

Wilshire Corridor Transit Alternatives Health Impact Assessment



Draft Report for Review

Prepared by the UCLA School of Public Health
Health Impact Assessment Project
in collaboration with
The Los Angeles County Department of Public Health

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***About the UCLA HIA Project**

Since 2001 the UCLA HIA Project has been working to advance the science and practice of health impact assessment in the U.S. Our multi-disciplinary team has conducted a wide range of health impact assessments on policies and projects, including HIAs of Living Wage laws, food and agriculture policies, education policies and transportation projects. Our work conducting HIAs, providing HIA training and technical assistance, and developing tools for HIA, including the HIA-CLIC website (<http://www.hiaguide.org>) has been generously supported by the California Endowment, the CDC Foundation, the Partnership for Prevention, the Pew Charitable Trusts, the Public Health Foundation and the Robert Wood Johnson Foundation. You can find more about our work on our project website at <http://www.ph.ucla.edu/hs/health-impact>

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I. Introduction

Aim

Transit alternatives for the Wilshire Corridor

Subway History

Purpose and scope of the HIA

Logic Framework and summary of impact pathways

Overview of potential health-related impacts

Aim

This health impact assessment (HIA) examines transit alternatives along the densely populated, highly congested Wilshire Corridor from mid-town Los Angeles to Santa Monica, eight and a half miles away. The HIA seeks to inform public policy decisions related to these transit alternatives, including project selection, specific project mitigation measures and other ancillary policies that could be adopted to maximize potential health benefits and minimize harm. Within the scope of this assessment and the recommendations are actions by Metro, the agency charged with building and operating transit in Los Angeles, as well as other city and county agencies, such as city planning and housing agencies whose policies are likely to shape the downstream public health effects of these transit projects.

Health impact assessment (HIA) (see Box 1 below) provides a concrete, focused approach for helping policy-makers and the public understand the range of likely health effects of proposed policies and projects where potential health impacts might not otherwise be recognized or well understood.¹ Information from an HIA can be used to help weigh the pros and cons of project alternatives, design mitigation procedures and plan complementary projects and policies to both minimize potential harm and maximize potential benefits for the public's health and reduce health disparities among different population groups.

Health impact assessments have been conducted on a wide range of policies, program and projects. Some HIAs, such as this one, are conducted concurrent with environmental impact assessments (EIAs). While the environmental review process mandated by the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) require assessment of many potential impacts that impinge on health, many potentially significant health-related impacts are omitted or insufficiently addressed.^{2,3,4,5} This is not to say that these

¹ National Research Council. 2011. Improving Health in the United States: The Role of Health Impact Assessment. National Academies Press, Washington, D.C.

² Steinemann, A. 2000. Rethinking Human Health Impact Assessment. Environmental Impact Assessment Review 20: 627– 645.. [\[link to free article\]](#)

³ Cole BL, Wilhelm M, Long PV, Fielding JE, Kominski G, Morgenstern H. 2004. Prospects for health impact assessment in the United States: new and improved environmental impact assessment or something different? J. Health Polit. Policy Law 29(6):1153—86. [\[link to free article\]](#) [\[alternate link\]](#)

environmental reviews are *necessarily* deficient under current environmental law, but rather that the place-based, environmental focus typical of EIA conducted within the legal framework of NEPA and CEQA differs from the population-based public health focus in HIA. Importantly, HIA looks at both potential harm and potential benefits, whereas EIA in the U.S. has traditionally focused primarily on the prevention of harm.

There is considerable room for expanding the analysis of human health effects represented by HIA within the context of EIA practice. Both California's CEQA and Federal NEPA statutes call for human health impacts to be addressed.⁶ Convention and narrow interpretations of law, however, have tended to limit the consideration of human health issues in EIA to a few well demarcated areas, such as air pollution effects on cancer incidence while neglecting effects on cardiovascular disease that likely take a far greater toll on the public's health,^{7,8} and relying on decades-old noise standards and metrics that miss many of the non-auditory health effects of noise⁹ related to sleep and stress that have recently been shown to present significant health risks in workplace and community settings.¹⁰ Even if many health issues are not explicitly examined in an EIA, information on the physical footprint of a project and data on environmental effects can provide a foundation for assessing potential health effects. This HIA draws heavily from the environmental review documents prepared by the Los Angeles County Metropolitan Transportation Authority (Metro) for the proposed Wilshire Bus Rapid Transit (BRT)¹¹ and the Westside Subway Extension¹² projects. While this HIA was designed to supplement these EIAs, it was conducted independently of the CEQA- and NEPA-mandated environmental impact reports (EIRs) and statements (EISs). To provide sufficient context and background for this freestanding HIA to be understandable and useful, there is some, hopefully not excessive, redundancy with the EIRs and EIS. For particular impacts that are examined in-

⁴ Bhatia R, Wernham A. 2008. Integrating Human Health into Environmental Impact Assessment: An Unrealized Opportunity for Environmental Health and Justice. *Environmental Health Perspectives* 116(8):991-1000. [\[link to free article\]](#)

⁵ National Research Council. 2011. *Improving Health in the United States: The Role of Health Impact Assessment*. National Academies Press, Washington, D.C.

⁶ National Research Council. 2011. *Improving Health in the United States: The Role of Health Impact Assessment*. National Academies Press, Washington, D.C.

⁷ Glantz S. 2002. Air pollution as a cause of heart disease: Time for action. *J Am Coll Cardiol*. 39(6):943-945.

⁸ Pope CA 3rd, Burnett RT, Turner MC, Cohen A, Krewski D, Jerrett M, Gapstur SM, Thun MJ. 2011. Lung cancer and cardiovascular disease mortality associated with ambient air pollution and cigarette smoke: shape of the exposure-response relationships. *Environ Health Perspect*. 119(11):1616-21.

⁹ Committee on Technology for a Quieter America; National Academy of Engineering. 2010. *Technology for a Quieter America*. National Academies Press. http://www.nap.edu/catalog.php?record_id=12928

¹⁰ Evans, GW, Lercher, P., Meis, M., Ising, H., and Kofler, W. 2001. Community noise exposure and stress in children. *J. Acoust. Soc. Am*. 109, 1023–1027.

¹¹ Los Angeles County Metropolitan Transportation Authority. 2011. Wilshire Bus Rapid Transit Project (webpage). <http://www.metro.net/projects/wilshire/>

¹² Los Angeles County Metropolitan Transportation Authority. 2012. Westside Subway Extension (webpage). <http://www.metro.net/projects/westside/>

depth in the EIRs and EISs, such as ambient air quality, readers are referred to those sections of the environmental documents, rather than repeating them in the HIA.

What is Health Impact Assessment (HIA)?

Health impact assessment (HIA) is a systematic process that uses an array of data sources and analytic methods and considers input from stakeholders to determine the potential effects of a proposed policy, plan, program, or project on the health of a population and the distribution of those effects within the population.*

HIA aims to provide evidence-based, actionable information to policy-makers about the potential health effects of pending decisions affecting policies, projects and programs.

HIA can bring attention to issues affecting health as they are affected by public policies and projects, and suggest alternatives to maximize the potential benefits and minimize potential harm, especially when public health considerations are not already a major consideration.

HIAs vary greatly, however, with respect to their scope of analysis, types of information utilized, how findings are introduced into policy deliberations, and the types of decisions that they seek to inform.

For a given project or policy proposal, an HIA will attempt to determine:

1. Potential health effects;
2. Affected populations;
3. The significance of potential health effects;
4. The distribution of potential health effects and effects on existing health disparities;
5. Steps that can minimize potential benefits and minimize potential harm to the health of affected populations.

Since HIAs tend to be most valuable as a tool to highlight unrecognized or under-appreciated health effects, they typically focus on projects and policies outside the purview of public health and health care, such as transportation, land-use planning, agriculture and economic policy. Recognizing that decisions about these policies and projects involve weighing many, varied priorities, the role of HIA is not to make decisions about which alternative is best, but rather to provide decision-makers and stakeholders with sound, evidence-based information about how a proposal is likely to affect the public's health; information that might not have otherwise been fully considered without an HIA.

* *National Research Council, Improving Health in the United States: The Role of Health Impact Assessment, 2011*

Box 1: What is “health impact assessment” (HIA)?

Transit alternatives for the Wilshire Corridor

This health impact assessment (HIA) examines transit alternatives along the densely populated, highly congested Wilshire Corridor from mid-town Los Angeles to Santa Monica, eight and a

half miles away (Figure 1). For decades, proposed transit projects along this corridor have generated a huge amount of interest and debate.¹³ A proposed subway for this corridor, the so-called “Subway-to-the-Sea, was the flagship project for rallying support for a voter initiative to implement a half-cent, countywide sales tax (Measure R) to generate revenue for new transit projects.¹⁴ Despite a severe economic downturn, more than two-thirds of Los Angeles County voters approved Measure R in November 2008.



Figure 1: Wilshire Corridor, Mid-City and Hollywood areas of Los Angeles showing current Metro subway lines (solid red and purple lines) and the proposed Westside Subway Extension (dashed purple line). For most of its proposed route the Westside Subway Extension would follow the Wilshire Corridor, except for a brief section from the western edge of Beverly Hills to Westwood where it dips south to Century City. (Map courtesy of Metro)

Complementary transit alternatives under consideration for the Wilshire Corridor include bus-only rapid transit lanes, a subway, and improved pedestrian and bicycle infrastructure. The Final Environmental Impact Report/Environmental Analysis (FEIR/EA) of the proposed Bus Rapid Transit Project was approved by the Los Angeles County Metropolitan Transportation Authority (Metro) Board in May 2011, followed by the U.S. Department of Transportation’s approval of a Finding of No Significant Impact (FONSI) in August 2011.¹⁵ Construction is expected to begin after completion of design and engineering in June 2013, with the lanes operational by June

¹³ Numerous articles have appeared in local media. The Los Angeles Times has a special “Bottleneck blog” with links to these at http://latimesblogs.latimes.com/bottleneck/subway_to_the_sea/

¹⁴ Hyman S. A closer look at measure R. Los Angeles Times, 10/30/08....
<http://www.articles.latimes.com/2008/oct/30/local/me-roadsage30>

¹⁵ U.S. Department of Transportation, Federal Transit Administration. 2011. Revised Final Environmental Assessment and Finding of No Significant Impact for the Wilshire Bus Rapid Transit Project.
http://www.metro.net/projects_studies/wilshire/images/Finding_No_Significant_Impact.pdf

2015.¹⁶ The draft environmental impact report/environmental impact statement (DEIR/EIS) of the proposed Westside Subway Extension was released in August 2010 with the final Environmental Impact Report/Environmental Impact Statement (FEIR/EIS) of the Westside Subway Extension approved in May 2012. Due to opposition to a portion of the subway route through Beverly Hills, Metro's Board has approved only the initial 3.9 mile segment of the subway.¹⁷ As of December 2012, work to date on the subway extension has been limited to pre-construction site testing.¹⁸ Even with an accelerated construction schedule, the subway would not be completed until 2022.¹⁹ Most of the changes in pedestrian and bicycle infrastructure that are within the scope of the HIA are included as part of the BRT and subway projects, but additional bicycle infrastructure suggested by the City of Los Angeles' 2010 Bicycle Plan²⁰ and Five-Year Implementation Strategy²¹ are also addressed to the extent that they interface with the proposed transit projects.

Westside Subway Extension

Due to the subway project's magnitude and potential for altering travel patterns and the urban environment, this HIA will focus primarily on the proposed subway project, the Westside Subway Extension. This project would extend the Purple Line subway from its current terminus at Wilshire and Western in mid-town Los Angeles approximately eight miles westward along the Wilshire Corridor toward Beverly Hills, Century City, Westwood and West Los Angeles, with an option to eventually extend the line to the western edge of Santa Monica at the edge of ocean. The proposed subway would not preclude other transit alternatives. Pedestrian and bicycle infrastructure, as well as rapid bus lanes, could be integrated into the project. And, with an expected completion date of 2022 at the earliest, there is a need for transportation alternatives that can be implemented in the interim to address to Corridor's problems of congestion and travel delay.

¹⁶ City of Los Angeles, Department of Transportation. 2011. Wilshire Bus Rapid Transit Project – Council File 11-0695. http://clkrep.lacity.org/onlinedocs/2011/11-0695_RPT_DOT_10-09-11.pdf

¹⁷ Los Angeles Times. Beverly Hills threatens legal action over subway extension. May 17, 2012. <http://latimesblogs.latimes.com/lanow/2012/05/beverly-hills-high-school-subway-extension.html>

¹⁸ Los Angeles County Metropolitan Transportation Authority. 2012. Westside Subway Extension: Fieldwork. <http://www.metro.net/projects/westside/field-work/>

¹⁹ Los Angeles County Metropolitan Transportation Authority. Westside Subway Extension: Construction Factsheet. <http://www.metro.net/projects/westside/westside-construction-fact-sheet/> Accessed 1/5/2012

²⁰ City of Los Angeles, Department of City Planning. 2011. 2010 Bicycle Plan. <http://planning.lacity.org/cwd/gnlpln/transelt/NewBikePlan/Txt/LA%20CITY%20BICYCLE%20PLAN.pdf>

²¹ City of Los Angeles, Department of City Planning. 2011. 2010 Bicycle Plan: Five-Year Implementation Strategy. http://clkrep.lacity.org/onlinedocs/2010/10-2385-S1_RPT_DOT_01-12-11.pdf

Dedicated Rapid Bus Lane

In April 2011 Metro, the City of Los Angeles and Metro completed a Final Environmental Impact Report/Environmental Assessment (FEIR/EA) for a proposed bus rapid transit project that would extend 12.5 miles from East Los Angeles to Santa Monica with dedicated peak period bus lanes along 7.7 miles of Wilshire Boulevard.²² Six miles of this route would parallel the route of the proposed subway from Western Boulevard to Westwood. Approximately two and one-half miles of Wilshire Boulevard that are within the Beverly Hills city limits and included in the proposed subway project are not included in the bus rapid transit project.

The proposed bus rapid transit project would convert existing curb lanes on Wilshire Boulevard to a bus and right-turn only operation in the peak traffic periods (7 a.m. to 9 a.m. and 4 p.m. to 7 p.m.) on weekdays. According to the FEIR/EA, bus passenger travel times would improve by an average of 24%. By making bus travel faster and more dependable, especially in relation to automobile travel, the proposed BRT project is anticipated to increase transit ridership 15% to 20% in the Wilshire Corridor.²³

The BRT project could theoretically be completed long before the subway is operational, however delays have made the construction timeline for the BRT project somewhat uncertain.²⁴ It is also not certain whether the BRT lane would remain operational once the subway opens—it could be seen as redundant, or on the other hand it could be seen as synergistic with the subway. Therefore, in the analyses they are examined separately and in isolation, assuming the other does not exist.

Surface-level Rail/Elevated Rail

No plans are currently being considered for a surface or elevated rail option for the Wilshire Corridor. An elevated rail option for Wilshire Boulevard was discussed in the late 1980s but ran into significant community opposition, related in large part to concerns about noise and visual blight.²⁵ Elevated and surface rail options were examined in the 2007 Alternatives Analysis for the Wilshire Corridor, but were dropped from further analysis primarily due to concerns about limited ridership and difficulties for transit riders and equipment to interface with the existing subway system.²⁶ Since surface rail is most likely not considered to be a viable option for the corridor, it will not be considered in the HIA.

²² <http://www.metro.net/projects/wilshire/revised-wilshire-brt-final-eirea>

²³ Metro/Federal Transit Administration. 2011. Wilshire Bus Rapid Transit Project FEIR/EIS: Executive Summary. <http://www.metro.net/projects/wilshire/revised-wilshire-brt-final-eirea/> Accessed 1/5/2012.

²⁴ LA.Streetsblog.org (website). Sept. 7, 2012. <http://la.streetsblog.org/category/agency-watch/metro/wilshire-brt>

²⁵ http://articles.latimes.com/1987-03-15/local/me-10968_1_wilshire-boulevard

²⁶ [Alternatives Analysis Study \(AA\)](#)

Improved Pedestrian/Bicycle Infrastructure

For the purposes of this HIA, improved pedestrian and bicycle infrastructure will be considered as an element integrated into other transit projects, not a separate alternative. The goals of such integrated pedestrian/bicycle infrastructure are three-fold:

1. Ensure the safety of pedestrians and bicyclists;
2. Minimize the use of automobiles and encourage mass transit use by facilitating non-motorized travel at the beginning and end of each transit trip;
3. Create an environment that is more conducive to active transport in general, whether or not additional mass transit is developed.

Recognizing the many benefits of creating more walkable and bikeable communities, there has been a surge in policy initiatives in this direction. The recently released "Model Design Manual for Living Streets"²⁷ produced by the Los Angeles County Department of Public Health and the UCLA Luskin Center presents principles and specific design features for incorporating active transportation considerations into transit projects and community planning more generally. In November 2011, the Metro Board adopted an "Active Transportation Agenda"²⁸ that calls for implementing these strategies and proposes metrics for tracking their implementation. Similar strategies for supporting "active transportation (i.e. walking and bicycling) are also laid out in the Southern California Association of Government's 2012-2035 Regional Transportation Plan.²⁹ Where pertinent, analyses in this report will examine potential health effects of adding or omitting these additional design features for active transportation.

Subway History³⁰

The Los Angeles County Metropolitan Transportation Authority (Metro) first began work on a subway in 1986 to connect downtown Los Angeles with other commercial hubs in the city. Despite technical, budgetary and political challenges, the first segment of the subway began operating in 1993. The last subway segment to-date was completed in 2000. On an average weekday there are now over 152,000 boardings.³¹

²⁷ Los Angeles County Department of Public Health and the UCLA Luskin Center for Innovation. 2011. Model Design Manual for Living Streets. <http://www.modelstreetdesignmanual.com>

²⁸ Los Angeles County Metropolitan Transportation Authority. 2011. Active Transportation Agenda. http://www.metro.net/board/items/2011/11_November/20111116AHSItem10.pdf

²⁹ Southern California Association of Governments. 2012. 2012-2035 Regional Transportation Plan/Sustainable Communities Strategy: Active Transportation Appendix. http://rtpsc.scag.ca.gov/Documents/2012/final/SR/2012fRTP_ActiveTransportation.pdf

³⁰ History at <http://www.urbanrail.net/am/lsan/los-angeles.htm>, [http://en.wikipedia.org/wiki/Red_Line_\(Los_Angeles_Metro\)](http://en.wikipedia.org/wiki/Red_Line_(Los_Angeles_Metro)) and http://www.metro.net/projects_studies/westside/images/Draft_EIS_EIR/Executive%20Summary%20DEIS.pdf

³¹ Los Angeles County Metropolitan Transportation Authority. Ridership statistics (webpage). <http://www.metro.net/news/pages/ridership-statistics>.

What the subway did not accomplish was to connect the two major hubs of Los Angeles, downtown and West Los Angeles/Santa Monica, as originally planned. Political pressure fueled by concerns about methane gas in the soil in the mid-Wilshire district near the La Brea Tar Pits brought an end to tunneling under Wilshire Boulevard. A spur of the subway that went under Wilshire Boulevard, dead-ended at Western Avenue, only three miles west of downtown and 13 miles short of the terminus of Wilshire Boulevard at the western edge of Santa Monica and the Pacific Ocean. Instead of continuing west along Wilshire Boulevard, the main line of the subway was rerouted north through Hollywood to North Hollywood in the San Fernando Valley (see Figure 2).



Figure 2: Central and West Los Angeles showing current and proposed Metro rail lines. Current subway lines represented by solid red and purple lines. Proposed Westside Subway Extension represented by dashed purple line. *Modified from original map published by the Transit Coalition.*

While the current subway line provides valuable, new transit linkages to densely developed parts of the city, it has left one of the most densely populated urban corridors in America and one of the main centers of employment in Southern California, the Beverly Hills/Westside/Santa Monica area, without access to a fast, reliable cross-town transit alternative. Peak-hour congestion, which is a problem everywhere in the region, is especially severe in the east/west corridors between downtown and West Los Angeles/Santa Monica. Expensive housing and a high concentration of jobs in that area create an imbalance between jobs and housing that fuels demand for transportation into and out of this area. Traffic gridlock is a daily occurrence in the corridor, around which residents, businesses and government plan their lives and work. To avoid the worst traffic commuters leave earlier and earlier to work. Freeways in the area are

heavily congested even at 6 AM.³² Traffic during the afternoon/evening peak travel period (3:00 to 7:00 PM) is especially congested. At peak travel times vehicle speeds in the project area are typically less than 10 mph.³³

Along the Wilshire Boulevard Corridor, which travels through the heart of this area, there is already substantial demand for transit, with about 80,000 bus boardings per day (Metro Rapid bus EIR/EIS). In addition, there is also probably substantial latent demand for a faster, more convenient transit alternative. Traditional urban bus transit is simply not an attractive option for most automobile drivers due to long travel times, delays, unreliability and poor connectivity requiring multiple transfers,^{34,35} in addition to generally poor public perceptions of the experience of bus travel.³⁶ In the Wilshire Corridor rush-hour traffic along sections of Wilshire Boulevard that pass through Beverly Hills creeps along at less than 10 miles per hour. So-called rapid transit buses with fewer stops than other buses and equipped with transmitters to give them priority at traffic signals, don't move any faster than the rest of traffic since major intersections are blocked by traffic in every direction despite the color of traffic signals. And, unlike automobile drivers who can seek alternative routes along side streets, bus passengers are confined to highly congested Wilshire Boulevard. As a result, a rush-hour transit trip from Westwood to downtown can easily take 60 to 90 minutes, including time for transfers between buses and subways. In addition, buses are often standing-room only. Noise levels inside buses are high, trash and graffiti are common and the ride can be bone-jarring, especially in the articulated buses that are prevalent along Wilshire Boulevard.

Increasing traffic congestion and fuel prices have renewed the public's interest in transit options. In 2008 the voters of Los Angeles County passed Measure R, which added a one-half cent sales tax to fund new transportation projects in the county for a period of thirty years. Although the proposed subway would provide service only along an eight-mile segment of mid-city Wilshire Boulevard in a county of over 4,700 square miles, was nonetheless the flagship project used by the Mayor of Los Angeles and others seeking to gain voter support for Measure R. Support for other, smaller projects throughout the County helped with the passage of Measure R, but broad interest in extending the subway played a pivotal role in winning passage of Measure R.

³² Southern California Association of Governments, California Department of Transportation. 2010. Corridor System Management Plan (CSMP): Los Angeles County I-405 Corridor Final Report: Executive Summary. http://www.dot.ca.gov/hq/tpp/corridor-mobility/CSMPs/d7_CSMPs/I-405/D7_I405_CSMP_110120_Final_Executive_Summary.pdf

³³ Los Angeles County Metropolitan Transportation Authority. 2012. Westside Subway Extension Final Environmental Impact Statement/Environmental Impact Report: Chapter 3: Transportation (p. 3-1). http://www.metro.net/projects_studies/westside/images/final_eir-eis/Chapter%203%20Transportation.pdf

³⁴ Broverman N. 2012. What Can LA Do to Get Angelenos Riding the Bus? Curbed LA. July 11, 2012. <http://la.curbed.com/archives/2012/07/what-can-la-do-to-get-angelenos-riding-the-bus.php>

³⁵ Demery LW Jr. 2007. An Analysis of Ridership Forecasts for the Los Angeles Metro Red Line: Alternative Strategies and Future Transit Improvements. publictransit.us Special Report 11 (Originally published May 1, 2005; updated Sept. 30, 2007). <http://www.publictransit.us/ptlibrary/specialreports/LosAngelesSubway.pdf>

³⁶ United States General Accounting Office Report to Congressional Requesters: Bus Rapid Transit Shows Promise 2001. <http://www.gao.gov/new.items/d01984.pdf>

Purpose and Scope of the HIA

In the fall of 2010 the UCLA Health Impact Assessment Project in conjunction with the Los Angeles County Department of Public Health (LACDPH) examined health-related issues in the Draft Environmental Impact Assessment/Environmental Impact Statement (DEIR/EIS) for the proposed Westside Subway Extension³⁷ that had been issued by the Los Angeles Metropolitan County Transportation Agency (Metro). Based on this review, LACDPH and the UCLA Health Impact Project submitted a joint, 18-page letter³⁸ to Metro as part of the formal EIR/EIS review process. Comments from this letter were then integrated into the Final EIR/EIS for the subway project.

This HIA builds on this review to provide a comprehensive assessment of how the proposed subway and related transit projects in the Wilshire Corridor might affect the public's health. Where appropriate, recommendations are made for minimizing potential harm to the public's health and maximizing potential benefits.

While regulations, legal precedents and common practice constrain the scope of environmental impact assessment (EIA),³⁹ HIA takes a more flexible approach.⁴⁰ Recommendations from this HIA extend to areas, such as housing, zoning and business incentives that are not strictly part of the construction or operation of a transportation project (see Figure 3 below).

³⁷ Los Angeles County Metropolitan Transportation Authority. 2010. Westside Subway Extension. Draft EIS/EIR. (State Clearinghouse No. 2009031083) <http://www.metro.net/projects/westside/draft-eis-eir-sept-2010>

³⁸ Los Angeles County Metropolitan Transportation Authority. 2012. Response to comments: UCLA/LACDPH Comments on the DEIR/EIS for the Westside Subway Extension. Appendix H (part 12), pp. 232-255 of the Final EIS/EIR for the Westside Subway Extension. http://www.metro.net/projects_studies/westside/images/final_eir-eis/2.3%20Local%20Agencies%20-%20Part%2012%20of%2012.pdf

³⁹ Environmental impact assessment (EIA) is used here as a generic term that encompasses environmental impact reports (California), environmental impact reports (federal) and environmental assessments (federal).

⁴⁰ The downside of the flexibility of HIA relative to environmental impact assessment, however, is that HIA may be seen as being ad hoc with ambiguous boundaries and lacking agreed upon standards for assessing the significance of impacts.

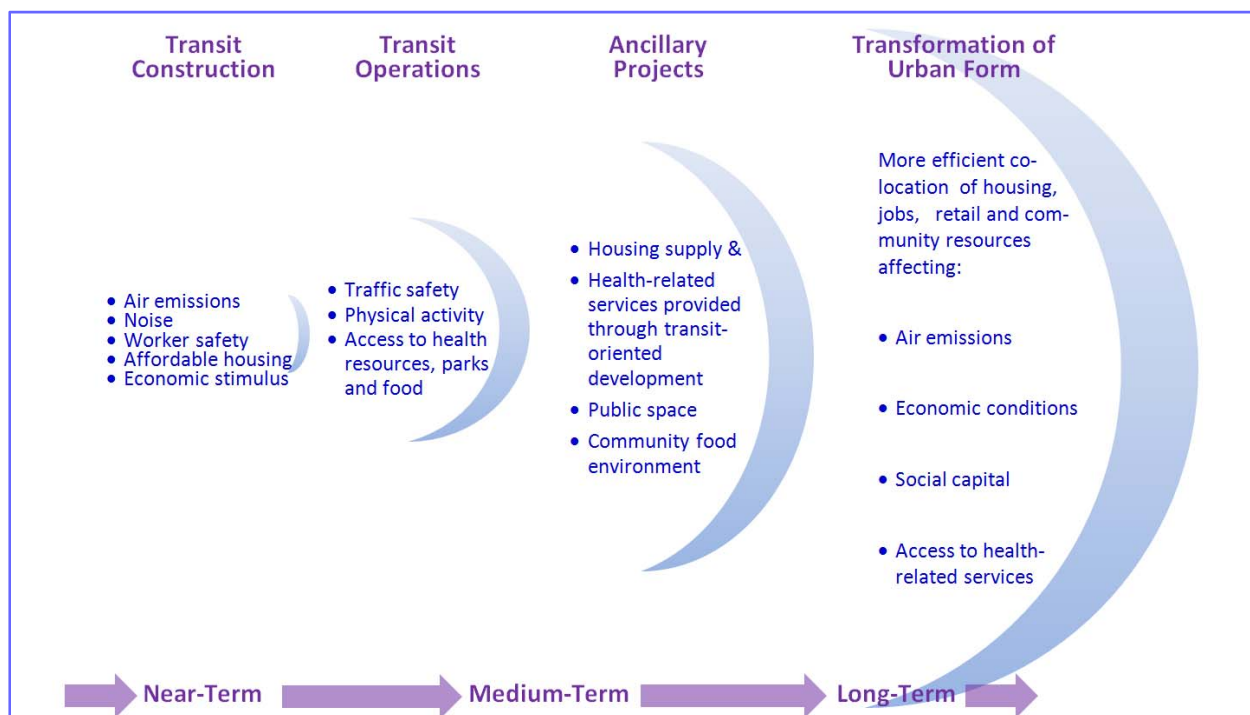


Figure 3: Health-related effects of transit projects in the Wilshire Corridor spreading outward over space and time.

Logic framework and summary of impact pathways

The Logic Framework presents a simplified, graphical representation of how project activities might impact key determinants of health and health outcomes. As conceptualized in the logic framework (see next page), the potential health impacts of the subway and other transit projects in the Wilshire Corridor flow primarily from activities: (1) construction activities, (2) changes in traffic conditions and travel patterns resulting from transit operations, and (3) changes in land-use patterns along transit routes resulting from transit operations. These activities may then lead to changes in intermediate factors, which in turn may affect an individual's likelihood of various health outcomes.

In general, HIAs do not attempt to predict changes in health outcomes, but rather focus on known risk factors and determinants of health that have a reasonable nexus with a proposed project or policy, weighing their potential likelihood and significance, and identifying specific strategies to minimize harm and maximize benefits for the public's health. The analysis of health outcomes, such as disease conditions and death, is problematic for several reasons. The occurrence of health outcomes depends on a plethora of environmental, social, behavioral and genetic factors, and may not become manifest for many years after exposure, especially for chronic conditions, such as cancers, obesity-related diseases and mental health problems. Individuals exposed to the health risks and benefits of a project have different levels of susceptibility and come with a history of other related exposures. Further, it is also often difficult to measure actual exposure. Daily routines and migration in a free-living society also mean that residential location at baseline is a poor proxy for actual exposure. Thus, analysis in

HIAs often focus on specific changes to determinants of health or risk factors, not outcomes. For instance, a substantial body of research has shown that access to safe, affordable, good quality housing is associated with a wide array of health effects from respiratory health, infectious disease, mental health and injury risks. HIAs will examine the proximate effects of a proposed project or policy on key determinants of health, such as affordable housing and household income, but more distal health outcomes, such as disease rates and life expectancy, are typically inferred from the general research literature.

The health-related impacts shown in the logic framework and discussed below were identified based on review of:

- (1) Environmental impact assessments for the subway and bus rapid transit projects;
- (2) Comments made in public meetings convened for the subway project or submitted in response to review of draft EIRs/EISs;
- (3) Related local planning documents (e.g. Regional Transportation Plan, County Bicycle Plan, etc.);
- (4) HIAs of transit projects in other locales;
- (5) Published research literature.

Once identified, potential effects were included in the logic framework based on having a logical nexus with the proposed transit projects and linked to health in the general research literature. Most of these effects are determinants of health, not health outcomes, with the exception of injury risk, which is a health outcome and can be tied directly to project activities.

The brief descriptions below are meant to present just a conceptual orientation to the health issues and their potential linkage to project activities. More detail is provided in the analysis section where the strength of the evidence and potential significance are assessed.

Key determinants of health and health-related impacts

As shown in the logic framework (Figure 4), the potential health impacts of transit projects in the Wilshire Corridor flow primarily from: (1) construction activities, (2) changes in travel patterns resulting from transit operations, and (3) changes in land-use patterns induced by transit development. Subsequent changes in intermediate factors in turn affect an individual's likelihood of various health outcomes. These health-related impacts were identified based on review of environmental impact studies for the subway and bus rapid transit projects, city and county planning documents, comments made in public meetings convened for the subway project, HIAs of other transportation projects, and research literature on linkages between health and transportation and land-use. The linkages between the transit project(s) and each of these health-related impacts are briefly summarized below. Additional background on these health impacts is available on the HIA Clearinghouse website at <http://www.HIAGuide.org>.

