HEALTH IMPACT ASSESSMENT

CALIFORNIA HIGH SPEED RAIL

SAN JOSE TO MERCED CORRIDOR

9 MAY 2011

ELLEN KERSTEN

JUSTIN RAUSA

JOE SCHUCHTER

BRIANNA VAN ERP

This Health Impact Assessment was conducted from January - May 2011 as part of a graduate-level course at the University of California-Berkeley. There was no financial support for this HIA. The course instructors - Rajiv Bhatia, Jason Corburn, and Edmund Seto - together direct the UC Berkeley Health Impact Group. They participated in the screening process and provided expert input throughout.

Ellen Kersten is a PhD student in Environmental Science, Policy, and Management. She focused on the Transportation Mode chapter.

Justin Rausa is a MPH student in Health and Social Behavior. He focused on the Footprint chapter.

Joe Schuchter, MCP, is a student in the interdisciplinary Doctor of Public Health (DrPH) program. He focused on the Parking chapter.

Brianna van Erp is a MPH student in Health and Social Behavior. She focused on the Employment chapter.

All of the four students above contributed to the entirety of the HIA and report.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

One-hundred and twenty-five miles of rail will directly connect the cities of San Jose, Gilroy and Merced, and additional rail will connect these cities to at least 30 others throughout California. Compared to existing options of travel by roadways or airways, HSR is generally more efficient and therefore more economical and environmentally-friendly. HSR may also be a progenitor of a smarter type of growth and connectivity within and among cities. As envisioned, the proposed High Speed Rail (HSR) represents great promise. However, the plans to achieve the vision must be checked against the existing conditions as well as knowledge about how those conditions might change with the development. Of particular interest are health conditions, since the ultimate goal of any public works project is to improve the public welfare. Done well, and objectively, such an analysis renders decision-makers accountable and stakeholders engaged.

Although the California High Speed Rail Authority (HSRA) and independent groups have studied and planned extensively, producing a multitude of alternatives analyses and environmental impact reports, there has been relatively little analysis of potential human health impacts of this proposed development. Health Impact Assessment (HIA) is intended to help decision-makers recognize opportunities for positive health benefits and conversely the threats and negative health costs. We used HIA to add value to decision-making regarding the design alternatives for the San Jose to Merced corridor of the California High Speed Rail (HSR).

Our team of graduate students at UC-Berkeley identified and assessed the most relevant health impacts possible in light of our resources and expertise. Our work was unfunded and occurred in the context of a semester-long graduate course in HIA. Practice standards were closely followed. We solicited expert input of the instructors for both process and content. Content was also derived from the HSR documentation and literature, and our own knowledge from various backgrounds in health and the environment. Working from an initial brainstormed list of over 40 potential mechanisms through which HSR might affect health, we narrowed the list to 21 mechanisms. The mechanisms included transportation, land-use, demographic, economic, ecological and political domains. Using criteria such as magnitude, certainty, permanence, and equity, we further narrowed the scope of potential impacts to 4 major mechanisms/ pathways. Each team member then focused on one pathway for analysis. The pathways analyzed included mechanisms of employment, transportation mode shift, parking and footprint. Employment and transportation mode were analyzed regionally (corridor-wide), while parking and footprint were analyzed a much smaller station level. Based on our findings, we provide recommendations to secure positive health impacts and mitigate negative ones.

Findings suggest that the direct employment benefits of the development might not fully serve the needs of corridor residents. In particular, the corridor workforce is not suited for temporary construction jobs, while permanent jobs are too few to substantially reduce corridor unemployment. Chronic unemployment and underemployment would have myriad health impacts among all residents throughout the corridor. Employment resulting from the growth and economic development spurred by HSR was not measured. Transportation mode findings are generally more positive. There may be some reductions in automobile use - shifting to transit and active options - within the corridor, encouraging more people to engage in health-promoting physical activity. However, these transportation mode shifts may not result in net improvements in the region's poor air quality, a cause for a host of adverse health conditions, as population increases throughout the corridor. HSR as a commuter option offers a potential reduction in overall household transportation expenses, thereby increasing financial security and resources for health. Findings from the parking pathway analysis suggest that many health impacts can be mitigated, yet the sheer volume of additional traffic in the station-area lead to additional pedestrian casualties. Finally, analysis of the footprint pathway suggests that station-level plans may displace vulnerable residents and valued community institutions which serve them. This is most relevant in the much smaller cities of Gilroy and Merced. Analysis of station footprints that land-use changes for HSR development will differentially and adversely impact low-income residents of the rural station-cities, especially Gilroy.

Represented below are some recommendations that would benefit the statewide HSR project, as it became clear that data was a significant limiting factor for this HIA. To see these explained, in addition to our short-and long-term recommendations, please refer to our full report.

- Develop and enforce strict standards for transparency and equity for the distribution of the $950 million in bond funding for local transit infrastructure that was approved by Proposition 1A in November 2008.
- All spatial and non-spatial data created and collected for planning publicly-funded projects should be made easily available to the public to enable concerned parties to evaluate the impact priorities of proposed plans, programs, and policies.

CHAPTER 1. INTRODUCTION

High speed rail is coming to California. As the largest public infrastructure project in the nation, the planning, construction, operation, and maintenance of high speed rail will transform the physical, built, and social environments throughout California. So far, the effects of these transformations have been framed by the High Speed Rail Authority (HSRA) as economic, environmental, and community benefits.[1] However, high speed rail also has the potential to affect individual and community health, and these effects have not yet been thoroughly articulated or analyzed.

Individual and community health encompasses a broad range of interacting influences and outcomes. As defined by the World Health Organization, "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity".[2] To explore, analyze, and communicate the potential impacts of high speed rail on the holistic health of Californians, health impact assessments (HIAs) were conducted from February to May 2011 for two of the project's nine planning segments.

This report documents the process and results from one of those HIAs, with a focus on the high speed rail corridor from San Jose to Merced. It summarizes the process and results of the HIA and provides guidance about how high speed rail could best promote the health of current and future residents in the corridor. Additionally, this report serves as starting point for additional HIAs of high speed rail and other transportation projects, policies, and programs.

CALIFORNIA HIGH SPEED RAIL OVERVIEW

California High Speed Rail (HSR) was approved by 52% of voters in 2008. It proposed borrowing $9 billion in bonds to build a 800 mile high speed rail network connecting San Francisco and Los Angeles, with plans to later expand to Sacramento and San Diego. Passengers are expected to be able to travel from San Francisco to Los Angeles in less than 2 hours and 40 minutes, reaching speeds up to 220 miles per hour. According to the HSRA, construction is expected to begin in 2012 and continue through 2017.

In December 2010, the High Speed Rail Authority (HSRA) approved plans to build the first segment of rail from Fresno to Bakersfield. As of January 2011, federal and state authorities have pledged approximately $5.5 billion to this corridor. This total includes approximately $600

[1] HSRA. Project Vision and Scope. http://www.cahighspeedrail.ca.gov/project_vision.aspx. Accessed 7 May 2011
[2] World Health Organization. FAQ. http://www.who.int/suggestions/faq/en/index.html. Accessed 7 May 2011.

million in federal stimulus money from states that declined to use funds to construct their own HSR systems.

HSR supporters have cited many potential benefits of this project. The HSRA projects that it will bring new employment opportunities to the state, particularly in areas of the central valley where there is a dearth of jobs. HSR is also anticipated to connect regions of California, previously reachable only by driving or flying. It is expected to reduce people's commute times, change chosen means of transportation, and reduce the environmental impacts of flying and driving. Proponents have also focused on the potential benefits to cities and towns that have a HSR station. Potential benefits include community revitalization and transit and pedestrian oriented area development efforts. If nothing else, HSR is one option for meeting future transportation needs, which are projected to increase dramatically over the next two decades; doing nothing will certainly leave California in severe gridlock.[3]

Critics of HSR have focused on the cost of this project, with many echoing concerns that it will be underused. In the words of California Congressman Dennis Cardoza, who serves a large part of the central valley, it may be a "train to nowhere." [4] Several cities, particularly in the peninsula region, have expressed concerns about the location of HSR tracks and speed of trains running through their towns. In the central valley, critics have expressed concern that the rail line will use needed farm land in efforts to construct the rail line.

Concerns have also been raised regarding the both the vertical and horizontal track alignment. Some areas have proposed vertical alignments placing the tracks high above or buried below ground to minimize disruptions to downtown areas and existing transportation infrastructure. There has also been some debate over the horizontal alignment of the train tracks, referring to the planned HSR routes and track placement.

SAN JOSE TO MERCED CORRIDOR

The San Jose to Merced section of California's High Speed Rail project is one of nine planning segments designated by the California High Speed Rail Authority. It is a particularly unique section of the project because it bridges the densely populated, urban San Francisco Bay Area with the agricultural-based, rural Central Valley. Three stations will be located along the segment in San Jose, Gilroy, and Merced. The 125 miles of high speed rail will cut the commute

[3] Project Overview. California High Speed Rail Authority. <http://www.cahighspeedrail.ca.gov>
[4] McKinley, J. "Worries follow route of high-speed California line." New York Times. 2 January 2011.

time between San Jose and Merced to 45 minutes, less than a third of what it currently takes to travel by car.

The San Jose to Merced segment of the HSR project has its own planning and construction timeline. The segment recently underwent public review of its Preliminary Alternatives Analysis Report, which was completed by the HSRA in June 2010. The Supplemental Alternatives Analysis Report was just released in May 2011. A draft EIR/EIS is planned to be released for public comment in August 2011, with the final EIR/EIS to be complete in 2012. Construction will begin shortly thereafter in 2013.

All areas in the segment have multiple rail alignment options that will be carried forward into the EIR/EIS (Figure 1.1). The segment's Preliminary Alternatives Analysis Report does not include alternative station locations for the San Jose and Merced stations, but it includes two viable HSR station location options for Gilroy (Appendix Figure 1). The Alternatives Report includes a potential station in Morgan Hill. However, this is not a likely station option because Morgan Hill has expressed that it would prefer Gilroy has the station, which Gilroy has accepted.

The decisions to be made about station locations, as well as other planning decisions, will affect the residents who live in the San Jose to Merced corridor. This project is at a critical stage in its development, and the timing of both the Alternatives Analysis and forthcoming final EIR, will have a profound effect on the future of HSR in this corridor. Because health is often not explicitly considered in the planning process, a HIA is a useful tool to guide both the public and decision makers in making key decisions about HSR in the San Jose to Merced corridor.

FIGURE 1.1 ALIGNMENT ALTERNATIVES

BRIEF DESCRIPTION OF HIA

The rationale for HIA is that a majority of decision making processes today do not explicitly consider health, and this tool re-inserts health back into the discussion. Furthermore, HIA seeks to frame the conversation around health disparities and the disproportionate impacts that may result. If analysis of decisions and their potential health impacts are found to be objectionable, then HIA can also provide reasonable alternatives to achieve the most equitable health outcomes possible for involved stakeholders.

Description of HIA Steps:

1. **Screening** determines if there is a need for HIA and if it can inform the decision making process.

2. **Scoping** determines the health impacts of interest, the research methods for analyzing them, and the plan for completion.

3. **Assessment** is the implementation of the scoping plan to determine the direction, magnitude, and distribution of potential health impacts within the priority population.

4. **Reporting** conveys assessment findings to stakeholders, decision-makers, and the public in various formats like full reports or summaries.

5. **Monitoring** is the process of following up on relevant decision outcomes and their respective health impacts.

This HIA was conducted by members of the University of California Berkeley Health Impact Group (UCBHIG), which is a non-partisan, independent group of graduate students and faculty. This HIA is a student exercise part of the seminar on Health Impact Assessment at the UC Berkeley School of Public Health and Department of City and Regional Planning. UCBHIG members do not receive funding for HIA nor do they have any vested interests in the outcomes of the decisions they evaluate regarding the California High-Speed Rail Project.

CHAPTER 2. SCREENING

Given the constraints of the classroom, this topic and corridor were already pre-screened by the instructors. The students therefore used the following questions as both an exercise and a confirmation that this HIA was important and would add value to the decision-making:

- Are there significant health impacts?
- Is this potentially unfamiliar information?
- Are the results likely to be valued?
- Is there sufficient data?
- Are there sufficient resources?
- Is the benefit of the HIA worth the expenditure of resources?
- Will the results be timely?

In making these judgments, we used a number of key documents from multiple sources. These included official analyses and plans from the HSRA, reviews and responses by local jurisdictions, third party assessments and reports from media and news outlets. Table A1 of the appendix lists the documents reviewed.

WHY ASSESS THE HEALTH IMPACTS?

The health impacts of the San Jose to Merced segment of the high speed rail were evaluated for several reasons. First, the statewide HSR proposal involves an enormous investment which may have far-reaching effects on local livelihoods and quality of life. Yet the current HSR analyses do not adequately address the immediate and long-term health consequences of HSR development, whether positive or negative. It is therefore prudent to expend some effort in considering these consequences. Second, this segment-specific HIA provides an interesting look at the potential impact of HSR across an urban to rural spectrum. Analysis of this segment may provide clues about impact in other gradients of urban and rural areas. Finally, as with all HIA's, the process translates the existing analyses and reviews into more meaningful and intelligible data for people. The HIA is intended to make a massive and complex project more accessible to the community at-large, and in doing so bring transparency, credibility and validity to decision-making.

WHAT ARE THE POTENTIAL HEALTH IMPACTS?

The potential impacts/ effects on health are many. They may be positive effects (health benefits) or negative effects (health costs). The effects may occur immediately or be delayed over time; the effects of development, construction and early operation of the HSR will look

much different than effects later in the HSR lifespan. Effects may be temporary and transient or permanent. They may occur directly or indirectly, via opportunities and threats in the environment. That is, the pathway from HSR to health is in some cases simple and others very complex. Because this is such a massive project, it is impossible to list all of the potential health effects. However, with just a few examples figure A1 in the appendix illustrates how wide the range can be. Subsequently, in the scoping stage a fuller but not quite comprehensive list of health determinants were identified (Figure 3.2). It is important to note that the impacts may also be health-related behaviors or precursors, rather than particular diseases or conditions. For better or worse, often only a subset of these effects is considered in decision-making. More importantly, the most prominent effects for local stakeholders are often those that are immediate and negative, such as noise and disruptions during construction. Our screening process considered with the entire range of effects; in the scoping section we then chose focus areas based on specific criteria. First though, we wanted to make sure our assessment added value to the process already underway.

HOW WILL THIS HIA ADD VALUE TO THE CURRENT PROCESS?

In determining whether and how to conduct this HIA, we considered the following factors:

- Unequal distribution of impacts across demographic groups
- Stakeholder concerns
- Potential for timely changes
- Resources available
- Alternative assessment strategies

It was clear that the positive and negative effects of this project had the potential to be unequally distributed[5]. However, the current alternatives analysis and project documents often do no extrapolate far enough into the human element, so that distributions (of project effects) might not seem as critical (Table 2.1). As well, reports in the media represent just some of the many potential impacts on all people. The primary goal of the project - improved inter-city transit and economic development - seems attainable for most stakeholders. However, the effects on neighborhoods, communities and individuals - in terms of jobs, housing and development, and environmental effects - could easily be skewed in favor of certain groups at the expense of others.

[5] Sánchez, Thomas W., Stolz, Rich, and Ma, Jacinta S. (2003). Moving to Equity: Addressing Inequitable Effects of Transportation Policies on Minorities. Cambridge, MA: The Civil Rights Project at Harvard University. http://civilrightsproject.ucla.edu/research/metro-and-regional-inequalities/transportation/moving-to-equity-addressing-inequitable-effects-of-transportation-policies-on-minorities/sanchez-moving-to-equity-transportation-policies.pdf. Accessed 10 Feb 2011.

This skewing may have some relationship with the voice of the stakeholders. Beyond routine public participation opportunities, those most able to relay their concerns to key decision-makers are more likely to be accommodated. At the inception of this HIA, residents of the City of Gilroy were much more vocal with their concerns regarding station development. This does not mean, however, that residents in Merced are not facing similar threats and having similar concerns. Though this HIA does not investigate the communication, participation and inclusion in the HSR process to date, it does offer another opportunity to identify opportunities/ threats for those who may not have had a voice to date. We therefore consider this HIA as a tool for teasing out the distribution of impacts on the human element and the voiced and unvoiced agendas in both locations.

The timing is also conducive for this HIA. In particular, the evaluation of station alternatives is at a point where the designs are still modifiable and decisions amenable to recommendations from an HIA. Hearings continue in Gilroy and Merced, and full EIR's are not expected until 2012. Hence the capacity and resources of our HIA team match the production timeline and the policy window. From a broader perspective, political opposition at the federal level currently threatens funding for the overall project. These threats can be addressed by objective local evidence which gives decision-makers a complete view of the costs and benefits for their constituents and others.

TABLE 2.1 EIR ALIGNMENT AND STATION EVALUATION OBJECTIVES AND CRITERIA

OBJECTIVE	CRITERIA
MAXIMIZE RIDERSHIP/REVENUE POTENTIAL	• TRAVEL TIME • LENGTH • POPULATION/EMPLOYMENT CATCHMENT
MAXIMIZE CONNECTIVITY AND ACCESSIBILITY	• INTERMODAL CONNECTIONS
MINIMIZE OPERATING AND CAPITAL COSTS	• LENGTH • OPERATIONAL ISSUES • CONSTRUCTION ISSUES • CAPITAL COST • RIGHT-OF-WAY ISSUES/COST
MAXIMIZE COMPATIBILITY WITH EXISTING AND PLANNED DEVELOPMENT	• LAND USE COMPATIBILITY AND CONFLICTS • VISUAL QUALITY IMPACTS
MINIMIZE IMPACTS TO NATURAL RESOURCES	• WATER RESOURCES • FLOODPLAIN IMPACTS • THREATENED & ENDANGERED SPECIES IMPACTS
MINIMIZE IMPACTS TO SOCIAL AND ECONOMIC RESOURCES	• ENVIRONMENTAL JUSTICE IMPACTS (DEMOGRAPHICS) • FARMLAND IMPACTS
MINIMIZE IMPACTS TO CULTURAL RESOURCES	• CULTURAL RESOURCES IMPACTS • PARKS & RECREATION/WILDLIFE REFUGE IMPACTS
MAXIMIZE AVOIDANCE OF AREAS WITH GEOLOGIC AND SOILS CONSTRAINTS	• SOILS/SLOPE CONSTRAINTS • SEISMIC CONSTRAINTS
MAXIMIZE AVOIDANCE OF AREAS WITH POTENTIAL HAZARDOUS MATERIALS	• HAZARDOUS MATERIALS/WASTE CONSTRAINTS

Given the size of the investment in preparing for the project, and the project costs itself (~ $60 billion), this HIA is certainly warranted. It will capitalize on the wealth of project documents produced to date, and utilize resources of students and faculty affiliated with the UC-Berkeley Health Impact Assessment Group. The segment-specific HIA made possible by these in-kind resources may spur further interest in additional pathways and segments. The ultimate goal of the HSR project, like all development projects, is to improve lives. It makes sense then to measure closer to that goal of improving the human element. The costs of an expanded HIA would be a tiny fraction of the amount already spent on assessment and planning alone. Relative to the costs of the project as a whole, the costs of such an assessment are negligible.

Other considerations in the determining whether and how to proceed with this HIA included the following:

- Other impact assessments: have impacts been assessed/ mapped in other sectors, e.g. social and economic impact assessments? How might a HIA build on them?
- Generalizability/ transferability: could local health impacts from specific portions of segments be expected elsewhere? This is a huge project and a small (limited and/or localized) but successful HIA can have major implications.
- Inputs: is there adequate data and an evidence-base for projecting the primary health concerns?
- Case studies: has HIA been used in other HSR projects? If so, how?

WHAT ARE THE GOALS OF THIS HIA?

- To assess segment-specific and local health impacts which have not been considered or evaluated to date
- To add the health lens to the HSR process and open up further consideration of the human element of this massive public investment
- To determine the potential health impacts of high-speed rail in the San Jose-Merced corridor.
- To highlight health impacts not being explicitly considered in the current planning process by the HSR Authority.
- To offer recommendations to help mitigate potential health impacts in the corridor

CHAPTER 3. SCOPING

BASELINE CONDITIONS

To get an understanding of the local and regional context of the San Jose to Merced corridor, we reviewed county and city level indicators from the U.S Census, county health departments, and California Health Interview Survey. Table 3.1 summarizes the city-level demographic, economic, and health measures for the three HSR station cities as they compare to statewide data. All three cities have a lower percent white population than the state as a whole, indicating that these areas are primarily communities of color and therefore highly vulnerable to structural racism, discrimination, low access to essential resources, and poor health outcomes.[6] Gilroy and Merced have primarily Latino residents, many of whom speak Spanish at home, and over a third of the city's population are under the age of 18. These factors suggest that language and childcare factors may inhibit the effective engagement of these populations in the public participation planning process of HSR, thereby preventing them from self-advocating for issues of potential health impact.

The median household incomes vary drastically throughout the corridor, with San Jose having wealthier households and Merced having more lower-income households than the statewide median. Over a quarter of Merced residents live in poverty and more than half are renters. These stark income disparities indicate the potential for inequitable influences of HSR on corridor residents.

The health status of the three station communities also varies greatly throughout the corridor. Of particular concern is Gilroy, where adults have higher rates of asthma, diabetes, high blood pressure, high cholesterol, and overweight/obesity than statewide rates. Merced also has high rates of overweight/obesity, and a third of San Jose adults have high blood pressure. It is essential to take into account these pre-existing health conditions because they can increase individual and community-level vulnerability to environmental changes.[7] Furthermore, these baseline health conditions illuminate the need for policies and programs that provide opportunities to address the root causes of the negative health outcomes.

---

[6] PolicyLink. Why Place and Race Matter http://www.policylink.org/site/c.lkIXLbMNJrE/b.6728307/k.58F8/Why_Place___Race_Matter.htm Accessed 30 Apr 2011.

[7] California Environmental Protection Agency and Office of Environmental Health Hazard Assessment. Cumulative Impacts: Building a Scientific Foundation. Dec 2010. http://oehha.ca.gov/ej/cipa123110.html. Accessed 1 May 2011.

TABLE 3.1 BASELINE CONDITIONS, STUDY AREA

INDICATOR		CALIFORNIA	SAN JOSE	GILROY	MERCED
Demographic					
POPULATION [1]					
Total		37,831,753	930,402	34,857	76,367
Age	Youth	9,641,121 (25%)	239,385 (26%)	10,898 (32%)	23,952 (32%)
	Adult	23,859,949 (63%)	595,819 (64%)	21,141 (60%)	44,901 (59%)
	Senior	4,330,683 (12%)	95,198 (10%)	2,818 (8%)	7,514 (10%)
Race/ Ethnicity	Hispanic	14,043,473 (37%)	305,634 (33%)	24,432 (70%)	38,616 (51%)
	White	15,472,445 (41%)	275,090 (30%)	7,740 (22%)	23,238 (30%)
	Asian	4,567,360 (12%)	284,923 (31%)	1,214 (3%)	7,604 (10%)
	Black	2,229,389 (6%)	27,889 (3%)	603 (2%)	4,101 (5%)
People with disabilities[2]		10%	8%	---	15%
Speak Spanish at Home[1]		9,874,598 (28%)	204,714 (24%)	16,178 (52%)	25,265 (36%)
Registered Voters, 2006[3]		15,755,794 (42%)	368,852 (40%)	13,435 (39%)	30,672 (40%)
Economic					
Median Household Income[4]		$60,392	$78,660	$67,317	$34,757
People in Poverty[4]		13%	10%	8%	27%
Renter Occupied Housing Units[1]		5,386,511 (43%)	109,759 (38%)	4,468 (47%)	13,620 (58%)
Health (adults) [5]					
Adults ever told have:	asthma	14%	13%	25%	17%
	diabetes	9%	12%	14%	8%
	high blood pressure	27%	30%	43%	26%
	high cholesterol	22%	30%	40%	23%
Obese/Overweight		61%	58%	66%	66%
Report vigorous physical activity		--	57%	52%	--

* red shading indicates value is substantially higher than the state average, blue indicates substantially lower

1. Nielsen Claritas, 2010 (accessed from Healthycity.org)
2. ACS 2008 1yr (accessed from Healthycity.org)
3. SWDB Registered Voters, 2006 (accessed from Healthycity.org)
4. American Community Survey 5-Year Estimates, 2005 ~ 2009
5. San Jose, Gilroy, and California data from the Santa Clara County Health Profile Report; Merced data from 2009 CHIS and is at the County level

At the county level, baseline health and environment indicators suggest Merced is at greater risk (Appendix Table A2). However, county-level differences are quickly diluted at the sub-county level, especially in the city of Gilroy which represents just 4% of the population of Santa Clara county. Upon further study, it was clear that Gilroy was also at risk, and the timing and project facts presented an opportunity for assessment to be a meaningful contribution to the process.

STAKEHOLDER INPUT

To understand the issues of concern and potential health influence in the corridor, we reviewed the details of HSR project facts and commentaries as they relate to the baseline contextual conditions. The City of Gilroy in particular has been in active communication with the HSRA through regular meetings and sharing comments in response to the Station Area Development Guidelines and the Preliminary Alternatives Analysis Report. These documents reveal numerous issues that Gilroy is concerned are not being adequately addressed by the HSRA's planning process, including a lack of funding for local government coordination and planning efforts, too short notice for public comment periods, unclear financing requirements and responsibilities, inadequate attention to environmental justice concerns from displacement, inattention to affordable housing issues, and design and development guidelines that do not distinguish between the unique characteristics of large and small cities[8]. Other points of contention throughout the corridor include the ridership and employment forecasts, which have varied across HSRA reports and been criticized by third-party groups[9].

Time and resource constraints prevented the research team from actively engaging with stakeholders throughout the course of this HIA. Although active communication and involvement with stakeholders is a priority component for HIAs[10], "desktop HIAs" such as this one can also prove useful[11], perhaps as a starting point for further collaborative investigations.

HEALTH DETERMINANTS CONSIDERED

The initial process of considering all possible HSR health determinants was formative, due to the team's inexperience with HSR and its potential health impacts. Furthermore, the health determinants considered outnumber the health determinants pursued due to the unexpected

[8] City of Gilroy. 2010. City of Gilroy Comments on Draft HST Station Area Development: General Principles and Guidelines.
[9] Brownstone et al. 2010. Review of "Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study" Institute of Transportation Studies. University of California, Berkeley.
[10] North American HIA Practice Standards Working Group (Bhatia R, Branscomb J, Farhang L, Lee M, Orenstein M, Richardson M). 2010. Minimum Elements and Practice Standards for Health Impact Assessment, Version 2. North American HIA Practice Standards Working Group. Oakland, CA.
[11] Health Impact Project. The HIA Process. http://www.healthimpactproject.org/hia/process. Accessed 5 May2011.

change in the HIA team's personnel, which resulted in a more specific final scope of analysis. Table 3.2 depicts the scope of health determinants considered, with the issues in red becoming components of this HIA's analysis.

TABLE 3.2 HEALTH DETERMINANTS CONSIDERED

Transportation	Land Use	Demographics	Economic	Ecological	Political
VMT	Farmland	Gentrification	Poverty	Wildlife	Local buy-in
Traffic delays, Congestion	City revitalization	Spatial mismatch	Ridership	Sustainable E source	Community input
Accidents, Injury	Aesthetics	Social cohesion	Alternate modes	Wildlife corridors	Model for other states
Noise	Walkability	Segregation	Income gain	Parks & Rec	Vulnerable sub-groups
Pollution	Open space		Tax Revenue		Alignment
Existing infrastructure	Watershed quality		Job access & creation		Shifts in political rep.
Access to health care			Property values		Safety net serv. at-risk
Parking Lots			Retail access		
Freight trucks			Competition		
Air Quality			Cost effective		

HEALTH DETERMINANTS PURSUED

In light of the multiple health determinants that will be influenced by HSR, it was necessary to narrow down the issues of concern to a set that is manageable in scope and scale given available resources and expertise. We referred to the HIA practice standards and selected issues based on factors such as the magnitude, certainty, permanence, and equity of potential health impacts. In some cases, a tool was used to help quantify and select impacts for detailed analysis and recommendations (Appendix Figure A3). Additionally, we selected issues that bridge multiple issue areas, have connections to both individual and community-level health outcomes of concern for the corridor, and have a strong base of established health connections and analytic tools. Several other pathways or variants were mapped out but not pursued (Appendix Figures A4-A6).

EMPLOYMENT

The first health determinant selected for analysis is employment, with a focus on the connections between a reduction in area unemployment and its association with stress, income stability, and associated health outcomes. Employment in the context of this HIA refers to jobs generated through the construction of HSR, as well as employment associated with daily system operations. While there may be some health outcomes associated with jobs generated by residents' ability to commute longer distances from this corridor to larger metropolitan areas, as well as the potential for station area secondary employment effects, the speculative nature of this job growth meant that employment in this context was not considered for the purposes of this HIA.

TRANSPORTATION MODE

The second health determinant selected for analysis is transportation mode, which refers to the means of transport that are used to travel within and through the corridor. High speed rail will provide an entirely new transportation mode option, resulting in shifts in the transportation behaviors of current and future California residents and visitors. Shifts in transportation mode choices can influence transformations in built, physical, and social environments, all of which have direction connections to multiple health outcomes.

PARKING

There are a number of different pathways through which parking may impact health. The health impacts stem from both the form and function of parking. Form characteristics include the area/ footprint, location, design and materials, and comprise at least two pathways: impacts related to run-off and to heat-island effects. There are numerous lot-level mitigations for both of these pathways. Function pertains more to the volume of traffic the lots will accommodate, and must be mitigated through traffic engineering and other measures.

FOOTPRINT

The fourth health determinant selected for analysis is the HSR station footprint, which refers to the land area requisite for constructing HSR stations, not including the area needed for rail alignment. The construction of these stations will bring new development opportunities to cities within the corridor, especially those marked for HSR stations. Such development can have significant long-term impacts on the demographic make-up and property values of San Jose, Gilroy, and Merced.

RESEARCH QUESTIONS

EMPLOYMENT

1. What will be the employment effects of HSR construction and operations in the San Jose to Merced corridor?
2. Is HSR going to create health relevant jobs in the San Jose to Merced corridor?
3. What will be the net benefit of the types of jobs generated by HSR construction and operations to corridor residents?

