

Health Impact Assessment

Seattle's Delridge Corridor Multimodal Improvement Project



Editors:

Gabrielle Gundersen

Hilary Jauregui, MN, RN

Meg Mager, MSc

Corey Snelson, PhD



UNIVERSITY *of*
WASHINGTON

Acknowledgements

The University of Washington Health Impact Assessment authors:

Benjamin Adrian, Rachel Beck, Bourke Betz, Jim Buckley, Dan Farmer, Katie Fellows, Gabrielle Gundersen, Josi Herron, Lee Hicks, Eva Hom, Ross Howell, Hilary Jauregui, Eric Knigge, Cait Lang, Meg Mager, Aaron Parker, Rebekah Petroff, Tashina Robinson, Andrew Rudzitis, Marissa Smith, Crystal Snare, Corey Snelson, Brittany Weldon, Maggie Willis and Dustin Wolfe

We would also like to thank the following people and organizations for their guidance, leadership, time, and generosity over the past ten weeks:

Andrew L. Dannenberg, MD, MPH

Affiliate Professor

Department of Environmental & Occupational Health Sciences, School of Public Health

Department of Urban Design and Planning, College of the Built Environments

University of Washington

Former Team Lead

Healthy Community Design Initiative

National Center for Environmental Health

Centers for Disease Control and Prevention

Fritz Wagner, PhD

Research Professor

Department of Urban Design and Planning, College of the Built Environments

University of Washington

Managing Director

Northwest Center for Livable Communities

Dean Emeritus

College of Urban and Public Affairs

University of New Orleans

Edmund Seto, PhD, MS

Associate Professor

Department of Environmental & Occupational Health Sciences,

School of Public Health

University of Washington

David Goldberg

Senior Planner

Seattle Department of Planning and Development

Sara Zora, MUP

Senior Transportation Planner

Seattle Department of Transportation

Suggested Citation

Gundersen, G., Jauregui, H., Mager, M. & Snelson, CD. (eds.) (2015). Seattle's Delridge Corridor Multimodal Improvement Project: A Health Impact Assessment

Figure 1 (title page): Mural on Retaining Wall at Youngstown Cultural Arts Center

Table Of Contents

Acknowledgements	ii
Suggested Citation	ii
List of Tables, Maps and Figures	v
Acronyms & Definitions in the HIA	vi
Executive Summary	vii
Introduction	1
About the Delridge Corridor	3
Background and HIA Scope	6
Why The Delridge Corridor?	6
What is a Health Impact Assessment?	7
What is the HIA Process?	7
Methods	8
Zoning	9
Mobility	11
Walkability & Multimodal Transportation	12
Recreation & Physical Activity	15
Disability Access & Wayfinding	18
Social Capital	21
Aesthetics & Green Space	27
Green Spaces & Nature Contact	28
Art & Community Aesthetics	31
Environmental Health	34
Soil	35
Water	38
Air	40
Healthy Housing	43
Noise	45
Safety	47
Traffic Safety	48
Crime & Crime Prevention	51
Disaster Response & Resilience	56
Access to Social & Community Services	60
Gentrification	61
Social Services	64
Food Access	66
Employment	69
Education	71

Priority Recommendations73
Monitoring & Evaluation75
Conclusion78
References79

List of Tables, Maps and Figures

Tables

Table 1: SDOH Domains and Sample Measures in HP2020	1
Table 2: Delridge vs. Seattle Demographics	4
Table 3: Health in Delridge, Compared to Other Seattle neighborhoods.....	5
Table 4: HIA Process.....	7
Table 5: Delridge Community Groups.....	22
Table 6: HIA Impact Analysis Summary of Findings	23

Maps

Map 1: Seattle's Delridge Corridor	3
Map 2: Zoning in Delridge	9
Map 3: Accessible Green Spaces in the Delridge Corridor	28
Map 4: CSOs in Delridge and West Seattle	35
Map 5: Vehicle Collisions on Delridge Way	48
Map 6: Bicycle Collisions on Delridge Way.....	49
Map 7: Pedestrian Collisions on Delridge Way	50
Map 8: Neighborhoods in Delridge	51

Figures

Figure 1: Mural on Retaining Wall at Youngstown Cultural Arts Center.....	Title Page
Figure 2: Sports fields along Delridge Way	15
Figure 3: Delridge Community Assets.....	21
Figure 4: Green Space Near Longfellow Creek.....	28
Figure 5: Greenery Along Delridge Way.....	29
Figure 6: Community Mural on Retaining Wall of Youngstown Cultural Arts Center	31
Figure 7: Relationship Between Employment and Health	69
Figure 8: Logic Model for the Evaluation of the Delridge Corridor Multimodal Transportation Project Health Impact Assessment	77

Acronyms & Definitions in the HIA

Acronyms

ADA	Americans with Disabilities Act
CSC	Community social capital
CSO	Combined Sewer Overflow
DON	Seattle Department of Neighborhoods
DPD	Seattle Department of Planning and Development
HIA	Health Impact Assessment
HLA	Healthy Living Assessment Report
PM	Particulate matter
SES	Socioeconomic status
SPU	Seattle Public Utilities
SDOH	Social Determinants of Health
SDOT	Seattle Department of Transportation
SOAC	Seattle Office of Arts and Culture
UW	University of Washington
VOCs	Volatile organic compounds

Definitions

Active Transport	Any transportation that is human-powered, including walking, biking, running, using a non-mechanized wheelchair, rollerblading, skateboarding, as well as walking to and from bus stops.
Complete Streets	Creation and maintenance of streets safe for everyone – pedestrians, bicyclists, transit riders and persons of all abilities, drivers and freight. It is the lens through which SDOT views major projects. ¹
“Eyes on the Street”	More people moving around in an area means more observers to dissuade and intervene on criminal acts. This effect is what Jane Jacobs calls, “eyes on the streets.” ²
Green Space	Undeveloped land that is accessible to the public, and is partly or fully covered with grass, trees, shrubs, or other vegetation. ⁴
Parklets	Converts a few parking spaces into an open space or park for all to use, which is privately-funded and maintained by the hosting organization. ³
Sharrows	Shared street lane markings to guide bicyclists to the safest place to share the road with drivers while also avoiding opening car doors. They do not designate a location for exclusive bicycle use as a bike lane does; rather, it is a guide to cyclists and motorists for safely sharing the lane. ⁵
Streateries	A sidewalk café nestled into a parklet. ³
Walkability/ Bikeability	Communities that allow and encourage residents to participate in regular active transportation by locating services, and transportation all within a short and safe walk or bicycle ride.

Executive Summary

The World Health Organization defines Social Determinants of Health (SDOH) as “the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life.”⁸ SDOH have substantial impacts on physical and mental health, as well as the quality of life, for both individuals and communities. The ways in which communities are designed and built have systematic impacts on health and strongly shape the social landscape. Increasingly, public health and urban planning professionals are collaborating to create environments that are not only pleasant places to live, work and play,

but also support health and promote equity.

HIA Process

Steps	Activities
Screening	Determine if HIA is feasible Determine if HIA would be helpful in decision-making process
Scoping	Create plan and timeline Identify priority issues Identify research methods
Assessment	Learn about current conditions in the area and/or population to predict change Evaluate potential health impacts
Recommendations	Develop recommendations to improve proposal and/or mitigate negative health impacts
Reporting	Create written report of HIA findings Communicate the results
Monitoring	Track the effect of HIA on decision-making process, decision and implementation Track the effect of the decision on health determinants

Health Impact Assessment

A Health Impact Assessment (HIA) is a tool for evaluating the potential health impacts of policies, plans, and projects on a population’s health. The overall goal of an HIA is to present practical recommendations that lead to health-supportive actions by decision-makers, which also promote health equity. See the figure on the left for the steps in the HIA process.

Project Background

The purpose of Seattle’s Delridge Corridor Multimodal Transportation Improvement Project is to transform the Delridge Corridor into a safer and healthier public space with predictable movement of people and goods. This project focuses on Delridge Way SW, between the West Seattle Bridge and SW Roxbury Street, and parallel streets.

HIA Team

A team of University of Washington (UW) graduate students, in partnership with the Seattle Department of Transportation (SDOT) and the Seattle Department of Planning and Development (DPD), conducted a voluntary, rapid HIA for the Delridge

Corridor Project. This project is part of SDOT's Multimodal Corridor Program, which focuses on transforming major arterial roads and associated streets into safer and healthier public spaces.

HIA Goals

The HIA was conducted over 10 weeks, from April 2 through June 4, 2015. The goals of this HIA were to help SDOT and DPD:

1. Examine the potential health impacts of proposed conceptual designs
2. Take steps to mitigate potential negative health impacts, and enhance positive health effects of the project.

Delridge Neighborhood

Seattle's Delridge neighborhood is located southwest of the downtown core. The Delridge Corridor extends from the West Seattle Bridge to Roxbury Way SW, and includes Delridge Way SW and parallel streets. Delridge is more diverse than the city of Seattle as a whole. The neighborhood has a higher percentage of people of color, foreign-born residents, and residents who speak a language other than English at home. The neighborhood also lags in educational attainment and experiences disproportionately high rates of numerous health conditions, such as obesity and cancer. In addition, Delridge residents die 6 years earlier than residents in the Seattle neighborhood with the longest lifespans. The median household income for the area is \$53,078 versus \$60,665 for all of Seattle. The Kirwan Institute has characterized South Delridge as a very-low opportunity neighborhood and North Delridge as a low opportunity neighborhood.¹

Scope of the HIA

The HIA team, together with Sara Zora of SDOT and David Goldberg of DPD, identified seven health areas of focus for this HIA.

1. Zoning
2. Mobility
3. Social Capital
4. Aesthetics & Green Space
5. Environmental Health
6. Safety
7. Access to Social & Community Services

Methods

Data from a variety of secondary sources was used, including technical and academic literature, public reports, previous HIAs and a field visit to the Delridge Corridor to evaluate each health focus area.

Key Findings

This HIA finds that the Delridge Corridor Multimodal Transportation Improvement Project could have a significant positive impact on health, as well as a moderate negative impact.

Zoning

A well-zoned and developed neighborhood has appropriately dense housing options, walkable communities, access to commercial businesses such as grocery stores and restaurants and adequately placed green spaces that contribute to overall health, wellbeing, and longevity. Zoning is crucial for creating healthier spaces. DPD has determined that the current zoning in Delridge does not adequately serve the needs of the community and are hosting community meetings to help better understand those needs in order to adequately plan for expected changes to the Delridge neighborhood as the population of Seattle increases.

Mobility

A consistent network of safe, multimodal thoroughfares to connect community members to places they frequent is essential in Delridge. While residents are geographically close to parks, trails, community centers, and other community assets and services, the absence of complete streets (safe streets for all users, including pedestrians, cyclists, transit users, and motorists of all ages and abilities) and linkages among community destinations limit residents' access and use. In addition, narrow sidewalks and those in a state of disrepair pose particular difficulty to residents with limited mobility. Further, the lack of an interconnected network discourages active transportation (any human-powered transportation) and the use of non-automobile modes. Lower access to green spaces can negatively affect mental health, while lower levels of physical activity negatively affects both mental and physical health.

Social Capital

Social capital describes the social relationships among community members, which foster trust and norms of reciprocity. Delridge has a wealth of community resources (e.g., parks, community centers, art installations) that could encourage social interaction and a sense of community, however, these resources are not currently well integrated into the neighborhood infrastructure and thus are not readily accessible by foot, bike, or bus, limiting their ability to enhance social capital. Higher social capital is consistently associated with better health across a variety of conditions – stroke, heart disease, suicide, and more. The Delridge Corridor Project offers an opportunity to enhance social capital-promoting features in the area, and in turn contribute to the physical and mental wellbeing of local residents.

Aesthetics & Green Space

There is mounting evidence that interaction with nature, and participation in art, each positively influence mental and physical health. Importantly, research has shown that children in particular benefit from art and green spaces; increased access to, and involvement in, art, is associated with higher literacy and increased academic achievement. Contact with nature is essential for healthy mental and cognitive development in young children, and studies have shown that poor access to urban green spaces is associated with behavioral problems and inattention and hyperactive disorders. Ensuring equal access to green spaces and nature for

vulnerable communities, like South Delridge, is crucial to social space to build community resilience. Urban green space contributes to equity by providing public outdoor spaces and access to nature for families without gardens or yards. Further, community-initiated and executed art projects create an opportunity for neighborhoods to come together, fostering social cohesion and potentially decreasing health-related inequities within the community.

Environmental Health

The environments in which people live, grow, and play enormously impact their health. It is important to consider the potential effects the Delridge Corridor Project on the quality of the air, water, soil, noise, and housing in the surrounding community. For instance, soil compaction and instability caused by construction and demolition can negatively affect the water that feeds into nearby Longfellow Creek. The creek is a source of drinking water and habitat for animals, and if polluted, could transmit disease. Air pollution from construction and increased traffic can also raise the risk of cancer, heart and lung disease, and increase hospitalizations from asthma and other respiratory illnesses. Noise pollution from traffic or construction can cause a variety of health issues, from stress to tinnitus (ringing in the ears) and difficulty sleeping – a problem on its own, and one that exacerbates other health conditions. Healthy and safe housing can lead to decreases in respiratory illness, reduced falls, and burns, and reduced cognitive impairment from excess environmental lead and depression caused by living in low-quality housing.

Safety

Safety plays a vital part in the health of individuals and the community by diminishing harm and stress. Safety can also foster a sense of community by instilling trust and respect among neighbors. Unsafe driving along Delridge Way SW is a top-ranked community-reported concern, reflecting the importance of traffic safety to local residents. Property crime ranked #2 and an overall sense of safety related to high-profile crimes (gangs, gunshots, etc.) ranked #4, indicating the concern of local citizens for their own personal safety in terms of crime. While not included on the list, disaster preparedness is always an important part of safety, especially given Seattle's predisposition for landslides, earthquakes, flooding, and volcanic activity.

Access to Social & Community Services

Social services, food, education, affordable housing, and well-paying jobs are critical to increasing the health of any neighborhood. Many studies have demonstrated that education is the cornerstone of living a longer, healthier life. During revitalization of an area, it is important for planners to recognize critical areas that affect the long-term health of residents such as access to schools, libraries, and green space and assure that they are easy to access. Mindful planning to assure that large-scale displacement of long-term residents does not occur through revitalization efforts is of critical importance for maintaining a healthy community that reflects the diversity of Delridge.

Key Recommendations

SDOT and DPD should consider integrating the following priority recommendations into the Delridge Corridor Transportation Improvement Project to enhance the health benefit to the community:

Create a Complete, Safe and Connected Network: SDOT

1. Focus public transit, bike lane, sidewalk, and street improvements on creating a complete network that connects residents to community services, green space, and other community assets in line with the Seattle Transit, Bicycle, and Pedestrian Master Plans.
 - a. Install a transit-only lane in one direction throughout Delridge Way SW, and in two directions where right of way allows

Strengthen Community Engagement: SDOT and DPD

2. Establish robust communication lines with local residents and engage the community in each stage of the project – planning, implementation, monitoring, and evaluation
 - a. Establish a community coalition for oversight, community representation, and feedback. The coalition should include representatives from all stakeholder groups
 - b. Provide translated materials and language interpretation at all meetings targeting groups who speak a language other than English
 - c. Make concerted efforts to include vulnerable and traditionally underrepresented groups through partnership with the DON Public Outreach and Engagement Liaisons and Disability Rights Washington
3. Integrate communitywide celebrations throughout the project
 - a. Celebrate the completion of the project with a communitywide celebration
 - b. Educate community groups about free Neighborhood Block Party Permits and encourage celebrations at major accomplishments in the project

Ensure Safety: SDOT

4. Ensure that all sidewalks meet the six-foot requirement of the Seattle Right-of-Way Improvement Manual and repair existing sidewalks to improve wheelchair accessibility and general usability for all residents
5. Enhance safety of roadways through speed reductions of 5-10 mph, narrowed streets, and lanes to encourage speed reduction and installation of automated speed monitoring cameras, especially near schools and parks
6. Install safe, ground-level, protected pedestrian crossings in community-identified intersections and access points, as well as those identified by safety data

Utilize Construction Impact Mitigation: SDOT

7. Use Best Construction Practices for mitigating environmental pollution

Support the Development of Community Assets: SDOT

8. Work with other City of Seattle departments to increase green space in the Delridge area, including the incorporation of vegetation and natural materials into roadway design, expansion of existing parks, and addition of new parks and parklets
9. Together with SOAC and funding from the DON, support community-based art projects on retaining walls, non-arterial streets and intersections, pedestrian overpasses, and other visible public spaces, with special emphasis on engaging youth and historically underrepresented groups in these projects
10. Use biophilic design – incorporate plants, natural materials and/or public art and décor that mimics natural elements – such as trees and grasses as buffers between streets and the sidewalk
11. Work with DON and the Delridge community to identify sub-neighborhoods, and provide wayfinding signage and support for community-based art to identify each area and promote a sense of place and community cohesion

Change Zoning: DPD

12. Grant permits for larger multi-family unit developments, but permits with more than 10 units should include a minimum of 10% affordable housing, for the lowest third of the income bracket of the city of Seattle
13. Support planned zoning changes for Brandon and Andover nodes, which include increased commercial zoning

Monitor Health Impact: SDOT and DPD

14. Partner with Public Health – Seattle/King County or the UW to update this HIA with a more detailed review for health issues once a clear proposal or potential options have been identified for the project
15. Develop and maintain an Evaluation Team to evaluate the impact of this HIA

This HIA shows how Seattle’s Delridge Corridor Multimodal Transportation Project, through changing the way that residents move through and interact with their environment and each other, has the potential to profoundly improve disparities, and increase the health and wellbeing of the overall community. The recommendations provided here will assist SDOT, DPD, policymakers, and community stakeholders enhance the health- and equity-promoting aspects of this project.

Introduction

The World Health Organization defines Social Determinants of Health (SDOH) as “the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life.”⁸ SDOH have substantial impacts on physical and mental health, as well as the quality of life, for both individuals and communities. SDOH include varied influences, such as the availability of resources to meet daily needs (e.g. safe, affordable housing, access to healthy food), access to quality education and employment, transportation options, safety and exposure to crime and violence. The ways in which communities are designed and built have systematic impacts on health and strongly shape the social landscape.

Healthy People 2020 (HP2020) is a set of 10-year national objectives, produced every 10 years by the US Department of Health and Human Services, for improving the health of all Americans.⁹ It includes a wide variety of specific and ambitious, yet achievable, health benchmarks covering more than 40 topic areas, including nutrition, child development, cancer and SDOH. Of particular relevance to this report, two of the overarching goals of HP2020 are to (1) achieve health equity, eliminate health disparities and improve health for all groups, and (2) create social and physical environments that promote good health for all.

New to HP2020 is a set of objectives specifically focused on SDOH, which are organized into five key domains:

<p>Neighborhood & Built Environment</p>	<ul style="list-style-type: none"> • Zoning & development for access to healthy food & housing • Environmental conditions surrounding living conditions that influence the health of whole neighborhoods
<p>Social & Community Context</p>	<ul style="list-style-type: none"> • Willingness to participate in civic actions • Social cohesion • Perceptions of discrimination & inequity
<p>Education</p>	<ul style="list-style-type: none"> • % of students completing primary education • Early child development • Language & literacy
<p>Economic Stability</p>	<ul style="list-style-type: none"> • Poverty • Food & housing security • Sustained employment
<p>Health & Health Care</p>	<ul style="list-style-type: none"> • Access to health care • Access to primary care • Health literacy

Table 1: SDOH Domains and Sample Measures in HP2020

To address health inequities created through SDOH, HP2020 recognizes two key strategies as essential: the use of Health Impact Assessments (HIAs) to analyze the health effects of proposed policies, and a “health in all policies” approach to consider how well-intended neighborhood improvement policies may actually negatively affect vulnerable populations.

In 2008, recognizing health disparities between different racial and ethnic groups based on SDOH, which disproportionately affect vulnerable populations, King County and Seattle adopted separate but similar initiatives that focused on race, equity, and social justice. Each initiative promotes analysis of proposed policy changes to assure that all impacts are considered by proposed policies before implementation. Guidelines from HP2020 and the Seattle’s Race and Social Justice Initiative were crucial to the crafting of the recommendations found throughout this HIA.¹⁰ HIA is a tool for evaluating the potential health impacts of policies, plans, and projects on a population’s health. The overall goal of an HIA is to present practical recommendations that lead to health-supportive actions by decision-makers, which also promote health equity.

The subject of this HIA is Seattle’s Delridge Corridor Multimodal Transportation Improvement Project. This project is part of SDOT’s Multimodal Corridor Program, which focuses on transforming streets or combinations of streets into safer and healthier public spaces. This HIA evaluates the potential health effects of the conceptual designs put forward by SDOT for The Delridge Corridor, and offers recommendations to maximize health benefits and minimize harms to the Delridge community.

A team of 25 UW graduate students conducted this HIA as a part of a course on HIAs. The multidisciplinary team included broad perspectives, with students from degree programs in health services, environmental health, epidemiology, public health genetics, public affairs, landscape architecture, real estate, civil engineering, environmental science, and nursing. The HIA was conducted over 10 weeks, from April 2 through June 4, 2015. Project leaders at SDOT and DPD provided consultation and guidance throughout the HIA process. This HIA was a voluntary, rapid HIA, which used currently available data to make determinations about the health impacts of the proposed project.

This report is organized into twelve sections. It begins with the Introduction and Background and HIA Scope sections, which provide an overview of the project, Delridge population, and the HIA process. The subsequent sections include a chapter for each of the health areas analyzed in this HIA. Within each chapter, specific components of the health area are considered through analysis of its impact on health, the current conditions in Delridge, and an assessment of the opportunities for improvement in Delridge, followed by a set of recommendations. The HIA concludes with prioritized recommendations for the project – anticipated to have the greatest impact on health – as well as a discussion of monitoring and evaluation, and a conclusion.