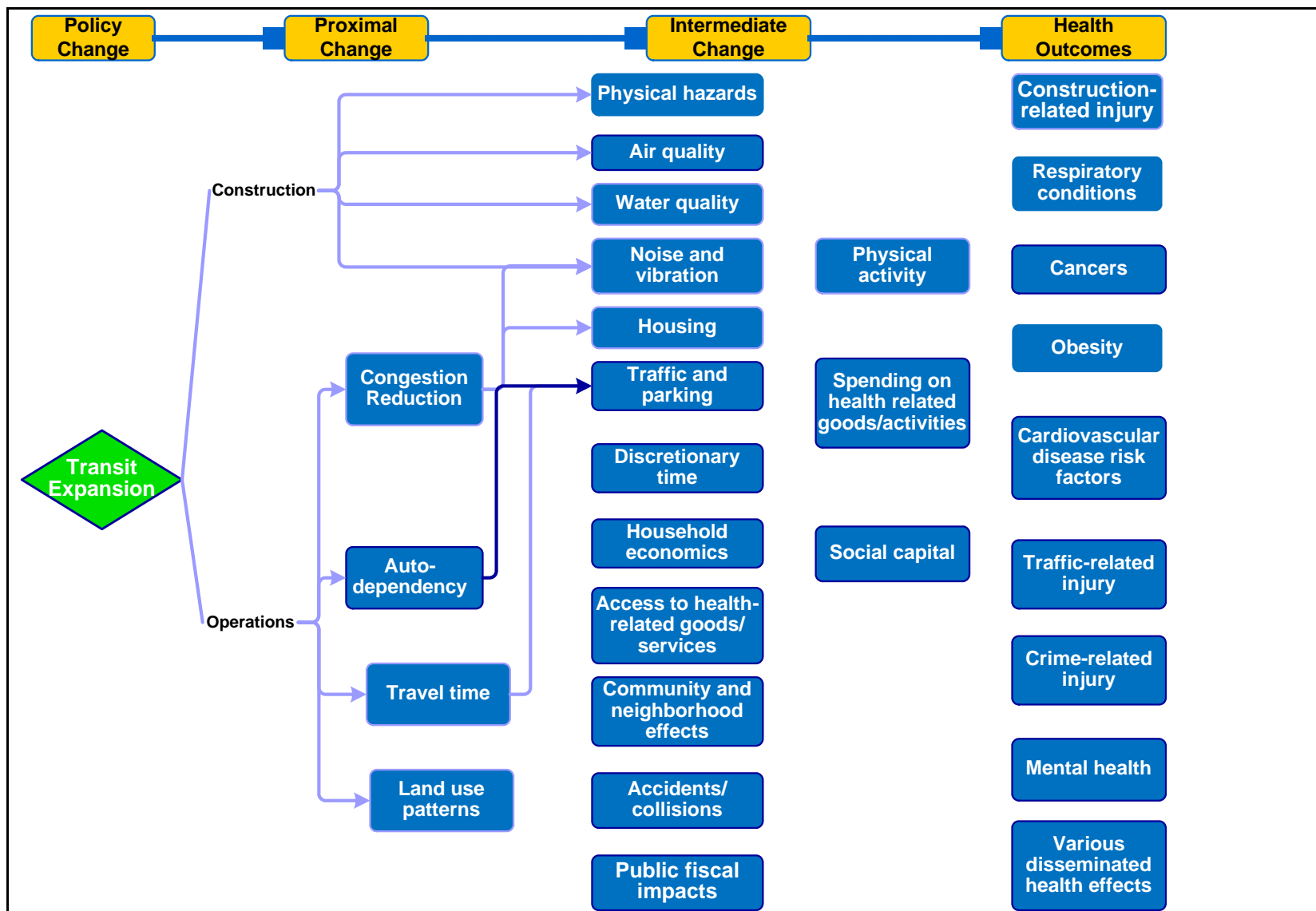


Figure 4: Logic Framework showing the potential health effects and linkages examined as part of this HIA

Construction-related injury

As with any construction activity, the proposed transit projects pose potential worksite health and safety hazards. These hazards include but are not limited to slips/trips/falls, falling debris, fires and explosions, excessive noise, exposure to toxics, collapse of trenches and tunnels, and traffic accidents that could result in worker injury or death. Some types of workplace accidents, such as the release of toxic and explosive gases may pose a hazard to non-workers who are nearby, as well as to workers. Despite state and federal standards and industry guidelines, underground construction is inherently dangerous.⁴¹ A number of worksite safety problems and accidents were reported during work on previous sections of the subway in the 1990s.⁴² Since then, however, new technologies, such as automated tunnel boring machines using earth-balanced pressure methods that minimize worker exposure to hazardous conditions,⁴³ have significantly improved tunneling safety, in general, and in conditions in the Wilshire Corridor in particular.⁴⁴ Nonetheless, the presence of "gassy" soil conditions in the project area, with naturally occurring methane, hydrocarbons and hydrogen sulfide, pose significant safety

⁴¹ U.S. Department of Transportation, Federal Highway Administration. 2011. Technical Manual for Design and Construction of Road Tunnels - Civil Elements: Chapter 14 - Tunnel Construction Engineering. <http://www.fhwa.dot.gov/bridge/tunnel/pubs/nhi09010/14.cfm>

⁴² Reporting in the Los Angeles Times on worksite safety problems during Red Line subway construction:

- Red Line Conditions Draw Fines... July 31, 1992. http://articles.latimes.com/1992-07-31/local/me-4434_1_metro-red-line
- U.S. Cites Poor Record-Keeping by Safety Officials on Subway Project. October 09, 1992. http://articles.latimes.com/1992-10-09/news/mn-757_1_federal-officials
- Safety Audit of Subway Work Finds Violations. August 19, 1994. http://articles.latimes.com/1994-08-19/local/me-28979_1_safety-audit
- Breaches in Subway Safety Cited. July 9, 1996. http://articles.latimes.com/1996-07-09/local/me-22457_1_carbon-monoxide-levels
- Subway worker killed by falling half-ton bin. February 16, 1997. http://articles.latimes.com/1997-02-16/local/me-29365_1_subway-worker
- MTA's Tunnel Injury Figures Questioned. February 18, 1997. http://articles.latimes.com/1997-02-18/local/me-33501_1_head-injury
- Subway Construction Worker Seriously Hurt. April 23, 1997. http://articles.latimes.com/1997-04-23/local/me-51674_1_construction-worker
- Subway worker falls to death in Year's 2nd Fatality. July 26, 1997. <http://articles.latimes.com/1997/jul/26/local/me-16380>
- Subway worker is killed. October 9, 1997. <http://articles.latimes.com/1997/oct/09/local/me-40830>

⁴³ Saczynski TM, Pearce M, Elioff A. 2007. Monitoring Earth Pressure Balance Tunnels in Los Angeles. Seventh International Symposium on Field Measurements in Geomechanics (Proceedings). http://www.canarysystems.com/papers/LAMetro_FMGM.pdf

⁴⁴ American Public Transportation Association Peer Review Panel. 2005. Peer review panel report on the Wilshire Corridor Tunneling Project, for Los Angeles County MTA. American Public Transportation Association, Washington, D.C. http://libraryarchives.metro.net/DPGTL/eirs/Westside_subway_extension/2005-apta-peer-review-report-wilshire-corridor-tunneling.pdf

challenges. Technologies to mitigate these hazardous, such as in situ neutralization of hydrogen sulfide, and facilities for treatment of tunneling slurries containing hydrogen sulfide and methane, can create new hazards (see Section III).

Relevant agencies: U.S. OSHA, Cal-OSHA, Metro.

Air Quality

Both transit project construction and operation may both affect air quality. Research has tied exposure to air pollutants to a wide variety of health conditions, including lung cancer, chronic bronchitis, heart attacks, asthma and poor fetal lung development. Studies of occupational exposure to diesel exhaust have demonstrated that diesel particulates are a potent carcinogen.^{45,46} For that reason, diesel particulates are regulated as a Toxic Air Contaminant in California. Studies of children have shown that living near busy diesel trucking routes is associated with increased risk of decreased lung function, wheezing, bronchitis and allergies.^{47,48,49} Air quality effects addressed in this HIA include:

- Emissions of diesel particulates, carbon monoxide, nitrogen oxides and other pollutants from operation of construction equipment;
- Emissions of fugitive dust, methane and sulfur dioxide from excavation (note special concerns related to excavation in soil high in naturally occurring hydrocarbons);
- Decrease in vehicle emissions resulting from shifts in travel mode from automobile to transit and decreases in congestion-related traffic delays.

Relevant agencies: South Coast Air Quality Management District (SCAQMD), Los Angeles County Department of Public Health (LACDPH), State Air Resources Board (ARB), Cal-OSHA (workplace exposures), Metro.

⁴⁵ CARB. Rulemaking on identifying particulate emissions from diesel-fueled engines as a Toxic Air Contaminant, 1998.... <http://www.arb.ca.gov/regact/diesltac/diesltac.htm> .

⁴⁶ [Garshick E, Laden F, Hart JE, Rosner B, Smith TJ, Dockery DW, Speizer FE](#). Lung cancer in railroad workers exposed to diesel exhaust. *Environ Health Perspect*. 2004 Nov;112(15):1539-43.

⁴⁷ Brunekreef, B., Janssen, N.A., de Hartog, J., Haressema, H., Knape, M., van Vliet, P. 1997. "Air pollution from truck traffic and lung function in children living near motorways." *Epidemiology* **8**:298-303.

⁴⁸ McConnell, Rob et al. 2006. "Traffic, susceptibility and Childhood Asthma." *Environmental Health Perspective*. 114(5):766-772.

⁴⁹ McCreanor J, Cullinan P, Nieuwenhuijsen MJ, Stewart-Evans J, Malliarou E, Jarup L, Harrington R, Svartengren M, Han IK, Ohman-Strickland P, Chung KF, Zhang J. Respiratory effects of exposure to diesel traffic in persons with asthma. *N Engl J Med*. 2007 Dec 6;357(23):2348-58.

Water Quality

Water quality may impact health in a number of ways. While it is unlikely that project activities will affect supplies of drinking water, changes in surface water quality could impact water-based recreational opportunities. Water quality issues addressed in this HIA focus on run-off from excavations and staging areas during construction that could enter storm drains and contaminate surface waters. Construction work on surface streets also presents an opportunity to implement technologies that will allow natural soil infiltration of rainfall.

Relevant agencies: Los Angeles City Department of Transportation (LADOT), City of Los Angeles Bureau of Sanitation: Water Protection Division, State Water Resources Control Board (SWRCB), Metro.

Noise and Vibration

Noise, even relatively low levels, may have a plethora of health effects. Commonly used noise standards for workplace safety, are designed to protect against noise-induced hearing loss,⁵⁰ local noise ordinances aim to prevent community annoyances, such as loud noises during night-time hours, but clear, quantitative thresholds for preventing other, less obvious health effects of noise have not been determined.⁵¹ Even at levels below which noise is unlikely to have effects on hearing, noise can cause elevated stress levels, sleep disturbance, inability to concentrate, impaired communication, and can make it uncomfortable to use some areas.⁵² Noise and vibration issues addressed in this HIA include noise and vibrations emanating from construction activities, as well as noise and vibrations resulting from transit operations.

Relevant agencies: Los Angeles Department of Public Health (LADPH), Los Angeles and Beverly Hills Unified School Districts (LAUSD, BHUSD) for noise at school sites, Cal-OSHA (for workplace exposures), and Metro.

Housing

The availability of safe, healthful and affordable housing has profound effects on the public's health.^{53,54,55} Project construction may lead to some limited displacement of residents.

⁵⁰ Niquette NA. 2011. Noise exposure: An explanation of OSHA and NIOSH safe-exposure limits and the importance of noise dosimetry. Etymotic Research, Inc. http://www.etymotic.com/pdf/er_noise_exposure_whitepaper.pdf

⁵¹ Los Angeles World Airports/U.S. Federal Aviation Administration. 2001. Technical Report LAX Master Plan EIS/EIR 14b. Health Effects of Noise Technical Report. http://ourlax.org/docs/draft_eir_NE/T14b_LR.pdf

⁵² de Hollander AEM, van Kempen EEMM, Houthuijs DJM, van Kamp I, Hoogenveen RT, Staatsen BAM. 2004. *Environmental noise: an approach for estimating health impacts at national and local level*. Geneva, World Health Organization.

⁵³ For more information on the links between housing and health see the U.S. Centers for Disease Control "Healthy Homes" website at <http://www.cdc.gov/healthyplaces/newhealthyhomes.htm>.

⁵⁴ Bashir SA. Home is where the harm is: inadequate housing as a public health crisis. *Am J Public Health*. 2002;92(5):733-8.

Secondary effects of transit projects on land-use and development, however, could have much greater effects on housing through effects on neighborhood gentrification, housing prices and housing supply.

Relevant agencies: City of Los Angeles Housing Agency, City of Los Angeles Department of Planning, Metro (for properties owned by Metro). Community-based organizations including: Community Health Councils, Esperanza Community Housing, Koreatown Youth & Community Center, Westside Shelter and Hunger Coalition.

Physical Activity

Insufficient physical activity has also been linked to overall mortality, cardiovascular disease, diabetes mellitus, colon and breast cancer, hypertension, osteoporosis and osteoarthritis), and poor mental health.⁵⁶ While recreational physical activity during leisure time is important (e.g. sports, jogging, gym workouts), integration of physical activity into daily routines, such as walking or biking to work and to do errands, probably has greater potential to increase physical activity for a greater proportion of the population. Transit projects in the Wilshire Corridor have the potential to affect physical activity by:

- Increasing walking trips associated with increased utilization of transit;
- Improving the integration of transit and bicycle infrastructure;
- Changing the attractiveness of walking or biking along routes where transit infrastructure is under construction or in operation;
- Affecting land-use and development in the corridor in ways that impact walkability and bikeability.

Relevant agencies: Los Angeles Department of Public Health (LADPH), Los Angeles City Department of Transportation (LADOT), Los Angeles City Department of Planning, Beverly Hills Planning Department, Los Angeles Department of Parks and Recreation, Beverly Hills Community Services, Los Angeles County Bicycle Commission (non-profit), Los Angeles County Bicycle Commission (non-profit).

Mental health

An emerging body of research is demonstrating how mental health is impacted by elements of the built environment, including noise levels, time spent commuting by automobile,⁵⁷

⁵⁵ Krieger J, Higgins DL. Housing and health: time again for public health action. *Am J Public Health.* 2002;92(5):758-68.

⁵⁶ U.S. Dept. of Health and Social Services. 1996. Surgeon General's Report On Physical Activity and Health. Available at <http://wonder.cdc.gov/wonder/prevguid/m0042984/m0042984.asp>

⁵⁷ Wener RE, Evans GW, Lutin J. 2006. Leave the Driving to Them: Comparing Stress of Car and Train Commuters. Available at: http://www.apta.com/passenger_transport/thisweek/documents/driving_stress.pdf

opportunities for social interaction and recreation,⁵⁸ and the extent of greenspace.^{59,60} Transit projects in the Wilshire Corridor, thus, have the potential to affect mental health through changes in noise levels, commuting options, access to social and recreational opportunities and secondarily through effects on land-use and development with subsequent changes in the amount of urban greenspace.

Relevant agencies: Los Angeles City Department of Planning, Los Angeles City Department of Transportation, Los Angeles County Department of Public Health, Los Angeles City Department of Parks and Recreation, Beverly Hills Department of Community Services.

Household Economics

Economic well-being is among the most significant factors influencing the health of individuals and the aggregate health of a community.⁶¹ Transit projects in the Wilshire Corridor could affect the economic well-being of households by providing an alternative to automobile travel, thus helping defray the costs of owning and operating an automobile.⁶² This is particularly pertinent to this area with its many low income residents and severe jobs/housing imbalance. Expenditures for building and operating transit systems can also stimulate the local economy. On the other hand, some may question the fairness and efficiency of devoting limited transit resources towards the expansion of rail service and eventually leading to increased fares for bus passengers who tend to be somewhat poorer than rail passengers.⁶³ The economic effects of the proposed subway and other transit alternatives for the Wilshire Corridor are intertwined with related decisions on fare structures and policies, requirements for contractors, and land-use, development and housing policies in the corridor will also affect the economic impacts of these transit projects.

Relevant agencies: Southern California Association of Governments (SCAG), Los Angeles City Department of Planning, Los Angeles County Economic Development Corporation (LAEDC), City of Los Angeles Housing Agency, Los Angeles County Department of Public Social Services. Non-

⁵⁸ Kawachi I, Berkman LF. 2001. Social ties and mental health. *Journal of Urban Health*, 78:458-67.

⁵⁹ Sugiyama, T., Leslie, E., Giles-Corti, B., Owen, N. (2008). Associations of neighbourhood greenness with physical and mental health: do walking, social coherence and local social interaction explain the relationships? *Journal of Epidemiology and Community Health*, 62, e9.

⁶⁰ Kuo, F.E., & Sullivan, W.C. (2001). Aggression and violence in the inner city: Effects of environment via mental fatigue. *Environment & Behavior*, Special Issue 33(4), 543-571.

http://lhlh.illinois.edu/download.php?article=2_article_Aggression%20and%20violence%20in%20the%20inner%20city.pdf

⁶¹ Adler NE, Newman K. *Health Aff (Millwood)*. 2002. Socioeconomic disparities in health: pathways and policies. 21(2):60-76. <http://content.healthaffairs.org/cgi/pmidlookup?view=long&pmid=11900187>

⁶² Surface Transportation Policy Project. 2003. *Transportation Costs and the American Dream: Why a Lack of Transportation Choices Strains the Family Budget and Hinders Home Ownership* (summary). Available at: http://www.transact.org/library/decoder/american_dream.pdf

⁶³ Grengs J. 2002. Community-based planning as a source for political change. *APA Journal* 68(2):165-178. http://nexus.umn.edu/Courses/Cases/CE5212/F2008/CS2/Joe_Grengs_Article.pdf

profit advocacy groups: The Transit Coalition, Bus Riders' Union, Los Angeles Alliance for a New Economy (LAANE).

Social Capital/Community Cohesion

Social capital, representing the amount and quality of social connectedness in a community, is associated with mental and physical health. Increases in social capital have been shown to deter unhealthy activities such as crime, drug use, and alcoholism. The pathways through which social capital benefits health include providing social support, encouraging healthy behaviors, and improving access to health-related goods and services.^{64,65}

Transit projects along the Wilshire Corridor have the potential to improve social capital chiefly by improving the ease with which residents can travel to different locations in the city to access services, such as recreation centers and public libraries,⁶⁶ and to participate in civic activities and community life more broadly. Projects could have detrimental effects on social capital if trains, buses, stations and/or station-adjacent areas become perceived as unsafe by residents and transit passengers. Noise from construction and transit operations, even if it is below thresholds established to protect hearing, could also negatively impact social capital by impairing communication and social interaction in transit-adjacent public spaces.^{67,68,69} By increasing opportunities for face-to-face interaction and neighborhood engagement, improvements in neighborhood walkability are likely to improve social capital and associated health effects.⁷⁰

Relevant agencies: Metro, Los Angeles City Dept. of Planning, Beverly Hills Planning Department, Los Angeles Department of Transportation, Los Angeles Public Library, Beverly Hills Public Library, Los Angeles Department of Parks and Recreation, Beverly Hills Community Services.

⁶⁴ Altschuler A, Somkin CP, Adler NE. 2004. Local services and amenities, neighborhood social capital, and health. *Social Science & Medicine* 59 (2004) 1219–1229.

⁶⁵ Kawachi I, Kennedy BP, Glass R. 1999. Social capital and self-rated health: A contextual analysis. *American Journal of Public Health*, 89:1187-93.

⁶⁶ Public libraries play a critical role in building a community's social capital. See Cart M. 2002. America's Front Porch—The Public Library. *Public Library Quarterly*, 21(1).

<http://www.informaworld.com/smpp/content~db=jour~content=a903924257>

⁶⁷ Sutter AH. 1991. Noise and its effects (prepared for the administrative conference of the United States).

<http://www.nonoise.org/library/suter/suter.htm>

⁶⁸ Bergland B, Lindvall T, Schwela DH. 1999. 3.8. Effects of Noise on Residential Behaviour and Annoyance. Pp. 32-34 in *Guidelines for Community Noise* (World Health Organization). <http://whqlibdoc.who.int/hq/1999/a68672.pdf>

⁶⁹ Korte C, Grant R. 1980. Traffic noise, environmental awareness and pedestrian behavior. *Environment and Behavior* 12(3):408-420. <http://eab.sagepub.com/content/12/3/408.abstract>

⁷⁰ Rogers SH, Halstead JM, Gardner KH, Carlson CH. 2010. Examining Walkability and Social Capital as Indicators of Quality of Life at the Municipal and Neighborhood Scales. *Applied Research Quality Life* 6:201–213.

http://download.springer.com/static/pdf/697/art%253A10.1007%252Fs11482-010-9132-4.pdf?auth66=1364662868_2ddf44b19f2111ec9bcf63431dfc37fa&ext=.pdf

Access to health-related goods and services

Many residents living in the Wilshire Corridor and adjacent areas have limited access to automobiles due to age, income or disability (see Tables 2 and 5). Mass transit makes it easier for these transit-dependent individuals to visit doctors and clinics and access social services. Improved mass transit can reduce travel time and costs, make trips more predictable and reduce the financial burden of transportation.⁷¹ Even for those who have access to a car, a fast, dependable transit system provides a valuable alternative in an area with extreme congestion and limited parking. Transit services provide crucial redundancy and create a transportation system that is resilient during disasters and other extreme events.^{72,73}

Relevant agencies: Los Angeles County Department of Health Services, Los Angeles County Department of Health Services, U.S. Department of Veterans' Affairs, U.S. Department of Homeland Security.

Community and Neighborhood Effects

As subway stations have opened along existing segments of Metro's subway system, the surrounding neighborhoods, such as Westlake, Koreatown, Hollywood and North Hollywood, have undergone tremendous transformation—new and renovated buildings, new businesses, increases in property values, changes in housing stock and shifts in the demographics of people living and working in, and visiting these neighborhoods. Some of these neighborhood changes are in part tied to transit-oriented development projects that are being developed adjacent to transit stations.⁷⁴ Similar changes are likely to occur in neighborhoods served by the proposed subway line. Improvements in pedestrian and bicycle infrastructure may also stimulate such neighborhood transformation, but, like the bus rapid transit lanes, these projects by themselves are probably too small to lead to significant neighborhood change.

The effects of transit and TOD on property prices and land uses, vary depending on local characteristics, such as economic conditions, zoning, demographics and other concurrent

⁷¹ Bailey, Linda (STPP). 2003. Aging Americans: Stranded Without Options. Available at: http://www.transact.org/library/reports_html/seniors/aging.pdf

Center for Third World Organizing (CTWO), People United for a Better Oakland (PUEBLO) and the Transportation and Land Use Coalition (TALC). 2002. Roadblocks to Health. Transportation Barriers to Healthy Communities.... http://www.transcoalition.org/reports/roadblocks_to_health.pdf

⁷² Giuliano G, Golog J. 1998. Impacts of the Northridge Earthquake on Transit and Highway Use. Journal of Transportation Statistics, Vol. 1, No. 2 (www.bts.gov), May 1998, pp. 1-20.

⁷³ Litman T. 2005. Lessons From Katrina and Rita: What Major Disasters Can Teach Transport Planners, Victoria Transport Policy Institute (www.vtpi.org); available at www.vtpi.org/katrina.pdf

⁷⁴ Los Angeles County Metropolitan Transportation Authority. 2008. Metro transit-oriented development (presentation at the Partnerships in Transit Conference, July 30-31, 2008). Available at http://www.ncppp.org/publications/TransitSF_0807/Roger%20MoliereMetro%20TOD.pdf

policies and projects.^{75,76} In built-out areas with high levels of commercial activity, new subway stations may have little if any effect on neighborhood conditions.⁷⁷ These neighborhood changes could affect health through effects on employment opportunities, the retail food environment, housing and social capital. Changes in neighborhood conditions are likely to include both beneficial and detrimental effects, with the balance determined by land-use and other ancillary policies in affected communities.

Relevant agencies: Metro, Los Angeles City Department of Planning, Beverly Hills Division of Planning, Los Angeles Economic Development Commission, Southern California Association of Governments.

Traffic Accidents/Collisions

Motor vehicle collisions are the leading cause of fatal injury and serious, non-fatal injury in the U.S.⁷⁸ When available, bus and rail transit are far safer than automobile travel.⁷⁹ By providing people with an alternative to automobile travel, transit can decrease injury risk. However, conflicts between transit vehicles and other roadway traffic can create new hazards. While not an issue for subways, bus rapid transit lanes, which separate buses from most traffic most of the time, can create hazardous conflicts with other traffic at intersections and places where BRT lanes end and merge with the rest of traffic. Mixing of bus and bicycle traffic is also potentially problematic. Bicyclists using BRT lanes benefit from their separation from vehicles in general-use lanes, but they are exposed to buses that have limited visibility and maneuverability and may be travelling at relatively high speeds.

Relevant agencies: Los Angeles City Department of Transportation, Los Angeles City Department of Planning, Beverly Hills Division of Planning, Los Angeles Police Department, Beverly Hills Police Department.

⁷⁵ Cervero R, Duncan M. 2002. Land Value Impacts of Rail Transit Services in Los Angeles County. Report prepared for National Association of Realtors and the Urban Land Institute.

<http://www.realtor.org/wps/wcm/connect/e7187a004e88a38db7bcf76019b6e772/losangeles.pdf?MOD=AJPERES&CACHEID=e7187a004e88a38db7bcf76019b6e772>

⁷⁶ Diaz RB. 1999. Impacts Of Rail Transit On Property Values. American Public Transit Association Rapid Transit Conference Proceedings, May 1999. http://www.rtd-fastracks.com/media/uploads/nm/impacts_of_rail_transit_on_property_values.pdf

⁷⁷ King D. 2011. Developing densely: Estimating the effect of subway growth on New York City land uses. Journal of Transport and Land Use 4(2):19-32. <https://www.itlu.org/index.php/itlu/article/download/185/175>

⁷⁸ U.S. Centers for Disease Control. Ten leading causes of death and injury (webpage). Accessed 1/26/2012. <http://www.cdc.gov/injury/wisqars/leadingcauses.html>

⁷⁹ National Safety Council. 2010. Safety Facts 2010. http://static.mgnetwork.com/rtd/pdfs/20110610_deathrates10.pdf

Fiscal impacts related to health

Transit projects, especially ones of the magnitude of the proposed subway project, have profound effects on local government budgets. Projects that are a drain on public finances can negatively affect the ability of local government to carry out health-related functions. When there are budgetary shortfalls, allocations for public health and health care for the poor are among the first to be cut.⁸⁰ Since local funding for subway construction would come primarily from Measure R funds, generated from a one-half cent sales tax dedicated to transportation infrastructure projects,⁸¹ direct impacts on local government budgets would likely be minimal.

While expenditures of public funds for the construction and operation of transit systems can be a significant drain on local government budgets, these expenditures may also increase tax revenue as a result of increased commercial activity and property values. According to a recently released report from the Los Angeles Economic Development Commission (LAEDC), Metro's \$1.2 billion in expenditures for bus and rail operations in fiscal year 2009-10 yielded nearly a billion dollars in state and local tax revenue in the region.⁸² LAEDC's economic impact analysis of the Westside Subway Extension suggests that the estimated \$3.17 billion in initial construction expenditures will yield \$215 million in state and local tax revenue for the region.⁸³ The net fiscal effect depends on a host of factors including the regional economic conditions, the co-distribution of commercial, residential and transportation infrastructure, the effectiveness of the stimulus effect, time horizons and the efficiency of recapture of stimulus effects.^{84,85}

Relevant agencies: Los Angeles County, Chief Executive Office, City of Los Angeles Chief Legislative Analyst, Los Angeles County Departments of Health Services, Public Health and Mental Health Services, Southern California Association of Governments, Los Angeles Economic Development Corporation.

⁸⁰ Coughlin TA, Ku L, Holahan J, Heslam D, Winterbottom C. 1994. State Responses to the Medicaid Spending Crisis: 1988 to 1992. *Journal of Health Politics, Policy and Law* 19(4): 837-864.

⁸¹ Hymon S. 2011. Westside subway extension receives \$640.8 million federal loan. *The Source: Transportation News and Views (Metro)*. <http://thesource.metro.net/2011/07/06/westside-subway-extension-receives-640-million-federal-loan/>

⁸² Los Angeles Economic Development Commission (LAEDC). 2011. Annual Operations of the Los Angeles County Metropolitan Transportation Authority FY 2009-2010. An Economic Impact Study.... http://laedc.org/reports/consulting/Metro_Operations_FINAL.pdf

⁸³ LAEDC Consulting Practice. 2010. Westside Subway Extension (Economic Impact Study). http://libraryarchives.metro.net/DPGTL/eirs/Westside_subway_extension/Project_documents/economic_impact_laedc.pdf

⁸⁴ Taylor BD, Samples K. 2002. Jobs, jobs, jobs: Political perceptions, economic reality, and capital bias in U.S. transit subsidy policy. *Public Works Management & Policy*, 6:250-263.

⁸⁵ Weisbrod G. 2009. Economic Impact of Public Transportation Investment (prepared for APTA) http://www.apta.com/resources/reportsandpublications/Documents/economic_impact_of_public_transportation_investment.pdf

II. Affected Populations

- Overview
- Residents
- Workers and students
- Transit passengers
- Property and business owners
- Construction workers

As with most large transportation projects, multiple, overlapping populations would be affected by transit projects in the Wilshire Corridor. In the case of the proposed subway, potentially affected populations include:

- Residents living in the Wilshire Corridor, especially those near proposed subway/rail stations;
- Workers and students commuting into or through the project area;
- Individuals traveling into or through the project area to access health and social services;
- Business and property owners;
- Construction workers
- Commuters, transit riders and others traveling to, from or through the project area.

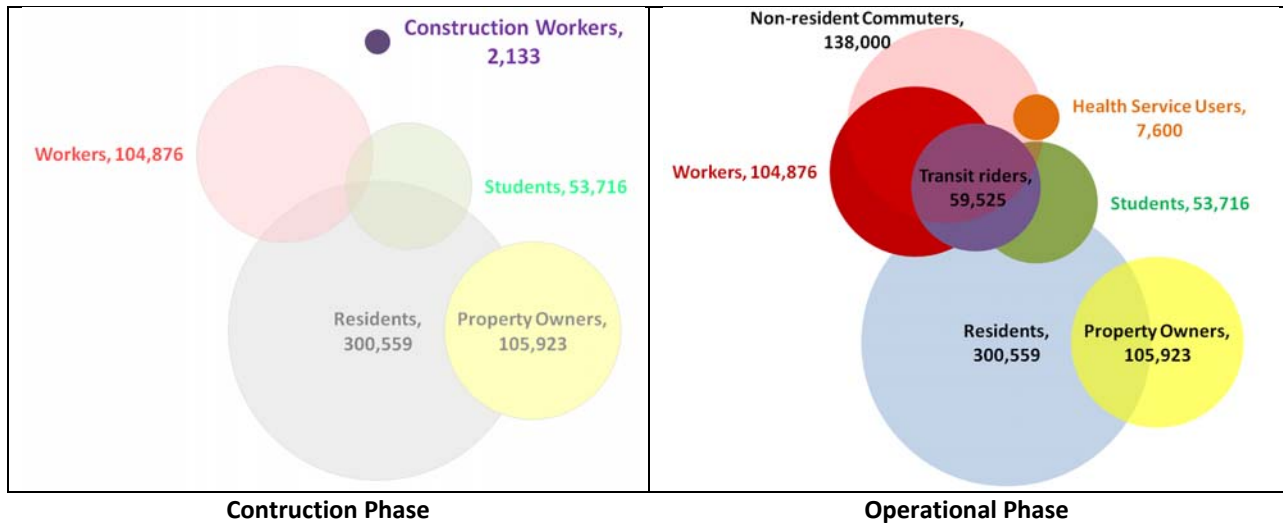


Figure 5: Populations potentially affected during the construction and operational phases of the proposed subway project. Overlap indicates that members of one group may also be members of another group. Lighter colors in the construction phase for all but construction workers suggest less intense effects on average for those populations compared to operational phase. Data sources for population estimates are shown in notes for Tables 1-5.

Over time the affected populations and the health-related impacts will shift. During the construction phase, most health-related impacts will be tied to construction impacts on the physical environment, such as air quality. The magnitude of health effects will depend largely on proximity to project activities, with construction workers being most impacted. During operational phases, impacts will shift to transit users and corridor residents. While proximity will still play a role in determining the magnitude of impacts experienced by affected individuals during the operational phase, other factors such as household income and neighborhood characteristics will mediate these effects.

Different impacts may affect these populations differently or not at all. Construction will affect different populations than transit operations, especially in the case of the subway, which will take at least eight years to complete and will likely operate for many decades. In the discussion of each health impact addressed in this report, the population(s) affected will be noted. The size and composition of these populations are summarized in Tables 1 and 2.

Table 1: Potentially affected populations in the project area and health-related impacts

Population	Population Size	Impacts of Concern	Duration of Exposure
Residents living in the Wilshire Corridor, especially those near proposed subway/rail stations	300,559 ^a	<ul style="list-style-type: none"> • Housing • Land-use/neighborhood conditions & economics • Travel-related • Air pollution • Noise 	Long-term, 14-24 hours/day
Workers, students and other commuters	313,000 trips/day entering project area ^b 138,000 trips/day leaving project area ^b 104,876 to 218,624 workers ^c 23,716 K-12 students + >30,000 post-2ndry ^d	<ul style="list-style-type: none"> • Travel-related, including safety • Construction-related impacts (e.g. noise and air pollution) similar to residents 	Medium to long-term 8-10 hours/day
Current transit users in the Wilshire Corridor	59,525/day ^e	<ul style="list-style-type: none"> • Travel-related, including safety 	
Individuals traveling into/through the project area to access health/social services	7,600/day ^f	<ul style="list-style-type: none"> • Access to health and social services 	Short-term
Business and property owners	87,162 homeowners ^g 18,761 employers ^h	<ul style="list-style-type: none"> • Economic, • Housing • Land-use • Other impacts similar to those of residents 	Variable
Construction workers (subway)	2,133 ⁱ	<ul style="list-style-type: none"> • Air pollution • Economic • Noise • Worksite accidents 	Short-to-medium-term, 8-10 hours/day

Notes for Table 1:

- a. Sum of population counts (2000 Census) for neighborhoods identified by Metro as being along the proposed Westside Subway Extension from current terminus at Wilshire/Western to Century City and terminating at the Veterans Administration Medical Center in Westwood.
- b. Trips into/out of project areas from Metro's Westside Extension Transit Corridor Study. March 7, 2008. Pp. 1-9. Available at http://www.metro.net/projects_studies/westside/images/purpose_need_report_2008_0228.pdf
- c. The lower estimate of workers in the project area includes only employment within ½-mile of stations (from Metro's Westside Subway Extension DEIR/EIS, Table 2-1). The higher estimate includes employment within zip codes along the proposed subway route from Wilshire/Western to Century City and terminating at the Veteran's Administration Medical Center in Westwood.
- d. Number of K-12 students based on enrollment in schools within 0.6 miles of the proposed subway route (see Appendix 1). UCLA (near western terminus of proposed subway route reports 29,000 students commute to UCLA. We assume the seven other colleges, vocational and professional schools along the alignment attract at least 1000 students.
- e. Number of current transit users is conservatively estimated by including only counts of current bus passengers on Metro's Wilshire Boulevard routes (#20, #720 and #920). Excludes passenger counts on other routes that intersect or are parallel with Wilshire Boulevard, as well as passenger counts from the Century City area, which would be served by the proposed subway.
- f. Trips taken for medical purposes estimated from data on trip purpose from the 2009 National Household Transportation Survey for the Los Angeles metro area (1.9% of trips were for medical purposes) applied to Metro's estimate of daily trips to destinations in the project area (313,000 from outside the area + 87,000 from within the area) and. This does not include travel to access non-medical social services, such as drug/alcohol counseling, etc.
- g. Number of owner-occupied homes calculated by multiplying the estimated population from the average percent of the population living in owner-occupied housing (29%).
- h. 2009 Economic Census data of business establishments in zip codes along the proposed subway route from Wilshire/Western to Century City and terminating at the Veteran's Administration Medical Center in Westwood.
- i. Number of construction workers estimated based on estimates of employment generated by the proposed subway project and data on the average percentage of such jobs that are on-site construction jobs from the Bureau of Labor Statistics.