TRANSPORTATION MODE

1. How will the HSR stations influence active transportation, public transit, and vehicle trips throughout the corridor? What are the resulting health effects?
2. Who will and will not be able to conveniently and affordably utilize HSR within the corridor?

PARKING

1. How will the convergence of commuters change local traffic flow, and subsequently pedestrian safety?
2. How will lot-level characteristics impact health?

FOOTPRINT

1. Who will be displaced by proposed HSR footprints in Gilroy and Merced? Will footprints affect more disadvantaged populations within these rural station-cities?
2. Is there evidence that suggest there is pre-existing segregation in Gilroy or Merced? Based on proposed footprint locations, will HSR increase or decrease segregation and social cohesion?
3. What effect can HSR footprints have on property values? Combined with the mechanism of eminent domain, how will communities with low socio-economic status be affected?

METHODS AND BOUNDARIES

Table 3.3 summarizes the connections between the selected health determinants and lists the analysis methods and scales used to evaluate the health impacts within the study area.

TABLE 3.3 HEALTH DETERMINANTS, OUTCOMES, METHODS, AND BOUNDARIES FOR ANALYSIS

Health Determinants	Related Health Outcomes	Analysis Methods	Boundaries/ Scale of Analysis
Employment	Chronic disease, premature mortality, heart disease, depression, suicide, injury, violence, poor birth outcomes, inability to meet basic needs (e.g. nutritious food, housing, medication)	Empirical literature review, Secondary data analysis	Corridor-wide (regional-level)
Transportation Mode Choice	Chronic disease, respiratory illness, cancer, depression, premature mortality	Empirical literature review, GIS analysis, Synthesis of planning data, Secondary data analysis	Corridor-wide (Regional-level)
Parking	Heat-related illness, flood-related morbidity and mortality, cancers, asthma exacerbations, pedestrian injuries	Empirical literature review, GIS analysis, Secondary data analysis	Station area
Footprint	Risky behavior (e.g. substance abuse), premature mortality, morbidity, depression, homelessness, suicide, hospitalization recovery, heart disease, stress	Empirical literature review, GIS analysis, Synthesis of planning data, Secondary data analysis	Rural station city

VULNERABLE POPULATIONS

This HIA is also concerned with vulnerable sub-populations in the San Jose-Merced corridor, including children, the elderly, the disabled, immigrants, and communities with low socio-economic status. In addition, there are hidden populations in Gilroy and Merced, such as migrant farm worker families that work and live in the productive farm land of these rural station-cities. Literature has shown that land use and transportation issues especially affect children, elderly, the disabled, and those with low-income[12], and communities of color[13]. The degree of impact on the health of these vulnerable populations is evaluated further in the following analysis sections.

[12] Ewing R, Frank L, Kreutzer R. Understanding the Relationship between Public Health and the Built Environment: A Report to the LEED-ND Core Committee. 2006.

[13] Sánchez, Thomas W., Stolz, Rich, and Ma, Jacinta S. (2003). Moving to Equity: Addressing Inequitable Effects of Transportation Policies on Minorities. Cambridge, MA: The Civil Rights Project at Harvard University. http://civilrightsproject.ucla.edu/research/metro-and-regional-inequalities/transportation/moving-to-equity-addressing-inequitable-effects-of-transportation-policies-on-minorities/sanchez-moving-to-equity-transportation-policies.pdf. Accessed 10 Feb 2011.

CHAPTER 4. EMPLOYMENT

OVERVIEW AND RESEARCH QUESTIONS

This chapter is focused on the health impact of potential employment effects of HSR in the San Jose to Merced corridor. Much has been presented on the potential employment gains in the state as a result of the construction of HSR. HSRA has broken down these effects even further, and has projected the following employment effects.

- Proponents of the project have cited that the rail line will create 450,000 jobs over the next 25 years in the state, but these constitute employment opportunities that may arise due to the increasing connectedness of state regions, and not created by the HSR Authority.[1]
- HSRA estimates that there will be 112,000 construction-related jobs per year during the construction phase of this corridor.[2]
- HSRA also estimates that the system will need to hire personnel to work in construction, train maintenance, on-board services, ticketing, security, administrative personnel, track and power systems maintenance, operations control, and power management.[3]

Within the San Jose to Merced HSR corridor, the train will pass through several diverse communities, each experiencing varying rates of unemployment, employment in different job sectors, and potentially vulnerable populations. This section of the analysis will address the following interrelated questions:

1. What will be the employment effects of HSR construction and operations in the San Jose to Merced corridor?
2. Is HSR going to create health relevant jobs in the San Jose to Merced corridor?
3. What will be the net benefit of the types of jobs generated by HSR construction and operations to corridor residents?

HEALTH IMPACTS OF EMPLOYMENT

A review of the literature enumerates several potential health outcomes connected with employment. The health effects of employment are complex, and have many potential mediating factors. Some of the effects of employment that have direct links with health outcomes include income, job security, and occupational status.

The majority of the literature has focused on the effects of unemployment. While this HIA is primarily concerned with the health impacts of potential job growth in this sector, it is worth highlighting the health impacts of an increase in area unemployment. Areas with high

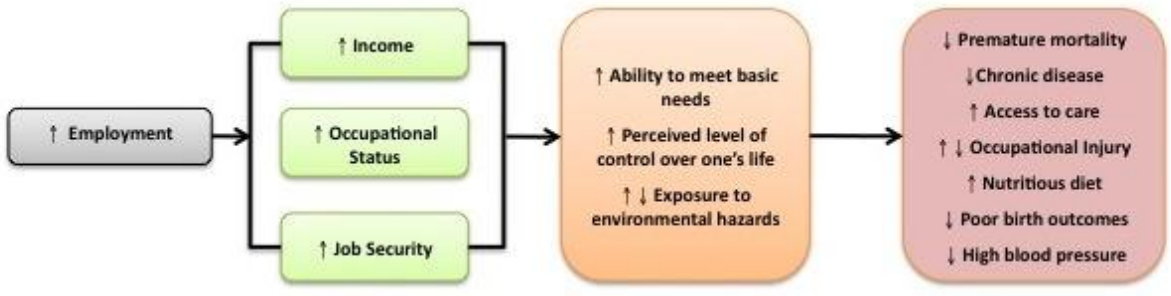
unemployment are associated with shortened life expectancy, higher rates of heart disease, hypertension, depression, and suicide. Suicides and accidents have been shown to be the primary cause of premature mortality among the unemployed, with the majority of these impacts affecting unemployed men. [4] Men, ages 35 to 60 and unemployed, have higher levels of mental health issues, including depression and anxiety, when compared to employed men in this age group. [5]

The health effects of regular access to stable and well paying employment are numerous. An increase in job security is associated with positive health outcomes such as a lower risk of heart disease, reduced risk of mental illness, and other illnesses, many of which can result from the associated stress of being unemployed or underemployed.[6] Access to a stable and well paying job enables greater income stability, another pathway for improved health outcomes.[7] Income stability enables people to purchase more nutritious food, secure better housing, and have increased schooling and recreational opportunities.[8]

Employment also affects income level. Lower income associated with increased risk for premature mortality, chronic health conditions, most cancers, injuries, violence, poor birth outcomes, and inability to meet basic needs (nutritious food, housing, medication, etc). [9 1011]

The quality and types of employment opportunities also matter. Some job categories have higher rates of mortality and morbidity and present occupational health risks to those employed in these sectors.[12] Occupational sectors categorized as "lower status jobs" often have increased risk of physical and psychosocial effects such as an elevated risk of physical injury. Among white collar workers, job classification also matters. The Whitehall study, a landmark study of British civil servants, showed that differences in heart disease outcomes differed by occupational classification. This health outcome was impacted by participants' perceived sense of control over their jobs.[13]

FIGURE 4.1 PATHWAY BETWEEN EMPLOYMENT AND HEALTH



The green boxes further divide employment into it main effects as previously described in the literature review: an increase in income, increase in occupational status, and an increase

in job security. While not all of these factors may be true for all categories of potential HSR employment, in the interest of linking employment with health outcomes, this diagram assumes that employment will lead to an increase in job security and greater occupational status. Arrows in the pathway diagram indicate the shift in directionality of the effects of employment, with the orange box showing some of the mediating effects along the pathway that connects employment with explicit health outcomes.

Unemployment rates are not uniformly distributed. Younger and older workers are the most likely be unemployed, as well as already vulnerable populations including low wage workers, recent immigrants, and people working in low skilled occupations. Data suggest that the health impacts associated with employment may be exacerbated in already low SES populations and may be due to fewer new employment prospects and lack of financial resources.[14]

OBJECTIVES AND EVIDENCE BASE

This chapter focused on the employment generated through the construction of HSR and its long term operations. This section did not focus on potential increases in employment as a result of residents' ability to commute longer distances, as well as secondary employment effects that may result from station area development. The chapter objectives were largely influenced by limitations in available data regarding HSR-related employment growth.

We drew from an evidence base comprised primarily of an empirical literature review regarding the connections between employment and health, as well as the use of secondary data sources. Secondary data sources such as the US Census, Bureau of Labor Statistics, Employment Development Department, and HSRA data were used to make both qualitative and quantitative links between both the match between unemployment and new jobs, as well as the health relevant profiles of the different employment categories.

BASELINE CONDITIONS

Baseline employment data was used to ascertain several key pieces of information about the current corridor-specific employment statistics, as well as how projected HSR-related jobs may potentially impact the residents of this corridor.

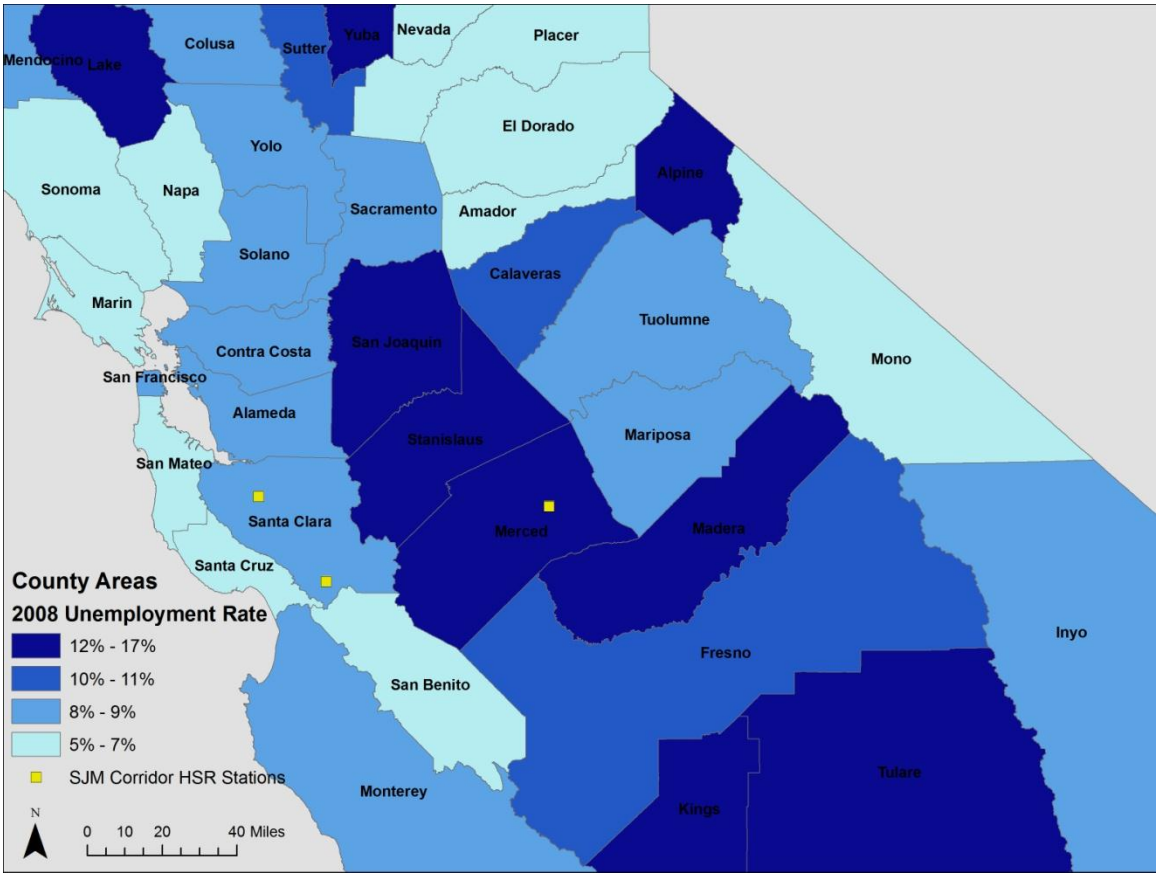
CORRIDOR UNEMPLOYMENT DATA

According to California's Employment Development Department, Santa Clara County and Merced County, the counties where the HSR corridor is projected to be built, have notably differing rates of unemployment. In Santa Clara County (encompassing the San Jose and Gilroy stations), the unemployment rate is 10.5 percent (89,900 people). In Merced County (where the Merced station is to be located), the unemployment rate is 21.2 percent (22,800 people).

As of January 2011, the average state unemployment rate was 12.7 percent.[15] These differences by county serve to illustrate not only the differing intra-corridor baseline conditions, but also how the potential employment effects of the HSR project may impact these existing rates.

The following map further contextualizes the differing statewide unemployment rates, showing the unequal distribution of unemployment in the states, as well as intra-corridor. The yellow dots indicate existing or planned station locations. Please note the GIS map was drawn using the most recently available GIS data, and not the January 2011 statistics. However, county disparities in employment levels within this corridor have remained consistent.

FIGURE 4.2 MAP OF 2008 UNEMPLOYMENT RATES IN THE SAN JOSE TO MERCED HSR CORRIDOR



In order to get a better picture of how employment opportunities may impact residents residing in towns with proposed stations, it is important to look at these rates in the cities of Gilroy and Merced. According to the current American Community Survey data, 68.1 percent of the population in Gilroy ages 16 and older is currently in the labor force, with a 5.6 percent unemployment rate. In the city of Merced, 61.3 percent of the population ages 16 and older are

currently in the labor force, with a 7.7 percent unemployment rate.[16]

SNAPSHOT OF CURRENT EMPLOYMENT

Employment further broken down by occupational sector is another way to establish baseline information for this corridor, as well as enable us to make projections about how likely area residents will be able to fill the potential jobs created by HSR.

TABLE 4.1: NUMBERS EMPLOYED IN EACH OCCUPATIONAL SECTOR BY COUNTY AND CITY

Occupational Sector	Santa Clara County	Merced County	San Jose (City)	Gilroy (City)	Merced (City)
Management/ Professional	402,801(48%)	21,646(23.6%)	186,174(41.2%)	6,449(29.8%)	7,960 (27.9%)
Service	114,980(13.7%)	16,527 (18%)	71,078(15.7%)	4,319 (20%)	5,561 (19.5%)
Sales and Office	185,708(22.1%)	20,004(21.8%)	106,152(23.5%)	5,340(24.7%)	6,692 (23.4%)
Farming	2,642 (0.3%)	7,719 (8.4%)	796 (0.2%)	919 (4.2%)	1,659 (5.8%)
Construction	60,349(7.2%)	9,649 (10.5%)	38,629(8.6%)	2,263(10.5%)	2,695 (9.4%)
Production, Transport, Material Moving	72,312(8.6%)	16,263(17.7%)	48,798(10.8%)	2,359(10.9%)	4,003 (14%)

VULNERABLE POPULATIONS

From the 2005-2009 American Community Survey, data suggest that many residents near proposed stations may face potential vulnerabilities in efforts to access stable and well paying employment. San Jose was not included in this section of the baseline data since Diridon Station already exists and the sheer size of the city makes it challenging to make assumption regarding the employment challenges faced by the city's vulnerable populations. For more information, please see a full-length version of this chart in the appendix.

TABLE 4.2 EMPLOYMENT-RELATED INDICATORS AND POTENTIAL VULNERABILITIES

INDICATOR	GILROY CHARACTERISTIC	SIGNIFICANCE	MERCED CHARACTERISTIC	SIGNIFICANCE
Education	26% less than high school diploma	Lagging education levels compared to county and state	30% less than a high school diploma	Lagging education levels when compared to state, similar levels common in county
Income	39% with income <$50,000	More low income households than county, but better than state average	62.6% with income <$50,000	Significant lower income population, potential vulnerable population that could be affected by HSR
Language	45% speak a language other than English at home, 39.6% speak Spanish at home	Outreach materials and meetings must be in Spanish to reach large portion of population	43% speak a language at home other than English, 33.5% speak Spanish at home	Outreach materials and meetings must be in Spanish to reach large portion of population
Nativity	25% foreign born	May be different cultural needs and preferences in Gilroy compared to other areas in county and state	20.9% foreign born	May be different cultural needs as compared with rest of state, number may also not be a fully accurate representation of non-US born residents

Combined with the project's employment facts, the corridor baseline information enabled us to analyze this information to determine the potential effects of HSR-related employment and the potential health effects of these changes for residents in the San Jose to Merced corridor.

ANALYSIS

The analysis phase of this chapter of our HIA was conducted using an empirical literature review and secondary data analysis, relying primarily on source material from HSRA, US Census, Bureau of Labor Statistics, and California Employment Development Department. All data is publically available.

Before delving into the analysis of the number and quality of employment opportunities that will be available to residents of the San Jose to Merced corridor, it is important to explain what constitutes HSR employment. For the purposes of this analysis, the impact of employment opportunities and health relevant characteristics of these jobs were divided into short and long term employment. Short term employment refers to the construction jobs anticipated to be generated by HSR construction in this corridor. Long term employment refers to permanent train operations jobs, including maintenance, ticketing, administration, and other job categories.

IMPACT OF SHORT TERM CONSTRUCTION EMPLOYMENT

The HSRA estimates that their project will create 112,000 construction jobs per year (with an estimate of 600,000 of these jobs over the life of the project). However, there are some discrepancies regarding whether these projections are San Jose to Merced corridor specific or for the whole statewide construction project. Despite some of these inconsistencies, the analysis of the impact of short term employment was conducted using data from the most recent version of the project facts sheet for the San Jose to Merced corridor.[17]

With the 112,000 jobs estimate in mind, we first considered whether these potential jobs met the employment needs of resident in the San Jose to Merced corridor. Nationally, the unemployment rate for construction workers in 20.6%.[18] EDD does not provide construction unemployment data on a per state level, but within Santa Clara County, 7.2% of its residents (60,349 people) currently work in the construction industry and in Merced County, 10.5% of its residents (9,649 residents) work in this industry. Please see Table 4.1 for more detail.

In determining who might be able to meet the requirements for this type of short term employment, it is also worth noting that there is not a clear set of education and skill requirements in order for someone to hold a construction job. Job classifications vary from on

the job training to vocational education to four year college degrees, depending on the level of job responsibility and pay. EDD publishes a full list of occupational titles and required training for each construction job classification on its website.[19]

For the purposes of this analysis, we assumed that most job opportunities would be available for construction laborers. This classification typically only requires on the job training.[20] Among construction laborers, a majority of them are white males, with Latino males the next most likely to be employed in this job sector.[21] Despite the tendency of the construction laborer profile to be primarily white and male, if corridor residents were to be exclusively hired to perform these 112,000 construction jobs, it would provide an influx of jobs for the approximately 122,700 residents currently unemployed in both counties. However, the potential health impacts of this influx of short-term employment cannot be considered without some additional information. First, construction firms are not one of the top twenty employers in either county.[22] In addition, construction labor is very physically demanding work and cannot likely be performed by all the unemployed residing in both counties.

Beyond area employment projections, we also examined the health relevant profile of construction employment. Laborers earn at minimum in either county approximately $15 to $20 an hour for this type of work, and this wage varies regionally. Benefits also vary widely by construction firm. About 13% of construction workers are unionized nationally, an indicator of both job and income stability.[23] We also assessed the incidence of injury and other effects that might make potential employment an "unhealthy" option. Among construction laborers, there is a 4 per 100,000 person incidence rate, combined with the already physically demanding nature of the job.[24] Using this data, we developed a chart to assess the health relevant characteristics of this type of employment in Table 4.3.

TABLE 4.3 HEALTH RELEVANT CHARACTERISTICS OF CONSTRUCTION EMPLOYMENT

Characteristics	Parameters	Present?
Wage/ Salary	Living wage, able to meet needs	✔
Benefits	Health, Life, Disability Insurance	✔ ✖
Security	Unionized, Long-term stability	✖
Safety	Minimal risk of mortality/morbidity	✖

These findings suggest that while construction has the potential to reduce area unemployment and provide a living wage to residents, the uncertainty of ongoing job security and as well potential safety risks as a potential area for further consideration. Much of the uncertainty rests on HSRA's ability to secure contracts with construction firms that provide benefits and permit unionization. In addition, the short term nature of construction work may mean that there will be a significant number of employees who find themselves out of work at the end of the projected 6 year construction timeframe. This could have the potential to reverse the effects of any potential health benefits associated with a reduction in area unemployment and increased income.

IMPACT OF LONG TERM OPERATIONS EMPLOYMENT

HSRA has not released final projections for long term, permanent employment opportunities for residents of this corridor. For the purposes of this analysis, we relied on a job factsheet published by HSRA that outlined the number of anticipated system-wide jobs needed to run HSR daily operations.[25] Table 4.4 shows these jobs delineated by job type, employment details, projected number of statewide hires, and required skill set.

TABLE 4.4 HSRA PROJECTED JOB CREATION

Job Type	**Employment Details**	**Projected Number of Hires (system-wide)**	**Required Skill Set**
Train Maintenance and Overhauls	Basic body and paint shop work, upholstery and fabric people	1,500	A mix of skills Similar to aircraft mechanics, systems and electrical engineers and technicians 4 year technical degree, plus specialized training High-tech skills important
Ticketing, Security, Passenger Service, Headquarter Management and Administration	Security staff, ticket machine maintenance, customer service, accounting, finance, scheduling,	1,100	Skills needed to run/ work in a business

	administration		
Drivers, Conductors, and Onboard Service		880	Similar to today's railroad personnel Training more rigorous, similar to airline personnel High-tech skills important
Track, Ballast, Power Systems, Signaling, Telecommunications, Structures Maintenance		440	Specialized training for some Similar to utility lines people, cable installers, IT people, road maintenance crews High-tech skills important for about half of the positions
Operations Control and Power Management		100	Specialized training Railroad dispatching, similar to air traffic control Utility load management type positions High-tech skills important

Based on the assumption that HSR will generate 4,020 permanent operation jobs system wide, we decided to estimate the number of jobs to be created in the San Jose to Merced corridor. We next did a rough calculation of the number of permanent operations related jobs to be created in this corridor. We considered the option of projecting these jobs based on ridership, but because ridership numbers have been in flux, this estimate would have likely been too speculative. As such, we decided to divide the total number of jobs by 24 stations (the total number of HSR stations throughout California) and then multiply this number by 3 (representing San Jose, Gilroy, and Merced stations). This resulted in a final estimate of 502.5 jobs in the San Jose to Merced corridor.

TABLE 4.5 NUMBER OF PROJECTED PERMANENT JOBS BASED ON STATION NUMBERS

Job Type	**# of Jobs/ 24 HSR Stations**	**SJ to Merced Corridor (multiplied by 3 stations)**
Maintenance	1500	187.5
Ticketing	1100	137.5
Drivers	880	110
Track	440	55
Operations	100	12.5
Total	**4020**	**502.5**

The estimated number of 502.5 jobs, if offered to all unemployed residents in Merced County, would only reach 2.2% of the currently unemployed. This number is even smaller when factoring in Santa Clara County's unemployment statistics. Considering that 2/3 of the stations in this corridor are in Santa Clara County, the long term employment generated by permanent HSR employment is likely to be marginal at best. However, this calculation does not include potential HSR-related secondary employment, such as residents who may be employed by station area development and growth. Consequently, these numbers may be higher, but at the present moment, secondary employment effects are too uncertain and should be considered in future projections.

In the next phase of the analysis, we considered the health relevant profiles of long term employment through HSR. Although required skill sets vary considerably, the HSR business plan projects that the average salary will be around $71,000 and provide benefits including health insurance, paid vacation and sick time, and savings plans.[26] This suggests that these jobs will most likely provide a living wage and have benefits. However, since information on these jobs is limited from HSRA, it remains uncertain if these jobs will have long term job security, be unionized, and have a minimal risk of mortality and morbidity.

TABLE 4.6 HEALTH RELEVANT CHARACTERISTICS OF LONG TERM EMPLOYMENT

Characteristics	**Parameters**	**Present?**
Wage/ Salary	Living wage, able to meet needs	✔
Benefits	Health, Life, Disability Insurance	✔
Security	Unionized, Long-term stability	✔ ✖
Safety	Minimal risk of mortality/morbidity	✔ ✖

Despite the increase in potential employment opportunities through the construction and operations of the rail system, the jobs created by the high speed rail are unlikely to benefit the majority of residents of the San Jose to Merced corridor who may be unemployed or seeking to change job classifications. However, the uncertainty over details of both projected long and short term employment opportunities provides several opportunities for HSR to both increase the likelihood of area residents to benefit from employment opportunities, as well as the potential for positive health impacts associated with these job opportunities.

LIMITATIONS

This analysis has several limitations. First, the lack of concrete data from HSRA regarding potential employment effects made it challenging to determine how and if these potential employment opportunities will reach corridor residents. Employment projections tended to change regularly, and there was some disagreement within HSRA documentation of whether projected construction employment would be statewide or regional.

Second, the employment calculations were rough estimates and are not intended to present the full picture of potential area employment growth. As previously mentioned, area residents may find additional employment opportunities through secondary job growth (e.g. station area retail and food service occupations) and increased ease of access to jobs in large metropolitan areas.

Third, employment data from state and federal agencies varies on level of scale, further complicating our ability to predict corridor specific employment effects. In addition, job sector skill requirements and pay varies considerably, as well as other ancillary benefits such as collective bargaining, paid leave, and risk of occupational injury.

RECOMMENDATIONS

In order to maximize the benefits of potential employment opportunities to residents of the San Jose to Merced Corridor, we have several recommendations.

Enact a local hiring policy for HSR employment. HSRA should quantify where workers will be hired from, as well the number to be hired within the corridor and per station area. Hiring locally will enable residents to access needed jobs, and will ensure that both short and long term occupational opportunities will help reduce area unemployment.

Require that employees receive benefits and job security through collective bargaining. Hiring construction workers who are unionized and receive benefits, will ensure that workers receive a living wage. Collective bargaining through unions will help secure wages, health benefits, and will increase the likelihood that these employment opportunities will

positively impact the livelihoods of corridor residents. This can be accomplished through requiring that all construction firms contracted by HSRA to build the rail system permit unions and provide comprehensive benefits to their workers.

Provide opportunities for job training and skills development for local residents. This will help avoid any potential skills mismatch between current and projected employment changes. Providing opportunities for skills development, particularly in the long term jobs that require high tech skills, will further aid in hiring and retaining residents to fulfill these job categories. Employing people with high skill levels and continued opportunities for training through job corps and/or community college courses will further ensure that the new HSR workforce is able to perform their job functions and rise to meet the challenges of maintaining the new rail system.

CHAPTER 5. TRANSPORTATION MODE

OVERVIEW & RESEARCH QUESTIONS

Transportation mode refers to the way that people decide to travel from one location to another. Examples of the most common transportation modes include personal vehicle, carpool, airplane, bus, conventional rail, biking, and walking. High speed rail will mark the creation of an entirely new transportation mode option, resulting in shifts in the transportation behaviors of California residents and visitors. For this analysis section, transportation mode is conceptualized as the means of transport that are used to travel within and through the San Jose to Merced corridor.

The HSRA emphasizes the potential for numerous benefits related to transportation mode shifts that will result from the operation of HSR, including[1]:

- Cities that are unserved or underserved by airlines, especially those in the Central Valley, will enjoy easy, economical, reliable, and fast commuter travel connections to Northern and Southern California
- High-speed trains will reduce traffic on freeways by creating high-speed options for long-distance travelers, freight movement, and enhanced local commuter transit
- The high-speed train system will help remove millions of passenger trips from the road, significantly helping to improve air quality in the Central Valley, home to some of the nation's poorest air

This section critically evaluates these assumptions as they relate to the potential transportation mode shifts from HSR that will occur within the San Jose to Merced corridor. It connects the projected transportation mode shifts to health impacts for individuals and communities within the corridor and provides recommendations for how to maximize the beneficial health outcomes of the HSR project. The analysis focuses on addressing two interrelated questions:

1. **How** will the HSR stations influence active transportation, public transit, and vehicle trips throughout the corridor? What are the resulting health effects?
2. **Who** will and will not be able to conveniently and affordably utilize HSR within the corridor?

HEALTH IMPACTS

Many direct and indirect health effects are associated with transportation mode choices. Vehicle miles traveled from autos and trucks are directly proportional to air pollution

and greenhouse gas emissions.[2] Both long and short-term exposure to air pollution from vehicle emissions has been linked to numerous adverse health outcomes[3], including the development and exacerbation of asthma[4,5,6], preterm births[7], infant mortality[8], heart attacks[9], lung cancer[10], and life expectancy[11]. Vehicle use also contributes to increased neighborhood noise[12], which in turn contributes to sleep disturbance, annoyance, leading to decreased concentration, increased aggressive behavior, decrease helping behavior, hypertension, cardiovascular disease, and metal disorder.[13] Airplane travel is also linked to detrimental levels of air and noise pollution[14].

Frequency of driving trips is associated with increased risk for collision15, and vehicle flows can increase risk for pedestrian injuries and fatalities16. Driving as a mode choice also has indirect effects on health, such as by taking time away from health promoting activities like physical activity, which in turn increases the likelihood for obesity[17.] Costs from transportation can severely decrease disposable income, which limits household's abilities to purchase essential goods and services, such as adequate shelter, healthy food and medical care, and can increase emotional stresses[18].

Although most of the established health outcomes related to the mode choice of motor vehicles are negative, car ownership in some environments, such as rural communities, can have health promoting effects by improving access to essential resources such as employment opportunities, nutritious food, recreational opportunities, and health care[19].

