

# Health Impact Assessment

## King Street Station Multimodal Hub



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Graduate Class  
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# Executive Summary

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This rapid health impact assessment (HIA), produced by a team of University of Washington graduate students, identifies potential health concerns and action items as the Seattle Department of Transportation (SDOT) launches a multiyear effort designed to improve infrastructure in the area surrounding King Street Station in the Pioneer Square and Chinatown-International District neighborhoods.

HIA is an emerging method for considering how policies, plans and projects may affect human health both for better or worse. The overall goal is to present practical recommendations that lead to health-supportive actions by decision makers. HIAs have no standardized formula or requirements and are almost always voluntary. The practice is relatively new in the United States but rapidly gaining in popularity.

## About the King Street Station Multimodal Hub area

The King Street Station Multimodal Hub (KSSMH), just south of downtown Seattle, takes its name from the array of transportation options that serve the site, including intercity trains, local and regional bus service, light rail, and, in the future, a streetcar. The KSSMH area also encounters heavy use by pedestrians, cyclists, general vehicle traffic, and freight. However, the dispersed nature of these various transportation options makes the area challenging to navigate.

This HIA's quarter-mile study area straddles two distinct but similarly historic neighborhoods: Pioneer Square and Chinatown/International District. Both neighborhoods feature clusters of restaurants, cafes, food markets, shops, galleries, and cultural activities, as well as social services organizations, housing, and major employers. The neighborhood's residents are more racially diverse, generally older, and less affluent than Seattle as a whole, according to the 2000 U.S. Census. In addition, the area serves thousands of commuters and visitors not captured by the census data.

Through meetings with relevant stakeholders, SDOT developed nine consensus goals for the KSSMH project. This HIA focused primarily on two of those goals: (1) build a lid over the openings at street level above railroad tracks and (2) Restoring the street grid pattern of the area by closing the 2nd Avenue Extension.

## Scope of HIA

The UW class, in conjunction with SDOT, identified five health areas of focus, each of which composes a chapter in this HIA:

1. Health equity
2. Safety and injury
3. Air and noise pollution
4. Social capital and mental health
5. Physical activity and obesity

## Overall Recommendations and Conclusion

Although each chapter presents its own recommendations, several major themes cut across the five topic areas. SDOT should prioritize the following actions:

- 1.) During any phase of construction pursue air quality and noise level monitoring and mitigation. Also, close bus stops only when absolutely necessary and pursue realistic alternatives for those travelers with physical disabilities.
- 2.) Pursue the proposed lidding of railroads along 4th Avenue South. and the closure of the 2nd Avenue Extension South to reclaim space for pedestrians. Consider installing green space and/or programmed gathering areas. Address air quality/filtering considerations.
- 3.) Transform the 2nd Avenue Extension reroute into green, public space and program the space to reduce the risk of inappropriate use.
- 4.) Improve the pedestrian and bicyclist experience through clearly marking bicycle and pedestrian infrastructure, ensuring appropriate street lighting, considering traffic calming measures, and other steps identified in the full HIA.
- 5.) Implement human-scale, iconic design features, such as distinctive paving or bricking to unite disparate transit stations and installation of canopies, benches, wayfinding tools, and other amenities.
- 6.) Attempt to not only meet but transcend established standards and policies, such as the Americans with Disabilities Act, Seattle Bicycle Master Plan, Seattle Pedestrian Master Plan, and Liveable South Downtown Plan.
- 7.) Establish methods for monitoring progress toward recommendations as projects move forward.

# Introduction

This rapid health impact assessment (HIA) identifies potential health concerns and action items as the Seattle Department of Transportation (SDOT) launches a multiyear effort designed to improve infrastructure in the area surrounding King Street Station in the Pioneer Square and Chinatown-International District neighborhoods.

The report represents the final product of a spring 2011 graduate course offered jointly by the University of Washington's Department of Urban Design and Planning and Department of Environmental and Occupational Health Sciences. The 24 student authors represent several fields of study, including public health, public policy, urban planning and design, engineering, nursing and social work. SDOT staff leading the projects provided close consultation during all steps of the HIA process.

HIA is an emerging method for considering how policies, plans and projects may affect human health both for better or worse. The overall goal is to present practical recommendations that lead to health-supportive actions by decision makers. HIAs have no standardized formula or requirements and are almost always voluntary. The practice is relatively new in the United States but rapidly gaining in popularity. Locally, Public Health-Seattle & King County conducted a state-mandated HIA for the State Road 520 Bridge replacement project in 2007-2008. In the case of this report, the HIA is voluntary and "rapid," meaning we undertook the research in a short time period.

## **Characteristics of King Street Station Multimodal Hub area**

The subject of this study, which SDOT calls the King Street Station Multimodal Hub (KSSMH), takes its name from the wide array of transportation options that serve the site. Historic King Street Station provides Amtrak train, intra-city bus, and Sounder commuter rail options. Across 4th Avenue South, the International District Station offers Link light rail and local bus service underground, while other major bus stops operate at street level. The area will also be the site of the future First Hill Streetcar. In addition to mass transit, the KSSMH area serves as a nexus for pedestrians, cyclists, general vehicle traffic, and freight. However, the dispersed nature of these

various transportation options makes the area challenging to navigate for area residents, visitors, and commuters, particularly those on foot.

This HIA focuses on a quarter-mile study area, designated by SDOT that covers a six to eight block radius around King Street Station. The KSSMH area straddles two distinct but similarly historic neighborhoods: Pioneer Square and Chinatown/International District. Both neighborhoods feature clusters of restaurants, cafes, food markets, shops, galleries, and cultural activities, as well as social services organizations, housing, and major employers.

### *Demographics*

Based on 2000 U.S. Census data, the population of the Pioneer Square and Chinatown International/District neighborhoods is more racially diverse than Seattle as a whole. Residents identify as 40 percent White, 32 percent Asian, and 16 percent African American. The remaining 12 percent identify as American Indian or Alaskan Native, a member of another ethnicity, or representing two or more racial or ethnic groups.

These neighborhoods are also less affluent than Seattle as a whole. The 2000 census reported a median household income for the area of \$19,069. By contrast, the median household income for Seattle was \$45,736 for the same period. Of the approximately 2,400 households in the area, 80 percent live on incomes of less than \$35,000 a year, and 43 percent are classified as living below the poverty level. About 53 percent of residents have attained a high school education or less.

Station-area residents also tend to be slightly older than those in Seattle as a whole. The vast majority of residents (more than 90 percent) are age 18 or older.

In addition to residents, the KSSMH area draws thousands of commuters to major employers, such as Sound Transit and Vulcan, and also attracts sports fans to the two major stadiums just south of King Street Station. The KSSMH is situated in the Downtown Seattle Regional Growth Center, with more than 155,000 jobs and more than 15,000 housing units. The KSSMH also serves the First Hill/Capitol Hill Regional Growth Center, which includes nearly 38,000 jobs and another 22,000 households.

## Methods

SDOT had already completed the first established step of an HIA: *screening* to identify projects or policies for which an HIA would be useful. We carried out the next four established steps for conducting an HIA: (1) scoping to decide which health effects to consider; (2) assessing to identify possible effects and populations affected; (3) developing recommendations; and (4) reporting the results to relevant stakeholders. The final step in a typical HIA process--monitoring and evaluating the HIA's effects on the given project--remains to be completed. This will likely be the responsibility of SDOT.

The following sources were used during our analysis: peer reviewed literature, existing quantitative data for each focus area, qualitative interviews with relevant agencies, observations from on-site visits, comments from public stakeholders who attended SDOT meetings, and Google Maps. Some chapters in this report also reference existing recommendations from the City of Seattle's Pedestrian Master Plan, Bicycle Master Plan, and Livable South Downtown Plan, all of which have intimate ties to the form and functionality of the KSSMH area.

## Scope of HIA

Through meetings with relevant stakeholders, SDOT developed nine consensus goals for the KSSMH project. This HIA focused primarily on the first two of those goals: (1) build a lid over the openings at street level above railroad tracks and (2) Restoring the street grid pattern of the area by closing the 2nd Avenue Extension.

The University of Washington class, in conjunction with SDOT, identified five health areas of focus, each of which composes a chapter in this HIA:

1. Health equity
2. Safety and injury
3. Air and noise pollution
4. Social capital and mental health
5. Physical activity and obesity

# Health Equity

## Introduction and Background

In order to holistically conduct a Health Impact Assessment (HIA) of the Seattle Department of Transportation (SDOT)'s King Street Station Multimodal Hub (KSSMH), vulnerable populations and equity need to be addressed. Many vulnerable populations reside in and move through the KSSMH area. Examples include individuals who are mentally ill, homeless, and disabled. Transit decisions play a pivotal role in the ability of these groups to move through the neighborhood safely and with dignity. Designing a more walkable, accessible, and cohesive community helps ensure this. Moreover, a focus on vulnerable populations and equity enables a HIA to “maintain a broad definition of health by considering social, economic and environmental influences” (Academy Health, 2011).

## The Relationship Between Health and Equity

The health impacts of transportation projects on vulnerable populations are well documented. The following examples include some of their direct and indirect effects on health.

- 1.) Air pollution: The negative effects of air pollutants are often more pronounced among the immuno-compromised, children, and older adults. Health effects include respiratory ailments, throat irritation, heart disease, and cancer (Environmental Protection Agency, 2008).
- 2.) Mental health: Residents living in mixed-use neighborhoods (i.e., areas where residential and commercial use are combined) with connected streets and paths experience improved mental health. Negative health outcomes can be associated with the stress of living and traveling in areas with dangerous road crossings (American Public Health Association, 2008).
- 3.) Access to health care: Challenges navigating transit systems and limited access to goods and services decreases residents' access health care (Guidry, 1997; Butrick, 1999).
- 4.) Individuals with disabilities: People with physical disabilities may have difficulty navigating sidewalks in disrepair and crosswalks with short pedestrian signals.



- 5.) Injury: Low-income and homeless populations are at a higher risk for traffic injuries because they often have lower rates of car ownership and are therefore more likely to walk (APHA, 2008).
- 6.) Older adults: Largely due to safety concerns, older adults in the United States make only 8 percent of their trips by foot or bike. Because of land use, available bicycle infrastructure, and social norms, older adults in European countries make 35 percent of their trips by foot or bike. As the population ages, investment in active transportation for seniors is an important public health issue (APHA, 2008).

## Existing Conditions

### *Demographics*

Identifying vulnerable populations within the study area is difficult for several reasons. First, given the small geography of the area, suppression issues<sup>1</sup> are expected when dealing with census geographies smaller than a census block. Second, the homeless population in Pioneer Square is unlikely to be fully captured in census reports. Third, other classifications that include individuals with physical and/or mental disabilities or a history of substance abuse were unavailable for this study. Fourth, it is difficult to determine the precise make-up of populations that commute to and visit the area. Finally, while we could not find disability statistics for the KSSMH area, the U.S. Department of Health and Human Services (2011) reports 18 to 19 percent of the general population has some form of disability. Given the nature of this area as a transit hub, the dependence of people with disabilities on transit services, and the older demographics of the area, we speculate this area has higher numbers of individuals with disabilities than the city as a whole.

To determine vulnerable population estimates, we contacted several community and social services organizations in the Chinatown-International District and Pioneer Square neighborhoods. However, numbers reported by each organization varied widely, suggesting a more comprehensive review would be necessary to pinpoint exact population numbers.

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<sup>1</sup> “The Census Bureau must ensure that the identity of individuals cannot be ascertained based on the socio-demographic profiles reported in the summary files. Suppression is the non-reporting of data when the total count for the selected population within a geographic area is so small that the members of the group could possibly be identified” ([http://library.columbia.edu/indiv/dssc/eds/census\\_tech.html#sup](http://library.columbia.edu/indiv/dssc/eds/census_tech.html#sup))

### *Zoning*

In coming years, the traffic near the KSSMH area is expected to increase. This expectation stems in part from recent zoning code changes, passed in Seattle City Council Ordinance 123589 (Council Bill 117140), which allows increased building heights with a series of housing development incentives. As noted by City Council Chair Richard Conlin, the bill's goals are, "To increase housing and business development and support the livability and health of these neighborhoods... To enliven the communities with maintaining the character that makes these communities unique and attractive neighborhoods. The legislation allows additional height for new buildings if developers include workforce-priced housing and use development credits from existing, lower-scale historic buildings" (Conlin, 2011). The plan also includes requirements for developing a pedestrian-friendly environments and amenities along key streets and adjacent industrial areas.