Residents

An estimated 300,559 residents (Table 2) live in neighborhoods within one-half mile of the proposed subway alignment (Figure 6). This collection of neighborhoods will be referred to as the "project area." Up to several million residents of a much larger area stretching from West Los Angeles/Santa Monica to East Los Angeles and including portions of South Los Angeles might also be affected, but residents living in the immediate vicinity of the subway alignment will be most intensely affected by the project.

Except for a short section where the proposed subway would veer south from Wilshire Boulevard to Century City and portions of Wilshire Boulevard west of the proposed subway terminus in Westwood, the rapid bus route would travel through the same neighborhoods as the subway. By 2035 the population of the project area is projected to increase by 10.1%.⁸⁶

⁸⁶ Los Angeles County Metropolitan Transportation Authority. 2010. Westside Subway Extension DEIR/EIS, p. 1-1.



Figure 6: Neighborhoods along Wilshire Corridor and the Proposed Subway Route

As shown below in Table 2, the demographic composition neighborhoods along the Wilshire Corridor are highly varied, generally following a gradient from predominantly low-income, Latino and Asian residents in Koreatown/Wilshire Center on the eastern edge of the corridor to predominantly high-income, majority White neighborhoods to the West. County-wide the population is expected to be significantly older with fewer Whites and more Latinos and Asians by 2035.⁸⁷ Similar demographic trends could be expected for most of the project area.

Among the potential impacts that might significantly affect the health of residents in the project area are impacts related to housing, land-use and travel as a consequence of changes to transit operations. During construction residents may also be exposed to noise and air pollution generated by project activities. This is of particular concern in the case of the proposed subway due to the project's magnitude and long construction timeline (at least eight years). While other groups in the project area, such as commuters and workers, may have similar types of exposure, residents are likely to have greater amounts of exposure to unmitigated noise and air emissions due to the number of hours they spend in the area each day and the likelihood that they will be in the project area for multiple years.

⁸⁷ Southern California Association of Governments. 2011. Draft Regional Transportation Plan: 2012-2035 Growth Forecast. Available at http://rtpscs.scag.ca.gov/Documents/2012/draft/SR/2012dRTP_GrowthForecast.pdf

Table 2a: Population Characteristics of Wilshire Corridor Neighborhoods* (p. 1/2)

Neighborhood listed from east to west	Pop. (2000)	Residential density (no./mi ²)	Race/Ethnicity (2000)				Age (2000)				% pop. in area < 5 years (2000)
			Afr Am/ Black	Asian	Latino	White	<18	18-44	45-64	65+	
Wilshire Ctr/Koreatown ^f	55,116	45,930	5.3%	40.1%	44.4%	7.7%	24.0%	51.0%	18.5%	6.5%	64.4%
Olympic Park ^c	26,564	22,137	15.3%	27.0%	48.0%	7.6%	24.1%	45.2%	19.9%	10.8%	55.1%
Wilshire Park ^c	15,272	3,356	10.0%	39.9%	32.0%	16.0%	21.6%	45.4%	20.6%	12.4%	68.9%
Windsor Square	14,275	4,199	5.0%	38.9%	27.3%	26.2%	24.1%	45.2%	21.4%	9.3%	56.4%
Hancock Park	11,352	7,568	3.9%	11.4%	6.9%	73.8%	19.2%	42.4%	24.4%	14.1%	54.5%
Pico ^c	12,547	3,585	47.9%	5.8%	17.2%	24.0%	17.8%	49.5%	20.6%	12.2%	53.3%
Miracle Mile ^c	6,416	16,040	18.6%	17.2%	11.2%	49.2%	10.8%	62.1%	15.0%	12.1%	70.2%
Mid-city West/Fairfax ^b	47,631	14,009	4.1%	10.4%	6.3%	75.1%	11.0%	55.9%	16.8%	16.2%	65.5%
Carthay	5,303	1,829	9.1%	5.9%	17.8%	62.1%	17.8%	46.9%	22.1%	13.2%	52.9%
Beverly Hills	31,232	5,466	1.4%	7.9%	4.6%	81.3%	19.8%	36.5%	26.4%	17.4%	52.4%
South Robertson ^d	12,558	25,116	2.6%	4.9%	5.8%	77.1%	15.4%	47.3%	18.7%	18.5%	47.7%
Century City	3,548	8,870	2.3%	8.3%	2.5%	85.2%	7.9%	28.1%	23.6%	40.4%	43.8%
Westwood ^e	58,745	12,771	2.1%	20.8%	6.8%	65.4%	8.1%	64.1%	15.4%	12.4%	58.8%
Pop. weighted avg ^h	300,559	9,036	7.1%	21.6%	19.9%	47.4%	16.9%	51.1%	19.2%	12.8%	59.4%
Los Angeles City	3,694,820	7,884	11.2%	10.0%	46.5%	29.8%	26.6%	45.1%	18.6%	9.7%	63.1%

*Continued on next page.
Notes for Table 2 on next page*

Table 2b: Population Characteristics of Wilshire Corridor Neighborhoods* (p. 2/2)

Neighborhood listed east to west	Median HH income (2000)	% HH below FPL (2000)	% HH earning <\$20,000/yr (2000)	Transit dependent ^g (2000)	Avg. household size ^a (2000)	% of HH renting ^a (2000)	Violent crimes /10,000/6 mo. May-Nov 2011 ^a
Wilshire Ctr/Koreatown ^f	\$25,603	29.9%	42.6%	28%	2.7	93.0%	20.3
Olympic Park ^c	\$33,306	23.3%	----	24%	----	----	-----
Wilshire Park ^c	\$44,647	20.2%	----	19%	----	----	-----
Windsor Square	\$73,954	8.0%	23.6%	?	2.5	59.0%	17.8
Hancock Park	\$90,246	7.0%	15.3%	?	2.1	52.7%	24.4
Pico ^c	\$41,816	13.7%	----	12%	----	----	-----
Miracle Mile ^c	\$46,538	8.4%	----	?	----	----	-----
Mid-city West/Fairfax ^b	\$49,726	11.5%	21.9%	?	2.1	78.3%	17.4
Carthay	\$54,112	12.4%	20.2%	?	2.1	64.7%	35.2
Beverly Hills	\$97,726	6.0%	14.2%	?	2.2	56.5%	Not available
South Robertson ^d	\$49,294	12.8%	21.8%	?	2.1	73.1%	10.9
Century City	\$93,353	8.7%	14.1%	8%	1.8	39.6%	1
Westwood ^e	\$66,356	22.4%	25.6%	8%	2	64.1%	3.8
Pop. wt'd avg ^h	\$54,688	17.6%	29.7%	?	2.3	76.7%	14
Los Angeles City	\$36,687	18.3%	28.0%	16.5% ^g	2.8	61.4%	28.2 ⁱ

Notes for Table 2

* Except where noted, data are from Metro’s 2010 Westside Subway Extension DEIR/EIS, “Technical Report 08 – Community and Neighborhood.” Other data are from the Los Angeles Times’ “Mapping L.A. Project.”

a. From Los Angeles Times’ “Mapping L.A. Project” (MLAP) <http://projects.latimes.com/mapping-la/neighborhoods>

b. Neighborhood definitions differed between data sources. MLAP “Mid-Wilshire” neighborhood corresponds most closely to the “Mid-city/Fairfax” neighborhood designated in Metro documents.

c. MLAP data did not have neighborhoods corresponding to the “Miracle Mile,” “Olympic Park,” “Pico,” and “Wilshire Park” listed in Metro documents. These areas are within other MLAP neighborhoods.

d. Data from MLAP’s “Pico/Robertson” neighborhood was paired with data from the “South Robertson” neighborhood listed in Metro documents.

e. Data from the Westwood neighborhood, esp. income, may be skewed by the high numbers of university students living in the neighborhood.

f. MLAP data for “Koreatown” was paired with Metro data for “Wilshire Center/Koreatown.”

g. The Federal Transit Administration and Metro define transit-dependent persons as those 1) without private transportation, 2) elderly (age 65+), 3) youths (age <18), or 4) below poverty or below median income levels defined by the U.S. Census Bureau. City-wide transit dependency is based only on vehicle ownership.

h. Population-weighted averages for data from the L.A. Times are calculated using the Times’ population totals for neighborhoods, not the totals from Metro’s Westside Subway Extension DEIR/EIS which are shown in this table.

i. City-wide crime statistics compiled from LAPD 2011 Statistical Digest. May-Oct. 2011. http://www.lapdonline.org/inside_the_lapd/pdf_view/51960

Workers, students and others traveling into or through the project area

Employment density in the project area is among the highest in the metropolitan region, averaging approximately 12,500 jobs per square mile. Housing prices are high in many of the neighborhoods, especially towards the western portion of the project area. The resulting jobs/housing imbalance in the project area increases commutes and congestion.

Table 3: Employers in the Project Area* by Sector and Number of Employees

Industry Code	Industry Code Description	1-4	5-19	20-49	50-99	100-499	500-999	1000 or more	Total Estab.
23----	Construction	234	97	32	8	2	0	0	373 2%
42----	Wholesale trade	518	138	24	8	1	0	0	689 4%
44----	Retail trade	765	529	103	36	34	1	0	1,468 8%
51----	Information	903	195	79	26	32	0	4	1,239 7%
52----	Finance and insurance	705	349	81	41	34	2	0	1,212 6%
53----	Real estate and rental and leasing	857	270	36	15	11	1	0	1,190 6%
54----	Professional, scientific, and technical services	2,992	790	196	72	42	2	1	4,095 22%
56----	Admin/Support and Waste Mgmt/Remed.	441	178	90	38	38	0	2	787 4%
62----	Health care and social assistance	1,565	564	121	35	26	1	2	2,314 12%
71----	Arts, entertainment, and recreation	2,137	215	34	12	12	2	0	2,412 13%
72----	Accommodation and food services	362	442	166	71	27	3	0	1,071 6%
81----	Other services (except public administration)	668	335	99	24	9	2	0	1,137 6%
-----	Other	445	209	68	24	26	1	1	774 4%
-----	Total for all sectors	12,592	4311	1,129	410	294	15	10	18,761

Total employees 218,624

Notes for Table 3

Data extracted from 2009 Economic Census. Includes data from zip codes: 90005, 90010, 90024, 90025, 90036, 90048, 90067, 90211, 90212. Sectors with less than 1% of employers in the area are classified with "Other."

Of the estimated 452,000 daily trips into or out of the greater project area,⁸⁸ about 313,000 trips into the area originate from homes outside its boundaries. Based on employment data from

⁸⁸ Includes Hollywood and Santa Monica, which were included in the subway DEIR/EIS study, but which would not be served by the selected alternative (Wilshire Boulevard to Century City and terminated at the Veteran's

the 2009 Economic Census, 218,624 workers are employed in zip codes along the subway’s proposed route from Wilshire/Western to Century City and Westwood. Ninety percent of the area’s employers have less than twenty employees (Table 3). About 104,876 workers are employed within a one-half mile walking distance of subway stations along the proposed route, including the current subway terminus at Wilshire and Western (Table 4).

Table 4: Employment within 1/2 mile of Westside Subway Extension Stations

Station	Jobs ^a	
	Current (2006)	Projected (2035)
Wilshire/Western ^b	15,223	15,223
Wilshire/La Brea	4,613	7,077
Wilshire/Fairfax	14,151	15,598
Wilshire/La Cienega	12,615	10,533
Wilshire/Rodeo	16,316	25,678
Century City	20,126	34,544
UCLA/Westwood	14,821	27,835
VA	7,011	4,888
Total	104,876	141,376

Notes for Table 4

- a. Except for the existing station at Wilshire/Western, data are from Table 2-1 in DEIR/EIS.
- b. Wilshire/Western data represent 2000 employment data and are based on 1/2 mile distance (not walking distance). From Figure 1-2 in the DEIR/EIS. No change assumed for 2035 projection.

Students could be impacted by the project during their commute into or through the project area and while attending schools in the project area. The student population may overlap with the population of residents. Some of these students may be residents within the project area, especially those attending public elementary schools that tend to have small catchment areas, but many others are likely to commute into the area, including students attending secondary schools, private schools, vocational schools and colleges and universities. According to the 2009 National Household Transportation Survey, 10.8% of home-based trips are to school or religious institutions.⁸⁹

Administration Medical Center in Westwood). Los Angeles County Metropolitan Transportation Authority. 2008. Westside Extension Transit Corridor Study. Accessed at http://www.metro.net/projects_studies/westside/images/purpose_need_report_2008_0228.pdf

⁸⁹ Our analysis of NHTS data on trip-purpose, including only home-based trips and excluding home as destination.

Schools located within 0.6 miles⁹⁰ of the proposed subway alignment (Wilshire/Western to Century City and West L.A. VA Medical Center) include 27 primary schools with an enrollment of 12,499 students and 8 secondary schools with an enrollment of 11,217 students (see complete list of schools in Appendix 1). In addition to K-12 schools, there are also five vocational education schools, one law school and one major university (UCLA) within this area. Nearly 29,000 students commute to UCLA in addition to another 25,000 faculty and staff.⁹¹ Other post-secondary schools in the project area are listed in Appendix 1, however, the numbers of students attending classes on-site at these schools is unknown.

Individuals working or attending school in the project area will have many of the same exposures and health-related effects as residents. Although they may spend less time in the project area than residents, their exposures related to construction activities (i.e. air pollution and noise) may be greater than that of residents, if construction activities are more intense during the daylight hours when students are present. Since public primary schools tend to draw students from small catchment areas, many students attending these schools in the project area are also likely to reside in the project area. As a consequence, their duration of exposure has the potential to be especially high. Of course, actual exposure also depends on proximity to construction activities and the effectiveness of mitigation measures. The burden of existing many health problems and risks, such as asthma, obesity and diabetes, will also tend to be higher among public school students, especially in Los Angeles Unified School District (all public schools in the project area, except those in Beverly Hills), since public schools are disproportionately poor and-white,⁹² common risk factors associated with a wide array of health conditions.

Transit passengers

Currently transit services in the Wilshire Corridor between Wilshire/Western and Westwood, including the Century City area, are limited to bus service. About 59,525 passengers travel daily on buses along Wilshire Boulevard through the project area.⁹³ Many additional passengers travel on adjacent bus routes that intersect or are parallel with Wilshire Boulevard. Metro's projections indicate increasing traffic congestion and demand for transit, as a result of population increases and continued growth in the imbalance between employment and housing in the project area.⁹⁴ Buses are extremely crowded and, as explained in the introduction, bus

⁹⁰ For the purpose of identifying affected schools we defined the boundary as 0.6 miles instead of the customary 0.5 miles since a large number of schools were found to be just outside (e.g. across the street) from the 0.5 mile boundary.

⁹¹ University of California, Los Angeles. 2010. State of the Commute. Transportation Statistics, January - December 2010.

⁹² LAUSD District Profile.... http://notebook.lausd.net/portal/page?_pageid=33,48254&_dad=ptl&_schema=ptl_ep

⁹³ Metro passenger counts for buses 20, 720 and 920. From the Westside Subway Extension DEIR/EIS.

⁹⁴ Los Angeles County Metropolitan Transportation Authority. 2008. Westside Extension Corridor Study: Mobility Problem Definition and Purpose and Need Statement.

speeds often drop below ten miles per hour during peak travel times. By making travel by transit faster and more comfortable, the proposed transit projects for the corridor are expected to attract more passengers. Metro estimates that bus rapid transit lanes could increase transit ridership by 15-20% (8,900 to 11,800 additional riders based on current Wilshire bus route ridership and no subway alternative).⁹⁵ The subway extension (through Century City to Westwood/VA) is projected to provide 80,757 “project trips”⁹⁶ each day with a net increase of 27,611 daily transit trips after subtracting out bus trips supplanted by subway trips.⁹⁷

While it is difficult to accurately ascertain the demographic and socio-economic characteristics of current transit riders, let alone future transit riders, Metro’s ridership surveys have shown that transit riders tend to be poorer and more often non-white compared to the population as a whole (see Table 5). Among Metro’s current transit riders, bus passengers tend to be somewhat poorer than rail passengers, with 68% of bus passengers living in households earning less than \$26,000 per year compared to 56% of rail passengers. Both groups of transit passengers are considerably poorer than the county population as a whole, which has 24% of households earning less than \$26,000 per year.

Table 5: Demographic composition of Metro transit riders^a

Demographic characteristic	Metro Transit Riders		Residents	
	Bus ^{a,c}	Rail ^c	Project Area ^d	Los Angeles County ^e
Ethnicity (2010)				
African-Am/Black	17%	19%	7.1%	8%
Asian	7%	11%	21.6%	14%
Latino/Hispanic	60%	49%	19.9%	48%
White	10%	16%	47.4%	28%
Other	5%	5%	7.1%	2%
Income				
Median Annual HH Income (2002) ^b	\$12,000 ^b (2002)	\$25,000 ^b (2002)	\$54,688(2000)	\$43,682 (2010)
HH income < \$26,000/year (2010)	68% (2010)	56% (2010)		24% (2010)
Age (2010)				
<18	11%	19%	16.9%	24%
18-22	18%	11%	↑	8%
23-49	48%	49%	70.3%	40%
50-64	18%	16%	↓	17%
Age 65+	5%	2%	12.8%	11%

Notes for Table 5

⁹⁵ Los Angeles County Metropolitan Transportation Authority. 2011. Wilshire Bus Rapid Transit Revised Final EIR/EA: Executive Summary. April 2011. Available at http://www.metro.net/projects_studies/wilshire/images/EIR-EA_rev/Ch_0.0_Executive_Summary_041911.pdf

⁹⁶ “Project trips” include all trips originating or ending at a project station.

⁹⁷ Los Angeles County Metropolitan Transportation Authority. 2010. Westside Subway Extension DEIR/EIS. Table 4-1.

Notes for Table 5 cont'd

- a. Except for median household income, ridership statistics are from the 2010 Metro Customer Satisfaction Survey. Statistics are for all Metro service areas.
- b. Metro has not reported median income for riders since 2002.
- c. Statistics for Metro rail riders include both subway and light rail passengers.
- d. Project area statistics from 2000 Census as reported in the Subway DEIR/EIS.
- e. Ethnicity and age statistics for Los Angeles County are from the 2010 Census. For purposes of comparability, median household income for Los Angeles County is from the 2002 American Community Survey. Cut-off point for income reported in ACS is \$25,000/year. Uses 2010 1-year ACS estimate.

The project area and the Wilshire Corridor as a whole are home to numerous health and social service providers. With four major hospitals in the project area, and six others in or near the Wilshire Corridor, the area is a regional hub for medical services. Health and social service providers located in or adjacent to the Wilshire Corridor are shown in Box 1. Access to these services is especially important to the high proportion of poor and elderly residents in the project area (see Table 2).

Box 2: Health and social service providers located in and adjacent to the project area

<p>Hospitals in the project area</p> <ul style="list-style-type: none"> • Veteran’s Affairs West Los Angeles Healthcare Center (Westwood) • UCLA Medical Center (Westwood) • Century City Hospital (Century City) • Cedars Sinai Medical Center (Beverly Hills) <p>Adult day care and convalescent centers</p> <ul style="list-style-type: none"> • Carmelite Elder Care Management (Beverly Hills) • Comfort Keepers (mid-Wilshire) • Garden of Palms (Fairfax) • Guardian Rehabilitation Hospital (South Robertson) • Williaman Villas HOA (Beverly Hills) • Elder Friends (Century City) • A and W Homecare (Beverly Hills) • Impact Clinical Trials (mid-Wilshire) • Wilshire Adult Day Healthcare (mid-Wilshire) 	<p>Nearby hospitals</p> <ul style="list-style-type: none"> • St. Vincent’s Medical Center (MacArthur Park) • Children’s Hospital L.A. (Hollywood) • Hollywood/Presbyterian (Hollywood) • Kaiser Permanente (Hollywood) • Kaiser Permanente (Pico-Robertson) • UCLA/Santa Monica (Santa Monica) • St. Johns Medical Center (Santa Monica) <p>Clinics</p> <ul style="list-style-type: none"> • Urgent care clinics (2 Beverly Hills) • Other public and private clinics (multiple)
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Compared to others traveling into the project area, the needs of transit riders traveling to access health and social services are of particular concern. They are likely to travel into the area less frequently than workers and students commuting into the area, but a disproportionately large proportion are likely to be poor, older, disabled or to have chronic health conditions. Ease of access is especially important for these groups.

Property and business owners

Property owners, including both home- and business owners, could be impacted by the transit projects in numerous ways. Homeowners and business owners who spend time on premises would have the same exposures to project activities as other residents and workers. In addition, their properties and businesses could be impacted economically. Based on Census data on the percent of residents who own their homes, there are approximately 87,162 homeowners in the project area. According to the 2007 Economic Census there are 18,761 businesses in the zip codes adjacent to the proposed subway route, 90% of which have fewer than 20 employees.

Construction workers (from DEIR/EIS) Section 4-15

As a result of their proximity to construction activities (e.g. excavation, diesel-powered machinery, etc.), construction workers are likely to have relatively high exposures to air pollution, noise and other construction-related exposures. The DEIR/EIS estimates that the subway (Alternative 2) would generate 36,218 job-years over the nine-year duration of the project. Many, but not all of these would be in construction. According to the U.S. Bureau of Labor Statistics, a high-end estimate for the percentage of jobs generated by construction projects that are on-site jobs is about 53%.⁹⁸ Workers' time on-site would be highly variable. Assuming that workers are employed on site for an average of one year per worker, the project's construction phase would employ a total of 2,133 workers on site over its nine-year duration.⁹⁹ Work on the bus rapid transit lanes and related BRT infrastructure would involve far fewer workers and be of shorter duration.

High Vulnerability Groups

Some people within the populations described above, because of their age, social/economic situation, or health status, are particularly vulnerable to certain health effects. The issue of vulnerability is typically addressed in environmental impact assessments under the rubric of "sensitive receptors" – groups that have been identified by mandate or standard practice as being particularly vulnerable to potential impacts. Vulnerability is, however, not uniform across health effects. Individuals may be highly vulnerable to certain health effects but not others.

Vulnerable groups and areas of particular concern include:

- Young children (air pollution, noise and nutrition)
- Older children and young adults (social factors, physical activity, personal security)
- Elderly (nutrition, social isolation, personal security and mobility)
- Women (personal security)

⁹⁸ Ball R. 1981. Employment Created by Construction Spending. Monthly Labor Review. 12:38-44.
<http://www.bls.gov/opub/mlr/1981/12/art5full.pdf>

⁹⁹ Calculation of total number of workers employed on site over the course of subway construction: 36,218 total FTE-years (from Metro's DEIR/EIS)/9 years (minimum est'd duration of construction) x 53% (US BLS estimate of the proportion of construction project employees who work on site) = 2,133.

- People living in poverty (access to healthy foods, mobility, personal security)
- Homeless (nutrition, mobility, personal security)
- People living with disabilities or chronic health conditions (mobility, noise, air pollution)
- Groups with disproportionately high rates of violent crime victimization and/or perceived risk, i.e. young, African American males, low-income adult males, school-age children, women and elderly (crime and violence)

Estimates of the approximate number of individuals in each of these vulnerable groups are shown in Table 6. These areas of vulnerability and how they impact these groups are addressed in more detail in the relevant sections in Parts II through IV on specific impacts. Since there is considerable overlap between vulnerability and environmental justice concerns, the high vulnerability of some of these groups is also addressed in the section on environmental justice. It is important to keep in mind, however, that concerns about vulnerability should not be equated with concerns about environmental justice. Vulnerability is an individual attribute tied to specific health risks, whereas environmental justice refers to the equitable distribution of risks and benefits, particularly in reference to low-income and racial/ethnic minority populations.¹⁰⁰

Table 6: Vulnerable groups in the project area and areas of concern (*data notes below*)

Vulnerable Groups	Est'd number and percent of pop.		Vulnerabilities of concern
	Residents (N=300,559)	Transit Riders (N=59,525) ^g	
Young children (0-5 years of age)	17,335 ^a (5.8%)	6,548 (11%)	Air pollution, noise, nutrition
Older children, adolescents (6-17 years of age)	33,460 ^a (11.1%)		Air pollution, noise, social factors, mobility, physical activity, personal security
Elderly (65+)	38,472 ^b (12.8%)	2,976 (5%)	Mobility, physical activity, social isolation, personal security, access to health and social services
Women	150,881 ^a (50.2%)	30,358 (51%)	Personal security
Poverty HH income ≤ 100% FPL HH income ≤ 150% FPL HH income ≤ 200% FPL	64,925 (21.6%) ^d 105,995 (35.3%) ^d 138,698 (46.1%) ^d	↑ 40,4777 (68%) w/ HH income < 26,000/yr 2002\$ ↓	Mobility, personal security, nutrition, housing
Homeless	10,009 ^e	---	Mobility, social isolation, personal security, housing, access to health/social svcs

¹⁰⁰ U.S. EPA. 1998. Final Guidance For Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analyses. http://www.epa.gov/compliance/ej/resources/policy/ej_guidance_nepa_epa0498.pdf

Health conditions and disability			
Disabled adults	49,204 (19.7%) [†]	---	Mobility, social isolation
Adults without health insurance	73,181 (29.3%) [†]	---	Access to health/social svcs
Obese adults	38,214 (15.3%) [†]	---	Nutrition, physical activity
Children w/special healthcare needs	7,416 (14.6%) ^f	---	Mobility, access to health/social svcs
Children with asthma	2,540 (5.0%) [†]	---	Air pollution

Notes for Table 6

- a. Age strata for children and adolescents estimated by applying the age distribution for the city of L.A. from the 2010 Census to the estimated population of residents under 18 in the project Area (see Table 2)
- b. From Table 2
- c. Assumed to be the same gender distribution as the City of Los Angeles (2010 Census)
- d. Poverty data in Metro’s Westside Subway Extension DEIR/EIS data is limited to 2000 Census data on the percent of households at or below the Federal Poverty Level (FPL) (17.6% of households in the project area). There is widespread agreement that the FPL underestimates the true extent of poverty, especially in California and urban areas.¹⁰¹ For a more complete and current estimate of poverty among residents, we applied poverty rates from the 2010 American Community Survey for the City of L.A. (21.6%) to the estimated population in the project area (300,559) from Table 2. The city-wide prevalence of poverty seems reasonably close to the rates reported in the subway DEIR/EIS (17.6% of households), at least at the aggregate level.
- e. Homelessness data from the 2011 Greater Los Angeles Homeless Count (<http://www.lahsa.org/docs/2011-Homeless-Count/HC11-Detailed-Geography-Report-FINAL.PDF>). Includes total for the Los Angeles County Metro and West Service Planning Areas, excluding counts for skid row (downtown L.A.) and Santa Monica.
- f. The prevalence of health conditions and disability are from the 2007 Los Angeles County Health Survey for the Hollywood/Wilshire and Central Health Districts and the West “Service Planning Area” (the administrative areas of the Los Angeles County Department of Public Health that are traversed by the proposed subway route – map at http://lapublichealth.org/epi/docs/spahd_2002.pdf). Denominators for percentages are 50,794 for children and 249,765 for adults (16.9% and 83.1%, respectively, of the total population living in the project area).

¹⁰¹ There is widespread agreement among economic, health and social service experts that the Federal Poverty Level significantly underestimates the true extent of poverty, especially in areas such as Los Angeles where with high cost of living. See Cauthen CK, Fass S. 2008. Measuring Poverty in the U.S. (Fact Sheet). National Center for Children in Poverty, Columbia University. http://nccp.org/publications/pdf/text_825.pdf and California Budget Project. 2010. Making Ends Meet: How much does it cost to raise a family in California. http://www.cbp.org/pdfs/2010/100624_Making_Ends_Meet.pdf

III. Health impacts related to construction

Project Footprint: Direct effects on the physical environment

Air quality

Water quality

Noise and vibration

Physical hazards

This section will focus on health impacts arising from the physical footprint of the project alternatives and affecting the physical environment. Since the dedicated bus lane alternative would involve mostly operational changes, with construction limited to reconfiguring traffic lanes and sidewalks, this section will focus primarily on the subway alternative.

Project Footprint

The proposed subway will extend approximately nine miles from the current terminus of the subway's purple line at Wilshire and Western to Wilshire and Westwood. For most of the route the subway would run beneath Wilshire Boulevard, except for a short segment deviating south from Beverly Hills to Century City then north again to Wilshire and Westwood. Since the subway operates underground, people's interface with the project would be limited to riding the subway, aboveground station entrances and during construction. Impacts related to construction will be addressed in this section. Impacts related to use of the subway will be addressed in Section IV. Since the physical footprint of station entrances is minimal, impacts arising from station entrances are expected to be minimal, however impacts related to their use (e.g. crowding on sidewalks near station entrances will also be addressed in Section IV.

Construction of the subway will include two distinct elements – (1) construction of stations and their entrances, and (2) construction of subway tunnels. Both elements would involve substantial amounts of excavation, however surface-level impacts of tunneling between stations is expected to be minimal.¹⁰² Staging areas for construction equipment, personnel and materials, along with transport of materials and personnel to and from the site, would substantially expand the surface-level footprint of the project during construction.

Station construction

Construction of the seven proposed subway stations would require a total of five to seven years. During station construction streets would be closed periodically and traffic rerouted to allow for initial street excavation and rerouting of utility lines. Excavations for each station would be

¹⁰² Los Angeles County Metropolitan Transportation Authority. Westside Subway Extension: Construction Factsheet. <http://www.metro.net/projects/westside/westside-construction-fact-sheet>. 2011

about 60 feet wide and 600-1,000 feet long and 50-60 feet deep. During construction each station would require additional surface-level staging areas nearby for construction equipment, personnel and materials (see below).

Tunneling

Between stations twin tunnels, each about 20 feet in diameter, would be dug at a depth of 50-60 feet (up to 130 feet in some places) with pressurized-face tunnel boring machines (TBMs). Pressurized-faced TBMs, which were used to dig a 1.8 mile tunnel for the Metro Gold Eastside line, but not on tunnels for Metro's earlier sections of the Red or Purple subway lines, maintain the pressure in the surrounding ground while tunneling and then precast concrete linings installed as the machines progress. Compared to previously used tunneling technologies, pressurized-faced TBMs reduce the likelihood and amount of surface subsidence and subsequent property damage,¹⁰³ which was an issue during tunnel excavation in the Hollywood area for Metro Red Line subway in the 1990s.¹⁰⁴

Concerns about tunneling through an area with active and abandoned oil wells, petroleum deposits and methane have given rise to previous moratoriums on subway construction in the area¹⁰⁵ and have been raised again.¹⁰⁶ Through the EIR/EIS process Metro has presented numerous studies showing that with proper safety procedures, design features and tunneling technologies the subway can be built and operate safely.¹⁰⁷ In order to minimize worker and public exposure to hazardous soil gases, Metro plans use slurry face TBMs in areas where hydrocarbons or hazardous gases are expected to be encountered then draw off this slurry via pipes to the surface for processing and shipping off-site.

Each mile of tunnel excavation would take 8-12 months to complete. With the total time required to complete all tunneling dependent on funding which would determine whether work on different segments would be done concurrently or consecutively.¹⁰³

¹⁰³ Los Angeles County Metropolitan Transportation Authority. 2012. Westside Subway Extension Final EIS/EIR: Appendix E – Construction Methods. http://www.metro.net/projects_studies/westside/images/final_eir-eis/Appendix%20E%20Construction%20Methods.pdf

¹⁰⁴ Tunneling halted for L.A. subway / Hollywood Blvd. damage cited again. San Francisco Chronicle. February 10, 1995. <http://www.sfgate.com/news/article/Tunneling-Halted-For-L-A-Subway-Hollywood-3045203.php>

¹⁰⁵ Gridlock restarts talks on L.A. subway extension. USA Today. Feb. 28, 2006. http://usatoday30.usatoday.com/news/nation/2006-02-08-la-subway_x.htm

¹⁰⁶ Subway line meets and obstruction : Beverly Hills High School. New York Times. July 15, 2012. <http://www.nytimes.com/2012/07/16/us/subway-line-under-beverly-hills-high-faces-roadblock.html?pagewanted=all>

¹⁰⁷ Los Angeles County Metropolitan Transportation Authority. 2012. Westside Subway Extension. Final EIS/EIR. Appendix L: Geotechnical Reports. <http://www.metro.net/projects/westside/final-eis-eir>

Staging areas

Project construction would require eleven above-ground staging sites for construction offices, equipment and materials. TBMs would be assembled and tunneling slurry would be processed at three of these staging areas – Wilshire/La Brea, Century City and Westwood/VA.¹⁰³ These three larger staging areas would be about three acres in size. The other staging areas would be about one acre.¹⁰² All staging areas, especially the three staging areas with slurry processing would be likely to generate substantial truck traffic. Slurry processing facilities may also generate additional noise.¹⁰³

Air quality impacts related to construction activity

While the subway project is expected to reduce air pollution in the long-term by shifting a portion of auto and bus trips to less polluting, more energy-efficient subway trips, construction of the project would likely produce short-term, localized increases in air pollution. Construction of bus rapid transit lanes due to the much small scale of the project would have no significant impact on air quality,¹⁰⁸ as would also likely be the case for improvements to bicycle and pedestrian infrastructure since they would also require only modest levels of construction.