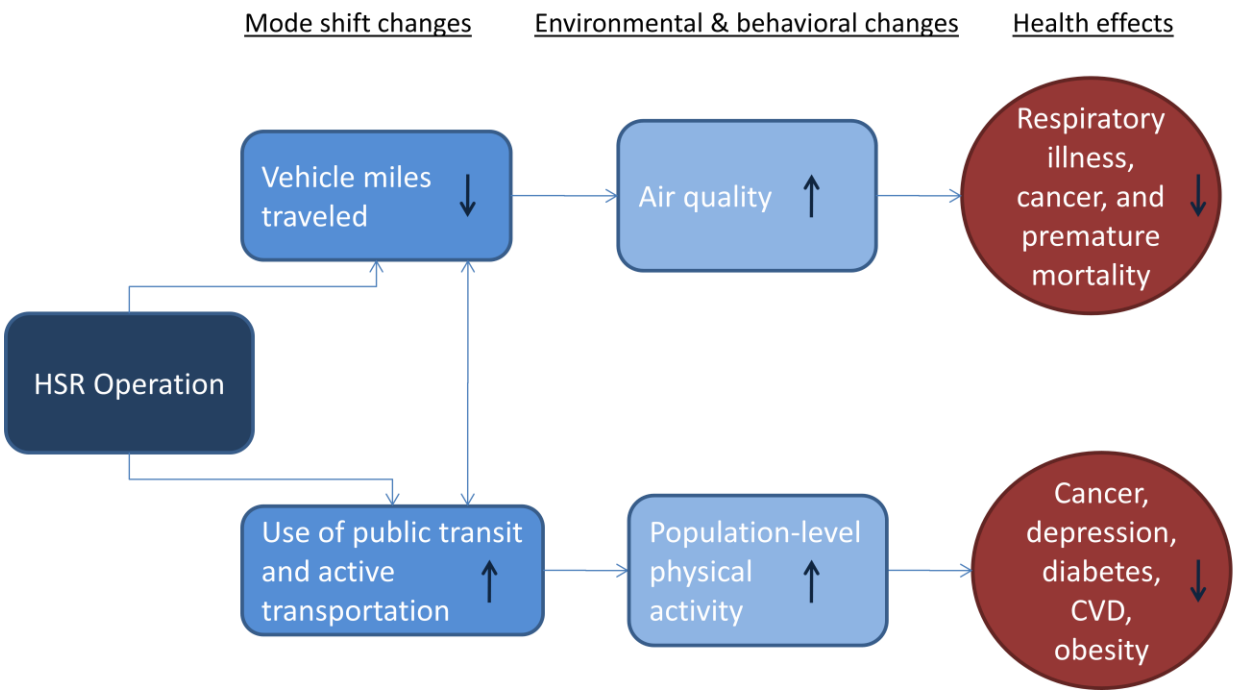
Transportation modes choices that utilize public transit, such as buses and rail, or carpooling can mitigate some of the negative health outcomes associated with personal vehicle use because of lower rates of air and noise pollution and traffic flow per person transported. Transit use is also associated with increased levels of physical activity, which is associated with reduced risk of premature death, coronary heart disease, hypertension, colon cancer, diabetes, depression and anxiety[20,21]. For both public transit and auto trips, longer commute times are associated with increased levels of psychophysiological stress[22].

Active transportation modes, including walking and biking, are also related to the increased physical activity benefits listed above. Although there is some debate about the safety risks associated with walking and biking due to increased risk for vehicular collisions, most empirical evidence suggests that the health benefits of physical activity far outweigh the increased risk,[23] and great enough increases in walkers and bikers can actually decrease overall risk for collision[24].

An analysis of how HSR may influence each of these multiple connections between transportation mode and individual and community health outcomes is beyond the scope of this particular analysis. Please see the Table A.3 in the Appendix for details on the criteria used

to select the particular pathways to pursue. Figure 5.1 displays the selected pathways that are the focus of this section's analysis.

FIGURE 5.1. PATHWAYS BETWEEN SELECTED TRANSPORTATION MODE INFLUENCES AND HEALTH



The arrows in each box of the figure indicate the directionality of the hypothesized changes to that factor that may result from the HSR transportation mode option being introduced to the San Jose to Merced corridor. Pathways related to transportation mode that are not included in this diagram or section analysis include changes in airplane trips, access to employment and essential goods and services, transportation cost burden, pedestrian and car injuries and fatalities, noise pollution, and commute time.

OBJECTIVES & EVIDENCE BASE

The Healthy Development Measurement Tool (HDMT)[25] was reviewed to select the particular health priorities and objectives that relate to the hypothesized transportation mode changes that may result from HSR operation within the study area. The HDMT is a comprehensive evaluation metric designed to consider health needs in an urban environment. Since this analysis focuses on a study area that includes urban, suburban, and rural areas, many of the HDMT benchmarks were not appropriate to apply to this diverse and regional-level analysis. However, the HDMT checklist's sustainable transportation section includes three applicable health-promoting objectives:

1. Decrease private motor vehicles trips and miles traveled
2. Provide affordable and accessible transportation options
3. Create safe, quality environments for walking and biking

With these objectives in mind, we reviewed the empirical literature to create an evidence base to illuminate the factors that contribute to the realization of each of these objectives. Results were narrowed to only include factors that relate to the San Jose to Merced region rather than just local-level influences. For example, site-specific design mitigations and pricing policies are not included in this review, but general land use and transportation planning suggestions are.

Ewing et al. (2006) conducted a comprehensive literature review of the factors that influence vehicle miles traveled and summarized the findings as relating to five main categories: residential and employment density, land use mix, regional location, street connectivity, and transit access. A more recent review[26] expanded on these factors and classified them as the 5Ds that affect mode choice:

> *Net Residential Density* - All else being equal, denser developments generate fewer vehicle-trips per dwelling unit than less dense developments.
>
> *Jobs/Housing Diversity* – Having residences and jobs in close proximity reduces the vehicle-trips generated by each by allowing some trips to be made on foot or by bicycle.
>
> *Walkable Design* – Many factors influence the pedestrian experience, and it is difficult to come up with a single definition that captures them all. A common important measure is sidewalk availability[27]. When measured, design variables usually have the weakest influence on the overall adjustment of the D factors, though it also seems to have important synergistic effects in conjunction with density and diversity.
>
> *Destinations* – Households situated near the regional center of activity generate fewer auto trips and vehicle-miles of travel.
>
> *Distance to Rail Mass Transit Station* – Automobile trip generation is lower for developments near transit stations. Transit ridership rates among station-area residents increase exponentially as the distance to a rail station declines.

Other empirical evidence exists regarding the proven influences on vehicle use, public transit, and active transportation. For example, VMT patterns are greatly influenced by broader economic factors such as employment rates and gasoline prices[28] and household-level measures of size and income[29]. Personal attitudes and circumstances can have more important influence on transportation mode choice than the built environment.[30] Cross-sectional evidence

shows that bicycle trip frequency increases in areas that implement policies related to bike-lanes and infrastructure, end-of-trip facilities and transit integration, incentive programs, improved bicycle access, decreased vehicle speed limits, and a comprehensive bike-friendly policy packages[31].

BASELINE CONDITIONS & ANALYSIS

The objectives and evidence base described above informed the evaluation of the potential health effects of transportation mode shift from HSR operation in the San Jose to Merced corridor. There are many research questions that could be evaluated with regards HSR's influence on health as it relates to shifts in transportation mode, but time and resource constraints required us to focus on a few key questions. We narrowed down the scope of analysis by choosing questions that relate to the core HIA priorities of evaluating impact, equity, and mitigation.

Baseline health data also influenced the question selection. For example, the fact that 13%, 25%, and 17% of the adult population in San Jose, Gilroy, and Merced (respectively) have been diagnosed with asthma, suggests that it is essential to evaluate the potential for changes in air quality throughout the corridor. Also, two thirds of the adult population in the corridor is overweight or obese, which suggests a need to analyze the effect that mode shifts could have on physical activity. This next section describes the baseline conditions and analysis results for both of the research questions mentioned in the first section.

QUESTION 1: HOW WILL THE HSR STATIONS INFLUENCE ACTIVE TRANSPORTATION, PUBLIC TRANSIT, AND VEHICLE TRIPS THROUGHOUT THE CORRIDOR? WHAT ARE THE RESULTING HEALTH EFFECTS?

Q1 BASELINE CONDITIONS

Current commute mode choices for the populations of the state, the three station cities, and two corridor counties are displayed in Table 5.1. Data for the HSR station cities is included as a way to assess if there are particularly different patterns at the city-level that may strongly influence or stray from the county-level figures. Statewide data is included as a reference to norms across HSR's customer base. The blue circles indicate commute mode patterns that are higher for modes that are related to health benefits (walking, biking, carpooling) or lower for modes that increase risk for adverse health outcomes (driving alone) as compared to the statewide percentage. The red circles indicate commute mode patterns that are lower for modes that are related to health benefits or higher for modes that increase risk for adverse health outcomes as compared to statewide percentage.

TABLE 5.1. STATEWIDE, HSR CORRIDOR STATION CITY, AND COUNTY-LEVEL MEANS OF TRANSPORTATION TO WORK, 2010[32]

	State	City			County	
Commute Mode	CA	San Jose	Gilroy	Merced	Santa Clara	Merced
Worked at Home	795,952 4.79%	15,576 3.48%	341 2.26%	1,034 3.87%	39,832 4.34%	3,711 3.98%
Walked	461,598 2.78%	9,212 2.06%	503 3.33%	634 2.38%	21,709 2.37%	3,001 3.22%
Bicycle	156,838 0.94%	3,940 0.88%	313 2.07%	385 1.44%	14,293 1.56%	720 0.77%
Carpooled	1,991,544 11.99%	48,184 10.76%	2,443 16.19%	3,967 14.86%	86,904 9.48%	12,993 13.94%
Drove Alone	12,102,044 72.85%	342,964 76.60%	10,194 67.54%	19,715 73.87%	704,283 76.80%	68,517 73.51%
Public Transportation	865,538 5.21%	18,952 4.23%	650 4.31%	195 0.73%	33,830 3.69%	616 0.66%
Other Means (e.g. Taxi or motorcycle)	239,258 1.44%	8,916 1.99%	650 4.31%	757 2.84%	16,241 1.77%	3,656 3.92%

Health promoting, as compared to statewide level

Health damaging, as compared to statewide level

In total, 872,697 of workers within the two county corridor area use vehicles to get to work (772,800 people drove alone to work + 99,897 who carpooled), 39,723 use active transportation, and 34,446 use public transit.

To assess the influence of these current commute pattern mode choices on the air quality of the region, we compiled air pollution data by pollution source from the National Emissions Inventory[33]. Table 5.2 shows that the majority (55%) of criteria pollutant emissions[34] in Santa Clara County come from on road light-duty sources, such as personal vehicles. On road heavy-duty vehicles, such as buses and commercial trucks, contribute to 11% of total emissions in the county, and non-road mobile sources (e.g. construction equipment) is responsible for 29% of emissions. In Merced, 40% of criteria pollutant emissions are from light-duty vehicles, while 43% are from heavy-duty vehicles and 14% are from mobile non-road sources. Total emissions from the 2 county region account for about 5% of statewide emissions in total and by source.

TABLE 5.2. STATEWIDE AND COUNTY-LEVEL CRITERIA POLLUTANT EMISSIONS BY SOURCE, 2008.

Area	Criteria pollutant emissions (tons) by source and % of area's total emissions										Total
	aircraft	%	on road light-duty	%	on road-heavy duty	%	mobile-non road	%	other	%	
Santa Clara County	2707	2	94917	55	18411	11	49316	29	7363	4	172714
Merced County	752	2	19060	40	20354	43	6787	14	740	2	47693
California	56869	1	2099042	48	756587	17	1214023	28	231682	5	4358203

Another environmental indicator that was considered in relation to air quality is the proportion of population living near busy roads, which includes 29% of population in Merced County, 71% of population in Santa Clara County, and 60% of residents statewide. Santa Clara's rate is the 5th highest in the state. A busy road is defined as a road with an average of more than 10,000 vehicles per day, and a person is considered to live near a busy road if their residence is within 300 meters of such a road.[35]

HSR project facts related to transportation mode shift include:

- Of all projected HST trips, about 75% will be diverted from auto, 15% from air, 8% from conventional rail , and 2% will be induced trips[36]
- About 6% of auto, 33% of air, and 27% of conventional rail interregional trips in California will be diverted to HST in 2030[37]
- It is likely that conventional rail ridership will increase as it is used as an access or egress option for HST, especially in the Central Valley[38]
- 30% of HST trips will be for commuting, 34% for recreation, 11% for business, and 25% for other purposes[39]
- Total HST boardings within the corridor range from 14,550 to 32,000[40]

Q1 ANALYSIS RESULTS

The facts and projections above can be combined to estimate the number of commute-related auto trips that will be replaced by HSR within the corridor. The maximum number of estimated station boardings is used.

32,000 boardings/day * 75% of trips diverted from autos =

24,000 trips within the corridor that otherwise would have been vehicle trips * 30% of HSR trips for commuting =

7,200 commute trips that would otherwise have been vehicle trips

872,697 daily commute trips that currently use autos within corridor – 7,200 diverted auto commute trips=

865,497 daily commute trips that will use autos within the corridor, which is about a 1% reduction in current commute-related auto trips.

This 1% does not capture the total reduction in VMT throughout the region because it does not evaluate mode shifts for non-commute trips, which will comprise 70% of HSR trips (see project facts above) and currently make up about 78% of all trips and 60% of trip miles[41]. However, if we assume that this same percent reduction in auto use applies similarly to the three non-commute purpose categories, we can expect an auto-use reduction for intraregional trips to be close to the 6% predicted decrease in interregional auto trips. Despite this modest reduction in personal auto trips, this mode shift may not result in significant reductions in VMT throughout the region because the population is expected to continue to grow 1-2% per year[42]. Overtime, the population increases could outweigh the auto trip reductions, potentially increasing VMT and decreasing air quality in the region. Air quality will still be better with the HSR mode option than without it, but additional measures will be needed to ensure that new residents in the corridor do not adopt the same auto-favoring habits of current residents.

Table 5.3 shows the relationship between current commute patterns and projected transportation modes of arrival to the three HSR stations within the corridor. These numbers would be expected to be somewhat different because HSR station arrival modes include passengers travelling for all purposes, while the current commute data only shows the modes that people use to travel to work. Nonetheless, the large differences in the auto trip and public transit categories are quite drastic, ranging from reductions in driving by 43% in San Jose to 26% increases in public transit use in San Jose and Gilroy. The difference between modes for work and personal trips is at most 10% in the Bay Area[43]. Therefore, it is unlikely that these changes in mode choices will be realized by HSR operation alone.

TABLE 5.3. CURRENT COMMUTE PATTERNS AND PROJECTED HSR ARRIVALS, BY HSR STATION

		Driving	Public transit	Walking/ Biking	Other
San Jose	Current commute pattern[1]	88%	4%	3%	2%
	Projected arrival to HSR station[2]	45%	30%	10%	15%
	Difference	**-43%**	**+26%**	**+7%**	**+13%**
Gilroy	Current commute pattern[1]	84%	4%	5%	4%
	Projected arrival to HSR station[2]	70%	30%	5%	5%
	Difference	**-14%**	**+26%**	**0**	**+1%**
Merced	Current commute pattern[1]	89%	1%	5%	3%
	Projected arrival to HSR station[2]	65%	20%	5%	10%
	Difference	**-24%**	**+19%**	**0**	**7%**

[1] Compiled from HealthyCity.org, data from Nielsen Claritas, Inc. 2010. Means of Transportation to Work. Accessed 15 Apr 2011.
[2] Compiled from HSRA Engineering Criteria Report Tables 4.6-2 and 4.6-3. 2004. "Estimated Station Parking Requirements—Commute Trips". Page 32.

The projected health effects from HSR's influence on mode choice within the corridor are difficult to estimate with precision because of the uncertainty of the relative and actual changes in transportation mode choices and volumes. Nonetheless, the evidence suggests that there may be some reductions in automobile use, and hence VMT within the corridor. This will have beneficial health effects for corridor residents, especially those in San Jose, where a majority of air pollution comes from personal vehicle use and many residents live in close proximity to busy roads. The improvements in air quality, however, may not be actual net reductions in emissions over time as population growth continues throughout the region.

There is also evidence, albeit questionably extreme, that more people will be encouraged to engage in physical activity as their use of public transit increases. However, exact projections are not possible without a more in depth analysis of the land use and design influences discussed in the evidence base section.

QUESTION 2: WHO WILL AND WILL NOT BE ABLE TO CONVENIENTLY AND AFFORDABLY UTILIZE HSR WITHIN THE CORRIDOR?

In order for individuals to utilize HSR, they will have to want to get to one of the locations where it stops, have sufficient disposable income to be able to afford it, and ideally have access to public transit to arrive at and move from their HSR station of choice. This evaluation considers measures of commute distances, income levels, and transit accessibility and makes projections about how those will relate to who and who may not benefit from HSR as a transportation mode choice.

Q2. BASELINE CONDITIONS

HSR is estimated to cut travel between cities within the corridor by one third. Table 5.4[44] compares the HSR travel times from Gilroy to neighboring cities as compared to current Caltrain and vehicle trips. The HSR estimates are based solely on time on the train and do not include travel to the station or wait time. With these factors included, it is likely that the typical HSR trip from Gilroy to San Jose would be about 30 minutes. To get to Merced from Gilroy, current drive times are about 1 hour and 40 minutes[45]. On HSR, it will be about 30 minutes, or most likely closer to 45 minutes including transit to the station and wait time.

TABLE 5.4. TRAVEL TIMES BY MODE FROM GILROY

Station	Journey times in minutes from Gilroy		
	Caltrain (scheduled)	HSR (estimated)	Auto (MapQuest)
San Jose	50	15	47
Redwood City	81	27	67
Millbrae	107	33	80
San Francisco	115	44	94

Table 5.5 shows that a majority (~60%) of workers within the corridor have commute times less than 30 minutes and about 14% (99,580) workers currently commute more than 45 minutes. As discussed above, commuting is not the only form of travel that will utilize HSR, but it is mentioned here because the data is readily available and may be indicative of driving patterns to other destinations in the area.

TABLE 5.5. STATEWIDE, HSR CORRIDOR STATION CITY, AND COUNTY-LEVEL ONE WAY TRAVEL TIMES TO WORK, 2010[46]

	State	City			County	
Travel Time	CA	San Jose	Gilroy	Merced	Santa Clara	Merced
Less than 15 minutes	4,038,652 25.28%	80,040 18.32%	5,688 38.29%	11,894 45.96%	197,167 22.19%	34,129 37.79%
15 to 29 minutes	5,696,289 35.65%	191,052 43.74%	4,200 28.27%	8,040 31.07%	389,291 43.81%	28,177 31.20%
30 to 44 minutes	3,371,754 21.10%	107,463 24.60%	1,939 13.05%	2,653 10.25%	195,204 21.97%	11,328 12.54%
45 to 59 minutes	1,254,891 7.85%	30,885 7.07%	1,258 8.47%	1,324 5.12%	55,292 6.22%	5,509 6.10%
60+ minutes	1,615,781 10.11%	27,387 6.27%	1,771 11.92%	1,970 7.61%	51,614 5.81%	11,165 12.36%

Even if a resident were to want to use HSR to get to work or another destination, could they afford it? HSRA projects that trips will cost $11 to $111 depending on distance travelled and pricing scenario selected[47].Table 5.6 displays the most current available data on transportation related expenses for households within the corridor's two counties.

TABLE 5.6. 2008 HOUSEHOLD LEVEL TRANSPORTATION RELATED EXPENSES, BY COUNTY[48]

	Housing & Transportation Costs as a % of Income		Monthly Transportation Expenses, 2008	
	Santa Clara County	Merced County	Santa Clara County	Merced County
Minimum	18%	38%	$771	$896
Average	44%	59%	$1,052	$1,107
Maximum	82%	117%	$1,538	$1,406

A final factor considered as influencing utilization of HSR within the corridor is access to transit, which is important for residents if they will be able to receive the physical activity related health benefits that go along with utilizing public transit and decreasing VMT by getting

out of their cars to arrive at or leave from the HSR stations. Table 5.7 displays the results from a GIS analysis that evaluates the access that Santa Clara county residents have to public transit stops. The Network Analyst extension in ArcGIS version 9.3.1. was used to create ½ mile network buffers around all public transit stops within the County as a proxy for walkable service areas around each station. Merced County was not included in this analysis because public transit infrastructure data was not readily available. The population values for the census block centroids that did not fall within the half mile network buffers were summed to create measures of the population without adequate access to public transit.

TABLE 5.7. PUBLIC TRANSIT ACCESS FOR POPULATION WITHIN SANTA CLARA COUNTY

	# bus stops per 1000 people	Population* w/o bus stop access	% Population* w/o bus stop access
San Jose	5.6	255,237	19.4%
Gilroy	6.9	32,679	38.7%
Santa Clara County	5.6	311,174	21.9%
Merced	--	--	--

* 2000 Population estimates used because most recent block-level available data

Although Merced is not included in this analysis because of data limitations, a cursory review of the County transportation map suggests that the transit access results for the County are likely similar to or worse than the measures for Gilroy.

Q2. ANALYSIS RESULTS

Commute feasibility: Combining HSR trip times with current commute times, we can see that the large majority of work trips are currently less than the travel time on HSR. These trips will likely stay in their current modes, mostly personal auto use, in the absence of other policies that increase the cost (time or monetary) of driving. However, for about 14% of workers in the corridor, HSR is a comparable option to their current commute times of 45 minutes or more. Because of the borderline time savings, it may be necessary to provide additional incentives to workers to encourage their mode shifts to transit and active transportation in order to realize the related health benefits from improved air quality and physical activity.

Income Effects: If we assume that a resident chooses to use HSR as a daily commute option, the minimum monthly costs will be $11 * 2 trips per day * 5 days per week * 4 weeks = $440 per month to commute via HSR. In comparison to existing monthly household travel expenses, which are based on car ownership and range from $771 to $1,538 in the corridor, using HSR could result in a reduction in overall household transportation expenses for single commuter households and households without many non-work travel desires or obligations. It is important to note that current levels of expenditure on housing and transportation for most of the households in the corridor, especially those in Merced, are paying more than 45% of their income on housing and transportation, which is the level that indicates an overburdened household[49]. Households that are overly cost burdened may suffer adverse health effects from poor nutrition, stress, and exacerbation of chronic and acute diseases from postponing medical treatment. The scope of this analysis originally did not include income effects of HSR, but affordability will be a main contributor to the viability of HSR as a transportation mode option for corridor residents. As such, cost effects were briefly considered here, but a more in depth consideration of how HSR will affect the disposable income and health of already cost-burdened households is still needed.

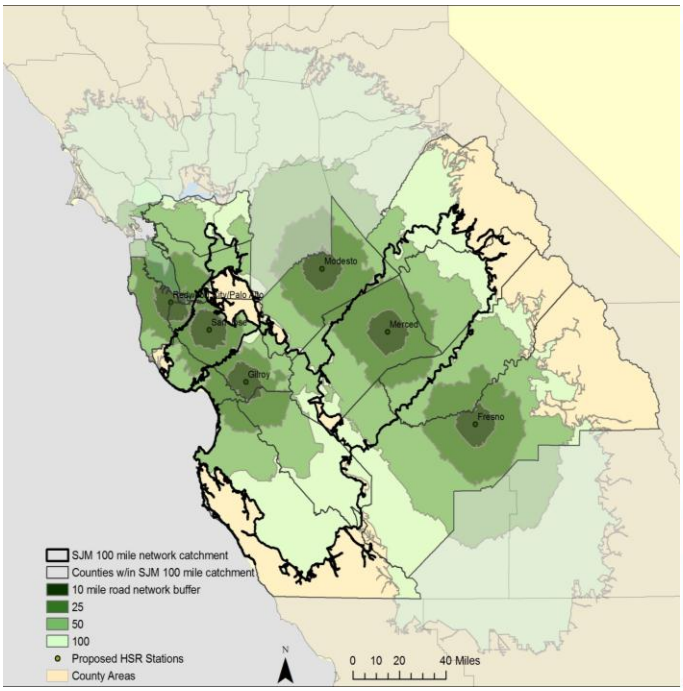
Transit Access: Over 20% of the corridor's population does not have adequate access to public transit. This is a significant barrier to encouraging and allowing all residents to reap the health benefits from decreased automobile use and increased public transit use. While it is positive that 80% of the residents in the corridor do indeed have access to transit stations, the efficiency, convenience, and affordability of these options should be further investigated to ensure that transit is indeed a viable transportation option. Furthermore, approximately 38,779[50] housing units within the corridor do not have access to a car, which means that they rely on public transit or active transportation options. Other populations that are especially vulnerable to adverse effects from poor public transit options include the elderly, children, and disabled. Specialized infrastructure, policies, and programs will be needed to ensure that these populations have access to transit in addition to expanding overall service availability.

LIMITATIONS

This analysis section is not without its limitations. In addition to the caveats discussed in relation to each of the conclusions above, data limitations and resource constraints prohibited a more thorough evaluation of the corridor-specific health impacts of transportation mode change. One particular point of concern is that the HSRA's ridership models treat the corridor as two separate analysis zones and do not provide specific information about how the activity in one zone may interact with another zone other than general intraregional or interregional differences. Figure 5.2 displays the HSRA transportation model analysis zones, including the two

that span this study area, as they compare to the actual catchment area for the corridor based on GIS network analysis of all three corridor and neighboring station locations. One hundred mile network buffers were chosen to encapsulate the corridor catchment area (black lines) because that is the priority definition by the HSRA for distinguishing between interregional and intraregional trips. The actual corridor catchment area includes parts of 13 counties, indicating that that many populations outside of the two county study area will be in closer proximity to this corridor's stations than those in other analysis zones. This analysis did not consider the potential health influences of trips that originate outside of the corridor.

FIGURE 5.2. COMPARISON OF CORRIDOR CATCHMENT AREA AND HSRA TRAVEL ANALYSIS ZONES



a. GIS network analysis shows that actual corridor catchment area includes parts of 13 counties

b. HSRA transportation models include Santa Clara County in the Bay Area region and Merced County as its own regional area.

These analyses of the health effects of air quality improvements from VMT reductions do not consider the effects that improved vehicle technology may have on the connection between VMT and air quality, nor does it incorporate macro-level influences on VMT such as gas prices and unemployment rates. The public transit and physical activity pathway does not consider the potential adverse health effects that increased exercise may have on respiratory symptoms if air quality does not improve within the corridor.

RECOMMENDATIONS

Although these analysis results support the hypothesized health benefits from HSR's influence on transportation mode throughout the corridor, there is still room for improvement to fully achieve the three interconnected sustainable transportation objectives outlined earlier (decrease private motor vehicle trips and miles traveled, provide affordable and accessible transportation options, and create safe, quality environments for walking and biking).

In light of the large discrepancies between current and projected transportation mode patterns in the corridor, **HSRA should create a clarifying report that explains the predicted changes in local and regional level travel behaviors**. The Ridership Revenue Forecast studies include different information from other reports, such as the Engineering Analysis, and these discrepancies should be resolved in a transparent way. Local travel survey data and preferences should be included as an evidence base in local-level mode shifts. A report commissioned by the Scottish Government[51] demonstrates as useful framing of the local and regional barriers and bridges to mode shift based on empirical literature and local transportation surveys. This sort of report for HSR regions could help illuminate additional mechanisms, such as marketing needs and local policies, that would better promote the use of public transit and decreased automobile use.

As evidenced by the borderline affordability of HSR trips in relation to current regional housing and transportation cost burdens and the limited use of transit in comparison to the proportion of the population who has access to it (3% vs 20%), it will be necessary to provide incentives to corridor residents to encourage and enable them to replace their automobile transportation habits public transit including HSR. **The HSRA should begin forming collaborations with employers throughout the region and state to institute employer-sponsored public transit pass programs.** Employer sponsored programs have been associated with increased transit use and physical activity levels for participating workers[52].

HSRA should also initiate collaborations among other transit providers and residential developers to coordinate ticketing, fares, and station locations that decrease time and monetary costs to riders, thereby increasing ridership rates and decreasing personal vehicle traffic. Subsidized transit passes will be needed for low-income and/or transit-dependent individuals, such as seniors, youth, and individuals with disabilities[53]

All spatial and non-spatial data created and collected for planning publicly-funded projects should be made easily available to the public to enable concerned parties to evaluate the impact priorities of proposed plans, programs, and policies.

A broad range of literature documents the health connections between land use, transportation, and public health. Only a few of the influential health determinants were evaluated in the section, and further analysis is needed to ensure health promoting and equitable changes across urban, suburban, and rural communities. **City and County governments should conduct HIAs of land use and transportation project**s to encourage the continued evaluation of the holistic health impacts from planning processes and decisions.

Large transportation infrastructure projects in the United States have a legacy of discriminatory outcomes against low-income and minority communities[54]. In addition to prioritizing the transparent, participatory, and just planning, construction, operation, and maintenance of HSR, the **HSRA should also develop and enforce strict standards for transparency and equity for the distribution of the $950 million in bond funding for local transit infrastructure that was approved by Proposition 1A in November 2008.** These funds, to be dedicated to finance capital improvements for commuter and intercity rail as well as local transit lines, should be used for projects that prioritize racial, economic, social, and regional equity.

CHAPTER 6. PARKING

OVERVIEW AND RESEARCH QUESTIONS

The potential HSR ridership demand in small cities may have both positive and negative health impacts. However, the direction of these impacts is not an absolute. It depends on the fine details of the design and implementation of the station-level plans. To date, this level of detail has not been provided in HSR project documents. That is, the decision alternatives in the planning documents do not address the micro-level details which will influence the direction of parking-related health impacts. Whereas HIA ideally begins with project facts with some level of specificity, our screening and scoping process suggests important potential health impacts which are drawn from relatively non-specific project facts. We are therefore left to make assumptions and extrapolate from those project facts based on the best available evidence. The impacts then are currently classified as negative (Table 6.1). In the assessment process we consider design standards, regulations and ordinances which may mitigate the negative impacts and in some cases move them into the positive column.