These zoning changes imply that the density as well as the proportion of residential uses in the area will increase. Future population density increases can partially address public safety concerns noted by organizations like Feet First, who stated a need for "more eyes on the street" and commented that people in the KSSMH area "sometimes do not feel safe because there are not too many people around after work hours" (public meeting *Feet First*, January 19, 2011). However, increased volume and flow of pedestrians can also cause a confusing, difficult, or overwhelming experience for vulnerable populations.

### **Findings**

We conducted qualitative interviews with a sample of seven community agencies that serve vulnerable populations in Seattle and that have a presence in the KSSMH area. These agencies included those who serve and/or advocate for older adults, individuals with physical or mental health disabilities, and the homeless. They also included non-profit community development groups. We interviewed staff by phone, e-mail, or in-person over a two-week period. We developed an interview guide prior to conducting the interviews (see Appendix A) to assess the agencies' knowledge of the KSSMH project, the transportation needs of the vulnerable populations the agencies serve, and the impact of the project on vulnerable populations. We also

asked the agencies for their recommendations for reducing the negative consequences of the project.

### *Detours & Construction*

The agencies often expressed concern about the effect that road closures and construction would have on the transportation needs of their clients. Many organizations reported that more than 90 percent of clients use public transportation because many cannot afford cars. Given the hills and sloped geography of the neighborhood, interviewees noted that an additional two-block walk to a rerouted bus stop can be a challenge for individuals with limited mobility. One agency uses volunteer drivers, and the coordinator was concerned that detours and longer drive times would discourage volunteers from transporting clients to the First Hill area. Moreover, because of the concentration of medical clinics northeast of the station area, the ability to get to medical appointments on time could be affected. There was also a concern about the time it would take the working poor to get to their jobs. As an interviewee said, “It’s hard to hold a job when it takes three hours to cross town” (personal communication, May 13, 2011).

Potential bus rerouting during construction could decrease access to the many grocery stores in the area that sell culturally and ethnically diverse foods. One of the interviewees noted that it is not necessarily the business and property owners that will be affected by this lack of access, but employees and customers that travel to the area to work and shop.

### *Long-Term Impacts*

Many agencies supported slowing vehicle speeds, implementing a consistent wayfinding system, and increasing signal times at crosswalks. These changes would benefit the residents of the area as well as the agencies’ clients.

The agencies recommended that the needs of the homeless population, businesses, and pedestrians be considered when deciding which 2nd Avenue Extension South option to choose. Homeless people sleep along 2nd Avenue Extension South (between South Main Street and South Washington Street), which is encouraged by shelter from awnings and leaning railings at the storefront entrances and windows of Mason’s Furniture (Seattle Department of

Transportation, 2010 & 2011). While awnings and similar building features are a common design feature to accommodate window shoppers, they also provide shelter from the elements for sleeping.

Because the improved facilities of the KSSMH are likely to increase the area's popularity as a destination, the resulting increased foot, bicycle, and vehicle traffic will also impact vulnerable populations. Sidewalk crowding may occur, leading to navigation challenges for older adults, individuals with disabilities, and children. In addition, KSSMH users often have conflicting reasons for traveling, with important implications for vulnerable populations. For example, large groups of quick-paced, non-local pedestrians heading to the sports arenas or to work may cause difficulties for an older adult pushing a shopping cart. One interviewee suggested that even though many residents depend on the local transit options, the KSSMH improvements will benefit non-residents of the area, who take advantage of the regional transit options, much more than residents living in the area (personal communication, May 25, 2011).

## **Recommendations**

A number of design and environmental standards required by local and federal agencies already impact development of the KSSMH area. The Americans with Disabilities Act (ADA) provides universal requirements for a subset of vulnerable populations. Its required design standards, such as ramps, longer light signals, proper signage, and sidewalk widths, are designed to accommodate individuals with disabilities. However, there are other important ways that the KSSMH project can increase health equity, as detailed below.

### *Construction Phase*

- 1.) Maintain or increase wayfinding during the construction phase and consider multiple languages.
- 2.) Keep bus stops in the same place as much as possible. Offer realistic alternatives for people with limited mobility when bus stops are closed (e.g., do not reroute a bus stop two blocks up a hill from the original location).
- 3.) Ensure dissemination of information regarding construction and traffic or bus rerouting by maintaining direct communication with area service providers and

posting fliers written in several languages at transit stops, health clinics, and service agencies.

#### *Railroad Lid*

- 4.) Use part of the railroad lid as a public greenway.

#### *2nd Avenue Ext. S. Closure*

- 5.) Provide mid-block crossings to facilitate pedestrian experience if the street is open to bike, bus, and emergency vehicle traffic.

#### *Long-term*

- 6.) Go beyond complying with ADA and bring agencies that work with individuals with disabilities to stakeholder meetings.
- 7.) Work with other city agencies to develop mitigation plans.
- 8.) For long-term monitoring and evaluation, use surveys or focus groups with service providers and community stakeholders.

## **Discussion**

Access to transportation is an important determinant of health. Identifying potential inequities and developing plans to reduce the health burdens of vulnerable populations will likely increase the overall health of the community. The KSSMH project will have an impact on the health of area residents and commuters alike – both of which include various vulnerable populations. Following the above recommendations will help make the KSSMH project and the city of Seattle a more equitable and healthy place to live, work and play.

## **References**

- Academy Health. (2011). *Insights of health impact assessments*. Retrieved May 15, 2011, from <http://www.academyhealth.org/files/publications/ResInsightsHealthImpactAssessment.pdf>
- American Public Health Association. (2008). *At the intersection of public health and transportation: promoting healthy transportation policy*. Retrieved May 15, 2011, from <http://www.apha.org/NR/rdonlyres/43F10382-FB68-4112-8C75-49DCB10F8ECF/0/TransportationBrief.pdf>
- American Public Health Association. (2008). *Reducing the burden of poor health and health inequities through transportation and land-use policies*. Retrieved May 24, 2011, from <http://www.apha.org/advocacy/policy/policysearch/default.htm?id=1378>

- Butrick E. (1999). *Factors in nonattendance in extended evening clinics in Contra Costa County*. Contra Costa Health Services (Unpublished).
- Child Health Impact Working Group. (2007). *Unhealthy consequences: energy costs and child health*. Retrieved May 15, 2011, from <http://www.hiaguide.org/sites/default/files/ChildHIAofenergycostsandchildhealth.pdf>
- Convergence Partnership. (2011). *The transportation prescription*. Retrieved May 22, 2011, from <http://www.convergencepartnership.org/atf/cf/%7B245a9b44-6ded-4abd-a392-ae583809e350%7D/TRANSPORTATIONRX.PDF>, p. 16
- Deehr, R. & Shumann, A. (2009). Active Seattle: Achieving Walkability in Diverse Neighborhoods, *American Journal of Preventive Medicine*, Volume 37, Issue 6, Supplement 2, December, Pages S403-S411, ISSN 0749-3797, DOI: 10.1016/j.amepre.2009.09.026. <http://www.sciencedirect.com/science/article/B6VHT-4XST2FF-J/2/e2b5c305652a60f7c57767967e788677>
- Guidry J., et al. (1997). Transportation as a barrier to cancer treatment. *Cancer Practice* 5(6).
- Health and Human Services. (2011). *Prevalence and impact*. Retrieved May 15, 2011, from [http://www.hhs.gov/od/about/fact\\_sheets/prevalenceandimpact.html#ij](http://www.hhs.gov/od/about/fact_sheets/prevalenceandimpact.html#ij)
- Humboldt County Public Health Branch, Humboldt Partnership for Active Living & Human Impact Partners. (2008). *Humboldt County general plan update health impact assessment*. Retrieved May 15, 2011, from <http://www.humanimact.org/component/jdownloads/finish/4/58>
- Seattle Department of Transportation. (2010, November 17; December 1). Public meeting notes: King street station HUB project.Center City Public Realm IDT (November) and Historic Preservation (Rebecca Frestedt and Genna Nashem).
- Seattle Department of Planning and Development. *Ordinance map exhibit a: rezones west of interstate 5*. Retrieved May 24, 2011, from [http://www.seattle.gov/dpd/Planning/South\\_Downtown/Overview/default.asp](http://www.seattle.gov/dpd/Planning/South_Downtown/Overview/default.asp)
- Seattle Government homepage: Richard Conlin. (2011). *Legislativepalooza: sodo zoning*. Retrieved May 15, 2011, from <http://conlin.seattle.gov/2011/04/28/legislativepalooza-april-25-sodo-zoning-%E2%80%93-wage-theft-%E2%80%93-chihuly/>
- Transportation Research Board. (2005.) *Integrating sustainability into the transportation planning process*. Retrieved May 22, 2011, from <http://books.google.com/books>
- UC Berkeley Health Impact Group. (2006). *Public Review Draft*. Retrieved May 15, 2011, from <http://ehs.sph.berkeley.edu/hia/OaktoNinthHIA.pdf>
- UCLA CHAT (Community Health and Advocacy Training) Program: Castro, A., Chen L., Edison, B., Huang, J., Mitha, K., Orkin, M., Tejani, Z., Tu, D., Wells, L., Yeh, J., Guerrero, A., Kuo, A. & Yazdani, S. (2010). *Santa Monica Airport Health Impact Assessment*. Retrieved May 15, 2011, from <http://www.hiaguide.org/hia/santa-monica-airport-health-impact-assessment>
- U.S. Environmental Protection Agency. (2008). *AIRNow*. Retrieved May 22, 2011, from [http://www.epa.gov/airnow/healthprof/EPA\\_poster-final\\_lo-res.pdf](http://www.epa.gov/airnow/healthprof/EPA_poster-final_lo-res.pdf)

# Safety and Injury

## Introduction and Background

The following section addresses how the proposed King Street Station Multimodal Hub (KSSMH) project affects safety in the area. Our assessment of safety spans four areas: bicycle, pedestrian, and automobile safety, as well as personal safety and crime. The analysis relies on data from the Seattle Department of Transportation (SDOT) and the Seattle Police Department (SPD), as well as health impact literature.

Research shows that transportation facilities and their design can improve or impede physical activity (Carver et al., 2008). Sidewalks, pedestrian infrastructure, and the connectivity of routes and networks are correlated with increased walking (Saelens et al., 2008). Perceived traffic safety is frequently cited as one of the reasons why people choose active modes of transportation, such as walking and bicycling (UCLA Health Impact Clearinghouse, 2011). Moreover, many Americans view bicycling and walking within their communities as unsafe because of the lack of sidewalks, crosswalks, and designated bicycle paths as well environmental barriers (CDC, 2009). Some factors to improve pedestrian safety include: vehicle volume, type and speed, intersection design, pedestrian facilities, lighting, and weather (Lee and Abdel-Aty, 2005). Reducing crime and perception of crime can also reduce physical injury, improve mental health, and promote healthy activities like bicycling and walking. Changes to the built environment, such as improved lighting, can deter crime (Welsh and Farrington, 2009).

## The Relationship between Health and Safety

### *Bicycle Safety*

Although bicycling is a health-supporting activity, it is also linked to personal health risks and public costs. According to the City of Seattle, between 2002 and 2005, there were 1,088 police-reported bicycle crashes in the city, or an average of 272 per year. There were two bicycle fatality deaths during this time. The crashes normally occurred in areas with high bicycle use and were more common on weekdays than on weekends. The average weekday had 70 percent more bicycle crashes than the average weekend day. The number one reason cyclists gave why they

did or did not ride their bike was safety considerations (City of Seattle, 2009). Marked bike lanes and routes reduce injury and crash rates by about half compared to unmodified roadways (Reynolds et al., 2009).