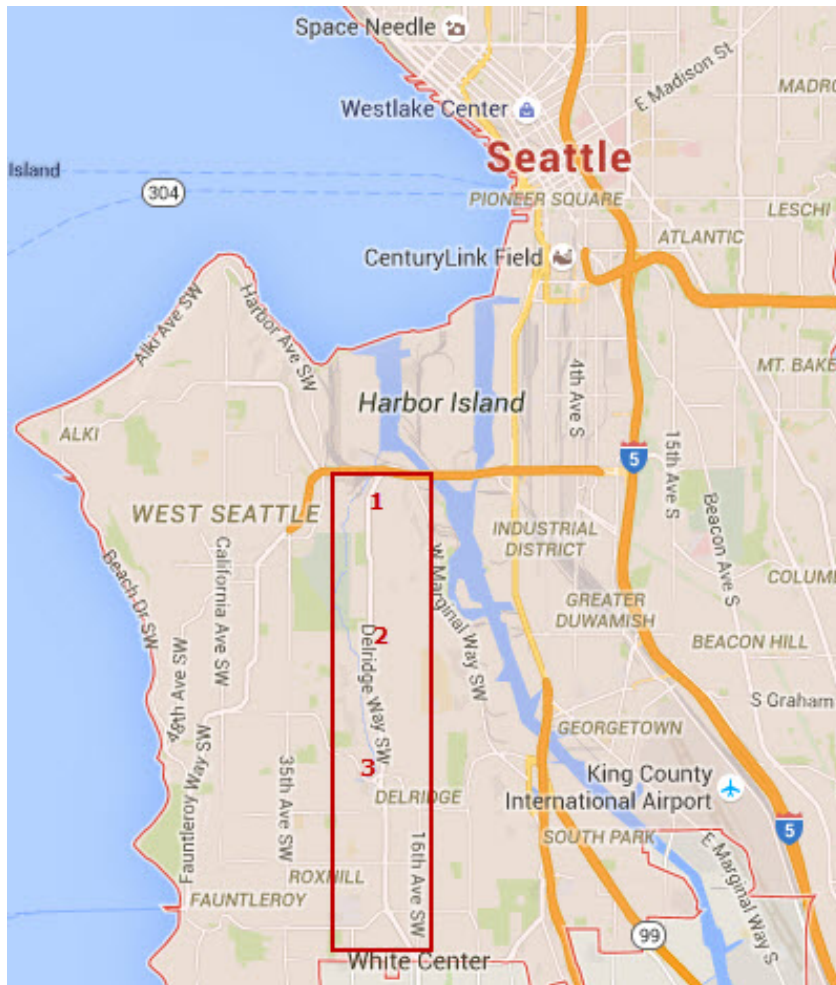
Ideally, an HIA is conducted when there are specific design alternatives under consideration. At the time of this HIA, the conceptual design for the Delridge Corridor project was still under development and SDOT had yet to hold formal community meetings for resident feedback on the plans. Therefore, SDOT provided a series of potential transit corridor designs for evaluation, which will certainly evolve as community input is gathered.

About the Delridge Corridor

The purpose of Seattle's Delridge Corridor Multimodal Transportation Project is to transform the Delridge Corridor, which includes Delridge Way SW and parallel streets between the West Seattle Bridge and SW Roxbury St. The goal is to make the Delridge corridor into a safer and healthier public space with predictable movement of people and goods. SDOT will invest in projects for The Delridge Corridor to create improvements that provide more travel choices to move safely in and around Seattle.

Seattle's Delridge neighborhood is located southwest of the downtown core. The Kirwan Institute has characterized South Delridge as a very-low opportunity neighborhood and North Delridge as a low opportunity neighborhood.¹ SDOT's Delridge corridor project has the potential to help address this issue by bringing opportunity to an opportunity-deprived area through fostering stronger connections between residents and places and bringing high quality public transit to the neighborhood.

In 1999, the City of Seattle and the Delridge community collaborated to develop the "Delridge Action Plan," a guide to focus the development of the area's affordable housing, wellbeing, diversity and other community features.⁴ One of the objectives in this plan was to create "activity nodes," or centers of mixed-use clusters of commercial, business, entertainment, community and/or public spaces at street level, with housing above. Each node is intended to



serve as the anchor of the surrounding area, as well as to reflect the unique character of that area. Today, the nodes are still developing. Though the Action Plan proposed four nodes, there are currently three in Delridge (Andover, Brandon and Sylvan), as shown in the map to the left. These areas continue to be the target for more concentrated development in Delridge.

Map 1: Seattle's Delridge Corridor

- 1: Andover Node**
- 2: Brandon Node**
- 3: Sylvan Node**

Demographics

The population of Delridge differs greatly from the city of Seattle as a whole, and from most other areas across the city. It is more diverse than Seattle overall and most other Seattle neighborhoods. In fact, in the adjacent neighborhood, 85.2% of residents identify as White, compared to just over half of Delridge residents. More Delridge families speak a language other than English at home and were born outside of the US. Delridge lags in educational attainment, but the population is also young – almost a quarter of residents are under 17 years of age. Table 2 compares the demographic characteristics of the Delridge population with the city of Seattle.










The average life expectancy in Delridge is just 79.2 years, the third lowest life expectancy among Seattle neighborhoods. Residents of Delridge live approximately six years fewer than residents of Seattle’s northeastern neighborhoods, who have an average life expectancy of 85.1 years.² These alarming disparities in life expectancy among groups living within the same city reflect underlying inequities.³ Such inequities – resulting from avoidable and unjust policies and practices that create barriers to opportunity and access to services – lead to poor health outcomes, and disproportionately affect people of color, as well as low-income, non-English-speaking and disabled individuals, among others. These social injustices often create circumstances in which some groups lack access to healthy food, safe places to exercise and recreate, as well as stable and safe housing. As a result, they experience much higher rates of chronic disease and other negative health outcomes compared to more privileged populations (e.g. high-income). While Delridge residents

Table 2: Delridge vs. Seattle Demographics

	Delridge	Seattle
Total Population	30,296	608,660
Age (%)		
0-17	23.6%	15.4%
18-24	8.5%	11.8%
25-44	36.2%	37.2%
45-64	23.5%	24.9%
65+	8.2%	10.8%
Median Household Income	\$53,078	\$60,665
Race/Ethnicity		
White	53.5%	69.5%
Black/ African-American	14.5%	7.9%
Asian	16.6%	13.8%
Hispanic Latino	13.2%	6.6%
Multiple race	6.6%	5.1%
American Indian/ Alaska Native	1.6%	0.8%
Native Hawaiian/ Pacific Islander	1.3%	0.4%
Education (25+ years)		
High school diploma	87%	92%
College degree	35%	65%
Other Characteristics		
Foreign-born	22%	17%
Non-English speaking at home	29%	21%

experience relatively high rates of many major health problems, more concerning is the how those rates compare with other Seattle neighborhoods. As shown in Table 3, the residents of Delridge experience disproportionately poor health when compared to other neighborhoods within Seattle.

Table 3: Health in Delridge, Compared to Other Seattle neighborhoods

Health Measure	Delridge	Rate Relative to Other Neighborhoods
Cancer		2 nd highest
Heart Disease		Higher than most
Stroke		Higher than most
Chronic Lower Respiratory Disease		Highest
Collisions		2 nd highest
Suicide		2 nd highest
Obesity		Highest
Liver Disease/ Cirrhosis		2 nd highest
Self-rated health: Fair or poor		Highest

The UW HIA team identified six health areas for focused assessment, each of which comprises a chapter:

1. Zoning
2. Mobility
3. Social Capital
4. Aesthetics & Green Space
5. Environmental Health
6. Safety
7. Access to Social & Community Health Services

This HIA shows how the Delridge Corridor Multimodal Transportation Project, in changing the way that residents navigate and live in the Delridge neighborhood, has the potential to profoundly improve these disparities, as well as the health and wellbeing of the overall community. The recommendations provided will assist SDOT and DPD to enhance the health- and equity-promoting aspects of this project.

Background and HIA Scope

Why The Delridge Corridor?

SDOT's Delridge Corridor project has the potential to help address health equity issues by bringing opportunity to an opportunity-deprived area through fostering stronger connections between residents and places and bringing high quality public transit to the neighborhood.

Approximately 30% of the U.S. population does not have access to transportation that would easily allow them to access basic needs like food, medical care, services, employment opportunities and education.¹ These are often members of very vulnerable communities, and for those who do have access to personal transportation, the vehicles are often older, unreliable and less fuel-efficient making trips more expensive and undependable. Low-income neighborhoods and communities of color have higher rates of traffic collisions and fatalities despite driving less than their more affluent, white counterparts.¹ Thoughtfully designed transportation can connect socio-economically disadvantaged, elderly and disabled populations with job and education opportunities and with access to services and social support. It can also help stimulate economic activity and foster community health.

Approximately one in five Americans over age 65 require other modes of transportation to leave their home.² More Delridge residents (43%) use alternative forms of transportation such as public transit, walking or biking than the Seattle average (32%).³ Transportation costs can be regressive with low-income households having to spend a higher percentage of their income on transportation costs compared to median income households. Spending more income on transportation costs means these families have less money to spend on food, housing, health care, and other necessities. How Delridge residents move around the Puget Sound from home to work or school, to places like grocery stores, healthcare clinics and community centers matters. It can help keep them healthy or make them sick.

What is a Health Impact Assessment?

HIAs systematically evaluate the potential health effects of a plan, policy, program, or project. There is special emphasis on the distribution of health effects – particularly how the proposal affects vulnerable populations. HIAs use diverse methods and resources, drawing upon input from community members, health experts, and decision-makers to analyze health impacts of a proposal. The goal is shape public decisions to promote and improve a population’s health, as well as to reduce health inequities experienced by vulnerable subpopulations. HIAs offer recommendations for improvements to the proposal to enhance the positive health effects and eliminate or mitigate the negative ones.

What is the HIA Process?

The following table outlines the 6 steps involved in conducting an HIA.

Table 4: HIA Process

Steps	Activities
Screening	Determine if HIA is feasible Determine if HIA would be helpful in decision-making process
Scoping	Create plan and timeline Identify priority issues Identify research methods
Assessment	Learn about current conditions in the area and/or population to predict change Evaluate potential health impacts
Recommendations	Develop recommendations to improve proposal and/or mitigate negative health impacts
Reporting	Create written report of HIA findings Communicate the results
Monitoring	Track the effect of HIA on decision-making process, decision and implementation Track the effect of the decision on health determinants

Methods

This HIA for SDOT's Delridge Corridor Multimodal Transportation Project is the final product of a graduate HIA course offered jointly by the University of Washington's School of Public Health and College of Built Environments. The goals of this HIA were to help SDOT and DPD:

1. Examine the potential health impacts of proposed conceptual designs.
2. Take steps to mitigate negative health impacts, and enhance positive health effects on the Delridge community during and after the Delridge Corridor Multimodal Transportation Project.

Screening

Dr. Andrew Dannenberg and Dr. Fritz Wagner worked with SDOT and DPD prior to the beginning of the UW HIA course to determine a project that would be well suited to, and would benefit from, a health impact analysis.

Scoping

The HIA team, together with Sara Zora of SDOT and David Goldberg of DPD, identified six health areas of focus: mobility, access to social and community health services, community and mental health, aesthetics and green space, environmental health and safety.

Assessment

For the assessment phase, data from a variety of secondary sources was used, including technical and academic literature, public reports, previous HIAs and a field visit to the Delridge Corridor to evaluate each health focus area.

Recommendations

Recommendations for each health focus area were developed and then prioritized to a set of recommendations that are specific, measurable, realistic, and anticipated to provide significant health benefit.

Reporting

The findings of the HIA were compiled into this written HIA report. In addition, the HIA findings were presented to SDOT and DPD stakeholders on June 4, 2015. Minor changes were made to the HIA in response to feedback following the presentation.

Monitoring

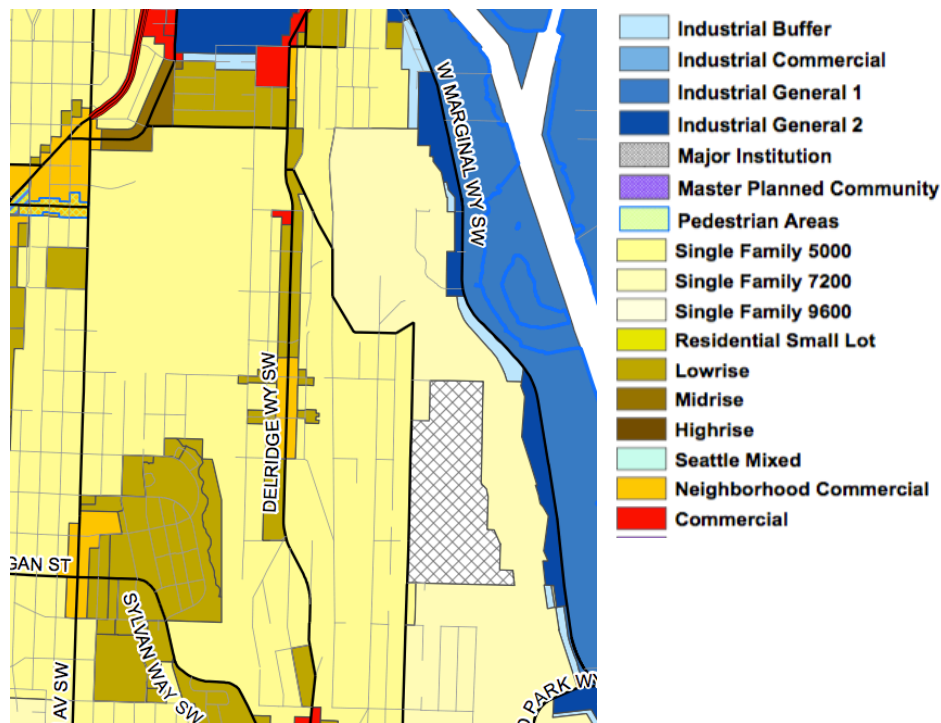
Due to time constraints and the timing of the HIA, the UW team will not be able to conduct the monitoring step for this project. Instead, a monitoring plan is proposed in the conclusion of this report.

Zoning

A well-zoned and developed neighborhood has appropriately dense housing options, walkable communities, access to commercial businesses such as grocery stores and restaurants and adequately placed green spaces that contribute to overall health, wellbeing, and longevity. Zoning is crucial for creating healthier spaces. Areas zoned for residential housing located near to industrial areas may be more polluted; wide areas primarily zoned for residential housing may be cut off from access to grocery stores, green spaces and commercial areas, potentially increasing communicable disease transmission and stress from added traffic from further travel to find healthy and fresh food.

Current Conditions in the Delridge Corridor

The Delridge neighborhood is predominantly zoned for single-family housing, with moderate amounts of low-rise multi-family housing. Commercial zoning is limited, with small pockets located largely at the northern and southern portions of Delridge.



Map 2: Zoning in Delridge

Delridge is primarily zoned as multilevel residential with limited neighborhood commercial zones. Large swaths of residential zoning create a neighborhood that is challenging to navigate any other way than by car. If this area were zoned with more commercial space it could encourage retail businesses such as grocery stores to move into the area. Delridge residents do not currently have easy access to grocery shopping, which impedes resident's ability to eat a healthy, well-balance, culturally appropriate diet.

Assessment

DPD handles commercial, industrial, multifamily and single-family zoning across all of Seattle. DPD has determined that the current zoning in Delridge does not adequately serve the needs of the community and are hosting community meetings to help them understand those needs better in order to adequately plan for changes that are expected to come to the Delridge neighborhood as the population of Seattle increases.

DPD must also carefully consider changes to zoning in Delridge. If areas that have classically been zoned for single-family residences are re-zoned to multifamily residences, gentrification could occur through demolition of single-family homes to build condominiums and microhousing units.

Impact on Health

Zoning code in Seattle and surrounding areas governs how development occurs over time and specifies certain districts for residential, commercial, and industrial areas. Zoning is of critical importance; improperly zoned areas can lead to major health effects through:

- Communicable disease outbreaks through increased exposure to pollution and widespread contamination of soil, air and water;
- Preventing access to commercial spaces that provide healthy and safe food;
- Gentrification of neighborhoods and increased displacement by allowing high-end communities to be built in historically red-lined neighborhoods
- Impeding access to green spaces
- Making transit between home and work more difficult, potentially increasing traffic and stress

Recommendations

1. DPD should consider holding community meetings to determine the needs of the residents of Delridge, and plan zoning according to the expressed needs of the residents.
2. DPD should practice mindful zoning to prevent gentrification and displacement of long-term residents, often people of color.
3. DPD should consider rezoning Delridge Way SW to encourage denser mixed use development
4. DPD should consider rezoning and developmental incentives to encourage centralized expansion around existing areas of dense community assets, especially around the established nodes.

Mobility

Mobility and access are a critical issues for any place, but especially so in Delridge. Valley geography limits cross-streets, parallel access roads and concentrates both local and through traffic onto Delridge Way. This geography also limits density, destinations and makes reliance on car-based transport a way of life for many residents. With rapid growth expected in the coming decades, this is unsustainable.

Another concern is safety. Delridge already has a high pedestrian and biking injury rate, and with more intensive roadway use due to the growing population, the rate will continue to climb without major pedestrian and biking infrastructure investment.¹

Active transportation is any transportation that is human-powered. This includes walking, biking, running, use of a non-mechanized wheelchair, rollerblading and skateboarding, among others. Walking to and from bus stops is also considered active transportation. Active transportation has a positive impact on health by encouraging physical activity. It also increases social interactions among participants, lessens traffic congestion, reduces pollution, as well as saves money on vehicle maintenance, fuel, and parking.

Proximity to transit helps determine travel choice. Twenty-nine percent of people using transit to get to work meet daily requirements for adequate physical activity just from active transportation to work.² Increased physical activity decreases risk of premature mortality, coronary heart disease, hypertension, colon cancer and diabetes, and may reduce depression and anxiety as well as decreasing obesity and other consequences of chronic disease.¹

Community engagement will support success and greater equity of this rezoning and transport revitalization project. Training community groups in Pedestrian Environmental Quality Index audits and performing them with a trained auditor can engage, inform and activate community, as well as provide feedback to SDOT on how the community views their specific needs.⁵ Another option is for SDOT to pursue partnerships with local universities; for most value to community, research should employ community-based participatory research methods.

It is essential that Delridge community members be consulted regarding what concerns local businesses – particularly those owned by residents of color – have about rezoning, health, and transportation. Similar projects have used this public meeting and question-asking process to educate groups and communities on the impacts of zoning, health and transportation options.¹ Community groups, Parent-Teacher Associations and local business groups, as well as housing-disadvantaged groups, will need to be part of planning as this project goes forward so that their concerns about access to preferred destinations, housing, health and area development to help shape the evolution of their community.

Walkability & Multimodal Transportation

Whether walking to the bus stop or from the parking lot to the intended destination, every person trip begins and ends with walking. While the human anatomy is built for walking, the environments in which humans live have been designed for automobiles rather than pedestrians. When asked why they don't walk or bike more often, survey respondents often cite a lack of safe sidewalks and places to bike as a primary reason.¹ According to the 2001 National Household Transportation Survey, 65% of metropolitan trips under one mile are made by automobile, in part because of incomplete streets that make it dangerous or unpleasant to walk, bicycle, or take transit.² It is essential that pedestrians, bicyclists and transit riders have access to safe, well-connected infrastructure that connects them to where they work, shop, gather, recreate, and more. Only through such design changes will it be possible to decrease auto dependence and increase the use of multimodal transportation – including pedestrian, bicycle, transit and automobile modes.

Current Conditions in the Delridge Corridor

Delridge Way, a fast moving arterial connecting the neighborhood to other destinations within the city, bisects this predominantly residential corridor. In addition to serving as an integral bus route, Delridge Way runs adjacent to many community gathering places and services. Currently, there are few protected signals for pedestrians to safely cross the arterial at street level. While planners have attempted to rectify the situation with a pedestrian bridge at SW Oregon Street, residents are often seen crossing unsafely at the unprotected intersection below the pedestrian bridge.

In addition to having limited pedestrian crossings, the neighborhood also has significantly fewer complete sidewalks (52%) than the city (72%).³ Many existing sidewalks are too narrow for a wheelchair and pedestrian to comfortably pass one another without requiring one to move off the designated path. It is unclear whether these narrow sidewalks or those with cracks are included in the 52% of sidewalks deemed complete. Pedestrians and bicyclists traveling along residential streets throughout the corridor find a patchwork of *complete streets* (streets safe for the full range of multimodal use) and incomplete streets.³ The complete streets, which contain wide sidewalks and *sharrows* (shared lane bicycle markings) are aesthetically pleasing and comfortable to walk or ride along. However, the interruption of incomplete streets reduces safety and comfort within the larger network.

At the very least, multimodal infrastructure needs to connect residents to employment, community and economic centers, as well as recreation facilities. Currently, 19.8% of Delridge residents who work outside the home commute to work using *active transport*—public transit (15.8%), walk (2.3%), bicycle (1.6%)—a sum considerably less than the citywide percentage of 32.1%.³ Many community centers and recreational facilities are located on either side of the arterial, which can be used to facilitate movement between such locations.

Impact on Health

Walkable and bikable communities are ones that both allow and encourage residents to participate in active transportation on a regular basis by locating stores, business, schools, libraries and transportation all within a short and safe walk or bicycle ride of residents. Transportation facilities, such as the presence and condition of sidewalks and design of roads, can encourage or impede physical activity. Increase physical activity is associated with reducing the risk for many chronic diseases, including obesity which is prevalent among Delridge adults (22.9%).^{4,5} Among youths, positive sidewalk characteristics, safe crossings, and traffic-calming features such as speed humps and traffic lights are related to greater total physical activity, which can help develop lifelong healthy active transportation habits.⁶ While these factors are inconsistently associated with total physical activity in adults, a study has shown adults living in highly *walkable* neighborhoods engaged in 41 more minutes of total physical activity per week when compared to those living in low-walkability neighborhoods.⁷

In addition to access to safe transportation infrastructure, walkable neighborhoods are also influenced by aesthetic and community elements. Aesthetic design strategies that promote physical activity and psychological health include, but are not limited to, tree canopy along pedestrian paths, landmark buildings, clean streets and sidewalk cafés (or “*streateries*”). Windows and other elements that reduce crime and increase security by promoting increased public usage are important – more people out in the community mean more “*eyes on the street*” to dissuade and interrupt crime or violence.¹⁰ Multiple studies have reported that higher levels of both neighborhood walkability and physical activity are associated with reduced risk of depression, after adjusting for other factors.^{8,9}

Assessment

The areas where Delridge has begun to implement complete streets are clearly utilized by community members, particularly those near greenbelts. However, the neighborhood lacks a consistent network of safe, protected pedestrian and bicycle thoroughfares to connect community members to the places they frequent. As part of the Delridge Corridor Multimodal Improvement Project, SDOT should partner with community members to use the “Issues and Opportunities” identified during community meetings to map a complete pedestrian and bicycle network to connect residents to community resources (e.g., schools, recreation facilities, community centers, libraries, stores, etc.). In an effort to collaboratively identify active transportation networks, community members should be engaged in the process and use community knowledge to identify intersections and other access points along Delridge Way that require protected pedestrian signals for safe crossing. These crossings should be at street level to ensure they meet the needs of all residents.