The City of Gilroy, on their website, states the parking challenge best: *"The implementation of HST through Gilroy will necessarily change Gilroy in many ways. The Authority indicates that a Gilroy HST station will require parking for approximately 6,000 vehicles as passengers from the Monterey Peninsula, San Benito and portions of Santa Clara counties drive to Gilroy to board trains. While this may bring increased economic opportunity, the location of HST tracks and their construction method will impact our community."*

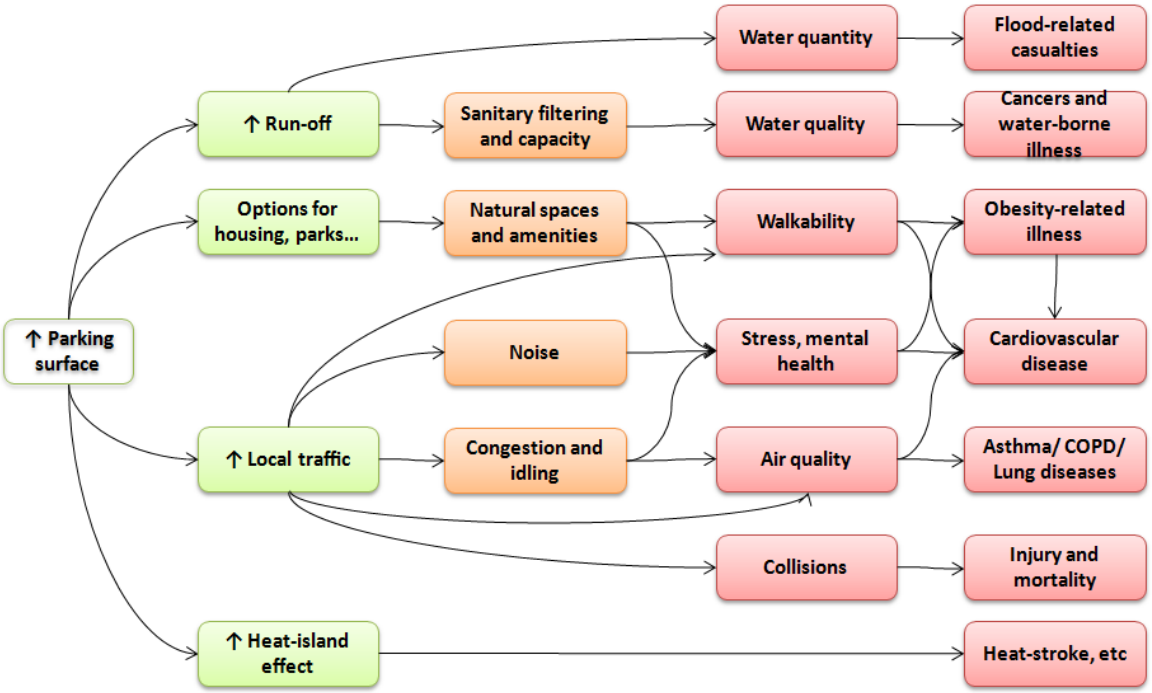
It is clear that the number of commuters converging on these small cities has the potential to do great good, and great harm. For example, the number of new commuters estimated in Gilroy represents nearly 15% of the current population. This section focuses on the impacts of this convergence near the stations and the requirements for the lots to hold the projected number of vehicles. The key questions are:

- How will the convergence of commuters change local traffic flow, and subsequently pedestrian safety?
- How will lot-level characteristics impact health?

HEALTH IMPACTS RELATED TO PARKING

There are a number of different pathways through which parking may impact health. These are explored in Figure 6.1. As drawn out here, the health impacts stem from both the form and function of parking. In general, form can be directly modified to mitigate health impacts. Function, however, is determined first by the HSR demands, and form in this case is a secondary concern. I.e. parking lot characteristics are more readily modifiable than is the ridership and number of spaces needed. Therefore, the scoping and assessment focus on functional aspects of parking which are not so readily modifiable.

FIGURE 6.1 PATHWAYS FROM PARKING TO HEALTH IMPACTS



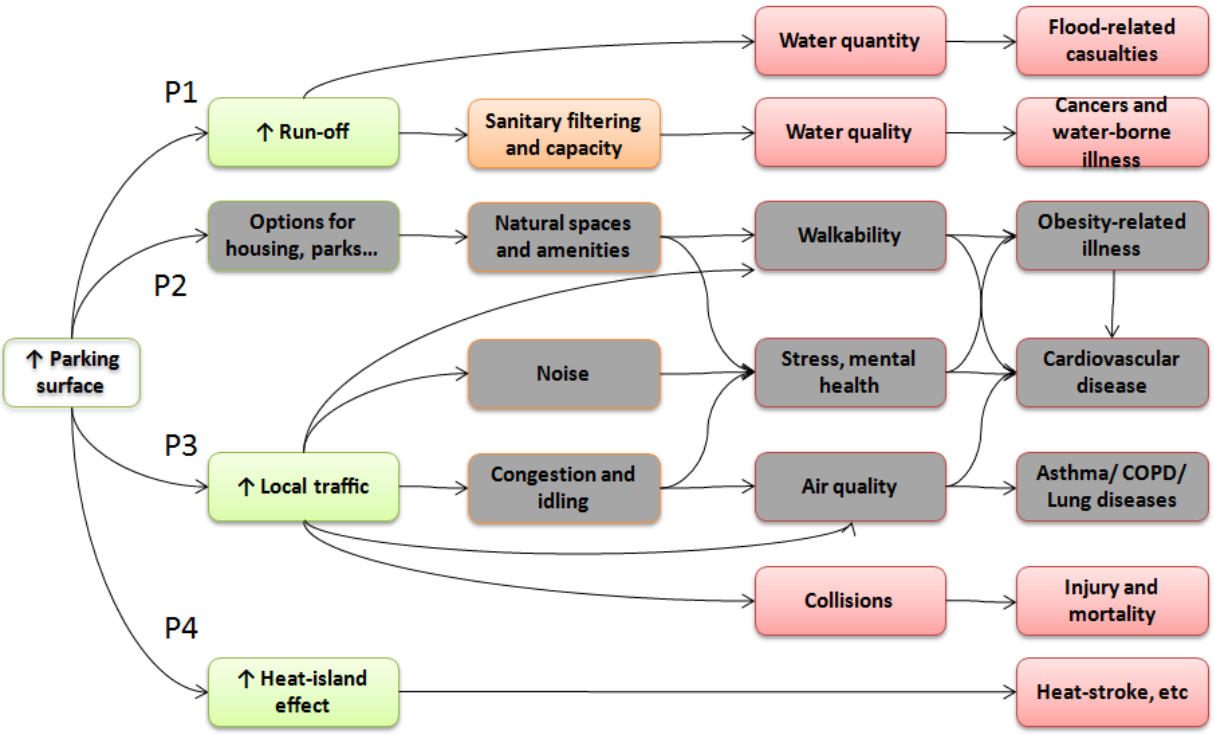
Health impacts related to parking include but are not limited to:

- flood-related morbidity and mortality
- carcinogenic and infectious disease effects of local water quality
- obesity and chronic disease resulting from land-use opportunity costs (parking lots vs. public use, greenspace, etc.)
- sleep and stress effects from traffic noise
- asthma and respiratory exacerbations due diminished local air quality
- vehicular-pedestrian collision injuries and fatalities
- heat-related illness resulting from heat-island effects

Form characteristics include the area/ footprint, location, design and materials. Form characteristics define at least two pathways: impacts related to run-off ("P1" in Figure 6.2) and to heat-island effects ("P4" in Figure 6.2). Impacts in both of these pathways can be substantially mitigated by building multi-story structures with minimal footprints and/or structures with features such as bioswales, porous surfaces and retention ponds for run-off reduction and capture [1], as well trees, solar panels and reflective surfaces to minimize the heat-island effect. Still, these pathways are briefly explored.

The pathway related to land-use options, P2, was not explored for various reasons. First, the changes in land-use may again be minimal if parking lots are well-designed. As well, the number of mediators in the pathways and level of uncertainty in the complex set of land-use determinants suggested that it was too difficult to make valid predictions given the information and resources available. A third pathway, P3 Local Traffic, showed one of the most direct and potentially unmitigated health impacts. Noise and congestion and idling mechanisms of local traffic were not further explored for a number of reasons. In particular, the lack of specificity in project facts regarding station area development make it difficult to determine the adjacency of vulnerable populations to new sources of air and noise pollution. As well, these pathways have already been assessed in other HIA's elsewhere.

FIGURE 6.2 PATHWAYS FOLLOWED IN ADVANCED SCOPING AND ASSESSMENT



P1: RUN-OFF AND WATER QUANTITY: FLOOD-RELATED CASUALTIES

Construct: The volume of additional run-off from parking areas may overwhelm storm sewers and local waterways, leading to localized and flash flooding

Flooding takes many different forms, each with a different morbidity and mortality risk. In general, however, most floods are predictable and loss of life per event is less than 1. However, flash floods in particular can be especially dangerous and unpredictable.[2, 3] Health impacts of flooding may also be mediated through damage to the environment, as outlined in Figure 6.3

FIGURE 7.3 IMPACTS OF FLOODS

	Tangible	Intangible
Direct	• Residences • Structure inventory • Vehicles • Agriculture • Infrastructure and other public facilities • Business interruption (inside flooded area) • Evacuation and rescue operations • Reconstruction of flood defences • Clean-up costs	• Fatalities • Injuries • Animals • Utilities and communication • Historical and cultural losses • Environmental losses
Indirect	• Damage for companies outside flooded area • Substitution of production outside flooded area • Temporary housing of evacuees	• Societal disruption • Damage to government

Source: Jonkman and Vrijling 2008

P1: RUN-OFF AND WATER QUALITY: CANCERS AND WATER-BORNE ILLNESSES

Construct: Unmitigated run-off may send a number of chemicals into water sources, including human drinking water

Parking lots collect pathogens, metals, sediment, and chemical pollutants and quickly transmit them to receiving waters during rain and snowmelt events. This nonpoint source

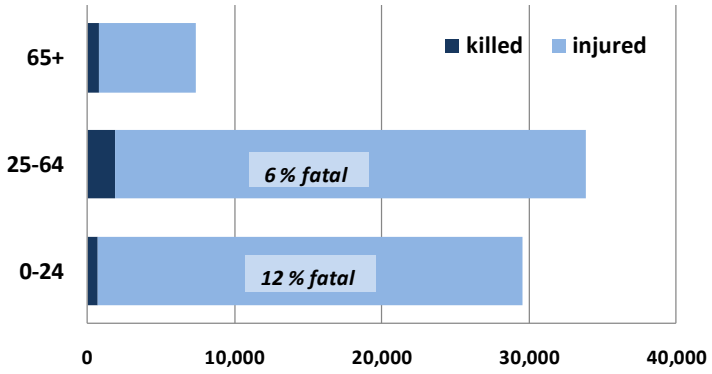
pollution is one of the major threats to water quality in the United States and is linked to chronic and acute illnesses from exposure through drinking water. Impervious surfaces also lead to pooling of storm water, increasing potential breeding areas for mosquitoes, a vector for infectious diseases.[4] Parking lot sealcoat is a source for polycyclic aromatic hydrocarbons, a known carcinogen. The effects of PAH's in humans via ingestion are unclear. A study of DOT park-and-ride lots in Wisconsin found 33 different chemicals in parking lot run-off, leech PAHs from sealcoat into drinking water.[5] Children, the elderly, pregnant women, and the immunocompromised—20% of the US population—are at the greatest risk for serious illness and mortality from waterborne pathogens.[4]

P3: LOCAL TRAFFIC: PEDESTRIAN SAFETY

The fact that so many vehicles will be converging presents many issues for local traffic engineers. Traffic on peripheral highways and arterials may result in vehicular collisions which have impacts primarily on the drivers, as the crashes are primarily involving only vehicles. Certainly there will be key intersections to study. As well, the project may involve multiple lots and shuttles to mitigate the dramatic effects of a single lot. This would certainly affect traffic in a broad area. Still, the focus for this assessment is on pedestrians harmed by vehicles with a 1 mile radius surrounding the station, assuming that all lots will be located in that radius. This also assumes that TOD surrounding the station will expose more pedestrians to this traffic.

There is substantial evidence on the relationship between traffic and pedestrian injury. Children, youth and elderly may be more exposed to injury and more vulnerable when injured.[6] Data from California confirm that a higher proportion of fatalities in older populations (Figure 6.4). This vulnerability may due in part to the routine use of facilities in certain locations, such as schools [7] and senior centers. As well, lower SES groups without vehicles are generally more exposed to these injuries.[8] Design is critical. Studies have shown an increase of 3–5 pedestrian injuries per year for each increase of 1,000 vehicles at intersections with simple configurations. However, there are no increases at intersections with complex configurations.[9] Many studies have identified designs for reducing injury.[10-13] In California in 2008, average cost of fatality was $13 million and injury $3.5 million. Children under the age of 15 accounted for 20.1% of pedestrian victims and 16.9% of bicycle victims (victims killed and injured) statewide (SWITRS).

FIGURE 6.4 PEDESTRIAN DEATHS AND INJURIES IN CALIFORNIA, 2004-2008



P4: HEAT-ISLAND HEALTH EFFECTS

Construct: Changes to the urban surface area may include heat-absorbing surfaces such as large expanses of asphalt. During heat waves, the heat-island effect may exacerbate heat-related morbidity and mortality among vulnerable residents adjacent to the parking lots.

Heat islands have been particularly important in some heat wave events. Dark surfaces such as asphalt roads or rooftops can reach temperatures 30–40 C higher than surrounding air. City-wide, this can add 5-11 C compared to rural areas.[14]

The most common cause of death and the most acute illness directly attributable to heat is heatstroke, a condition characterized by a body temperature of 103.0°F or higher and altered mental status. Other causes of death observed to increase following heat waves include ischemic heart disease, diabetes, stroke, respiratory diseases, accidents, violence, suicide, and homicide.[15] Heat mortality follows a J-shaped function with a steeper slope at higher temperatures.[16] The risk of heat-related mortality increases with natural aging, but persons with particular social and/or physical vulnerability are also at risk. Important differences in vulnerability exist between populations, depending on climate, culture, infrastructure (housing), and other factors. Within heat-sensitive regions, urban populations are the most vulnerable to adverse heat-related health outcomes. The elderly, young children, the poor, and people who are bedridden or are on certain medications are at particular risk.[15]

ESTABLISHED STANDARDS AND HEALTH OBJECTIVES

There are no regulations on parking lot design at the state level. At the local level, ordinances regarding the space size requirements, storm-sewer/ run-off allowances, shading , and building height (for parking structures) are relevant to the design of HSR parking. Caltrans and traffic engineers have very clear guidelines for maintaining flow and level of service, while the county health departments exercise some responsibility in surveillance of traffic-related injuries. The General Plans of Gilroy and Merced to not have a health element, and in general do not address traffic issues directly. Both have transportation plans calling for millions in road service improvements, but neither fully accounts for the demands of the HSR project.

BASELINE CONDITIONS

After consideration of evidence from the literature, only the pedestrian safety pathway was chosen. The precision and certainty of the other exposure-outcome pathway are too long and tenuous, even then requiring solid project facts which are not readily available. Baseline conditions for pathways not followed in the assessment are available in the appendix.

PEDESTRIAN SAFETY

There is no obvious trend in the number of vehicle-pedestrian collisions (Figure 6.5) When adjusting for population (growth) and fitting a linear slope, Merced shows a slight increase in the rate of collisions while Gilroy shows a slight decrease and San Jose remains stable (data not shown). In our study area [14], as elsewhere, nearly 80% of pedestrian victims over age 80 are killed (Figure 6.6). In our study area, pedestrian deaths and injuries cost 489 million dollars every year.

FIGURE 6.5 PEDESTRIAN COLLISIONS, BY CITY AND YEAR

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Gilroy	5	2	2	3	4	2	6	1	2	27
Merced	2	5	7	6	4	10	9	8	4	55
San Jose	77	71	69	61	75	63	62	61	65	604
Total	84	78	78	70	83	75	77	70	71	686

[14] Study area is the incorporated cities of Gilroy, Merced and San Jose

FIGURE 6.6 VICTIM STATUS BY AGE GROUP, STUDY AREA 2000-2008

Age	# of people	% killed	% severely injured
0 -7	62	13	79
8-15	59	5	92
16-23	89	16	73
24-31	63	19	73
32-39	68	24	72
40-47	103	22	75
48-55	81	30	67
56-63	53	32	64
64-71	40	35	63
72-80	54	44	54
over 80	18	78	22

Figure 6.7 details the location of collisions in our study area. In assessing injuries, we must also consider the density/ frequency of ped-vehicle interactions, the pedestrian composition/ their age and level of awareness/ sensitization to traffic. Among 686 vehicle-pedestrian or vehicle-bicycle collisions in our study area from 2000-2008, the pedestrian or bicyclist was faulted for the collision 27% and 9% of the time (TIMS).

FIGURE 6.7 PEDESTRIAN LOCATION AT TIME OF COLLISION

	Gilroy	Merced	San Jose	TOTAL
Crossing Not in Crosswalk	13	19	195	227
In Road, Including Shoulder	3	9	123	135
Crossing in Crosswalk at Intersection	4	9	101	114
Not in Road	0	1	25	26
Not Stated	0	0	10	10
Crossing in Crosswalk Not at Intersection	0	0	5	5
Approaching/Leaving School Bus	0	0	1	1
Bicyclist - location not reported	7	17	144	168
TOTAL	27	55	604	686

GILROY

In Gilroy, three major arterials feed into Highway 101. These roads - Leavesley, 10th St, and Monterrey Road - have the highest daily traffic volumes in Gilroy, in actuality and in master planning. Daily volumes near 101 are 42,000, 34,000, and 36,000, respectively. In downtown

Gilroy, Monterrey Road connects Leavesley and 10th street. This connection, from 3rd St to 7th St, is currently at a collector level of service. It is very conceivable that either station option, due to the high volume of new traffic, may require Highway 101 traffic to exit at any of the three exits and proceed through the downtown area on this Monterrey connection. A master traffic plans calls for over 200 million dollars in road improvements over the next 10 years.

Anywhere from 3000 to 7000 additional parking spaces will be need depending on ridership numbers. This will require a parking lot of 33 - 60 acres (single-story). Even a 3 story facility would need a footprint of 11 to 20 acres. Since only 5% of commuters are local and have any likelihood of walking to the station, there will be massive influxes of commuters needing to park their cars, especially during peak hours. Peak traffic is expected to range from 600 - 3000 cars per hour, again depending on ridership.

DOWNTOWN OPTION AREA

The current Caltrain station in Gilroy has 471 surface lot spaces. There is roughly 70,000 sq feet of open space / vacant land immediately adjacent to the downtown station option which could serve as parking. However, even in a three-level structure (the limit of current zoning), this amount of parking would be insufficient to serve the volume required. Roughly 33-60 acres of parking are needed, while structures on this adjacent land would provide only 5 acres. Hence, it is conceivable that parking sites would be scattered throughout Gilroy and served by shuttle, as suggested in HSRA documents. Downtown specific land-use plan calls for commercial and residential uses in the proposed station area.

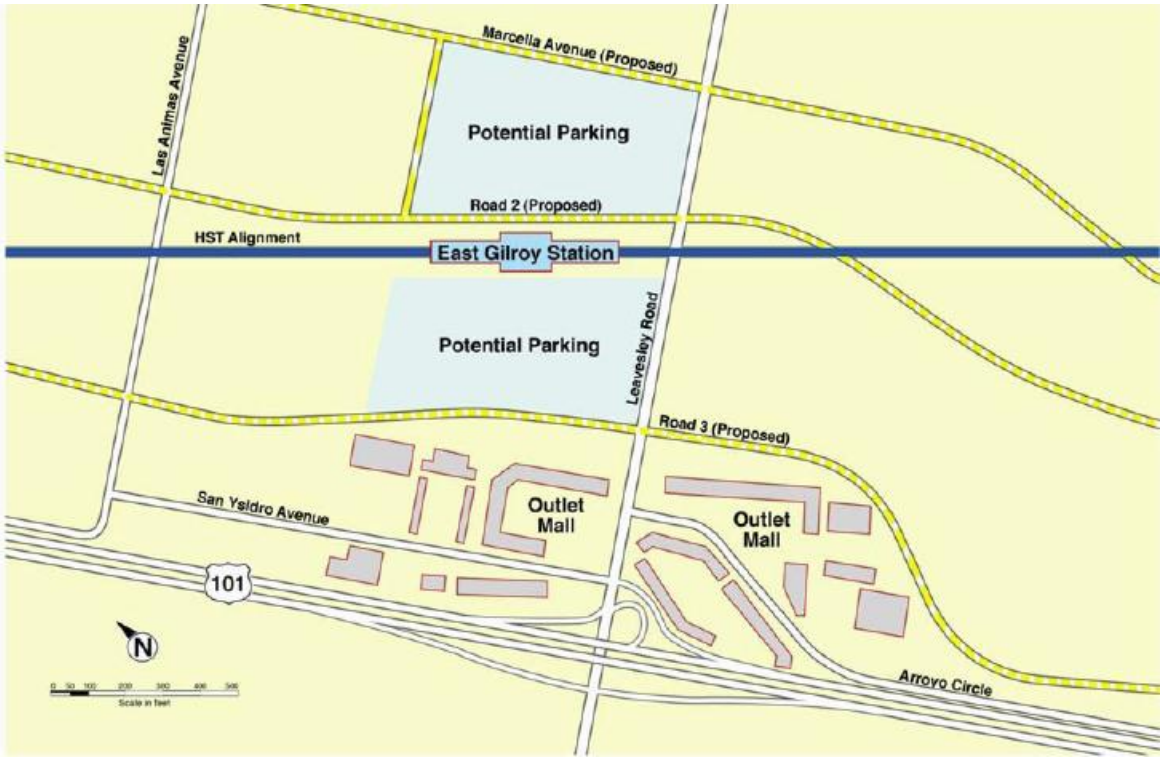
Regardless of parking locations, the traffic volume may have effects throughout Gilroy. Current studies of traffic flow in Gilroy indicate moderate congestion in downtown areas (Figure 7.9a). From the downtown station at Monterrey Road heading east to ramps to Highway 101,10th street is only 1500 feet and runs through a commercial/ industrial zone. Therefore, additional traffic accessing Highway 101 via 10th street may have less impact on pedestrians. However, from the downtown option heading south to 101, Monterrey Road runs roughly 4000 feet bounded by a residential area on one side and commercial shopping on the other. There are 2 schools within 1/2 mile of the station.

EAST STATION OPTION AREA

Volume on Leavesley at the site of the East station option is 17,000. The volume of Leavesley Road just east of Highway 101 is 54,000, as it also serves the Gilroy Premium Outlets. There are few institutions and no residential areas on Leavesley east of 101, and there is a vast and sufficient amount of open space/ vacant land adjacent to the station location. The urban surface area for the Gilroy Premium Outlets is 2.2 million square feet, of which roughly three-

quarters is parking. The outlets were built in 1990, but there is not clear documentation of its impact on local traffic. Figure 7.8 shows the site and size of potential lots.

FIGURE 6.8 GILROY, EXISTING AND POSSIBLE FUTURE EAST GILROY ROADWAY NETWORK FOR AN AERIAL STATION



Source: California High-Speed Train Project Environmental Impact Report / Environmental Impact Statement San Jose to Merced SUPPLEMENTAL ALTERNATIVES ANALYSIS REPORT, May 2011

COLLISIONS

From 2000-2008, there were 99 collisions, of which 21 involved pedestrians and 6 bicycles. In 2008 in Gilroy, vehicular collisions caused 9 pedestrian injuries, 1 of which was fatal. Parking lots are considered off-road, therefore fatalities in lots are not reported in actual lots. This might be relevant in large lots such as those at the Premium Outlets. With such small numbers, we need to look at multiple years prior and consider average or trend to accurately assess existing conditions.

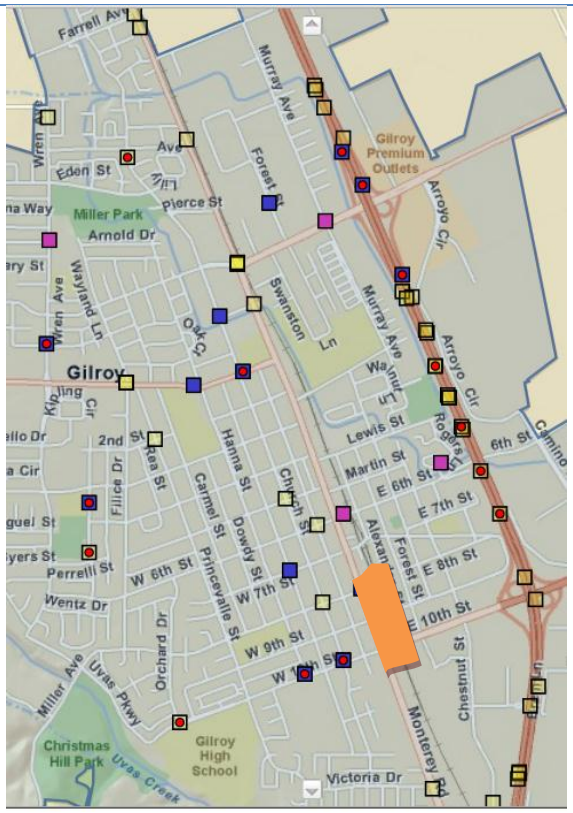
FIGURE6.9A: GILROY TRAFFIC FLOW, 2007

— 15 — = 24-Hour Volume Rounded to Nearest 1,000

Bandwidth Ranges

- 0 - 10 K
- 10 - 20 K
- 20 - 30 K
- 30 - 40 K
- 40 - 50 K
- 50 K +
- Freeway Volume

FIGURE 6.9B: ALL GILROY COLLISIONS, 2000-08



- Pedestrian
- Bicycle
- Fatal

It is worth noting that Gilroy City has an online system for reporting traffic violations, for example a vehicle speeding on a particular street between cross-street X and cross-street Y at a particular day and time. In other words, citizens may directly police and there aid in mitigating some of the traffic-related injury.

MERCED

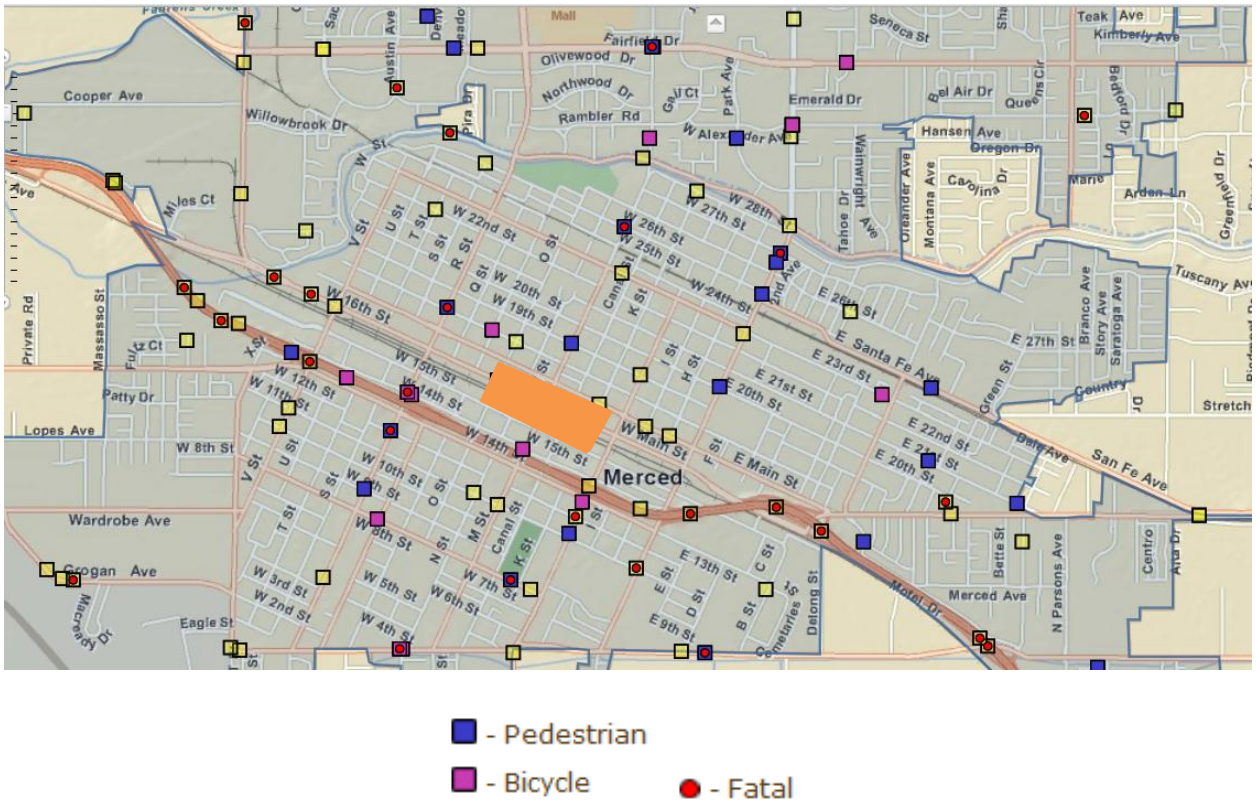
There are 3 freeway entrance/exit ramps within 1/2 mile of the proposed station location in downtown Merced. The area immediately adjacent to the proposed station and between the most proximate freeway ramps is a mix of commercial and residential uses. There are 6 educational institutions within a half-mile of the station location.

Though located far north of the city, the new UC-Merced campus offers an example of traffic resulting from new parking demand. UC-Merced has created parking lots for roughly 3000 vehicles, with plans to expand for 1000 more over the next 10 years.

COLLISIONS

From 2000-2008, there were 165 collisions, of which 38 involved pedestrians and 17 bicycles.