### *Pedestrian Safety*

Between 2005 and 2007, there were 1,433 reported crashes involving pedestrians, according to the Seattle Pedestrian Master Plan. Roughly 70 percent of those crashes occurred at intersections, compared to 30 percent at mid-block locations. Specific information for pedestrian safety within the KSSMH study area is discussed later in the report.

### *Vehicle Safety*

Vehicle collision data was used to identify the high accident areas within the study area. Three primary factors for vehicular safety are speed limit, presence of barriers, and traffic signals.

### *Crime and Personal Safety*

Crime has a direct impact on physical and mental health. Even the perception of crime can discourage healthy behaviors. The precincts located within the study area have higher rates of crime than the city average, though that can be partially attributed to higher population densities. Actions taken as part of the KSSMH project may be able to reduce both actual crime rates and the perception of crime.

## **Existing Conditions**

The SDOT Bicycle Master Plan identifies two primary goals: to increase the amount of bicycling and cyclist safety in Seattle. In addition, Seattle's 2007 Complete Streets policy states the need "to design, operate and maintain Seattle's streets to promote safe and convenient access and travel for all users--pedestrians, bicyclists, transit riders, and people of all abilities, as well as freight and motor vehicle drivers" (City of Seattle, 2010). Within the study area, the Bicycle Master Plan recommends bicycle markings between 7th Avenue South and 5th Avenue South on Jackson Street as well as bike sharrows from 7th Avenue South to 12th Avenue South, as part of the First Hill Streetcar Project. Table 1 shows bike traffic counts at major intersections in the KSSMH area at peak hours on weekdays.



**Table 1: Bike Traffic Counts at Peak Times**

Location	AM Peak Counts	PM Peak Counts
<b>2nd Ave Ext S and S Jackson St</b>	<b>N/A</b>	<b>115</b>
<b>4th Ave S and S Jackson St</b>	<b>98</b>	<b>N/A</b>
<b>1st Ave S and S Jackson St</b>	<b>76</b>	<b>82</b>
<b>3rd Ave S and S Jackson St</b>	<b>117</b>	<b>N/A</b>
<b>2nd Ave S and S Jackson St</b>	<b>20</b>	<b>26</b>

The KSSMH study team highlights accessibility, connectivity to transit, and increasing bicycle commuting from King Street Station to Chinatown/ International District as top priorities (City of Seattle, 2011). Jackson Street, which passes through the project area, is a designated bike corridor for commuters (City of Seattle, 2010). Bikers pass east and west on Jackson Street to access downtown and Pioneer Square, before turning off onto north-south streets. Within the study area, there were nine collisions between vehicles and bicycles between 2008 and 2010, although none resulted in fatalities. (See Appendix B)

Improvements suggested in the Pedestrian Master Plan largely center around sidewalk upgrades. Pedestrian volumes currently vary among the intersections surveyed, with several reporting over 5,000 pedestrians (SDOT, 2010). Table 2 provides specific information about average pedestrian counts at different times of the year in the KSSMH area. Within the study area between 2008 and 2010 there were 34 reported pedestrian collisions at intersections and 17 mid-block, including one fatality. (See Appendix B)

**Table 2: Average Pedestrian Counts**

Location	Winter Weekday	Summer Weekday	Summer Weekend
<b>1st Ave S between S Jackson St &amp; S Main St</b>	<b>3,144</b>	<b>6,492</b>	<b>5,316</b>
<b>2nd Ave S and S Jackson St.</b>	<b>2,772</b>	<b>6,300</b>	<b>2,484</b>
<b>S Jackson St and 3rd Ave S</b>	<b>3,042</b>	<b>4,698</b>	<b>2,796</b>
<b>S King St and 1st Ave S</b>	<b>1,842</b>	<b>3,414</b>	<b>960</b>
<b>Pedestrian Bridge by 4th Ave S</b>	<b>3,672</b>	<b>5,268</b>	<b>1,062</b>

Road design requirements for Seattle streets can be found in the City of Seattle Municipal Code, Title 11: Vehicles and Traffic. This HIA focuses on identifying areas that may require measures more stringent than set by regulations and policies in order to help minimize future vehicle collisions. Vehicle collision maps show high accident prevalence at Jackson Street and 2nd Avenue, Jackson Street and 4th Avenue, and Jackson Street and 5th Avenue. A map of these incidents is in Appendix A.

A number of existing plans suggest approaches designed to reduce crime and boost personal safety. The Chinatown/International District Strategic Plan (1998) calls for active and programmed public spaces. The Chinatown, Nihonmachi, Little Saigon International District Urban Design Streetscape and Open Space Master Plan (InterIm, 2004) recommends improved lighting and signage. The Livable South Downtown Plan (2009) proposes rehabilitating vacant buildings and increasing the number of “eyes on the street.” All of these actions can lead to decreased crime (Welsh and Farrington, 2009). SPD subscribes to the guidelines of Crime Prevention Through Environmental Design, which advocates crime reduction through surveillance, access control, and defensible space (Seattle Police Department, 2011).

SPD crime data for 2010 shows a relatively high rate of violent crimes in the beat containing the eastern part of the KSSMH study area. Both beats in the study area have higher rates of crime than the city average (see Appendix C). Table 3 breaks down incidents that occurred in the two beats that include the KSSMH study area in 2010. It is impossible to compare local level data from before 2008 when SPD redrew its beat boundaries, but citywide violent crime in 2010 was down 9 percent from the 10-year average 2000-2009 and total major crime was down 15 percent. Violent crime citywide in 2010 was the lowest per capita since 1967.

**Table 3: Number of Crimes in KSSMH Area, 2010**

SPD Beat	Homicide	Rape	Robbery	Assault	Burglary	Larceny	Vehicle Theft	Total
<b>K2</b>	<b>1</b>	<b>4</b>	<b>51</b>	<b>255</b>	<b>54</b>	<b>341</b>	<b>41</b>	<b>745</b>
<b>K3</b>	<b>0</b>	<b>1</b>	<b>38</b>	<b>191</b>	<b>52</b>	<b>691</b>	<b>56</b>	<b>1031</b>

## Findings

Bicycle incidents were scattered throughout the area, though two incidents were recorded at the intersections of South Main Street and 5th Avenue South, and 4th Avenue South and Seattle Boulevard South in the KSSMH study area. Data on severity of the incidents was not available.

Within the study area, pedestrian collisions were most severe at the intersection of 5th Avenue South and Jackson Street, including one fatality, and 3rd Avenue and Yesler Way. Mid-block collisions were most often adjacent to these intersections, between 4th Avenue and 5th Avenue South on Jackson Street, and between 3rd Avenue South and 2nd Avenue Extension on Yesler Way.

Signals are often installed when angle-type accidents are problematic at intersections. Rear-end collisions usually increase when a signal is installed; however, the more severe angle-type accidents tend to decrease (City of Seattle, 1996). When there is no angle-type accident problem at an intersection, a traffic signal may actually raise the number of accidents in the area. Due to the high accident prevalence at Jackson Street and 2nd Avenue, Jackson Street and 4th Avenue and Jackson Street and 5th Avenue should be further examined for types of collisions. Left turn signals are beneficial in high volume intersections with heavy vehicle and pedestrian use such as Jackson Street and 2nd Avenue, Jackson Street and 4th Avenue, and Jackson Street and 5th Avenue. High prevalence of left-turn accidents or poor visibility can also be a reason to add left-turn signals.

Violent crime was more prevalent in the west half of the study area, which includes the Pioneer Square neighborhood. Property crime rates were proportionately higher in the beat containing the east half of the study area, which includes the International District neighborhood.

## Recommendations

### *Bicycle Safety*

- 1.) Implement the goals of Bicycle Master Plan in the final plan for the KSSMH as much as possible.
- 2.) Study safest means to direct bike commuters on main north-south streets through KSSMH area where bus traffic shares roadway.
- 3.) Provide bicycle route confirmation signs at all roadway crossings.
- 4.) Advocate for covered, secure bike parking facilities at all stations and in public spaces

### *Pedestrian Safety*

- 5.) Improve sidewalk conditions throughout study area, with emphasis on areas identified in the Pedestrian Master Plan.
- 6.) Prioritize improvements to the intersection of Yesler Way, 3rd Avenue, Dilling Way, Prefontaine Place, and 3rd Avenue South. Consider options for shortening crosswalk between Dilling Way, Yesler Way, and Prefontaine Way and potentially lengthening the existing bus island.

### *Vehicles Safety*

- 7.) Conduct a more detailed analysis of the accidents at the intersections of Jackson Street and 2nd Avenue, Jackson Street and 4th Avenue, and Jackson Street and 5th Avenue to see if a speed limit reduction is appropriate.
- 8.) Synchronize signals throughout the entire corridor with maximum green-light time for the direction with the heaviest traffic. After construction, further investigate how to optimize the timing of signals based on actual usage.

### *Crime and Personal Safety*

- 9.) Advocate for programming and patrolling of public spaces.
- 10.) Create safer alleyways by encouraging pedestrian traffic through repaving, improved lighting, and landscaping.

## Discussion

The design of streets and infrastructure in the KSSMH area has the potential to improve safety in multiple ways. SDOT has the ability to facilitate safety for all users and transportation modes, which would positively impact the community's health.

## References

- City of Seattle. (1998). *Chinatown/International District Neighborhood Plan*. Retrieved from <http://www.seattle.gov/neighborhoods/npi/plans/id/Section1.pdf>.
- City of Seattle, Department of Planning and Development. (2009). *Livable South Downtown: Executive Recommendations*. Retrieved from [http://www.seattle.gov/DPD/cms/groups/pan/@pan/@plan/@proj/documents/web\\_informational/dpdp018365.pdf](http://www.seattle.gov/DPD/cms/groups/pan/@pan/@plan/@proj/documents/web_informational/dpdp018365.pdf).
- City of Seattle, Department of Transportation. (2011). Communication: pedestrian and bicycle counts.
- City of Seattle, Department of Transportation. (2011). *Background materials for transportation committee*. Retrieved from <http://www.seattle.gov/transportation/docs/ks/KSShreferencetotal.pdf>.
- City of Seattle. (2010). *Guidance for retrofitting Seattle streets to create dedicated bicycle facilities*. Retrieved from <http://www.seattle.gov/transportation/docs/bmp/final/AppendixF.pdf>.
- City of Seattle. (1996). *Making streets that work*. Retrieved from <http://www.seattle.gov/transportation/pdf/mstw.pdf>.
- City of Seattle. *Seattle Municipal Code, Title 11: Vehicles and traffic*. Retrieved from <http://clerk.ci.seattle.wa.us/~public/toc/t11.htm>.
- City of Seattle. (2010). *Seattle Master Bicycle Plan*. September 2010. Retrieved from <http://www.seattle.gov/transportation/bikemaster.htm>.
- City of Seattle. (2010). *Seattle Pedestrian Master Plan*. Retrieved from [http://www.seattle.gov/transportation/pedestrian\\_masterplan/](http://www.seattle.gov/transportation/pedestrian_masterplan/).
- InterIm. (2004). *Chinatown, Nihonmachi, Little Saigon International District Urban Design Streetscape and Open Space Master Plan*. Retrieved from [http://www.interimicda.org/downloads/cos\\_005296.pdf](http://www.interimicda.org/downloads/cos_005296.pdf).
- Lee C, Abdel-Aty M. (2005). Comprehensive analysis of vehicle-pedestrian crashes at intersections in Florida. *Accident Analysis and Prevention*, 37: 775-786.
- Reynolds, C. C., Harris, M. A., Teschke, K., Crompton, P. A., & Winters, M. (2009). The impact of transportation infrastructure on bicycling injuries and crashes: a review of the literature. *Environ Health* (Vol. 8, pp. 47). England.
- Saelens, B. E., & Handy, S. L. (2008). Built environment correlates of walking: a review. *Med Sci Sports Exerc* (Vol. 40, pp. S550-566). United States.
- Seattle Police Department. (2011). *Crime prevention through environmental design*. Retrieved from <http://www.seattle.gov/police/prevention/Neighborhood/CPTED.htm>.
- UCLA Health Impact Clearinghouse. (2011). Retrieved from <http://www.hiaguide.org/>.