Another way to incorporate community input is to have residents create a cohesive community theme, or thematic nodes, to be incorporated into future transit and development projects. By establishing a culturally appropriate theme and specific design elements (e.g., trees, murals, etc.), resident stakeholders could provide a more concrete sense of place and community both for Delridge residents and those visiting the neighborhood. Thoughtfully implemented aesthetic elements and transportation infrastructure will promote active transportation, mental health, and community cohesion.

Recommendations

To improve neighborhood walkability and transportation options in the Delridge Corridor, SDOT should consider the following recommendations:

1. Design all transportation facilities (i.e., pedestrian, bicycle, and transit) for all ages, abilities and cultures (i.e., linguistically appropriate) present within the community.
2. Improve walkability and bikeability by developing a pedestrian and bicycle network, with multiple avenues for community members to participate in and provide feedback on the networks.
 - a. Have the community identify intersections and other access points along Delridge Way that require safe, ground level, protected pedestrian crossings.
 - b. Prioritize pedestrian and bicycle infrastructure that completes the network and safely connects residents to the locations they frequent in line with the Seattle Bicycle and Pedestrian Master Plans.
3. Install transit-only lane in one direction and two directions where right of way (ROW) is available.
 - a. Install bus bump-outs for pedestrian safety and transit efficiency
4. Direct bike traffic to greenways, and discuss biking with community groups to learn preferences and interest protected greenway bike lane
 - a. Connect greenways to Alki and Duwamish Trails, and West Seattle and Spokane bridges.
 - b. Complete bike network with multiple connections to destinations of community interest.
5. Add a protected bike lane where the greenway off-Delridge is unavailable.
6. Install wayfinding signs in transit shelters and include maps of bike lanes and connections to destinations of community interest, e.g., community centers, and food and business districts, per the Seattle Transit Master Plan.
7. Work with residents to establish a community design theme that reflects the neighborhood's unique identity, and integrate this theme into all future development to create a sense of place for community members and visitors.

Recreation & Physical Activity

Recreational opportunities in a community are closely linked to the quality, number, and accessibility of community centers, parks and other recreation areas.¹ Furthermore, they can help foster a sense of community and place felt by residents and other recreation space users.² Thus, community design can play a critical role in promoting or limiting recreational activities. Effective community design enables active living and recreation access and opportunities and outcomes such as physical activity, stress alleviation, and safety.^{1,3} In contrast, poor community design can limit access to recreational opportunities, eliminating access or locations where community and physical activity can be fostered.

Current Conditions in the Delridge Corridor

The Delridge Corridor is home to an abundance of structured and unstructured green space and a number of community centers and pools to promote recreation and enable active living (See Figure 2).⁴ Delridge exceeds benchmarks for all but one of the five recreation indicators outlined in the background Healthy Living Assessment (HLA). For example, 99% of residents live within ¼ mile of a park, however park space may not be ideally suited for children, as only 42% live within ¼ of a mile of a playground. Additionally, as all residents live within 1 mile of a community center and with the numerous sports fields, the Longfellow creek trail, and other green spaces, Delridge far exceeds the benchmarks for acres of parkland per 1,000 households (41.6 versus 1) and residents (16.6 versus 10.3).

A number of physical activity indicators set for the HLA also exceed benchmarks, in particular the ratio of miles of bike facilities per mile of roadway (20% compared to the 10% Seattle average) but these indicators evaluate built environment and access, not necessarily actual use. All residents live within ½ mile of a bus or rail stop, and very few live without a car (only 7.5% of households). Theoretically, this conveys improved access to recreation and physical activity. However, access can be limited by parking restrictions, heavy traffic, sidewalk access—only 52% of roadways have complete sidewalks, and it has been noted that recreation sites could be better utilized to engender a sense of community and place.⁴



Figure 2: Sports fields along Delridge Way

Delridge is among Seattle's most diverse neighborhoods, but as previously reviewed, it is one not without substantial health disparities.⁶ It has the highest proportion of children and adolescents (23.6%) of any Seattle neighborhood and a low proportion of individuals aged over 65 (8.2%), an age distribution expected to be associated with good health and high levels physical activity. However, according to the 2010 census, more Delridge residents have fair or poor health (16%) than any other Seattle neighborhood and a high proportion (15%) reported no physical activity in the last 30 days—this in spite of the abundant green space, sports fields and trails in the neighborhood.⁵

Impact on Health

Community design affects human health quite significantly through creation and maintenance of recreational sites (and access to these community resources), which promote physical activity and active living. Physical activity is closely linked to human health through the reductions in obesity, which is important given the associations between obesity and diabetes, heart disease and stroke, cancer.⁷⁻¹¹ The most immediate impact of low physical activity is obesity—also related to nutritional access, which in the long term is linked to the more distal, downstream adverse health outcomes. However, physical activity conveys immense reductions in negative risks, particularly for heart disease, and urban development offers a number of solutions to improve physical activity.^{12,1-3}

Critical mediators of the relationship between community design and physical activity include residents' proximity to parks through trails, safe roadways and sidewalks, social cohesion and safety, as well as the quality and size of parks and community centers.¹ Improved access, social cohesion, and recreational opportunities enable walking and cycling as transit methods to access parks and also within green spaces and community centers. However, it is important to emphasize the multi-faceted nature of predictors of activity. Studies have found that geographic access and walkability alone do not always result in more physical activity.¹³⁻¹⁵

Social cohesion and safety are underemphasized factors in considering the relationship between recreation spaces and physical activity. Access to recreation, particularly for children, is significantly restricted in communities that are not perceived as safe—whether judging by crime rates, safe streets—or social cohesion (e.g. level of segregation).¹⁶⁻¹⁸ Areas with crime, poor lighting, and many vacant areas convey disrepair and lack of safety to residents and disincentive physical activity.¹⁸ In turn, this reduces access to recreation and limits physical activity, particularly among children, while increasing risks of overweight and obesity.¹⁹⁻²¹

Assessment

Delridge currently has more than adequate amounts of recreation space to promote physical activity and improve human health, according to the HLA indicators.⁴ However, in spite of residents' geographic proximity to parks, trails, and community centers, actual physical activity is mediated by the completeness of streets and social cohesion (e.g., integration of diverse populations). The absence of complete streets (with sidewalks on both sides of the street), linkages between sidewalks and biking on the street grid, and limited parking can all be resolved. However, any re-construction of Delridge Way for the Multimodal Corridor Improvement project is likely to worsen each situation in the interim. Great care should be taken to promote access to green space and engender community amidst revitalization of the Delridge Corridor. In the final solution, planners should work with residents and community leaders to optimize parking opportunities for recreation spaces while also increasing safe access through healthier, more sustainable alternatives of walking, cycling, and public transit. In collaboration with the local community and Seattle Parks and Recreation, SDOT should also consider solutions such as pocket parks to revitalize vacant lots and areas without safe, easy access to playgrounds and other locations for children.²² These parks can be tailor made in a small lots to meet needs specific to proximate residents, which could be useful given the finding that only 42% of children have access to a playground within ¼ mile.⁴

Recommendations

1. DON should consider surveying residents from different age and gender subsets (i.e. adolescents, elders, etc.) from historically underrepresented groups regarding their use of recreation and community centers for physical activity and incorporate insights into policy recommendations for development and community centers to address equity while improving access to recreational activity.
2. DPD should consider continuing to address vacant lots, through advocating for re-zoning, or Seattle Parks and Recreation purchasing and developing vacant lots into pocket parks containing small playgrounds to improve children's access to playgrounds and improve physical activity.
3. SDOT should consider developing interim plans to preserve access to recreation activities amidst construction.
4. SDOT should consider prioritizing connectivity and access in the final solution by developing complete streets, with adequate lighting, sidewalks, crosswalks, and bike lanes to increase access to recreational sites in line with the Seattle Bicycle and Pedestrian Master Plans.

Disability Access & Wayfinding

The ease of physical navigation through a space is predicated on one's ability to maneuver and understand the environment. Disabilities, defined as limitation(s) on performing age- and socially-appropriate roles due to long-lasting physical, mental or emotional conditions, and language barriers present obstacles that are often overlooked by the general population in the U.S.⁵ The Americans with Disabilities Act (ADA) of 1990 prohibits discrimination based on disability and sets forth requirements for physical access of public spaces. Any public space that is not accessible to residents with disabilities constitutes discrimination under Title II of the ADA. Improvements such as widening and repairing sidewalks and providing safe and frequent crossings are needed to comply with these standards. Additionally, landmarks and maps in multiple languages for wayfinding are crucial to aiding navigation by non-English speakers.

Current Conditions in the Delridge Corridor

The Delridge Corridor serves a diverse community with varying levels of physical ability. Though the population of older adults is small, Delridge has high levels of obesity and other health problems (see Introduction). The rate of disability of residents aged 18 and older is approximately 23%.² In terms of linguistic limitations, 29% of Delridge residents do not speak English at home.³ Specifically, Delridge is home to large Vietnamese, Somali, and Cambodian communities. This data highlights the need for infrastructure that addresses the physical limitations of aging and disabled residents, and is useful to non-English speakers.

Impact on Health

Built environments become "disablist" when they do not meet basic needs of all users.⁴ Despite their prevalence in society, urban design often ignores or fails to meet the needs of individuals with disabilities because they lack representation in the design and development process. In addition to a lack of ADA-accessible infrastructure, streets left in disrepair pose a daily threat to residents with disabilities. Sidewalk cracks and potholes cause significant mobility impairment in adults with severe neuromuscular or movement-related disability.⁶ Additionally, elderly individuals are most likely of all age groups to suffer fatal injuries when struck by a car.⁷ Providing safer crossings and lowering speed limits can reduce the risks of these incidents.

Wayfinding comprises the many ways in which individuals navigate a space. It is crucial to the health and safety of the Delridge community, particularly for residents with disabilities and non-English speakers. Individuals rely on a combination of landmarks and route knowledge to navigate their surroundings and reach their destinations.⁸ While maps can be useful, landmarks are the most important navigational tool for pedestrians and thus should be incorporated frequently throughout the neighborhood.⁹ Distance information and street names are less frequently used by pedestrians, and are usually only available in English.¹⁰ It is important that residents and visitors to Delridge have clear visual cues in order to safely navigate their way through the community.

Walkability and open access have positive downstream effects for all people, particularly those with disabilities.¹¹ Being outside in the community facilitates development of social capital by allowing those with limited mobility or language barriers to interact with their neighbors and become involved with community issues. Social capital is critical for residents with disabilities who may be more isolated than their able-bodied peers, as improving social connections has a positive affect on mental health. Safety is also an issue for these populations; improved public infrastructure reduces the risk of injury and can increase physical activity by making people feel more comfortable spending time outside. Making streets safe and accessible to all residents – regardless of ability or background – is key to developing a connected and healthy community.

Assessment

While manageable in some parts, the majority of Delridge Way is not responsive to the needs of residents with disabilities. Most sidewalks are barely wide enough to fit a wheelchair and are in such a state of disrepair that they would be difficult to navigate in a wheelchair. The pedestrian overpass near the Delridge Playfield poses a significant challenge to residents in wheelchairs, as the slope is too steep for an individual to cross the road without assistance. There are several bus stops near the overpass, but the lack of surface-level crosswalks cause many individuals to illegally cross several lanes of fast-moving traffic. This is not an option for residents with limited mobility, who are forced to travel a long distance to the next crosswalk. Since King County Metro is ADA-accessible, public transportation provides a key service to disabled residents. However, most surface-level crosswalks are located far from bus stops along the corridor and thus pose a challenge for mobility-limited residents.

Wayfinding along Delridge Way is adequate but can be improved. Large neighborhood maps near some bus stops provide information about nearby parks and amenities, as well as educational information about preserving the natural environment. These signs provide useful information to residents and visitors, but do not extend along the entire length of Delridge Way. Additionally, information is only available in English.

Recommendations

To improve neighborhood accessibility for residents with disabilities and non-English speakers, SDOT should consider the following recommendations:

1. Include limited-mobility residents in the design and development process for the Delridge Corridor. SDOT could partner with Disability Rights Washington to address these issues.
2. Ensure that all pedestrian zones meet the minimum width requirement of six feet stipulated in the Seattle Right-of-Way Improvements Manual and repair existing sidewalks to improve wheelchair accessibility.
3. SDOT should add more surface-level crosswalks, specifically near Delridge Playfield and bus stops.
4. SDOT should consider enhancing existing crossings with tactile warning strips, sound- and light-enhanced crossing signals, and sloped curbs.
5. SDOT should consider providing wayfinding information in multiple languages (Spanish, Vietnamese, Somali, and Khmer) at bus stops.

6. SDOT and SOAC should consider creating identifiable landmarks along the Delridge Corridor through a community art project that honors the neighborhood's diverse cultures. This will require working closely with members of the community.
7. SDOT should consider consulting the Seattle ADA Compliance Team throughout the planning and construction phases of the Delridge Corridor Project.

Social Capital

Social capital describes the social relationships among community members, which foster trust and norms of reciprocity. High social capital helps community residents feel connected to one another and their community, trust each other, participate in the community (e.g. volunteering), as well as share resources and support. In high social capital communities, neighbors know each other, talk regularly, and help each other with different types of support.

Social capital offers many benefits both at the individual- and community-level. When neighbors trust each other and work together, they help to deter crime, spur economic growth and improve the quality of community resources – all factors positively linked to health. Research also shows that people who have rich social networks and who are active in their communities tend to live longer and enjoy better physical and mental health, even when accounting for such factors as ethnicity, income, and education.¹⁹ Community design influences both social capital and health – community engagement, green space, neighborhood walkability and connectivity, and place-making can be used to promote community social capital (CSC) and the health of area residents.

Current Conditions in the Delridge Corridor

Neighborhood-level data on CSC for the Delridge area is not currently available. However, in 2011 King County conducted a study on countywide social cohesion; King County scored a mean 36.2 out of a possible range of 10 (low) to 50 (high). However, there were notable differences once the data was broken down by area, income, age and other factors. Adults ages 18-44, Blacks and Asians, those born outside the US, and non-native English speakers – groups which are well-represented in Delridge – each reported lower levels of social cohesion. Based on this data it can be assumed that the Delridge area has lower levels of CSC relative to other Seattle neighborhoods.

Broadly defined, a community asset is anything that can be used to enrich the quality of life in a community, such as a park.²⁰ These assets create spaces both for formal and informal interaction among residents, provide access to valuable resources, and serve to strengthen local identity and neighborhood cohesion, all elements of CSC. Key community assets in the Delridge neighborhood are listed below in Figure 3.

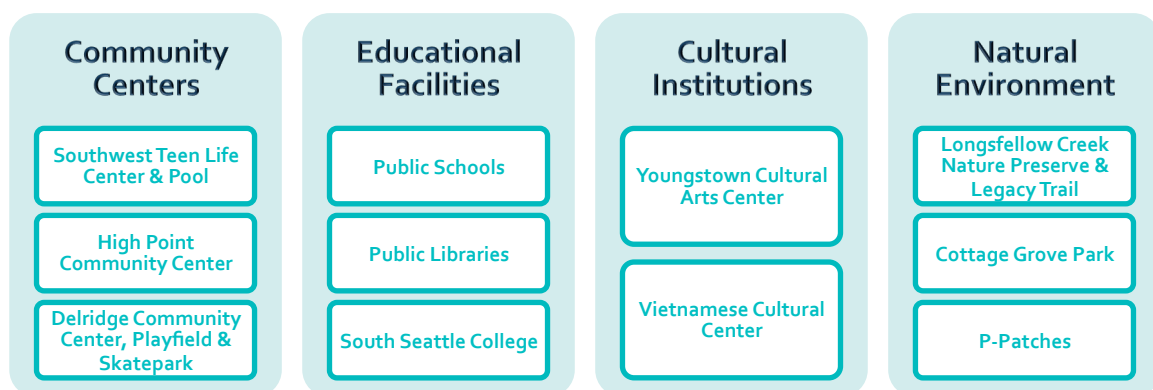


Figure 3: Delridge Community Assets

The Delridge area also features many built environment elements that promote social capital. The northern end of the Delridge Corridor between SW Genesee St. and Sylvan Way SW has significant green space and relatively wide sidewalks with tree lawns, features that improve walkability. Walkable neighborhoods encourage residents to walk, rather than drive, to local destinations and increase the likelihood of informal interaction.³ Certain stretches of the Delridge Corridor are less inviting to pedestrians, however. Heading south along Delridge Way SW, sidewalks narrow around Sylvan Way SW, where there are also fewer green buffer strips, infrequent crosswalks, and sidewalks are in poor condition.

Along with pedestrian features, the Delridge neighborhood has a number of art installments that add to the aesthetic appeal of the area, including murals, hand painted traffic signal control boxes, and public sculptures. Aesthetic elements enhance the quality of the neighborhood and create a sense of community identity.

While the Delridge community boasts a wealth of community assets, unfortunately, they are not well integrated into the neighborhood infrastructure.⁴ As a result, they are not readily accessible by foot, bike or bus, thus limiting their ability to enhance area social capital.

Another aspect of CSC that is very strong in Delridge is community engagement. Members of the Delridge community are highly civically engaged. The area has many community associations that advocate for change to enhance the wellbeing of local residents, including improved access to healthy foods and affordable housing. These groups also organize community events and programs that bring residents together and strengthen local social ties. Table 5 shows the breadth of community groups in Delridge.

Table 5: Delridge Community Groups

Camp Long Advisory Council	Pigeon Point Neighborhood Council
Delridge Grocery Co-op	Puget Ridge Neighborhood Council
Delridge Neighborhoods Development Association	Southwest Community Center Advisory Council
Delridge Neighborhoods District Council	Southwest Youth and Family Services
North Delridge Neighborhood Council	Sunrise Heights Neighborhood Association
High Point Neighborhood Association	West Seattle Transportation Coalition
High Point Resources Coalition	White Center Chamber of Commerce
Highland Park Action Committee	White Center Community Development Association
Highland Park Improvement Club	Westwood/Roxhill/Arbor Heights Community Council

Impact on Health

Community social capital affects health in three key ways:

1. Informal social control: in communities with high CSC, neighbors band together (independent of law enforcement) to discourage unwanted behaviors such as smoking, vandalism and crime.
2. Mutual aid: Social networks provide access to valuable social support and resources which can help people cope during difficult life events, and also provide means for advancement.
3. Ability to undertake collective action: Communities with higher collective efficacy are better able to negotiate for health facilities, transportation access and other community assets linked to mental health.^{18,19}

Extensive research has been done on the key health disparities seen in Delridge. It consistently shows that higher social capital improves these health outcomes. The following table summarizes the most recent research on the affect of the level of social capital on the health conditions that have the largest health disparities in the Delridge neighborhood.

Table 6: HIA Impact Analysis Summary of Findings – Interventions to Increase Social Capital

	Direction	Magnitude	Severity	Likelihood	Distribution
Cancer					
Incidence ⁸	Positive	Medium	High	Unclear	Equally distributed
Mortality ¹⁷	Positive	Medium	High	Possible	Equally distributed
Heart Disease ^{8,14}	Positive	Medium	Medium	Possible	Equally distributed
Obesity ¹³	Positive	High	Medium	Likely	Female residents impacted more
Lower Respiratory Disease ⁸	Uncertain	Medium	Medium	Unclear	Equally distributed
Stroke					
Incidence ¹¹	Positive	Medium	High	Likely	White residents impacted more
Mortality ¹⁰	Positive	Low	High	Likely	Equally distributed
Suicide ¹²	Positive	Medium	High	Possible	Males, Over 65-years-old males impacted more
Self-rated health ¹²	Positive	High	Low	Likely	Equally distributed
Liver Disease	No data	No data	No data	No data	

Research suggests that CSC offers valuable protection against depression and mental illness. Individuals who trust their neighbors are less likely to become depressed; those who are active in local associations and organizations are also less likely to experience depression, though the relationship is less robust.²¹ CSC appears to be especially important to the mental health of youth and the elderly, two key vulnerable groups. Studies show a strong inverse association between CSC and depressive symptoms, anxiety and mood disorders in children and adolescents.²² Elements of CSC most important to mental wellbeing in youth are neighborhood cohesion, the quality of the neighborhood environment and supportive social networks outside the home.²²

Social capital has also been shown to improve health disparities related to SES.¹⁵ People with lower SES tend to have low social capital, which is related to health disparities. High levels of social capital can buffer some of the negative impact on health from low SES for both children and adults. The trust, social networks and reciprocity present in a child's school, peer group and community, have far-reaching effects on behavior and development through opportunities, choices and educational attainment, in addition to health.¹⁶

Assessment

Both transportation systems and the design of a community affect the time available for social capital-building activities. Long work commute times are especially damaging to social capital; for every additional 10 minutes required to commute to work, there is a 10% decrease in social capital.¹⁶ Neighborhood walkability also affects CSC.³ In a well-connected, walkable communities, with easy access to local resources and employment, more time is available for:

- Extracurricular activities for children and teens,
- Recreation time for adults after work,
- Community involvement in activities to improve the community, and;
- Time for families to spend together.^{3,16}

Seattle's Delridge Corridor Project offers an opportunity to enhance social capital-promoting features in the area, and in turn contribute to the physical and mental wellbeing of local residents.

A key goal of the project is to improve neighborhood walkability and pedestrian safety. Planned enhancements include new and improved sidewalk infrastructure, additional crosswalks, and increased pedestrian lighting. Also planned is the introduction of the Safe Routes to School program, which includes placement of crossing guards at key intersections and crosswalks. These improvements would serve to strengthen social capital by increasing neighborhood pedestrian activity and opportunities for informal interaction, and by fostering a sense of safety.

Another focus of the Delridge Corridor project is the expansion of green space. Additional parks, green features, and trails along the Delridge Corridor would enhance the quality of the neighborhood environment and add community-shared spaces that promote neighborhood identity and cohesion.