FIGURE 6.10: MERCED TRAFFIC COLLISIONS, 2000-2008



ANALYSIS

There are two excellent databases of existing collisions (Pedestrian and Bicycle Crash Analysis Tool and Crossroads Traffic Collision Database) but neither offers a forecasting model. There are also prediction models at both intersection and aggregate levels for all collisions, with no specificity for pedestrian collisions.[17, 18] Many pedestrian-specific models predict collisions only at the intersection level, rather than the aggregated (area) level.[19]

MODELING TOOL

The process for projecting additional collisions is based on similar strategies used by Wier, et.al.[20] It uses the parametric road safety function as follows:

$$\Delta\ (\%),\ \text{vehicle-pedestrian collisions} = \left[\left(\frac{\text{Future AADT}}{\text{Baseline AADT}}\right)^{\beta} - 1\right] \times 100$$

There were insufficient small area data to use a more robust, non-parametric method such as multivariate regression. The assessment relied on the following assumptions:

- Few collisions occur on expressways restricted to pedestrians
- Changes in traffic flow can only be reliably predicted at the arterial level. Collectors and local roads will be affected uniformly, that is, additional volume will be distributed evenly throughout the road network.
- Therefore, injuries need not be associated with particular intersections
- development does not change pedestrian composition (age, income, race, etc.) which affects outcomes and disparities
- Each parking space serves just one commuter per day

An additional set of assumptions followed those of Wier [20]

- development does not affect pedestrian flow and behavior
- development does not implement pedestrian safety countermeasures
- AADT changes at intersections or street segments selected for evaluation are reasonable surrogates for changes at adjacent area roadways

ANALYSIS LEVEL

Vehicle volume and collisions were measured and projected at the city level for several reasons. First, Gilroy and Merced do not have large enough areas to project additional collisions

robustly at the census tract level. Robustness is dependent both on assumptions and sample or population size. Gilroy and Merced have only 3 and 9 tracts, respectively, that are at least 90% contained within the city boundaries (Figure 6.10). A cursory look at the coordinates of collisions suggested that a small portion could be associated with particular intersections (Figures 6.9a, 6.9b, 6.10). The limited data on intersection traffic volume and the uncertainties of predicting the change in traffic flow and volume in such a small area suggested that a city level analysis was warranted. As well, because a simple parametric function was used, there was no need for other variables such as population demographics which would be available at the census tract level.

DATA SOURCES

Sources for the baseline measures and projections of collisions are from the Statewide Integrated Traffic Records System (SWITRS), 2008 Annual Report of Fatal and Injury Motor Vehicle Traffic Collisions (http://www.chp.ca.gov/switrs/). This data is also compiled and distributed via the UCB Transportation Group (ITS).

CalTrans served as the source of Average Annual Daily Traffic (AADT) data. CalTrans provides Back and Ahead AADT; Back AADT represents traffic South or West of the count location. Ahead AADT represents traffic North or East of the count location. In other words, back and ahead represent traffic in all directions, and should therefore be summed to get the total AADT at a given intersection.

FIGURE 6.11 CENSUS TRACT VS. CITY BOUNDARIES, GILROY AND MERCED, 2000

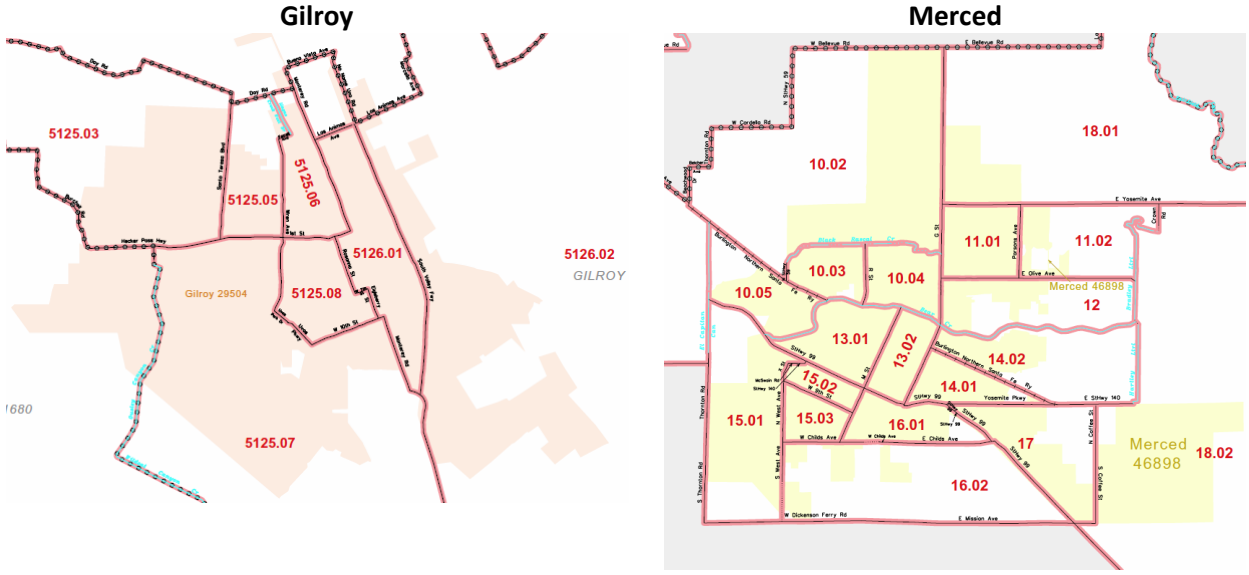


FIGURE 6.12 MODEL PARAMETERS AND ESTIMATES

	Gilroy	Merced	San Jose
BASELINE			
# arterials included	1	2	2
# of intersections included	4	14	22
length of arterial studied (miles)	2.4	8.9	12.5
average intersection vehicle volume (AADT)	33,250	25,332	39,882
# of collisions (2000-2008)	27	55	604
injuries	15	38	441
deaths	12	17	163
annual average collisions	3.0	6.1	67.1
population	34,857	76,367	930,402
injuries/ year/ 100,000 people	4.8	5.5	5.3
deaths/ year/ 100,000 people	3.8	2.5	1.9
PROJECT FACTS			
# of new parking spaces required	3,300	1,800	3,800
# of additional vehicle trips (daily)	6,600	3,600	7,600
PROJECTIONS			
average intersection vehicle volume (AADT)	39,850	28,932	47,482
change % collitions	9.5%	6.9%	9.1%
# additional collisions, per year	**0.28**	**0.42**	**6.12**
# additional collisions, 2020-2050	**6**	**8**	**122**

LIMITATIONS

In general, the primary limitations involve data gaps, uncertainty in project facts and predictions and resource constraints. In particular, the assumptions used in modeling collisions limit the reliability of the findings. The model assumes a linear relationship between the volume of traffic and the number of collisions. It assumes that collisions will continue to occur at the same rate. The percentage change in collisions is the same as the percentage change in vehicle volume, assuming a fixed pedestrian volume. In reality, a number of both short and long-term station-area changes related to transit-oriented development, most notably area traffic calming and population growth, were not factored into the model. Population growth in the station area affects vehicle-pedestrian interaction, some argue in favor of pedestrians.[21] However, this non-linearity of risk, "safety in numbers", is still contentious and unproven.[22] As well, the uncertainties regarding station-area growth and mode-shift limit the ability to quantitatively

predict collisions accounting for them. Still, as is the percent increase in collisions may be an overestimate assuming non-linear risk. Shifts to walking and cycling in the station area, as well as an overall increase in the number of people, may decrease the frequency of collisions as "safety in numbers" is reached. A more substantial threat to the reliability of the model is actually the vehicle volume. Flighty ridership and commuter estimates make it difficult to gauge what direction the projection could be biased. Finally, the projections are limited because the distribution of lots, traffic and collisions on the road network is uncertain.

RECOMMENDATIONS

The primary recommendation from these findings is that HSRA work with regional and local agencies to ensure mitigations of health impacts. Most of the parking-related impacts can be avoided or lessened through good design. In terms of collision, the most important mitigations include:

- Traffic calming throughout the station area, including pedestrian options (e.g. crosswalks) at and between intersections
- Multiple-site parking lots in adjacent commercial-industrial zones
- Demand management programs (as in mode-shift)

Increased monitoring is also recommended. Currently, only the largest intersections are monitored for traffic volume. However, intersections at sites such as schools and senior centers should also be monitored to protect these vulnerable populations. This is mostly up to agencies such as CalTrans. However, enhanced citizen reporting (as in Gilroy) is another worthwhile endeavor for local agencies. The reliability and weight of the evidence may not be great enough to make recommendations regarding the broader decision alternatives. In particular, the additional collisions projected may not warrant an East Gilroy station option when weighed against other impacts.

CHAPTER 7. FOOTPRINT

OVERVIEW & RESEARCH QUESTIONS

The HSR Authority is considering footprints and displacement of residential housing and businesses, specifically the "biological, cultural, agricultural, parkland, and visual impacts of these stations (1)." However, upon assessing the HSR Authority document library, these issues are not currently being analyzed through the lens of health.

In this section, the term footprint refers to the area enclosed by the proposed HSR stations only, not including track alignment or external parking lots. Therefore, throughout this chapter's discussion, the estimated health impacts are conservative projections, due to the exclusion of land required for track alignments travelling through the corridor. The assessment of HSR station health impacts are guided by this overall argument:

> HSR station footprints will displace residents and businesses within the SJ-M corridor, and may negatively impact station-cities' social cohesion as well as decrease the disposable income of those displaced.

Potential positive impacts	**Potential negative impacts**
	Decreased disposable income due to displacement
	Disproportional impacts on low-income families due to eminent domain
	Footprint location promotes segregation
	Footprint location degrades social cohesion
	Poor health outcomes such as:

The potential negative impacts are displayed in the negative column due to the current lack of information regarding station design and how these health impacts will be mitigated. As information for the stations in this corridor become publicly available, then more definitive statements can be made regarding HSR footprints and their potential health impacts. This HIA chapter will focus on the station footprints of Gilroy and Merced, the rural station-cities of the HSR corridor, since these footprints are still being debated by respective city governments (2), and this chapter can contribute something of value to the station footprint and design discussion.

RESEARCH QUESTIONS

- Who will be displaced by proposed HSR footprints in Gilroy and Merced? Will footprints affect more disadvantaged populations within these rural station-cities?
- Is there evidence that suggest there is pre-existing segregation in Gilroy or Merced? Based on proposed footprint locations, will HSR increase or decrease segregation and social cohesion?

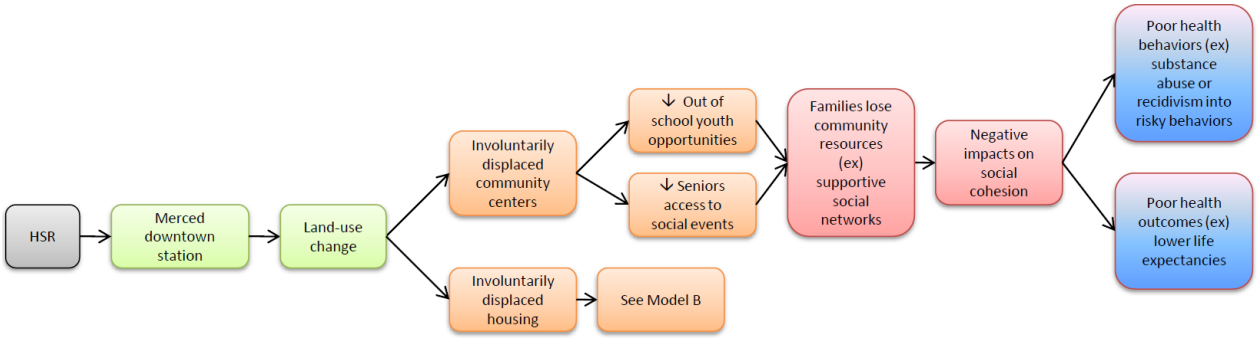
- What effect can HSR footprints have on property values? Combined with the mechanism of eminent domain, how will communities with low socio-economic status be affected?

HEALTH IMPACTS OF FOOTPRINT

In this section of the HIA analysis, the discussion will focus on the rural station-city footprints of Gilroy and Merced within the San Jose-Merced corridor. San Jose is not discussed in this chapter because this footprint is further along in geographical placement and design, and the footprint is within a commercial/industrial district, far removed from community centers or large residential areas (3).

The HSR footprint health impacts are highly variable, and will depend largely on the final design details of these footprints, and in the case of Gilroy, whether the Downtown or East of Gilroy/Leavesley (East Gilroy) footprint will be chosen as the final option. The following represents three pathways for potential health impacts of station footprints, to introduce the three components of this analysis: social cohesion, displacement, and social isolation.

Model Pathway A, Merced Downtown Footprint:



The downtown footprint will have significant impacts on the social resources of Merced through the displacement of community centers and housing (4). In this model, the pathway following involuntarily displaced community centers for youth and seniors is hypothesized. A footprint displacing these physical spaces for social interaction is significant and will negatively affect the social cohesion of a community (5). Not only will the individuals and families that access these community centers lose these physical facilities, but also the services and programs that accompany them.

As an example, youth will no longer be able to attend activities at the Boys & Girls Club of Merced, and may not have access to alternate community after school programs; losing peer networks from the center and opportunities for constructive activities. Worst case scenario, without protective social networks or safe physical spaces for social interaction, some youth may turn to more risky and unsafe behaviors to fill in their time. With crime in Merced prevalent compared to other American cities (6), out-of-school programs are extremely valuable for social cohesion, enabling youth to participate in positive activities and gain

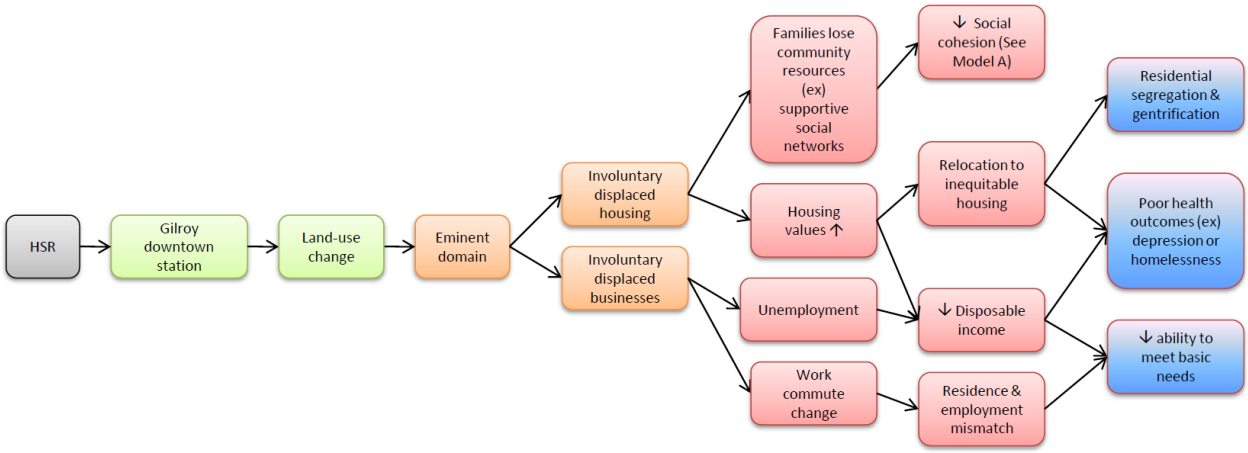
protective life skills. Thus, social networks help individuals and families access materials and emotional support in times of need.

The social ties among the youth and elderly should be given considerable attention, as these groups are among the vulnerable populations identified earlier in Scoping. In Alameda County, CA, men and women who lacked social ties to others were 1.9 – 3.1 times more likely to die than those with many social contacts (7). Furthermore, people with self-reported severe lack of social support were 2.19 times more likely to report fair or poor health than people who did not lack social support (8). Not only do social ties and social support have direct links towards distal health outcomes, but in San Francisco public housing, social cohesion also allows for community members to have confidence in their fellow community members, like knowing their children will be able to walk from school to home safely as people they know watch out for them along the way (5).

In addition its link with health, social cohesion is potentially affected, both positively and negatively, by land use redevelopment (9) which in this case is the HSR footprint. This is partially explained by social support and networks, and how these two principles are essential components of positive social cohesion. As depicted in the pathway, loss of these community centers can lead to loss of supportive social networks, which is significant since social support can affect self-esteem and value, suicide rates, life expectancy, self-reports for health, hospitalization recovery, and be protective towards substance abuse control and witnessing community violence (5). Furthermore in a study of social capital, the collective value of multiple social networks, for each standard deviation increase in group membership in a community, mortality was shown to decrease by 83.2 individuals per 100,000 (10). In addition, social support can buffer stressful situations, prevent feelings of isolation, and contribute to self-esteem (11).

Pathway A, which focuses on social cohesion, is a construct that will be affected by Merced's downtown footprint (4), and as discussed can affect health in a variety of mechanisms.

Model Pathway B, Gilroy Downtown Footprint:



Model B hypothesizes a pathway starting from the proposed Downtown Gilroy footprint, and the certain displacement of residential housing and businesses (12) (13). Without yet differentiating between residents and businesses, involuntary displacement can cause or contribute to mental stress, loss of supportive social networks, costly school and job relocations, and increases the risk for substandard housing and overcrowding (14). In addition, displacement can lead to uneven employment, residential segregation, and depression (5).

Although this will not be discussed in detail here since it is the focus of Model A, displacement will have impacts on social cohesion as well. According to an HIA by the UC Berkeley Health Impact Group (UCBHIG), which assessed public housing redevelopment in San Francisco, CA, displacement can stress social ties because families were relocated throughout the Bay Area (2009). Furthermore, many residents were not able to return because fewer housing units were available, people had established new lives in other areas during redevelopment, or previous residents did not meet re-entry criteria (5). Displacement is directly tied into the social cohesion pathway discussion and health outcomes, with residents losing social networks and social support through involuntary relocation into new environments. Residential displacement can have severe health impacts, like severing "health-promoting social networks and health-supportive family relationships" (15).

Moreover, lack of affordable housing can lead to homelessness, and other economic sacrifices (16), such as forcing families to choose between other basic necessities like food and clothing (17). Displaced residents will need to seek new housing elsewhere, but with the current housing market, it is difficult to seek equitable housing if a property is purchased via eminent domain, since property values are lower than before the recession and the HSR Authority will be setting their own fair market values based on the present (18). Vulnerable populations are at additional risk, with residential instability and mobility for children and adolescents linked with depression (19).

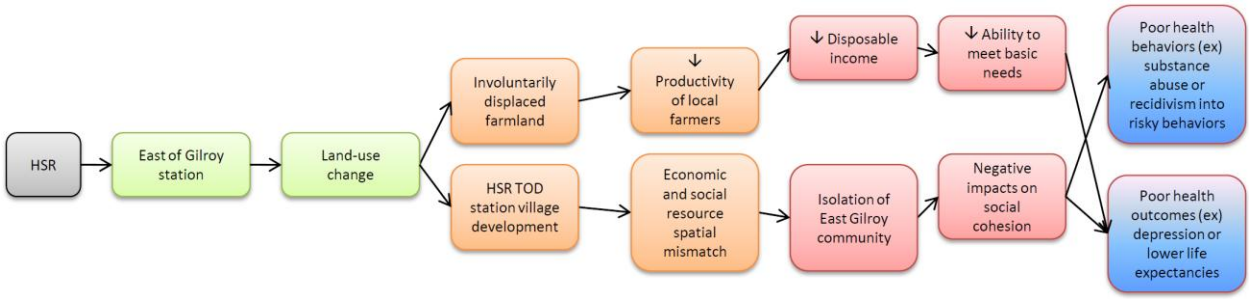
"Direct displacement" primarily occurs through either eminent domain or involuntary tenant relocation (20). With the HSR Authority prepared to exercise eminent domain (18), direct displacement is a realistic possibility with the Downtown Gilroy footprint. Residents will also experience indirect residential displacement, where individuals and families may have to move because their homes or apartments become unaffordable (21), another realistic pathway with the proposed Transit Oriented Development (TOD) of HSR stations. Gentrification is also a long-term mechanism for displacement (22), a possibility with the Downtown Gilroy footprint due to the TOD transit villages that are planned to be focal points for development. In this case, property values will increase to a point where original residents in the footprint area can be priced out of their homes. TOD and protective housing policies will be discussed in more detail later in this chapter.

In addition to residential displacement, there is also a strong possibility for direct commercial displacement, where local businesses are replaced by chain stores or new buildings (21). In addition, local Gilroy businesses that are not directly within the station footprint, but within the vicinity of TOD, may be indirectly displaced over the long-term through unaffordable leases, decrease in clientele, or through an inability to compete with new stores (21).

Loss of employment will decrease disposable income for affected employees and any dependents they support, and unless businesses displaced in the downtown footprints are incorporated back into station footprint development, then these businesses must relocate to another part of the city or cease to exist. In the East Gilroy footprint, the displacement of productive farmland is permanent and irreversible, affecting both the farmers and the farm workers they employ. Therefore, displacement of businesses will deteriorate the health of residents who are unable to find equitable employment, or who might relocate to follow their employer, losing their social support structures in the process. Furthermore, a low level of control in jobs is linked with poor health outcomes like heart disease and stress (23) (24).

Research demonstrating that segregation to health can amount to differences in life expectancy between neighborhoods in U.S. cities by as much as 20 years (25) (26) (27). In addition, displacement can destroy peoples' place attachment, which refers to people's emotional bonds with places; the longer a person resides someplace, the stronger the place attachment (28). There are multiple components to this complex displacement pathway, but displacement of residents and businesses due to the footprint will be very direct.

Model Pathway C, East of Gilroy Footprint:



Model C proposes a pathway hypothesizing social isolation of the East Gilroy community, a possibility that is being suggested by non-HSR Authority bodies (12) Transport infrastructure is known to act as a physical barrier to social interaction, playing a divisive role and severing communities (29). Figure 7.1 is an example of HSR infrastructure acting as a physical barrier. While this chapter is assessing station footprints and not rail alignments, there is a lack of data for East Gilroy station design. Therefore the example provided is of a Downtown Gilroy alignment, which is expected only to have a handful of breaks for major passage ways (1).

Figure 7.1: Example of HSR at-grade alignment

Fast moving traffic on highways can divide communities, especially those with elderly and disabled citizens and this isolation is associated with higher mortality and morbidity in the elderly (30). In social exclusion, certain members or groups in a society are marginalized, discriminated, or

disenfranchised relative to others, impacting economic position and mobility, educational attainment, and living standards (5). The East Gilroy community is at great risk of becoming socially isolated from other areas of the city, excluded from both the current downtown and potential HSR transit village east of the Gilroy Premium Outlets. This can severely affect residents whose place of home is socially isolated and segregated from the areas where they must go for work, creating divisions between the different communities within Gilroy.

A Downtown Merced or East Gilroy footprint can cause significant stress through their potential social cohesion or segregation effects, respectively. The degree to which these impacts actually occur will determine whether these psychosocial stressors that affect a central part of a resident's life will affect multiple areas (15) (31). If segregation and social cohesion are not a part of the station design conversation, the resulting stress could potentially lead to even more loss of resources, and negatively impact an individual's normal daily life through change, disruption, and/or readjustment (31).

Key Findings from the Footprint Analysis

- East Gilroy is a community at risk of many negative health impacts from an HSR footprint. However, these impacts are more easily mitigated with a downtown station footprint.
- The Downtown Merced footprint threatens social support and social networks of the elderly and the youth.
- Final HSR station designs and city-wide housing policies can protect the vulnerable low-income populations from displacement and loss of social networks.

EVIDENCE BASE & OBJECTIVES

The High-Speed Rail Authority requests that residents and businesses that are within proposed station footprints and track alignments begin to think about relocating. According to "Your Property, Your High-Speed Rail Project," the HSR Authority will employ Right of Way Agents to purchase properties within designated footprint and alignment areas at fair market value (2009). Affected residents and businesses will receive a written offer from the Rail Authority to purchase their property, and that it is "in your best interest to look for a new place to live as soon as possible" (18). If residents or businesses choose not to agree to the terms of the purchasing contract, then HSR will invoke California Eminent Domain Law in conjunction with federal precedents to acquire the land (18).

In addition to eminent domain, the HSR Authority will also employ federal legal precedents established by hearings such as *Kelo V. City of New London* to acquire necessary land. In these proceedings, the Supreme Court of Connecticut ruled that the government can grant a non-governmental body eminent domain power if the development plan is for public use for the purpose of economic development (32). Therefore, HSR will have the legal ability to acquire the land needed for this project, as early as next year in 2012 (18). However, Supreme Court Justice Thomas was concerned with the court's ruling, on whether eminent domain will have

differential effects on the public; with losses potentially falling disproportionately on poor communities, and the benefits going to the rich (33).

STANDARDS

There are federal and state standards in place that are relevant to some of the considerations regarding HSR station footprints. However, these policies are more explicit for the issue of displacement than that of social cohesion. The U.S. Department of Housing and Urban Development has objectives directed towards displacement including (5):

- A. Increase homeownership opportunities.
- B. Promote decent affordable housing.
- C. Strengthen communities.
- F. Promote participation of faith-based and community organizations.

In addition, the State of California Department of Housing and Community Development designed overall broad housing goals (5):

- Goal 1: Ensure local governments "take care of their own" by providing an adequate housing supply in an efficient land use pattern while minimizing impacts on valuable habitat and productive farmland.
- Goal 2: Remove barriers to increasing overall housing supply.

According to UCBHIG, there are no explicit government standards for promoting or achieving social cohesion in the context of land use. However, there are "principles and guidance" that can potentially assist in preventing social exclusion, residential segregation and promote development of social capital (5).

The National Environmental Policy Act (NEPA) created requirements for prospective environmental analysis that primarily analyzes a project's land use effects on the environment, but also includes any indirect health effects. NEPA requires the preparation of an Environmental Impact Statement by the agency pursuing the project, guided by six overall principles (5):

1. Determine if minority or low-income populations will be affected by any adverse health or environmental impacts in project area.
2. Consider public health or industry data regarding cumulative exposure to health or environmental hazards, historical patterns of exposure to environmental hazards.
3. Consider cultural, social, occupational, historical, and economic impacts of changes in the physical environment, including disruption of physical or social structure of a community.
4. Develop effective public participation strategies to overcome linguistic, cultural, institutional, geographic, or other barriers to meaningful participation and incorporate active outreach to affected groups.
5. Be aware of diverse constituencies when seeking community representations and endeavor to have complete representation of the community as a whole.

6. Seek tribal representation that is consistent with established government-to-government policies when Native American groups are involved.

In addition, relevant goals from the U.S. Department of Housing and Urban Development (HUD) Strategic Plan include (5):

- C. Strengthen communities (through offering economic opportunities, healthful living conditions, and an end to homelessness).
- D. Ensure equal opportunity in housing.
    - D1. Ensure access to a fair and effective administrative process to investigate and resolve complaints of discrimination.
    - D2. Improve public awareness of rights and responsibilities under fair housing laws.
- E. Embrace high standards of ethics, management, and accountability.
- F. Promote participation of faith-based and community organizations.

The HUD Fair Housing Act of 2009 (5):

- It is unlawful to discriminate in housing against a person based on race, color, religion, sex, national origin, disability, or familial status.

These federal and state standards are applicable towards the discussion of HSR footprints within the San Jose-Merced Corridor, especially to address concerns raised in the pathway models earlier in the chapter. For instance NEPA Principle 1, determining if minority or low-income populations are affected by any adverse health impacts, is applicable to the footprint alternatives of Gilroy due to the potential impacts on these communities of Gilroy.

BASELINE CONDITIONS

SAN JOSE

The downtown station footprint will not displace residential, commercial, or industrial units due to the above-Diridon Station aerial platforms. This above-grade footprint seeks to minimize displacement of businesses by superimposing itself on the existing Diridon Station. However, the HSR Authority's Preliminary Alternatives Analysis Report for SJ-M cites that the aerial option will have medium risk/impact on residential and business units, as well as city division due to the size of the station and station platform. Furthermore, the massive aerial HSR structure can potentially create a new perceived physical divide for nearby communities, a component of pathway model C.