- U.S. Centers for Disease Control and Prevention. (2009). *Healthy places, injury*. Retrieved from <http://www.cdc.gov/healthyplaces/healthtopics/injury.htm>.
- U.S. Centers for Disease Control and Prevention. (2009). *Injury prevention & control: home and recreational safety, bicycle related injuries*. Retrieved from <http://www.cdc.gov/HomeandRecreationalSafety/bikeinjuries.html>.
- U.S. Department of Transportation, Federal Highway Administration. (2010). *United States Department of Transportation policy statement on bicycle and pedestrian accommodation regulations and recommendations*. Retrieved from [http://www.fhwa.dot.gov/environment/bikeped/policy\\_accom.htm](http://www.fhwa.dot.gov/environment/bikeped/policy_accom.htm).
- Washington Department of Transportation. (2011). *Traffic manual M 51-02.05*.
- Washington Department of Transportation. (2011). *Designing for bicycle*. Retrieved from <http://www.wsdot.wa.gov/bike/designing.htm>.
- Welsh, B. C., & D. P. Farrington. (2009) *Making public places safer: surveillance & crime prevention*. Oxford University Press, New York.

# Air and Noise Pollution

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## Introduction and Background

The KSSMH project offers a number of opportunities to identify and reduce the negative health effects of air pollution and excessive noise. This chapter explores those potential impacts and offers recommendations designed to support health in this regard as SDOT pursues two major infrastructure projects: lidding the railroads along 4th Avenue South and closing the 2nd Avenue South Extension.

## The Relationship between Health and Air & Noise Pollution

Potential health impacts caused by air emissions and noise pollution depend on the individual's age, gender, and susceptibility to health effects. Young children and older adults are more at risk to develop respiratory issues from pollutants such as particulate matters (PM10) and fine PMs (2.5). Certain noise levels can cause individuals to feel annoyance and stress. The research from the *Santa Monica Airport HIA* (Castro, 2010) suggests a strong correlation between noise and the ability for young children to comprehend and retain topics covered in class. Health effects of exposure to diesel exhaust, other vehicle related emissions, and noise pollution will be discussed in the following sections.

### *Noise Pollution*

Evidence linking noise to adverse health effects is strong, especially concerning children and other vulnerable populations. Chronic exposure to high levels of noise can cause physical and psychological health effects such as hypertension, tachycardia, increased stress, sleep disturbance, cognitive impairment, and full or partial hearing loss (Seidman & Standring 2010). Long or repeated exposures to noise over 85 decibels (dB) can cause hearing loss. Most tools at a construction site exceed 85 dB, and many reach close to 110dB (Neitzel 2005). Traffic noise varies based on the volume and type of vehicles, but even when noise does not reach 85 dB, health effects can occur. Specifically, chronic exposure to traffic noise below 85 dBs has been linked to increased incidences of heart attacks and sleep disturbances resulting in fatigue,

inattentiveness, and restlessness (Fyhri and Aasvang 2010).

### *Air Pollution*

Evidence links air pollution to both short- and long-term adverse health effects. Short-term health effects include irritation of the eyes, nose, and throat, upper respiratory infections, headaches, and nausea. Long-term effects include lung cancer, heart disease, asthma, and possible damage to the brain, nerves, or kidney (World Health Organization 2008). The KSSMH project is likely to relate to two major producers of air pollution: construction and traffic.

At a construction site, air pollution comes from diesel vehicles, asbestos and particulate matter from demolished buildings, and dust. These pollutants can affect construction workers as well as residents (Dorevitch et al. 2006). Common construction equipment, such as dump trucks and bulldozers, typically runs on diesel fuel. Burning the fuel produces diesel exhaust, a mixture of many particles and gases, including known or suspected cancer-causing substances. There is currently no standard specific to diesel exhaust, though some of the major components are addressed by the National Ambient Air Quality Standards (NAAQS) set by the EPA.

Vehicles in the area using unleaded gasoline also have an effect on health. Benzene, toluene, and hydrocarbons are present in unleaded gasoline in addition to particulate matter. These vehicles would be present at the site before, during, and after the construction phase. Using the 1996 Summer Olympic Games in Atlanta as a natural experiment, Friedman et al (2001) found that a decrease in traffic and ozone was correlated with a decrease in asthma acute care events at local emergency rooms. With this in mind, it is important that the KSSMH project works to minimize air pollution from construction and traffic sources.

Green spaces and trees can improve air quality by absorbing, binding, intercepting, and storing pollutants including ozone, particulate matter, nitrogen dioxide, and carbon monoxide; by sequestering carbon dioxide; and by helping to counteract the urban heat-island effect (Carr, West, & Wright 2008).



## Existing Conditions

Noise and air quality data specific to the study area are not currently available. Noise and air pollution from both the construction and post-construction phase will mainly affect the users of the buildings directly west of the railroad tracks which include art galleries, art studios, consulting firms, and homeless shelters.

## Findings

An assessment of the noise and air pollution concerns generated from the two major KSSMH projects reviewed in this HIA--the lidding of the BNSF railroad, and the rerouting of 2nd Avenue Extension South--follows.

### *Railroad Lidding*

The construction phase of the lidding project would increase the amount of noise and air pollution exposure for the building occupants at grade with the railroad tracks. Pedestrians, bicyclists, and vehicle drivers traveling on the surface streets near the project site would be exposed to more noise and air pollution during construction. The amount and the length of emission exposure will determine whether impacts are short or long term.

Construction-related dust is another concern during the construction phase. These particles, referred to as PM, are commonly kept to minimal levels by watering down the construction premises at regular intervals. Metal components in PM can lead to lung inflammation and cardiac arrhythmias. It has been a challenge for researchers to pinpoint certain health effects because many compounds make up PM. Sulfate, nitrate, ammonium, carbonaceous materials, and elemental carbon are several compounds found in fine PM (EPA, Health and Environmental Effects Research on Hazardous PM Components).

### *Second Avenue Extension*

There are two options for rerouting 2nd Avenue Extension. Both of the rerouting scenarios involve a decrease of traffic on 2nd Avenue Extension South, which would reduce exposure to air pollutants on the street. However, because the project is not expected to affect overall traffic

volumes, there will be an increase in exposure on the streets where traffic is to be rerouted, largely 4th Avenue South. The effect on ambient air quality is expected to be insignificant. The overall public health impact of the project is thus dependent on what routes pedestrians will use to access different transit stations and bus stops. In addition to the rerouting scenarios, the project involves several small-scale changes in pedestrian accessibility. If these changes lead to increased volumes of people out on foot, more people will be exposed to noise and air pollutants either reroutes.

The first option for 2nd Avenue Extension involves rerouting all traffic except buses, emergency vehicles and bicycles from 2nd Avenue Extension South between Main Street and 4th Avenue South. This option would decrease exposure to air pollutants on 2nd Avenue Extension South. Since bus traffic volumes would not change, the amount of diesel exhaust would remain stable. Noise will increase during construction, with effects similar to those described in the lidding project. After construction, bikers and walkers using the road will experience noise from public transportation and other vehicles.

The second option for rerouting 2nd Avenue Extension South involves closing the road completely and turning it into public space. This option would increase green space in the area and, as a result, could improve the area's air quality.

## **Recommendations**

To minimize health hazards presented by air pollution and noise effects, SDOT should consider the following action items:

- 1.) Perform air quality and noise monitoring at all construction sites before, during, and after construction. Fixed air samplers can be placed at the proposed lidding construction site, the proposed green space site north of the King Street Station, and at the intersection of South Main Street and 4th Avenue South. Portable and temporary noise meters designed for construction and industrial use should be used to check noise levels at areas specified by the City of Seattle noise ordinance to ensure noise-level compliance.

- 2.) Encourage contractors to use high-efficiency construction equipment that uses low-emissions engines.
- 3.) Close Second Avenue Extension South and add a green space. (See Appendix D for tables containing tree species known to reduce air pollutants and air temperature)

## Discussion

Given SDOT's experience with large-scale construction projects, the organization is familiar with several recommendations, such as regulating construction hours and mitigation of noise. Some of the recommendations are costly (for example, additional green space) but should be a priority because of their potential for reducing the health risks associated with pollution and noise. We recognize that not all of the recommendations will be practical for SDOT to implement alone. However, SDOT can be a catalyst in improving the health of residents and visitors to the KSSMH area.

## References

- Carr, P., West, J., Wright, B. (2008). SR 520 Health Impact Assessment. Retrieved May 23, 2011, from King County: <http://www.kingcounty.gov/healthservices/health/ehs/hia.aspx>.
- Castro, A., Chen, L., Edison, B., et al. (2010). Santa Monica Airport Health Impact Assessment. Retrieved May 23, 2011. <http://www.healthimpactproject.org/resources/document/SantaMonicaAirport.pdf>.
- City of Seattle. (2009, December 29). *DPD's Noise Abatement Program*. Retrieved May 2011, from Department of Planning and Development: [http://www.seattle.gov/dpd/Enforcement/Noise\\_Abatement/FAQ/index.htm](http://www.seattle.gov/dpd/Enforcement/Noise_Abatement/FAQ/index.htm).
- Dorevitch, S., Demirtas, H., Perksy, V.W., Erdal, S., Conroy, L., Schoonover, T., & Scheff, P.A. (2006). Demolition of high-rise public housing increases particulate matter air pollution in communities of high-risk asthmatics. *Journal of the Air & Waste Management Association*, 56(7), 1022-1032. Retrieved from Academic Search Complete.
- EPA. Air Quality Criteria for Particulate Matter (Final Report, Oct 2004). U.S. Environmental Protection Agency, Washington, DC, EPA 600/P-99/002aF-bF, 2004.
- EPA. (2011). *Diesel Particulate Matter*. Retrieved May 2011, from EPA: <http://www.epa.gov/ne/eco/airtox/diesel.html>.
- EPA. (2011). *Research Areas: Hazardous Components*. Retrieved May 2011, from EPA. [http://www.epa.gov/NHEERL/research/pm/research\\_area05.html](http://www.epa.gov/NHEERL/research/pm/research_area05.html).
- Fhyri, A. & Aasvang, G.M. (2010). Noise, sleep and poor health: Modeling the relationship between road traffic noise and cardiovascular problems. *The Science of the Total Environment*, 408(21), 4935-4942. doi:10.1016/j.scitotenv.2010.06.057.

- Friedman, M.S., Powell, K.E., Hutwagner, L., Graham, L.M., & Teague, W.G. (2001). Impact of changes in transportation and commuting behaviors during the 1996 summer Olympic games in Atlanta on air quality and childhood asthma. *JAMA*, 285(7), 897-905. doi: 10.1001/jama.285.7.897.
- Neitzel, R. (2005). Probable noise levels of common construction tools. Retrieved May 23, 2011. <http://staff.washington.edu/rneitzel/commontools.pdf>.
- Nowak, D. & Heisler, G. (2010). *Executive Summary: Air Quality Effects of Urban Trees and Parks* (pp. 35-38). Ashburn, VA: National Recreation and Park Association.
- Seidman, M.D. & Standring R.T. (2010). Noise and quality of life. *International Journal of Environmental Research and Public Health*, 7(10), 3730-3738. doi:10.3390/ijerph7103730.
- United States Environmental Protection Agency. (2011). National ambient air quality standards (NAAQS). Retrieved May 24, 2011, from EPA: <http://www.epa.gov/air/criteria.html>.
- World Health Organization. (2008). Air quality and health. Retrieved May 23, 2011, from WHO: <http://www.who.int/mediacentre/factsheets/fs313/en/index.html>.