The project also seeks to create a completed, connected network of multimodal pathways to improve access to community destinations and ensure better coordination among community assets and services. Interconnectedness among these resources foster spontaneous and information interactions among community members

Increasing social capital has numerous positive effects on health and the community, however, it can hurt historically underrepresented groups, who may have fewer opportunities to obtain and use social capital²⁵. In fact, people are healthier in communities with less close social ties than those in communities where they are socially excluded. It is of utmost importance to take steps to avoid inadvertently harming the very groups who stand to benefit most from building community social capital. By actively and meaningfully involving all historically underrepresented groups in Delridge, equal access to newly built social capital is fostered.

Recommendations

1. SDOT should consider forming a community coalition for oversight, community representation, and feedback. Ideally, the coalition should include representatives from all stakeholder groups in the Delridge community. Representatives from established community organizations in Delridge should be included to enhance connections among the groups.

Intentionally Include Historically Underrepresented Groups

1. The Department of Neighborhoods (DON) should consider utilizing the Public Outreach and Engagement Liaisons to:
 - a. Engage in community outreach with underrepresented groups to determine their priorities, needs and preferences.
 - b. Encourage the participation of members of underrepresented groups in ongoing project work (e.g. community coalition).
2. DPD and SDOT should consider addressing barriers to participation in the project process by ensuring a meeting accessible via public transportation, scheduled at a time that does not conflict with typical work or cultural religious/cultural activities, and provides on-site childcare.
3. DPD and SDOT should consider providing translated materials at all meetings, and interpretation at meetings targeting non-English-speaking groups.

Encourage Residents to be out in the Community

1. DPD should consider installing benches and work with SPU to install additional pet waste receptacles (Mutt Mitt dispenser) in parks and high pedestrian traffic areas along the Delridge Corridor to increase opportunities for informal social interaction.
2. DPD should consider centralizing development around the identified nodes to encourage use of community assets.

3. In line with the Seattle Bicycle and Pedestrian Master Plans, SDOT should consider focusing on multimodal connections among the community assets – particularly walking, biking and public transportation access – to facilitate increased use.
4. SDOT should consider supporting the organization of a Spring Clean Community Cleanup event in April or May 2016.
 - a. Supplies provided at no charge from SPU
 - b. Delridge community organization leads the event
 - c. DON should provide technical support to apply for \$1000 DON Small Sparks grant
5. SDOT and DPD should consider planning a community celebration at the completion of the project. Consider inviting community groups and organizations (e.g. the community centers) to present information at tables to build community awareness of and engagement with these resources.
6. The DON should consider conducting a brief social capital assessment in Delridge, as well as a reassessment after the project is completed to evaluate the change in social capital.

Aesthetics & Green Space

There is mounting evidence that interactions with nature and participation in art each positively influence mental and physical health. Importantly, research has shown that children especially benefit from art and green spaces; with increased access to, and involvement in, art they have higher literacy and increased academic achievement. Contact with nature is essential for healthy mental and cognitive development in young children and studies have shown that poor access to urban green spaces is associated with behavioral problems and inattention and hyperactive disorders.

Ensuring equal access to green spaces and nature for vulnerable communities, like South Delridge, is crucial to providing relief and social space to build community resilience. Urban green space contributes to equity by providing public outdoor spaces and access to nature for families without gardens or yards. Further, community-initiated and executed art projects create an opportunity for neighborhoods to come together, fostering social cohesion and potentially decreasing health-related inequities within the community.

Green Spaces & Nature Contact

Interaction or mere contact with nature and greenery can have significant benefits to one's mental wellbeing. Despite the average person spending 90% of their day indoors, most people have an inherent desire to be with nature.¹⁴ This idea that people have an instinctive emotional attachment to the natural world is called biophilia.¹ Growing research links nature contact, even in small doses, to a variety of long-term mental health benefits.



Figure 4: Green Space Near Longfellow Creek

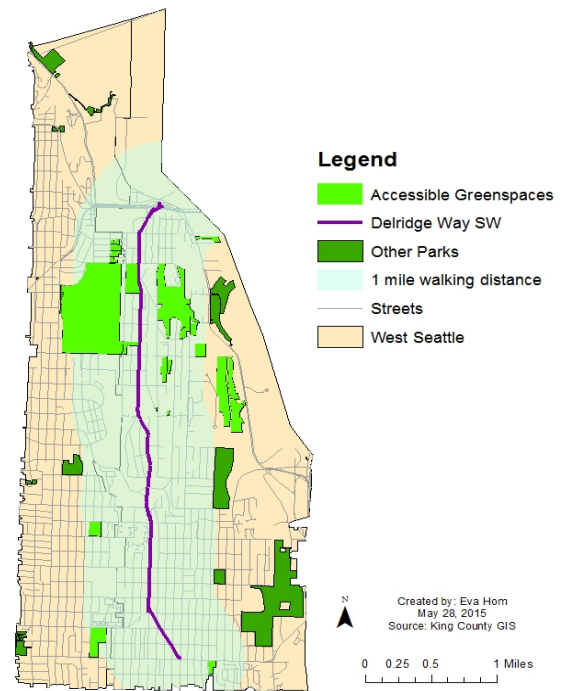
environment is often an afterthought or an addition made solely for aesthetic purposes; however, there is a plethora of evidence that supports green spaces as not only pleasing to the human experience but essential to wellbeing.

Current Conditions in the Delridge Corridor

Seattle's Delridge Corridor provides access to many parks and an abundance of opportunities for nature contact. In the four miles of the proposed project area, there are 16 parks, playgrounds and green spaces, all within a one-mile walk from Delridge Way SW. These destination green spaces provide, not only opportunities for physical recreation, but also the benefits of improving social connection and mental health.

Eighty-one percent of destination green spaces in Delridge are located in North Delridge. Traveling south on Delridge Way SW after Brandon Street, there is noticeably less greenery, particularly near the border of the White Center neighborhood on Roxbury Street.

In an urban built environment such as the Delridge Corridor there are many ways to incorporate biophilic features and ensure equitable access to green spaces and parks. This HIA outlines two key ways for nature contact to be enhanced: 1) by creating *destination spaces* such as parks and playfields to which people purposely travel to visit, and; 2) by *biophilic integration*, the deliberate inclusion of nature into the urban landscape. The inclusion of natural elements in the built



Map 3: Accessible Green Spaces in the Delridge Corridor

Impact on Health

A biophilic environment not only enhances wellbeing but also serves to shield against negative stressors such as anxiety, depression and aggression. Proximity to open green spaces in urban areas is associated with reduced stress levels.² Nature extends beyond trees and plants, other natural elements such as stones, water, and sunlight are equally effective in creating a healthy environment. In an increasingly techno-centric society, more time is spent in artificial settings, causing attention fatigue. Prolonged time in these settings is related to memory loss, diminished ability to focus, impatience and frustration. Contact with nature can provide attention restoration and improve task performance.³ Frequent, brief restorative nature experiences may, over the long run, offer cumulative benefits.¹

People of all ages benefit from nature contact, but for children, nature can play a crucial role in cognitive development and learning. A play session at an outdoor playground provides a very different experience than one indoors. Children's ability to develop perceptual and expressive skills, imagination, moral judgments and other attributes is greatly enhanced by contact with nature.³ Schools that bring children into natural places find that students perform better academically, and are more engaged and motivated to learn.⁴ Children can also reap educational benefits from learning *with* nature; more schools are building school gardens to help teach the sciences, teamwork, and nutrition. Nature provokes wonder, curiosity and engagement and can have a powerful impact on the cognitive development of Delridge neighborhood youth.



Figure 5: Greenery Along Delridge Way

The redesign of the Delridge Corridor will greatly impact how people interact with each other and their environment. Aside from the basic need for individuals to have a personal private space, they also need to feel like they share, own and are responsible for shared community space. Neighborhoods that provide equal access to parks and public spaces can promote informal social interactions in a pedestrian-oriented design. Public spaces that prioritize walkability and nature can nurture place attachment and a sense of community ownership. Transforming parts of Delridge that are not often frequented, blighted, or are perceived as uninviting or unsafe will encourage residents to use active transportation, socialize outside, and gather together creating positive social bonds and a safer, healthier community.

Assessment

While parts of the Delridge Corridor already have significant amounts of green space, this project presents an opportunity to create a biophilic corridor that can enhance mental and social health, and in turn decrease chronic disease burden. Nature integration can play a prominent role in creating pedestrian-oriented streets and improve the traveler's experience. Integrating nature into the area does not have to be large scale, quite the contrary; it can be the small changes and subtle details that make an impactful difference. The following recommendations advocate for incorporating biophilic design and reimagining the streets not as conveyance for automobiles and traffic, but as a community space where people can experience nature as part of their daily routine and promote mental and social health.

Recommendations

Incorporate nature into the Delridge Corridor Multimodal Improvement Project

1. In collaboration with the Urban Forest Stewardship Plan, plant more trees and shrubbery along the Delridge Corridor, incorporating them into the streetscape.⁵
2. Build rain gardens to collect and treat stormwater and self-support greenery.
3. Install public benches and seating on sidewalks under tree shade.
4. Use natural materials (e.g., rocks, pebbles, water, and sustainable woods), when appropriate, and include public art and décor that mimics natural elements.
5. Use easy-to-maintain grasses and planters as dividers for space-use (e.g., between parking spaces, sidewalk and streets, crosswalks and street, etc.).
6. Use bushes or hedges to “soften” any man-made barriers (fences, concrete walls, etc.), buildings, and street corners.⁶
7. Incorporate natural elements at bus stops. For example, plant trees that provide additional shelter from the rain, but ensure their maintenance for safety and visibility.
8. Involve community members and groups in projects that incorporate natural elements into The Delridge Corridor whenever possible and/or feasible (e.g., a tree planting party).

Prioritize access to destination green spaces for all ages and abilities

1. Plant rows or lines of plants/trees to lead people to entrances of parks and trails.
2. Reduce drivers’ speeds near parks and green spaces to provide safer, designated access for pedestrians with striped crosswalks, in-pavement LED crosswalks lights and/or signs.
3. Increase signage and directions to parks and green spaces to encourage visitation and awareness, especially near bus stops and major intersections.
4. Include designated bike lanes that lead or connect to nature trails or other points of interest in line with the Seattle Bicycle Master Plan.

Art & Community Aesthetics

Art and community aesthetics can provide an interface for social interactions, fostering an environment of inclusion across diverse socioeconomic, cultural, and age groups. The benefits of art and aesthetics include chronic disease reduction, especially related to anxiety, depression and stress. Children particularly benefit from art, as it contributes to brain and academic development.

Current Conditions in the Delridge Corridor

Two of Delridge community's greatest assets are the area's natural beauty and the Youngstown Cultural Arts Center. Both assets have the potential to contribute toward building an aesthetically pleasing community through community arts engagement. In fact the North Delridge Community Neighborhood Council has identified beautification as a key objective. Areas of Delridge that require aesthetic attention are shown in the left and center panels of Figure 6. A community created mural is shown in the right panel. Consideration of art and aesthetics in the Delridge Action Plan is important because these concepts are associated with improved mental health and child brain development, and are community priorities.



Figure 6: Community Mural on Retaining Wall of Youngstown Cultural Arts Center

Impact on Health

Art and aesthetics have been noted to positively affect mental health and wellbeing through the following pathways: increased access to art creation, participating in community created art and existing in an aesthetically pleasing environment. These pathways specifically impact community equity and the wellbeing and development of children. Including space for community art and maintaining, or increasing, accessibility to Youngstown Cultural Arts Center could help community members obtain the mental health benefits associated with the pathways above. These benefits, and their relevance to the Delridge action are assessed below.

Assessment

Access to Art

Creating art has long been associated with improved mental and physical health. However, many of the benefits of art creation are not realized equally across socioeconomic groups. In many cases, low-income individuals may not have the time or funds to devote to art. Community art classes held at Youngstown Cultural Arts Center encourage participation from all individuals through scholarship and donation based classes. Argyle et al. 2005 conducted a

study introducing art to a single parents support group.¹ Many study participants were low-income and struggled with mental health issues including anxiety and depression. Study participants reported increased social cohesion, self-confidence and creativity. One quote from a teenage parent group member highlights the mental health benefits of art particularly well; "I have found it relaxing because you could get rid of your pent-up emotions by actually channeling it into something."¹ Supportive environments for parents can improve child health and wellbeing by building healthier, happier families. Access to art may improve parents' mental health, conferring benefits to their children in the process.

Access to art is important for children. In a study of 49 children ages 7-12, musical training correlated with reading fluency.² Art can also help children develop fine motor skills, which are linked with academic performance later in life.³ Encouraging and increasing access to art in the Delridge community would increase local children's exposure art and consequently, may improve their academic performance.

Community Created Art

Community created art can enhance the aesthetics of an urban environment as well as create a unique sense of place for community members. In Portland, Oregon, community members painted a giant sunflower in an intersection. The development of the idea, the planning and the implementation were all community-led. The program boasted a 60% participation rate and following the art installation, 65% of community members rated their community an excellent place to live, compared to only 37% of residents in a neighboring community.⁴ Another study, which explored the equity-related benefits to community based art, found that in diverse communities, art projects can help shatter stereotypes and give voices to those who may be silenced by other means.⁵ Fostering communities that embrace equity is an important factor in mental health and can help decrease discrimination.

Aesthetic impacts of Art

Art and community aesthetics encourage residents to spend time in their communities; strengthening social cohesion and building stronger support networks that are critical to achieving and maintaining mental wellbeing. The sunflower installation, discussed above, drew 32% of passersby to stop and interact with the art, establishing a sense of place created by the community. Community art has also been associated with decreased vandalism. Additionally, individuals who agreed with the statement, "Your local area is attractive" were more likely to go out walking in their neighborhoods.⁶ Physical and mental health are inextricably linked. An increase in walking and physical activity can promote positive mental health benefits. Installation of art can also boost cultural tourism and enhance land values.⁷ There are economic benefits to these activities, but art that is out of line with community values can be poorly perceived and create divisions within a community. One example of this was the statue of Donald Dewar erected in Glasgow in 1999. This statue was political and as a result was repeatedly vandalized.⁷

Recommendations

1. SDOT should consider adding space on sidewalks for community art installations.
2. SDOT and the Seattle Office of Arts and Culture (SOAC) should commission local artists to design art pieces for installation along sidewalks, bus stops, retaining walls and other available space- this is in line with SDOT's "Art Plan" and SOAC's 1% for the Arts Program. Examples of sidewalk art include "Sidewalk Stamps" and "Rain works."⁸
3. SDOT and SOAC should consider supporting community based art projects on retaining walls, non-arterial streets and intersections, pedestrian overpasses and on any newly constructed retaining walls. Funding for these types of community-initiated projects is available through the DON 's Neighborhood Matching Fund.
4. SDOT should consider increasing multimodal public transportation access to the Youngstown Cultural Arts Center in line with the Seattle Transit Master Plan's goal of improving access to cultural assets.

Environmental Health

The environments in which people live, grow, and play enormously impact their health. It is important to consider the potential effects the Delridge Corridor Project on the quality of the air, water, soil, noise, and housing in the surrounding community. For instance, soil compaction and instability caused by construction and demolition can negatively affect the water that feeds into nearby Longfellow Creek which is a source of drinking water for residents and habitat for animals, and if polluted could transmit disease. Air pollution from construction and increased traffic can also raise the risk of cancer, and heart and lung disease, and increase hospitalizations from asthma and other respiratory illnesses. Noise pollution from traffic or construction can cause a variety of health issues, from stress to tinnitus (ringing in the ears) and difficulty sleeping – a problem on its own, and one that exacerbates other health conditions. Healthy and safe housing can lead to decreases in respiratory illness, reduced falls and burns, and reduced cognitive impairment from excess environmental lead and depression caused by living in low-quality housing. Careful planning is necessary as community improvements are made to reduce the number of illnesses, deaths, and injuries.

Soil

When redeveloping the Delridge Corridor, planners must consider the impact of construction on the environment, in particular soil. Construction equipment will compact soils; compaction from construction vehicles alone can reduce soil water infiltration by 70-90% creating a potential for flooding.¹ Demolition of streets and buildings may also release toxic materials into the surrounding soil; of particular concern are the leaded paint and asbestos often found in older structures. It is important to maintain health soils, which nurture plant growth and provide valuable water infiltration, which is particularly important during Seattle's frequent heavy rains.

Current Conditions in the Delridge Corridor

Compaction limits the soil's ability to absorb water, especially during storms and heavy rains. Compacted soils also contain less oxygen, water and microbiological activity than natural soils, and are less effective in filtering polluted runoff from streets. The Delridge corridor is located in the Longfellow Creek watershed; any water not running into the sewage system runs into Longfellow Creek and eventually through the Duwamish River into Elliott Bay.



Map 4: CSOs in Delridge and West Seattle

improvements will likely only reduce the frequency and volume of sewage overflows into Longfellow Creek.⁴

Waterway pollution not only impacts aquatic life but also has adverse effects on human health. Waterborne disease transmission is a common and efficient way of spreading infectious agents, particularly fecal coliform and rotavirus, to large populations. Public Health – Seattle/King County monitors access to safe surface water by assessing levels of fecal coliform bacteria present in local lakes and waterways directly related to the presence of CSOs and how they might affect other aspects of environmental health.⁵ Introducing methods to increase soil permeability during demolition and construction along with the addition of other biofiltration

efforts can reduce the risks presented by overflows. Bioswales, vegetation barriers and constructed wetlands all help to mitigate soil compaction, both improving soil health and adding to neighborhood aesthetics. Healthy soils and biofiltration systems can also reduce maintenance costs and need for drainage equipment, and provide greater flexibility in redesigning the Delridge corridor.

During its near 100-year operation (1988-1986), the ASARCO copper smelter, located in Ruston, Washington, released significant amounts of lead and arsenic and into the air. According to the Seattle and King County Environmental Health Services, West Seattle and the Highline neighborhood are 'soil safety' areas affected by these potentially dangerous pollutants. The lead that settled into soil from the smelter operation is linked to developmental disabilities in children and lower intelligence scores. Arsenic is linked to cancer later in life and is believed to contribute to heart disease. Any disturbance of soil in the contamination area may release these toxins, exposing the community.

Impact on Health

The mental and physical health of a community is directly impacted by access and exposure to green space and vegetation.⁶ Healthy soils produce healthier vegetation and trees, which absorb carbon dioxide, provide shade, and prevent unwanted runoff.⁴

Roughly half the homes in Delridge were built before 1980, and may contain lead paint, asbestos, polychlorinated biphenyl (PCB) or chlorinated hydrocarbons, and other potentially harmful toxins used before modern construction regulations.⁸ Children are at an especially high risk for exposures as they play near the ground and regularly consume more soil than adults due to hand-to-mouth behaviors. Children are also more vulnerable to the neurotoxic effects of lead exposure. Careful control of how soil is handled can significantly reduce the risk of permanent brain injury and disease transmission.

Assessment

Delridge is in a unique watershed that directly impacts the health of the superfund site around the Duwamish River and Elliot Bay. This area has been battling environmental health issues since industry first moved into the bay over 150 years ago. Recently the waterways have seen an overall improvement of aquatic health, and with proper soil management in Delridge, this trend can continue.⁹ Using bioremediation and biofiltration techniques on the soil in the corridor, will improve the ability of Delridge CSOs to handle major storm water events and reduce overflow events, which pollute local water sources. The improved health of local waterways will reduce the risk of waterborne illness. With less reliance on CSOs, Delridge will also save money by reducing the need for maintenance and upgrade to their sewage and storm water systems. When moving any dirt or soil, the presence of toxins should be considered and tested for as these actions could put workers and the community at risk. Best management practices should be exercised and all soils should be tested before any project is initiated.

Recommendations

1. Work with the City of Seattle Green Stormwater Infrastructure program and refer to the Seattle Right-of-Way Improvement Manual sub-chapter 4.17 on Street Drainage, Storm Drains and Sewers to prioritize the use of biofiltration during street, housing and industrial redevelopment designs.
2. Assess the current conditions and health of the soil in the proposed project areas and also assess the potential impacts to the soils in the project area by focusing on compaction, degradation of nutrients, and release of toxic materials.
 - a. Consider “uncompacting” the soil under Delridge Corridor roads and mitigating any toxins stored in the soil
3. Hire appropriate professionals to test structures for toxic materials such as PCBs, asbestos, and lead.
4. Use best practice methods during demolition or deconstruction as well as proper toxins containment for road redevelopment.
5. Monitor effectiveness of biofiltration impacts on the CSOs and perform compaction tests on sites undergoing redevelopment.
6. Develop relationships between the King County Local Hazardous Waste Management Program and Delridge, and educate residents on the proper disposal of toxic waste.

Water

As one of the four largest urban streams in Seattle, Longfellow Creek is one of the most visible connections urban residents in the Delridge corridor have with an iconic Pacific Northwest resource. After more than a decade of community effort and volunteerism, Longfellow Creek has been restored to the point that salmon now return yearly after an absence of over 60 years.¹⁰ Healthy streams provide numerous benefits to the urban community aside from immediate environmental benefits, including: reconnecting adults with and introducing children to nature; increasing opportunities for inner city environmental stewardship, education and awareness; providing an outdoor laboratory for schools; increasing property values, and; creating vibrant spaces that attract customers to local businesses.¹¹⁻¹³

Current Conditions in the Delridge Corridor

Urban streams provide opportunities for recreational and subsistence fishing. Unhealthy urban streams have the potential to harm human health when toxic polyaromatic hydrocarbons (PAHs) from urban areas are deposited into streambeds, and then scoured out to waterways and consumed by fish and shellfish, and subsequently humans. Toxic PAHs are ubiquitous in urban environments.¹⁴ "PAHs have many urban sources, including used motor oil, automobile exhaust, industrial atmospheric emissions, tire particles, and asphalt."¹⁴ PAHs have been found to be present in the receiving waters of urban streams, e.g., the Duwamish Waterway.¹⁵ Due to the human health impacts of PAH, PAHs are considered pollutants of concern. PAHs have been found to adversely impact developing fetuses. Adverse developmental outcomes include low birth weight, premature birth, heart malformation, and DNA damage associated with cancer and lower IQ and asthma.¹⁶⁻¹⁸ Best management practices during construction can minimize the risk of depositing sediment into Longfellow Creek.¹⁹

Many pollutants migrate attached to sediments, and soil particles are also considered potential pollutants. Streambed contamination occurs when toxic PAHs bound to sediments migrate by storm water runoff, CSO spills and atmospheric dust into urban streams.¹⁴ Toxic PAHs can be found in wastewater and sewage released from urban areas.²⁰ When discharged untreated into stream waters, they can pose problems for human health. Traffic activities have been found to negatively impact PAH levels in streams up to 500 meters away.²⁰ Delridge Corridor construction activities are expected to occur well within this range. PAHs can potentially enter the environment and the streambed when construction activities disturb bounded sediments. Any rain or storm event during construction can cause migration of these bounded sediments.