Construction equipment is one of the largest sources of diesel soot and smog-forming nitrogen oxides in California. Even though the generation of construction-related emissions is temporary, these emissions can have an impact on local and regional air quality. Recognizing the significance of air emissions from construction activities, Metro has adopted a Green Construction Policy that requires construction equipment on Metro projects to use best available emission control technologies and cleaner burning fuels.¹⁰⁹

Los Angeles County/South Coast Air Quality Basin is classified by the U.S. EPA as a nonattainment area for PM_{2.5}, a serious non-attainment for PM₁₀ and an extreme non-attainment area for ozone.¹¹⁰ At the air quality monitoring station in downtown Los Angeles, several miles east of the project area, air quality standards were exceeded over the past five years on an average of 3.5 days per year for ozone (state 8-hour standard), 2.5 days for PM₁₀ (state 24-hour standard) and 10 days per year for PM_{2.5} (national 24-hour standard).¹¹¹

¹⁰⁸ Los Angeles County Metropolitan Transportation Authority. 2011. Revised Wilshire BRT Final EIR/EA. Chapter 4: CEQA Environmental Analysis of the Proposed Project.

http://www.metro.net/projects_studies/wilshire/images/EIR-EA_rev/Ch_4.0_CEQA_Environmental_Analysis_041111.pdf

¹⁰⁹ Los Angeles County Metropolitan Transportation Authority. 2011. Green Construction Policy (adopted by Metro Board of Directors Aug. 4, 2011). http://www.metro.net/board/items/2011/07_July/20110720EMACItem43.pdf

¹¹⁰ U.S. EPA. Currently Designated Nonattainment Areas for All Criteria Pollutants, as of December 12, 2012 (webpage). <http://www.epa.gov/oaqps001/greenbk/ancl.html>

¹¹¹ California Air Resources Board. iADAM Air Quality Data Statistics 2006-2011 for North Main Street, downtown Los Angeles. <http://www.arb.ca.gov/adam/> (accessed 10/2/2012).

The emissions generated from common construction activities include:

- Exhaust emissions of diesel, particulate matter (PM) and oxides of nitrogen (NO_x) from fuel combustion for mobile heavy-duty diesel and gasoline powered equipment, portable auxiliary equipment, material delivery trucks and worker commute trips;
- Fugitive particulate matter dust from soil disturbance and demolition activity;
- Evaporative emissions of reactive organic compounds (ROG) from paving activity and the application of architectural coating;
- Release of hydrogen sulfide (H₂S) methane (CH₄) and hydrocarbons when tunneling and processing of slurry (tunneling spoils) in zones with soil with high concentrations of these compounds;
- Greenhouse gas (GHG) emissions, including carbon dioxide (CO₂), and nitrous oxide (N₂O) from engine exhaust and methane releases from excavation of methane-laden soils.

Individuals' actual exposures to air pollution in high traffic areas, such as along Wilshire Boulevard, are likely to be underestimated by ambient level monitoring stations that have been located in a way to best assess air pollution levels for a broad area. It is also important to keep in mind that high emissions do not necessarily lead to high levels of exposure. Sufficient time and air flow can disperse air pollutants, especially particulates, to relatively safe levels. On the other hand, photochemical reactions can increase levels of dangerous pollutants, such as ozone, over time and space. In the densely populated Wilshire Corridor limited space will generally bring between community members in closer proximity to truck-traffic and other construction-related activities.

Types of air pollutants and their health effects

Air pollutants of concern for this project include particulate matter, especially diesel particulates, and nitrous oxides (NO_x) emitted from the exhaust of engines powering construction equipment and vehicles, along with ozone generated secondarily through photochemical processes from NO_x and other pollutants. While the fine and ultrafine particles found in the exhaust of both gasoline- and diesel-powered vehicles are linked to a wide array of negative health effects, diesel exhaust is particularly dangerous. Numerous studies of occupational exposure to diesel exhaust have demonstrated that diesel particulates are a potent carcinogen.^{112,113} For that reason, diesel particulates are regulated as a Toxic Air Contaminant in California. A number of studies have shown that children living near busy diesel trucking routes are more likely to suffer

¹¹² CARB. Rulemaking on identifying particulate emissions from diesel-fueled engines as a Toxic Air Contaminant, 1998.... <http://www.arb.ca.gov/regact/diesltac/diesltac.htm> .

¹¹³ [Garshick E, Laden F, Hart JE, Rosner B, Smith TJ, Dockery DW, Speizer FE.](#) Lung cancer in railroad workers exposed to diesel exhaust. *Environ Health Perspect.* 2004 Nov;112(15):1539-43.

from decreased lung function, wheezing, bronchitis and allergies.^{114,115,116} Research has shown that traffic-related emissions affect ambient air quality, and members of the public located up to 150-300 m from a major roadway are the most affected by emissions.¹¹⁷

Outdoor air pollution may also permeate buildings, leading to elevated indoor exposures. Since people spend a larger proportion of their time indoors (children may spend an estimated 85% of their time indoors),¹¹⁸ indoor exposure may account for a substantial portion of an individual's total exposure to air pollution. Many single- and multi-family residences are poorly insulated and ventilated and are thus more permeable to outdoor air pollutants such as ultrafine and fine particulates and gases. Vehicle-generated air pollution may also infiltrate school buildings due to occupant movement and open doors and windows, older ventilation equipment and building design.¹¹⁹ Air filtration technologies may reduce levels of particulates and some gases, but even in the best of circumstances with proper installation and maintenance and using top performing technologies, air filters may reduce but not eliminate pollutants permeating buildings from outdoor sources.¹²⁰

In addition to air emissions from construction machinery, construction of the subway project is anticipated to temporarily disrupt and reroute traffic, which would contribute to the cumulative increases in traffic congestion in the study area. This would result in increases in vehicular emission concentrations, leading to poor air quality. This project will have a more lasting impact on the future development and land use distribution in the region. Although the construction of the subway project has the potential to provide benefits it will affect the traffic patterns of roadways and highways in the project area. All health-related impacts due to travel pattern impacts will be discussed in the next section.

Emissions of gases and vapors from excavation

¹¹⁴ Brunekreef, B., Janssen, N.A., de Hartog, J., Haressema, H., Knape, M., van Vliet, P. 1997. "Air pollution from truck traffic and lung function in children living near motorways." *Epidemiology* **8**:298-303.

¹¹⁵ McConnell, Rob et al. 2006. "Traffic, susceptibility and Childhood Asthma." *Environmental Health Perspective*. 114(5):766-772.

¹¹⁶ McCreanor J, Cullinan P, Nieuwenhuijsen MJ, Stewart-Evans J, Malliarou E, Jarup L, Harrington R, Svartengren M, Han IK, Ohman-Strickland P, Chung KF, Zhang J. Respiratory effects of exposure to diesel traffic in persons with asthma. *N Engl J Med*. 2007 Dec 6;357(23):2348-58.

¹¹⁷ Zhu Y, Hinds WC, Kim S, Shen S, Sioutas C. 2002. Study of ultrafine particles near a major highway with heavy-duty diesel traffic. *Atmospheric Environment*. 36(27):4323-4335.

¹¹⁸ Wiley JA. 1991. Study of Children's Activity Patterns. California Air Resource Board. Contract No. A733-149. Available at: <http://www.arb.ca.gov/research/apr/past/a733-149a.pdf>.

¹¹⁹ South Coast Air Quality Management District. 1999. Pilot Study of High Performance Air Filtration for Classrooms Applications. <http://www.aqmd.gov/rfp/attachments/2010/AQMDPilotStudyFinalReport.pdf>

¹²⁰ U.S. Environmental Protection Agency. Residential Air Cleaners (Second Edition): A Summary of Available Information. http://www.epa.gov/iaq/pdfs/residential_air_cleaners.pdf

As discussed in Section 4.4 of the DEIS/EIR, air pollutant emissions from construction activity include those associated with the slurry treatment plant, tunneling, removal and transport of soil for disposal, station construction and workers' travel. High levels of emissions are expected to primarily occur during station and tunnel excavation when large amount of soil is removed from the work site or stored within the construction area for reuse.

The presence of naturally occurring, hazardous surface gases has presented major challenges to tunnel projects in the Los Angeles region. The segment between the Wilshire/Western and Wilshire/La Cienega stations is located in an area known to have pockets of subterranean methane (CH₄) and hydrogen sulfide (H₂S). Methane and H₂S can also occur in dissolved state in groundwater. Methane and H₂S are considered hazardous gases due to their explosive properties, posing a safety hazard to all construction personnel. H₂S is also highly toxic. These gases can seep into tunnels and other excavations through soil and fractures in the bedrock. In some areas of the project corridor near the La Brea tar pits, methane concentrations can be 90-100% by volume. Off-gassing of these pollutants at staging and disposal sites also presents another route for air emissions.

Methane is also a greenhouse gas that remains in the atmosphere for approximately 9-15 years. Methane is over 20 times more effective at trapping heat in the atmosphere than carbon dioxide over a 100-year period.¹²¹ According to the DEIR/EIS report, *"The project is estimated to slightly lower all regional greenhouse gas emission burden levels for all alternatives."* This slight reduction in GHG emissions from roadway vehicles can have major public health benefits as this reduction is mainly due to a decline in VMT. Studies have shown that reductions in miles traveled and the distance traveled by motor vehicles could have greater health benefits in terms of physical activity, air pollution and road traffic injury than by only driving low-emissions vehicles.¹²² Additionally, the report states that "by 2035, the population and employment density in the Study Area will increase by 10 and 12 percent, respectively, leading to more vehicles on the road and greater concentration of mobile-source pollutants along and near roadways."¹²³ While the project is expected to reduce regional greenhouse gas emissions burden, the construction-related emissions still need to be considered and make sure that all efforts are being taken to have the least impact on air quality and the health of construction employees.

Asbestos

Asbestos may be encountered during demolition and excavation, posing health risks to both workers and community members. Airborne asbestos fibers are a known cause of several types

¹²¹ U.S. Environmental Protection Agency. 2010. Methane (webpage).
<http://www.epa.gov/outreach/scientific.html#greenhouse>

¹²² Woodcock J, Edwards P, Tonne C et al. 2009. Public health benefits of strategies to reduce greenhouse-gas emissions: urban land transport. *Lancet* 374:1930-1943.

¹²³ Los Angeles County Metropolitan Transportation Authority. 2010. Westside Subway Extension. Draft Environmental Impact Analysis Report/Environmental: Final Traffic Analysis Impact Report, p. 4-1.

of cancer and chronic scarring of the lungs (asbestosis). Many older buildings, particularly schools and other public buildings constructed prior to 1980, contain asbestos-containing materials,¹²⁴ however asbestos products continue to be used and may be found in newer structures as well.¹²⁵ Asbestos-reinforced water pipe may also be encountered during excavation. The Los Angeles Department of Water and Power service area, which includes the Wilshire Corridor, has approximately 650 miles of asbestos-containing pipe, installed primarily from the 1950s through the 1970s.¹²⁶ Guidelines for inspecting sites prior to demolition to find asbestos and to develop appropriate control measures are outlined in the South Coast Air Quality Management District's Rule 1403.¹²⁷

Fugitive dust

Construction projects can contribute to a type of particulate matter (PM) emission called "fugitive dust." Fugitive dust is PM that becomes airborne from activities such as construction, commercial mining, driving on unpaved roads, demolition, and soil and wind erosion. Unpaved roads, paved roads, construction, and wind erosion together constitute more than 80% of PM10 and 75% of PM2.5 fugitive dust emissions. In urban areas, vehicular movement on paved roads, unpaved roads, parking lots and construction sites account for the most common sources of fugitive dust.¹²⁸ In the South Coast Air Basin, construction and demolition and paved road dust are the largest PM10 emitters, accounting for 58% of total emissions in the region.¹²⁹ Depending on the level of activity, the specific operations and prevailing meteorological conditions, fugitive dust can be harmful to human health and a public nuisance. Fugitive dust can also reduce visibility (i.e. by causing hazy conditions), resulting in traffic and work-site accidents.

Diesel particulates

¹²⁴ USEPA, Region 6. 2009. Asbestos – General (webpage).

<http://www.epa.gov/region6/6pd/asbestos/asbgenl.htm>

¹²⁵ American Public Health Association, Occupational Health and Safety Section. 2009. The elimination of asbestos (Resolution No. 20096, Adopted 11/10/2009)

http://www.asbestosdiseaseawareness.org/eLibrary/Educational_Materials/APHA_Asbestos_Resolution.pdf

¹²⁶ City of San Diego Public Works Contracting Group. 2012. Appendix A: Agency Questionnaires. Request for proposal for professional engineering services for City of San Diego asbestos cement water main replacement program master plan for the public utilities department, pp. 3-5.

<http://www.ebidboard.com/docs/1206/250029/Addendum1H12580807-11-12.pdf>

¹²⁷ South Coast Air Quality Management District. 2007. Rule 1403. Asbestos emissions from demolition/renovation activities. <http://www.aqmd.gov/rules/reg/reg14/r1403.pdf>

¹²⁸ Watson JG, Chow JC and Pace TG. 2000. Fugitive Dust Emissions. Air Pollution Engineering Manual. 2nd Ed. Air & Waste Management Association. Available at:

<http://www.wrapair.org/forums/deif/documents/Watsonetal2000APEngMan.pdf>

¹²⁹ Watson JG, Chow JC, Chen L, and Wang X. 2010. Measurement System Evaluation for Fugitive Dust Emissions Detection and Quantification. South Coast Air Quality Management District. Available at:

<http://www.dri.edu/images/stories/editors/eafeditor/Watsonetal2010SCAQMDFugDustReport.pdf>

Reducing harmful emissions and particulates from diesel engines is one of the most important challenges facing the state, and construction equipment is a large source of diesel emission in Southern California. Non-road diesel engines, such as those found on construction vehicles and equipment are significant sources of air pollution. For example, a bulldozer with a 175 horsepower engine emits as much particulate matter as 500 new automobiles.¹³⁰ Therefore, it is imperative to reduce pollution from these sources to provide a healthier environment for construction employees and the public and to reduce overall environmental impact. Additionally, due to the proposed use of diesel locomotives to extract soil during the tunnel boring process, nitrogen oxides (NOx) levels are also expected to be elevated. According to air emissions modeling presented in the subway DEIR/EIS, construction activities would lead to exceedences of nitrogen oxides during both mining and other construction activity, while PM10 emissions would exceed South Coast Air Quality District (SCAQMD) standards during mining. Emissions of volatile organic compounds, carbon monoxide and ultrafine particulate matter (PM2.5) would be below SCQAMD thresholds.¹³¹ Through photochemical processes NOx emissions contributes to the formation of smog and ground-level ozone.

Metro estimates that the duration of excavation and construction activity at each station to be about 48 months. Based on anticipated volume of excavation for the tunnel and stations, it is estimated that an average of 25-80 dump trucks per day would be required to haul and dispose of the soil during excavation cycles. This poses a potentially significant exposure for community members as diesel trucks transport excavated soil and treated slurry to landfills, and even more so for construction personnel who are in close proximity to construction equipment and trucks for longer periods of time. Traffic congestion around project sites and idling of haul trucks while queuing and loading/unloading can further increase air emissions and exposure.

Less Polluting Equipment

- 1) Off-road diesel-powered construction equipment shall meet Tier-4 off-road emission standards and be equipped with Best Available Control Technology (BACT) devices for particulate emissions;
- 2) On-road heavy-duty diesel trucks or equipment shall comply with EPA 2007 on-road emission standards for PM and NO (0.01g/bhp-hr and at least 1.2 g/bhp-hr, respectively);
- 3) Use grid-based electric power at any construction site, where feasible. If no access to power grid, generators must meet a 0.01 gram PM per brake-HP-hour standard, or be equipped with BACT for PM emissions reductions.

Best Management Practices (BMPs)

Where applicable and feasible and in coordination with local jurisdictions:

¹³⁰ EPA. 2005. Clean construction USA. EPA -420-F-05-032, Washington, DC.

¹³¹ Los Angeles County Metropolitan Transportation Authority. 2010. Westside Subway Extension DEIS/EIR: Air Quality Technical Report. Available at:
http://www.metro.net/projects_studies/westside/images/Draft_EIS_EIR/tech-reports/10-Air-Quality-Technical-Report.pdf

- 1) Use diesel particulate traps or best available control technology;
- 2) Maintain equipment according to manufacturers' specifications;
- 3) Restrict idling of construction equipment and on-road heavy-duty trucks to 5 minutes;
- 4) Provide 1,000 foot buffer zone between truck traffic and sensitive receptors, where feasible;
- 5) Synchronize signals to improve traffic flow;
- 6) Configure construction parking to minimize traffic interference;
- 7) Implement truck parking restrictions;
- 8) Designate haul routes to minimize travel through congested streets or near sensitive receptor areas;
- 9) Provide dedicated turn lanes for movement of construction trucks and equipment on- and off-site;
- 10) Schedule construction activities that affect arterial traffic flows for off-peak hours;
- 11) Use electric power in lieu of diesel power where available;
- 12) Limit traffic speeds on all unpaved roads to be 15 mph or less.

Figure 7: Core elements of Metro's Green Construction Policy (adopted July 2011).¹⁰⁹

Recommendations

In July 2011 Metro's board of directors adopted a "Green Construction Policy" (see Figure 7) to reduce air emissions from Metro construction projects.¹⁰⁹ The recommendations below for controlling air emissions from construction of Wilshire Corridor Transit overlap substantially with requirements of the Green Construction Policy. It is important to note, however, that the BMPs are couched in terms of feasibility. Overly broad judgments of infeasibility could weaken the effectiveness of the policy for reducing construction-related air emissions and protecting the public's health. Although these judgments often involve highly technical, situation-specific information, it will be important for Metro to make determinations of compliance feasibility as transparent as possible.

1. **Community notification/hotline:** Provide notification of construction activity to local residents in addition to providing them with phone numbers for complaints and questions (*Metro, SCAQMD, Los Angeles County Dept. of Public Health (in consultative role)*)
2. **Expanded use of low emission vehicles/equipment:** Since one of Metro's key goals is to create a more sustainable transportation system in Los Angeles, the equipment and vehicles used to build these projects must further this essential objective. Studies conducted in Sacramento by the Sacramento Metropolitan Air Quality Management District have shown reductions in regional ambient levels of NO_x and PM with use of cleaner construction equipment.¹³² Metro should fully implement its new Green Construction Policy and ensure full compliance among all project contractors and sub-contractors.¹⁰⁹ (*Metro, SCAQMD*)
3. **Plan construction staging and schedules, and adopt policies to reduce truck trips/queuing and idling:** Since transporting materials to and from construction sites result in extra GHG (and other pollutant) emissions, steps should be taken to reduce vehicle trips and idling to the construction site. This will also result in lower fuel consumption. Selecting

¹³² Sacramento Metropolitan Air Quality Management District. Available at: www.airquality.org.

staging sites that minimize truck queuing and traffic disruption will be important to reducing diesel exhaust emissions. (*Metro, City Dept. of Transportation*)

4. **Locate staging areas away from populated areas and sensitive populations:** Although it may be difficult in the densely populated Wilshire Corridor, construction staging areas where there is likely to be a high volume of truck traffic should be sited in areas with the least dense areas, especially away from land-uses with sensitive populations (e.g. schools, hospitals and nursing homes). (*Metro, City Planning/Community Development*)
5. **Locate slurry treatment plants away in least populated areas away from sensitive populations. Use best available technology to contain gases and odors:** When tunneling through soils with high levels of methane and/or hydrogen sulfide, Metro plans to use wet tunneling methods that will mix excavated earth with water and chemical treatment agents (e.g. zinc oxide) then transport this slurry to an above-ground, on-site treatment plant.¹³³ This will minimize the fire, explosive and toxic exposure risks posed by these gases. The collection, storage and treatment of this slurry, however, creates potentially hazardous conditions, nuisance odors and greenhouse gas emissions that are not addressed in detail in the Final EIS/EIR. It is unclear from Metro reports how slurry will be treated in such a way as to allow for simultaneous off-gassing methane and containment of odors from sulfides and residual hydrocarbons in the treated slurry. While release of methane from this slurry to the atmosphere is probably the safest option, methane is a potent greenhouse gas. Furthermore, contingency procedures need to be put in place to assure that methane is not allowed to build up to explosive levels anywhere in the transport or treatment system even during equipment malfunction and any stoppage or slowing of slurry flows. In situ treatment of hydrogen sulfide with zinc oxide, unlike sodium hydroxide and hydrogen peroxide treatment, poses little risk for workers, but the resulting zinc sulfide has the potential to create nuisance odors in the vicinity of the treatment plant and wherever they are loaded onto trucks for transport off-site. (*Metro, Public Health*)
6. **Maximize the use of trees and greenspace in landscaping. Include air pollutant removal in tree species selection criteria.** Landscaping (trees and vegetation) enhances the visual appeal and neighborhood aesthetics. Through improved air quality increased green space can lower asthma rates,^{134,135} lower childhood obesity rates,¹³⁶ improve

¹³³ Los Angeles County Metropolitan Transportation Authority. 2011. Addendum to the Geotechnical and Hazardous Materials Technical Report. August 2011. P. 13.
http://www.metro.net/projects_studies/westside/images/final_eir-eis/Addendum%20to%20the%20Geotechnical%20and%20Hazardous%20Materials%20Tech%20Report%20-%20Part%201%20of%202.pdf

¹³⁴ Lovasi GS, Quinn JW, Neckerman KM, Perzanowski MS, Rundle A. Children living in areas with more street trees have lower asthma prevalence. *J Epi Community Health*. 2008; 62(7):647-9.

¹³⁵ USEPA. Reducing urban heat islands- Compendium of strategies, Trees and Vegetation. 2009.
<http://www.epa.gov/heatisland/resources/compendium.htm>

¹³⁶ Bell JF, Wilson JS, Liu GC. Neighborhood Greenness and 2-Year Changes in Body Mass Index of children and youth. *Am J Prev Med*. 2008;35:547-553.

psychological well-being.¹³⁷ Green space can also help reduce summertime temperatures and provide shade and protection from the sun. Street trees can sequester and store carbon.¹³⁸ (*Metro, City Planning/Community Development, Public Works, Street Services*)

Water Quality

According to Metro's draft and final environmental studies, the build alternatives would not add a significant amount of impervious surfaces to the study area, and as a result, the long-term operation of the proposed project is not expected to lead to significant increase in stormwater runoff. Nevertheless, construction and operations related to the proposed subway still have the potential to negatively impact both surface and ground water in the short-term. Project construction activities have the potential to affect the quality of ground and surface water resources in four ways:

1. Discharge of water used in construction activities that then pollutes canals and creeks and eventually the ocean;
2. Release of materials, such as dust, debris soil, into the air and soil that then contaminate waterways during rain storms;
3. Increasing the volume of stormwater flows by decreasing the amount of permeable surface or making soils more vulnerable to erosion during the construction period;
4. Disturbance of existing soil contaminants and naturally occurring hydrocarbons that can then more easily migrate into groundwater or surface waters.

Stormwater runoff from construction activities can have a significant impact on water quality,¹³⁹ resulting in environmental damage, increased chance of flooding and potentially exposing people to water-borne communicable diseases and toxins.

Run-off and current water quality

The proposed project lies entirely within the 130 square-mile Ballona Creek watershed which drains to Santa Monica Bay. Flat topography and near-surface impermeable rock strata combine to create a high water table throughout most of the project area. While surface water flows are generally low as a result of the semi-arid climate, naturally occurring seepage and

¹³⁷ Iverson CT, Hagerhall CM. The perceived restorativeness of gardens-Assessing the restorativeness of a mixed built and natural scene type. *Urban Forestry & Urban Greening*. 2008;7:107-118.

¹³⁸ USEPA. Reducing urban heat islands- Compendium of strategies, Trees and Vegetation. 2009. <http://www.epa.gov/heatisland/resources/compendium.htm>

¹³⁹ U.S. EPA. 2009. Environmental Impact and Benefits Assessment for Final Effluent Guidelines and Standards for the Construction and Development Category. http://water.epa.gov/scitech/wastetech/guide/construction/upload/2008_12_8_guide_construction_files_environment.pdf

urban run-off maintain flows even in dry periods. During rainy periods flows can increase by several orders of magnitude. Approximately 40% of the watershed is covered with impervious surfaces and the creek itself is a concrete-lined canal, creating conditions for extreme run-off events during storms and creating high potential for pollution from run-off.¹⁴⁰ Miles of stormwater canals and underground pipes now constitute a major part of the watershed drainage system. Storm drain systems operated by Los Angeles County and the City of Los Angeles are completely separate from sewer systems. Water from these storm drain systems receives no filtering or treatment prior to being discharged in waterways.

Waters in the creek have high levels of boron, cadmium, copper and selenium that routinely exceed acutely toxic levels, a wide range of other metals from chromium to vanadium that periodically exceed chronic or acutely toxic levels, in addition to microbial pollution. Sediments in the creek have high levels of heavy metals, chlordane, dichlorodiphenyltrichloroethane (DDT), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs).¹⁴¹

Stormwater pollution and human health

Stormwater or urban runoff is the largest source of pollution in Santa Monica Bay.¹⁴⁰ Urban runoff can carry with it trash, biological contaminants, chemicals, and nutrients which can pollute the body of water. These chemicals can accumulate in fish and other marine life making some fish unsafe to eat, causing harmful effects in other animals, including humans, who consume these contaminated foods.

As more land is paved over during the course of urban development pervious surfaces are lost, preventing ground infiltration of rain and run-off that naturally filters out a large number of harmful contaminants. Without infiltration, surface flow volumes and velocities reach much higher levels when it rains. This run-off then picks up much greater amounts of contaminants, including oil and grease from roadways and parking lots, pesticides, bacteria and sediments, then deposit them directly into waterways.

Stormwater carries disease-causing bacteria, viruses, and protozoa. Waterborne illnesses can be caused not only by drinking contaminated water, but also by eating seafood caught in contaminated water and by swimming or other recreational contact.¹⁴² A study of Santa Monica Bay found that swimming in the ocean near a flowing storm sewer drain during dry weather conditions significantly increased the swimmer's risk of contracting a broad range of health effects. Comparing swimming near flowing storm-drain outlets to swimming at a distance of 400 yards from the outlet, the study found a 66 percent increase in a group of symptoms

¹⁴⁰ Ballona Creek Watershed Task Force. 2004. Ballona Creek Watershed Management Plan. Chapter 2: Existing Conditions. <http://ladpw.org/wmd/watershed/bc/bcmp/docs/sept04/Chapter%202.pdf>

¹⁴¹ California State Coastal Conservancy. 2011. Ballona Wetlands Ecological Reserve, Los Angeles, California. Santa Monica Bay Restoration Commission Baseline Assessment Program: 2009-2010 Report, ch. 1: Water Quality.

¹⁴² Wade TJ, Calderon RL, Sams E, Beach M, Brenner KP, Williams AH, et al. 2006. Rapidly Measured Indicators of Recreational Water Quality Are Predictive of Swimming-Associated Gastrointestinal Illness. *Environ Health Perspect* 114:24-28.

indicative of respiratory disease and a 111 percent increase in a group of symptoms indicative of gastrointestinal illness within the next 9 to 14 days.¹⁴³ Sensitive populations such as children, the elderly, or those with a weakened immune system are particularly at risk for long-term effects. For example, research has shown that children under the age of nine have more reports of diarrhea and vomiting from exposure to waterborne pathogens than any other age group, with at least a twofold increase occurring over the summer swimming months.

The effects of contact or ingestion of contaminated water are much greater in vulnerable populations such as children, the elderly, those with compromised immune systems and pregnant women. During pregnancy and lactation mothers can pass ingested toxins to their infants. Increased sediment in receiving water is also related to human illness: sediment prolongs life of pathogens and makes it easier for them to reproduce.¹⁴⁴ Sediment in stormwater also has a number of harmful effects on aquatic life. Pathogens in stormwater can also contaminate shellfish beds, and this contamination, along with pollution from other sources, causes closure of shellfish beds nationwide.¹⁴⁵ Impervious surfaces also lead to pooling of stormwater, increasing potential breeding areas for mosquitoes, the disease vectors for dengue hemorrhagic fever, West Nile virus, and other infectious diseases.

Stormwater run-off also introduces excess nutrients into aquatic ecosystems. The same nutrients used to fertilize plants on farms and in gardens and yards, stimulate excess growth of algae and aquatic plants, resulting in declining oxygen levels in water, mass die-offs of aquatic organisms, and releasing toxic aerosols and hydrogen sulfide that can be harmful and even fatal to humans.^{146,147,148} In marine systems, nutrient enrichment can lead to red and brown tides that are a threat to marine organisms and human health. These harmful algal blooms can cause potentially life-threatening illnesses and include symptoms such as diarrhea, nausea vomiting, abdominal cramping, chills, diminished temperature sensation, muscular aches, dizziness, anxiety, sweating, seizures, numbness and tingling of the mouth and digits, and paralysis, as well as cardiovascular and respiratory symptoms.¹⁴⁹ Approximately 10% of all food-borne disease

¹⁴³ Santa Monica Bay Restoration Project. *An Epidemiological Study of Possible Adverse Health Effects of Swimming in Santa Monica Bay*, pp. iv, v, 122.

¹⁴⁴ Henrickson SE, Wong T, Allen P, Ford T, Epstein PR 2001. Marine Swimming-Related Illness: Implications for Monitoring and Environmental Policy. *Environ Health Perspect* 109:645-650.

¹⁴⁵ Rose JB, Epstein PR, Lipp EK, Sherman BH, Bernard SM, Patz JA 2001. Climate Variability and Change in the United States: Potential Impacts on Water- and Foodborne Diseases Caused by Microbiologic Agents. *Environ Health Perspectives* 109:211-221.

¹⁴⁶ Natural Resources Defense Council. 1999. The consequence of urban stormwater pollution. Ch. 3 in *Stormwater Strategies: Community Responses to Runoff Pollution* <http://www.nrdc.org/water/pollution/storm/chap3.asp#f> <

¹⁴⁷ U.S. Centers for Disease Control. 2012. Promoting clean water for health: Harmful Algal Blooms (HABs) (webpage). <http://www.cdc.gov/nceh/hsb/hab/default.htm>

¹⁴⁸ California Department of Public Health. 2012. Blue-green algae (cyanobacteria) blooms (webpage). <http://www.cdph.ca.gov/healthinfo/environhealth/water/pages/bluegreenalgae.aspx>

¹⁴⁹ Woods Hole Oceanographic Institution, "The Harmful Algae Page," www.whoi.edu/redtide/.

outbreaks in the United States are caused by eating seafood contaminated by algal toxins.¹⁵⁰ When inhaled, aerosols of toxins from cyanobacteria (aka “blue-green algae”) and dinoflagellates can cause respiratory distress even in beach visitors who do not enter the water.

Erosion and sediment runoff

Construction-related activities including grading and excavation have the potential increase erosion and sedimentation. The impact of tunnel construction activities on stormwater is a consideration due to the potential for excavated materials (and any associated pollutants) to come into contact with stormwater or be discharged into the stormwater drainage facilities. Fugitive dust from excavated soil may carry contaminants, which may also end up in the storm drain system. Compliance with the State Water Quality Control Board’s construction permit requirements¹⁵¹ to control run-off from construction sites and the South Coast Air Quality Management District’s Rule 403 for control of fugitive dust¹⁵² will minimize potential impacts on surface water quality.

The processed water used in the slurry is also a potential source of concern if it is not properly contained and disposed. Additional water disposal needs are created by the use of slurries used to remove excavated debris when drilling in areas with high levels of sub-surface methane and hydrocarbons. Tunneling activities would also require the use and eventual disposal of water used in water cooling towers. While much of this water can be recycled and reused on site, it will eventually need disposal. According to plans laid out by Metro in the FEIS/EIR, wastewater would be contained onsite and disposed of periodically, however, if proper measures are not taken, the water quality of the Los Angeles River and Ballona Creek will be further impacted. Once the subway is built and operational, stormwater runoff from station platforms will need to be mitigated, especially considering the presence of lubricants, metallic dust and refuse. Best management practices (BMPs) for control of stormwater runoff during construction of transportation projects are presented in guides from the California Department of Transportation.¹⁵³

¹⁵⁰ J B Rose, P R Epstein, E K Lipp, B H Sherman, S M Bernard, and J A Patz. 2001. Climate variability and change in the United States: potential impacts on water- and foodborne diseases caused by microbiologic agents. *Environ Health Perspect.* May; 109(Suppl 2): 211–221.

¹⁵¹ California Environmental Protection Agency: Water Resources Control Board. 2013. Construction Stormwater Program (webpage). http://www.waterboards.ca.gov/water_issues/programs/stormwater/construction.shtml

¹⁵² South Coast Air Quality Management District. Rule 403: Fugitive Dust. <http://www.aqmd.gov/rules/reg/reg04/r403.pdf>

¹⁵³ California Department of Transportation. 2003. Storm Water Quality Handbooks, Construction Site Best Management Practices Manual. http://www.dot.ca.gov/hq/construc/stormwater/CSBMPPM_303_Final.pdf

Groundwater

Underground excavation and tunneling would encounter shallow groundwater along the alignment. Groundwater is a major component of water supply in the Los Angeles Metro area. Local groundwater resources provide approximately 15% of the total water supply, but in drought years it accounts for nearly 30%. Once contaminated, groundwater is both difficult and expensive to treat. Leaks and spills of fuels, lubricants and coolants from construction vehicles and machinery can pollute groundwater if not promptly contained and cleaned up. One liter of oil can contaminate 1 million liters of water so it is especially essential for vehicles not to leak oil on surfaces that can drain into a water source. In addition, as excavations cut through pockets of contaminated soil and groundwater they may facilitate the diffusion of contaminated groundwater. Due to both naturally occurring hydrocarbons in the soil and past land-uses that may have released contaminants into the soil and groundwater, such as dry cleaners, gas stations and auto repair facilities, the likelihood of encountering undocumented soil/groundwater contamination during construction is high.