# Social Capital and Mental Health

## Introduction and Background

The human-made places where we work, play, learn, and live have a large impact on psychosocial well-being. This chapter addresses two major concepts related to this: social capital and mental health.

Social capital is defined as the social networks and interactions that inspire trust and reciprocity among citizens (Putman, 2000). People who are socially engaged with others and actively involved in their communities tend to live longer and be healthier physically and mentally (Leyden, 2003). Social capital is not only linked to better health but has also been found to support proper functioning of democracy, prevent crime, and enhance economic development (Leyden, 2003).

Mental health, on the other hand, is not as easy to define. The World Health Organization (2011) defines mental health as “a state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to make a contribution to his or her community.” In this positive sense, mental health is the foundation for individual wellbeing and the effective functioning of a community.

The KSSMH project is set in two distinct neighborhoods in Seattle: the Chinatown/International District and Pioneer Square. Both of these neighborhoods have mechanisms that promote social capital and mental wellbeing, such as strong neighborhood associations and engaged community groups that “embrace their unique and distinct community characteristics” (Seattle Department of Transportation [SDOT], 2011). Alterations to the built environment can enhance the social capital and mental health of all those who use the KSSMH project area. The remainder of this chapter will focus on how social capital and mental health are impacted by three distinct parts of the built environment as they relate to the KSSMH project: wayfinding, public space and placemaking.

## Relationship between Health and Social Capital & Mental Health

Wayfinding is the process of orienting one's self in physical space and navigating from place to place. An easy-to-use wayfinding system can reduce the mental stress associated with navigating new environments and chaotic spaces. From several survey-based evaluations of buildings, people have reported anger, anxiety, and hostility when they are lost. For example, when a federal prison lobby added signs, the visitors reported increased comfort, decreased crowding, less confusion, and less anger. In addition to the mental stress associated with feeling lost, biological changes can occur, including increased heart rate (Evans, 1982). When people feel lost, they also lose a sense of control and feel helpless. People generally feel better and have better mental health when they can control their surroundings (Evans, 2003). Effective wayfinding can get people to their destinations faster, resulting in fewer occurrences of stress associated with missed connections. The addition of signage in a confusing university building resulted in 13 percent increase in rate of travel, 50 percent decrease in wrong turns, and 62 percent decrease in backtracking (O'Neill, 1991).

Although research links social cohesion more to homeownership, social networks, or longevity in a neighborhood, contemporary neighborhood planning attempts to build a sense of community through thoughtfully designed public spaces. Access to attractive public markets, parks, sidewalks, streets, and alleys increases the likelihood of social interactions and may contribute to increased perceptions of neighborhood safety and pride. Residents in more walkable neighborhoods report higher levels of community participation and social capital, which can promote sound mental health (Leyden, 2003; Lund, 2002). More is known about the micro-level features of the built environment, such as site layout and architecture, that contribute to a sense of community than macro-level characteristics, such as neighborhood form. However, public space features that promote direct observation or what urban activist Jane Jacobs calls "eyes on the street" may encourage interaction and promote social support.

Placemaking is urban design principle that incorporates considerations of existing economic, environmental, and social characteristics in an attempt to promote the development of public

space that encourages community inclusion and engagement. A sense of belonging may be designed by the creation of public space that responds to and enables the promotion of group, neighborhood or cultural identity. (Adams and Heller, 2009)

## Existing Conditions

There are currently multiple wayfinding methods used in the KSSMH area. One such method is a series of red kiosks, located throughout the downtown Seattle area, that provide maps and information about area attractions. To supplement information kiosks, SDOT introduced red poles with arrows pointing to destinations located in heavily traveled areas. King County Metro Transit has a wayfinding system that is consistent throughout King County. This includes uniform bus stops design, bus route information signs, and tunnel entrance information. Sound Transit and Amtrak use other wayfinding systems near and within King Street Station.

Much of the space within the KSSMH area could be considered “public,” as there are many informal gathering places. Two Pioneer Square parks, Occidental Park (between South Washington Street and South Main Street) and Waterfall Garden (South Main and 2nd Avenue South), fall within the project’s geographical boundaries. Union Station and King Street Station are two iconic, publicly owned buildings with some of the area’s few unrestricted restrooms. However, because SDOT only has independent authority to alter streets and sidewalks, discussions of modifiable “public space” are limited. Community members and residents who use these streets and sidewalks regularly request that the spaces improve connectivity between the two neighborhoods and facilitate travelers’ ability to make quick transit connections.

## Findings

Pursuant to Seattle’s Green Street guidelines, the majority of the KSSMH project’s public space developments relate to how pedestrians experience the area. Possible enhancements include widening sidewalks (2nd Avenue Extension South and Jackson Street), improving intersections (South Jackson Street and Occidental Avenue South), and upgrading features at several transit connections (Jackson Street between 4th Avenue and 5th Avenue). The plan also prioritizes the pedestrian right-of-way by proposing the closing of streets to vehicle traffic (3rd Avenue South

from 2nd Avenue Extension South to Jackson Street), lidding portions of the railroad tracks (west side of 4th Avenue South), expanding alley improvements, and encouraging sidewalk cafes and street vending. SDOT's draft recommendations also pay particular attention to aesthetics by encouraging the installation of landscaping (3rd Avenue south of Yessler Way), decorative paving treatments (key intersections on Jackson Street), and temporary art (triangle at South Jackson Street between 2nd Avenue Extension South and 4th Avenue Street). Local demographics and history should be taken into account when placemaking. The 2010 Census data will soon be available and will give the most current and comprehensive demographics of the two neighborhoods.

## Recommendations

The following recommendations are based on SDOT's draft recommendations (May, 2011). Many suggestions have come out of the public meetings they held.

- 1.) When designing the rail lid, plan for a good balance between structures, public space and open space for train viewing. Make sure that any public space is programmed in a way that reflects the character of the Chinatown/International District and Pioneer Square neighborhoods. Consider having informational signs concerning the neighborhoods as well as the passing trains.
- 2.) Increase public space with the 2nd Avenue Extension reroute as well as the 3rd Avenue closure as programmed space. Add features like chess board tables for increased personal interactions that do not cost users money. Consider installing benches that face iconic views of Seattle and the local area.
- 3.) Establish a clear and consistent wayfinding system throughout the entire KSSMH project area. This should reflect the history and current demographics of the two neighborhoods. To encourage community involvement and foster social capital, consider having a design contest to develop the wayfinding system and form a committee from groups in both neighborhoods, SDOT and other stakeholders.
- 4.) Build a pedestrian bridge that connects King Street Station to the Chinatown/International District Station as well as permanent canopies to increase the



ease of transitioning from one station to the other especially for older adults, individuals with disabilities, and children.

- 5.) Follow through with decorative recommendations like the neighborhood specific light fixtures, the Jackson Street Triangle, unique paving features and decorative street crossing. Encourage designs that increase the iconic nature of the area.

## Discussion

Many, if not all the recommendations for the KSSMH project can be structured in some way to improve the social capital and mental health of the surrounding neighborhoods. We understand that not all of the recommendations will be implemented because of time and money issues; however, these are not planning extras to be tacked on if finances permit, but important aspects of urban design that keep people healthy and happy.

## References

- ESRI Business Analyst Online. U.S. Census Bureau, Census 2000, Redistricting Data (P.L. 94-171). Web. 4 May 2011.
- Evans, Gary. (1982). *Stress*. Cambridge University Press
- Evans, Gary. (2003). The Built Environment and Mental Health. *Journal of Urban Health*. 80:4.
- Heller, Allison and Adams, Toby (2009) 'Creating healthy cities through socially sustainable placemaking', *Australian Planner*, 46: 2, 18-21
- Leyden, K.M (2003). Social Capital and the Built Environment: The Importance of Walkable Neighborhoods. *American Journal of Public Health*. 93(9); 1546-1551.
- Lund H. (2002). Pedestrian environments and sense of community. *Journal of Planning Education and Research*, 21 (3), 301-12.
- O'Neill, Michael J. (1991). Effects of Signage and Floor Plan Configuration on Wayfinding Accuracy. *Environment and Behavior*. 23:5 pgs 553-574.
- Putman, R.D. (2000). *Bowling Alone: The Collapse and Revival of American Community*. New York: Simon & Schuster.
- Seattle Department of Transportation [SDOT] (2011). King Street Multimodal Hub Study. Accessed online May 14, 2011 from <http://www.seattle.gov/transportation/kingsstreethub.htm>.
- Talen, E. (1999). A sense of community and neighborhood form: an assessment of the social doctrine of new urbanism. *Urban Studies*, 36 (8), 1361-1379.
- World Health Organization [WHO] (2011). Mental Health. Accessed online May 14, 2011 from [http://www.who.int/topics/mental\\_health/en/](http://www.who.int/topics/mental_health/en/)



# Physical Activity and Obesity

## Introduction and Background

This chapter focuses on the relationship between the physical design of the KSSMH area and the physical activity levels and health of both those who live in the area and those who travel through it. Research shows a strong, well-documented relationship between physical activity, obesity, and human health. Moreover, the built environment, including street design and pedestrian safety accommodations, can have a significant impact on a population's health and well being (Dannenberg, et al., 2003). Transportation choices and physical activity are also linked in the public health and transportation planning literature (Frank, Saelens, Powell & Chapman, 2007). This section highlights SDOT's opportunities for promoting increased physical activity through conscious redevelopment of the KSSMH area to be welcoming of pedestrian and bicyclist activity.

## Relationship between Health and Physical Activity & Obesity

Four of the top ten leading causes of death in adults (heart disease, diabetes, cancer, and stroke) are related to poor nutrition and low levels of physical activity (McMillan, 2009). Much of this inactivity stems from our sedentary jobs and the use of passive rather than active transportation. The result is an increasingly overweight population that experiences adverse health effects. Obesity is a risk factor for heart disease, Type 2 Diabetes, various cancers, hypertension, stroke, and liver and gallbladder disease.

The Centers for Disease Control and Prevention report that both Type 2 Diabetes and obesity have reached epidemic proportions (CDC, "Obesity and Overweight Health Consequences," 2011). In 1993, the percentage of obese people in most states (33 states) was between 10 and 14 percent. By 2009, only Colorado and the District of Columbia were below 20 percent (CDC, "Obesity and Overweight Health Consequences," 2011).

Obesity is not only harmful to health but is also costly for individuals and governments. In 2006, annual medical costs for obese people were approximately \$1,429 higher than those of healthy

weight individuals (Finkelstein, Trogden, Cohen, & Dietz, 2009). The CDC estimated that in 2008, the total medical care costs of obesity in the United States totaled \$147 billion (CDC, “Obesity and Overweight Economic Consequences,” 2011).

Increasing individual levels of physical activity helps reverse this trend and improve health. To achieve the health benefits associated with physical activity, the CDC recommends that the average adult perform at least 30 minutes of activity most days per week, with the 30 minutes occurring all at once or spread throughout the day (McMillan, 2009; CDC, “Obesity and Overweight Health Consequences,” 2011). Data from the CDC’s 2007 Behavioral Risk Factor Surveillance System (BRFSS) indicate that 43.5 percent of adults nationally consider themselves “highly active,” constituting at least 300 minutes of moderate-intensity activity or more than 150 minutes of vigorous-intensity activity (or a combination of the two totaling more than 300 minutes) per week. About a quarter of the adult population reports participating in “no leisure time physical activity” at all, meaning no exercise at all a week, including gardening, walking or calisthenics (CDC, 2007).