Impact on Health

Human PAH consumption occurs indirectly through movement up the food chain. PAHs are ingested by macroinvertebrates, the base of the food chain. Juvenile salmon, krill and other feeder fish consume the macroinvertebrates. Shellfish live and feed in contaminated sediments. Despite the danger of eating contaminated fish and shellfish, the Duwamish Waterway is the site of much recreational and subsistence fishing and shellfish collection, particularly among low-income local Cambodian and Vietnamese populations.²¹

Assessment

To protect Seattle's waterways, the City of Seattle has charged SPU to oversee a plan managing storm water runoff using green infrastructure. The Delridge Natural Systems Drainage Project (DNSDP)² is one element of this overall objective.² Where SDOT construction overlaps SPU's Natural Drainage project, care should be taken that construction activities do not damage the water quality of Longfellow Creek. One very visible public (and scientific) indicator of the stream's health has been the return of salmon.²³ Therefore, a best management practice plan for construction and a monitoring plan should be developed to minimize related pollution of local waterways. One of the critical indicators of watershed health is sediment levels.²³ Heavy construction can contribute to sediment erosion. The Department of Permitting and Environmental Review handles plans to mitigate soil erosion at construction sites and should be heavily involved in redevelopment plans in the Delridge Corridor.²⁴

A monitoring program that utilizes turbidity measurements would be an appropriate indicator of water quality.²⁵ Daily turbidity measurements should be made before construction begins in order to establish baseline background readings or retrieved from Washington State Department of Ecology (WDOE) records. During construction WDOE personnel should take turbidity measures. Collection of samples should be made according to the guidelines located in Chapter 4 of A Citizen's Guide to Understanding and Monitoring Lakes and Streams.²⁶ As Longfellow Creek is considered a Class A stream a water quality standard for turbidity is based on the amount of increase over background conditions. Violations attributable to construction activities would be investigated and mitigated by Best Management Practices.

Recommendations

To preserve water quality in the Delridge community, SDOT should consider the following recommendations:

1. Work with SPU to implement a monitoring program that utilizes turbidity measurement as an indicator of water quality and evaluate changes in trends over time.
2. Build or maintain relationships between stakeholder groups that utilize the surrounding waterways for fishing and cultural purposes.

Air

Air quality has a significant impact on the health of a community. A growing body of evidence links air pollution with premature deaths from lung cancer, and cardiovascular, and respiratory diseases. In addition, air pollution may contribute to the development of chronic bronchitis, acute respiratory illness, development or exacerbation of asthma, coronary disease, and impairment of lung function.²⁸ The proposed Delridge Corridor Project involves road construction and redevelopment of the area that may result in demolition and construction activities and changes to traffic patterns. Because construction, demolition and traffic emissions are known contributors to air pollution, it is important to consider the potential health impacts of such plans for the Delridge community.

Current Conditions in the Delridge Corridor

Based on national and regional air monitoring data, King County is well below federal standards for ambient air levels of carbon monoxide, sulfur dioxide, nitrogen dioxide and lead. However, particle pollution and ozone are still pollutants of concern for the area.²⁹ According to the Washington State Department of Ecology, King County exceeded the EPA clean air standards for fine particulate matter (PM) on five out of 365 days in 2013. The Ozone Air Quality Index in King County never exceeded standards monitoring and never ranked higher than “moderate” risk on the air quality index ranking. However, Seattle-Tacoma ranked 18th for U.S. cities most polluted by short-term particle pollution. While smoke from wood and garbage burning is thought to be the greatest contributor to these short term exposures, construction and traffic emissions could be a significant source of temporary exposures to airborne PM to those living in close proximity.

According to the American Lung Association, people with asthma, chronic bronchitis or emphysema, diabetes, cardiovascular disease, children under the age of 18 and adults over the age of 65, and people of low socioeconomic status and those living in poverty are at increased risk of harm from airborne pollution.³⁰ Compared to other neighborhoods in Seattle, the Delridge neighborhood has the highest percentage of residents under the age of 18 (20%), the highest rate of obesity (a risk factor for developing heart disease and stroke), the lowest life expectancy (79.2 years), and the highest percentage of individuals with general health rankings of fair to poor (16%). In addition, 28% of residents live below 200% of the federal poverty level. The leading causes of death are cancer, heart disease, chronic lower respiratory disease, and stroke.³¹

The disproportionate level of poverty and poor health within the Delridge community warrants even closer consideration to air quality as a growing body of research suggests that the chronic stressors of poverty may negatively affect the way the body reacts to pollutants, especially in young children. For instance, studies show more asthma symptoms in children with simultaneous exposure to air pollution and socioeconomic problems.³²

Impact on Health

Traffic emissions include Volatile Organic Compounds (VOCs) and nitrogen oxides. These pollutants react with sunlight to form ozone. When inhaled, ozone causes inflammation of the lungs.³³ In the short term, this can exacerbate heart and lung conditions increasing the risk for heart attacks, strokes and asthma attacks. Over time, the damage caused by ozone can decrease lung function and lead to permanent lung disorders.³⁴ Traffic emissions also increase airborne PM. PM is solid or liquid particles in the air that are so small that they penetrate deeply into the lungs, causing damage to the lungs that may lead to illness, hospitalizations, and premature death. One study looking at the long term health effects of PM on children found a 20% decrease in expected lung function for developmental age, a finding similar to that of a child who grow up in a home with parents who smoked.³³

Health effects that have been associated specifically with proximity to roads include onset and aggravation of asthma, cardiovascular disease, reduced lung function, impaired lung development in children, pre-term and low-birth weight infants, childhood leukemia, and premature death.³⁵ Children are most susceptible to harm because their respiratory systems are still developing, they breathe more air (and air pollution) per pound of body weight than adults and are more likely to be playing outdoors.³³

As with traffic emissions, the primary pollutants of concern from road construction or building demolition and construction are PM and VOCs. Unlike traffic emissions, pollution from these sources is likely to be more localized, more intense, and of far shorter duration. In addition, airborne lead is a potential concern if construction or demolition is being done on structures built before 1980 that may contain lead paint. Lead containing dust from construction can be inhaled and the lead absorbed into the bloodstream. Lead exposure is especially harmful to children. Even low levels of lead in the blood of children is associated with behavior and learning problems, lower IQ and hyperactivity, slowed growth, hearing problems, and anemia.³⁶

Assessment

Delridge Way SW is considered a principal arterial roadway in Seattle with an estimated 19,600 vehicles traveling on it per day. Sanislo Elementary School, Seattle High, the Delridge Community Center and several community green spaces are located in close proximity to the road and could be impacted by pollution from road construction. In addition, many family residences are located directly on or in close proximity to the road. It is unlikely that there would be a significant difference in temporary air pollution between the proposed plans for the road reconstruction. Construction as a result of efforts to increase density and multiuse land zoning could be a significant source of temporary air pollution to those in close proximity to the projects. While short term increases in air pollution can be expected during road reconstruction and demolition or new construction projects, the proposed plan for the Delridge Corridor may actually improve long-term air quality if it successfully slows traffic, increases use of transit or other modes of transportation and/or reduces the number of vehicles traveling on the road.

Recommendations

1. Reduce the risk of exposure to air pollution from any new construction or demolition.
 - a. Give preferential hiring or incentives to use (private) construction companies that are affiliated with the U.S Green Building Council, have experience in LEED (Leadership in Energy and Environmental Design), or who present a plan for an Environmental Management System.³⁷
2. Mitigate contributions from traffic to air pollution.
 - a. Encourage use of public transit and non-motorized transportation modes.
 - b. Design roads with low speed limits and efficient travel without frequent stops/accelerations to reduce emissions.³⁸
3. Reduce risk of exposure to vulnerable populations.
 - a. Follow EPA recommendations for building where children or other vulnerable populations live or spend time as far from high traffic areas as possible, a minimum of 500 feet.³⁵
 - b. Outfit existing public facilities close to roadways or construction areas with air filtration systems to reduce indoor exposures to PM and other pollutants.
 - c. Send public notices prior to conducting activities where creation of PM, VOCs or other pollutants is unavoidable that includes recommendations for reducing risks of exposure.
4. Monitor air quality in parks, near schools, or other areas where vulnerable populations may spend time to establish any change in air quality, especially near construction.
 - a. Use air quality monitors to determine compliance with National Ambient Air Quality Standards for pollutants that are emitted from on-road mobile sources for nitrogen dioxide, carbon monoxide, and fine PM.
 - b. Collaborate/engage with existing resources for monitoring and assessing impact on air quality such as such as the UW, the Puget Sound Clean Air Agency, and the Washington Department of Ecology.

Healthy Housing

According to Maslow's hierarchy of needs, air, food, water, and shelter are among the most basic requirements to sustain human life.⁴⁰ Often overlooked, the quality of housing and crowding of individuals within individual units can lead to poor health outcomes. Transmission of infectious diseases can occur through poor water quality, rodent infestation and poor waste disposal. Crowded living conditions also may lead to the transmission of infectious diseases such as tuberculosis. Injuries are also often sustained through substandard housing¹ including falls and burns from exposed heating sources, missing screens, slippery surfaces and poor lighting. Chronic illness has also been linked to poor housing quality. For instance, indoor air pollution and damp environments may lead to mold, mites, and dust that can result in chronic respiratory illnesses. Substandard housing has multiple definitions; however, it is usually viewed as housing that is not only unsightly or worn-down, but also poses significant threat to health and wellbeing. Substandard housing occurs most frequently in areas where the majority of individuals are of lower SES, and is often concentrated among people of color.⁴²

Current Conditions in the Delridge Corridor

A large proportion of the Delridge population consists of people of color. Forty-six percent of Delridge residents rent their homes compared to 48% citywide for Seattle. Of available rental properties, only 6.6% are unoccupied compared to 7.1% citywide. Forty percent of residential units are owned with a mortgage while 6% are owned free and clear. The U.S. Department of Housing and Urban Development suggests that people and families who pay more than 30% of their income to housing costs are considered cost burdened.^{3/4} About 43% of Delridge residents are classified as cost burdened.

DPD maintains the quality and safety of housing stock in the city of Seattle. DPD enforces Building Code, Residential Code, Electrical Code, Energy Code, Mechanical Code and most importantly Housing and Building Maintenance Code and Land Use Code.⁴⁴ In conjunction with Public Health – Seattle/King County Department, Division of Environmental Health Services, nuisance rodents are kept under control through an enforcement program, and the spread of disease through controlling indoor and outdoor triggers is kept to a minimum through comprehensive education programs that assist residents seeking changes to their dwellings or information on potential hazards in the home.⁴⁵

Impact on Health

Many poor health outcomes may be attributable to poor housing quality, but among the most notable is asthma. Asthma has been a continuous problem in the damp Pacific Northwest. Seattle/King County has been a leader in reducing the number of asthma-related emergency room visits by developing and sustaining a research program helping low-income families with children diagnosed with asthma to learn how to prevent triggers in their home environments.⁴⁶ Public Health – Seattle and King County also has a long-standing lead poisoning prevention program that assists families with understanding the dangers of lead in the environment.

¹ Here substandard housing refers to housing that does not conform to minimal criteria for habitability according to the code that was written and enforced at the time of the construction of the unit.

Assessment

Public Health – Seattle/King County publishes guidelines for how to maintain a healthy home including controlling pests and triggers such as dust, dust mites, moisture and mold, roaches, and rodents. Additionally, they also produce guidelines that help families choose the correct protocols for cleaning, lead and asbestos, as well as environmental control checklists. Substandard housing is defined differently for different areas of the country. Seattle has determined the minimum threshold for safety and health as defined by the inspection criteria for the Rental Registration and Inspection Ordinance program.

Community groups such as the Tenants Union of Washington State, Got Green?, and Puget Sound Sage have been influential in encouraging the passage of legislation that encourages healthy and safe communities. In 2012, the Rental Registration and Inspection Ordinance was enacted requiring all rental units to be inspected every five years for basic health and safety. Prior to the passage of this ordinance, collecting reliable data on the number of substandard rental units in the city of Seattle was difficult because DPD only investigated properties that had been reported to their code enforcement hotline. While this is an effective way to identify some unsafe properties, it requires knowledge of the system and bravery in the face of potentially punitive landlords and neighbors.

Recommendations

To keep the available housing stock in Delridge not only livable, but also healthy for its occupants, partners in the Delridge Corridor Project should consider the following recommendations:

1. Build relationships with Public Health – Seattle and King County Department Division of Environmental Health Services and community members to guide considerations of what makes a healthy home, and mindfully plan to help reduce pollution along Delridge Way SW.
2. Build and maintain relationships with The City of Seattle DPD Code Enforcement Agency for assistance with problematic houses and rental units.
3. Engage key stakeholders such as community groups like the Tenants Union of Washington who have an education program targeted to renters living in areas with chronically bad landlords or negligent property owners.
4. Practice mindful planning to prevent displacement of low income and communities of color, and work toward increasing social capital by engaging residents in decisions that will impact the quality of their homes with respect to corridor planning.
5. Assure that healthy housing stock is maintained and increased by periodic monitoring of reports of negligent homes to DPD. Compare locations of complaints that come to the Education Services Division of the Tenants Union of Washington State to monitor trends in calls for healthy housing.

Noise

One of the goals of the Delridge Corridor project is to create a healthier public space. In order to achieve this, the health impacts of noise pollution must be considered. Noise is defined as a class of sounds that are considered unwanted and may adversely affect the health and wellbeing of individuals or populations.¹ As the focus of The Delridge Corridor Project is transportation, it is important to consider traffic-related noise and its effects on mental health. Traffic-related noise pollution may affect the mental health status of Delridge community members, especially of those that live on or near Delridge Way SW. It is important that the health outcomes related to traffic-related noise pollution are considered in order to lessen their potential adverse health effects on Delridge community members.

Current Conditions in the Delridge Corridor

One limitation in assessing noise pollution in the Delridge Corridor is that baseline levels of noise pollution have not been measured in the area. However, previous research has shown significant associations between road traffic noise levels and traffic flow rates; thus, traffic flow rates can provide insight into levels of traffic noise pollution.² The speed of vehicles and the nature of the road surface also contribute to noise levels.¹ In 2011, SDOT determined that 19,600 vehicles per week drive on Delridge Way SW. The 2006-2010 U.S. Census found that of workers 16 years of age and older in the Delridge community, 78% relied on a car, truck, or van to get to work. These estimates of traffic in the Delridge Corridor indicate that noise pollution due to high traffic volumes is a cause for concern and should be considered during the decision-making process of the Delridge Corridor project.

Impact on Health

Noise adversely impacts mental health by increasing psychosocial stress and annoyance.³ People bothered by noise may experience a variety of negative mental health responses, such as anger, disappointment, dissatisfaction, withdrawal, helplessness, depression, anxiety, distraction, agitation or exhaustion.⁴ Environmental noise can also cause tinnitus, or the inability to perceive silence due to a roaring, hissing or ringing in one's ear. It is known that tinnitus can cause adverse mental health effects in some patients including anxiety, psychological distress, depression, suicide, frustration, irritability, tension and restricted participation in social life.⁴ Noise pollution can also lead to chronic diseases such as cardiovascular disease. Exposure to noise causes physiological activation including increases in heart rate and blood pressure.⁵

Noise pollution can negatively impact sleep. Many people experience sleep disturbances due to noise. These sleep disturbances include alterations in sleep pattern or depth, awakenings, and difficulty falling asleep.¹ Studies in both adults and children suggest that sleep problems may contribute to development of some psychiatric disorders. Sleep disturbances are also more likely to affect patients with a diagnosed mental illness, further exacerbating the disease.⁶

The effect of noise pollution on children’s mental health should especially be considered, as they are a population more sensitive to adverse effects. Children in noisy environments have poor school performance, which leads to stress and misbehavior. They also have decreased learning capacity, lower reading comprehension and concentration deficits.³ Not only does noise pollution affect learning, research has shown that chronic noise exposure creates both physical and psychological stress that manifests as elevated blood pressure, learned helplessness and annoyance.¹

Assessment

Although noise has not been measured along the Delridge Corridor, previous research has shown traffic flow rates can be a strong predictor of noise. Due to the significant traffic flow rate through the Delridge Corridor, traffic-related noise pollution may directly impact the mental health of Delridge community members. The Washington Department of Transportation’s website (www.wsdot.wa.gov) states that traffic noise is not a serious problem for people who live 100-200 feet away from lightly traveled roads, however a majority of the residences along the Delridge Corridor are within the 100-200 foot zone.⁷ Therefore, those community members that reside along Delridge Way SW may experience levels of noise pollution that cause adverse effects. Noise during the Delridge Corridor Improvement Project construction period may contribute to short-term noise pollution. As previously described, there is a large body of evidence describing associations between noise pollution and adverse mental health impacts. SDOT should consider noise abatement strategies for both when designing the project and also during the construction phase of the project.

Recommendations

To minimize adverse mental health impacts from noise pollution, SDOT should consider the following actions:

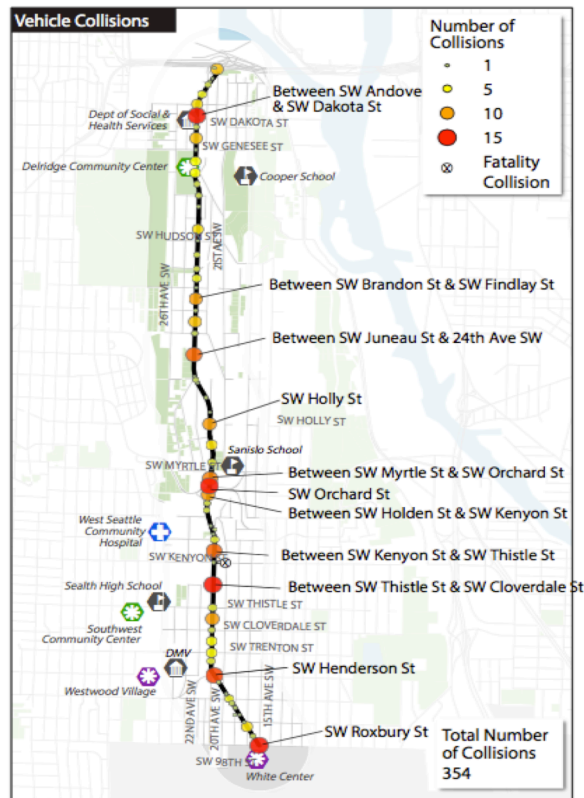
1. Increase vegetation along roadways to decrease traffic noise levels; if dense vegetation already exists alongside the roadway it should be preserved.
2. Ensure that all pedestrian zones meet the six-foot width requirement stipulated in the Seattle Right-of-Way Improvements manual in order to increase the distance between traffic noise and residences along Delridge Way SW.
3. Reduce the speed limit on Delridge Way SW to decrease traffic-induced noise pollution.
4. Update the current roadway pavement to quieter pavement designs and materials.
5. Limit construction activities to appropriate hours in line with the Seattle Noise Code and Best Construction Practices.
6. Notify residents of planned potentially affected areas prior to construction activities well in advance following the guidance set forth in the “Community Notification for City Construction Projects: A Guide for Seattle’s Elected Officials” handbook.⁸

Safety

The following section addresses how the Delridge Corridor Project affects safety in the Delridge community. The assessment covers three main areas: traffic safety, crime and personal safety, and disaster preparedness. Safety plays a vital part in the health of individuals and the community by diminishing harm and stress. Safety can also foster a sense of community by instilling trust and respect among neighbors. When the North Delridge Neighborhood Council prepared a policing plan with the Seattle Police Department in October 2014, they gathered community input on top neighborhood crime concerns. Unsafe driving along Delridge Way SW ranked at the top of this list, reflecting the importance of traffic safety to local residents. Property crime ranked #2 and an overall sense of safety related to high-profile crimes (gangs, gunshots, etc.) ranked #4, indicating the concern of local citizens for their own personal safety in terms of crime. While not included on the list, disaster preparedness is always an important part of safety, especially given Seattle's predisposition for landslides, earthquakes, flooding, and volcanic activity.

Traffic Safety

Seattle's Complete Streets Ordinance requires SDOT to "design, operate and maintain Seattle's streets to promote safe and convenient access and travel for all users--pedestrians,



Map 5: Vehicle Collisions on Delridge Way

The current proposed Plan considers reformatting the roads to ensure consistent lane use designations throughout the Corridor.

Historically, there have been a high number of vehicle collisions along Delridge Way SW, with a total 354 vehicle collisions, 9 bicycle collisions and 14 pedestrian collisions occurring between January 2012 and April 2015. The highest number of vehicle collisions occurred in the lower southern section of Delridge Way SW (see Map 5). Most bicycle collisions occurred between Juneau St. and 24th Ave. SW (see Map 6) with four out of the nine total bicycle collisions occurring during the study time period along a single block. This area is notably lacks bicycle travel markings. Several other bicycle collisions have occurred at the far north and south ends of the Delridge Way SW. Pedestrian collisions with vehicles occurred relatively evenly throughout the corridor, with a slightly higher incidence toward the south end of Delridge Way SW, as shown in Map 7.

bicyclists, transit riders and people of all abilities, as well as freight and motor vehicle drivers.”¹ Ensuring the safety of these respective users is a critical element of effective transportation and community planning and design. Traffic ns are a major cause of fatality and serious injury, and are also linked to poorer health outcomes, and lower quality of life and community comfort levels.² SDOT should prioritize safety considerations in the transportation plan for the Delridge Corridor Project to improve health outcomes for Delridge residents and those traveling through the area.

Current Conditions in the Delridge Corridor

Delridge Way SW is a major arterial road in West Seattle that travels north-south through the Delridge neighborhood and is roughly four miles in length. Currently, there are inconsistencies in traffic flow along Delridge Way SW, with lane patterns changing four to five times throughout this four-mile stretch.