Pumping out water that seeps into excavated areas (dewatering) has the potential to result in a localized over-withdrawal of groundwater resources and to speed up the subterranean transport of contaminated groundwater. Since tunnels and stations will be below groundwater levels, potential impacts on groundwater resources linked to dewatering will be unlikely once excavations are lined and the subway is operational.¹⁵⁴

Dust control

A commonly recommended method of controlling fugitive dust on a construction site is the use of water. Water is used to dampen excavated soil storage piles and to spray clean truck tires in order to prevent spreading dust onto city streets. While there is potential for run-off and seepage of contaminants into the groundwater, best management practices and procedures laid out by the South Coast Air Quality Management District (i.e. Rule 403) are designed to prevent such an occurrence.

Recommendations

Taking these impacts into consideration, best management practices have the potential to reduce, but not eliminate pollutant overloading of stormwater. Given the different ways operations and construction activities can impact water quality, it is essential to consider control strategies for each. Most of these procedures represent best construction practices, are addressed in State construction permit procedures for protecting water resources¹⁵¹ and overlap

¹⁵⁴ Los Angeles County Metropolitan Transportation Authority. 2012.Final Environmental Impact Statement/Environmental Impact Report: Groundwater (p. 4-237).
http://www.metro.net/projects_studies/westside/images/final_eir-eis/Chapter%204%20Environmental%20Analysis%20-%20Part%203%20of%203.pdf

with control measures described by Metro in the Final Environmental Impact Statement/Environmental Impact Report.¹⁵⁵

1. **Strictly adhere to and State Water Board permit rules,¹⁵¹ and construction site best management practices¹⁵³ for limiting run-off, and SCAQMD Rule 403 for control of fugitive dust¹⁵²** (*Metro, SCAQMD, Water Resources Board*)
2. **Consider innovative reuse of recycled water.** Metro's Water Use and Conservation Policy calls for minimizing the use of potable water where feasible.¹⁵⁶ Recycled water is used for some Metro transit operations but there is potential to expand water conservation and re-use for both operations and construction.¹⁵⁷ New York City uses recycled water for geothermal cooling and to wash subways.¹⁵⁸ San Francisco's Transbay Terminal, to be completed in 2017, will have a green roof that will reuse recycled water.¹⁵⁹ (*Metro*)
3. **Encourage greater use of low emission construction equipment beyond the mandates set forth in Metro's Green Construction Policy.**¹⁰⁹ This not only reduces air pollution but addresses concerns about sedimentation from vehicle emissions polluting the water supply. (*Metro, SCAQMD*)
4. **Consider designs that collect runoff and allow it to infiltrate the soil (*operational phase*).** Since there will be stormwater generated at station locations after construction has been completed, Metro should consider design features, such as swales and permeable pavement, allow soil uptake of water. Such measures have the highest documented pollutant-removal efficiency, eliminating nearly all lead, zinc, and solids and more than 50% of total nitrogen and phosphorus. (*Metro, City Planning/Community Development, Public Works, Street Services, Public Works, Water Resources*)
5. **Installation of permeable pavements and trees at station locations (*operational phase*).** This allows for natural filtration and prevents overloading of the storm drain system. (*Metro, City Planning/Community Development, Public Works, Street Services, Public Works, Water Resources*)

¹⁵⁵ Los Angeles County Metropolitan Transportation Authority. 2012. Final Environmental Impact Statement/Environmental Impact Report. Section 4.11: Water Resources. http://www.metro.net/projects_studies/westside/images/final_eir-eis/Chapter%204%20Environmental%20Analysis%20-%20Part%203%20of%203.pdf

¹⁵⁶ Los Angeles County Metropolitan Transportation Authority. 2009. Water Use and Conservation Policy. http://www.metro.net/about_us/sustainability/images/Water-Use-and-Conservation-GEN-52-Policy.pdf

¹⁵⁷ Los Angeles County Metropolitan Transportation Authority. 2010. Water Action Plan. http://www.metro.net/projects_studies/sustainability/images/Water_Plan2010_0825.pdf

¹⁵⁸ Peek, K. 2010. What would you do with eight million gallons of water every day? Scienceline: Environment Blog. <http://scienceline.org/2010/02/what-would-you-do-with-eight-million-gallons-of-water-every-day/>

¹⁵⁹ Transbay Terminal Center project.... <http://www.ranacreek.com/projects/transbay-transit-center/>

NOISE AND VIBRATION

Noise and vibration are among the environmental impacts that are extensively evaluated under the National Environmental Policy Act (NEPA). In the Noise and Vibration Technical Report for the Environmental Impact Statement/Report for the Westside Subway Extension Metro thoroughly discusses the methodology and assumptions used to analyze the potential impacts from noise and vibration generated during the construction and operation of the proposed Westside Subway Extension project alternatives. In this report, however, we will primarily discuss the health impacts associated with exposure to noise and vibration, in an effort to add to the information already provided by Metro.

Health effects of noise exposure

Numerous scientific studies have demonstrated that exposure to high levels of sound can damage hearing. Exposure to continuous noise of 85–90 dBA, particularly over a lifetime in industrial settings, can lead to a progressive loss of hearing.¹⁶⁰ Prolonged exposure to noise can also cause tinnitus, a ringing, roaring, buzzing, or clicking in the ears. The American Tinnitus Association estimates that 12 million Americans suffer from this condition, with at least 1 million experiencing it to the extent that it interferes with their daily activities. Prevalence rates of hearing loss among mining and construction workers are the highest of any occupation in the U.S., 27% and 23% respectively.¹⁶¹

Noise-induced hearing impairment may be accompanied by abnormal loudness perception, distortion, and tinnitus. Tinnitus may be temporary or may become permanent after prolonged exposure.¹⁶⁰ Because hearing impairment is usually gradual, the affected worker will not notice changes in hearing ability until a large threshold shift has occurred. It is irreversible and increases in severity with continued exposure. The other consequences of noise-induced hearing loss are: social isolation, impaired communication with coworkers and family, decreased ability to monitor the work environment, increased injuries from impaired communication and isolation, anxiety, irritability, decreased self-esteem, lost productivity, and expenses for workers' compensation and hearing aids.

Exposure to noise is also associated with other health effects, such as: annoyance, disruptions in performance by school children, sleep disturbance, mood, heart rate, and ischemic heart disease. According to the WHO *Guidelines for Community Noise*, "these health effects, in turn, can lead to social handicap, reduced productivity, decreased performance in learning, absenteeism in the workplace and school, increased drug use, and accidents." Noise-related annoyance can cause sleep deprivation, which can also have negative health effects when it becomes a chronic problem. Sleep disturbance can hinder normal functions performed by sleep such as brain restoration and cardiovascular respite. It can also impact mood, fatigue, performance, cognitive

¹⁶⁰ Kryter KD. *The Effects of Noise on Man*, 2nd edn. Orlando, FL: Academic Press, 1985

¹⁶¹ Masterson EA, Tak S, Themann CL et al. 2012. Prevalence of hearing loss in the United States by industry. *Am. J. Ind. Med.* Published online 5 Jul 2012.

abilities, and can boost epinephrine levels which contribute to stress.¹⁶² Noise-related annoyance increases significantly when noise is accompanied by vibration or by low frequency components. The term annoyance does not begin to cover the wide range of negative reactions associated with noise pollution; these include anger, disappointment, dissatisfaction, withdrawal, helplessness, depression, anxiety, distraction, agitation, or exhaustion. Lack of perceived control over the noise intensifies these effects.

The effects of noise pollution on cognitive task performance have been well-studied. Noise pollution impairs task performance at school and at work, increases errors, and decreases motivation. Reading attention, problem solving, and memory are most strongly affected by noise. Two types of memory deficits have been identified under experimental conditions: recall of subject content and recall of incidental details. Both are adversely influenced by noise. Deficits in performance can lead to errors and accidents, both of which have health and economic consequences.

Even at levels below that associated with hearing loss, noise exposure has been linked to a number of other health effects. Urban environments are full of noise from roadways, aircraft and construction.^{163,164,165} Among the effects of urban noise exposure are annoyance, impaired concentration and learning, hypertension, disturbance of psychosocial well-being, and psychiatric symptoms.⁵²

Increases in blood pressure and cardiovascular begin to be seen with long-term daily exposure to noise levels above 65 dB or with acute exposure to noise levels above 80 to 85 dB.¹⁶⁶ Acute exposure to noise activates nervous and hormonal responses, leading to temporary increases in blood pressure, heart rate, and vasoconstriction. Studies of individuals exposed to occupational or environmental noise show that exposure of sufficient intensity and duration increases heart rate and peripheral resistance, increases blood pressure, increases blood viscosity and levels of blood lipids, causes shifts in electrolytes, and increases levels of epinephrine, norepinephrine, and cortisol.

Uninterrupted sleep is known to be a prerequisite for good physiologic and mental functioning in healthy individuals. Environmental noise is one of the major causes of disturbed sleep. When sleep disruption becomes chronic, the results are mood changes, decrements in performance,

¹⁶² Passchier-Vermeer W, Passchier WF 2000. Noise Exposure and Public Health. *Environ Health Perspect* 108:123-131.

¹⁶³ Jakovljevic B, Belojevic G, Paunovic K, Stojanov V. 2005. Road traffic noise and sleep disturbances in an urban population: cross-sectional study. *Croat Med J* 47:125-133.

¹⁶⁴ Moudon AV. Real noise from the urban environment: How ambient community noise affects health and what can be done about it. *Am J Prev Med* 37(2):167-171.

¹⁶⁵ Stansfeld SA, Matheson MP. Noise Pollution: non auditory effects on health. *British Med Bulletin* 68:243-257.

¹⁶⁶ Jarup L, Babisch W, Houthuijs D et al. 2008. Hypertension and exposure to noise near airports: the HYENA study. *Environmental Health Perspectives*; 116(3). Available at: <http://ehp03.niehs.nih.gov/article/fetchArticle.action?articleURI=info:doi/10.1289/ehp.10775>.

and other long-term effects on health and well-being. Much recent research has focused on noise from aircraft, roadways, and trains. It is known, for example, that continuous noise in excess of 30 dB disturbs sleep.¹⁶⁷ For intermittent noise, as in construction, the probability of being awakened increases with the number of noise events per night. Noise during sleep also causes increased blood pressure, increased heart rate, increased pulse amplitude, vasoconstriction, and changes in respiration, cardiac arrhythmias, and increased body movement. Secondary effects measured the following day include fatigue, depressed mood and well-being, and decreased performance. Decreased alertness leading to accidents, injuries, and death has also been attributed to lack of sleep and disrupted circadian rhythms. Long-term psychosocial effects have been related to nocturnal noise. Noise annoyance during the night increases total noise annoyance for the following 24 hours. Particularly sensitive groups include the elderly, shift workers, persons vulnerable to physical or mental disorders, and those with sleep disorders.

While noise pollution is not known to be a cause of mental illness, it is believed to accelerate and intensify the development of latent mental disorders. Mental health related effects of noise pollution include anxiety, stress, nervousness, nausea, headache, emotional instability, argumentativeness, and changes in mood, increase in social conflicts, neurosis, hysteria, and psychosis.¹⁶⁴ Children, the elderly, and those with underlying depression may be particularly vulnerable to these effects because they may lack adequate coping mechanisms. Children in noisy environments find the noise annoying and report a diminished quality of life. Studies also suggest that children seem to be more vulnerable than adults to noise induced hearing impairment. Children who live in noisy environments have been shown to have elevated blood pressures and elevated levels of stress-induced hormones.

Exposure to excessive noise also has adverse effects on children's learning and academic performance.¹⁶⁸ High levels of external noise can make it difficult for students to hear teachers and to concentrate. Episodic noise, such as noise from aircraft, is more strongly associated with impaired learning.¹⁶⁹ Children with learning disabilities react differently to noise than other children. Background noise has been shown to improve performance on learning tasks of children with attention deficit/hyperactivity disorder (ADHD), but worsens performance for other children.¹⁷⁰ Since the impacts of noise on learning are mediated by perception, which in turn is mediated by culture and individual learning styles, when noise is below levels that impede

¹⁶⁷ Hume K. 2010. Sleep disturbance due to noise: current issues and future research. *Noise Health*. 12(47):70-6.

¹⁶⁸ Shield BM, Dockrell JE. 2008. The effects of environmental and classroom noise on the academic attainments of primary school children. *J Acoustical Society of America*. 123(1):133-144.

¹⁶⁹ Stansfeld SA, Berglund B, Clark C et al. 2005. Aircraft and road traffic noise and children's cognition and health: a cross-national study. *Lancet*. 365(9475):1942-9.

¹⁷⁰ Söderlund G, Sikström S, Smart A. 2007. Listen to the noise: noise is beneficial for cognitive performance in ADHD. *J Child Psychol Psychiatry*. 48(8):840-7.

communication, researchers suggest participatory approaches to noise assessment and control.¹⁷¹

Occupational exposure to noise

According to NIOSH, about 30 million workers are exposed to hazardous sound levels on the job in the United States. Some industries that have a high number of workers exposed to loud sounds include construction, agriculture, mining, manufacturing, utilities, transportation, and the military. Workers in construction are exposed to noise not only from what they are doing but also from what is going on around them.

Occupational hearing loss is the most common work-related injury in the United States. Although many industries have noise exposures, construction workers are at particularly high risk. Noise levels associated with heavy construction equipment range from 80 to 120 dBA and power tools commonly used in construction produce exposures up to 115 dBA. Such exposure levels are clearly high enough to require hearing conservation efforts since noise exposure above 85 dBA is considered hazardous.

Many jobs in construction involve the use of hand-held power tools such as pneumatic breakers and disk grinders. Hand-arm vibrations, as a result of using such hand-held power tools, may cause carpal tunnel syndrome. The disease affects the fingers and hands. Over a long period of time, permanent damages to the nerve will result in a loss of the sense of touch and dexterity. Whole-body vibration can occur from operating large mobile equipment, such as drillers, air hammers, pile drivers, tractors, graders, excavators, earth-moving equipment, and other large machinery, and this musculoskeletal disorder can be debilitating for a lifetime.

Standards promulgated by the Occupational Safety and Health Administration for construction sites¹⁷² have been developed to prevent noise-induced hearing loss in most workers, but have been widely criticized as being insufficiently protective.⁵⁰ By setting lower noise thresholds, durations of permissible exposure and providing more comprehensive hearing protection programs other (non-mandatory) standards and guidelines provide more protection to workers exposed to noise, including National Institute for Occupational Safety and Health (NIOSH) Recommended Standards,¹⁷³ noise standards for construction approved by the American National Standards Institute (ANSI) and the American Society of Safety Engineers (ASSE),¹⁷⁴ and

¹⁷¹ Woolner P, Hall E. 2010. Noise in schools: a holistic approach to the issue. *Int J Environ Res Public Health*. 7(8):3255-69.

¹⁷² U.S. Dept. of Labor: Occupational Safety and Health Administration (OSHA). CFR 1926.52 Safety and Health Regulations for Construction: Occupational Noise Exposure.

<http://www.osha.gov/SLTC/noisehearingconservation/standards.html>

¹⁷³ U.S. Centers for Disease Control: National Institute for Occupational Safety and Health. 1998. Criteria for a Recommended Standard. Occupational Noise Exposure. <http://www.cdc.gov/niosh/docs/98-126/pdfs/98-126.pdf>

¹⁷⁴ American Society of Safety Engineers, American National Standards Institute. 2007. Hearing Loss Prevention for Construction and Demolition Workers.

best practices approved by the Laborers' Health and Safety Fund.¹⁷⁵ All of these are aimed at preventing noise-induced hearing loss, not necessarily other noise-related health effects, such as stress, cardiovascular effects and impaired concentration.

Community exposure to construction noise

Although community exposure to above-ground noise would be minimal, according to the DEIS/EIR, "noise and vibration impacts during construction would be adverse and significant."¹⁷⁶ This is especially a concern where ambient levels of noise are already high, since persistent noise levels, as well as vibrations, have a number of health consequences.

Impacts of construction-related noise and vibration will vary greatly depending on location. The greatest potential for exposure is in the vicinity of underground stations, tunnel access portals, and construction lay down areas, especially during the heavy construction phase. Noise from ground-level station-related activities, such as parking and passenger drop-off locations, tunnel vent discharge ducts, standby emergency generators and maintenance shops/yards, are all considered part of subway operations.

Equipment used for construction is reported to be significantly louder than ambient noise levels, with peak hour noise levels going as high as 79dBA. With each increase of 10 dBA, loudness doubles; therefore, with ambient noise levels of 70dBA, the use of a piece of equipment emitting 80dBA sounds twice as loud as background, and equipment emitting 90dBA sounds four times louder than background. Noise levels from stationary point sources decrease at a rate of 6 dB per doubling distance. Damage to hearing is cumulative and exposure limits are based on 8-hr averages. Especially in enclosed work areas, workers not using or operating equipment may be exposed to as much excessive noise as much as the operators.

Noise from construction will certainly impact sensitive groups such as children, the elderly, workers and those who are ill. According to the DEIS/EIR, there are a total of 17 identified potential noise and vibration sensitive receptors within 250 feet of the proposed alignment to the VA Hospital and an additional nine potential noise and vibration sensitive receptors within 500 feet of the proposed alignment.¹⁷⁷ These health effects are of particular concern to this project as much of the construction is taking place near residential areas and some schools. In addition, there are at least seven convalescent homes or centers along Wilshire Boulevard

¹⁷⁵ Laborer's Health and Safety Fund of North America (LHSFNA). Best Practices Guide - Controlling Noise at Construction Sites. Describes how to evaluate and control noise hazards at construction sites. Additional resources on noise are also provided. <http://www.lhsfna.org/index.cfm?objectID=F829FED8-D56F-E6FA-99A3B1B04E173AC8>

¹⁷⁶ Los Angeles County Metropolitan Transportation Authority. 2010. Westside Subway Extension DEIS/EIR: Construction and Mitigation Technical Report. Available at: <http://www.metro.net/projects/westside/draft-eis-eir-sept-2010/>

¹⁷⁷ Los Angeles County Metropolitan Transportation Authority. 2010. Westside Subway Extension DEIS/EIR: Construction and Mitigation Technical Report. Pg. 6-35. 2010. Available at: <http://www.metro.net/projects/westside/draft-eis-eir-sept-2010/>

between Western and Doheny. Based on measurement and modeling data reported in the Westside Subway Extension EIR/EIS, during subway operations noise levels in the project area will be in the range of 60-70dBa.¹⁷⁸ It is expected that majority of the properties along the project alignment currently experience ambient noise levels within this range. The less urban areas that are further away from the primary roadways along the alignment will experience lower noise levels, while areas closest to the busiest intersections will experience noise levels greater than those listed on the table.

Noise from transit activities

Subways present a special concern with respect to noise, especially older subway systems, which are obviously noisy environments. This is not only because of the many processes involved in rail transit, but also because noise is amplified in the enclosed space of the underground subway. Therefore, both passengers and subway workers may be at risk of exposure, and because of the time spent on the job, presumably workers would be at a greater risk for subway-related noise-induced hearing loss (NIHL) compared with passengers. There are many other noise reduction strategies that have been shown to reduce subway noise levels, such as improved wheel maintenance, the use of rubber wheels, seamless (not jointed) welded rails, antilock braking systems, and the use of noise dampening and noise absorption systems.

Additionally, the question of whether subways are associated with excessive exposure to noise is also difficult to assess, because data on this topic are particularly sparse. Data from a 1971 study of NYC subways noted noise levels on specific train lines ranging from 75 to 110 dB, both at the platform level and inside cars. Results from the study noted that certain subway cars, especially those manufactured prior to 1970, had higher noise levels than newer cars, and that certain subway workers were at particularly high risk, such as operators and conductors, with their rates calculated at 93–110 dB for 6–8 hours per day. Trackmen, token booth operators, and structural, power, and lighting specialists were also at risk.¹⁷⁹ Recent measurements of noise on New York City subways found noise levels on platforms and inside cars averaged about 80 dBA and were as high as 102 dbA, with the highest levels occurring when trains braked as they entered stations and when express trains passed local stops.¹⁸⁰ Peak noise levels on Bay Area Rapid Transit (BART) trains exceeded 140 dBA. The BART study researchers estimated that BART train passengers are exposed on average to 19 to 23 minutes of noise in excess of 85 dBA each day during their train trips.¹⁸¹

¹⁷⁸ Los Angeles County Metropolitan Transportation Authority. 2010. Westside Subway Extension DEIS/EIR: Construction and Mitigation Technical Report. Pp:5-17. <http://www.metro.net/projects/westside/draft-eis-eir-sept-2010/>

¹⁷⁹ Harris CM, Aitken BH. 1971. Noise in subway cars. *Sound Vibration*. February:21–24.

¹⁸⁰ Neitzel R, Gershon RRM, Zeltser M, Canton A, and Akram M. 2009. Noise Levels Associated With New York City's Mass Transit Systems. *Am J Public Health* 99(8):1393-1399.

¹⁸¹ Dinno A, Powell C, King MM. 2011. A study of riders' noise exposure on Bay Area Rapid Transit trains. *J Urban Health*. 88(1):1-13.

Recommendations

While these recommendations overlap substantially with Metro's planned control measures, their aim is to go beyond just preventing noise-induced hearing loss and community annoyance, the basis of most existing thresholds and standards,⁹ and to better prevent the whole range of stress-induced and psychosomatic health effects of noise. Mitigating noise impacts to the fullest extent feasible is especially important around facilities serving populations that are highly sensitive to the health effects of noise, including schools and day care facilities, nursing homes, hospitals and housing with large numbers of elderly.

1. **Adopt a comprehensive approach to noise control, emphasizing engineering controls** over personal noise protection.¹⁸² (See also OSHA guidelines <http://www.osha.gov/SLTC/noisehearingconservation>) (*Metro, Cal-OSHA*)
2. **Strictly enforce noise control policies with all contractors and sub-contractors.** (*Metro, Cal-OSHA*)
3. **Work with schools and other institutions serving noise-sensitive populations adjacent to construction sites and staging areas to schedule the noisiest construction operations periods during hours when it is least disruptive.** (*Metro, City Planning/Community Development, Schools*)
4. **Site construction staging areas away from areas with noise-sensitive populations** (e.g. schools, hospitals, nursing homes, high pedestrian travel) (*Metro, City Planning/Community Development, Public Works, Street Services*)
5. **Design construction traffic routes to minimize vehicle-miles, number of trips, number of people exposed to noise, esp. sensitive populations** (*Metro, City Transportation*)
6. **Mitigate unavoidable noise from construction activities to minimize workplace and community noise exposures. Routinely monitor noise levels and quickly remediate excess noise levels.** (*Metro, Cal-OSHA*)
7. **Notify community members, schools, medical facilities, workplaces and appropriate local agencies (e.g. LACDPH in unincorporated areas about construction schedules. Set-up a noise complaint hotline and put in place plans for rapid response to noise complaints.** (*Metro, City Planning/Community Development*)
8. **Use best available technology to minimize noise from subway operations in tunnels and stations.** (*Metro, Cal-OSHA*)
9. **Continue to monitor noise levels in the subway system and adopt new control technologies when feasible.** (*Metro, Cal-OSHA*)

¹⁸² National Academy of Engineering, Committee on Technology for a Quieter America. 2010. Technology for a Quieter America. Washington, D.C.: National Academies Press.
http://www.nap.edu/openbook.php?record_id=12928&page=R1

IV. Health impacts related to changes in travel

Changes in travel patterns
 Physical activity
 Mental Health
 Safety and security
 Access to health, social and other community services
 Household finances

Changes in travel patterns

With a projected ridership of over 80,000 person-trips per day, the proposed subway extension will transform travel in the Wilshire Corridor and between Downtown Los Angeles and the Westside. It will reduce travel times and improve on-time service for those who are currently traveling by bus on Wilshire Boulevard. For bicyclists it will extend the area that can be easily reached by bicycle without having to depend on buses whose bicycle racks are typically full. For those who usually travel by automobile, it will provide an alternative to automobile dependence. For everyone living in, working in or travelling through the Wilshire Corridor the proposed subway will create a more resilient transit system with more travel options. These effects on travel mode choice, mobility, connectivity and travel time have a number of health-related effects.

Physical Activity: Integration with bicycle and pedestrian networks

Tight integration of bicycle and pedestrian networks, including both “hard infrastructure” as well “soft infrastructure,” such as safety patrols, education, bike-friendly business promotions, and bike share programs, can help increase ridership and encourage physical activity across a broad spectrum of the population. Just putting in bicycle lanes and pedestrian crosswalks is unlikely to significantly increase walking and biking to access transit. These are important features, especially for improving safety for those who already walk and bike, but to shift significant numbers of people from automobiles to transit it is essential to connect destinations, not just stations. Planning for the last one-quarter, one-half or one-mile from the transit to destinations is a major part of this. Making walking and biking convenient, easy and the norm is essential for making this connection.

With sufficient amenities to improve the proposed subway’s interface with non-motorized transportation, the proposed subway could help minimize the need for automobile travel and thus reduce air pollution, congestion and greenhouse gas emissions.¹⁸³¹⁸⁴ In addition to the

¹⁸³ Southern California Association of Governments. 2008. 2008 Regional Transportation Plan: Non-motorized Transportation Report.

environmental benefits, even small increases in physical activity associated with increased non-motorized travel can also generate significant improvements in health and reduce health care costs.

Merely having a sidewalk does not mean that pedestrian access is safe or attractive. For example, a cross walk that without a traffic signal or is poorly lit can actually increase pedestrian injury risk. Similarly, a bike lane or a sign indicating the presence of a bike route will not assure that bicyclists can safely or easily access a transit station. Narrow bicycle lanes, street parking, rough or broken pavement, high volumes of vehicle traffic, high vehicle speeds, high noise and poor air quality pose significant deterrents to bicycling. Furthermore, given the underdeveloped bicycle infrastructure of the region, almost any bicycle trip will require significant amounts of travel in lanes with vehicle traffic and/or parked cars. While dedicated bicyclists and those without any other means of transportation will persist in bicycling under such conditions, bicycling will not be seen as a viable transportation alternative for most people and bicycling rates will remain low.

If improved transit is to significantly increase rates of bicycling and walking, then infrastructure needs to be in place to support walking and biking as part of an entire trip, not just in the vicinity of the station. A look at the proposed Westwood/VA subway station offers insight into this problem. There are sidewalks along Wilshire from Veteran Avenue to the VA Hospital, but freeway off-ramps and on-ramps, noise levels, refuse along the freeway underpass, and the proximity to high volumes of traffic near the intersection of Wilshire and Sepulveda Boulevards (see Figure 8), sometimes traveling at high speeds makes walking and biking dangerous. Relatively simple measures could improve access and make it significantly safer for non-motorized travelers. While motorized traffic in the immediate vicinity of Wilshire and Bonsall may not pose any undue safety hazards to pedestrians and bicyclists, significant hazards would exist for those attempting to access the station from the east and south.

Pedestrians and bicyclists accessing the station from any point east of the southbound on-ramp to the 405 Freeway from westbound Wilshire (just west of the 405 Freeway) will encounter dangerous conditions as they cross the off and on-ramps of the 405 Freeway and pass under the 405 Freeway. According to Figure 4-30 (Westwood/VA Optional Station) this area is within the walkability zone. Signals, pavement-embedded flashing lights, etc. should be put in place to facilitate safe passage for pedestrians. Although bicyclists accessing the subway from east of the 405 will probably use the Westwood station, bicyclists from the north (i.e. from Sepulveda Boulevard north of Wilshire) may attempt to access the station from along this dangerous portion of Wilshire. A satisfactory mitigation measure would be to secure agreement from the VA to guarantee bicycle access from Constitution Avenue and Sepulveda through the VA grounds and to provide good signage to indicate this safer bicycle route to the VA/Westwood station.

¹⁸⁴ Woodcock J, Edwards P, Tonne C et al. 2009. Public health benefits of strategies to reduce greenhouse-gas emissions: urban land transport. *Lancet* 374:1930-1943.



Figure 8: Intersection of Wilshire and Sepulveda Boulevards and I-405 Freeway interchange with red lines indicating areas where high speed vehicle traffic, freeway off-/on-ramps and tunnels create hazardous conditions for bicyclists and pedestrians traveling along Wilshire Boulevard. Non-annotated graphic courtesy Metro. Annotations added.

Also, problematic is pedestrian and bicycle access to the station from the south during evenings and weekends when the gate to the VA campus at Ohio and Bonsall is locked. For pedestrians coming from the high density area around Sawtelle and Ohio the extra walking distance presents a significant barrier. When the gate is closed bicyclists accessing the VA/Westwood station from this area would be forced to ride along streets, such as Federal Avenue immediately to the west, with significant hazards such as narrow lanes and parallel parked cars. A possible mitigation measure would be to provide a bicycle and pedestrian corridor through the VA campus that would be accessible even when the gate is closed to motorized vehicles.

Recommendations

1. **Assess and take steps to maximize non-motorized transportation performance:** Assure conformity with the policies and performance measures for active transportation laid out in the Southern California Association of Government's 2012-2035 Regional Transportation Plan/Sustainable Communities Strategy.²⁹ (*Metro, City Planning/Community Development, Public Works, Street Services, Southern California Association of Governments*)
2. **Assess bikeability/walkability in one-mile radius around stations:** Assess bikeability/walkability from stations to major housing centers and work, school, recreational and retail destinations within one mile of stations, including universal accessibility and public safety for

daylight and nighttime travel. Correct deficiencies. (*Metro, City Planning/Community Development, Public Works, Street Services, Police*)

3. **Assess and address barriers to bicycling to transit among women, youth and seniors:** Work with groups who might access transit by bicycle but who are currently under-represented among bicyclists, such as youth, women and seniors, to identify barriers to accessing transit by bicycle and formulating feasible actions to address these barriers. (*Metro, City Planning/Community Development, Public Works, Street Services, Police*)
4. **Add street trees to improve shade and walkability** (*see Recommendations for Parks and Greenspace*)

Mental Health

Modern American life is highly time-constrained with attendant costs to physical and mental well-being. Large portions of the American public report that they are too busy to get enough sleep, cook a meal at home, sit down to eat with their families, exercise or take a vacation (Robinson & Godbey, 2005), all activities that are associated with good health (Harrison & Horne, 1995; Eisenberg, Olson et al., 2004; Gump & Matthews, 2000; U.S. Department of Health and Human Services, 1996). As more and more time of each day is spent traveling, especially traveling by car, less time is available for individuals to engage in those things that they enjoy and that can make them healthier.

Short commute times prevent and mitigate poor mental health outcomes through community connectedness.¹⁸⁵ Residents with less auto-travel stress are more likely to know their neighbors and experience greater social capital as commute times and predictability of commutes are inversely related to stress. Longer commute times are associated with elevated salivary cortisol levels, which measure stress.¹⁸⁶ Of those who do use transit, individuals on direct, non-transfer train rides have lower stress levels compared to those who have to transfer train lines.¹⁸⁷¹⁸⁸ In a study of rail and car commuters who lived in New Jersey and worked in New York City, train commuters had significantly lower levels of stress than their counterparts who drove to work.¹⁸⁹ Thus, transit can improve service coverage, ease-of-use, providing an attractive, time-efficient alternative to automobile use, which affects levels of stress. Measures such as comfort and

¹⁸⁵ Evans, GW, Wener, R. E., Phillips, D. (2002). The morning rush hour: Predictability and commuter stress. *Environment and Behavior*, 34(4):521-530.

¹⁸⁶ Evans GW, Wener RE. (2006). Rail commuting duration and passenger stress. *Health Psychology*, 25(3):408-12.

¹⁸⁷ Wener RE, Evans GW, Lutin J. (2006). Leave the Driving to Them: Comparing Stress of Car and Train Commuters. Available at: http://www.apta.com/passenger_transport/thisweek/documents/driving_stress.pdf

¹⁸⁸ Wener RE., Evans GW, Phillips D, Nadler N. (2003). Running for the 7:45: The effects of public transit improvements on commuter stress. *Transportation*, 30:203-220.

¹⁸⁹ Wener RE, Evans GW. (2007). A morning stroll: Levels of physical activity in car and mass transit commuting duration and passenger stress. *Health Psychology*, 25(3):408-12.

perceived security in the transit system are essential for increasing use, providing stress-free travel and creating opportunities for positive social interaction.

While in certain situations time spent in public transit may be greater than time spent in the car, it is important to consider that these two are not necessarily equivalent. In particular, the time spent in the automobile in congestion and other high stress situations has been shown to be very different from the time spent during a ride that permits activities such as reading, sleeping, or working (Litman, 2006). This time can be spent on activities that would not be allowed if driving a car and should be placed in the context of the entire day.

Families are an essential resource for social connectedness.¹⁹⁰ Long commutes and limited choices, such as having to schedule work and family life schedules around long commute times, strain family connectedness. A well-functioning transit system that gives people travel choices and reduces travel time can increase discretionary time can benefit mental health by encouraging social connectedness.¹⁹¹

Recommendations: See Recommendations for Social Capital (Section V)

Travel Safety

Expanded mass transit service and utilization can result in a decrease in traffic-related injury by shifting a portion of daily trips from a more dangerous mode (e.g. automobile travel) to a safer mode of travel (e.g. bus or train). Understanding the relative safety of different modes of travel is complicated; however, by the fact that trip distance and duration, both of which affect risk exposure, also vary greatly by mode of travel. For instance, because of its longer duration, a half-mile walking trip that takes 20 minutes will have more potential exposure to injury than the same half-mile trip in an automobile that takes only two minutes. Simply comparing injury rates per unit of population is an especially biased measure since so many people in the U.S. spend so much more of their time traveling by automobile than by any other mode of travel.