The physical design of a community may promote or discourage residents and visitors from engaging in physical activity. Areas that offer more opportunities for walking and cycling, employ traffic-calming measures, orient their designs toward people rather than cars, curtail motor vehicle use, and carefully enforce traffic regulations are more likely to promote physical activity (Pucher & Dijkstra, 2003). The odds of achieving recommended levels of walking for exercise also increase with promotion of walking or use of public transit, and access to attractive open spaces and areas that are aesthetically pleasing with trees, sidewalks, and local shops (Giles-Corti & Donovan, 2003). The existence of attractive neighborhoods, access to designated bicycle paths, and traffic-calming devices, as well as an abundance of four-way street intersections is linked with increased levels of bicycling (Titze et al, 2010). King County’s Office of Strategic Planning and Performance Management further notes that people who live and work in walkable neighborhoods drive less, use public transit more often, and are more likely to be physically active and less likely to be overweight or obese. Elements of walkable neighborhoods include well-maintained sidewalks, streets with adequate lighting, sheltered

transit stops, slower flowing traffic and lower perception of crime (Livable Neighborhoods, 2010).

Health and socioeconomic status are also profoundly intertwined. Obesity throughout the nation is negatively associated with income and education, and research is increasingly pointing to the built environment as the key factor in the relationship between the socioeconomic status of a community and obesity rates. Proximity to recreational space, connectivity, walkability and safety of the area are just some of the many components that may contribute to the above inequities (Papas, 2007). In King County, a 2009 study confirms that for each additional \$100,000 in the median price of homes in a given ZIP code, obesity prevalence rates in the area drop by 2 percent. The study further highlights data from 2000 to 2005 showing that obesity rates in King County are 63 percent higher among African Americans when compared to Whites and 32 percent higher among those with incomes of less than \$15,000 a year when compared to those with incomes of more than \$50,000 (Drewnowski et al., 2007). BRFSS data for Washington State as a whole further demonstrates these relationships, confirming that as education and income level rise, so do rates of physical activity and exercise (CDC & BRFSS, 2007).

## **Existing Conditions**

### *Area Demographics*

Understanding the demographics of the KSSMH area is important because physical activity levels decrease with age, vary among racial and ethnic groups, and are lower among those with lower incomes and less education (Dannenberg et al., 2003; Kruger et al., 2007). As described in the Introduction to this HIA, the neighborhoods surrounding the KSSMH area are more racially diverse, generally older, and have lower median incomes than city of Seattle as a whole.

Figures on obesity, overweight, and physical activity rates for the study area were not immediately available. However, in King County, recent figures indicate that 56 percent of adults are medically defined as overweight or obese, and 46 percent do not meet the physical activity recommendations. (CDC, 2007; McMillan, 2009; CDC, 1999).

### *Pedestrian Issues*

The KSSMH area has high pedestrian use. According to 2000 U.S. Census data, the majority of residents of the surrounding neighborhoods reported that they use public transportation (38.2 percent) or walk (29 percent) to get to work (ESRI, 2011). However, the KSS area currently presents numerous physical and psychological barriers that may discourage physical activities beyond what is absolutely necessary to make transit connections.

In its Pedestrian Master Plan, the city has categorized seven of the intersections in or bordering the quarter-mile study area as “tier 1.” This designation indicates that they are the most challenging intersections to cross due to concerns such as road width or traffic volumes. Four of these tier 1 intersections are located on South Jackson Street (SDOT, 2011). According to SDOT pedestrian count data, many of the tier 1 intersections also have the highest levels of pedestrian foot traffic at morning and evening peak commuting times (SDOT, 2011). In addition, another four intersections in the study area fall into the “tier 2” category, which is slightly less challenging than tier 1 areas but remains a concern. In the northeast quadrant of the study area, about four blocks clustered near the 5th and Washington intersection have been designated “tier 1” for their “along the roadway” conditions, which suggests gaps in infrastructure to “buffer” pedestrians from heavy traffic (SDOT, 2011).

4th Avenue South in particular is a major pedestrian travel corridor that lacks features to make the pedestrian experience more appealing and easier to navigate. The section of 4th Avenue adjacent to the KSSMH is devoid of trees and largely lacks retail and restaurant attractions. Because this section of road is elevated, street trees and other vegetation cannot be added except in planter boxes. Moreover, vehicle traffic adjacent to walking areas is fast-moving and abundant.

Traveling from King Street Station to the International District/Chinatown Tunnel Station to make transit connections can be dangerous and difficult because of short traffic signal cycles at 4th Avenue South and Jackson Street. This situation creates a nuisance for pedestrians, and, as noted by the pedestrian advocacy group Feet First, the triangular traffic island located in the intersection between the two stations is inadequate (SDOT, 2011). Sidewalk conditions in the

area are generally good, but some sidewalks in the blocks just north of King Street Station were rated “fair” by SDOT as of 2008 (SDOT, 2011).

### *Bicycling Issues*

Few of the streets in the area have marked, on-street bike lanes or sharrows, and the bicycle infrastructure that exists is not optimally connected. Currently there is no continuous, marked east-west cyclist route that connects King Street Station to the International District-Chinatown station. South Jackson Street has sharrows only on the west side of 4th Avenue South and then again beginning at 12th Avenue South, east of 4th. South King Street has sharrows, and South Dearborn Street has on-street bike lanes, but this infrastructure does not connect directly with King Street Station (City of Seattle, 2011). On-street bike lanes on 1st and 4th Avenues provide northbound connections to downtown Seattle and beyond, but the stadiums to the south of the KSSMH and other rail yard connections prevent easy, direct bicycle connections to the south. In addition, 4th Avenue South lacks on-street bike lanes---and instead has only sharrows---in the two blocks just north of the KSSMH, and the bike infrastructure completely vanishes south of Jackson Street (City of Seattle, 2011).

Running along Main Street, the streetcar tracks from the defunct Waterfront Streetcar pose a serious hazard for bicyclists and bike advocacy groups such as Cascade Bicycle Club have repeatedly called for their removal (SDOT, Summary conversations, 2011). The area also lacks strong bicycling facilities. One bike shop, located one block northwest of King Street Station, currently serves the KSSMH. Both Cascade Bicycle Club and the Bike Board have expressed the need for additional covered, secured bike parking with lighting in the area (SDOT, Summary conversations, 2011).

### **Findings**

The KSSMH project and associated redevelopment of the South Downtown region offer numerous opportunities to improve the health of both residents and visitors to the area. SDOT and the City of Seattle have already offered plans to prioritize many of the above elements citywide through documents such as the Pedestrian Master Plan and Bicycle Master Plan and the Livable South Downtown Planning Study. Further efforts, such as increasing South

Downtown's open and commercial spaces or redesigning streets and sidewalks to promote safe walking and biking, will likely increase physical activity and potentially lower obesity rates in the region.

## Recommendations

SDOT and its partners can encourage greater levels of physical activity among area residents, commuters, and visitors alike in the KSSMH vicinity through the following recommendations:

- 1.) Implement recommendations from the Pedestrian Master Plan, the Bicycle Master Plan, the Livable South Downtown Plan, and the city's existing design and zoning guidelines for the area.
- 2.) Remove unused Waterfront Streetcar tracks to accommodate concerns raised by bicycling advocates.
- 3.) Lid the railroad tracks in order to activate and reclaim the extra space for pedestrian facilities, such as, plazas for transit waiting, food trucks and vendors, mobile fruit and vegetable stands, space for plantings/landscaping, shelter from rain (similar to Pergola in Pioneer Square), and bike parking.
- 4.) Create a pedestrian-friendly path between stations. Expand crosswalks at 4th and Jackson Street intersection and consider alternative paving/bricking (similar to Westlake Center) at this intersection and other high-traffic intersections in the area. Explore alternatives to make traffic islands (especially the one separating the two stations) more pedestrian-friendly.
- 5.) Investigate ways to provide continuous bicycling infrastructure (on-street bicycle lanes preferred) between the two major transit stations.
- 6.) Adopt the same landscaping themes (such as potted trees) from new King Street Station Plaza in the Union Station area across Jackson Street in order to further unify the design of the area and create a more pleasant pedestrian atmosphere. Connecting the stations should create both a sense of place and a sense of arrival at the KSSMH.
- 7.) Consider expanding existing clear alleys program to more of the KSSMH area.
- 8.) Explore ways to attract mobile food trucks or produce stands in underutilized blocks in order to offer more convenient access to fresh food sources for KSSMH users. Sitting



areas and benches can both activate spaces and provide pleasant above-ground waiting areas for Sounder Trains or other mass transit options.

- 9.) Ensure adequate bicycle parking and storage in the KSSMH area.
- 10.) Tame motorized vehicle traffic. Due to their high traffic volumes and proximity to the primary transit transfer locations, South Jackson Street and 4th Avenue South, should be prioritized for pedestrian improvements. Explore options for controlling high traffic volumes while accommodating higher pedestrian and bicycle counts (light timing, etc.). Pursue proposed closure of 2nd Avenue Extension to motorized vehicles and prioritize bicycles and pedestrians in this space.

## Discussion

Although the City of Seattle has a reputation for physically active citizens, there is still a need to expand the current “active lifestyle” culture to all populations (Melnick, 2011, February 18). The design of the KSSMH could do more to encourage visitors, commuters and residents to use the multimodal transportation offerings. Improving both pedestrian and bicycle connectivity in the area may promote increased levels of physical activity and, in turn, help decrease obesity rates.

As discussed throughout this HIA, the population within and surrounding the KSSMH area is ethnically diverse, many residents live below the poverty, and less than half have had any college education. Because negative health outcomes disproportionately impact individuals with low-incomes, low levels of educational attainment, and members of minority groups, residents of the KSSMH area may be able to achieve the greatest gains from physical activity-oriented improvements to the area.

## References

- City of Seattle. (2007). Bicycle Master Plan. Retrieved from <http://www.seattle.gov/transportation/docs/bmp/final/BikeMasterPlanCOMPLETE.pdf>
- City of Seattle & Department of Planning and Development. (2009). Livable South Downtown Study: Executive Recommendations. Retrieved from [http://www.seattle.gov/dpd/cms/groups/pan/@pan/@plan/@proj/documents/web\\_informational/dpd018365.pdf](http://www.seattle.gov/dpd/cms/groups/pan/@pan/@plan/@proj/documents/web_informational/dpd018365.pdf)

- Drewnowski, A., Rehm, C., & Solet, D. (2007). Disparities in obesity rates: Analysis by ZIP code area. *Social Sciences and Medicine*, 65(12), 2458-2463.
- Dannenberg, A. L., Jackson, R. J., Frumkin, H., Schieber, R. A., Pratt, M., Kochtitzky, C., et al. (2003). The impact of community design and land-use choices on public health: a scientific research agenda. *American Journal of Public Health*, 1500-1508.
- ESRI (2011). Pioneer and International District – GIS based Demographic Data. Retrieved from <http://www.ESRI.com>
- Frank, L.D., Saelens, B.E., Powell, K.E., & Chapman, J.E. (2007). Stepping towards causation: do built environments or neighborhood and travel preferences explain physical activity, driving, and obesity? *Social Science and Medicine*, 65(9), 1898-914.
- Finkelstein, E.A., Trogden, J.G., Cohen, J.W., Dietz, W. (2009). Annual medical spending attributable to obesity: payer- and service-specific estimates. *Health Affairs*, 28, 822–831.
- Giles-Corti, B., & Donovan, R. J. (2003). Relative influences of individual, social environmental, and physical environmental correlates of walking. *American Journal of Public Health*, 1583-1589.
- Kruger, J., Yore, MM., Solera, M., et al. (2007) Prevalence of Fruit and Vegetable Consumption and Physical Activity by Race/Ethnicity - United States, 2005. *Journal of the American Medical Association*, 297(19), 2072-2074
- McMillan, T. E. (2009). Urban form and a child's trip to school: the current literature and a framework for future research. *Journal of Planning Literature*, 440-454.
- Melnick, M. (2011, February 18). America's 15 most active cities. *Time Magazine*. Retrieved May 25, 2011 from <http://healthland.time.com/2011/02/18/americas-15-most-active-cities/slideshow/5/>.
- Papas, M., Alberg, A., Ewing, R., et al. (2007). The Built Environment and Obesity. *Epidemiologic Reviews*, 29(1), 129-143.
- Pucher, J., & Dijkstra, L. (2003). Promoting safe walking and cycling to improve public health: lessons from the Netherlands and Germany. *American Journal of Public Health*, 1509-1515.
- Seattle Department of Transportation. (n.d.) Pedestrian Master Plan website. Retrieved from [http://www.seattle.gov/transportation/pedestrian\\_masterplan/default.htm](http://www.seattle.gov/transportation/pedestrian_masterplan/default.htm)
- Seattle Department of Transportation. (2011). King Street Station Multimodal Hub Study - Reference Materials. Retrieved from [http://www.seattle.gov/transportation/kshub\\_maps.htm](http://www.seattle.gov/transportation/kshub_maps.htm)
- Seattle Department of Transportation. (2011). King Street Station data - summarized. Unpublished data file.
- Seattle Department of Transportation. (2011). King Street Station - Summary Conversations. Unpublished data file.
- Seattle Department of Transportation. (2011). 2016 Pedestrian Elements [map]. Unpublished file.
- Seattle Department of Transportation. (2011). Sidewalk conditions - Pioneer Square [map]. Unpublished file.
- Seattle Department of Transportation. (2011). Sidewalk conditions - Chinatown/International District [map]. Unpublished file.
- Sherry, B., Blanck, H.M., Galuska, D.A., Pan, L., & Dietz, W.H. (2010). Vital signs: State-specific obesity prevalence among adults---United States, 2009. *Morbidity and Mortality Weekly Report*, 59, 1-5.
- Titze, S., Giles-Corti, B., Knuiiman, M.W., Pikora, T.J., Timperio, A., Bull, F.C. & van Niel, K. (2010). Associations between intrapersonal and neighborhood environmental characteristics and cycling for transport and