Health Outcomes & Causal Pathways

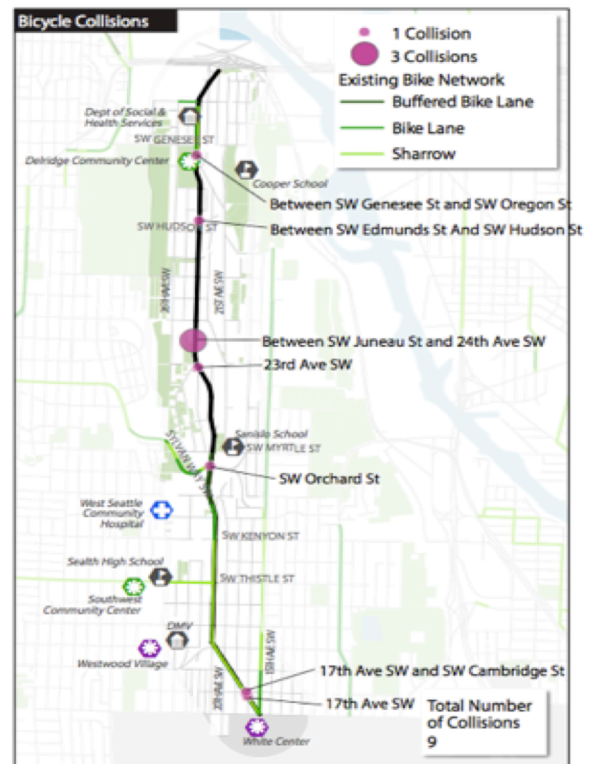
Injuries and trauma resulting from traffic collisions of any transportation mode can have severe and lasting effects on individuals and communities. Costs incurred from traffic-related injury include immediate and long-term medical costs, lost productivity, legal and court costs, and workplace losses. Serious traffic-related injuries in Washington State caused an estimated societal cost of over \$850 million in 2011.² For the affected individual, increased healthcare costs and lost productivity due to traffic-related injury may also reduce the funds available for other basic needs such as food and housing, and may further reduce quality of life. In addition, traffic-related collisions may cause psychological trauma and limit travel from the home or use of different modes of transportation, such as biking and walking, due to fear of further injury.

Assessment

Evidence supports that increased driver speed is positively correlated with increased risk of collision and severity of collision outcomes. While the current speed limit along Delridge Way SW is 35 miles per hour (MPH), 40% of deaths from fatal traffic collisions in Washington State between 1994 and 2011 occurred in areas with speed limits of 35MPH or less. A 2012 survey of Washington drivers reported that 67% of drivers report they would rarely or never travel faster than 30mph in a 25mph zone and 26% reported they would “sometimes” do so.³ Reducing speed limits may work to reduce the number of traffic collisions occurring on Delridge Way.

Research supports that driver speed is also influenced by roadway design.⁴ Narrowing streets and increasing the presence of islands, crosswalks and designated bike lanes can improve drivers’ attitudes toward roadway sharing and encourage drivers to slow down. Automated speed enforcement cameras also increases compliance with posted speed limits.² These speed cameras, especially when placed in school and high pedestrian traffic zones, can significantly reduce traffic-related injury to drivers, pedestrians, and cyclists. The presence of sidewalks has also been shown to improve pedestrian safety.⁵

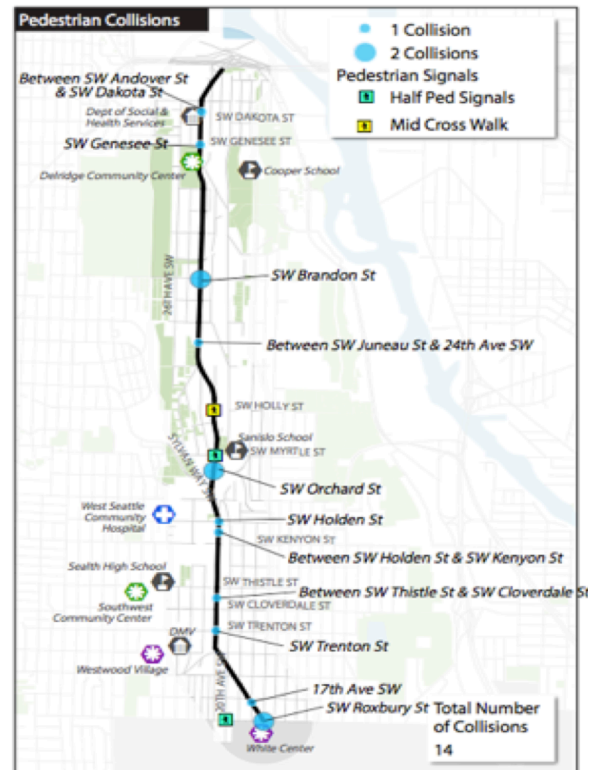
Cyclist safety should also be considered in roadway design. According to the literature, marked bicycle lanes reduce bicycle traffic incidents and are the most protective means of bicycle travel. When protected bike lanes were installed in New York City in 2011, injury from collisions for bicyclists, drivers, and pedestrians dropped by an average of 40%.⁷ Protected bike lanes have also been shown to reduce bike intersection injuries by as much as 75% post-intallment.⁸



Map 6: Bicycle Collisions on Delridge Way

Recommendations

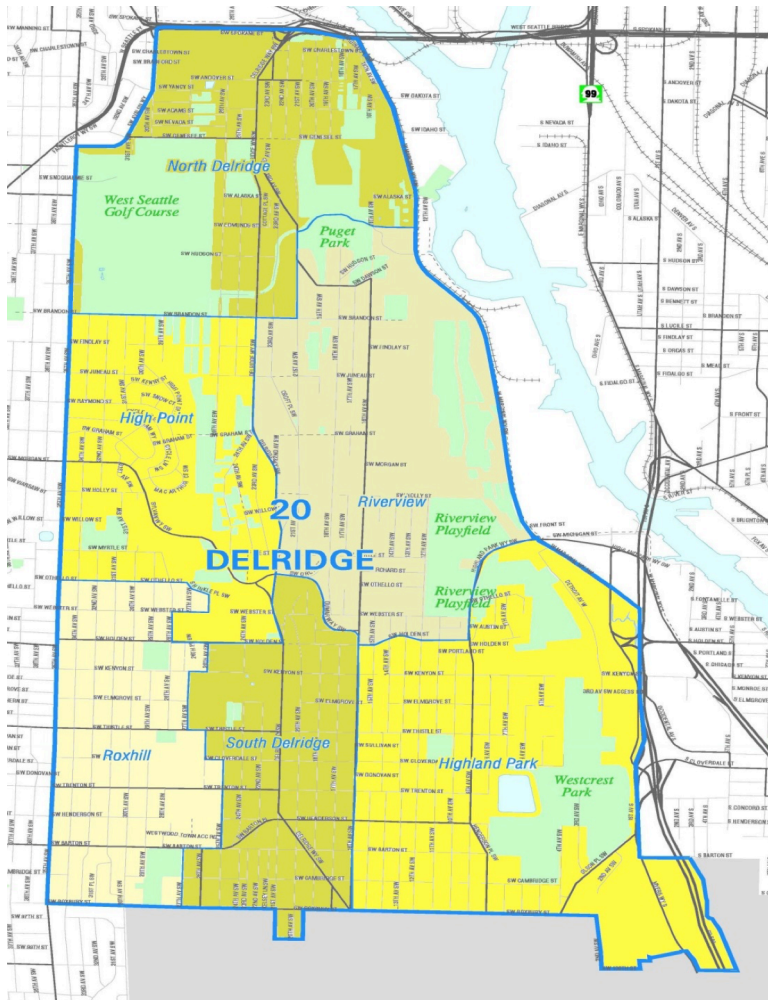
1. SDOT should analyze the collision reports for the Delridge Corridor to identify collision hotspots and patterns to target areas for traffic-related safety changes
2. SDOT should consider the following improvements to road conditions to improve safety for all forms of traffic:
 - a. Reduce the current speed limit from 35 MPH to 25-30 MPH.
 - b. Narrow streets to encourage speed reduction.
 - c. Install automated speed monitoring cameras, especially near schools, parks and other high traffic areas.
 - d. Create consistency in traffic flow by maintaining roadway layout throughout the corridor.
 - e. Create crosswalks midway between intersections.
 - f. Ensure that all bus stops have an adjacent crosswalk.
 - g. Make crosswalks more visible by installing flashing in-pavement lights and mid-road pedestrian crossing signs.
 - h. Create marked bike lanes for each direction of travel along Delridge Way SW.
 - i. Create marked bike routes on lower traffic streets parallel to Delridge Way SW to encourage bicycling among groups of all experience and comfort levels.



Map 7: Pedestrian Collisions on Delridge Way

Crime & Crime Prevention

Safety plays a vital role in health, both at the individual and community levels. When the North Delridge Neighborhood Council prepared a policing plan with the Seattle Police Department in October 2014, they gathered community input on top neighborhood crime concerns. Property crime ranked the second priority and an overall sense of safety related to high-profile crimes (gangs, gunshots, etc.) ranked fourth, indicating local residents concerns for their own personal safety in terms of crime.¹ Crime presents a risk of physical harm and also results in significant



Map 8: Neighborhoods in Delridge⁹

financial costs. In addition, people who feel unsafe in their neighborhood may also have higher levels of anxiety and other adverse mental health issues. People who live in high-crime and low-income neighborhoods are at greater risk of drug abuse, unwanted pregnancy, and relationship problems.² Increasing foot and bike traffic on city streets through pedestrian and cycling infrastructure improvements creates a stronger natural surveillance system.³ Traffic calming measures and walkability infrastructure such as shade trees and sidewalk improvements can increase perceptions of cyclist and pedestrian safety and improve usage rates.^{3,4} More people moving around in an area means more observers to dissuade and intervene on criminal acts. This effect is what Jane Jacobs calls, “eyes on the streets.”⁵ Developing an infrastructure to increase the rate of foot and cycle traffic at all times of day is an important component of crime prevention through environmental design.⁶

Current Conditions in the Delridge Corridor

Delridge has slightly higher crime rates than the Seattle metropolitan area as a whole. Delridge has a higher assault hospitalization rate than Seattle (36.6 cases vs. 31.8 per 100,000 residents [2008-2012]). Delridge also has more homicidal deaths (6.7 vs. 3.4 per 100,000 residents), and more firearm deaths than Seattle as a whole (11.8 vs. 6.4 per 100,000 residents); however,

these rates are based on few overall cases so should be interpreted with caution.⁷ Data were not available on North Delridge in particular, but according to some estimates South Delridge has a 17% higher crime rate than Seattle and North Delridge has a 13% lower crime rate than Seattle.⁸ Regardless, the proximity of the two sections of Delridge indicates that crime is an issue of concern both for areas (see Map 8).

Property crime is also deserves consideration, as it is typically much more prevalent than violent crime and still poses safety concerns. Property crime may also escalate into violent crime. In 2012, the FBI reported a property crime rate in Seattle of 5,094 counts per 100,000 residents.¹⁰ Delridge has 15% less property crime than Seattle; however it is important to note that Seattle's crime rate is 138% above the national average.¹¹

Drug and alcohol use can be linked to crime. There are currently no recreational marijuana dispensaries in North Delridge or the wider West Seattle area. A recreational marijuana dispensary was planned in North Delridge with construction beginning in May 2014, but was later abandoned.¹² Currently no policy exists to control the density of alcohol outlets in Delridge, though the area does not appear to have a higher density of alcohol retail than the rest of Seattle. Furthermore, out of 11 western states, Washington currently has the second lowest density of liquor retail outlets at one store per 20,502 inhabitants.¹³

Health Outcomes and Causal Pathways

Marijuana and Crime

Should a recreational marijuana dispensary open in North Delridge in the future, it will likely not affect area crime or safety. The State of Colorado, which opened its first recreational marijuana store on January 1, 2014, has not since experienced an increase in crime or injury. In fact, the state capital of Denver reported a decrease in crime in 2014; state-wide, traffic-related fatalities also decreased in 2014.¹⁴

Urban Contexts and Crime

Large cities have higher crime rates than suburban and rural areas, owing to increased human-human interactions and a breakdown of family structure, among other factors.¹⁵ The increased traffic brought about by the Delridge Corridor Project could increase crime by increasing the flow of people and goods through the area, and by increasing human-to-human interactions.

Unemployment, Poverty and Crime

Conversely, such a project could foster a sense of community and, by improving transportation options, provide for more employment opportunities. Research shows a link between poverty, unemployment, and crime rates.¹⁶ The unemployment rate in North Delridge is higher than the city of Seattle as a whole (9.4% vs. 6.3%; 2006-2010). Furthermore, in North Delridge, 10% of families are living under the poverty line.¹⁷ The employment opportunities that are facilitated by the Delridge Corridor Project could potentially decrease poverty and crime.

Lighting

Lighting and visibility have a significant impact on individuals' perceptions of danger and risk when using streets and sidewalks. Pedestrians feel more at ease when they can easily see their surroundings and be seen by others, and feel safest in well-lit open spaces with visible sources of refuge.¹⁸ Improving perceived safety will increase use of streets and in turn enhance natural surveillance by putting more eyes on the street.³

Real and Perceived Crime Rates

Crime rates are also associated with perceptions of safety and perceptions of high crime can dissuade use of public infrastructure for recreation, active transit, and socializing.^{18,19} Those living in areas with high observed, and perceived, crime are less inclined to use public spaces. By reducing both real and perceived crime, residents will be more likely to walk, bike, and visit amenities in their neighborhoods—and by putting more eyes on the street, increased use of community infrastructure and facilities will help to further reduce crime.^{3,5}

Mixed-Use Developments

Mixed-used developments blend residential and commercial usages, placing restaurants, cafes and shopping amenities alongside multi-family homes and apartment complexes. Mixed-use development reduces the need for vehicle travel and encourages walking and biking. With more people using the streets and sidewalks throughout the day and night, natural surveillance rates will increase and crime rates should decrease.^{19,20}

Public Art

Excessive graffiti can create the appearance of lawlessness or lack of law enforcement in an area.^{21,22} The presence of graffiti signals that there is not sufficient surveillance to prevent tagging and that public authorities are not actively engaged in maintaining public space. In contrast, controlled and permitted graffiti or public art can create a sense of community and unique neighborhood culture.^{21,22} Community art projects also divert potential taggers from illegally defacing property and reduce the number of blank canvases available for defacement.

Chronic/Metabolic Health Impacts of Crime

Both real and perceived crime has a demonstrated impact on health. Communities with higher violent crime rates have higher rates of heart attack and anxiety after controlling for income and community resources.²³ Neighborhood crime rates are also associated with elevated body mass index and cardiovascular risk in adolescents. High levels of crime increase stress levels among residents and contribute to perceived neighborhood disorder, which can lead to chronic stress. Health issues linked to chronic stress include cardiovascular disease, poor endocrine regulation, cancer, and psychological disorders.²⁴⁻²⁸ Finally, high crime rates discourage physical activity both for utilitarian and recreational purposes in children and adults. Metabolic disorders, cardiovascular disease, and carcinogenesis are all complications of low physical activity.²⁹⁻³²

Assessment

Developments proposed for the Andover, Brandon, and Sylvan nodes (see Map 1) in the Delridge Multimodal Corridor Study all carry potential crime prevention measures through improvements to neighborhood use and amenities.

Andover

Andover's public sports fields offer a strong asset for crime prevention, putting eyes on the streets when fields are in use. Powerful field lights illuminate the fields and the surrounding area at night, while field usage places people in the area all day.

The Youngstown Cultural Arts Center at the Andover Node has a plain brick face and the adjacent overpass is a utilitarian concrete and steel structure. The overpass shows some rust and other damage, which conveys neglect. This could discourage use of the space.

Brandon

Public greenways, P-patch community gardens, and food trucks all play an important role in preventing crime by putting more people on the streets to provide natural surveillance. Public art around this node creates a sense of place, which serves to deter crime. Traffic calming interventions in the Brandon node, such as narrow streets and traffic humps increase use of the streets for activity and play by children and adults.

While there are mixed-use developments in this node along Delridge Way SW that include businesses, cafes and residential buildings, their street visibility and sidewalks could be improved to encourage additional use.

Recommendations

Overall

1. Increase pedestrian lighting on the city right-of-way and on structures owned and operated by the city throughout the Delridge Corridor, in particular along high collision and crime incident areas of Delridge Way SW, in line with the Seattle Pedestrian Lighting Citywide Plan and Crime Prevention through Environmental Design principles.

Andover Node

1. Install an at-grade crosswalk on Delridge Way SW adjacent to the overpass to increase pedestrian usage on both sides of the street and slow motor traffic.
2. Add murals and public art installations throughout this node, and improve maintenance of the Youngstown Arts Center to enhance the quality of the neighborhood environment, strengthen a sense of place, and improve pedestrian use of the area.

Brandon Node

1. Strengthen neighborhood businesses—especially cafes, restaurants, groceries, and other food industry establishments—through zoning and business incentives to improve food access and use of local businesses residents.

2. Build additional trail connections to increase foot and bike traffic, drawing more potential customers to neighborhood businesses, and putting more eyes on the streets.

Sylvan Node

1. Ensure that all pedestrian zones meet the Seattle Right-of-Way Improvements Manual width requirement of six feet, introduce trail connectors, and zone for infill retail to increase usage of the streets throughout the day—putting more eyes on the street and reducing opportunities for crime.

Disaster Response & Resilience

The following section addresses how the proposed Delridge Corridor Project may affect disaster response and resilience in the Delridge community. This assessment focuses on natural disasters specific to the Pacific Northwest and Seattle in particular, including landslides, earthquakes, floods, volcanic activity and the possible impacts of climate change. This analysis draws on examples and lessons learned from other community disasters, and offers recommendations designed to improve resilience in the Delridge community.

Current Conditions in the Delridge Corridor

Landslides are a common problem along hillsides, shorelines, and roadways and have frequently created emergency situations in the Seattle area over the past 20 years.¹ They are complex and unpredictable, and are most often triggered by prolonged or high-intensity rain events, earthquakes, fires, rain-on-snow events, and human influences. In the Delridge Corridor, most land is classified as 'highly modified by human activity', particularly along the West and East Waterway of the Duwamish.² These land modifications create an unpredictable slope response to natural processes and/or human activities. However, most of this potential hazard is located just north of the corridor project and is unlikely to pose any danger to the Delridge community.

Earthquakes pose a much larger risk with as many as 1,000 occurring in Washington State each year.¹ Most damage from earthquakes occurs from amplification of seismic waves or soil liquefaction. Along the Delridge corridor, the hazard from ground shaking is extremely low; in fact, this area of the city appears to be at the lowest hazard from earthquake damage relative to the rest of Seattle. However, most of the corridor does fall into the zone of buried sedimentary rocks in the Seattle basin (which may prolong seismic shaking) and possible ground rupture along the Seattle fault.⁴ As there are major sewer pipelines in the area and a liquid fuel pipeline just east of the Duwamish Waterway, the likelihood of damage in a major earthquake along this fault is high.

Floods are one of the most common natural disasters, damaging communities after spring rains, heavy thunderstorms or winter storm thaws. King County is at a high risk for flooding, as 2.7% of the county is located on a flood plain, and typically sees a flood resulting in major damages every three years.⁶ Communities at greatest risk of this danger are those located in low-lying areas near water, which is descriptive of the Delridge area. The Longfellow Creek is considered to be a flood hazard area, however, actual flood risk is low to moderate, meaning there is a less than 1% chance of flooding each year.⁷

Volcanoes are a unique hazard to Washington State, with the most recent example of potential damage being the 1980 eruption of Mt. St. Helens. Active volcanoes still considered a risk include Mt. Baker, Mt. St. Helens, Mt. Rainier, and Glacier Peak.⁸ Most damage from volcanic eruptions is due to massive mudflows and ash blanketing. Because Delridge does not lie along a valley forged from glaciers or rivers from one of these active volcanoes, and has not been inundated during past volcanic activity, any damage from a volcanic eruption is likely to be indirect.

Projected climate changes in Seattle include sea-level rise, extreme precipitation, extreme heat and impacts on hydrology. Over the past century, the water along Seattle's shoreline has risen more than six inches, and climate change is expected to contribute an additional seven inches by 2050 and 24 inches by 2100 – possibly as high as 19 to 56 inches, respectively, under worst case emissions scenarios.⁹ This will result in more frequent tidal flooding events and storm surges, turning annual extreme events into monthly or possibly daily occurrences. Extreme precipitation is much more difficult to model due to the complex terrain in the Pacific Northwest and in Seattle; however, the city of Seattle is preparing for increased rainfall intensities in the coming years. Due to a changing climate, the scale and frequency of disasters are expected to continue to increase, which makes it imperative to focus on preparedness and resilience of proposed projects.

Health Outcomes and Causal Pathways

Risk and vulnerability to natural hazards and disasters are characteristics of populations that are dispersed unequally, even within small neighborhoods and cities. The impact of natural disasters is greater for those who were already at risk and vulnerable before a disaster, such as those of lower socioeconomic status.^{10,11} This is particularly evident in evacuation events, where vulnerable populations are at an even greater disadvantage. The potential health impacts of disaster preparedness are therefore mainly related to evacuation efficiency and resiliency.

Evacuation may not be feasible for every individual within a community. Often times, evacuation routes are configured to optimize the number of vehicles and individuals that can evacuate the city within a given period of time.¹² However, to expect an individual to evacuate is to make a number of assumptions, including that the said individual:

- has access to and speaks the language of the evacuation order;
- is physically able to evacuate;
- is financially able to evacuate;
- has access to a vehicle; and
- has a destination, or can afford to rent a room in a hotel/motel.

Drawing on the New Orleans case study, one of the frequently cited failures of city officials in the aftermath of Hurricane Katrina was the poor and untimely communication of risk to vulnerable populations, particularly to those of low-mobility. Prior to the hurricane, it was estimated that 112,000 people did not have access to personal vehicles and would face challenges evacuating. The decision was still made to rely on a 'neighbors-helping-neighbors' policy, which likely contributed to approximately 100,000 to 300,000 people not being able to evacuate New Orleans during Hurricane Katrina.¹³ The aftermath of this disaster accentuates the need for equitable emergency planning that considers those without access to automobiles, which is often correlated with poverty, old age and disability.