Probably the least biased measure for comparing injury rates across different modes of travel is injuries per person-trip (Beck, Dellinger & O'Neill, 2007). By this measure, mass transit provides one of the safest modes of travel. According to national transportation and injury statistics, the risk of fatal injury per person-trip by bus in the U.S. is 23 times less than by car (0.4 versus 9.2 fatalities per 100 million person-trips) and the risk of non-fatal injury is five times less for bus trips compared to automobile trips (161 versus 803 per 100 million person-trips) (Beck, Dellinger & O'Neill, 2007). Thus, a shift from automobile travel to travel by transit will probably lead to an overall reduction of injury risk. Unfortunately, risk of fatal injury for pedestrians is about 50 percent higher per person trip than for persons traveling by automobile (13.7 versus 9.2 fatalities per 100 million person-trips) and about two times higher for bicycle trips (18.5 versus 9.2

¹⁹⁰ Bubolz M. (2001). Family as source, user, and builder of social capital, *Journal of Socio-Economics*, n.30.

¹⁹¹ UCLA Health Impact Assessment (2007). Health Impact Assessment of California State Funding for Mass Transit.

fatalities per 100 million person-trips) (Beck, Dellinger & O'Neill, 2007). Since every transit trip is also a pedestrian trip, some of the potential decrease in injuries resulting from a shift from automobile to transit trips may be eroded by increase in injuries incurred in the walking portion of trips. In order to minimize such risks, it is essential to implement pedestrian and bicycle safety measures along routes utilized by transit riders accessing the transit system.

Change in collision risk for other vehicles and pedestrians

Mass transit infrastructure can also affect injury rates by changing the potential interface between different types of traffic—trains, buses, trucks, cars, bicyclists and pedestrians. Traffic collision risks are particularly high where there is a mismatch between the type, size and speed of vehicles and pedestrians using common roadways. Pedestrian traffic accidents are exceedingly rare when pedestrian and vehicular traffic are completely separated. Train accidents are far more likely to occur where there is potential interface with other vehicles and pedestrians, such as at railroad crossings. Such risks can be greatly reduced by grade separation that eliminates this interface between different kinds of traffic.

In the event of a collision, risk of injury is also greater when there is a mismatch in vehicle size. William Haddon's (Haddon, 1970) conceptualization of traffic collisions and subsequent injury in terms of energy transfer has provided great insight into traffic injury prevention. Larger vehicles in motion have more momentum than smaller vehicles traveling the same speed. When a collision occurs, the kinetic energy of the colliding objects is transferred from one to another. If one of the colliding objects is smaller than the other, the instantaneous acceleration (i.e. impact) of the smaller object will be greater than for the larger object. In a collision between a large vehicle and a small vehicle, what may be experienced as a small bump for occupants in the large vehicle may be experienced as a catastrophic impact for occupants in the smaller vehicle.

When expanded mass transit results it creates interfaces for disparate types of traffic, such as at unprotected railroad crossings, then collisions and injuries may be expected to increase. However, if infrastructure is put in place that separates traffic, such as pedestrian overpasses, separate bus lanes and subways, then the likelihood of traffic collisions and injuries are likely to decrease.

Recommendations

1. **Minimum width of dual-use rapid bus lanes:** Assure that rapid bus lanes are wide enough for buses and bicycles to pass each other safely and that rules for dual use conform to international best practices. If insufficient space is available due to limited right-of-way or other design considerations, consider rerouting bike lanes off Wilshire, limiting hours of dual use to when buses are relatively less frequent, or other safety measures. (*Metro, City Planning/Community Development, Public Works, Street Services, Transportation*)
2. **Closely monitor implementation of bicycle use of rapid bus lanes,** especially around intersections and lane merge zones to track and analyze accidents and near-misses in order

to formulate corrective measures, including possible abandonment of dual use if hazardous conditions cannot be corrected. (*Metro, L.A. City Dept. of Transportation, Police*)

3. **Take a "complete streets" approach to designing transportation infrastructure around transit stations.** A project of the magnitude of the proposed subway presents an opportunity to take a more holistic approach to planning for all modes of transportation, not just motorized vehicles. (*Metro, City Planning/Community Development, Public Works, Street Services, Transportation, SCAG*)

Access to health, social and other community services

Populations who are transit-dependent also tend to be the populations with the greatest need for health and social services. Since needs are high and transportation is often a significant barrier to access, transit improvements that enhance these populations' access to health and social services can make significant improvements in health.¹⁹²

Approximately 13% of households in the City of Los Angeles do not have access to a vehicle.¹⁹³ Among households headed by an adult over 65 years of age, 23% do not have access to a vehicle. As the population overall ages over the coming decades,¹⁹⁴ the percentage of the population who do not have access to a vehicle is expected to increase. Nationwide, 21% of Americans age 65 or older do not drive and more than 50% of non-drivers stay at home partially because they lack transportation options decreasing their ability to participate in the community. They make 15 percent fewer trips to doctor, 59 percent fewer shopping trips and visits to restaurants, and 65 percent fewer trips for social, family and religious activities.¹⁹⁵ Vehicle ownership is also less common among recent immigrants,¹⁹⁶ and among the poor.¹⁹⁷ As shown in Section II, both of these groups are found in high proportions among residents of the Wilshire Corridor. For these groups and others who cannot or chose not to drive, the network of transit and paratransit services is crucial for accessing health care services.

¹⁹² Iacono M, Krizek K, El-Geneidy A. Measuring non-motorized accessibility: issues, alternatives, and execution. *Journal of Transport Geography* 2010;18:133-41

¹⁹³ American Community Survey, 3-year estimate (2008-2010) for the City of Los Angeles.

¹⁹⁴ California Department of Aging. 2007. Demographics – Facts about California's Elderly (webpage). http://www.aging.ca.gov/stats/fact_about_elderly.asp

¹⁹⁵ Bailey L. 2003. Aging Americans: Stranded Without Options. Surface Transportation Policy Project. http://www.transact.org/library/reports_html/seniors/aging.pdf

¹⁹⁶ Tal G, Handy S. 2005. The Travel Behavior of Immigrants and Race/Ethnicity Groups: An Analysis of the 2001 National Household Transportation Survey. Davis, CA: Institute of Transportation Studies. Available at: <http://repositories.cdlib.org/itsdavis/UCD-ITS-RR-05-24>

¹⁹⁷ Holtzclaw J, Clear R, Dittmar H, Goldstein D, Haas P. 2002. Location Efficiency: Neighborhood and Socio-Economic Characteristics Determine Auto Ownership and Use - Studies in Chicago, Los Angeles and San Francisco. *Transportation Planning and Technology* 25(1):1-27.

Access to Health Services

The Wilshire Corridor and adjacent areas are a regional hub of healthcare services. Among the facilities that would be directly served by the proposed subway and rapid bus service in the Wilshire Corridor are the Veterans Medical Center and UCLA Ronald Reagan Hospital in Westwood, the Century City Medical Center in Century City and the Cedars Sinai Hospital in Beverly Hills. Transit improvements would also improve access to other facilities in the area already served by existing bus and subway service, including St. John's Hospital in Santa Monica, Kaiser Permanente and Children's Hospital Los Angeles in Hollywood, and hundreds of other clinics, doctors' offices and social service agencies. While all or nearly all of these facilities have nearby transit service, decreased travel time and improved dependability resulting from transit improvements could make significant, and sometimes critical, improvements in access.

Access to health care is strongly associated with transit accessibility.¹⁹⁸ Elderly and persons with disabilities who are unable to drive are often dependent on public transit to access medical services.¹⁹⁹ For both drivers and non-drivers, transportation options provided by a robust transit system can help reduce some of the barriers to getting regular, consistent care. Difficulty in accessing public transportation to reach hospitals and clinics is often cited as a barrier to health care access. It is estimated that 3.6 million Americans miss medical care due to a lack of transportation in a given year.²⁰⁰

Those who depend most on public transportation to access care tend to be elderly, female, and poor. Homeless individuals are also at most risk of poor access to care due to the inability to reach appropriate services. A study by the Government Accountability Office (GAO) found homeless people face significant barriers to accessing appropriate care and appropriate diagnoses, even in community health centers designed to ensure access to care.²⁰¹ The lack the transportation necessary to access the clinics is one of the barriers homeless individuals face and can prohibit getting the necessary long term care for chronic health conditions. Homeless individuals have high rates serious medical problems,²⁰² yet do not use the level of medical services required to match their health needs.²⁰³ Approximately 43% of homeless people in the

¹⁹⁸ LaMondia JL, Blackmar CE, Bhat CR. Comparing transit accessibility measures: a case study of access to healthcare facilities. Available at: <http://www.ce.utexas.edu/prof/bhat/ABSTRACTS/ComparingAccessibility.pdf>

¹⁹⁹ The Future of Disability in America.

Institute of Medicine (US) Committee on Disability in America; Field MJ, Jette AM, editors.

Washington (DC): National Academies Press (US); 2007.

²⁰⁰ Transit Cooperative Research Program, Transportation Research Board of the National Academies. 2005. Cost Benefit Analysis of Providing Non-Emergency Medical Transportation, TCRP Web-Only Document 29 (Project B-27). http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_webdoc_29.pdf

²⁰¹ U.S. General Accounting Office. Homelessness: Barriers to Using Mainstream Programs, Appendix V. July 2000.

²⁰² Gelberg L, Linn LS. 1988. Social and physical health of homeless adults previously treated for mental health problems. *Hosp Community Psychiatry*. 1988 May;39(5):510-6.

²⁰³ Stein JA, Andersen R, Gelberg L. Applying the Gelberg-Andersen behavioral model for vulnerable populations to health services utilization in homeless women. *J Health Psychol*. 2007 Sep;12(5):791-804.

United States have either a mental health or a substance use problem, and 23% a concurrent mental health and substance use problems.²⁰⁴ Among the homeless chronic medical conditions, including hypertension and diabetes, are often poorly controlled. Access to regular care is especially critical in the case of mental health care. Other special needs occur from the hazards of living in harsh conditions, such as injuries, skin problems, and infectious diseases, including tuberculosis, HIV, hepatitis, and sexually transmitted diseases.²⁰⁵

Furthermore, homeless veterans constitute a substantial proportion of the homeless population. Somewhere between 32 to 47% of homeless men have served in the armed forces.²⁰⁶ Homeless veterans require special care, especially those who have been physically injured, as injuries exert not only trauma to the physical body but also are associated with poor mental health and alcohol abuse²⁰⁷. Numerous VA programs have been initiated specifically to target homeless veterans. The VA system is among the largest providers of public mental health care in the United States²⁰⁸. The VA Greater Los Angeles (GLA) Healthcare System is the largest, most complex healthcare system within the Department of Veterans Affairs. GLA has three ambulatory care centers, a tertiary care facility and 10 community based outpatient clinics. There are 1.4 million veterans in the GLA service area.

Recommendations

1. **Plan for universal accessibility**, not just in stations, but around stations and to major destinations, as well. Consider complete routes that mobility- and vision-impaired transit riders are likely to use. (*Metro, City Planning/Community Development, Public Works, Street Services, Transportation*)
2. **Provide space for paratransit and hospital shuttle drop-off/pick-up** adjacent to stations. Even if a scheduled bus route connects a Metro station and a hospital, waiting time, crowding on buses, long travel times and other factors may make bus connections infeasible and inconvenient for some patients who nonetheless are able to take the subway. A

²⁰⁴ Hwang SW, Tolomiczenko G, Kouyoumdjian FG, Garner RE. 2005. Interventions to improve the health of the homeless: a systematic review. *Am J Prev Med.* 2005 Nov;29(4):311-9.

²⁰⁵ Baggett TP, O'Connell JJ, Singer DE, Rigotti NA. The unmet health care needs of homeless adults: a national study. *Am J Public Health.* 2010 Jul;100(7):1326-33. Epub 2010 May 13.

²⁰⁶ Rosenheck R, Frisman L, Chung AM. The proportion of veterans among homeless men. *Am J Public Health.* 1994;84: 466-9.

²⁰⁷ O'Toole TP, Gibbon JL, Hanusa BH, Fine MJ. Utilization of health care services among subgroups of homeless and housed poor. *J Health Polit Policy Law.* 1999;24: 91-114.

²⁰⁸ Gamache G, Rosenheck R, Tessler R. Factors predicting choice of provider among homeless veterans with mental illness. *Psychiatr Serv.* 2000;51:1024-8.

universally accessible loading/unloading zone adjacent to the station can provide a crucial link in connectivity for these individuals and improve their independent mobility.²⁰⁹ (*Metro*)

3. **Provide transit schedules and maps** to local hospitals and medical centers, along with training to enable staff and volunteers to assist patients with transit trip planning. Providing training on-line with interactive components would be a cost-effective approach. (*Metro*)
4. **Provide and maintain LED displays at all transit stops** providing transit riders with expected arrival and travel times for buses and trains. In addition, to passive displays, currently used in Metro rail stations and at Metro rapid bus stops, provide simple-to-use, self-service kiosks where transit riders can get up-to-the-minute estimates of travel times to destinations. Uncertain waiting times are stressful for all transit passengers, but they are especially critical for riders traveling to medical appointments and other occasional users. (*Metro, City Public Works, Street Services*)

Household Finances

A well-functioning transit system has the potential to improve household finances by improving access to jobs and reducing household expenditures on transportation. For communities and the region, improved transit systems have the potential to improve economic efficiencies, stimulate economic growth and make an area more attractive for economic investments.

Lowering household transportation expenditures can free up household resources for other uses. For middle and upper income households, this might mean additional funds for discretionary items and savings and fewer constraints on housing choices. For lower income households, reduced transportation costs can free up funds for essential products and services and for improved housing, and it may expand employment options for workers by increasing their feasible commuting distance.²¹⁰

The high cost of housing, the only single household expense greater than transportation, is a major factor driving transportation costs. Combined housing and transportation costs comprise an average of 52 percent of Americans' household expenses.²¹¹ In order to make ends meet, families are often forced into choosing between paying more for housing and less for transportation, or more for transportation and less for transportation.^{211,212} Car ownership might

²⁰⁹ Koffman D, Weiner R, Pfeiffer A, Chapman S. 2010. Funding the transportation needs of an aging population. American Public Transportation Association. <http://libraryarchives.metro.net/DPGTL/harvested/ocm427915575.pdf>

²¹⁰ California Energy Commission, 2006. Spring 2006 petroleum fuels price spike report to the Governor. Available at <http://www.energy.ca.gov/2006publications/CEC-600-2006-012/CEC-600-2006-012.pdf>

²¹¹ Surface Transportation Policy Project (STPP). 2003. Transportation Costs and the American Dream: Why a Lack of Transportation Choices Strains the Family Budget and Hinders Home Ownership (summary). (5 pp.) Available at: http://www.transact.org/library/decoder/american_dream.pdf

²¹² Lipman BJ. 2006. A heavy load: The Combined Housing and Transportation Burdens of Working Families. Washington, DC: The Center for Housing Policy. Available at: http://www.nhc.org/pdf/pub_heavy_load_10_06.pdf

enable a family to live in less expensive housing in a distant, less accessible place but they end up paying more in terms of commuting time and transportation costs (not to mention higher environmental externalities such as air pollution and loss of agricultural land).

Housing costs can also accelerate trends towards more sprawling, periurban development. In their search for lower cost housing, people look further and further out from established commercial and residential centers, trading housing costs for transportation costs.²¹² This stimulates demand for new low cost housing, leading to more sprawl.

The health status of individuals is clearly associated with income and socio-economic status.²¹³ Poorer people die sooner,^{214, 215, 216} have higher rates of morbidity associated with diseases such as asthma,²¹⁷ have higher rates of depressive symptoms, and have poorer self-rated health.²¹⁸ The mechanism and components of economic status that explain these effects are still, however, the matter of much debate.²¹³ It is by no means certain that additional income will lead to improved health. Most of the research evidence suggests that a marginal change in income is likely to have a larger effect on the well-being of the poor than on the more affluent.²¹³

The effects of transit utilization on household finance

Transit systems have the potential to benefit household budgets in two ways—increasing earnings by providing better access to a broader choice of jobs²¹⁹ and reducing the burden of automobile-related expenditures.²¹¹ The evidence supporting these suppositions is mixed and is likely to be affected by local conditions.

Transportation costs comprise a substantial share of Americans' household expenses—on average 20 percent of household expenses. Only housing comprises a larger share of household expenses. Much of this expense is related to the high cost of owning, maintaining and operating automobiles.^{220, 211}

²¹³ Adler NE, Newman K. 2002. Socioeconomic disparities in health: Pathways and policies. *Health Affairs* 21:60-76.

²¹⁴ Rogot E, Sorlie PD, Johnson NJ. 1992. Life expectancy by employment status, income, and education in the National Longitudinal Mortality Study. *Public Health Reports* 107:457-61.

²¹⁵ Backlund E, Sorlie PD, Johnson NJ. 1999. A comparison of the relationships of education and income with mortality: the national longitudinal mortality study. *Social Science & Medicine* 49:1373-1384.

²¹⁶ Wood E, Sallar AM, Schechter MT, Hogg RS. 1999. Social inequalities in male mortality amenable to medical intervention in British Columbia. *SocSocSciSoc Sci Med* 48:1751-8.

²¹⁷ Weitzman M, Gortmaker SL, Sobol AM, Perrin JM. 1992. Recent trends in the prevalence and severity of childhood asthma. *JAMA* 268:2673-7.

²¹⁸ Ettner S, 1996. New evidence on the relationship between income and health. *J Health Economics* 15: 67-85.

²¹⁹ Taylor BD, Samples K. 2002. Jobs, jobs, jobs: Political perceptions, economic reality, and capital bias in U.S. transit subsidy policy. *Public Works Management & Policy*, 6:250-263.

²²⁰ U.S. Bureau of Transportation Statistics. 2003. Commuting Expenses: Disparity for the Working Poor, BTS Issue Brief, No. 1. March 2003. Available at http://www.bts.gov/publications/issue_brief/01/index.html

According to the 2001 American Household Survey, American households spent an average of \$7,233 each year to own and operate their cars and trucks, including costs of vehicle purchase, maintenance, fuel, motor oil, and insurance.²¹¹ While not having any car saves the greatest amount, this is not a viable alternative for most families. Still, owning fewer vehicles, driving them less and using transit more can still yield considerable savings. Households that own at least two vehicles and rarely use transit spend 19 percent of their income on transportation. Households that own one vehicle or less and do not use transit spend 16 percent of their income on transportation. But, households who own one vehicle or less and have above average transit use spend on average only 10 percent of their incomes on transportation.²²¹ Considering only the marginal costs of commuting to work (i.e. extra fuel, maintenance and parking costs, and excluding vehicle purchase and basic automobile insurance costs), workers commuting by private vehicle spent an average of \$1,280 in 1999, compared to workers using public transit who spent an average of \$765.²²⁰

The burden of transportation costs hits the poor especially hard. The poorest 20 percent of American households, those earning less than \$13,908 per year after taxes, spend 40.2 percent of their income on transportation.²¹¹ And, the proportion of their income that the poor pay for transportation is growing. Between 1992 and 2000, transportation expenses increased 36.5 percent for households earning less than \$20,000 per year, 57 percent for households earning from 5,000 to \$9,999, but only 16 percent for households with incomes of \$70,000 and above.²²²

Present Conditions in California: Effects of transportation expenses on household budgets

Transportation costs are currently the fastest increasing category of household expenses,²²³ burdening household budgets and the overall economy. Over the past decade annual household expenditures for gasoline have more than doubled nationwide from \$1291 in 2000 to \$2832 in 2011.²²⁴ Punctuating the overall upward trend, sudden spikes in gasoline prices have hit drivers particularly hard. A surge in prices in 2004 forced Californians to spend an average of \$361 more per household (\$4.28 billion statewide) in 2004 than in 2003 (Center for Neighborhood Technology & the Surface Transportation Policy Project, 2005). A sharp surge in gasoline prices in May 2006 cost Californians an additional \$1.3 billion for gasoline for the three-month period from May through July 2006 based on same-week 2005 versus 2006 gasoline prices.²¹⁰ Transit has the potential to mitigate these impacts on household budgets, but only

²²¹ Center for Neighborhood Technology and the Surface Transportation Policy Project. 2005. Driven to spend: Pumping Dollars out of Our Households and Communities. Available at: http://www.transact.org/library/reports_pdfs/driven_to_spend/Driven_to_Spend_Report.pdf

²²² Sanchez TW, Stolz R, Ma JS. 2003. Moving to Equity: Addressing Inequitable Effects of Transportation Policies on Minorities. Cambridge, MA: The Civil Rights Project at Harvard University. Available at: <http://www.civilrightsproject.harvard.edu/research/transportation/MovingtoEquity.pdf>

²²³ U.S. Department of Labor. 2012. Consumer Expenditures, 2011 (webpage). <http://www.bls.gov/news.release/cesan.nr0.htm>

²²⁴ Consumer Federation of America. Gasoline prices and expenditures in 2011.... <http://www.consumerfed.org/pdfs/Gasoline-Prices-and-Expenditures-Report-3-16-11.pdf>

when there is a well-developed network of transit that provides needed connections between home, work, school, shopping and recreation without excessively long travel times.

How a well-developed transit system can ease the burden of transportation costs is illustrated by a comparison of transportation costs in San Francisco and Los Angeles during the 2004 spike in gasoline prices. During that year households in the Greater San Francisco metropolitan statistical area (MSA), where, according to the American Community Survey, 13.7% of workers commuted to work by transit in 2005, saw their annual gasoline and motor oil expenses go up an average of about \$100, while in the Greater Los Angeles MSA, where 5.7% of workers commuted to work by transit, the average annual household expenditure increased by \$400 for the same time period.²¹⁰

Recommendations

Since automobile travel is so expensive relative to transit travel, recommendations for easing the burden of transportation costs center on making it easier and cheaper to access and use transit without using an automobile as part these trips. While automobile travel will continue to be the predominant mode of travel throughout the region for the foreseeable future and will be necessary for many trips within the Wilshire Corridor, there are opportunities to make transit more attractive and restructure indirect subsidies and other incentives so that they favor travel by transit, foot and bike rather than by automobile.

1. **Modify fare structure** so that transit-dependent populations who access the subway via bus instead of car are not penalized (i.e. count bus+subway trip as a single trip rather than multiple trips). (*Metro*)
2. **Parking occupancy tax.** Consider a parking tax surcharge in transit/pedestrian-oriented development areas to encourage and support automobile-free travel and partially capture the external costs of automobile travel. (*City Planning/Community Development, Public Works, Street Services, City Office of Finance*)
3. **More free transit days** on holidays and during special events to encourage automobile commuters to try the subway. (*Metro*)
4. **Adopt plans to easily expand bicycle locker space** at subway stations as demand increases. (*Metro*)
5. **Create pedestrian and bicycle-friendly business districts around subway stations and other transit hubs** (*Metro, City Planning/Community Development, Community Development, Los Angeles County Department of Public Health, LA County Bicycle Coalition, local business associations*)
6. **Integrate bicycle service/bicycle valet (e.g. BikeStation) into TOD designs** (*Metro, City Planning/Community Development, LA County Bicycle Coalition, local business associations*)

V. Health impacts related to changes in land-use

Coordination of transportation and land-use decisions

Housing

Parks, Community Services and Facilities

Retail Food Environment

Community/Neighborhood Social Capital

Coordination of transportation and land-use decisions

A successful transportation system can be an important lever in dealing with the challenges of urban housing availability.²²⁵ Such a system is not solely about moving people from one place to another. It is part of a coordinated approach to community planning that also provides employment and other economic opportunities, improved availability and affordability of housing, social, cultural and recreational amenities, an efficient and equitable geographic distribution of different land-uses.^{226,227} For the individual, the community and the region decisions about housing, employment and transportation are intertwined. Each is influenced by and influences by the other. Decisions about transit infrastructure in the Wilshire Corridor have the potential to affect the availability and accessibility of housing, employment, retail, recreation and health and social services. To improve the quality-of-life of area residents and to effectively address the problems that the proposed transit improvements are trying to address will require coordinating public policy decisions on transportation with land-use, housing, economic development and other sectors.

Transit projects, such as the proposed subway, potentially impact housing and land-use development in three ways: (1) direct, physical impacts, such as noise and vibration, on structures and their occupants related to transit construction and operations, (2) redistributing and changing the level of demand for housing and employment centers in certain areas by changing commuting modes, times and routes, and (3) creating redevelopment opportunities for commercial uses, housing and employment centers, especially near transit stations. Direct impacts of the proposed transit projects on the physical environment are addressed in Section III. This section will focus on secondary changes that occur as a result of longer term, planned and unplanned effects in land-use driven by policy decisions and social and economic conditions. Since changes to bus lanes are unlikely to be of sufficient magnitude to change economic conditions or land-use in the project area, this section will focus on health-related impacts tied to the proposed subway project.

²²⁵ Kneich R, Pollack M. 2010. Making Affordable Housing at Transit a Reality: Best Practices in Transit Agency Joint Development. <http://www.reconnectingamerica.org/assets/Uploads/2010TransitAgencyJointDevelopment.pdf>

²²⁶ Belzer D, Autler G. 2002. Countering sprawl with transit-oriented development. Issues in Science and Technology (online). <http://www.issues.org/19.1/belzer.htm>

²²⁷ PolicyLink. 2008. Equitable development toolkit. What is transit-oriented development?

http://www.policylink.org/atf/cf/%7B97c6d565-bb43-406d-a6d5-eca3bbf35af0%7D/TODTOOL_FINAL.PDF

Housing

Nexus with health

Housing quality, affordability and location affects people's health in a myriad of ways. Sub-standard housing is associated with increased risk of childhood lead poisoning, injuries, respiratory diseases such as asthma, and quality of life issues.²²⁸ High housing prices relative to local prevailing wages may force people to live in sub-standard housing and decrease incentives for owners to keep rental housing up to current standards. Lack of affordable, quality housing close to employment centers may force workers into longer commutes, which negatively affects health through decreased social capital in residential communities, decreased physical activity and higher levels of stress.^{229,230,231,232}

Housing conditions

The effects of housing conditions on health, including building materials and the age and maintenance of structures, have been well documented.²³³ Housing residents may be exposed to a wide array of toxins in the indoor environment such as indoor pollutants, asbestos, carbon monoxide, radon, lead, molds and volatile organic chemicals. Poor insulation makes housing cold and damp. Poor housing conditions are also associated with rodent and insect infestation, hazardous structures, and noise. At the community level, areas with poor housing conditions are typically associated with such as overcrowding, crime, lack of social cohesion and lack of availability and accessibility of health services, parks, and healthy foods.

The proposed project may affect housing conditions if it changes incentives for owners to maintain and update housing stock. A large body of research has shown that rail stations

²²⁸ U.S. Centers for Disease Control and Prevention. 2012. Healthy Homes (webpage).

<http://www.cdc.gov/healthyplaces/newhealthyhomes.htm>

²²⁹ Arigoni D. 2001. Affordable Housing and Smart Growth: Making the Connection. Smart Growth Network and National Neighborhood Coalition. http://www.smartgrowth.org/pdf/epa_ah-sg.pdf

²³⁰ Christian TJ. 2009. Opportunity Costs Surrounding Exercise and Dietary Behaviors: Quantifying Trade-offs Between Commuting Time and Health-Related Activities. Social Science Research Network (working paper). <http://ssrn.com/abstract=1490117>

²³¹ Gallup. 2010. Wellbeing Lower Among Workers With Long Commutes: Back pain, fatigue, worry all increase with time spent commuting. Gallup-Healthways Well-being Survey. <http://www.gallup.com/poll/142142/wellbeing-lower-among-workers-long-commutes.aspx>

²³² Lopez-Zetina J, Lee H, Friis R. 2006. The link between obesity and the built environment. Evidence from an ecological analysis of obesity and vehicle miles of travel in California. *Health Place* 12(4):656-64.

²³³ Bonnefoy XE, Annesi-Maesano I, Aznar LM et al. 2004. Review of evidence on housing and health. Background document to the Fourth Ministerial Conference on Environment and Health, Budapest, Hungary, June 23-25, 2004. www.euro.who.int/document/HOH/ebackdoc01.pdf

generally have a positive effect on nearby property values,²³⁴ although this may depend on local conditions and may differ somewhat between suburban and urban settings. In Los Angeles property values have increased around Metro's light rail stations.²³⁵ Unless countervailing policies are put in place, new subway stations are likely to increase property values and create conditions that will reduce the local availability of affordable housing. Other potential changes in housing conditions are less obvious and less consistent. In some cases anticipated increases in property values and improved sales prospects may incentivize owners to invest more in upkeep in order to maximize sale prices. On the other hand, anticipation of property price increases could attract speculators who fail to invest in properties while they hold them until prices peak. Given the wide array of effects on the quantity and quality of affordable housing, plans to simply stabilize the number of low income housing units are unlikely to be enough to protect the interests of low income renters. Housing and other agencies need to be attentive to potential declines in property upkeep and tenants need to be especially well informed of their rights in neighborhoods where transit projects are causing rapid changes in property values.

Housing Affordability

Forty-nine percent of workers in the city of Los Angeles earn less than \$25,000/year and 76% of workers in the city of Los Angeles earn less than \$50,000/year.²³⁶ Nearly 30% of residents in some neighborhoods in the project area live below the federal poverty level (see Table 2, Section II). Median housing costs in several of these neighborhoods are estimated to exceed 45% of median household income.²³⁷

The economic hardships imposed on households by high housing costs have negative health effects, particularly on lower income families. When housing costs are high:

- Families have less money to spend on healthy food, medical care and other health-related goods and services;
- Families are subject to more stress and disruption in education and health care as a result of unwanted moves;
- Families are more likely to have to choose housing that is poorer quality, insufficient in

²³⁴ Robert Cervero, Christopher Ferrell and Steven Murphy, *Transit Oriented Development and Joint Development in the United States: A Literature Review*, (Washington, D.C.: Transportation Research Board, Transit Cooperative Research Program: Research Results Digest, 2002): 52. http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rrd_52.pdf

²³⁵ Ryan J. 2012. *Gold Line Mine? - Los Angeles Business Journal: Special Report Real Estate Quarterly*, April 16, 2012. <http://www.foothillextension.org/news/headlines/special-report-real-estate-quarterly-gold-line-mine-los-angeles-business-jo/>

²³⁶ (US Census Bureau, 2005-2007 American Community Survey, table B20001). Reported in Housing LA. *Income Distribution of Workers in the City of Los Angeles*. <http://www.housingla.org>

²³⁷ Center of Neighborhood Technology. *H+T Affordability Index* (website), based on American Community Survey Data from 2009 5-Year estimates. <http://htaindex.cnt.org>. Accessed October 21, 2012.

size and/or in less safe neighborhoods.²³⁸

Mixed Income Housing

Mixed-income housing developments are comprised of housing units with differing levels of affordability, typically with some market-rate housing and some housing that is available to low-income occupants below market-rate. Mixed income housing is an important mitigation strategy for this project, given that it includes housing units for very low-income and low-income families. Developing mixed-income housing has been identified as one of the priorities for the City of Los Angeles. Mayor Villaraigosa recently created a \$100 million Housing Trust Fund to create more affordable units.

Mixed-income housing has shown to work in helping households out of poverty. In the Moving to Opportunity (MTO) demonstration in 1994 that included Los Angeles among five other cities, families living in some of the nation's poorest, highest-crime communities and used housing subsidies had a chance to move to lower-poverty neighborhoods. Parents who moved to low-poverty neighborhoods reported significantly less distress than parents who remained in high-poverty neighborhoods. Children who moved to less poor neighborhoods reported significantly fewer anxious/depressive and dependency problems than did children who stayed in public housing.²³⁹

There have been mixed-income development successes in the Los Angeles region. One such project is the Working Artists project in Ventura, which combines luxury market rate ownership units with low-income rental spaces. The Southern California Association of Governments (SCAG) has asserted that to attract market-rate tenants and minimize vacancy losses, sponsors of mixed-income housing could perhaps need to invest more resources in construction and maintenance than they would if their housing were occupied solely by poor households.²⁴⁰ Moderate- and middle-income households may be more interested in mixed-income developments if housing offers high-quality amenities—for example, architectural details, better appliances, landscaping, and services.

Gentrification and displacement

²³⁸ Cohen R. 2011. The Impacts of Affordable Housing on Health: A Research Summary. National Housing Conference and the Center for Housing Policy.
http://www.nhc.org/media/files/Insights_HousingAndHealthBrief.pdf

²³⁹ Leventhal T, Brooks-Gunn J. Moving to opportunity: an experimental study of neighborhood effects on mental health. *Am J Public Health*. 2003 Sep;93(9):1576-82.

²⁴⁰ Southern California Association of Governments. 2008. Workforce housing study: Westside subregion, November 2008. http://www.scag.ca.gov/Housing/pdfs/trends/WestsideWorkforceHousingStudy_111908.pdf

What is seen as community improvement and revitalization to some may be seen by others as gentrification²⁴¹ that excludes current low income residents, often with racial overtones.²⁴² While increased property values have valuable economic, fiscal and social benefits for local communities, community redevelopment efforts can displace low-income households as the neighborhood becomes increasingly unaffordable. As a result of increased property values, increased property tax revenue collections can enable cities, counties and the state to provide improved services, although under California's Proposition 13 increases in property tax for both residential and commercial property are limited to 2% per year unless a property is sold, ownership is transferred or a new structure is built.²⁴³ By bringing in new, successful retail businesses, redevelopment also tends to increase sales tax revenue, which is especially important for local government. These increases in revenue set off a cascade of improvements in public services, from police protection, road maintenance, to local public school education.

