and out of downtown (Popovich et al.). Applying this concept to Los Angeles, making communities livable by building up infrastructure for people to work, live, play, attend school, access medical care, and shop locally would reduce the reliance on freeways and attempt to reverse some of the impacts on communities of color that were impacted by the destruction of homes and businesses for freeway construction. Partnering this community building approach with transit infrastructure has the potential to impact health more than either transformation could have independently.

Additionally, when adding green space, pedestrian safety protections, and more resources, it is important that policies prevent previous residents from being pushed out of their homes. Using Rochester as an example, rent-to-buy initiatives and community engagement with policy planning can be used to counter gentrification efforts (Popovich, et al.).

Lastly, proponents of car travel suggest that building road capacity, including tunnel construction, is the solution to Los Angeles traffic, tired of the slow moving and costly rail transit projects (Beyer). Building more roads to alleviate transportation challenges while approaching redevelopment projects from an equitable lens is not a solution in Los Angeles for many reasons. Primarily, if traffic congestion is the main goal, the destruction of highways may be a more affordable and effective goal. Secondly, building more roads does nothing to solve environmental pollution from car emissions. Drawing from historical evidence, road construction has disproportionately affected low-income areas and communities of color. Given this historical

narrative, it seems unlikely that roads would be built in wealthy white neighborhoods, and more plausible that proposed expansion would pose air and noise pollution threats to lower income residents, repeating the mistakes (or intentional institutional racism) of the past.

Conclusion

Complex challenges presented by complex systems such as cities are often characterized by the difficulty in predicting health outcomes due to the multilevel interactions and feedback loops occurring (Ompad & Tozan). For this reason, the health impacts of revitalizing Los Angeles transportation are difficult to predict directly. While direct impacts of expanding rail and bus transit are vague, cross-sector collaboration through stakeholder involvement has the potential to build community access to nutritious food, education, economic opportunities, and greenspace within walkable in addition to increasing intracity public transportation. Long term goals such as the removal of highways for pedestrian friendly streets, which frees up space for the construction of housing, may assist in creating the desired community spaces. More research is required on which areas of the GLA highway system have potential to be removed based upon frequency and magnitude of use, current state of repairs, and community input. Stakeholder meetings between city, county, state, and community organizations have the potential to identify more specific courses of action and develop feasible plans to use public transportation reforms as a means of improving public health.

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AppendixAppendix A. Stakeholder List

Organization	Description
U.S. Environmental Protection Agency	Federal executive government agency responsible for
	environmental protection measures
Department of Transportation	Federal government agency responsible for overseeing
a. Federal Transit Administration	movement of people and goods
b. Federal Highway Administration	a. Oversee highway management
	b. Assistance (financial and technical) to public
	transportation systems
California Department of Transportation	State executive government agency responsible for
(Caltrans)	managing highways, rails, and public use airports
South Coast Air Quality Management	Government agency responsible for regulating air
District	pollution in Southern California
Automobile Club of Southern California	Advocacy for auto and traffic safety
(AAA)	
Los Angeles Board of County	County governing board
Commissioners	Y
Los Angeles Metropolitan Transportation	Agency that plans and operates Los Angeles Country
Authority	transportation system
Office of Mayor of Los Angeles	Government office(s) responsible for management of
(Mayoral Offices of 87 other cities in LA	municipal government
County)	
Port of Los Angeles and Long Beach	Port facilitating United States imports and exports
American Lung Association, Clean Air	Advocacy for air quality improvement through reducing
Advocacy Initiative	emissions
Sierra Club Angeles Chapter,	Advocacy for environmentally sustainable transportation
Transportation Committee	
Move LA A Project of Community	Advocacy for comprehensive, environmentally friendly