Distribution of Hispanic Population (%), and Median Household Income Maps, by San Jose Census Block Groups (34)*:*

Figure 7.2: San Jose % Hispanic Population

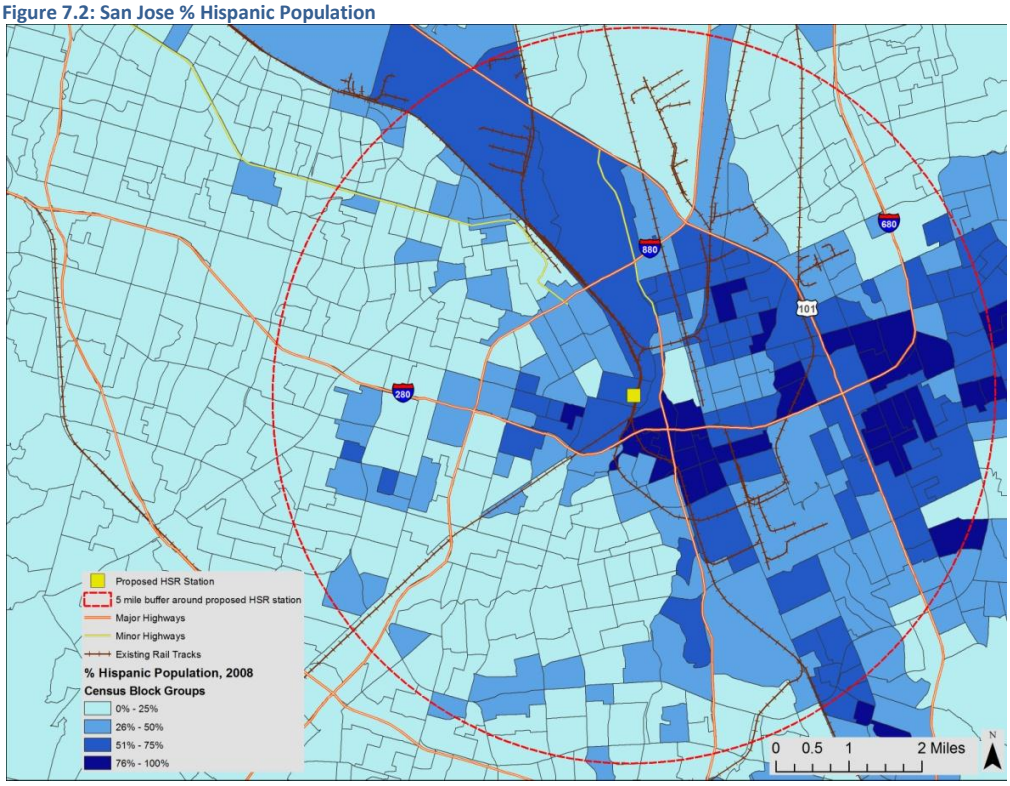
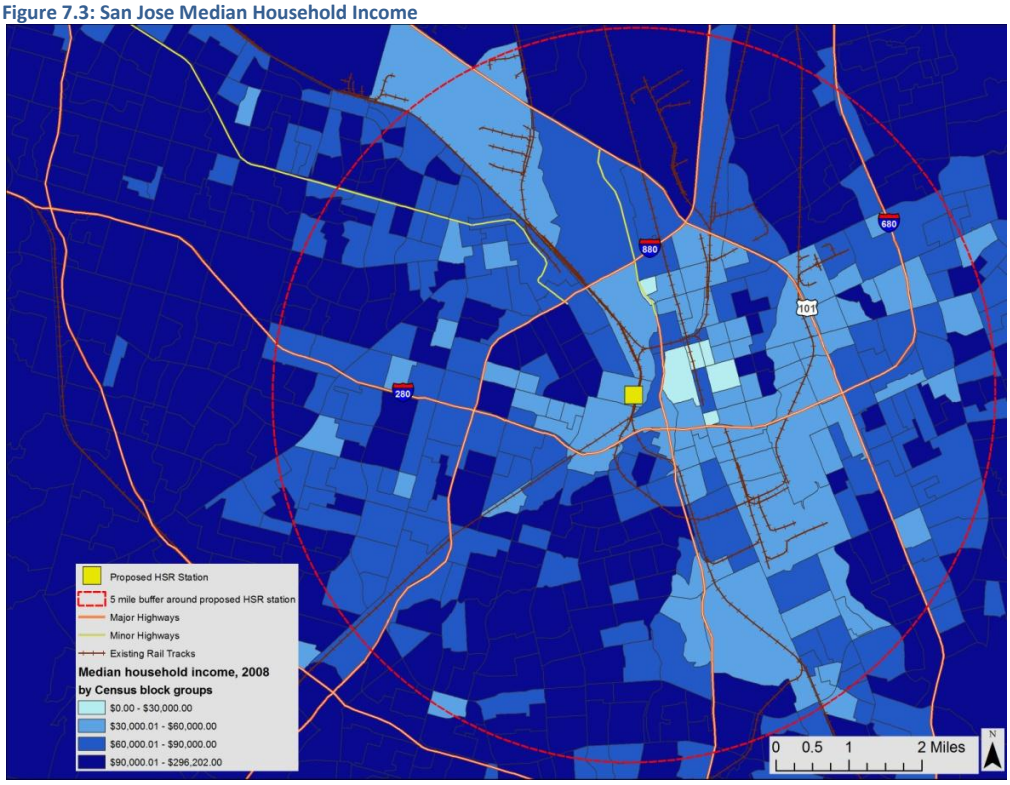


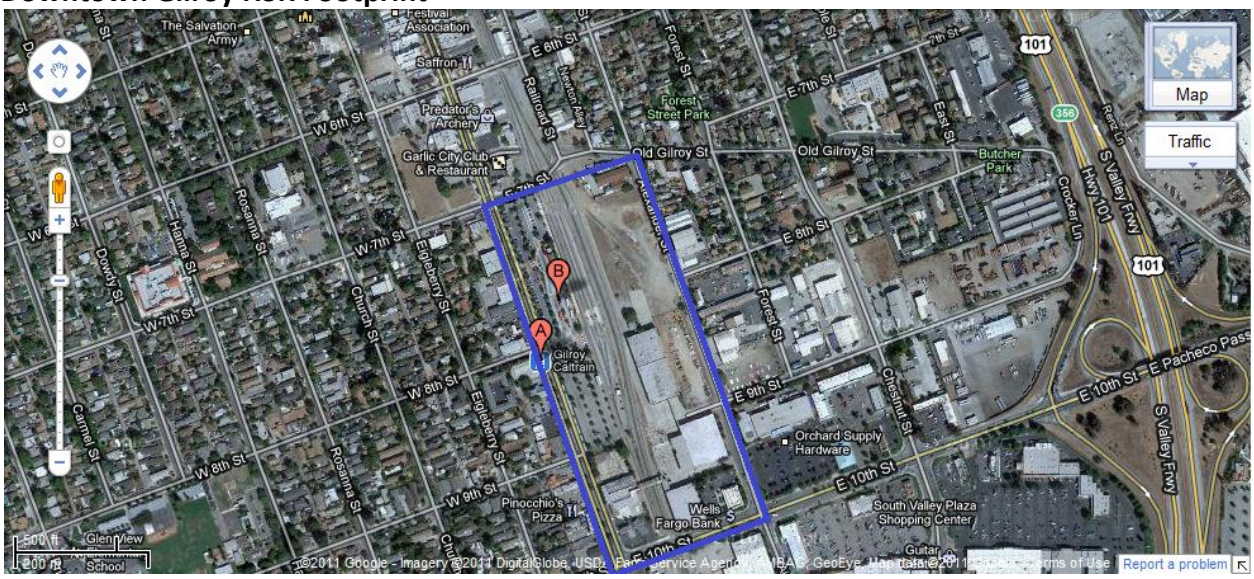
Figure 7.3: San Jose Median Household Income



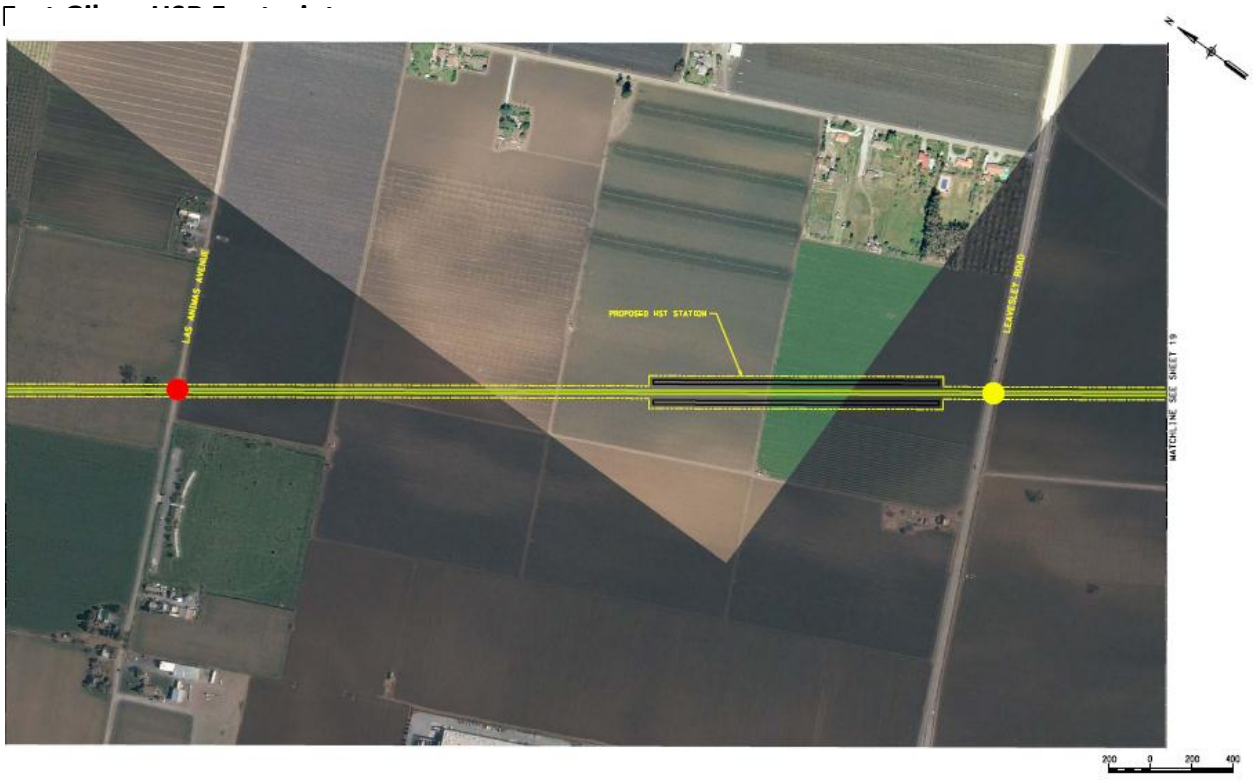
GILROY

The Gilroy downtown footprint will be positioned at the existing Gilroy Caltrain Station and is currently the primary footprint option being pursued by the HSR Authority (1). The East Gilroy footprint represents the alternative footprint and will be East of U.S. 101, and the Gilroy Premium Outlets.

Downtown Gilroy HSR Footprint



The area enclosed by the rectangle represents the proposed footprint of the Downtown Gilroy Station. To date, this area designated by the HSR Authority includes both the station and a 2-tier parking lot meant for initial ridership (12); this preliminary parking space is not designed to accommodate potential ridership once the statewide HSR corridor is complete. The HSR alignment will displace 30-45 residential units, a mixture of houses and apartment complexes along the outer edges of the footprint. Moreover, small businesses, banks, restaurants, and auto-related businesses are either within the proposed footprint or just along the edge of the footprint boundary, which will displace approximately 15-25 commercial and industrial units.



The footprint for the East Gilroy HSR Station will significantly impact land currently used for agriculture, requiring 660 acres of farmland. In addition, the East Gilroy HSR station is expected to create a new line of segregation, increasing the social isolation of East Gilroy's Hispanic community (12).

Whether the Downtown Gilroy or East Gilroy Station is chosen, there will be additional significant HSR related land use in the form of necessary parking structures, due to Gilroy's anticipated ridership consisting primarily of non-Gilroy residents (35). Current estimates by HSR Authority of parking footprints are significant, requiring an additional 2800-3800 parking space capacity (4); there are 471 existing parking spaces at the existing Gilroy Caltrain Station.

Distribution of Hispanic Population (%), and Median Household Income Maps, by Gilroy Census Block Groups (34)*:*

Figure 7.4: Gilroy % Hispanic Population

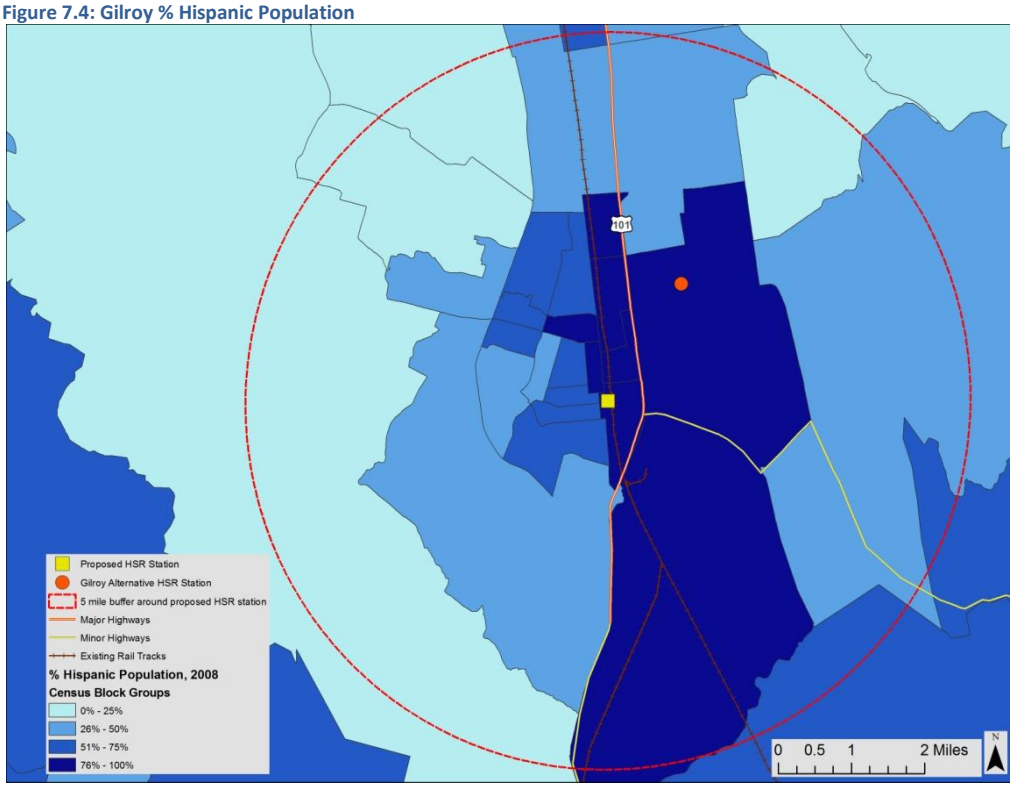
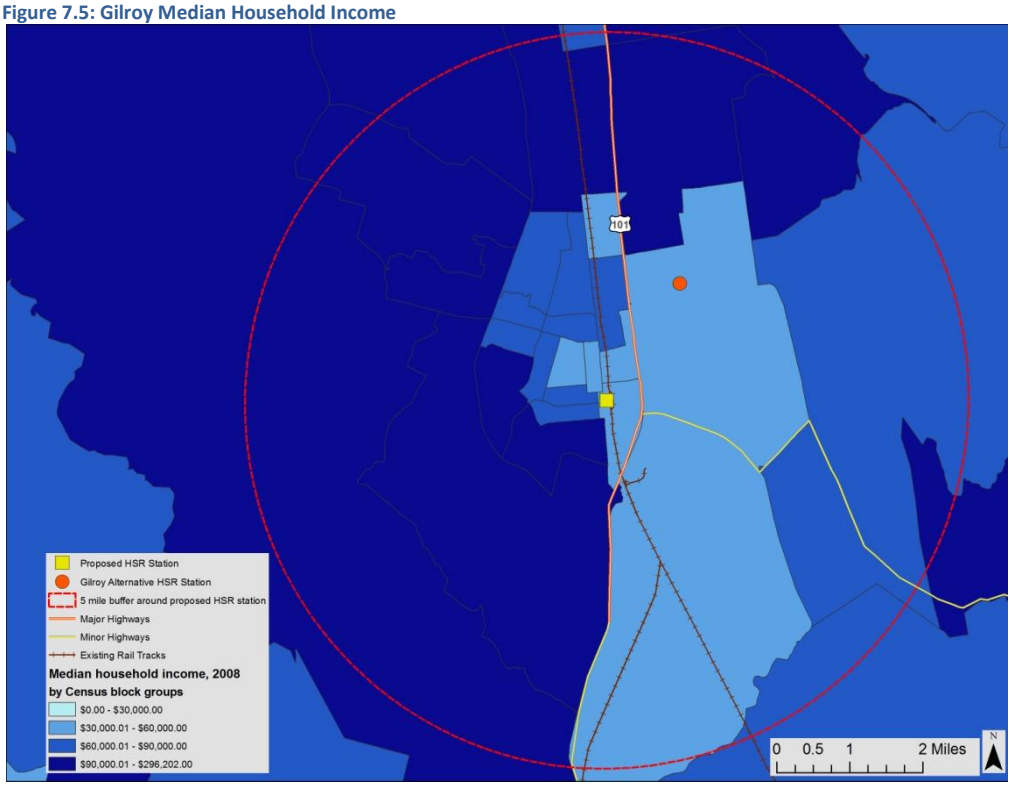


Figure 7.5: Gilroy Median Household Income



Distribution of Poverty, and Renter vs. Owner Occupied Housing Map (36):

Figure 7.6: Gilroy Multiple Indicators

Note: The house insignias represent banks and grocery stores.

Gilroy's Hispanic population resides within East Gilroy, primarily east of the Caltrain tracks (Fig 7.4). According to City of Gilroy Police Department data, from October 2010 to April 2011, there have been 51 incidents of crime, of which 17 are thefts and 16 are assaults (37). A majority of the reported incidences of assault occurred within Downtown Gilroy where census block groups are more than 76% Hispanic (34). Citywide, Gilroy is below the national median in violent crimes per annum with 4.35 per 1,000 residents (National median is 4.7 per 1,000), and is considered to be safer than 19% of cities in the US (6). Furthermore, approximately 16.4% - 100% of people living in poverty in Gilroy are consolidated in the East Gilroy block groups (Fig 7.5 & 7.6), the area enclosing the downtown footprint.

There is additional health data for East Gilroy residents due to the resources of the Santa Clara County Public Health Department (compared to the Merced County's Public Health Department which lacks such health data). The following data bullets all refer to the East Gilroy community, which accounts for a majority of Gilroy's Hispanic population (38):

- 49% of residents in these neighborhoods live at or below the Federal Poverty Level (185% FPL).
- Only 67% of residents report having health insurance even though 94% of total Gilroy residents have health insurance.
- 67% of adults are categorically overweight or obese as adults.

- 40% of youth enrolled in the local elementary school are not at a healthy weight.
- 37% of deaths in Gilroy are due to diabetes, heart disease, or cerebrovascular disease.
- 49% of adults self-report participating in some form of vigorous physical activity.
- There are 11 fast food outlets in the neighborhood.

MERCED

Downtown Merced HSR Footprint

The proposed Merced HSR station footprint will be in Merced downtown, across the street from and including the existing Greyhound bus-stop. The area enclosed by the blue line represents both the station and parking footprint. The station footprint is the section within O and M Streets, and the remaining area is for the 1800 parking spaces needed to accommodate expected ridership for Merced (4). The downtown footprint is expected to have significant impacts on social services, displacing the Merced Senior Community Center, the Boys & Girls Club of Merced, and the Corrections Department Parole Office. Furthermore, four commercial businesses will be displaced, including a chain supermarket.

The HSR Authority has also posted a Heavy Maintenance Facility Technical Memorandum which considers Merced County as the primary option for a regional maintenance and terminal storage facility (2009). The 154 acres required for these facilities will be sequestered from Castle Air Force Base near Atwater, CA (northwest of Merced), and is expected to have significant impacts on productive farmland.

Distribution of Hispanic Population (%), and Median Household Income Maps, by Merced Census Block Groups (34)*:*

Figure 7.7: Merced % Hispanic Population

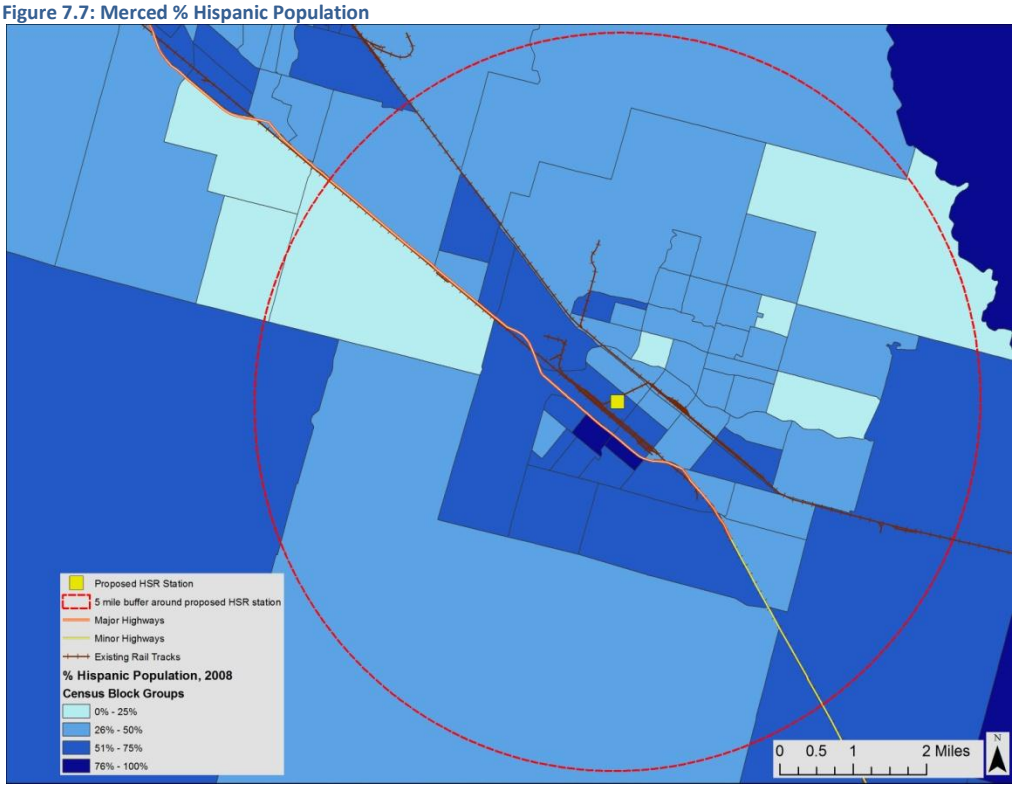
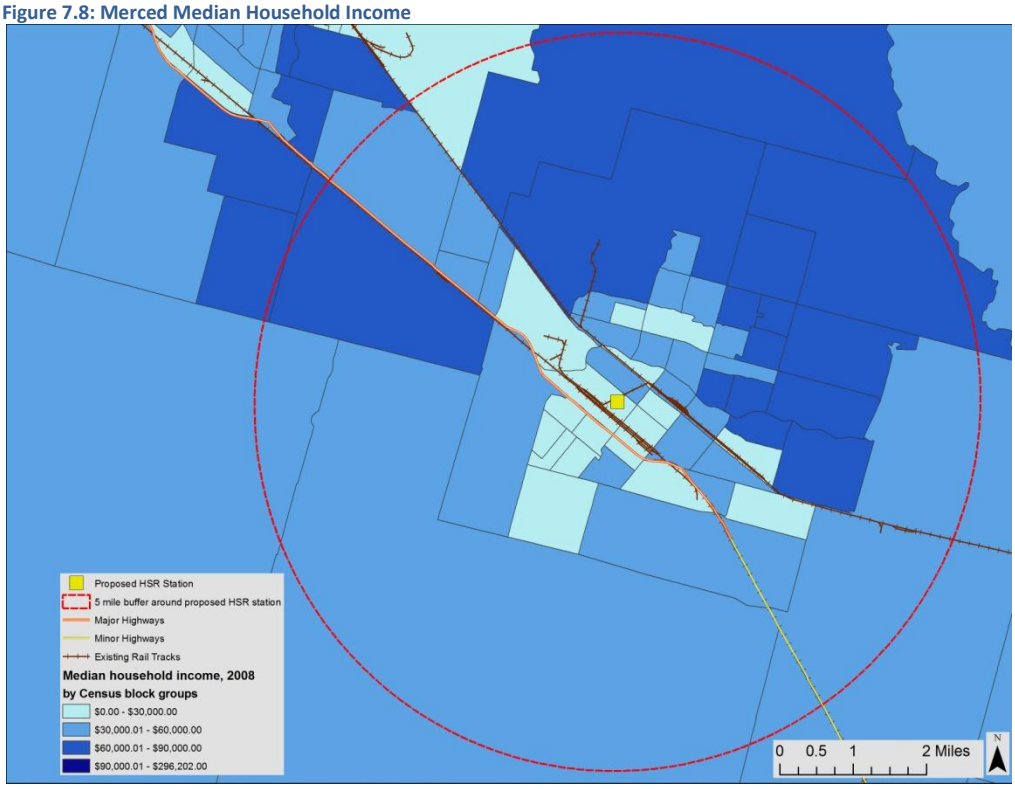
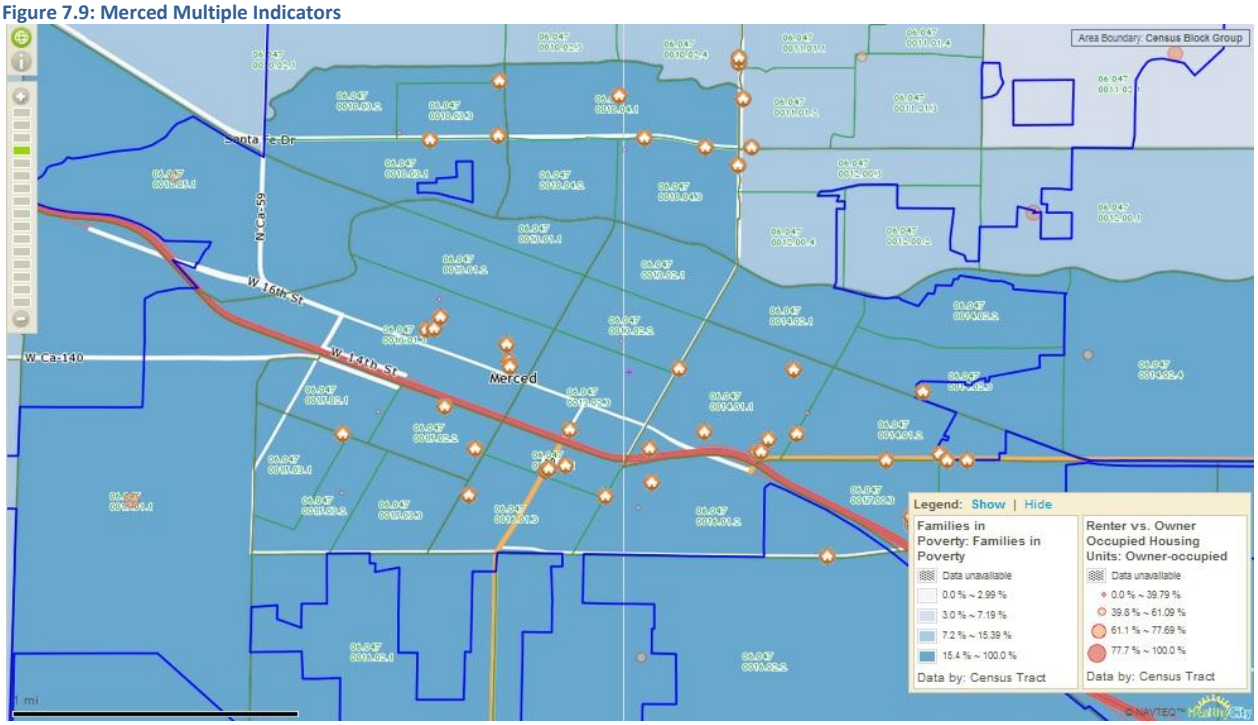


Figure 7.8: Merced Median Household Income



Distribution of Poverty, and Renter vs. Owner Occupied Housing Map (36):

Figure 7.9: Merced Multiple Indicators



Note: The house insignias represent banks and grocery stores.

Merced's Hispanic population resides mostly in West Merced, west of the Merced Amtrak railway alignment. Block groups surrounding and containing the Downtown HSR station footprint are predominantly Hispanic, with the highest density of Hispanic block groups adjacent the proposed HSR footprint but on the opposite side (west) of the freeway that splits Merced (Fig 7.7). Citywide, Merced is above the national median in violent crimes per annum, with 9.41 per 1,000 residents (National median is 4.7 per 1,000), and is considered to be safer than only 3% of cities in the US (6). In Merced, the highest incidence of crime is in the city center (6), an area encompassing that of the HSR downtown footprint. Unlike Gilroy, Merced's population in poverty is distributed throughout the city (Fig 7.8 & 7.9), in both the predominately White and Hispanic block groups.

ANALYSIS

One reason the analysis of HSR footprints does not include San Jose, is that the rural station-cities are predominantly composed of White and Hispanic residents; 92% of the Gilroy population and 81% of Merced collectively (39). Therefore, the spatial arrangement of these two ethnic groups is much clearer, and easier to analyze considering this HIA's time constraints. Furthermore, the methods for assessing baseline conditions and analyzing the health impacts of HSR were decided upon through expert guidance.

According to baseline conditions of Gilroy, it appears that there is segregation occurring, whether intentional or not. In Gilroy, the area isolated by the CA 152 highway/Caltrain rail alignment and Highway 101 is where the majority of the city's Hispanic population lives (Fig 7.4), accounts for 62% of Gilroy's renters (Fig 7.6), over 70% of the population in poverty (Fig 7.6), and a large proportion of Gilroy's crime (37). In Merced, locations for crime, poverty, and renters are spread throughout the city (Fig 7.8 & 7.9) (6). Furthermore, the Hispanic community resides primarily west of the 140/59/99 freeways (Fig 7.7).

These statistics are why the City of Gilroy is concerned with the East Gilroy HSR footprint increasing the social isolation of the city's Hispanic community (12). In the Model C pathway scenario discussed earlier, the segregated Hispanic population will be spatially excluded from the current Gilroy city center and future HSR transit village. Thus, if the Downtown HSR footprint is chosen, then at least the development of the transit village will bring investment and development to East Gilroy, an area that suffers from high poverty and crime. In Gilroy, the design of the HSR station combined with its geographical footprint will determine whether or not this ethnic segregation will improve, worsen, or persist.

In Merced, the downtown footprint will displace the Boys & Girls Club center and Senior Community center, affecting two of the most vulnerable populations identified earlier in the HIA scoping process. These centers are important Merced community resources: the senior center hosts numerous senior activities both social and instructional, and the Boys & Girls Club served over 1,000 youth in 2009 (40) with library, computing, gym, game room, and multi-purpose room facilities. The numerous services and high utilization of both these community resources provide an example of positive local cohesiveness (29), which is now at risk due to the coming HSR station footprint. Where these centers will be relocated should be a primary concern for Merced, in light of their statistics on poverty and crime. If these community resources are relocated to an area that would make them inaccessible to the populations they serve, the footprint will sever health promoting ties (15), impacting health in ways discussed in the Model A pathway.

The Hispanic community of Gilroy is especially at-risk to the potential economic effects of eminent domain and the Downtown Station footprint on property values. Displacement of residents via eminent domain will disproportionately impact communities with low socioeconomic status, unless rising property values and relocation of residents are properly mitigated. Purchasing their properties at a low-rate determined by HSR Right of Way Agents (18) will force them to search for affordable housing options, and impact health in multiple ways as discussed in the Model B pathway.

Furthermore, the HSR Authority's proposals for these transit villages follow that of TOD with mixed land use of commercial and residential properties, and public spaces (41). The city governments of these rural station-cities are developing future general plans to coincide with that of HSR stations (35), showing that these footprints will have greater impacts beyond the immediate communities that surround them. Economic models for TOD show that station proximity lead to travel cost savings that can translate into increased competition and higher property values, with travel cost savings reincorporated into property price (42). Furthermore,

commercial properties within ¼ of a mile of TOD can increase in value by 12.2% (43). Moreover, residential properties located within a ¼ mile radius of a light rail station can earn a premium 2-5% more than a city's median home value (44) or being within ¼ of a mile from any TOD station can add $5,000 to a home's value (42).

Based on data from the empirical literature and documents from both the HSR authority and cities of Merced and Gilroy, it is fairly clear that these station footprints will be designed to bring economic growth and development to the city overall. However, the expected increase in property values can negatively impact Gilroy's Hispanic community, especially the low-income renters who are within a mile radius of the station footprint. Renters are at greatest risk, especially those whose jobs are displaced by the footprint, because these individuals cannot afford their original place of residence or an equitable alternative, experiencing long-term displacement and loss of social support networks. Furthermore, neither Gilroy nor Merced has rent-control laws in place for non-mobile home properties (45), which leaves low-income renters at high risk of displacement once the HSR TOD is complete.