The problem is that indigent dwellers in these areas are often displaced from their neighborhoods, or even made homeless, and are not able to reap the benefits of the redevelopment. As property values rise, there are likely corresponding increases in rents for rental housing, as well as conversions from rental housing to more upscale housing types such as luxury rental apartments and condominiums. The loss of affordability is a significant concern in urban areas such as Los Angeles. According to the report, *Affordability Matters*, (Livable Places 2008),²⁴⁴ the Westside of the City of Los Angeles experienced a net loss of affordable housing units between 1998 and 2005, while at the same time a significant number of households experienced overcrowding and over-paying for rent. Apart from displacement, gentrification also leads to the depletion of neighborhood social capital and identity (Atkinson, 2000; Shaw, 2005; Davidson, 2008).

Jobs/Housing Mismatch

At the western edge of the project area, West Los Angeles is a major regional employment center, but housing, especially affordable housing, is in short supply. The number of jobs on the Westside exceeds the number of working age adults by 60%.²⁴⁰ Even if more housing were available, it is unlikely that many of the workers commuting into the area would be able to afford this housing. In West Los Angeles housing prices per square-foot are two to three times

²⁴¹ Little Tokyo Service Center and A3PCON Equitable Development Task Force. 2006. *Gentrification and Equitable Development in Los Angeles' Asian Pacific American Ethnic Enclaves*. (p. 18)

http://www.apanet.org/documents/Gentrification_in_APA_Enclaves.pdf

²⁴² Kennedy M, Leonard P. 2001. *Dealing with Neighborhood Change. A Primer on Gentrification and Policy Choices*. A Discussion Paper Prepared for The Brookings Institution Center on Urban and Metropolitan Policy. <http://www.brookings.edu/~media/research/files/reports/2001/4/metropolitanpolicy/gentrification.pdf>

²⁴³ California State Board of Equalization. *California Property Tax Propositions – Frequently Asked Questions*. (webpage) <http://www.boe.ca.gov/proptaxes/faqs/caproptaxprop.htm>

²⁴⁴ Livable Places. 2008. *Affordability Matters*. Available at: <http://www.livableplaces.org/files/Affordability+Matters+Final+1.pdf>

higher than the median price for the rest of the city.²⁴⁵

Faced with high housing prices in areas where there are more jobs, lower and middle income families are forced to commute to lower cost housing areas on the periphery, trading housing costs for transportation costs.^{246,247} Due to the sprawling nature of the Los Angeles region and the lack of a well-developed transit network, the decision to live in less expensive outlying areas necessitates car ownership. A car might enable a family to live in less expensive housing in a distant, less accessible place but they end up paying more in terms of commuting time and transportation costs. In addition to the costs borne by households, commuting longer distances to more affordable housing creates external costs in terms of traffic congestion, air pollution, loss of agricultural land for new housing developments in outlying areas, and difficult-to-measure erosion of the quality and quantity of social networks as people spend more time commuting and less time engaged in family and community activities.

Housing costs can also accelerate trends towards more urban sprawl. Demand for lower cost housing creates demand and provides an incentive for developers to locate new housing further out from the urban center. This suggests that the relationship between transportation and housing expenses is strongly mediated by patterns of development.

While transit projects and supporting policies in the Wilshire Corridor and will not solve regional issues around housing affordability and sprawl caused by the jobs/housing mismatch, there are some actions that can be taken to make the project part of the solution, rather than part of the problem, and most importantly for health, to help address the needs of low income households.

Transit-oriented development

Transit oriented development (TOD) has been identified as a regional priority to encourage transit use, reduce vehicle trips and congestion, catalyze economic development, minimize sprawl and encourage more efficient land-use.^{248,249} The Wilshire Corridor already has considerable high density commercial, residential and mixed use development, however there is ample opportunity for in-fill of vacant buildings and parcels, renovation and better integration with transit and current community needs.

²⁴⁵ Zillow.com. Los Angeles Home Prices and Home Values (Median sale prices/sqsqsqft), Sept. 2012.

²⁴⁶ Center for Neighborhood Technology/Surface Transportation Policy Project. 2005. Driven to Spend: Pumping Dollars out of Our Households and Communities. http://www.transact.org/library/reports_pdfs/driven_to_spend/driven_to_spend_report.pdf

²⁴⁷ Lipman BA. 2006 A Heavy Load: The Combined Housing and Transportation Burdens of Working Families. Center for Housing Policy, October 2006. http://www.nhc.org/media/documents/pub_heavy_load_10_06.pdf

²⁴⁸ Southern California Association of Governments. 2004. Southern California Compass: Growth Vision Report. <http://www.compassblueprint.org/files/scag-growthvision2004.pdf>

²⁴⁹ Southern California Association of Governments. 2012. 2012-2035 Regional Transportation Plan/Sustainable Communities Strategy. <http://rtpscscs.scag.ca.gov/Pages/2012-2035-RTP-SCS.aspx>

A TOD is a mixed-use residential or commercial area designed to maximize access to public transport, and often incorporates features to encourage transit ridership. A TOD typically has a center with a transit station, surrounded by high-density residential development, often with space for retail and services at street-level. There have been successful TODs at Metro subway locations, for example the stations at Wilshire/Vermont and Hollywood/Highland. TOD is one of the major development opportunities along the transit line. As reported in the DEIS/EIR, SCAG forecasts substantial growth for 2035 at many stations, with the highest growth projected to occur near the Wilshire/Fairfax, Wilshire/Rodeo, and Westwood/UCLA.

TOD has the potential to introduce a number of benefits to households and communities (Center for Transit-Oriented Development, 2010). One of the primary objectives of TODs is to encourage economic growth by improving access by linking residents and employment centers. They have the potential to reduce the costs of transportation and housing again by bringing employees closer to their workplaces. They can reduce the costs for public infrastructure by encouraging development in areas with existing networks that efficiently link residents with employment, thus reducing the level of urban sprawl. TODs can significantly reduce the need for cars to reach employment and commercial destinations thereby reducing air pollution stemming from vehicular traffic. And, TOD's orientation on improving walkability and bikability improves the level of physical activity among residents as well as visitors. Improvements in job access, cleaner air, and physical activity that are a result of TOD have the potential to yield valuable health benefits, such as improved cardiovascular health, reductions in overweight/obesity, improved mental health and quality of life.

By providing a stimulus for new housing development, such as TODs, that are made to be affordable and accessible to low-income households, the project can improve housing conditions for this population. These benefits will be realized, however, only if specific policies are put in place to assure that housing is truly affordable and available to current low income residents. Without such policies in place, market conditions tend to favor development geared to more affluent tenants, displacing current residents. Policies to support TODs with mixed-income housing can make these developments economically viable while at the same time improving the housing conditions of low income residents.²²⁵

A well planned TOD can also help the transit system achieve its goal of reducing the number of trips taken by automobile. Since lower income individuals are more likely to use transit, a TOD with the right mix of affordable housing, retail and services will increase transit patronage and farebox revenue, making the transit system more efficient and economically sustainable.^{250,251} Reduced vehicle trips and improved co-location of housing, employment, retail and services will in turn increase the likelihood that the full health benefits of transit are realized.

²⁵⁰ Hendricks, S J, Winters, P Wambalaba, F Barbeau, S Catala, M and Thomas, K (2005) Impacts of Transit Oriented Development on Public Transportation Ridership. Florida: Centre for Urban Transportation Research

²⁵¹ Hale C, Charles P. Making the most of transit oriented development opportunities. Proceedings of the 29th Australasian Transport Research Forum 2006 (ATRF06). The Australasian Transport Research Forum

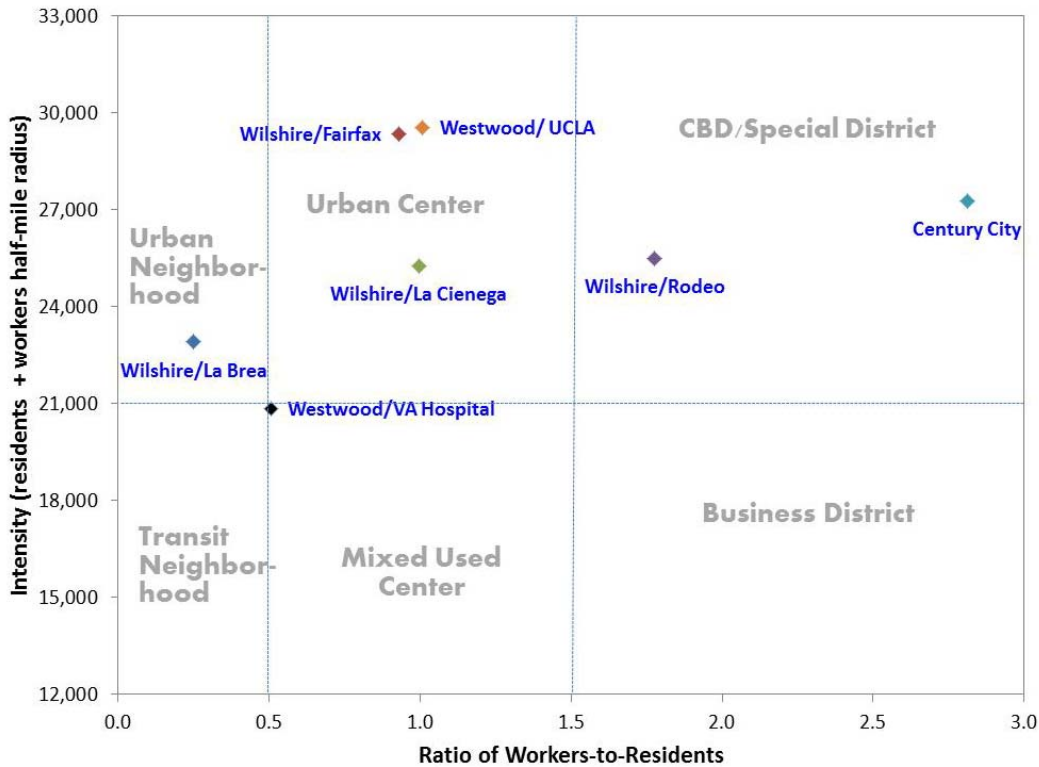


Figure 9: TOD-related characteristics of areas within 1/2-mile of proposed subway stations plotted on “TOD typology matrix”(Center for Transit-Oriented Development http://latod.reconnectingamerica.org/typology_matrix_explanation)

*Recommendations*²⁵²

1. **Provide affordable housing:** Maintain or expand the amount of affordable housing, including mixed income housing in TOD developments. Mechanisms identified by the U.S. General Accounting Office for incentivizing and financing affordable housing include:²⁵³
 - a. Density bonus permits allowing building housing units in excess of current zoning limits if a certain number of units are priced at a specified level below market rates;
 - b. Parking reductions to ease minimum parking requirements in lieu of additional affordable housing units;
 - c. Tax increment financing to subsidize affordable housing units using revenues from sales of municipal bonds tied to incremental future tax increases;

²⁵² Recommendations include actions of many agencies, not just Metro. This broad scope is in accord with guidance from the federal Council on Environmental Quality (NEPA 40 FAQs, #19b) that requires agencies preparing NEPA environmental reviews to identify all potentially viable mitigation measures, not only the ones that the lead agency has authority to implement.

²⁵³ Recommendations for assuring affordable housing in TOD are gleaned from the U.S. General Accounting Office’s 2009 report “Affordable Housing in Transit-Oriented Development: Key Practices Could Enhance Recent Collaboration Efforts between DOT-FTA and HUD.” (GAO-09-871).). <http://www.gao.gov/products/GAO-09-871>

- d. Establishment of affordable housing trust funds;
- e. Inclusionary zoning to generate funds for affordable housing from developers paying for each affordable unit they choose not to build;
- f. Affordability requirements as a condition of the sale or lease of public land or as a condition of granting tax incentives to businesses.

(Metro, City Council, City Planning/Community Development, Housing, private-public partnerships)

2. **Provide development incentives to assure a full complement of amenities near stations** (e.g. grocery stores, entertainment options, childcare, etc.) that appeal to area residents so that a car-free lifestyle is an attractive option, not a difficult burden. *(Metro, City Council, City Housing, City Planning/Community Development, private-public partnerships)*
3. **Include development further from stations.** Don't neglect development between stations. As stations become hubs for commercial activities, real estate values will inevitably increase; neighborhoods that are further from stations will serve a higher proportion of low income residents.; *(City Planning/Community Development)*
4. **Protect renters' rights:** As transit development causes changes in real estate markets, assure maintenance of safe and healthful living conditions for renters through enhanced enforcement of renter protections, rental property inspections, and educating tenants of their rights. *(City Housing, Los Angeles County Department of Public Health)*
5. **Engage residents in participatory decision-making:** Include input from current area residents, especially low income residents, on housing design specifications addressed in ordinances, area plans and requests for bids. *(City Housing, City Planning/Community Development)*

Parks and Greenspace

Improving access to parks and greenspace

Access to parks and greenspace is a valuable amenity for improving residents' health and quality of life. Parks and outdoor recreational centers can encourage physical activity as they provide green and open space, tree cover and in many cases special facilities for play, leisure, structured exercise, and sport activities.²⁵⁴ A recent study of adolescents in urbanized areas in California found that access to a safe park was positively associated with regular physical activity and negatively associated with inactivity.²⁵⁵ Parks are also used for social gatherings, an important contributor to social cohesion. An emerging body of research suggests that the availability of

²⁵⁴ Bedimo-Rung A, Mowen A, Cohen D. The significance of parks to physical activity and public health. A conceptual model. *Am J Prev Med* 2005; **28**: 159–168.

²⁵⁵ Babey SH, Hastert TA, Yu H, Brown ER. Physical activity among adolescents. When do parks matter? *Am J Prev Med.* 2008 Apr;34(4):345-8.

green space increases perceived and objective physical and mental health and well-being.²⁵⁶ The relative lack of park and greenspace in lower income neighborhoods may explain a portion of the links between income inequality and health disparities.²⁵⁷ Greenspace is also a critical element in making sustainable urban environments.²⁵⁸

The health benefits of green space are not limited to vegetation in parks. Tree cover and greenery along streets alone has also been found to be associated with increased physical activity, reduced stress, noise, and ambient temperature.²⁵⁹ The presence of trees is also associated with increases in property values and positive perceptions of neighborhood.²⁶⁰ While trees and vegetation enhances the visual appeal and neighborhood aesthetic, it also provides air quality and greenhouse gas benefits by:

1. Removing various pollutants from the air through “dry deposition;”
2. Reducing emissions the evaporation of fuel and other volatile organic compounds from parked vehicles,
3. Sequestering and storing carbon.²⁶¹

The resulting improvements in air quality can lower rates of asthma²⁶² and childhood obesity,²⁶³ and improve psychological well-being.²⁶⁴ Green space can also help reduce summertime temperatures and provide shade and protection from the sun. A recent study from NYC demonstrated a compelling connection between asthma prevalence and the presence of street trees. It was estimated that increasing the urban canopy of New York City by 10% could lower ground-level ozone by approximately 3%. Areas with more street trees had lower

²⁵⁶ Bowler DE, Buyung-Ali LM, Knight TM, Pullin AS. A systematic review of evidence for the added benefits to health of exposure to natural environments. *BMC Public Health*. 2010 Aug 4;10:456.

²⁵⁷ Mitchell R, Popham F. Effect of exposure to natural environment on health inequalities: an observational population study. *Lancet*. 2008 Nov 8;372(9650):1655-60.

²⁵⁸ Marmot M. Sustainable development: the key to tackling health inequalities, Sustainable Development Commission, London (2010).

²⁵⁹ McPherson EG, Simpson JR, Zio Q, Wu C. Million trees Los Angeles canopy cover and benefit assessment. *Landscape and Urban Planning* 2011;99(1):40-50.

²⁶⁰ Payton, G. Lindsey, J. Wilson, J.R. Ottensman and J. Man, Valuing the benefits of the urban forest: a spatial hedonic approach. *J. Environ. Plann. Manage.*, 51 (2008), pp. 717–736.

²⁶¹ USEPA. Reducing urban heat islands- Compendium of strategies, Trees and Vegetation. 2009. <http://www.epa.gov/heatisland/resources/compendium.htm>

²⁶² Lovasi GS, Quinn JW, Neckerman KM, Perzanowski MS, Rundle A. Children living in areas with more street trees have lower asthma prevalence. *J Epi Community Health*. 2008; 62(7):647-9.

²⁶³ Bell JF, Wilson JS, Liu GC. Neighborhood Greenness and 2-Year Changes in Body Mass Index of children and youth. *Am J Prev Med*. 2008;35:547-553.

²⁶⁴ Iverson CT, Hagerhall CM. The perceived restorativeness of gardens-Assessing the restorativeness of a mixed built and natural scene type. *Urban Forestry & Urban Greening*. 2008;7:107-118.

prevalence of early childhood asthma.²⁶⁵ Ground-level ozone is associated with asthma development.

Transit system design features along with land-use planning and policies that help extend availability and access to parks, recreation opportunities, greenspace, and other public spaces can improve transit ridership and maximize potential health benefits. An effective transit system can make it easier for people to access such destinations, for which travel time, costs and inconvenience are currently deterrents. Major development projects, such as the proposed subway, also present opportunities to improve landscaping and to create usable, health-promoting public spaces.

A park-poor city

Despite having a few large parks, such as Griffith Park, the city of Los Angeles has relatively few parks, given its population. There are 6.2 acres of parkland per 1,000 residents and only 10% of the city area is designated as parkland, compared to 6.6 acres of parks per 1,000 residents and a park area of 25% in San Francisco, and 31 acres of parks per 1,000 residents and a park area of 17% in San Diego.^{266, 267} Park access is especially limited in neighborhoods with high proportions of low income and non-White residents, such as those in the eastern and central portions of the Wilshire Corridor near Koreatown.^{268,269, 270} Many neighborhoods in the project area have been designated as high or very high need by the Trust for Public Lands *ParkScore*.TM
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Given the surfeit of parkspace, improving access is all the more important. The Southern California Association of Governments (SCAG) has called for improved public transportation to improve access to all parks in the region in their 2008 Regional Transportation Plan (RTP) Environmental Justice Report. The City Project, a Los Angeles based organization, has worked in the area of making parkland more accessible to the residents of the city. They make the case for a “Transit to Trails” program that takes people via public transit to parks, beaches, forests, and

²⁶⁵ USEPA. Reducing urban heat islands- Compendium of strategies, Trees and Vegetation. 2009.

<http://www.epa.gov/heatisland/resources/compendium.htm>

²⁶⁶ Harnik P. Inside City Parks. Washington D.C.: Urban Land Institute. 2000.

²⁶⁷ The Trust for Public Land. Acres of Parkland per 1,000 Residents, by City (FY 2010) (webpage).).

http://cityparksurvey.tpl.org/reports/report_display.asp?rid=4 (accessed Oct. 30, 2012).

²⁶⁸ Wolch, J. [et al]. Parks and Park Funding in Los Angeles: An Equity Mapping Analysis. Urban Geography. 2005. 26, 1. <http://bellwether.metapress.com/content/f16714n6m3t25g11>

²⁶⁹ Sister MCE. 2007. Do Blacks and Browns have less green? Examining the distribution of park and opens space resources in the greater Los Angeles metropolitan region. Doctoral Dissertation. University of Southern California.... <http://digitallibrary.usc.edu/assetserver/controller/item/etd-Sister-20070719.pdf>

²⁷⁰ The City Project. 2011. Healthy Parks, Schools and Communities: Green Access and Equity for Los Angeles County, 2011. <http://www.mapsportal.org/thecityproject/socalmap/LosAngelesCounty.html>

²⁷¹ The Trust for Public Land *ParkScore*TM Los Angeles California....

http://parkscore.tpl.org/ReportImages/Los%20Angeles_CA.pdf (accessed Oct. 30, 2012)

other public natural greenspaces. By providing lower income residents and those without cars who live in park-poor neighborhoods with access to the rich recreational resources in the greater Los Angeles area, such as Griffith Park, the Santa Monica Mountains, the San Gabriel Mountains and the Pacific Ocean beaches, these programs can help reduce economic and geographic disparities in park access.

While few parks or recreation centers are on Wilshire Boulevard or adjacent to proposed subway stations, many are found within one-half to one mile from stations (Table 7). Improved transit along Wilshire Boulevard will not substantially improve access to parks without transit connections, walking and biking infrastructure, neighborhood safety, and signs and other wayfinding support to help people traverse the last half-mile from transit stations to parks and recreation centers.

Table 7: Parks and recreation centers near* Metro stations in the project area

Facility	Neighborhood	Acres	Nearest Station (proposed route)	Walking distance to facility/park border
Metropolitan YMCA	Koreatown	N/A	Wilshire/Vermont (existing station)	0.2
Harold A Henry Park	Koreatown	1.7	Wilshire/Western (existing station)	1.1
L.A. High Memorial Park	Koreatown	2.5	Wilshire/Western (existing station)	1.2
Hancock Park	Mid-City	27.2	Wilshire/La Brea	0.1
Pan Pacific Park	Mid-Wilshire/Fairfax	31.9	Wilshire/Fairfax	0.8
Carthay Circle Park	Carthay	0.3	Wilshire/Fairfax	0.5
La Cienega Park	Beverly Hills	22.4	Wilshire/La Cienega	0.3
Beverly Gardens Park	Beverly Hills	70.0	Wilshire/Rodeo	0.5
Roxbury Memorial Park	Beverly Hills	11.0	Constellation/Avenue of the Stars	0.6
Reeves Park	Beverly Hills	0.3	Wilshire/Rodeo	<0.1
Beverly Canon Park	Beverly Hills	0.14	Wilshire/Rodeo	0.1
Century Park	Century City	4.0	Constellation/Avenue of the Stars	<0.1
Westwood Park & Rec Ctr	Westwood	29.0	Westwood/UCLA	0.4
			Westwood/VA	0.5
Felicia Mahood Senior Center	West Los Angeles	n/a	Westwood/VA	1.1
University H.S./YMCA Joint Use	West Los Angeles	n/a	Westwood/VA	0.9
Barrington Rec Ctr	Brentwood	12.0	Westwood/VA	1.4

* In addition to parks which are within a ½ mile walking distance from stations, this list also includes parks

which provide a large share of park space in neighborhoods traversed by the subway.

Need for greenspace

Like park space, tree cover in Los Angeles is not evenly distributed, ranging from 31% of land area in low-density residential areas to 3% to 6% in industrial and commercial areas.²⁵⁶ Most of the areas surrounding the proposed Westside Subway Extension stations are highly urbanized and lack greenspace and tree cover. In response to growing concern about the lack of greenspace, the City of Los Angeles initiated the “Million Tree Initiative” in 2006 with the goal of planting a million trees in order to reduce the urban heat island effect, improve air and water quality, sequester carbon, and improve neighborhood aesthetics.²⁵⁹ Difficulties fully implementing the program highlight the need to take advantage of opportunities that arise to expand greenspace.²⁷² Planting trees in parking lots alone can be an easy, innovative approach to improve local air quality, reduce stormwater runoff, cool urban heat islands, and improve community attractiveness; on streets, tree shade can protect paving from weathering.²⁷³

Recommendations

1. **Increase tree cover and greenspace:** Plant trees to provide shade and greenspace around stations, in outdoor plazas and along streets. When selecting tree species, include shade among the selection criteria while avoiding species, such as fig trees, with roots that tend to break sidewalks and create hazards for pedestrians. Whenever possible avoid palms and small species that provide little if any shade and serve only as architectural accents. (*Metro, City Planning/Community Development, Public Works, Street Services, Parks and Recreation*)
2. **Incorporate swales where feasible:** Incorporate vegetated swales into the design of sidewalks, plazas and stations to reduce run-off, increase greenspace and provide a buffer between pedestrian space and vehicle traffic. (*Metro, City Planning/Community Development, Public Works, Street Services, Parks and Recreation*)
3. **Improve connectivity from stations to destinations:** Plan for the “last half-mile” to improve pedestrian connectivity between stations and recreation centers, neighborhood parks and local schools allowing public access to playgrounds during after-school hours. Address sidewalk quality, lighting, safety patrols, bus or shuttle service and signage in station and along routes). (joint effort of Metro, cities of Los Angeles and Beverly Hills, schools, senior centers, community groups and other non-profits). (*Metro, City Planning/Community Development, Public Works, Street Services, Police, Public Health, school districts, VA, Parks & Rec*)

²⁷² Pincetl S. 2009. Implementing Municipal Tree Planting: Los Angeles Million-Tree Initiative. *Environ Manage.* 2010 February; 45(2): 227–238.

²⁷³ McPherson EG, Muchnick J. 2005. Effects of street tree shade on asphalt concrete pavement performance. *J of Arboriculture* 31(6):303-310.
http://www.fs.fed.us/psw/publications/mcpherson/psw_2005_mcpherson001_joa_1105

4. **Build pocket parks:** Provide greenspace with “pocket parks” with sitting and play areas near stations. Consider incorporating specs for park space and maintenance into leases of Metro property (joint effort of Metro, cities of Los Angeles and Beverly Hills, and private property owners). (*Metro, City Planning/Community Development, Parks and Recreation*)

Retail Food Environment

Significant disparities exist in the types of food available in different neighborhoods in Los Angeles.^{274,275} Compounding these environmental disparities, limited household financial, transportation and time resources present barriers to access sufficient, healthful food. Thirty-eight percent of Los Angeles County households are classified as having “low food security,” among whom one-third, (14% of all County households), have “very low food security.”²⁷⁶ While research findings are not entirely consistent, the confluence of food insecurity^{277,278} and unhealthy food environments^{279,280} create conditions conducive to poor nutrition and health.

Improved transit has the potential to improve food access and over the long-term to shape neighborhood food environments by:

- Making travel faster and easier to supermarkets, farmers’ markets and other retail outlets with more healthy food options;²⁸¹
- Attracting more and different kinds of retail food establishments through economic stimulus and changes in travel patterns. Undirected development, however, may transform

²⁷⁴ Lewis LB et al. 2005. African Americans’ access to healthy food options in South Los Angeles Restaurants. *Am J Public Health* 95:668,671.

²⁷⁵ Shaffer A. The Persistence of L.A.’s Grocery Gap: The Need for a New Food Policy and Approach to Market Development. Center for Food and Justice, Urban and Environmental Policy Institute, Occidental College. 2002. Available at www.departments.oxy.edu/uepi/publications/the_persistence_of.htm

²⁷⁶ Chaparro, M. Pia; Langellier, Brent; Birnbach, Kerry; Sharp, Kerry; & Harrison, Gail. (2012). Nearly Four Million Californians Are Food Insecure. UC Los Angeles: UCLA Center for Health Policy Research. <http://escholarship.org/uc/item/5407m7mh>

²⁷⁷ Adams EJ, Grummer-Strawn L, Chavez G. Food insecurity is associated with increased risk of obesity in California women. *J Nutr.* 2003 Apr;133(4):1070-4.

²⁷⁸ Larson NI, Story MT. Food insecurity and weight status among U.S. children and families: a review of the literature. *Am J Prev Med.* 2011 Feb;40(2):166-73.

²⁷⁹ Larson NI, Story MT, Nelson MC. Neighborhood environments: disparities in access to healthy foods in the U.S. *Am J Prev Med.* 2009 Jan;36(1):74-81. Epub 2008 Nov 1.

²⁸⁰ Story M, Kaphingst KM, Robinson-O’Brien R, Glanz K. Creating healthy food and eating environments: policy and environmental approaches. *Annu Rev Public Health.* 2008;29:253-272.

²⁸¹ Support for the idea that transportation improvements are likely to help reduce disparities in food access is provided by an analysis of the correlates of census tract level disparities in supermarket access across the U.S. which found that the combined effects of socio-economic factors and road connectivity were associated with supermarket access. USDA. 2009. The Interaction of Neighborhood and Household Characteristics in Explaining Areas With Limited Access, ch. 3 in *Access to Affordable and Nutritious Food: Measuring and Understanding Food Deserts and Their Consequences.* http://www.ers.usda.gov/media/242602/ap036c_1.pdf

neighborhood “food deserts” into “food swamps” with an overabundance of energy dense, low nutrient foods.²⁸² The quality of the resulting food environment depends in large part on steps to incentivize affordable, healthy food retail and/or curb the proliferation of establishments that feature primarily less healthy food options.

- Providing space in or near transit stations (e.g. TODs) that provide healthy food options for area residents and transit users. Again, without policies in place to guide the type of food retail coming in, this could result in more harm than benefit to the public’s health.

Availability of healthy food options

Fresh fruits and vegetables are at the core of a healthy diet, but getting a variety of fresh, high quality produce can be a challenge in many neighborhoods. Because disparities in the neighborhood food environment reflect many other social and economic disparities, the lack of healthy food options and the prevalence of unhealthy food options in low income communities is frequently framed in terms of social justice,^{283, 284} not unlike equal access to education and environmental justice concerns about the siting of polluting industries.

Supermarkets are a key source of fresh produce,²⁸⁵ but full-service supermarkets, as well as farmers’ markets, tend to be scarce in low-income areas of Los Angeles.^{286,287} A 2002 study of grocery stores in Los Angeles County found that there are over twice as many supermarkets per capita in upper income compared to low income zip codes, three times more in majority White zip codes compared to majority African-American zip codes, and 70% more in majority White zip codes compared to majority Latino zip codes.²⁸⁸ Corner markets and convenience stores help fill this gap,²⁸⁹ but these tend to have far fewer fresh fruits and vegetables available.²⁹⁰

²⁸² Rose D, Bodor HN, Swalm CM et al. 2009. Deserts in New Orleans? Illustrations of urban foods access and implications for policy. Paper prepared for: University of Michigan National Poverty Center/USDA Economic Research Service Research "Understanding the Economic Concepts and Characteristics of Food Access" February 2009. http://npc.fordschool.umich.edu/news/events/food-access/rose_et_al.pdf

²⁸³ Vallianatos M. 2009. Food Justice and Food Retail in Los Angeles. Ecology Law Currents 36:186-194. <http://elg.typepad.com/currents/2009/06/currents36-05-vallianatos-2009-0625.pdf>

²⁸⁴ Community Health Councils. 2010. Food Desert to Food Oasis: Promoting Grocery Store Development in South Los Angeles. <http://www.chc-inc.org/downloads/Food%20Desert%20to%20Food%20Oasis%20July%202010.pdf>

²⁸⁵ Cassady D, Mohan V. 2004. Doing Well by Doing Good? A Supermarket Shuttle Feasibility Study. J Nutrition Ed and Behav 36(2):67-70.

²⁸⁶ Schuetz J, Kolko J, Meltzer R. 2012. Are Poor Neighborhoods “Retail Deserts?” Research Brief, USC Lusk Center for Real Estate.... <http://www.usc.edu/schools/price/lusk/research/pdf/are-poor-neighborhoods-retail-deserts.pdf>

²⁸⁷ Shaffer A. 2002. The persistence of L.A.’s Grocery Gap: The Need for a New Food Policy and Approach to Market Development. UEP Faculty & UEPI Staff Scholarship. Retrieved from http://scholar.oxy.edu/uep_faculty/16

²⁸⁸ Shaffer A. 2002. The persistence of L.A.’s Grocery Gap: The Need for a New Food Policy and Approach to market development. Center for Food and Justice, Urban and Environmental Policy Institute, Occidental College. 2002. Available at www.departments.oxy.edu/uepi/publications/the_persistence_of.htm

²⁸⁹ Sturm R, Cohen D. 2009. Zoning for Health? The Year-Old Ban on New Fast-Food Restaurants in South LA. Health Affairs 28(6):1088-1097. <http://content.healthaffairs.org/content/28/6/w1088>

Fast food outlets are ubiquitous throughout the project area, but the number of supermarkets serving area residents is highly variable (*see Table 8 below*). Within one-half mile of the proposed Westwood/UCLA station there are 5 supermarkets with an average of 2,945 residents per supermarket, while there is only one supermarket serving a population of 15,215 residents within one-half mile of the proposed Wilshire/Fairfax station. And, there are no supermarkets within one-half mile of the proposed Wilshire/La Cienega station.

Table 8: Population and food retail establishments within ½-mile of proposed subway stations

Station	Residents	Farmers' Market	Convenience Store	Fast food	Supermarkets	Residents/supermarket
Wilshire/ La Brea	18,307	0	3	7	2	9,154
Wilshire/Fairfax	15,215	0	5	8	1	15,215
Wilshire/ La Cienega	12,657	0	4	8	0	---
Wilshire/Rodeo	9,190	0	2	5	2	4,595
Century City	7,162	1	0	5	2	3,581
Westwood/UCLA	14,727	1	2	16	5	2,945
Westwood/VA Hospital	13,835	1	1	2	1	13,835

Population estimated based on 2010 Census block group location. Store data from Network for a Healthy California, Farmers' Market data from the California Farmers' Market Association.

For residents living in of these areas, a trip to the grocery store may require substantial time and effort, especially since households with less access to healthy food options often face transportation challenges as well. In Los Angeles County's Metro Health Service Planning Area (SPA 4) that includes the eastern half of the Wilshire Corridor where the poorest neighborhoods of the corridor are found, 26% of residents do not have a car. Among "food insecure" households in this area, 43% lack access to a car.²⁹¹ Among residents without a car, nearly one-third typically use transit to go to the grocery store, but long waits, transfers and difficulties carrying bags on crowded buses create significant deterrents to using transit for grocery shopping.