- recreation in adults: baseline results from the RESIDE study. *Journal of Physical Activity & Health*, 7(4), 423-31.
- United States Centers for Disease Control and Prevention & Behavioral Risk Factor Surveillance System. (2007). 2006 Calculated Variables Report - Washington. March 2, 2007. Retrieved from <http://www.doh.wa.gov/ehsphi/chs/chs-data/brfss/Links/WA06CALC.pdf>.
- United States Centers for Disease Control and Prevention. (2007). State/Area Profile, United States compared with Seattle-King County (WA). Retrieved from <http://apps.nccd.cdc.gov/cdi/SearchResults.aspx?IndicatorIds=26,1,33,37,2,15,3,4&StateIds=46,101&StateNames=United%20States,--%20Seattle-King%20County%20%28WA%29&FromPage=HomePage>.
- United States Centers for Disease Control and Prevention. (2010). State Indicator Report on Physical Activity, 2010. Atlanta, GA: U.S. Department of Health and Human Services.
- United States Centers for Disease Control and Prevention. (2011). *Obesity Trends* web page. Retrieved from <http://www.cdc.gov/obesity/data/trends.html>
- United States Centers for Disease Control and Prevention. (2011). *Obesity and Overweight Health Consequences* web page. Retrieved from: <http://www.cdc.gov/obesity/causes/health.html>
- United States Centers for Disease Control and Prevention. (2011). *Obesity and Overweight Economic Consequences* web page. Retrieved from: <http://www.cdc.gov/obesity/causes/economics.html>.
- United States Department of Health and Human Services. (2008). At-A-Glance: A Fact Sheet for Professionals. Physical Activity Guidelines for Americans. Retrieved from <http://www.health.gov/paguidelines/factsheetprof.aspx>
- 2011 Seattle Bicycling Guide Map. (2011). [Bicycle facilities map from Seattle Department of Transportation]. Retrieved from <http://www.seattle.gov/transportation/docs/2011BikeMap.pdf>

# Overall Recommendations

A number of recommendations cut across the five topic areas. We recommend that SDOT prioritize the following actions:

- 1.) During any phase of construction pursue air quality and noise level monitoring and mitigation. Also, close bus stops only when absolutely necessary and pursue realistic alternatives for those travelers with physical disabilities.
- 2.) Pursue the proposed lidding of railroads along 4th Avenue South and the closure of the Second Avenue Extension South.
  - Reclaim space for pedestrians
  - Consider installing green space and/or programmed gathering areas
  - Address air quality/filtering considerations
- 3.) Transform the 2nd Avenue Extension reroute into green, public space and program the space to reduce the risk of inappropriate use.
- 4.) Improve the pedestrian and bicyclist experience.
  - Clearly mark bicycle lanes and signage
  - Clearly mark crosswalks and wayfinding signage
  - Ensure appropriate street lighting
  - Consider traffic calming measures and changes in signal timing to aid pedestrian crossings
  - Build a pedestrian bridge between the King Street Station and the Chinatown-International District Station
- 5.) Implement human-scale, iconic design features.
  - Consider distinctive paving or bricking to unite disparate transit stations (KSS and International District Station) across 4th Avenue South.
  - Install canopies, benches, wayfinding tools, and other amenities.
- 6.) Attempt to not only meet but transcend established standards and policies, such as the Americans with Disabilities Act, Seattle Bicycle Master Plan, Seattle Pedestrian Master Plan, and Liveable South Downtown Plan.

## Conclusion

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One remaining step involves evaluating and monitoring the effects of these recommendations. It is important that SDOT develop methods for keeping tabs on two aspects of the project: (1) the extent to which the recommendations are adopted and (2) the effectiveness of those recommendation actions after implementation. As SDOT moves forward with the KSSMH project, the recommendations and findings of this rapid HIA can support and guide its ongoing work.

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Barbara Wright, formerly with Seattle-King County Public Health Department

Darby Watson, Sara Robertson, and Barbara Gray, Seattle Department of Transportation

# Appendix A. Questionnaire for Qualitative Assessment of Vulnerable Population Needs

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I am a graduate student at the University of Washington working on a Health Impact Assessment for the King Street Station “HUB” project. A Health Impact Assessment is a process looking at the effect on people a project may have while the plans for it are still being developed.

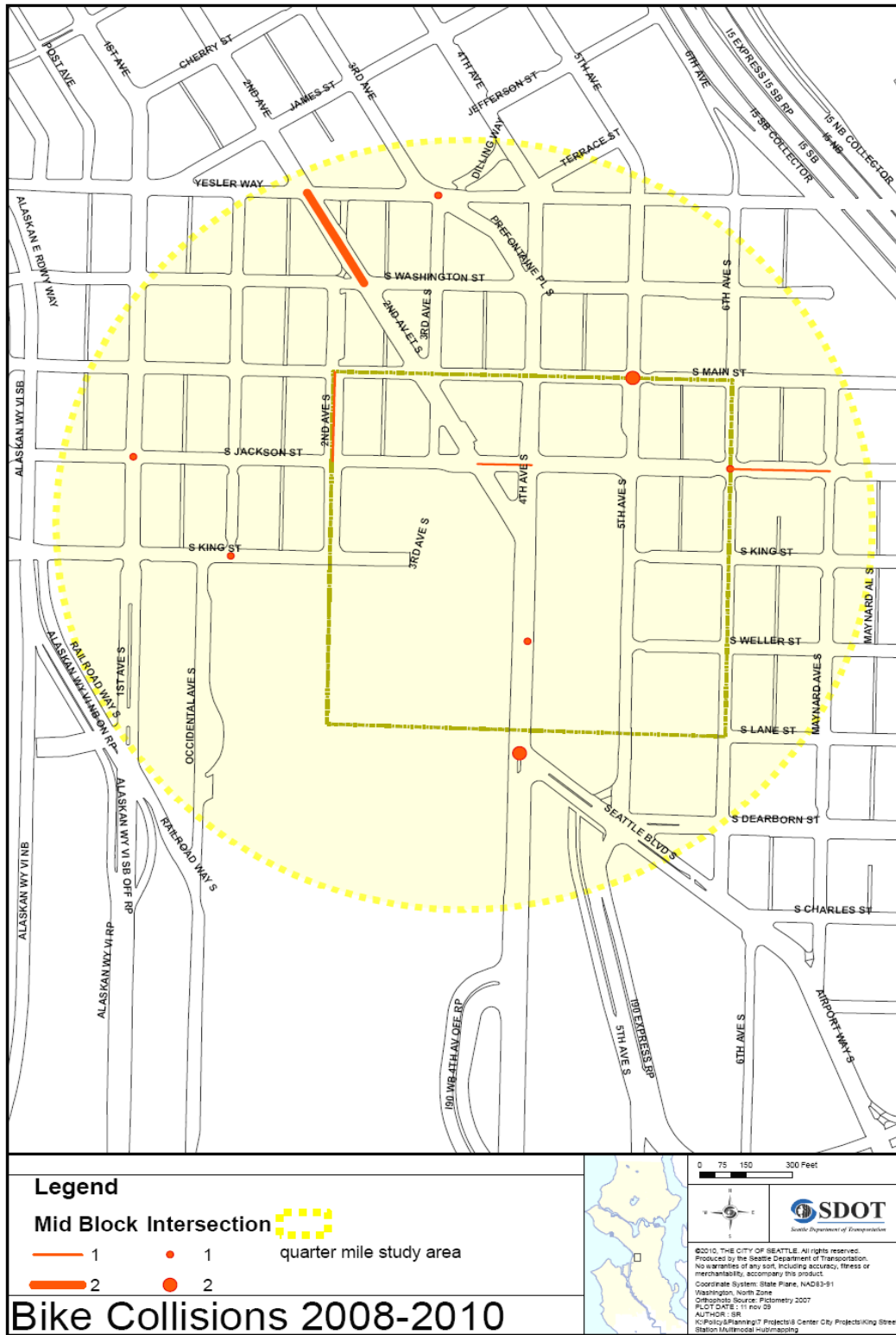
This final assessment will be presented to the Seattle Department of Transportation to consider the impact of this project on people’s health. I am wondering if you have about 15 minutes to answer some questions?

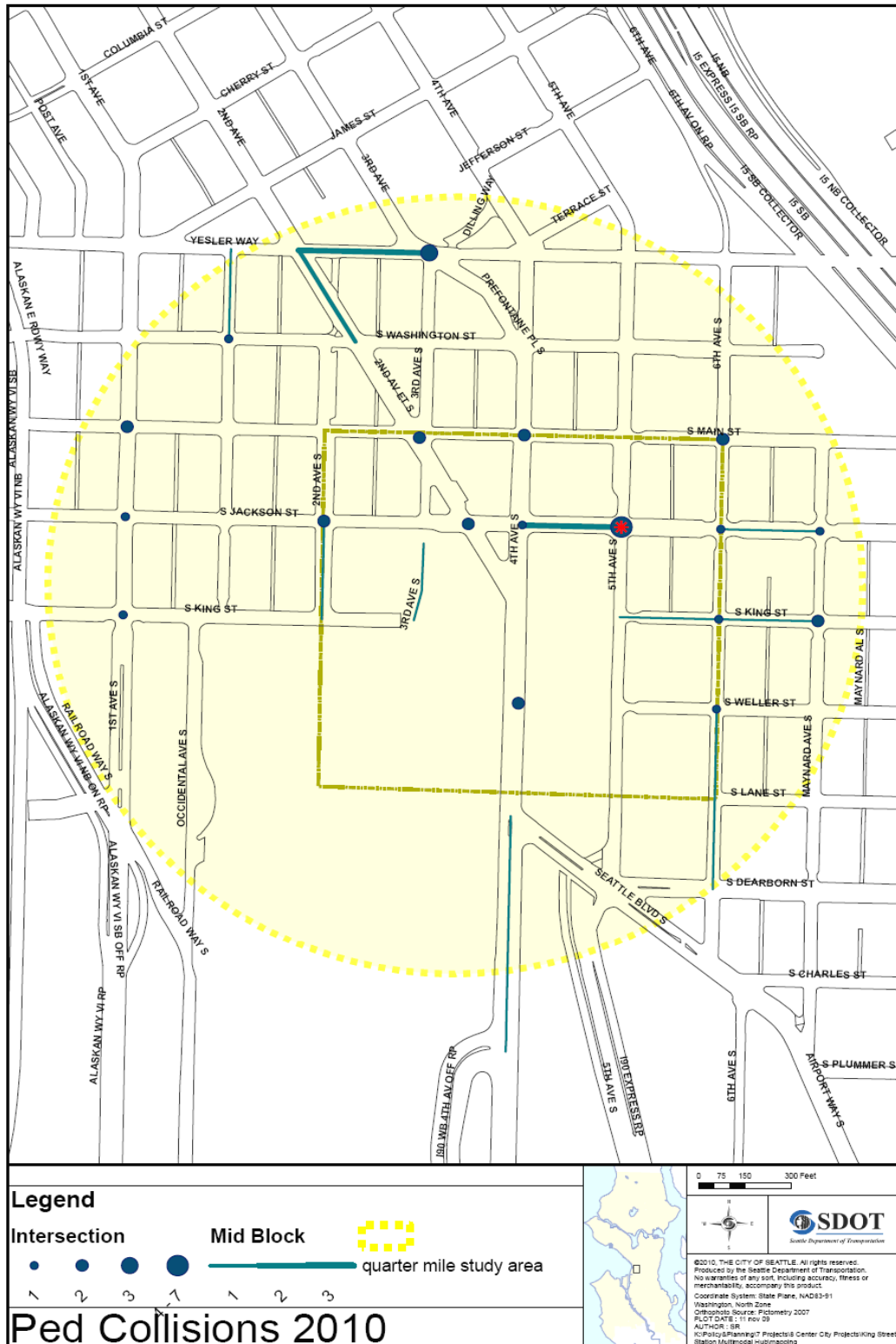
In case you are not familiar with this project, SDOT plans to cap the railroad tracks at King Street Station and make numerous seismic upgrades in a several block area around the station. There are also plans to close 2nd Avenue Extension South, but the timeline on this is unknown. By 2013 the First Hill Streetcar will be in operation.