Furthermore, eminent domain can affect homeowners wherein their properties will be bought out at fair market value (18). However, fair market value will likely be set at a price lower than the future, higher property value, and is definitely less than the market value pre-recession. Therefore, homeowners may also experience displacement as they will be unable to purchase equitable property to the one they lost due to the increase in property values associated with TOD. Being priced out from one's community could result in health impacts similar to those discussed in the Model A and B pathways, due to a loss of income, housing, and social networks.

LIMITATIONS

The research methodologies utilized in this chapter are due to personnel and time constraints. Although the Dissimilarity Index was initially discussed as a tool for assessing segregation in Gilroy and Merced, it was determined that the added value for calculating this index was minimal compared to GIS map analysis. In addition, no original qualitative study was undertaken for this chapter i.e. semi-structured interviews or focus groups with Gilroy and Merced residents, despite its tremendous added value for the discussion of social cohesion, segregation, and displacement.

Another limitation is that social cohesion research has primarily focused on urban African-Americans (46) (47) (48) (49), while this analysis attempts to project the social cohesion impacts of the HSR footprints for rural cities. Furthermore, the ability to make footprint related projections for the corridor's rural communities is limited since the population of interest in this context is Hispanic.

Without more detailed station design and footprint location information, it is difficult to make clearer projections for the San Jose-Merced HSR corridor in regards to health impacts of the station footprints. However, it is clear that these footprints will affect station-city

communities, and that the final station design and city housing policies are what will likely determine how the adverse health impacts will be mitigated.

RECOMMENDATIONS

Based upon current data, it appears that the displacement and social cohesion impacts on the rural station-cities of this HSR corridor are perhaps being considered as acceptable tradeoffs for the success of the overall North-South HSR corridor. Or they have not yet come into the purview of this project's relevant planning bodies. Outlined below are recommendations for how to mitigate footprint related health impacts, in addition to the standards section earlier in the chapter:

	Policies to Mitigate Footprint Health Impacts	**Relevant Stakeholder**
Housing Rights Committee of San Francisco	From HUD, CFR 24, Part 4: ➢ **In public housing, rent should be no more than 30 – 40% of annual income.** ➢ Section 8 Type II sets a defined number of units that can get vouchers at 30% of income rate. ➢ Focus on "very and extremely low income" households with an average income of $13,000 - $18,000. Note: Section 8 is a housing subsidy program, where renters can use vouchers in non-public housing unites.	City governments
UCBHIG HOPE VI to HOPE SF HIA	➢ On-site community centers are important to HOPE VI residents. ➢ Displacement recommendations: (1) Education on housing options during redevelopment relocation (2) **Comprehensive support for families undergoing involuntary relocation** (3) Effective case management, particularly to vulnerable populations (4) Connect relocators to culturally and age-appropriate institutions in their new neighborhoods & provide coping services. ➢ Social cohesion recommendations: (1) Increase support for & improve awareness of programs and services offered by on-site community centers (2) Empower resident access and use of community spaces (3) Improve tenants' communication w/ management, including increasing participation in tenant's associations (4) Improve safety to enable residents to feel safe congregating and interacting in public space (5) Involve residents in the review of rules w/ management (6) Explore entrepreneurship opportunities for residents to fill vacancies in mixed-use public housing redevelopment and (7) **Economic integration**.	City planners and HSR Authority
Hill District	➢ **Create a community master plan for land-use and**	City

Consensus Group	**enforce through a Community Benefits Agreement. This requires a steering community or consensus group to petition the HSR planning Commission or city council to adopt the master plan**. ➢ "Build-First" – replacement housing built in the surrounding neighborhood before residents required to move. ➢ "Master Lease" – housing authority pays to lease a block of apartments in the new HSR transit villages. ➢ "Project-based" subsidy – public housing, project based Section 8, and low-income housing tax credits. ➢ "**Inclusionary zoning**" – housing developments of a certain size contain at least some affordable units for low-income residents. ➢ Preserve affordable rental housing in an appreciating market and provide tenants with ownership interest via "**limited equity cooperatives**" (tenants have cooperative ownership and control over their housing) and "installment land sale contract" (tenants build equity and purchase their home over time). ➢ **Inclusionary business development**, which requires a developer to set aside at least 10% of all retail spaces for locally-owned small businesses.	government and HSR Authority
Healthy Development Measurement Tool	Objective SC.1 Promote socially cohesive neighborhoods, free of crime and violence ➢ Increase social connection and sense of community by providing appealing and comfortable street environments, parks, and active open spaces for social networking, civic engagement, personal recreation, and other activities that create social bonds between individuals and groups (Healthy People 2010 (HP), Objective 15-36). ➢ Incorporate space in building design that could be used for community meetings, afterschool programming, tutoring/mentoring, senior activities or other social programs (HP 2010, Objective 15-37). ➢ **Create community centers where people can gather and mingle as part of their daily activities** (HP 2010, Objective 15-38). ➢ Since the HSR footprint is within ½ mile of a community center (Benchmark #1), will the HSR project contribute funding (via impact fee or CBA) towards an existing community center or for the construction of a new community center. Objective HH.2 Protect residents from involuntary displacement. ➢ Encourage development agreements to include rent-control commitments and provide model language to support this.	City government and HSR Authority

CHAPTER 8. RECOMMENDATIONS & CONCLUSIONS

Based upon the best available evidence, the authors of this HIA would like to put forth the following recommendations applicable to the entire San Jose-Merced corridor. Most of these recommendations are for additional actions by the HSRA, but City governments and existing transit operators also have crucial roles to play to support the execution of these health-promoting recommendations.

Short-Term Recommendations:

- Enact a local hiring policy.
- Ensure jobs have a living wage, union protections, and benefits.
- Establish job training opportunities.
- Create a clarifying report that explains the predicted changes in local and regional level travel behaviors.
- Form collaborations with employers throughout the region and state to institute employer-sponsored public transit pass programs.
- Perform focus groups with residents to assess footprint possible displacement effects.
- Initiate collaborations among other transit providers and residential developers to coordinate ticketing, fares, and station locations that decrease time and monetary costs to riders and improve access to transit options for all Californians.
- Develop and enforce strict standards for transparency and equity for the distribution of the $950 million in bond funding for local transit infrastructure that was approved by Proposition 1A in November 2008.
- Work with regional and local agencies to ensure design mitigations of pedestrian risks from increased vehicle flow in and around parking lots and stations.

Long-term Recommendations:

- Include extensive and holistic considerations of public health in all EIR/EIS analyses with particular attention to impacts on vulnerable populations such as youth, elderly, and socially marginalized populations and individuals with low-incomes, pre-existing health conditions, or disabilities.
- All spatial and non-spatial data created and collected for planning publicly-funded projects should be made easily available to the public to enable concerned parties to evaluate the impact priorities of proposed plans, programs, and policies.
- City and County governments should conduct HIAs of land use and transportation projects. In addition, these governing bodies should implement protective policies for current residents and local-businesses to ensure that vulnerable populations are not displaced due to future HSR-related development.
- Create ongoing skills development opportunities for current and potential HSRA employees throughout California.

Conclusions

Upon completion of this HIA for the San Jose-Merced corridor, it is clear that the construction of high-speed rail and its related development will be a significant regional project. As shown in the analyses of four HSR-related health determinants, stakeholders involved in the planning processes will need to make important decisions on project details that will affect the lives and livelihoods of corridor residents. To some degree, the results of this HIA raise issues relevant to the entire corridor, with both urban and rural segments represented.

Although the planning stages for the San Jose-Merced HSR corridor is still in its initial phases, the HSR Authority should recognize that there are a variety of health impacts yet to be considered in the most recent project EIR/EIS. To highlight, overall issues of concern raised during the process of this HIA are that HSR short and long term employment opportunities will likely not meet employment needs of corridor residents if HSRA does not take into consideration potential mitigation strategies (Ch 4). Transportation mode choices may not change enough to produce health benefits unless additional policies and programs are implemented (Ch 5). Many of the health impacts of parking requirements can be mitigated, but some additional pedestrian injuries and fatalities are likely simply because of the additional vehicle volume (Ch 6). Land-use redevelopment will have the most significant adverse health impacts on low-income communities (Ch 7). With the inertia of this statewide project pushing it towards initiation, considerable effort should be placed on planning corridor- and city-specific details, and transition away from an impetus on statewide project planning.

As this HIA was performed as a class exercise with no public participation by stakeholders, the extent of monitoring by this team will likely take the form of reading project updates through major media outlets. However, since this California HSR is a test subject for future high-speed rail projects nationwide, this report may serve as a useful tool for assessing the long-term health impacts of high speed rail, beyond our corridor specific findings.

APPENDIX

TABLE A1. DOCUMENTS REVIEWED

Author	Type	Document	Date
City of Gilroy	General Plan	General Plan, Final Environmental Impact Report	6/13/02
Santa Clara Valley Transportation Authority	Plan	Valley Transportation Plan 2035	1/1/2009
CHSRA	Plan	FINAL Public Participation Plan	10/1/2009
Richard Tomlach (President of the California Rail Foundation)	Comment/ Review	Gilroy fooled – high-speed rail turns city into 'Thunder Alley'	1/11/2010
CHSRA	Alternatives Analysis	Preliminary Alternatives Analysis, San Jose to Merced	6/1/2010
CHSRA	EIR	Bay Area to Central Valley High-Speed Train Revised FINAL Program Environmental Impact Report Vol 1	8/1/2010
City of Gilroy, Administrator	Comment/ Review	Comments on Draft HST Station Area Development	8/26/10
City of Gilroy, Engineer	Comment/ Review	Review of CHSRA Preliminary Alternatives Analysis	9/2/10
City of Gilroy, City Council	Resolution	A Resolution Voicing No Confidence in CHSRA	10/19/10

Hatch Mott MacDonald. 2010. A Review of the California High Speed Train preliminary Alternatives Analysis Report: San Jose to Merced Section High-Speed Train EIR/EIS.

High Speed Rail Authority. 2010. DRAFT HST Station Area Development: General Principles and Guidelines.

McKinley, J. “Worries follow route of high-speed California line.” New York Times. 2 January 2011.

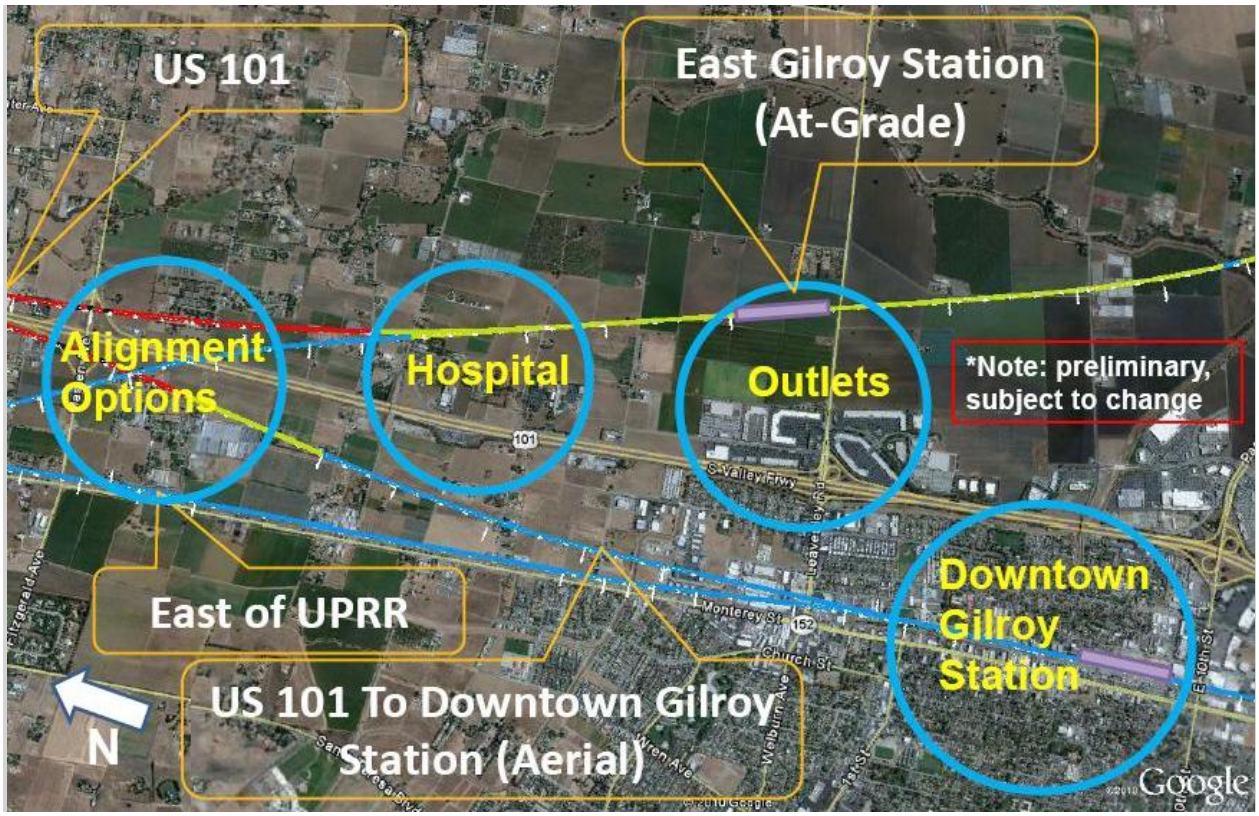
North American HIA Practice Standards Working Group. 2010. Minimum Elements and Practice Standards for Health Impact Assessment, Version 2.

Project Overview. California High Speed Rail Authority. <http://www.cahighspeedrail.ca.gov>

Tolmach, R. 2010. “Gilroy Fooled- high-speed rail turns city into ‘Thunder Alley.’” Gilroy Dispatch.

U.S. Census American Factfinder. 2005-2009. Gilroy. http://factfinder.census.gov/

FIGURE A1. GILROY STATION OPTIONS



A recent presentation by the HSRA at a South Santa Clara County community workshop included an aerial view of Gilroy's two station options, East Gilroy and Downtown Gilroy. The HSRA indicates that downtown Gilroy station is currently the preferred station location because it meets the HSRA's priorities for stations to be located in city centers (HSRA, 2010). However, a report commissioned by the City of Gilroy suggests that the East Gilroy alignment would, "be less disruptive to buildings and the environment than the Downtown Gilroy alignments" (City of Gilroy, 2010). This conflict of opinions by stakeholders over the optimal plans for station development in Gilroy presents an ideal situation to apply a health impact assessment.

TABLE A2

This contextual data about Gilroy is from the 2010 Santa Clara County Health Profile Report and 2005-2009 U.S. American Community Survey Data.

INDICATOR	GILROY CHARACTERISTIC	SIGNIFICANCE
Socioeconomic		
Population	52,027	Lowest populated city with a planned HSR station
Youth	27% ages 14 and younger	Younger population than county and state
Race/Ethnicity	59% of total population and 68% of newborns are Hispanic; 32% white, 6% Asian, 1% African American	Much higher % Hispanic population than county and state
Education	26% less than high school diploma	Lagging education levels compared to county and state
Income	39% with income < $50,000	More low income households than county, but better than state average
Poverty	29% below 200% Federal Poverty	Higher poverty levels than county, but lower than state
Language	45% do not speak English "very well" (88% Spanish speaking; 12% other language)	Outreach materials and meetings must be in Spanish to reach large portion of population
Nativity	25% foreign born	May be different cultural needs and preferences in Gilroy compared to other areas in county and state
Housing costs	61% of renters spent > 30% of income on housing ($1,181 median)	Need for affordable rental housing
Home ownership	9,000 (63%) owner occupied housing units	Need for both ownership and rental housing options
Car ownership	7% without access to private vehicle	Most people have cars
Health		
Asthma	25%	Much higher than county and state levels
Diabetes	14%	
High blood pressure	43%	
High cholesterol	40%	
Obese/Overweight	66%	
Vigorous physical activity	52%	
Environment		
Area	15.9 sqare miles	
Walkscore	58/100	Room for improvement. Similar to than San Jose and Merced (both 55).
Walkability	92% of adults think it is easy to walk in their local community	Most residents can walk in their neighborhoods now
Cleanliness	85% of adults think neighborhood is clean	High levels of pride in community
Crime	11% adults report crime as major problem in their neighborhood	Not a current concern, but there may be resistance to any community changes that may increase crime
Park access	16% of adults think that better access would improve health in their neighborhood	Park access in station area design would be favorable to many residents
Safety	12% of adults think that improving safety would improve health in their neighborhood	Some see a need for better safety measures
Fresh produce access	20% of adults think better access would improve health in their neighborhood	Healthy food retail options would be favorable to many residents

FIGURE A2. THE RANGE OF HEALTH IMPACTS, BY DIRECTION AND TIMING

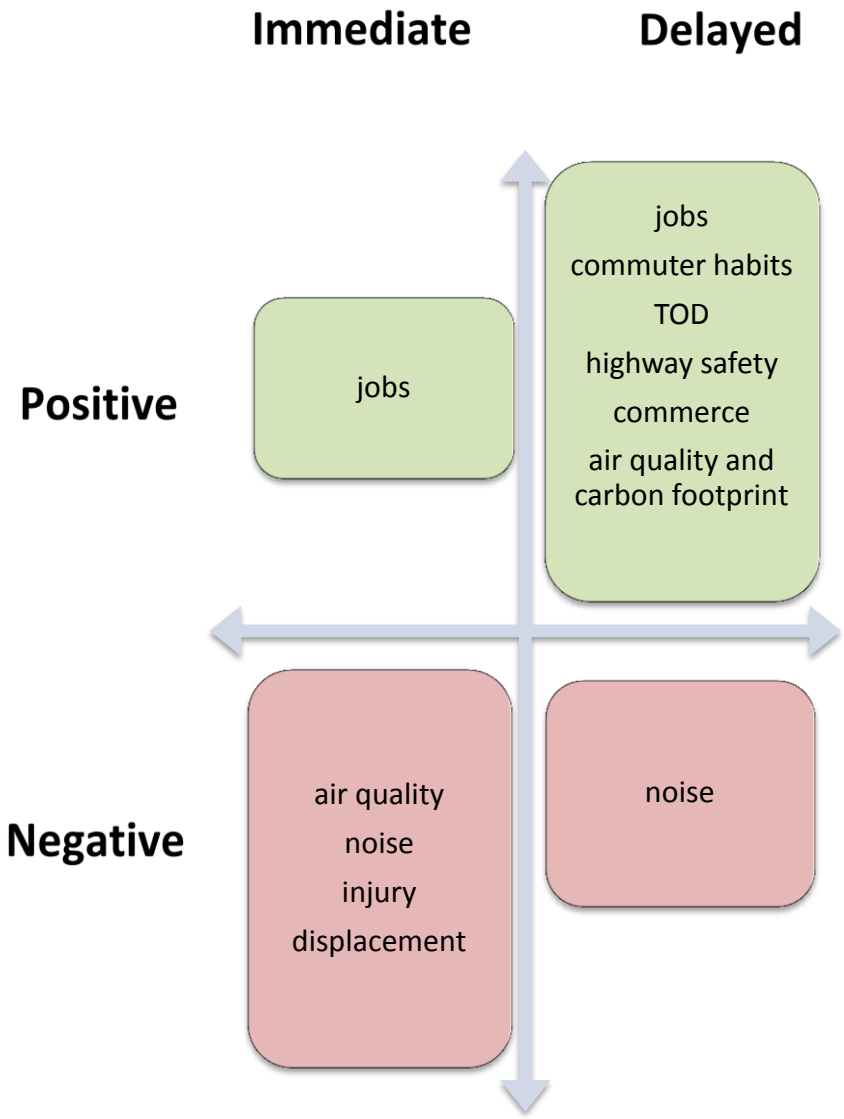


TABLE A3. COUNTY HEALTH AND ENVIRONMENT INDICATORS

	Santa Clara County	Merced County	State average	Best in CA
Overall population health				
% of adults obese	19	30	23	16
ADULT OBESITY RANK	7	56		1
% of adults with diabetes	7.1	6.9		6.1
% of low-income preschoolers obese	16.6	17.8		8.4
HEALTH OUTCOMES RANK	4	40		1
Socioeconomic factors				
% of children in poverty	10	26	17	7.39
income inequality: Gini coefficient	45	45	47	4.4
% single-parent households	7.7	14.4	10	1
SOCIOECONOMIC RANK	3	52		
Nutrition environment				
% low income & >1 mile to store	1.4	15.3		0.9
grocery stores per 10,000 people	2	2.4		6.7
fast-food restaurants per 10,000 people	7.4	4.9		3.9
farmers markets per 10,000 people	0.1	0.2		2.1
% of zip codes with a healthy food outlet	50	55	46	75
Physical activity environment				
# of air pollution-particulate matter days	17	26	13	0
# of air pollution-ozone days	3	20	37	0
recreation & fitness facilities per 10,000	1.3	0.9		3.9
PHYSICAL ENVIRONMENT RANK	34	36		1

Source: These data are from the 2007 County Health Rankings and Food Environment Atlas. The County Health Rankings data are compiled by the University of Wisconsin Population Health Institute through a collaboration with the Robert Wood Johnson Foundation. The data include percentages, rates and rankings for each county within the 50 states according to its health outcomes and multiple health factors. Data sources include the U.S. Census and the Behavioral Risk Factor Surveillance System, among others.

The Food Environment Atlas is a project of the US Department of Agriculture (USDA) Economic Research Service (ERS) which aggregates statistics on food choices, health and well-being, and community characteristics. This resource does not provide state averages. Data sources include the U.S. Census and USDA.

Both the County Health Rankings and Food Environment Atlas have online mapping tools, data dictionaries and other resources to understand the origin and meaning of the indicators on their respective websites: www.countyhealthrankings.org and www.ers.usda.gov/FoodAtlas.

FIGURE A3. TOOL FOR FINAL SCOPING AND IMPACT SUMMARY

Standards for determining the final scope and significance of impacts were operationalized using these criteria and definitions:

- **certainty:** the # of contingencies, likelihood of decision and level of exposure, project facts
- **precision:** the # of mediators in pathway
- **magnitude:** the # of people affected
- **permanence:** the likelihood outcome changes when exposure is removed
- **equity:** socioeconomic disparity
- **stakeholder priorities:** specifically mentioned in comprehensive plan, but also news reports

				Significance criteria						
Health Determinant	**Exposure**	**Mechansim**	**Health Outcome**	**certainty (likelihood)**	**precision**	**magnitude**	**permanence**	**equity**	**stakeholder priorities**	**TOTAL**
FOOTPRINT	segregation	social networks, job security, stress	multiple	3	1	3	5	5	1	18
	displacement	social networks, job security, stress	multiple	5	2	3	4	5	4	23
	walkability	physical activity, stress	CVD, obesity, mental health	3	2	4	3	1	3	16
	access to goods	physical activity, stress, nutrition	CVD, obesity, mental health	2	3	3	1	4	3	16
	access to services	physical activity, stress, health care,	mental health, mortality	2	3	2	1	4	2	14
TRANSPORTATION	vehicle miles traveled	air quality	multiple	3	3	5	4	5	3	23
MODE	airplane trips	air quality	multiple	1	2	2	4	3	1	13
	access to employment	improved mobility and income	multiple	2	2	3	3	3	4	17
	use of public transit & active transportation	physical activity	multiple	3	4	4	3	5	4	23
	noise pollution	stress, sleep disturbance	multiple	3	2	3	4	3	2	17
	commute time	stress	multiple	2	1	4	3	3	4	17
	traffic flow	collisions	pedestrian injury and	3	5	3	5	4	3	23
	access to goods	stress, nutrition	CVD, obesity, mental health	2	3	3	1	4	3	16
	access to services	stress, health care, social networks	mental health, mortality	2	3	2	1	4	2	14
	affordability	stress, health care, nutrition	multiple	2	2	4	3	5	2	18
PARKING	traffic	collisions	ped injury	2	5	3	3	4	3	20
	traffic	air quality	asthma	2	3	2	3	4	3	17
	traffic	air quality	COPD & cardio	2	2	2	3	3	3	15
	traffic	noise	stress	2	2	2	3	3	2	14
	runoff	water quantity	flood casualties	2	3	2	1	3	3	14
	runoff	water quality	cancers	2	1	5	4	3	3	18
	heat-island	heat-waves	heat-stroke, etc	2	2	1	1	4	2	12

FIGURE A4. CONSTRUCTION PATHWAY

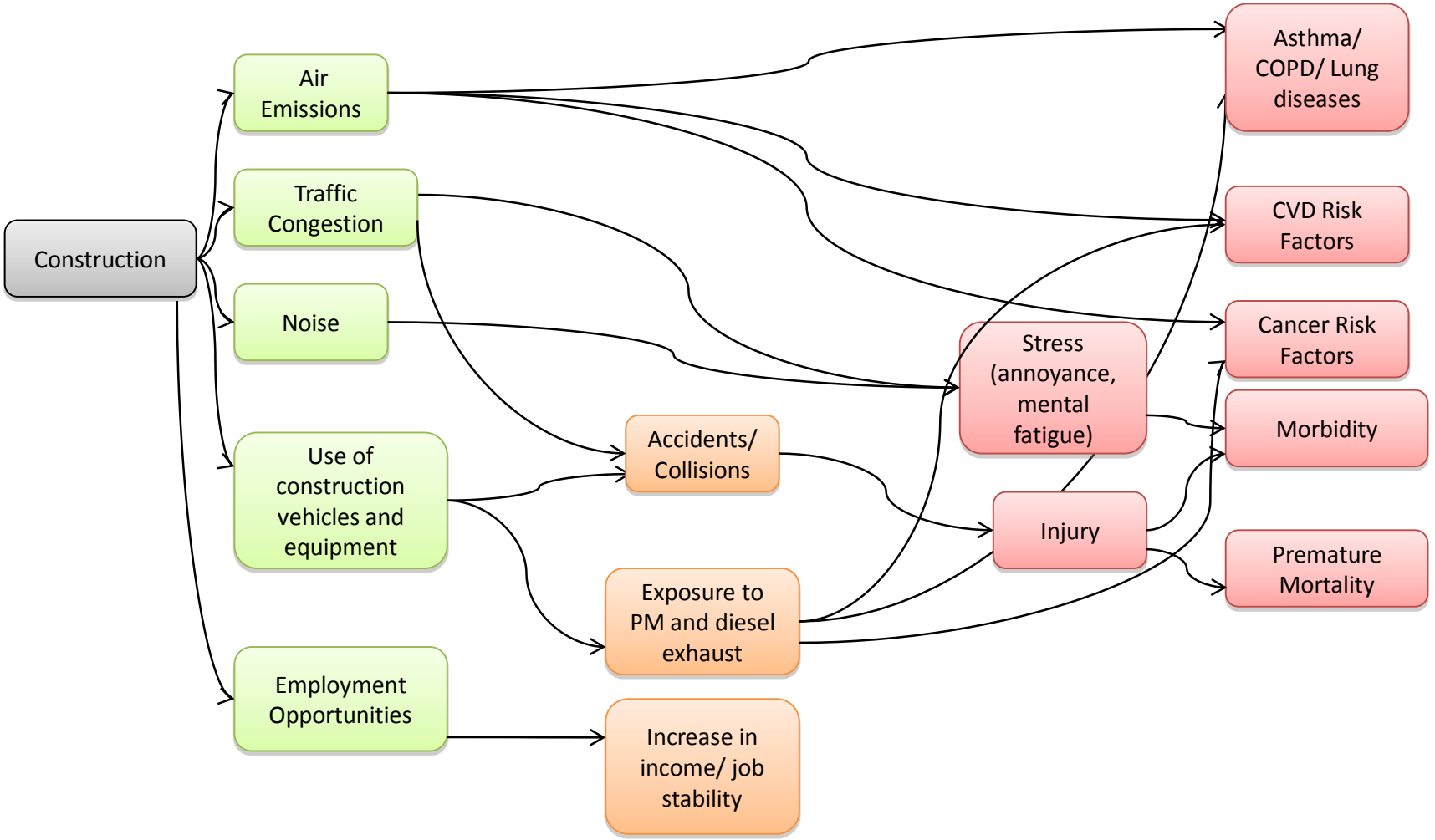


FIGURE A5. FOOTPRINT PATHWAY

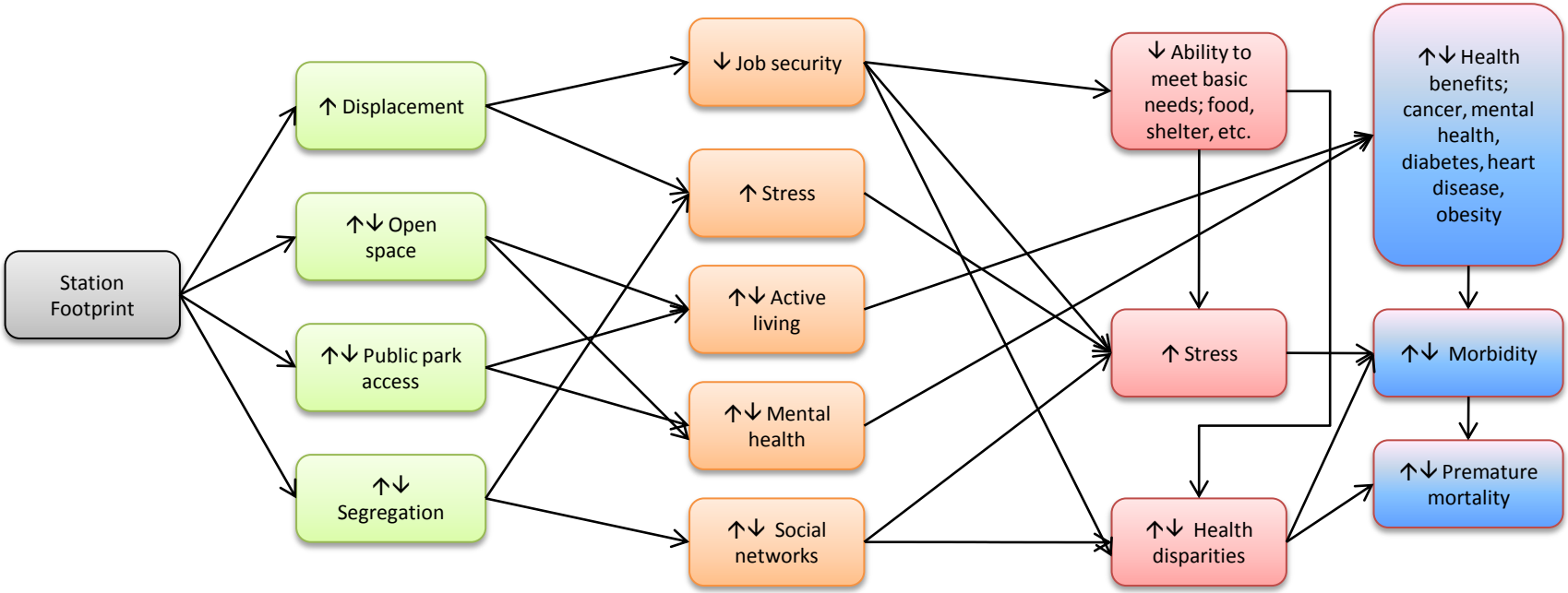
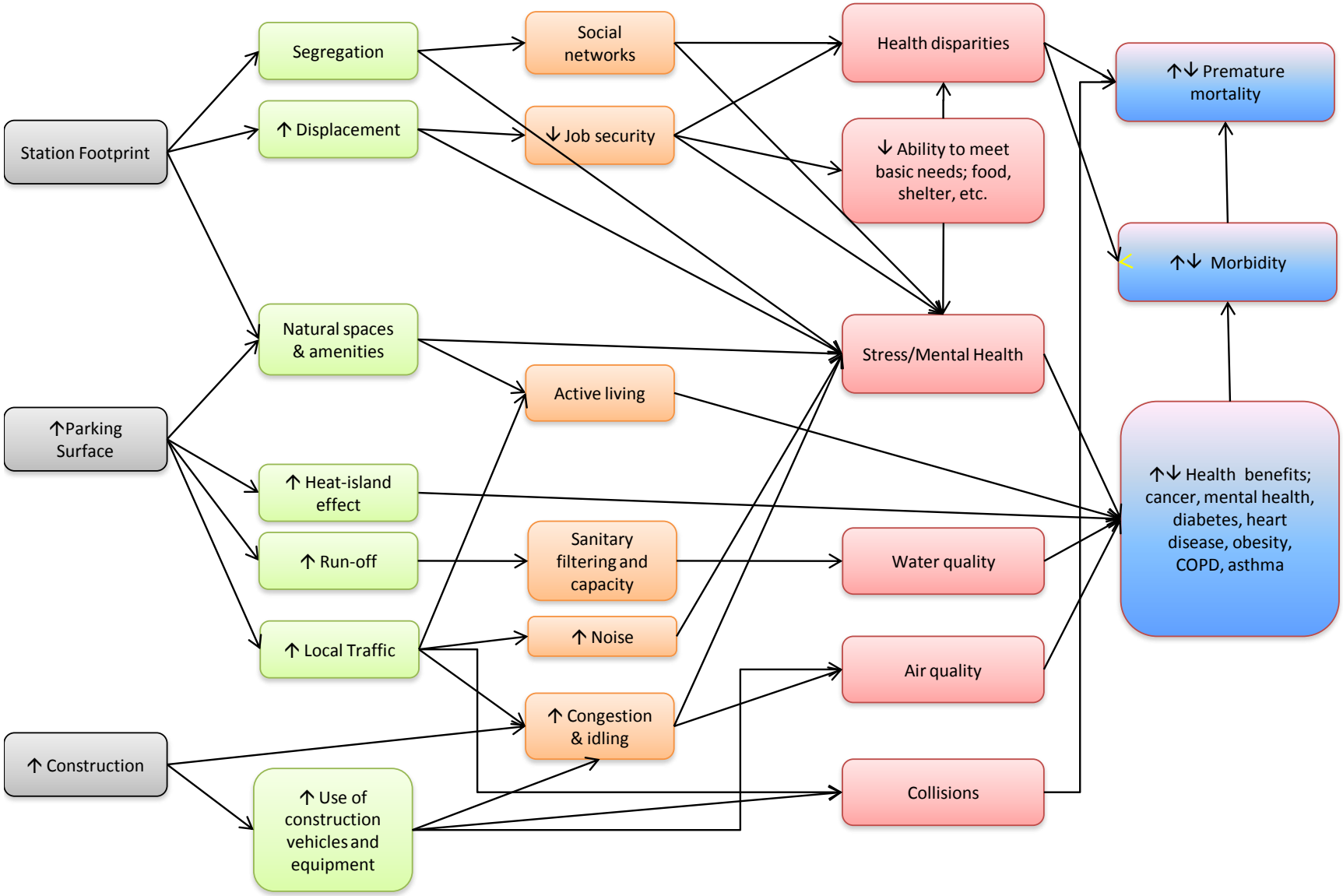