Transportation and land use policies, programs and projects attuned to the communities food security needs can build bridges between local fresh produce, food retailers and consumers. Transportation programs and projects can make it easier for low-income families, the aged, and

²⁹⁰ Farley TA, Rice J, Bodor N, et al. 2009. Measuring the Food Environment: Shelf Space of Fruits, Vegetables, and Snack Foods in Stores. *J Urban Health* 86(5):672-682. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2729874>

²⁹¹ California Health Interview Survey. 2007. <http://www.chis.ucla.edu>

other with mobility challenges and particular nutrition needs to access supermarkets, farmers' markets and other sources of affordable, healthful foods.

Improving neighborhood food environments and access to healthy foods requires a multi-pronged approach that includes incentivizing healthy food retail, deterring sales of unhealthy food and combining environmental/land-use approaches with education and public health approaches.^{292,293} Approaches to expand the availability and access to healthy foods include:

- **Incentives to attract grocery stores to under-served areas:** Pennsylvania's Fresh Food Financing Initiative that has invested almost \$60 million in supermarket development in underserved areas;
- **Incentives to expand healthy food retail:** New York City's FRESH program that provides local tax reductions, easing of parking requirements and other zoning incentives to encourage new and expanded healthy food retail;²⁹⁴
- **Farmers' Markets and other direct Farm-to-Consumer Programs:** With support from federal farm bill legislation beginning in 1976 and fueled by consumer interest, the number of farmers' markets in the U.S. has increased by over 12% annually.²⁹⁵ Los Angeles County has 128 farmers markets.²⁹⁶ Encouraging more vendors to accept electronic benefit cards (EBTs) for payment will increase low income households' access to markets is for vendors.
- **In-store labeling and education:** The Baltimore Healthy Store Initiative²⁹⁷ and the Healthy Bodegas Initiative in New York City²⁹⁸ that provided in-store shelf labels and signage, along with consumer and owner education sessions, to promote healthier food choices;
- **Shuttle Service:** Supermarket shuttles, such as the ones pioneered by Numero Uno Markets in Los Angeles,²⁹⁹ providing on-demand, store-to-home service to supermarket customers;

²⁹² USDA. 2009. Policy Options, ch. 8 in Access to Affordable and Nutritious Food: Measuring and Understanding Food Deserts and Their Consequences. http://www.ers.usda.gov/media/242622/ap036h_1_.pdf

²⁹³ American Academy of Pediatrics. Prevention and Treatment of Childhood Overweight and Obesity: Fruits and Vegetables/Community: Increased Access to Healthy Food (website). http://www2.aap.org/obesity/community_5.html (accessed Nov. 9, 2012)

²⁹⁴ New York City FRESH program: <http://www.nycedc.com/program/food-retail-expansion-support-health-fresh>

²⁹⁵ USDA Agricultural Marketing Service. 2012. Farmers Markets and Local Food Marketing (webpage). <http://www.ams.usda.gov/AMSV1.0/ams.fetchTemplateData.do?template=TemplateS&navID=WholesaleandFarmersMarkets&leftNav=WholesaleandFarmersMarkets&page=WFMFarmersMarketGrowth&description=Farmers%20Market%20Growth&acct=frmrdirnkt>.

²⁹⁶ Los Angeles Food Policy Council. 2012. Farmers Markets (webpage). <http://goodfoodla.org/connect.php?sectionID=13>

²⁹⁷ Gittelsohn J, Song HJ, Suratkar S, et al. 2010. An urban food store intervention positively affects food-related psychosocial variables and food behaviors. *Health Educ Educ Behav*. 7(3):390-402.

²⁹⁸ Healthy Bodegas Initiative. New York City Department of Health and Mental Hygiene Physical Activity and Nutrition Program. http://www.nyc.gov/html/ceo/downloads/pdf/BH_PRR.pdf

- **Mobile food carts:** New York City's "Green Carts" program that combines permitting and low/no interest loans to for carts selling fresh produce has expanded access to fresh produce and provided a valuable entrepreneurial opportunity for low income residents.^{300 301} Ordinances to permit or loosen regulation of mobile produce vendors, such as that recently enacted in Chicago, can greatly expand produce sales to satisfy unmet demand for affordable, convenient produce.³⁰² Since produce cart sales target pedestrians, transit stations and hubs are prime locations;
- **Produce Trucks :** Mobile produce trucks, once common in most American cities, are seeing a resurgence, especially in predominantly Latino neighborhoods.³⁰³ Although they provide a valuable service where access to supermarkets is difficult because of distance, transportation or price, various health, business and parking ordinances may make their operation difficult or illegal.^{304,305} Nashville (TN), Columbus (OH) and Boston (MA) are a few of the local jurisdictions that have begun to accommodate and support produce trucks and mobile farmers markets.³⁰⁶

Transportation plays a key role in many of these food access strategies. The matrix in Figure 10, which was developed for a food access project in Minnesota, summarizes ways in which transportation can enhance food security and access to healthy food.

²⁹⁹ Numero Uno Market Shopper's Shuttle Service. Pp. 259-268 in TCRP Web Document 7: Using Public Transportation to Reduce the Economic, Social and Human Costs of Personal Immobility. Washington, DC: The National Academies Press, 1998. http://www.nap.edu/openbook.php?record_id=9438&page=261

³⁰⁰ NYC Green Cart. (2011). Retrieved January 15, 2011, from NYC Health: http://www.nyc.gov/html/doh/html/cdp/cdp_pan_green_carts.shtml

³⁰¹ Collins G. 2009. Customers prove there's a market for fresh produce. New York Times June 10, 2009. http://www.nytimes.com/2009/06/11/nyregion/11carts.html?_r=0

³⁰² Sudo C. 2011. City council approves outdoor produce carts. Chicagoist June 7, 2012. http://chicagoist.com/2012/06/07/city_council_approves_outdoor_produ.php

³⁰³ Gerber J. 2010. Bring the produce to the people. Care2 (Blog). <http://www.care2.com/greenliving/bringing-the-produce-to-the-people.html>

³⁰⁴ Tester JM, Stevens SA, Yen IH, Laraia BL. 2011. An Analysis of Public Health Policy and Legal Issues Relevant to Mobile Food Vending. Am J Public Health 100(11):2038-2046. <http://ajph.aphapublications.org/doi/pdf/10.2105/AJPH.2009.185892>

³⁰⁵ Lepasca D. 2011. Grocery stores on wheels. The Atlantic Cities. Nov. 18, 2011. <http://www.theatlanticcities.com/neighborhoods/2011/11/grocery-stores-wheels/528/>

³⁰⁶ Health Law and Policy Clinic of the Harvard Law School/Harvard Law School Mississippi Delta Project. Creating a More Efficient and Effective Food Safety System in Memphis and Shelby County (p. 41). <http://blogs.law.harvard.edu/foodpolicyinitiative/files/2011/09/Final-Memphis-Report-FINAL2.pdf>

	Brings Food to People	Brings People to Food	Operates Year-Round	Locally Grown Emphasis	Reduced Food Price	Shared Business Benefits	Prepay for Food	Full-Scale Grocery Selection	Can be Volunteer Run	Continuous Access	Geographic Limitations	Healthy Eating Education
Modify Public Transit		●	●			●		●		●		
Circulator Route		●	●			●		●		●		
Shuttle Service		●	●			●		●	●			
Grocery-Run Shuttle		●	●			●		●		●		
Mobile Food Carts	●		●	●	●					●	●	●
Virtual Supermarket	●		●		●		●	●	●		●	●
Mobile Farmers Market	●			●	●		●		●		●	●
Mobile Produce Trucks	●		●		●				●		●	●
Carpools		●	●			●		●	●			

Figure 10: Increasing Healthy Food Access via Transportation (from University of Minnesota, Humphrey School of Public Affairs³⁰⁷)

*Recommendations*³⁰⁸

1. **Provide shuttle loading/unloading zones** and work with supermarkets to allow supermarket shuttle programs to drop off passengers next to transit stations. (*Metro*)
2. **Mobile food carts:** Legalize, license³⁰⁹ and provide incentives for independently owned and operated produce carts to sell fresh produce around Metro subway stations and transit hubs. With support network, such as that used by Esperanza Community Housing Corporations' Mercado La Paloma, a food cart program could provide valuable business experience to new entrepreneurs, in addition to increasing access to healthy foods for residents and transit riders. (*Metro, City Planning/Community Development, Public Works, Street Services, Police, Public Health*)

³⁰⁷ Swingley S. 2011. The Northside Healthy Eating Project: Transportation Access to Affordable Fresh Produce. University of Minnesota, Humphrey School of Public Affairs. Prepared for Northpoint Health and Wellness Center.... <http://northpointhealth.org/LinkClick.aspx?fileticket=AAw867IPVrs%3D&tabid=135&mid=845>

³⁰⁸ Recommendations for linking transit projects to efforts to improve neighborhood food environments are based in part on the Los Angeles Food Policy Task Force's "Good Food for All Agenda." http://goodfoodlosangeles.files.wordpress.com/2010/07/good-food-full_report_single_072010.pdf

³⁰⁹ See Los Angeles City Public Works Department report on regulation of mobile vending in the City of Los Angeles.... http://eng.lacity.org/docs/dpw/agendas/2006%2F200603%2F20060331/st/20060331_ag_br_st_1.pdf

3. **Farmers markets:** The mid-Wilshire area, especially, has few farmers markets compared areas such as West L.A./Santa Monica and Hollywood/Silverlake.³¹⁰ Metro and the City of Los Angeles can partner with organizations³¹¹ that organize and manage farmers markets to provide farmers' market sites near stations. (*Metro, City Planning/Community Development, Public Health, LA Co. Ag Commissioner*)
4. **Corner store makeovers:** Following the example of programs in New York, San Francisco and elsewhere,³¹² the City of Los Angeles can work with neighborhood stores to increase the amount, quality and prominence of fresh produce sold in these stores. Focusing on areas adjacent to transit stations, this could increase access to fresh produce, local economic activity and transit use, and deter automobile use. (*City Planning/Community Development, Public Health*)
5. **New supermarkets:** Incentivize Supermarkets to locate in the project area, especially near transit stations. (*City Planning/Community Development*)
6. **Anchoring TODs with food markets** that provide affordable food options for local residents. And, avoiding high end food retailers when it is likely that they will displace more affordable healthy food retail establishments. (*Metro, City Planning/Community Development*)

Community/Neighborhood Social Capital

Increasingly public health researchers recognize that the social fabric of a community—cohesion and trust between community members, community engagement, and networks of mutual support—is a valuable resource in supporting the health and well-being of community members. By strengthening this fabric through changes in mobility, access, housing and land-use, transit improvements in the Wilshire Corridor have the potential to advance the health and well-being of community residents. Subway stations are also important as they are examples of public space that can encourage social connectedness and provide opportunities for social interaction and engagement.

Along with the rise in inequality there has been a shift in the ways neighborhoods are structured within metropolitan areas. Increasingly, affluent individuals are segregated into affluent neighborhoods and poor individuals into poor neighborhoods.³¹³ This may be particularly true in Los Angeles, the focal location of this research. Economic segregation in the Los Angeles area follows a “relative concentric zone” model wherein poor communities are more concentrated

³¹⁰ Los Angeles Times' map of farmers' markets locations. <http://projects.latimes.com/farmers-markets/>

³¹¹ Some organizations operating farmers markets in the Los Angeles area include the Southland Farmers Market Association (<http://www.sfma.net>), the SEE-LA (<http://www.see-la.org>)

³¹² Healthy Corner Stores Network. 2012. (website) <http://www.healthycornerstores.org/>

³¹³ Dwyer, RE 2007. Expanding homes and increasing inequalities: US housing development and the residential segregation of the affluent. *Social Problems* 54:23-46.

and centralized.³¹⁴ It follows that the wealthy have less interaction with the poor than in areas she characterizes as taking on a “relative proximity model” (e.g. Seattle, WA). Minorities, including immigrants, are disproportionately likely to live in disadvantaged communities.

Social capital is often defined as of features of social organization, such as trust between citizens, norms of reciprocity, and group membership, which facilitate collective action.³¹⁵ While social cohesion (e.g. the degree of citizen involvement in a community, the degree to which people know and trust their neighborhoods, and the social interactions that people have) is an important part of social capital, social capital is an “overarching concept that incorporates the relational, material, and political dimensions of social cohesion, information exchange, and networks of support.”³¹⁶ Kawachi and Berkman suggest there are three ways that social capital affects health: (a) health-related behaviors - more rapid diffusion of health information, which supports healthy behavioral norms; (b) access to services and amenities (e.g., transportation, community health clinics, and recreational facilities); and (c) psychosocial processes which provide support and foster self-esteem.³¹⁷

Social capital has thus been shown in numerous settings to be negatively associated with mortality, stress, mental health conditions and some chronic diseases.^{318,319,320} Opportunities for social interaction, such as those provided by transit and public spaces, reduce the mental health effects of isolation.³²¹ In areas with high collective efficacy, (i.e. mutual trust, cohesion, and willingness to intervene in group³²²), social interactions tend to deter violent crime, support healthy behaviors and make it more likely for community members to help each other. Studies have found associations between collective efficacy and self-rated health, asthma, and all cause-homicide, and cardiovascular mortality rates.^{323,324,325,326}

³¹⁴ Dwyer, RE 2012. Contained dispersal: the deconstruction of poverty in the U.S. metropolitan areas in the 1990s. *City & Community*, Volume 11, Number 3,:309-331.

³¹⁵ Kawachi I, Kennedy BP, Glass R. (1999). Social capital and self-rated health: A contextual analysis. *American Journal of Public Health*, 89:1187-93.

³¹⁶ Hawe P, Shiell A. (2000). Social capital and health promotion: A review. *Social Science & Medicine* 51;6: 871–885.

³¹⁷ Kawachi I, Berkman LF. 2001. Social ties and mental health. *Journal of Urban Health*, 78:458-67.

³¹⁸ Frumkin H. (2002). Urban Sprawl and Public Health. *Public Health Reports* 117:201-217.

³¹⁹ Matthews SA, Yang TC. Exploring the role of the built and social neighborhood environment in moderating stress and health. *Ann Behav Med*. 2010 May;39(2):170-83.

³²⁰ Ahern MM, Hendryx MS. (2005). Chronic Illn. 3:183-90. Social capital and risk for chronic illnesses.

³²¹ Cacioppo, JT, Patrick, B. 2008. Loneliness: human nature and the need for social connection. New York: W. W. Norton & Company.

³²² Sampson RJ, Raudenbush S, Earls F. 1997. Neighborhoods and violent crime: a multilevel study of collective efficacy. *Science*, 277:918-24.

³²³ Browning, C. R., Cagney K. A. 2002. Neighborhood structural disadvantage, collective efficacy, and self-rated physical health in an urban setting. *Journal of Health and Social Behavior* 43: 383–399.

³²⁴ Cagney, K. A., Browning, C.R. 2004. Exploring neighborhood-level variation in asthma and other respiratory diseases: The contribution of neighborhood social context. *Journal of General Internal Medicine* 19:229–236.

Simply providing an alternative to the stress of congested traffic and the isolation of automobile travel can benefit health. Residents with less auto-travel stress are more likely to know their neighbors and experience greater social capital as commute times and predictability of commutes are inversely related to stress. Longer commute times are associated with elevated salivary cortisol levels, which measure stress.³²⁷ Of those who do use transit, individuals on direct, non-transfer train rides have lower stress levels compared to those who have to transfer train lines.^{328,329} In a study of rail and car commuters who lived in New Jersey and worked in New York City, train commuters had significantly lower levels of stress than their counterparts who drove to work.³³⁰ Thus, transit can improve service coverage, ease-of-use, providing an attractive, time-efficient alternative to automobile use, which affects levels of stress. Measures such as comfort and perceived security in the transit system are essential for increasing use, and creating opportunities for positive social interaction. Furthermore, public transit has been shown to improve stress by improved access to employment and education opportunities, improve community cohesion from improved access to social and recreational activities, and improve interactions with other community members.^{331,332}

While there is often a perception that busy, dense city streets, are areas of high crime, research finds no direct relationship between population density and the crime rate.³³³ Fifty years ago Jane Jacobs in her seminal work on urban planning asserted that a healthy neighborhood is one that has many people in the streets.³³⁴ More “eyes on the street” means there are people to

³²⁵ Cohen DA, Farley TA, Mason K. Why is poverty unhealthy? Social and physical mediators. *Social Science & Medicine*. 2003;57(9):1631–1641.

³²⁶ Cohen DA, Finch BK, Bower A, Sastry N. Collective efficacy and obesity: the potential influence of social factors on health. *Soc Sci Med*. 2006 Feb;62(3):769-78. Epub 2005 Jul 21.

³²⁷ Evans GW, Wener RE. (2006). Rail commuting duration and passenger stress. *Health Psychology*, 25(3):408-12.

³²⁸ Wener RE, Evans GW, Lutin J. (2006). Leave the Driving to Them: Comparing Stress of Car and Train Commuters. Available at: http://www.apta.com/passenger_transport/thisweek/documents/driving_stress.pdf

³²⁹ Wener RE., Evans GW, Phillips D, Nadler N. (2003). Running for the 7:45: The effects of public transit improvements on commuter stress. *Transportation*, 30:203-220.

³³⁰ Wener RE, Evans GW. (2007). A morning stroll: Levels of physical activity in car and mass transit commuting duration and passenger stress. *Health Psychology*, 25(3):408-12.

³³¹ Allen, H. (2008). Sit next to someone different every day – how public transport contributes to inclusive communities. International Conference Series on Competition and Ownership in Land Passenger Transport. Available at: http://www.thredbo-conference-series.org/downloads/thredbo10_papers/thredbo10-plenary-Allen.pdf

³³² Bell J, Cohen L (2009). The Transportation Prescription: Bold New Ideas for Healthy, Equitable Transportation Reform in America, PolicyLink and the Prevention Institute Convergence Partnership. Available at: <http://www.convergencepartnership.org/transportationhealthandequity>.

³³³ Browning, C.R., Byron, R.A., Calder, C.A., Krivo, L.J., Kwan, M-P., Lee, J-Y., and Peterson, R.D. 2010. Commercial density, residential concentration, and crime: Land use patterns and violence in neighborhood context. *Journal of Research in Crime and Delinquency* 47(3): 329-357.

³³⁴ Jacobs, J. 1961. *Death and Life of Great American Cities*. New York: Random House.

interact with, children can be watched, and help can be easily summoned. Increased street activity is presumed to enhance neighborhood cohesion and reduce crime.^{335,336}

There is increasing recognition of the potential impact of subway stations as an urban public space that can influence the extent of human communication/interaction, exposure to commercial advertising, and foster economic and political activity.³³⁷

Towards the aims of developing neighborhood social capital, as well as increasing transit use, it is particular to take into account the needs and concerns of women. A number of planning studies indicate that the design of public spaces has greater impact on the daily lives of women than on men.³³⁸ This is because women tend to have a much closer relationship with their immediate environment, and spend more time outdoors on tasks mostly related to family affairs and domestic work (e.g. picking up children from school, accompanying them to the doctor or to extra-curricular activities, shopping, etc). Making transit, stations and adjoining spaces accommodating and secure for women is likely to create a transit system and community that is functional and inviting for all community members.

Recommendations

1. **Encourage community art to improve station aesthetics.** (*Metro*)
2. **Sponsor community events at stations and adjacent locations.** (*Metro, City Planning/Community Development, L.A. County Dept. Public Health, City Cultural Affairs*)
3. **Allow musicians and other entertainers to perform at station locations.** (*Metro, City Planning/Community Development, Cultural Affairs*)
4. **Allow farmers' markets and mobile food vendors** where appropriate space is available in areas adjacent to stations. (*Metro, City Planning/Community Development, Los Angeles County Department of Public Health, Los Angeles County Agricultural Commissioner*)
5. **Integrate space for public use into TOD designs**, e.g. meeting space, sitting areas and farmers' market space. (*Metro, City Planning/Community Development*)
6. **Foster sense of security in AND around stations** through good quality lighting, providing "sense of enclosure" that also has good visibility, acoustic design that minimizes extraneous sound, and providing patrols. (*Metro, City Planning/Community Development, Police, County Sheriff's Department*)

³³⁵ Calthorpe, P, Fulton, W. 2001. *The Regional City*. Washington, DC. Island Press.

³³⁶ Duany, A, Plater-Zyberk, E, Speck, J. 2001. *Suburban Nation: The Rise of Sprawl and the Decline of the American Dream*. New York: North Point Press.

³³⁷ Lewis SW. (2011). The potential for international and transnational public service advertising in public spaces in American and Chinese global cities: Conclusions from a 2010 survey of advertisements in subways in Beijing, New York, Shanghai and Washington, DC, *Public Relations Review* 38(5):765-778.

³³⁸ Garcia-Ramon, MD, Ortiz, A, Prats, M. 2004. Urban planning, gender and the use of public space in a peripheral neighbourhood of Barcelona. *Cities* 21(3):215-223.

VI. Recommendations

Based on the analysis of potential impacts, recommendations have been developed to minimize potential harm and maximize potential health benefits associated with the proposed projects. Many of the recommendations go beyond the transit project to include public policy actions that tie into the transit projects, for example transit-oriented development, parking and commercial development in areas around transit stations. Many of the recommendations pertain to actions of public agencies other than Metro. In a few cases where non-profit organizations might play a key role in implementing a recommendation, these organizations are also identified.

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Figure 11: Recommendations from the HIA (page 1 of 4)

	Regional		City (Los Angeles & Beverly Hills)						Los Angeles County
	Metro	AQMD	Planning, Comm. Development	Public Works, Street Services	Housing	Police	Public Health	Public Works	Other
Air Quality									
Community notification/hotline: Notify residents and businesses of construction activity. Provide information on hotline(s) to call for air quality complaints.	X	X					X		SCAQMD
Expand use of low emission vehicles/equipment: Encourage adoption of low emission technologies beyond minimum required by Metro's Green Construction Policy.	X								SCAQMD
Reduce truck trips/queuing and idling. Select staging sites that minimize truck queuing & traffic.	X								Dept. of Transporta.
Locate staging areas away from populated areas and sensitive populations	X		X						
Locate slurry treatment plants in les populated areas away from sensitive populations. Use best available technology to contain gases and odors	X						X		
Maximize use of trees and greenspace in landscaping. Include air pollutant removal in tree species selection criteria.	X		X	X					
Water Quality									
Strictly adhere to and State Water Board permit rules, construction site BMPs for limiting run-off, and SCAQMD Rule 403 for control of fugitive dust	X								Water Resources, SCAQMD
Consider innovative reuse of recycled water for washing machinery, subway cars, etc.	X								
Encourage greater use of low emission construction equipment beyond the mandates set forth in Metro's Green Construction Policy	X								SCAQMD
Design structures, pavements and landscaping to collect runoff and allow it to infiltrate the soil.	X		X	X			X		Water Resources
Noise and vibration									
Adopt a comprehensive approach to noise control, emphasizing engineering controls	X								Cal-OSHA
Strictly enforce noise control policies with all contractors and sub-contractors. (Metro)	X								Cal-OSHA
Work with schools and other sites w/ noise-sensitive populations to schedule noisiest construction operations for hours when least disruptive.	X		X						Schools
Site construction staging away from noise-sensitive populations (e.g. schools, hospitals, high pedestrian travel)	X		X	X					
Design traffic routes during construction to minimize miles traveled and number of trips, and to minimize noise exposure	X								Dept. of Transport.

Figure 11: Recommendations from the HIA (page 2 of 4)

	Regional		City (Los Angeles & Beverly Hills)					Los Angeles County	
	Metro	AQMD	Planning, Comm. Development	Public Works, Street Services	Housing	Police	Public Health	Public Works	Other
Mitigate unavoidable noise from construction activities. Routinely monitor noise levels and quickly remediate excess noise levels.	X						X		Cal-OSHA
Notify community members, schools, medical facilities and workplaces about construction schedules. Set-up a noise complaint hotline.	X						X		
Use best available technology to minimize noise from subway operations in tunnels and stations.	X								Cal-OSHA
Continue to monitor noise levels in the subway system, adopt new control technologies as feasible	X								Cal-OSHA
Physical activity									
Assess and take steps to maximize non-motorized transportation performance	X		X						
Assess bikeability/walkability in one-mile radius around stations	X		X	X					
Assess and address barriers to bicycling to transit among women, youth and seniors:	X		X	X		X			
Add street trees to improve shade and walkability									
Mental health									
(see recommendations below for social capital)									
Traffic safety									
Assure minimum safe width of dual-use rapid bus lanes	X		X	X					Dept of Transportat
Closely monitor implementation of bicycle use of rapid bus lanes,	X								Dept of Transportat
Take a "complete streets" approach to designing transportation infrastructure around transit	X		X	X					Dept of Transportat
Access to health, social & community svcs									
Plan for universal accessibility, not just in stations, but also around stations and to major destinations.	X		X	X					Dept of Transportat
Provide space for universally accessible paratransit and hospital shuttle drop-off/pick-up	X								
Provide transit schedules and maps to local hospitals and medical centers, with training for staff and volunteers.	X								
Provide and maintain LED schedule and travel-time displays at all transit stops	X			X					

Figure 11: Recommendations from the HIA (page 3 of 4)

	Regional		City (Los Angeles & Beverly Hills)						Los Angeles County
	Metro	AQMD	Planning, Comm. Development	Public Works, Street Services	Housing	Police	Public Health	Public Works	Other
Travel-related costs									
Modify fare structure so that transit-dependent populations who access the subway via bus instead of car are not penalized (i.e. count bus + subway as a single trip)	X								
Parking occupancy tax. Consider a parking tax surcharge in transit/pedestrian-oriented development areas to encourage automobile-free travel			X						Angeles City Office of Finance
More free days on holidays and during special events to encourage automobile commuters to try the subway	X								
Adopt plans to easily expand bicycle locker space at subway stations as demand increases.	X								
Create bicycle-friendly business districts around subway stations			X				X		L.A. County Bicycle Coalition,
Integrate bicycle service/bicycle valet (e.g. BikeStation) into TOD designs	X		X						
Housing									
Maintain or increase number of affordable housing units, including mixed income housing in TOD developments using innovative financing and planning tools.	X		X		X				
Provide development incentives to assure a full complement of amenities near stations (e.g. grocery stores, entertainment options, childcare, etc.) that appeal to area residents so that a car-free lifestyle is an attractive option, not a difficult burden.	X		X						
Include development further from stations. Don't neglect development between stations, since over time low income housing is likely to shift to these areas			X						
Protect renters' rights: Assure maintenance of safe and healthful living conditions for renters through enhanced enforcement of renter protections, rental property inspections, and educating tenants of their rights.					X		X		
Engage residents in participatory decision-making (esp. low income residents) on housing design specs, area plans, etc.			X		X				
Parks, recreation and greenspace									
Increase tree cover and greenspace: Plant trees for shade and greenspace around stations, in outdoor plazas and along streets. Include shade in species selection criteria.	X		X	X					Parks & Rec
Incorporate swales where feasible: to reduce run off, increase greenspace and provide a buffer between pedestrian space and vehicle traffic.	X		X	X					

Figure 11: Recommendations from the HIA (page 4 of 4)

	Regional		City (Los Angeles & Beverly Hills)					Los Angeles County	
	Metro	AQMD	Planning, Comm. Development	Public Works, Street Services	Housing	Police	Public Health	Public Works	Other
Improve connectivity from stations to destinations: Plan for the "last half-mile" to improve pedestrian connectivity between stations and destinations (esp. parks, schools and playgrounds). Address sidewalk quality, lighting, safety patrols, bus or shuttle service and signage in station and along routes.	X		X	X		X	X		school districts, VA, Parks & Rec
Build pocket parks: "Pocket parks" with sitting and play areas near stations to provide valuable greenspace.	X		X						Parks & Rec
Retail Food Environment									
Provide shuttle loading/unloading zones and work with supermarkets to allow supermarket shuttle programs to drop off passengers next to transit stations. (Metro)	X								
Mobile food carts: Legalize, license[1] and provide incentives for independently owned and operated produce carts to sell fresh produce around Metro subway stations and transit hubs.	X		X	X		X	X		
Farmers markets: Partner with organizations that organize and manage farmers markets to provide farmers' market sites near stations.	X		X				X		LA Co. Ag Commissioner
Corner store makeovers: Work with neighborhood stores to increase the amount, quality and prominence of fresh produce sold in these stores, potentially benefitting both health and local economic activity.			X				X		
New supermarkets: Incentivize supermarkets to locate in the project area, especially near transit stations.			X						
Anchoring TODs with food markets, avoiding high end food retailers when it is likely that they will displace more affordable healthy food retail establishments.	X		X						
Community/Neighborhood Social Capital									
Encourage community art to improve station aesthetics.	X								
Sponsor community events at stations and adjacent locations.	X		X				X		Cultural Affaris
Allow musicians and other entertainers to perform at station locations.	X								
Allow farmers' markets and mobile food vendors where appropriate space is available in areas adjacent to stations.	X		X				X		LA Co. Ag Commissioner
Integrate space for public use into TOD designs, e.g. meeting space, sitting areas and farmers' market space.	X		X						
Foster sense of security in and around stations through good quality lighting, providing "sense of enclosure" that also has good visibility, acoustic design that minimizes extraneous sound, and providing patrols.	X		X			X			L.A. County Sheriff's Dept.

	Regional		City of Los Angeles					City of Beverly Hills	Los Angeles County	Other	
	Metro	AQMD	Planning	Street Services	Housing	Police	Community Development	Police	Public Health		Public Works
Improve connectivity from stations to destinations: Plan for the "last half-mile" to improve pedestrian connectivity between stations and destinations, including parks, schools and playgrounds. Include consideration of sidewalk quality, lighting, safety patrols, bus or shuttle service and signage in station and along routes.	X		X			X	X	X			school districts, VA, parks and rec
Build pocket parks: "Pocket parks" with sitting and play areas near stations to provide valuable greenspace.	X		X				X				LA & BH Parks & Rec
Retail Food Environment											
Provide shuttle loading/unloading zones and work with supermarkets to allow supermarket shuttle programs to drop off passengers next to transit stations. <i>(Metro)</i>	X										
Mobile food carts: Legalize, license[1] and provide incentives for independently owned and operated produce carts to sell fresh produce around Metro subway stations and transit hubs.	X		X	X		X	X	X			
Farmers markets: Partner with organizations that organize and manage farmers markets to provide farmers' market sites near stations.	X		X				X	X			LA Co. Ag Commissioner
Corner store makeovers: Work with neighborhood stores to increase the amount, quality and prominence of fresh produce sold in these stores, potentially benefitting both health and local economic activity.			X				X	X			
New supermarkets: Incentivize supermarkets to locate in the project area, especially near transit stations.			X				X				
Anchoring TODs with food markets, avoiding high end food retailers when it is likely that they will displace more affordable healthy food retail establishments.	X		X				X				
Community/Neighborhood Social Capital											
Encourage community art to improve station aesthetics.	X										
Sponsor community events at stations and adjacent locations.	X		X				X	X			City of Los Angeles Dept. of Cultural Affaris
Allow musicians and other entertainers to perform at station locations.	X										
Allow farmers' markets and mobile food vendors where appropriate space is available in areas adjacent to stations.	X		X				X				LA Co. Ag Commissioner
Integrate space for public use into TOD designs, e.g. meeting space, sitting areas and farmers' market space.	X		X				X				
Foster sense of security in and around stations through good quality lighting, providing "sense of enclosure" that also has good visibility, acoustic design that minimizes extraneous sound, and providing patrols.	X		X			X		X			L.A. County Sheriff's Dept.

Appendix 1: Schools in the Project Area

K – 12 Schools located within 0.6 miles* of the proposed subway alignment

School Name	Public/Private	Enrollment	Grades
<u>PRIMARY</u>			
Beverly Vista Elementary	public	710	0-8
Camino Nuevo Charter Academy – Harvard K-8	public	984	0-8
Carthay Center Elementary	public	411	0-5
Cathedral Chapel School	private	285	0-8
El Rodeo School	public	700	0-8
Fairburn Avenue School	public	423	0-5
Hancock Park Elementary	public	717	0-5
Hillel Hebrew Academy	private	626	0-8
Hobart Boulevard Elementary	public	965	0-5
Horace Mann Elementary	public	600	0-8
Kabbalah Children's Academy	private	96	0-6
OhrOhrOhrEliyahu Academy	private	251	0-8
Page Private School	private	135	0-6
Rabbi Jacob Program Academy	private	506	0-8
Samuel A. Fryer – Yavneh Hebrew Academy	private	349	0-8
Shepherd Catholic School	private	191	0-8
Sinai Akiba Academy	private	569	0-8
St. Brendan School	private	300	0-8
St. Gregory Nazianzen	private	255	1-8
St. James Episcopal School	private	351	0-6
St. Paul the Apostle School	private	535	0-8
St. Sebastian School	private	220	0-8
Temple Emmanuel Academy Day School	private	60	0-6
Third Street Elementary	public	715	0-5
Westwood Charter School	public	793	0-5
Wilshire Crest Elementary	public	277	0-5
Wilshire Park Elem	public	475	0-5
	subtotal	12,499	
<u>SECONDARY</u>			
Beverly Hills High	public	2,201	9-12
Burroughs Middle School	public	1,966	6-8
Emerson Middle School	public	983	6-8
Los Angeles Senior High School	public	2,855	9-12
Marlborough School	private	530	7-12
Shalhevet	private	375	9-12
University High School	public	2,226	9-12
Yeshiva Gedolah School	private	81	9-12
	subtotal	11,217	
	Total (Primary + Secondary)	23,716	

List generated from analysis using Google Earth. School data from Greatschools.org and school websites.

* Boundares of 0.6 miles miles were chosen rather than the standard 0.5 miles since a large number of schools were just outside the 0.5 mile boundary.

Trade/Vocational Schools in the project area

- Bryan College
- Los Angeles ORT College
- Beverly Hills Playhouse Acting School
- Cinema Makeup School
- Meridian Institute

Universities/Professional Schools in the project area

- Concord Univ School of Law
- University of California, Los Angeles
- UCLA Extension