Many urban areas in the U.S. with significant carless populations may be just as unprepared for mass evacuations. A Department of Homeland Security review of large urban areas in the U.S. revealed that few are adequately prepared for carless evacuees and disadvantaged populations.¹⁴ This suggests that evacuation plans should consider multimodal evacuation planning, paying special attention to the movement of people by foot, public transit, coaches and vans. In past situations, this has proved to be efficient, such as the emergency evacuation that occurred in the aftermath of the terrorist attacks of September 11, 2001. Transit resources were used to evacuate approximately 1.2 million people out of the affected lower Manhattan area; such resources are necessary in urban settings and should be included in any development plans.¹⁵

Assessment

The Delridge corridor is not at any particular risk for natural disasters. Landslides are not a likely occurrence, though the highly modified land along the mouth of the Duwamish Waterway has the potential to cause damage in localized areas should a landslide occur. Earthquakes pose a greater risk for the community; the proximity to the ground rupture zone and several city lifelines, including sewer and liquid fuel, suggests possible catastrophe during an extreme earthquake. Flooding may occur in the area, especially along the Longfellow Creek. While the risk may currently be low, climate change may increase the likelihood and severity of such flooding. It is therefore important to consider these potential natural disasters in planning for the Delridge Corridor Project, and to ensure the community is adequately informed, prepared and able to react and evacuate in a natural disaster event.

The Delridge neighborhood is a racially and ethnically diverse community, with lower education levels, moderate linguistic isolation, high rates of obesity, and moderate health. Overall, the community is not overtly vulnerable compared to other neighborhoods in Seattle, but there may be pockets of disadvantaged groups to consider in the event of a catastrophe, as well as those with low-mobility.

It is also important to consider evacuation routes out of the area. Delridge is surrounded by water on three sides: the Duwamish Waterway to the east, Elliott Bay to the north, and the Puget Sound to the west. Currently the only evacuation routes would be to cross the Duwamish Waterway using the West Seattle Bridge or the 1st Avenue South Bridge (Highway 99/509), or to drive south and connect with major highways or alternate routes. This may create congestion as other neighborhoods also evacuate West Seattle using the same routes and bridges.

Recommendations

SDOT, DPD, the Seattle Office of Emergency Management, the Seattle Office of Sustainability and Environment, and other partners in the Delridge Corridor Project should consider the following recommendations to improve disaster response and resilience in the Delridge community:

1. Include resilience in the planning and building of the Delridge Way SW Corridor, such as earthquake and flood-resilient structures and open roadways, as detailed in the Seattle Climate Action Plan.
2. Reinforce existing structures, particularly public buildings such as schools and community centers, against earthquake shock and flooding.
3. Include emergency planning as part of the project, and create deliverables to inform the community on how to prepare for and respond to natural disasters in languages that reflect the diversity of the community.
4. Consider multi-modal transportation, utilizing existing mass transit as well as shuttles to evacuate those without cars and with low mobility and clearly separating pedestrians from vehicular traffic for safety.

Access to Social & Community Services

Social services, food, education, affordable housing, and well-paying jobs are critical to increasing the health of any neighborhood. Many studies have demonstrated that education is the cornerstone of living a longer, healthier life. During revitalization of an area, it is important for planners to recognize critical areas that affect the long-term health of residents such as access to schools, libraries, and green space and assure that they are easy to access. Mindful planning to assure that large-scale displacement of long-term residents does not occur through revitalization efforts is of critical importance for maintaining a healthy community that reflects the diversity of Delridge.

Gentrification

Over the past decade, Seattle has experienced a period of rapid growth and urbanization. With this, the city has blossomed into one of the most highly educated cities in the United States. Though most economists, planners, and legislators are happy to hear this, the influx of highly educated individuals with higher paying jobs often means long-term residents are pushed out of their neighborhoods to make way for those who can afford more expensive housing units that replace older homes.¹ This process is called gentrification; it is the process of revitalization accompanied with an influx of middle or upper class residents. Neighborhoods most affected by the development practices that lead to gentrification are frequently composed of people of color, shifting from areas predominantly composed of people of color due to longstanding discriminatory housing and mortgage lending practices, to mostly white after desirable neighborhoods are redeveloped. The Delridge Corridor is already experiencing gentrification. Combined with the efforts of SDOT through the Multimodal Improvement Project, gentrification for this area is likely inevitable, however care can be taken to avoid wide scale displacement of long-term occupants.² Instead of trying to halt the process of gentrification, city planners should consider incorporating aspects of positive gentrification to support the ability of low-income residents to stay in Delridge and encourage the development of a mixed-income community.

Without proper planning and control, gentrification can lead to health disparities for community residents. First, the process of gentrification may lead to tensions between people from different socioeconomic classes. Residents of lower socioeconomic status may feel both social and financial pressures to leave the area. They may be pushed into concentrated neighborhoods, where they can afford the housing and have more of sense of place.¹ This process leads to an even more extreme gap in health equity, as seen in urban areas in many cities across the United States.²

Current Conditions in the Delridge Corridor

The Delridge Corridor and surrounding neighborhoods are comprised primarily of families from diverse backgrounds. As of 2010, only 53.5% of Delridge residents were white, with black, Asian, and Hispanic the next three highest represented.³ Compared to other Seattle neighborhoods, Delridge is a rich mixture of diversity. White Center, the city just south of Delridge, is a hub of small ethnic restaurants and grocery stores, providing a space of diverse resources for the community. Unfortunately, this area also experiences some of Seattle's higher rates of adults below the federal poverty level, obesity, and markers of overall poor health. The housing is a mixture of buildings from different eras, with most consisting of older post-WWII builds.

Impact on Health

Developments that contribute to gentrification can help improve the lives of those already present in the community without creating large-scale displacement. For example, more transit may lead to better access to healthier food and higher paying jobs. These improvements can lead to a more stable lifestyle, with healthier options on the dinner table and lower stress from financial difficulties. More development in the community can promote

newer and higher quality of homes, thus fewer developmental problems or respiratory diseases from homes with lead or mold contamination. Growth in this neighborhood may also bring a vested interest in improving schools, more community outreach through targeted social services, and lower crime rates. All of these efforts can help families support children in a welcoming and open environment to better education and social welfare in the future.

This process is only beneficial to those who still live in the area. It is important that the access to all of these benefits do not include forcing the current residents out of the neighborhood, either by increased cost in housing, or by losing the sense of place that the residents need to be a part of the community.

Assessment

To reach for positive gentrification and equity, city planners should focus on two areas: affordable, healthy housing and maintaining the community connections already present. If gentrification occurs as it has famously in other cities, such as San Francisco, displacing current residents to other areas can be detrimental to mental health. However, building up current community values as the neighborhood develops will strengthen one's self-identity and allow for a better mental health, as discussed in this report's chapter on sense of place. City planners should consider how local families will be able to afford to stay in the neighborhood, not be gradually replaced by those of higher incomes able to afford more expensive housing.⁴ With mixed housing, resentment and differences between communities can often become problematic, and can even lead to increases in cross-cultural violence.⁴ Planning for potential community tensions and building equity is essential in increasing the health impacts of gentrification. The 2014 Action Plan for North Delridge should increase their development scope to include more equitable improvements.

As the composition of the neighborhood changes, current residents should not feel disconnected. City planners are already working on improving the community resources by identifying cultural gathering places and increasing access to healthy food, these improvements should be more conscientious of the diversity of the community already present. New grocery development must include cultural food important to the current residents. Allowing local businesses to continue to operate will encourage residents to stay in a community in which they are familiar.⁴

Recommendations

Stimulate Affordable Housing Development

1. Mixed Multifamily Housing Rentals
 - a. City planners should grant permits for larger multi-family unit developments but carefully consider how and where cars from new residents will be parked
 - b. Permits with more than 10 units should include a minimum of 10% affordable housing, for the lowest $\frac{1}{3}$ of the income bracket of the city of Seattle
 - c. Establish tax incentives for developments meeting the above requirements
 - d. Enact policy to assure mixed housing has equitable access to resources

2. Homeownership

- a. City planners should work with community groups to develop tax credits for homeowners with approved developments
- b. Home ownership programs with low down payments and competitive mortgage rates should be promoted in this area with the help of local banks

Maintain Community Spaces

3. Culture

- a. City planners should continue working with the Delridge community to identify and promote access to cultural hotspots
- b. Ensure that local grocers and other food retail stock culturally appropriate foods, comprising a recommended minimum of one full aisle

4. Transportation

- a. Continue to identify routes of transit to and from community centers in line with the Seattle Master Transit Plan.
- b. Work with SDOT to repave sidewalks and ensure that all pedestrian zones meet the minimum six feet width requirement stipulated in the Seattle Right-of-Way Improvements Manual.
- c. Consider bus routes that provide residents with access to key areas of interest as identified by the community in line with the Seattle Master Transit Plan.

5. Outreach

- a. Engage community groups to develop after-school programs for all citizens to foster trust between different groups.

Social Services

Social services are basic services that are provided to a community usually through the government. They include public education, libraries, subsidized housing, food subsidies, health care, and job training. Social services also include privately funded sources including food banks, addiction counseling services, and homeless shelters. There are several barriers to these services that need to be addressed in order to assure that they are available to the community they are intended to help. First, they must be available in an amount that fits the needs of the community. Next, assuring that there are no barriers to utilization so that they can continue to be available to the community for the future. Barriers to utilization could be financial, logistic, cultural, or from lack of transportation. Finally, available social services must be relevant to the population they serve. Meeting all three of these criteria must occur in order to state that individuals within a community can access the services they need.¹ Without access, individuals and neighborhoods could suffer from poor health outcomes, significant problems accessing employment opportunities, and create financial and familial stress.² Availability, access and utilization of social services are themselves social determinants of health.

Current Conditions in the Delridge Corridor

The Delridge Corridor offers an array of different social services for a variety of individual needs. While current data on who is accessing and utilizing these services is unavailable, it is hoped that the services target vulnerable populations and those of lower socioeconomic status, many of whom likely access them do so through the use of public transportation. Several organizations that offer social services specific to the Delridge community include:

- Navos: provides a variety of services for people with mental illness and addiction
- SW Youth and Family Services: promotes healthy family functioning, early childhood learning, student success and youth development.
- Delridge Library: provides Internet access, resources and assistance with social services.
- Community Care: provides one-on-one care for children and youth with special needs.

Impact on Health

Social services impact health in a number of ways. Access to housing, education, libraries, basic nursing services, and other services and community building organizations allow people to live longer, healthier lives. Availability, access and utilization of social services are all necessary components to a thriving community that reflects the diversity of Delridge. Access to public education is foundational to healthy outcomes, and has recently been linked with longevity through acquisition of better paying jobs and increased standards of living.³ Having services available to those in need is key to supporting and increasing the health of Delridge residents. As the Delridge redevelopment plans are being made, consistent access to available services and encouragement of building new services that are needed by community members should be at the forefront of redevelopment plans.

Assessment

This outlines a framework for envisioning how the Delridge project will have an impact on the ability of vulnerable populations to access social and mental health services. To the extent that the people who utilize these services access them through public transportation the redevelopment plans might have a significant impact in terms of access. In the initial construction phase of the project care needs to be taken so that disruptions to public transportation services are limited.

Recommendations

1. Reduce disruptions in access to social services for vulnerable populations by coordinating with local social service organizations before, during, and after the construction phase of the Delridge Corridor Project.
2. Gather data from local social services regarding population served and transportation-related barriers to access in order to prioritize access.
3. Prior to construction and using Transportation Demand management strategies, communicate directly with vulnerable populations through use of culturally and language specific materials regarding relevant disruptions in transportation services.

Food Access

Food deserts are defined differently – some define it as an area more than one mile away from a grocery store in an urban area. Others define it as an area with a population that has limited access to food, has limited mobility, low income, a higher calorie diet, and a reliance on small grocery stores that have poor quality and high prices.¹¹ The common theme is that a food desert is a region where access to affordable, healthy and culturally relevant food choices is difficult, if available at all. Supermarkets are typically consolidated in suburban areas, which cater to the middle- and upper-class residents; access to these locations is difficult without a car, and expensive with one.¹¹ Research shows that the cost of food is often higher in urban areas than suburban areas because of higher operating costs. Other studies suggest that higher prices are a result of smaller quantities of fresh foods, and a larger amount of processed foods available in smaller stores in urban neighborhoods.⁸ This problem is compounded by the fact that urban areas tend to have a higher percentage of low-income households which have greater financial constraints that limit their power to purchase high-quality nutritional foods.¹⁶

Current Conditions in the Delridge Corridor

In order to better address the issue of food deserts, it is important to understand its dynamics and the populations it impacts. Studies have shown that there are often numerous factors involved in decisions made regarding purchasing food - the roots are often culturally and geographically derived.¹⁸ Due to its demographics (see Introduction), the population in Delridge is especially susceptible to problems related to poor nutrition. A major repeated complaint among Delridge residents is the lack of a suitable grocery store close by.

Impact on Health

Food insecurity affects the most vulnerable populations – low-income, people experiencing homelessness, minorities, and rural populations.¹⁰ Access to traditional food is vital for preserving cultural traditions and the health of immigrant communities. In many cultures, food preparation and consumption are integral parts of religious celebration and gatherings.³

Food deserts have a significant impact on families, especially on children. Poor dietary choices during childhood can increase obesity, the prevalence of chronic diseases, and form unhealthy habits that are much more difficult to break later in life.¹⁵ Residents of Delridge also have a higher rates of cancer, heart disease, overweight and obesity, compared to the city average. Most (72.3%) of residents are not consuming 5 or more fruits and vegetables daily.

There are many benefits to improved food access - higher fruit and vegetable consumption, formation of better habits, and family health benefits.¹ One of the studies conducted on introducing a new supermarket into a food desert showed that there was an increase in fruit and vegetable consumption.² Another study found that increased access to supermarkets was associated with lower rates of obesity.⁹ In a largely family environment the effect may be the formation of healthy food habits - teaching children to make good choices with what they eat, and improved family health (a sense of togetherness felt within the family).¹ The effect of community gardens has been studied, and interviewees reported improved mental health, as well as economic and family health benefits.¹

Assessment

The city of Seattle has created goals to improve access to healthy and fresh food in Delridge.¹⁴ These objectives include:

- A supermarket within ½ mile of residential areas that accepts a food assistance program payment, or transportation within ¼ mile that allows easy and frequent access to grocery stores.
- One p-patch/community garden for every 2,500 households.
- A farmers market in the neighborhood that accepts food assistance program payment or the Fresh Bucks program.
- Curbing the number of fast food restaurants in the neighborhood such that they do not exceed the citywide average.

Using distance as a metric for food availability has shortcomings as the numbers may not capture access to nutritionally and culturally appropriate foods.⁷ Low-income neighborhoods tend to have fewer grocery stores - typically one-third less, and with less selection. The result is that residents often have no choice but to eat less nutritional food that is more calorie dense.¹⁷

Both the Delridge Action Plan and Seattle's Comprehensive Plan call for development in nodes.⁵ These areas have been identified qualitatively in the Neighborhood Planning Element of the Comprehensive Plan,¹³ and quantitatively in the proposed land use map.¹² More specifically, additional commercial zoning will be added around Delridge Way and SW Andover St and Delridge Way and SW Brandon St (see Map 1). The intended outcome is an increase in business activity and improved access to healthy food.⁵ An unintended benefit and product of increased commercial competition may be a reduction in the number of fast food restaurants independent of the city's plan to control them. The health effects are also likely to extend beyond having more food choices - one study found that nearly one-third of people who live in a food oasis (an area with a large-chain supermarket with ½ mile of the center of the zip code) prefer to walk to the grocery store.¹⁸ In the meantime, the population should be educated about bus lines and alternative transport to other full-service supermarkets.

While the comprehensive growth plan anticipates future growth, the effect will not be immediate. Thus, it is important that the community also pursues other options such as setting up a food buying group or grocery cooperative. Forming a food-buying group would include assembling interested parties and contacting a food distributor. The food could be shipped to a community center or convenient location to be picked up, or distributed through community members.⁶ The Delridge neighborhood has already begun the process of setting up a Grocery Co-operative (Co-op). The Co-op is a customer-owned business in which members for capital expenditures provide non-collateralized loans. Over time, and as the business becomes profitable, these loans are repaid in full. As of spring 2015, the Delridge Grocery Co-operative has become a reality – business is expected to open in summer 2015 near the Brandon node at 5444 Delridge Way SW.

Recommendations

1. Use City of Seattle Delridge Neighborhood District webpage (<http://www.seattle.gov/neighborhoods/neighborhood-districts/delridge>) and social media platforms (e.g., Facebook, Twitter, etc.) to alert residents to changes in planned and existing healthy food access.¹⁹
2. DON should consider assisting with development and expansion of p-patches community gardens to meet or exceed food metrics set by the DPD. Efforts and timeline for goal attainment should be coordinated between these two departments. P-Patches should be installed and a food to table curriculum taught at local schools.
3. DON or DPD should consider supporting the establishment of a local farmer's market by creating a friendly zoning area for farmers markets. Utilize preferred locations such as the parking lots at Home Depot or the Boren School near the Brandon intersection.¹⁹
4. DPD should support planned zoning changes for Brandon and Andover nodes, which include increased commercial zoning to support.
5. Increase frequency and duration of service for King County Metro lines 120, 128, and 50 or seek funding to begin bus rapid transit along Delridge Way SW to improve mobility.¹⁹

Employment

Employment status and job type have significant bearing on an individual's health. Employment provides one with income and can bring a feeling of dignity and wellbeing. However, some jobs present exposure to risky environments, or have other negatively associated factors such as a long commute, insufficient pay, discrimination and job insecurity. Job loss can exacerbate personal stress levels, and insufficient income can significantly impact all aspects of life. For some, unemployment payments, reliance on family or other mitigating factors help minimize health impacts associated with unemployment. In communities with high levels of unemployment, low rates of education, and existing health disparities, social and economic support may not be as easily available as it is to higher income communities with generally more resources.³

Current Conditions in the Delridge Corridor

The economic profile of the Delridge area of Seattle shows a higher unemployment rate, lower educational attainment rate and lower income levels than Seattle as a whole.¹ Looking at retail activity in the area, there are low rates of neighborhood retail completeness, meaning small and mid-size commercial establishments such as banks, places to eat, food stores and retail entertainment. These types of stores can both improve the quality of life of the area and also provide employment opportunities for residents, though concern should be given to whether or not the jobs provide an adequate living wage.

Impact on Health

The causal pathway of how employment connects to health outcomes is diagrammed below. On the left side are factor inputs that alter the employment prospects, and on the right, health outcomes.

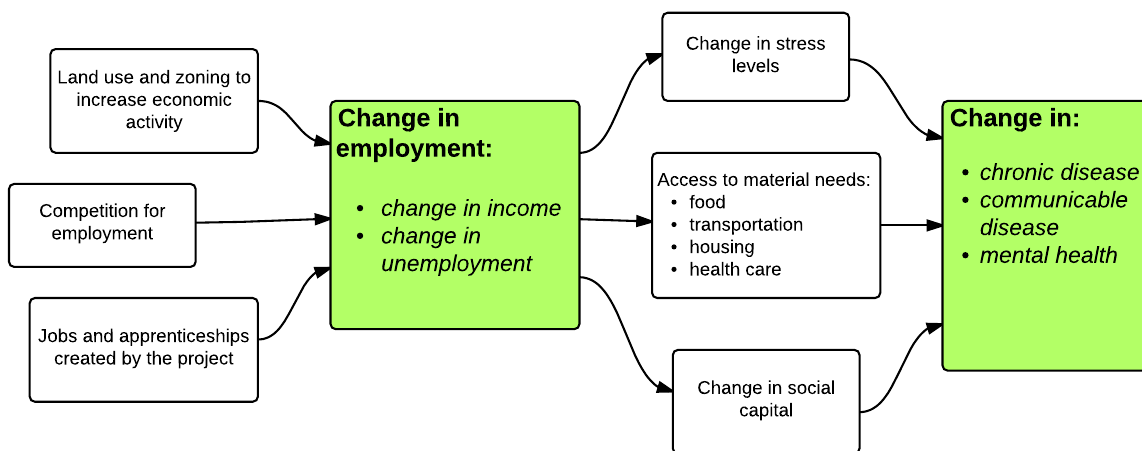


Figure 7: Relationship Between Employment and Health

Changes in employment status are moderated by changes in zoning and land use. Delridge is currently zoned primarily as residential single and multi-family housing with little commercial zoning, therefore sources of employment have been difficult to find in the area. Because there are few opportunities nearby, the competition for those jobs is much greater. However once employment is obtained, changes in income and unemployment likely increase healthier outcomes by increasing access to food, transportation, housing and health care. Increases in these lead to changes in social capital, all of which can lower the incidence of chronic and communicable disease and lower the incidence of mental health problems.

Assessment

Strengthening the capacity for Delridge residents to benefit from the robust Seattle economy will help existing resident's incomes rise and be resilient to the broader changes taking place in Seattle. Using a strategic community economic development plan to respond to the broader changes and opportunities is key. The most concrete way Seattle's Delridge Multimodal Transportation project could impact employment and health related outcomes are by using the project itself to create jobs and apprenticeships for local residents. Consistent with existing City of Seattle policy of developing project labor agreements for publicly funded capital projects of \$5 million.² Maximizing the access of Delridge residents to gain employment and training with the street reconfiguration project could have lasting effects by helping people gain new skills and work opportunities in the future.

Recommendations

1. Prioritize employment and apprenticeship opportunities for local residents for jobs generated by the street reconfiguration project per Seattle Priority Hire Ordinance no. 124690.
2. Strengthen the economic vitality of the existing residents by increasing opportunities specifically targeted to Delridge residents, rather than seeking to generally increase access to jobs in the downtown core.

Education

Education is the basic foundation of human growth and development. It prepares individuals with essential life skills and exposes students to many diverse career opportunities.¹ Educational development and attainment is an important part of determining socio-economic status, life expectancy, and health outcomes.