FIGURE A6. COMBINED PATHWAY



REFERENCES

CHAPTER 4. EMPLOYMENT

[1] CA HSR Regional Factsheet. http://www.cahighspeedrail.ca.gov/uploadedFiles/Routes/Project_Sections/San_Francisco_-_San_Jose(1)/SanJose-Merced_031111.pdf

[2] CA HSR Regional Factsheet. http://www.cahighspeedrail.ca.gov/uploadedFiles/Routes/Project_Sections/San_Francisco_-_San_Jose(1)/SanJose-Merced_031111.pdf

[3] California High Speed Rail Creates Jobs. Jobs Factsheet.

[4] Iversen L, Andersen O, Andersen PK, et al. Unemployment and mortality in Denmark, 1970-80. *BMJ* 1987; 295: 878-884.

[5] Linn M, Sandifer R, Stein S. Effects of unemployment on mental and physical health. *Am J Public Health* 1985; 75: 502-506.

[6] Jin RL, Shah CP, Svoboda TJ. The impact of unemployment on health: a review of the evidence. *The Journal of the Canadian Medical Association.* 1995;153:529–540.

[7] Adler, N. and K. Newman Socioeconomic Disparities In Health: Pathways And Policies *Health Affairs*, 21, no.2 (2002):60-76

[8] Adler, N. and K. Newman Socioeconomic Disparities In Health: Pathways And Policies *Health Affairs*, 21, no.2 (2002):60-76

[9] Catalano, R. and S. Serxner, "The Effect of Ambient Threats to Employment on Low Birthweight," Journal of Health and Social Behavior 33, no. 4 (1992): 363–377.

[10] Adler, N. and K. Newman Socioeconomic Disparities In Health: Pathways And Policies *Health Affairs*, 21, no.2 (2002):60-76

[11] Arber S. Integrating nonemployment into research on health inequalities. *Int J Health Serv* 1996; 26: 445-481.

[12] California Department of Industrial Relations. <http://www.dir.ca.gov/dlsr/Injuries/2009/Menu.htm>

[13] D.I. Gregorio, S.J. Walsh, and D. Paturzo, "The Effects of Occupation-Based Social Position on Mortality in a Large American Cohort," American Journal of Public Health 87, no. 9 (1997): 1472–1475.

22. Marmot, M., et al.,"Contribution of Job Control and Other Risk Factors to Social Variations in Coronary Heart Disease Incidence," Lancet 350, no. 9073 (1997): 235–239.

[14] Arber S. Integrating nonemployment into research on health inequalities. *Int J Health Serv* 1996; 26: 445-481.

[15] California Employment Development Department. http://www.labormarketinfo.edd.ca.gov/iomatrix/IndList.asp

[16] American Community Survey. <www.census.gov>

[17] CA HSR Regional Factsheet. http://www.cahighspeedrail.ca.gov/uploadedFiles/Routes/Project_Sections/San_Francisco_-_San_Jose(1)/SanJose-Merced_031111.pdf

[18] Bureau of Labor Statistics. http://www.bls.gov/bls/unemployment.htm

[19] California Employment Development Department. http://www.labormarketinfo.edd.ca.gov/iomatrix/IndList.asp

[20] California Employment Development Department. http://www.labormarketinfo.edd.ca.gov/iomatrix/IndList.asp

[21] Bureau of Labor Statistics. http://www.bls.gov/bls/unemployment.htm

[22] California Employment Development Department. http://www.labormarketinfo.edd.ca.gov/

[23] California Employment Development Department. http://www.labormarketinfo.edd.ca.gov/

[24] California Department of Industrial Relations. <http://www.dir.ca.gov/dlsr/Injuries/2009/Menu.htm>

[25] California High Speed Rail Creates Jobs. Jobs Factsheet.

[26] HSR Business Plan. December 2009.

CHAPTER 5. TRANSPORTATION MODE

[1] California High-Speed Rail Authority. 2008. California High-Speed Trains for the Central Valley, Factsheet. http://www.cahighspeedrail.ca.gov/assets/0/152/159/6fddd231-7aa4-46ad-8d80-067b12189305.pdf. Accessed 10 Mar 2011.

[2] Ewing R, Frank L, Kreutzer R. Understanding the Relationship between Public Health and the Built Environment: A Report to the LEED-ND Core Committee. 2006.

[3] Laden F, Neas LM, Dockery DW, Schwartz J. Association of fine particulate matter from different sources with daily mortality in six US cities. *Environ Health Perspect.* 2000;108:941–947

[4] American Thoracic Society, Committee of the Environmental and Occupational Health Assembly. Health effects of outdoor air pollution. Part 1. *Am J Respir Crit Care Med.* 1996;153:3–50

[5] American Thoracic Society, Committee of the Environmental and Occupational Health Assembly. Health effects of outdoor air pollution. Part 2. *Am J Respir Crit Care Med.* 1996;153:477–498

[6] McConnell R, Berhane K, Gilliland F, et al. Asthma in exercising children exposed to ozone: a cohort study. *Lancet.* 2002;359:386–391

[7] Bobak M. Outdoor air pollution, low birth weight, and prematurity. *Environ Health Perspect.* 2000;108:173–176

[8] Woodruff TJ, Grillo J, Schoendorf KC. The relationship between selected causes of postneonatal infant mortality and particulate air pollution in the United States. *Environ Health Perspect.* 1997;105:608–612

[9] Dockery DW. Epidemiologic evidence of cardiovascular effects of particulate air pollution. *Environ Health Perspect.* 2001;109(suppl 4): 483–486

[10] Pope, C., R. Burnett, M. Thun, E. Calle, D. Krewski, K. Ito, and G. Thurston. 2000. Lung cancer, cardiopulmonary mortality, and long-term exposure to fine particulate air pollution. *Journal of the American Medical Association* 287: 1132-41.

[11] Hoek, Gerard, Bert Brunekreef, Sandra Goldbohm, Paul Fischer, and Piet A. van den Brandt. 2002. Association between mortality and indicators of traffic-related air pollution in the Netherlands: A cohort study. Lancet 360: 1203-9.

[12] Miedema HME, Vos H. 1998. Exposure response for transportation. Journal of the Acoustical Society of America. 104:3432-3445

[13] See references in Seto, EYW, Holt A, Rivard T, Bhatia R. 2007. Spatial distribution of traffic induced noise exposures in a US city: an analytic tool for assessing the health impacts of urban planning decisions. International Journal of Health Geographics. 6:24.

[14] Holzman D, 1997 Plane Pollution. Environ Health Perspect 105(12).

[15] Ewing R, Schieber RA, Zegeer CV. Urban sprawl as a risk factor in motor vehicle occupant and pedestrian fatalities. Am J Public Health. 2003;93(9):1541-5.

[16] Wier M, Weintraub J, Humphreys EH, Seto E, Bhatia R. An area-level model of vehicle-pedestrian injury collisions with implications for land use and transportation planning. Accid Anal Prev 2009; 41:137–145.

[17] Frank L, Andersen, M, Schmid, T. 2004. Obesity relationships with community design, physical activity, and time spent in cars. American Journal of Preventative Medicine. 27;87-96.

[18] Victoria Transport Policy Institute. 2010. Evaluating Public Transportation Health Benefits. Prepared for the American Public Transportation Association.

[19] Wachs, M., & Taylor, B. D. 1998. Can transportation strategies help meet the welfare challenge?

Journal of the American Planning Association 64(1), 15–19.

[20] Bouchard C, Shephard RJ, Stevens T, eds. Physical activity, fitness, and health: international proceedings and consensus statement. In: Proceedings of the 1992 International Conference on Physical Activity, Fitness, and Health. Champaign, IL: Human Kinetics Publisher, 1994.

[21] PolicyLink. 2002. Regional Development and Physical Activity: Issues and Strategies for Promoting Health Equity. http://www.policylink.org/site/apps/nlnet/content2.aspx?c=lkIXLbMNJrE&b=5136581&ct=6999767. Accessed 2 May 2011.

[22] Wener, R. E., Evans, G. W., & Boately, P. 2005. Commuting stress: Psychophysiological effects on the trip and spillover into the workplace. *Transportation Research Record, 1924*, 112-117.

[23] Pucher, J. Jennifer Dill, and Susan Handy, 2010."Infrastructure, programs, and policies to increase bicycling: An international review," *Preventive Medicine* 50, no. 1: S106-S125.

[24] Jacobsen, 2003 P. Jacobsen, Safety in numbers: more walkers and bicyclists, safer walking and bicycling, Inj. Prev. 9: 205–209.

[25] San Francisco Department of Public Health. The Healthy Development Measurement Tool. http://www.thehdmt.org/. Accessed 4 Mar 2011.

[26] Lee R, Cevero R. 2007. The Effect of Housing Near Transit Stations on Vehicle Trip Rates and Transit Trip Generation: A Summary Review of Available Evidence. California Department of Housing and Community Development and the California Department of Transportation. http://www.reconnectingamerica.org/assets/Uploads/hcd_tod_resource_paper_2008_09_20.pdf. Accessed 25 Apr 2011.

[27] Daniel A. Rodriguez and Joonwon Joo. 2004. "The relationship between non-motorized mode choice and the local physical environment," *Transportation Research Part D: Transport and Environment* 9, no. 2: 151-173.

[28] CalTrans. 2008 State Highway Congestion Monitoring Program. 2009. http://www.dot.ca.gov/hq/traffops/sysmgtpl/HICOMP/pdfs/2008HICOMP.pdf. Accessed 15 Apr 2011.

[29]Holtzclaw, J. et al, "Location Efficiency: Neighborhood and Socio Economic Characteristics Determine Auto Ownership and Use – Studies in Chicago, Los Angeles and San Francisco"*, Transportation Planning and Technology*, Vol. 25, 2002, page 1-27.

[30] Kitamura et al., 1997 R. Kitamura, P.L. Mokhtarian and L. Laidet, 1997 A micro-analysis of land use and travel in five neighborhoods in the San Francisco Bay Area, *Transportation* **24** : 125–158.

[31] Pucher, J., Jennifer Dill, and Susan Handy, 2010. "Infrastructure, programs, and policies to increase bicycling: An international review," *Preventive Medicine* 50, no. 1: S106-S125.

[32] HealthyCity.org, data from Nielsen Claritas, Inc. 2010. Means of Transportation to Work. Accessed 15 Apr 2011.

[33] United States Environmental Protection Agency. 2008. National Emissions Inventory. http://www.epa.gov/ttn/chief/net/2008inventory.html. Accessed 3 May 2011.

[34] Criteria pollutants included in these measures include CO, PM 2.5, PM 10, SO2, NO2. Omitted criteria pollutants include VOC, ozone, and lead because they are measured in units other than tons and would not be comparable to include in the percent calculations.

[35] California Environmental Health Investigations Branch. 2004. http://www.ehib.org/page.jsp?page_key=130&year=2006&pmn=PERPOPNBR. Accessed 2 May 2011.

[36] Cambridge Systematics. Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study: Ridership and Revenue Forecasts. 2007. Page 2-4.

[37] Id.

[38] Id.

[39] Cambridge Systematics. Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study: Ridership and Revenue Forecasts. 2007. Page 2-5.

[40] City of Gilroy. A Review of The California High Speed Train Preliminary Alternatives. Analysis Report San Jose to Merced Section High-Speed Train EIR/EIS. August 2010. Page 9.

[41] Metropolitan Transportation Commission. 2008. Travel Forecasts Data Summary. Tables D4.

[42] HSRA. 2005. Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study.

[43] Metropolitan Transportation Commission. 2008. Travel Forecasts Data Summary. Page 78.

[44] City of Gilroy. A Review of The California High Speed Train Preliminary Alternatives

Analysis Report San Jose to Merced Section High-Speed Train EIR/EIS. August 2010. Page 10.

[45] Google Maps. www.maps.google.com. Accessed 1 May 2011.

[46] HealthyCity.org, data from Nielsen Claritas, Inc. 2010. Travel Time to Work. Accessed 15 Apr 2011.

[47] HSRA. Ridership and Revenue Forcasts. Pages 8-9.

[48] H&T Affordability Index. http://www.htaindex.org/mapping_tool.php#region=Merced%2C%20CA&theme_menu=1&layer1=24&layer2=28. Accessed 3 May 2011.

[49] Id.

[50] HealthyCity.org, data from Nielsen Claritas, Inc. 2010. Vehicles Available. Accessed 15 Apr 2011.

[51] Scottish Executive Social Research. 2003. Barriers to Modal Shift. Transport Research Planning Group. http://www.scotland.gov.uk/Publications/2003/09/18178/26361. Accessed

[52] Lachapelle, Ugo and Frank D. Lawrence. 2009. Transit and Health: Mode of Transport, Employer-Sponsored Public Transit Pass Programs, and Physical Activity. Journal of Public Health Policy. 30:S73-S94

[53] Transportation and Land Use Coaltion. 2004. "It Takes a Transit Village: How Better Planning Can Save the Bay Area Billions of Dollars and Ease the Housing Shortage." http://transformca.org/resource/it-takes-transit-village. Accessed 2 May 2011.

[54] Sánchez, Thomas W., Stolz, Rich, and Ma, Jacinta S. (2003). Moving to Equity: Addressing Inequitable Effects of Transportation Policies on Minorities. Cambridge, MA: The Civil Rights Project at Harvard University. http://civilrightsproject.ucla.edu/research/metro-and-regional-inequalities/transportation/moving-to-equity-addressing-inequitable-effects-of-transportation-policies-on-minorities/sanchez-moving-to-equity-transportation-policies.pdf. Accessed 10 Feb 2011.

CHAPTER 6. PARKING

1. Frazer L. Paving paradise: the peril of impervious surfaces. *Environmental Health Perspectives.* 2005;113(7):A456.

2. French J, Ing R, Von Allmen S, Wood R. Mortality from flash floods: a review of national weather service reports, 1969-81. *Public Health Reports.* 1983;98(6):584.

3. Jonkman S, Vrijling J. Loss of life due to floods. *Journal of flood risk management.* 2008;1(1):43-56.

4. Gaffield SJ, Goo RL, Richards LA, Jackson RJ. Public health effects of inadequately managed stormwater runoff. *American Journal of Public Health.* 2003;93(9):1527.

5. Mahler BJ, Van Metre PC, Bashara TJ, Wilson JT, Johns DA. Parking lot sealcoat: An unrecognized source of urban polycyclic aromatic hydrocarbons. *Environmental science & technology.* 2005;39(15):5560-5566.

6. Laflamme L, Diderichsen F. Social differences in traffic injury risks in childhood and youth—a literature review and a research agenda. *Injury Prevention.* 2000;6(4):293.

7. LaScala EA, Gruenewald PJ, Johnson FW. An ecological study of the locations of schools and child pedestrian injury collisions. *Accident Analysis & Prevention.* 2004;36(4):569-576.

8. Cottrill CD, Thakuriah P. Evaluating pedestrian crashes in areas with high low-income or minority populations. *Accident Analysis & Prevention.* 2010;42(6):1718-1728.

9. Brugge D, Lai Z, Hill C, Rand W. Traffic injury data, policy, and public health: lessons from Boston Chinatown. *Journal of Urban Health.* 2002;79(1):87-103.

10. LaScala EA, Gerber D, Gruenewald PJ. Demographic and environmental correlates of pedestrian injury collisions: a spatial analysis. *Accident Analysis & Prevention.* 2000;32(5):651-658.

11. Peek-Asa C, Zwerling C. Role of environmental interventions in injury control and prevention. *Epidemiologic reviews.* 2003;25(1):77.

12. Retting RA, Ferguson SA, McCartt AT. A review of evidence-based traffic engineering measures designed to reduce pedestrian–motor vehicle crashes. *American Journal of Public Health.* 2003;93(9):1456.

13. U.S. Environmental Protection Agency. *Parking Spaces / Community Places: Finding the Balance through Smart Growth Solutions.* Washington, DC: Development, Community, and Environment Division, U.S. Environmental Protection Agency;January 2006.

14. Kovats RS, Hajat S. Heat stress and public health: a critical review. *Annu. Rev. Public Health.* 2008;29:41-55.

15. McGeehin MA, Mirabelli M. The potential impacts of climate variability and change on temperature-related morbidity and mortality in the United States. *Environmental Health Perspectives.* 2001;109(Suppl 2):185.

16. Patz JA, Campbell-Lendrum D, Holloway T, Foley JA. Impact of regional climate change on human health. *Nature.* 2005;438(7066):310-317.

17. Naderan A, Shahi J. Aggregate crash prediction models: Introducing crash generation concept. *Accident Analysis & Prevention.* 2010;42(1):339-346.

18. Naderan A, Shahi J. Crash Generation Models. *Transportation Research Record: Journal of the Transportation Research Board.* 2010;2148(-1):101-106.

19. Pulugurtha SS, Sambhara VR. Pedestrian crash estimation models for signalized intersections. *Accident Analysis & Prevention.* 2011;43(1):439-446.

20. Wier M, Weintraub J, Humphreys EH, Seto E, Bhatia R. An area-level model of vehicle-pedestrian injury collisions with implications for land use and transportation planning. *Accident Analysis & Prevention.* 2009;41(1):137-145.

21. Elvik R. The non-linearity of risk and the promotion of environmentally sustainable transport. *Accident Analysis & Prevention.* 2009;41(4):849-855.

22. Bhatia R, Wier M. "Safety in Numbers" re-examined: Can we make valid or practical inferences from available evidence? *Accident Analysis & Prevention.* 2011;43(1):235-240.

CHAPTER 7. FOOTPRINT

[1] CA High-Speed Rail Authority. (2011). *CA High-Speed Train Project. Environmental Impact Report: Environmental Impact Statement. San Jose to Merced Supplemental Alternatives Analysis Report.*

[2] City of Gilroy. (2010). *A Resolution of the City Council of the City of Gilroy Voicing "No Confidence" in the Planning, Design and Management of the California High Speed Rail Project. City Council Regular Meeting: Resolution No. 2010-56.*

[3] CA High-Speed Train Project. (2010). *San Jose to Merced Alternatives Analysis, Gilroy City Council Study Session; Project Briefing.*

[4] The Center for Global Metropolitan Studies, University of California Berkeley. (2008). *Transit Oriented Development for High Speed Rail (HSR) in the Central Valley, California: Design Concepts for Stockton and Merced.*

[5] UC Berkeley Health Impact Group (UCBHIG). (2009). *HOPE VI to HOPE SF, San Francisco Public Housing Redevelopment: A Health Impact Assessment.* Berkeley, CA: University of California, Berkeley.

[6] Location Inc. (2000-2009). *Crime Rates for Merced, CA*. Retrieved March 2011, from Neighborhood Scout: http://www.neighborhoodscout.com/ca/merced/crime

[7] Berkman, L., & Glass, T. (2000). Social integration, social networks, social support, and health. In L. Berkman, & I. Kawachi, *Social Epidemiology* (pp. 279-313). New York: WH Freeman & Company.

[8] Berkman, L., & Kawachi, I. (2000). A Historical Framework for Social Epidemiology. In *Social Epidemiology* (p. Ch1). New York, NY: Oxford University Press.

[9] WHO. (2004).

[10] Kreuter, M., & Lezin, N. (2002). Social capital theory: Implications for community-based health promotion. In R. DiClemente, R. Crosby, & M. Kegler, *Emerging Theories in Health Promotion Practice and Research.* San Francisco, CA: Jossey-Bass.

[11] Cohen, S., Underwood, L., & Gottlieb, B. (2000). *Social Support Measurement and Intervention.* New York: Oxford University Press.

[12] The City of Gilroy, CA. (2010). *A Review of the California High Speed Train Preliminary Alternatives Analysis Report: San Jose to Merced Section HIgh-Speed Train EIR/EIS.* Hatch Mott MacDonald.

[13] CA High-Speed Rail Authority. (n.d.). *Gilroy Station Fact Sheet.*

[14] Guzman, C., Bhatia, R., & Durazo, C. (2005). *Anticipated Effects of Residential Displacement on Health: Results from Qualitative Research.* San Francisco Department of Public Health.

[15] Corburn, J., & Bhatia, R. (2007). Health Impact Assessment in San Francisco: Incorporating the Social Determinants of Health into Environmental Planning. *Journal of Environmental Planning and Management* , 50(3):323-341.

[16] Fertig, A., & Reingold, D. (2007). Public housing, health and health behaviors: Is there a connection? *J Policy Anal Manage* , 26(4):831-59.

[17] Great Communities Collaborative. (2007). *Preventing Displacement Policy Fact Sheet.* San Francisco Bay Area, CA.

[18] CA High-Speed Rail Authority. (2009). *Your Property, Your High-Speed Rail Project.* Sacramento, CA.

[19] Dong, M., & Anda et al, R. (2005). Childhood Residential Mobility and Multiple Health Risks During Adolescence and Adulthood. *Arch Pediatr Adolesc Med* , 159:1104-10.

[20] Hill District Consensus Group. (2009). *Strategies to Prevent Displacement of Residents and Businesses in the Hill District (draft v4).* Pittsburgh: HDCG.

[21] Koebel, C. (1996). *Urban Redevelopment, Displacement, and the Future of the American City.* The Federal Reserve Bank of Richmond.

[22] Right to the City. (2010). *We Call These Projects Home, Solving the Housing Crisis from the Ground Up.* Accessed from: http://www.wehavenoart.net/public/righttocitycolor4-10-10.pdf.

[23] Syme, S. (1998). Social & Economic Disparities in health: Thoughts about intervention. *The Milbank Quarterly* , 76.

[24] North, F., Syme, S., & Feeney et al, S. (1996). Psychosocial work environment and sickness absence among British civil servants: the Whitehall II study. *Am J Public Health* , 86(3)332-40.

[25] Geronimus, A., Colen, C., & Shochet et al, T. (2006). Urban-rural differences in excess mortality among high-poverty populations: evidence from the Harlem Household Survey and the Pitt County, North Carolina Study of African American Health. *J Health Care Poor Underserved* , 17(3):532-58.

[26] Murray, C., Kulkami, S., & Michaud et al, C. (2006). Eight Americas: Investingating mortality disparities across races, counties, and race-counties in the United States. *PLoS Med* , 3(9):e260.

[27] ACPHD. (2008). *Life and Death of Unnatural Causes. Health and Social Inequity in Alameda County.* http://www.acphd.org/healthequity/index.htm: Alameda County Public Health Department.

[28] Kleit, R., & Manzo, L. (2006). To Move or Not to Move: Relationships to Place and Relocation Choices in HOPE VI. *Housing Policy Debate* , 17(2):271-308.

[29] Bradbury, A., Tomlinson, P., & Milington, A. (2007). *Understanding the Evolution of community Severance and its Consequences on Mobility and Social Cohesion Over the Past Century.* United Kingdom: Association for European Transport.

[30] Greenwood et al, D. (1999). Coronary Heart Disease: A Review of the Role of Psychosocial Stress and Social Support. *Journal of Public Health Medicine* , 18:2.

[31] Williams, D., & Mohammed, S. (2009). Discrimination and Racial Disparities in Health: Evidence and Needed Research. *J Behav Med* , 32(1):20.

[32] Kelo V. City of New London, 125 S. Ct. 2655 (The Connecticut Supreme Court, USA 2005).

[33] Rutkow, E. (2006). *Kelo V. City of New London.* Harvard Law School.

[34] Environmental Systems Research Institute. (2011, February 15). Community Demographics Data. ArcGIS Business Analyst Extension. ESRI.

[35] City of Gilroy. (2002). *General Plan. Final Environmental Impact Report.*

[36] American Community Survey. (2008 estimates). *Poverty, and Renter vs. Owner Occupied Housing Units*. Retrieved April 15, 2011, from HealthyCity.org: http://www.healthycity.org/c/map

[37] City of Gilroy. (2008). *Crime Reports*. Retrieved April 13, 2011, from http://www.cityofgilroy.org/cityofgilroy/online_services/crime_reports/default.aspx

[38] Champions for Change. (2008). *Communities of Excellence in Nutrition, Physical Activity and Obesity Prevention; East Gilroy Neighborhood.* Santa Clara County Public Health Department.

[39] Nielsen Claritas. (2010). *Five year estimates 2005-2009*. Retrieved February 2011, from http://www.Healthycity.org

[40] Boys & Girls Club of Merced County. (2010). *Fall Newsletter.* V.2 Issue 2.

[41] CA High-Speed Rail Authority. (2010). *Preliminary Alternatives Analysis Report. San Jose to Merced Section High-Speed Train EIR/EIS.*

[42] Duncan, M. (2011). The Impact of Transit-Oriented Development on Housing Prices in San Diego, CA. *Urban Studies* , 48(1):101-27.

[43] Debrezion, G., Pels, E., & Rietveld, P. (2007). The Impact of Railway Stations on Residential and Commercial Property Value: A Meta-analysis. *J Real Estate Finan Econ* , 35:161-80.

[44] Hess, D., & Almeida, T. (2007). Impact of Proximity to Light Rail Rapid Transit on Station-Area Property Values in Buffalo, New York. *Urban Studies* , 44(5/6):1041-68.

[45] National Multi Housing Council. (2011). *California Rent Control Laws*. Retrieved May 2011, from Apartments: Smart Communities, Smarter Living: http://www.nmhc.org/Content/ServeContent.cfm?ContentItemID=3763

[46] Dluhy, M., Revell, K., & Wong, S. (2002). Creating a Positive Future for a Minority Community: Transportation and Urban Renewal Politics in Miami. *Journal of Urban Affairs* , 24(1):75-95.

[47] Perkins, D., Florin, P., & Rich et al, R. (1990). Participation and the Social and Physical Environment of Residential Blocks: Crime and Community Context. *American Journal of Community Psychology* , 18(1):83-115.

[48] Kramer, M., & Hogue, C. (2009). Is Segregation Bad for Your Health? *Epidemiologic Reviews* , 31:178-94.

[49] Smith, C. (2009). Economic Deprivation and Racial Segregation: Comparing superfund sites in Portland, Oregon, and Detroit, Michigan. *Social Science Research* , 38(3):681-92.