1. Did you know of the transportation changes that are being proposed in the area?
2. Can you tell us about the population you work with?
3. How many people do you serve in this area?
4. Tell me about the transportation needs of the individuals you serve. Are there any special considerations?
5. What is your sense of how this project will impact the population that you work with?
6. What do you think are some (other) things that the Seattle Department of Transportation can do to help improve the overall health of the populations that you work with?
7. Do you know of any agencies that we could contact that also work with the population you serve?

Thank you for your time.

# Appendix B: Collision Maps by Mode





**Legend**

**Intersection**  
 1 2 3  
 1 2 3

**Mid Block**  
 1 2 3

quarter mile study area

**Ped Collisions 2010**

0 75 150 300 Feet

**SDOT**  
 Seattle Department of Transportation

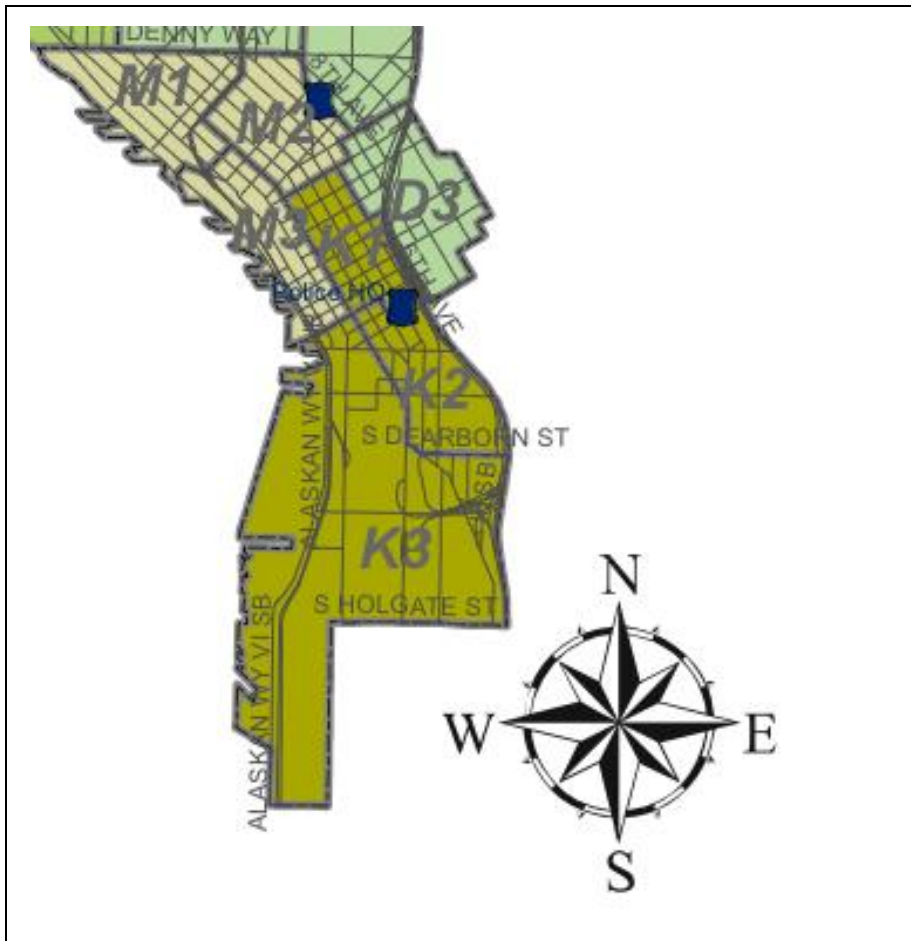
©2010 THE CITY OF SEATTLE. All rights reserved.  
 Produced by the Seattle Department of Transportation.  
 No warranties of any sort, including accuracy, fitness or  
 merchantability, accompany this product.  
 Coordinate System: State Plane, NAD83-91  
 Washington, North Zone  
 Orthophoto Source: Pictometry 2007  
 FILE DATE: 11/11/09  
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 Station\Multimedia\mapmaking





## Appendix C: Seattle Police Department Precinct and Beat Map (South Side of the West Precinct)

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## Appendix D: Recommended Tree Species for Air Pollution

Nowak, D. & Heisler, G. (2010). *Executive Summary: Air Quality Effects of Urban Trees and Parks* (pp. 35-38). Ashburn, VA: National Recreation and Park Association.

### *Best Tree Species for Air Temperature Cooling*

<b>Species Latin Name</b>	<b>Common Name</b>
<i>Acer rubrum</i>	red maple
<i>Aesculus hippocastanum</i>	horse chestnut
<i>Betula alleghaniensis</i>	yellow birch
<i>Cedrus deodara</i>	deodar cedar
<i>Celtis occidentalis</i>	northern hackberry
<i>Fagus grandifolia</i>	American beech
<i>Fraxinus americana</i>	white ash
<i>Juglans nigra</i>	black walnut
<i>Liquidambar styraciflua</i>	sweetgum
<i>Liriodendron tulipifera</i>	tulip tree
<i>Magnolia acuminata</i>	cucumber tree
<i>Picea abies</i>	Norway spruce
<i>Pinus strobus</i>	eastern white pine
<i>Platanus hybrida</i>	London planetree
<i>Populus deltoides</i>	eastern cottonwood
<i>Taxodium distichum</i>	baldcypress
<i>Tilia americana</i>	American basswood
<i>Tsuga canadensis</i>	eastern hemlock
<i>Ulmus americana</i>	American elm
<i>Zelkova serrata</i>	Japanese zelkova

### *Best Tree Species for Reduction of Various Pollutants (not a comprehensive list)*

<b><i>Carbon Monoxide</i></b>	
<b>Species Latin Name</b>	<b>Common Name</b>
<i>Aesculus hippocastanum</i>	horse chestnut
<i>Betula alleghaniensis</i>	yellow birch
<i>Carpinus betulus</i>	European hornbeam
<i>Carya glabra</i>	pignut hickory
<i>Catalpa speciosa</i>	northern catalpa
<i>Celtis occidentalis</i>	northern hackberry
<i>Chamaecyparis thyoides</i>	Atlantic white cedar
<i>Fagus grandifolia</i>	American beech
<i>Fraxinus americana</i>	white ash
<i>Ligustrum sinense</i>	Chinese privet
<i>Liriodendron tulipifera</i>	tulip tree
<i>Paulownia tomentosa</i>	royal paulownia

<i>Picea rubens</i>	red spruce
<i>Prunus serotina</i>	black cherry
<i>Sassafras albidum</i>	sassafras
<i>Thuja plicata</i>	western red cedar
<i>Tilia americana</i>	American basswood
<i>Tsuga canadensis</i>	eastern hemlock
<i>Ulmus americana</i>	American elm

#### *Ozone*

<b>Species Latin Name</b>	<b>Common Name</b>
<i>Acer rubrum</i>	red maple
<i>Aesculus hippocastanum</i>	horse chestnut
<i>Betula alleghaniensis</i>	yellow birch
<i>Carpinus betulus</i>	European hornbeam
<i>Carya caroliniae-septentrionalis</i>	southern shagbark hickory
<i>Celtis occidentalis</i>	northern hackberry
<i>Corylus colurna</i>	Turkish hazelnut
<i>Fagus grandifolia</i>	American beech
<i>Fraxinus americana</i>	white ash
<i>Juglans nigra</i>	black walnut
<i>Liriodendron tulipifera</i>	tulip tree
<i>Magnolia acuminata</i>	cucumber tree
<i>Metasequoia glyptostroboides</i>	dawn redwood
<i>Sassafras albidum</i>	sassafras
<i>Sequoia sempervirens</i>	coast redwood
<i>Prunus serotina</i>	black cherry
<i>Tilia americana</i>	American basswood
<i>Tsuga canadensis</i>	eastern hemlock
<i>Ulmus americana</i>	American elm
<i>Zelkova serrata</i>	Japanese zelkova

#### *Sulfur and Nitrogen Oxides*

<b>Species Latin Name</b>	<b>Common Name</b>
<i>Acer rubrum</i>	red maple
<i>Aesculus hippocastanum</i>	horse chestnut
<i>Betula alleghaniensis</i>	yellow birch
<i>Cedrus deodara</i>	deodar cedar
<i>Celtis occidentalis</i>	northern hackberry
<i>Fagus grandifolia</i>	American beech
<i>Fraxinus americana</i>	white ash
<i>Ginkgo biloba</i>	ginkgo
<i>Gymnocladus dioicus</i>	Kentucky coffeetree
<i>Juglans nigra</i>	black walnut
<i>Liriodendron tulipifera</i>	tulip tree
<i>Magnolia acuminata</i>	cucumber tree
<i>Picea abies</i>	Norway spruce
<i>Pinus strobus</i>	eastern white pine
<i>Platanus hybrida</i>	London planetree
<i>Populus deltoides</i>	eastern cottonwood
<i>Tilia americana</i>	American basswood
<i>Tsuga canadensis</i>	eastern hemlock
<i>Ulmus americana</i>	American elm

<i>Zelkova serrata</i>	Japanese zelkova
------------------------	------------------

<i>Particulate Matter (PM10)</i>	
<b>Species Latin Name</b>	<b>Common Name</b>
<i>Abies concolor</i>	white fir
<i>Calocedrus decurrens</i>	incense cedar
<i>Cedrus deodara</i>	deodar cedar
<i>Chamaecyparis thyoides</i>	Atlantic white cedar
<i>Cryptomeria japonica</i>	Japanese red cedar
<i>Cupressus macrocarpa</i>	Monterey cypress
<i>Magnolia grandiflora</i>	Southern magnolia
<i>Picea abies</i>	Norway spruce
<i>Picea pungens</i>	blue spruce
<i>Picea rubens</i>	red spruce
<i>Pinus ponderosa</i>	ponderosa pine
<i>Pinus strobus</i>	eastern white pine
<i>Pinus taeda</i>	loblolly pine
<i>Sequoia sempervirens</i>	coast redwood
<i>Taxus cuspidata</i>	Japanese yew
<i>Thuja plicata</i>	western red cedar
<i>Tilia americana</i>	American basswood
<i>Tsuga canadensis</i>	eastern hemlock
<i>Ulmus americana</i>	American elm
<i>Zelkova serrata</i>	Japanese zelkova