Current Conditions in the Delridge Corridor

Access to Education

The Delridge community is home to 10 primary and secondary schools, 7 preschools, and one community college. The Seattle Public Schools system is the main educational hub in Delridge, with an enrollment population of over 5,000 students in 2013.² Seattle Community College hosts over 14,000 students on its southern campus, with 43% of students attending full time.³

In addition to the traditional educational establishments found in Delridge, there are several community centers in the neighborhood that provide supplemental educational support to neighborhood residents. Centers such as the Southwest Youth and Family center focus on promoting healthy family functioning, early childhood learning, and student academic success.⁴

Educational Attainment

Approximately nine thousand Delridge residents are over the age of 25. Within this population, only 35% of residents hold a bachelor's degree or higher, compared to 55% of residents in Seattle.⁵ About 36% of the population obtained a high school degree or less, compared to less than 20% of Seattle residents. The Delridge community has a slightly higher percentage of residents who have completed some college/Associates degree, compared to the rest of Seattle.⁵

Impact on Health

Causal Pathways

Those who receive higher education have a lower rate of joblessness and a higher standard of living, shaped largely by diversity in the types of employment possibilities.⁶ These links between higher education and employment is more important for good health; those jobs that pay more often have better health insurance, resulting in lower rates of chronic illness. It is estimated that if the number of residents receiving at least partial college education increased by 5%, over five thousand cases of diabetes could be prevented. As a leading health care expenditure, this could result in reducing the cost of diabetes care by \$32.8 million every year.⁷

Health outcomes

Low-income neighborhoods have disproportionately poor health outcomes. High Poverty areas in King County (including the Delridge Corridor) face higher rates of cancer, heart disease, and chronic lower respiratory diseases.⁸ In contrast, higher income areas have significantly lower rate of chronic diseases than communities such as Delridge.⁸ In addition to higher rates of chronic disease, lower income communities such as Delridge face greater risk of suffering less common health problems than higher income areas in King County including unintentional injuries.⁸

Heart disease is correlated to early exposure to poor nutritional habits, physical activity practices, and obesity.⁹ Initiatives geared to improve the built environment and encourage physical activity among youth including construction of bike trails and establishment of youth bike programs can help support efforts to improve healthy lifestyles.¹⁰ Aside from preventing chronic diseases such as heart disease and diabetes, higher education and access to infrastructure that increases physical activity may reduce the incidence of depression and psychiatric illness. A study of over twenty thousand school-aged children found that walking or bicycling to school advanced mental alertness advancing educational achievement by half a school year.

Studies point to educational attainment and socioeconomic status as key indicators of greater life expectancy. In Delridge, the average life expectancy is 79.7 years, compared to 86 years in Northeast Seattle, proving that education is the key to a longer, more productive life.¹¹

Recommendations

1. The Delridge Community has a wide range of formal and informal systems in place to maintain equity in access to education and educational attainment. During construction, it is important for SDOT to maintain accessibility to community centers, preschools, and other afterschool activities that facilitate continued educational growth.
2. Comfortable spaces and places contribute to educational attainment. DPD's redevelopment plans should incorporate symbols of cultural significance to those that live in Delridge in order to increase a sense of belonging.
3. Safe access to schools increases educational attainment and reduces healthcare burden. Therefore, SDOT planning consider making the following improvements through its Safe Routes to School program:
 - a. Install pedestrian crossings at key school facility access points;
 - b. Install speed cameras near schools to enforce the 20mph speed limit during school hours, and;
 - c. Improve sidewalks near schools per the Seattle Pedestrian Master Plan (e.g., widen and install buffer strips between street and the sidewalk) to improve accessibility and access.

Priority Recommendations

The analysis of health effects in this HIA led to a set of 15 priority recommendations focusing on the following key areas: (1) a complete, safe and connected network, (2) community engagement, (3) safety, (4) mitigation of construction impacts, (5) the development of community assets, (6) zoning changes, and (7) monitoring of impact. SDOT and DPD should consider incorporating the following recommendations during the planning, implementation, monitoring, and evaluation of the Delridge Corridor Multimodal Improvement Project:

Create a Complete, Safe and Connected Network: SDOT

1. Focus public transit, bike lane, sidewalk, and street improvements on creating a complete network that connects residents to community services, green space, and other community assets in line with the Seattle Transit, Bicycle, and Pedestrian Master Plans.
 - a. Install a transit-only lane in one direction throughout Delridge Way SW, and in two directions where right of way allows

Strengthen Community Engagement: SDOT and DPD

2. Establish robust communication lines with local residents and engage the community in each stage of the project – planning, implementation, monitoring, and evaluation
 - a. Establish a community coalition for oversight, community representation, and feedback. The coalition should include representatives from all stakeholder groups
 - b. Provide translated materials and language interpretation at all meetings targeting groups who speak a language other than English
 - c. Make concerted efforts to include vulnerable and traditionally underrepresented groups through partnership with the DON Public Outreach and Engagement Liaisons and Disability Rights Washington
3. Integrate communitywide celebrations throughout the project
 - a. Celebrate the completion of the project with a communitywide celebration
 - b. Educate community groups about free Neighborhood Block Party Permits and encourage celebrations at major accomplishments in the project

Ensure Safety: SDOT

4. Ensure that all sidewalks meet the six-foot requirement of the Seattle Right-of-Way Improvement Manual and repair existing sidewalks to improve wheelchair accessibility and general usability for all residents
5. Enhance safety of roadways through speed reductions of 5-10 mph, narrowed streets, and lanes to encourage speed reduction and installation of automated speed monitoring cameras, especially near schools and parks
6. Install safe, ground-level, protected pedestrian crossings in community-identified intersections and access points, as well as those identified by safety data

Utilize Construction Impact Mitigation: SDOT

7. Use Best Construction Practices for mitigating environmental pollution

Support the Development of Community Assets: SDOT

8. Work with other City of Seattle departments to increase green space in the Delridge area, including the incorporation of vegetation and natural materials into roadway design, expansion of existing parks, and addition of new parks and parklets
9. Together with SOAC and funding from the DON, support community-based art projects on retaining walls, non-arterial streets and intersections, pedestrian overpasses, and other visible public spaces, with special emphasis on engaging youth and historically underrepresented groups in these projects
10. Use biophilic design – incorporate plants, natural materials and/or public art and décor that mimics natural elements – such as trees and grasses as buffers between streets and the sidewalk
11. Work with DON and the Delridge community to identify sub-neighborhoods, and provide wayfinding signage and support for community-based art to identify each area and promote a sense of place and community cohesion

Change Zoning: DPD

12. Grant permits for larger multi-family unit developments, but permits with more than 10 units should include a minimum of 10% affordable housing, for the lowest third of the income bracket of the city of Seattle
13. Support planned zoning changes for Brandon and Andover nodes, which include increased commercial zoning

Monitor Health Impacts: SDOT and DPD

14. Partner with Public Health – Seattle/King County or the UW to update this HIA with a more detailed review for health issues once a clear proposal or potential options have been identified for the project
15. Develop and maintain an Evaluation Team to evaluate the impact of this HIA

Monitoring & Evaluation

A significant and often overlooked area of HIAs is the monitoring and evaluation of the recommendations it offers. Evaluating the HIA involves three steps: process evaluation, in which an independent assessor assess the process by which the HIA was produced, outcome evaluation, to determine the HIA's influence on the decision making processes, and outcome evaluation, which investigates whether the recommendations and predictions in the HIA were accurate. Because HIAs are relatively new tools for decision-making processes, evaluation is crucial to understanding the effectiveness of an HIA, strengthening the HIA process through experimentation, and affecting future HIAs by generating commitment to the HIA process.¹

Process evaluation

As with any relatively new public health tool, producing an HIA costs time and money, and understanding the resources that go into producing an HIA will help future HIA practitioners understand how HIAs can be used most effectively. AN HIA that has minimal impact for a small number of people would be unlikely to result in significant change. Therefore conscientious scoping of a potential HIA is important for its success not only as an exercise but to assure participants feel that their time was well worth the effort. Similarly, economic evaluation is required to understand not only the personnel costs associated with conducting an HIA, but the resource costs as well. If the authors of the HIA are taking time away from valuable work projects, the HIA would at best be a waste of time, and at worst take away from other important projects. Investigators should also assess whether they worked well together as a team. A successful team will produce recommendations that are thoughtful, actionable, measurable and succinct. The process of prioritizing recommendations is particularly important. Investigators should prioritize recommendations based on potential economic and health impacts, and determine whether the recommendations are truly measurable. Finally, evaluators should think specifically about how recommendations are presented to decision makers. Presentation can make an enormous difference in whether HIA recommendations are followed as projects are undertaken.

Impact Evaluation

Investigators also must evaluate the impact of the HIA by first asking whether the HIA provided useful information to the policy-making process. As with any new public health tool, the HIA process is under investigation for efficacy. Should an HIA not produce useful information, future HIAs may be approached with skepticism. Successful HIAs also incorporate the voices of those who are going to be most deeply affected by the changes outlined in the process. For instance, changes in a community center in a neighborhood that is largely ethnic might not incorporate ethnically important symbols or design unless the community has input into that design. Areas that have been designed *for* community members rather than *with* them may impact the number of people who use the redesigned space for its intended purpose. Often, HIAs are performed at a time when policy decisions are being made. The measure of a good HIA would be its usefulness during immediate policy decisions such as decisions that may change the design of a project.

A second, equally important step in determining the impact of the HIA is understanding where the process deviated from the assessment plans. Investigators might ask if the HIA led to unexpected or unnecessary changes that could be useful in designing and evaluating similar future assessments. Investigators should also be curious whether potential new partnerships have been forged from the HIA process that may influence future policy, particularly those that led to successful coalitions. And a final broader question would be asking whether the HIA influenced large scale planning processes for institutions outside of the HIA itself. Documenting how an HIA might have changed public policy or institutional processes would be especially effective moving forward as a means to build a network of strategies.

Outcome Evaluation

While process evaluation and impact evaluation can be relatively quickly performed, determining long-term outcomes could take significantly longer. Outcome evaluations primarily assess whether the adoption of recommendations has resulted in quantifiable health outcomes, the accuracy of health-related prediction, and investigate the assumptions that are made that gave rise to particular recommendations. Investigators are first going to want to understand whether the predicted outcomes matched the actual outcomes. Importantly, depending on the length of time scheduled for completion and complexity of the HIA, other health impacts may have arisen that should be addressed in similar HIAs moving forward, particularly evaluation of those health impacts that were not predicted by the HIA itself.²

Challenges to Evaluation

While HIAs are often necessary for assuring a thorough check for health impacts have been undertaken prior to work on a specific project or policy change, completing the evaluation metrics can be challenging both in terms of time for staff taking part and for continued funding for completion of the evaluation. Determining the start and finish of an HIA is of critical importance; this can be managed though setting expectations for completion of the evaluation. Without defined beginning and ending points, the HIA may extend for far longer or shorter than is necessary to complete the assessment. Additionally, managing stakeholders, especially if they are diverse and have opposing definitions of success can be particularly challenging. Leadership among those producing the evaluation can also be tricky. Ultimately, evaluation planning occurs at the time of inception of the project as a way to plan for proper time and resource allocation.²

Logic models are tools that are used by program evaluators to visualize a link between a decision at hand and its potential impact on human health. Logic models incorporate environmental, social, physical, biological, and behavioral information with theories and research from a variety of disciplines in order to understand all possible impacts on human health.

The following model outlines a basic logic framework that can be used to evaluate the efficacy of this HIA. Over time, this HIA will be monitored for its influence on legislative decision-making, environmental monitoring, and ongoing impacts on health to assure that suggestions that have been implemented have had the desired effect. This logic model first outlines the reasons that require putting together this HIA. It next investigates the inputs to the system including financial resources, available data, time and institutional knowledge that are required to perform outlined activities. Community meetings, stakeholder meetings and developmental recommendations assist in the creation of outputs such as this HIA. Additional outputs include community awareness and development and facilitation of new partnerships. Finally, this logic model outlines several short, medium and long-term outcomes that arise through the completion of the recommendations.

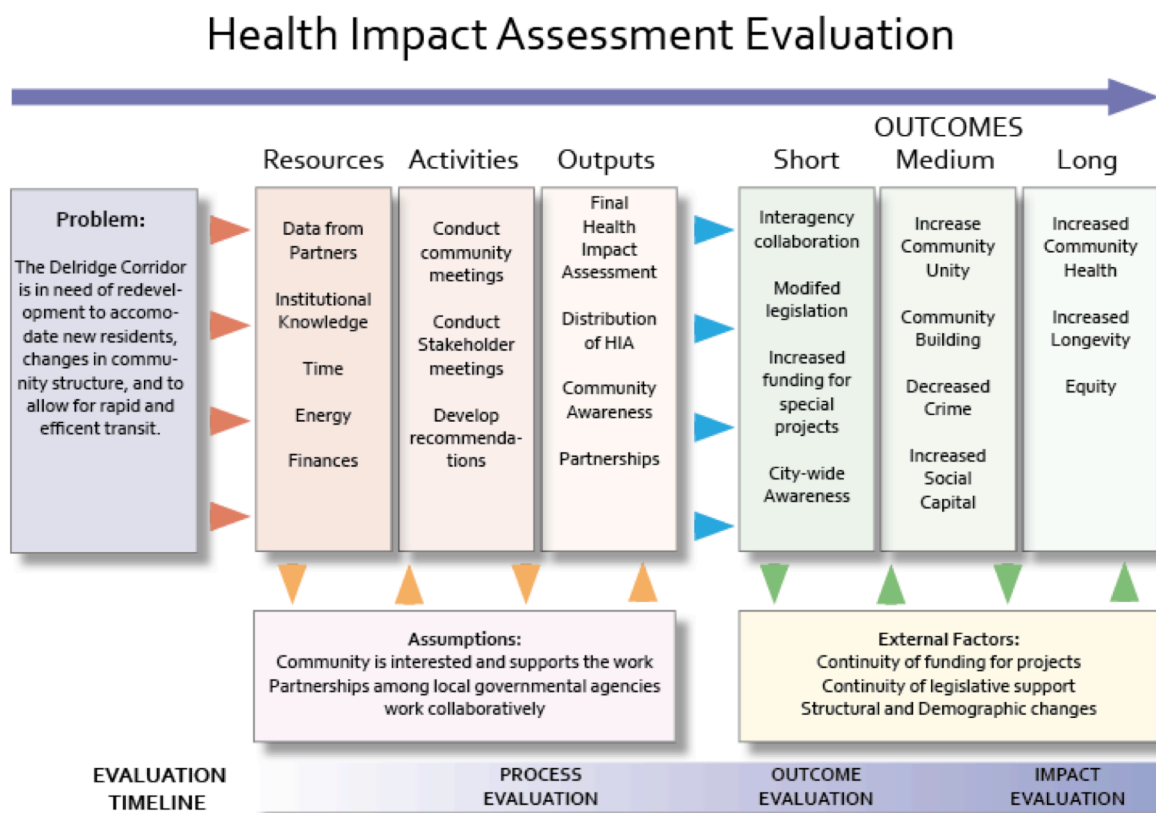


Figure 8: Logic Model for the Evaluation of the Delridge Corridor Multimodal Transportation Project Health Impact Assessment

Finally, an implementation plan for how to assure that these evaluations are carried out must be determined. A team of agency and community partners must work together to determine what is being done in accordance with the HIA and how it is affecting desired community outcomes. Proper evaluation is a necessary and required tool to determine effectiveness of any HIA. It is recommended that development of an evaluation implementation team representing all stakeholders be assembled to plan for and conduct the evaluation as a first priority.

Conclusion

Limitations

This HIA has several limitations. The conceptual design for the Delridge Corridor project was still under development when the UW team conducted this assessment. Therefore, SDOT provided a series of potential transit corridor designs for evaluation. The city also has yet to hold formal community meetings to gather resident feedback on the plans. Additionally, due to time constraints requiring completion of this project during the 10-week period of the class, public engagement, data collection, evaluation and monitoring were not possible.

Conclusion

Seattle's Delridge Corridor Multimodal Improvement project Health Impact Assessment is a collaborative effort between Seattle's Department of Transportation, the Department of Planning and Development, and the University of Washington's Environmental Health Department in the School of Public Health. This work spans areas the spectrum of healthy redevelopment including environmental health, social cohesion, safety, transportation, and access to recreational space. Based on the "health in all policies" framework outlined by Healthy People 2020, the suggestions offered here are intended to highlight particular areas where inequitable policies could negatively impact vulnerable populations, often people of color.

Fifteen years ago, Delridge completed a neighborhood plan that has aided the city planners to address some of the more crucial concerns of the community with respect to redevelopment, however this plan is being outpaced by growth and expansion in Seattle. The Multimodal Corridors Program is a citywide program that identifies areas that are likely to be highly impacted by Seattle's continued growth and expansion.

Delridge is more diverse than most neighborhoods in Seattle. Neighborhood changes or improvements may negatively impact the health of community members. The goal of this HIA is to determine where decision-makers should focus attention to assure that any decisions do not inequitably influence marginalized populations who have been long-term residents of Delridge. Careful policies and decisions can actively promote the health and equity of this population. Collaborative efforts between all stakeholders, including community members and various public policy departments and divisions will assure that the health of the Delridge neighborhood is improved during redevelopment and into the future, fulfilling the mission of Seattle's Race and Social Justice Initiative and increasing equity across all residents.

References

Acronyms & Definitions in the HIA

1. Seattle Department of Transportation (n.d.) "Complete Streets in Seattle." Retrieved from <http://www.seattle.gov/transportation/completeStreets.htm>.
2. Jacobs, J. (1961). *The Death and Life of Great American Cities*. New York: Random House.
3. SDOT Blog (2015, Feb.) Parklets and "Streeteries." Retrieved from <http://sdotblog.seattle.gov/2015/02/23/parklets-and-streeteries/>.
4. United States Environmental Protection Agency (2014, May). "What is Open Space/Green Space?" Retrieved from <http://www.epa.gov/region1/eco/uep/openspace.html>.
5. SDOT (n.d.) "Bicycle Program: Sharrows." Retrieved from <http://www.seattle.gov/transportation/sharrows.htm>.

Introduction

1. Reece, J., Gambhir, S., Ratchford, C., Martin M., Olinger, J. (2010, April). The Geography of Opportunity: Mapping to Promote Equitable Community Development and Fair Housing in King County, WA. *Kirwan Institute for the Study of Race and Ethnicity*. Retrieved from: http://kirwaninstitute.osu.edu/reports/2010/04_2010_KingCountyWAOppportunityMapping.pdf
2. Malekafzali, S., & Bergstrom, D. (2001). *Healthy corridor for all: A community health impact assessment of transit-oriented development policy in Saint Paul, Minnesota*.
3. Besser, L. M., & Dannenberg, A. L. (2005). Walking to Public Transit. *American Journal of Preventive Medicine*, 29(4), 273–280. <http://doi.org/10.1016/j.amepre.2005.06.010>
4. City of Seattle. *Delridge Assessment—Background Analysis Report*. Department of Planning and Development. December, 2014.
5. Human Impact Partners. (n.d.). Pathway diagram showing links between projects and health. Retrieved from <http://www.humanimpact.org/downloads/examples-of-pathway-diagrams-linking-projects-plans-and-policies-to-health-outcomes/> *Modified by author/Snare with permission of HIP.
6. San Francisco Department of Public Health. (n.d.). Pedestrian Environmental Quality Index (PEQI). Retrieved from <http://www.sfhealthequity.org/elements/24-elements/tools/106-pedestrian-environmental-quality-index>
7. Streetmix.net. (n.d.). Streetmix.net. Retrieved from <http://streetmix.net>.
8. World Health Organization (n.d.). "Social Determinants of Health." Retrieved from http://www.who.int/social_determinants/en/.
9. Office of Disease Prevention and Health Promotion, US Department of Health and Human Services (2015, Jun). "Social Determinants of Health." Retrieved from <http://www.healthypeople.gov/2020/topics-objectives/topic/social-determinants-health>.
10. King County Executive (2015, Jun). "Equity and Social Justice." Retrieved from <http://www.kingcounty.gov/elected/executive/equity-social-justice.aspx>.

Background and HIA Scope

1. American Public Health Association (2009, April). At The Intersection of Public Health and Transportation: Promoting Health Transportation Policy. American Public Health Association. Retrieved from: http://www.apha.org/~media/files/pdf/fact%20sheets/at_the_intersection_public_health_and_transportation.ashx
2. Farber, N., Shinkle, D., Lynott, J., Fox-Grage, W., Harrell, R. (2011, December). Aging In Place: A State Survey of Livability Policies and Practices. National Conference on State Legislatures. AARP Public Policy Institute. Retrieved from: <https://assets.aarp.org/rgcenter/ppi/liv-com/aging-in-place-2011-full.pdf>
3. Delridge Assessment – Background Report (2014, December). City of Seattle, Department of Planning and Development.
4. Delridge Planning Committee (1999). "Delridge Action Plan." Retrieved from <http://www.seattle.gov/documents/departments/neighborhoods/planning/plan/delridge-plan.pdf>.

Walkability & Multimodal Transportation

1. Wilbur Smith Associates. (2007, May). Public Attitude Survey of Bicycle and Pedestrian Planning. Bellevue, Washington.
2. Federal Highway Administration. (2001). *National Household Travel Survey*.
3. City of Seattle. *Delridge Assessment—Background Analysis Report*. Department of Planning and Development. December, 2014.
4. U.S. Department of Health and Human Services. (2008). *2008 Physical Activity Guidelines for Americans*. Washington, DC.
5. King County. King county city health profile - seattle. PDF, December 2012.
6. Carver, A., A. F. Timperio, and D. A. Crawford. 2008. "Neighborhood Road Environments and Physical Activity among Youth: The Clan Study." *Journal of Urban Health: Bulletin of the New York Academy of Medicine* 85: 532-44.
7. Sallis, J. F., B. E. Saelens, L.D. Frank, T.L. Conway, D. J. Slymen, K.L. Cain, J.E. Chapman, and J. Kerr. 2009. "Neighborhood Built Environment and Income: Examining Multiple Health Outcomes." *Social Science & Medicine* 68:1285-93.
8. Saxena, S., M. V. Ommeren, K. C. Tang, and T. P. Armstrong. 2005. "Mental Health Benefits of Physical Activity." *Journal of Mental Health* 14 (5): 445-51.
9. Berke, E.B., L.M. Gottlieb, A. V. Moudon, and E. B. Larson. 2007 "Protective Association between Neighborhood Walkability and Depression in Older Men." *Journal of American Geriatrics Society* 55 (4): 526-33.
10. Jacobs, J. (1961). *The Death and Life of Great American Cities*. New York: Random House.
11. Public Health Agency of Canada (2014). "What is Active Transportation?" retrieved from <http://www.phac-aspc.gc.ca/hp-ps/hl-mvs/pa-ap/at-ta-eng.php>.

Recreation & Physical Activity

1. Heath G, Brownson R, Kruger J, et al. The effectiveness of urban design and land use and transport policies and practices to increase physical activity: a systematic review. *J of Phys Activity and Hlth* 2006;3(S1):S55-S76.
2. Coulson J, Fox K, Lawlor D, Trayers T. Residents' diverse perspectives of the impact of neighbourhood renewal on quality of life and physical activity engagement: Improvements but unresolved issues. *Hlth Place* 2011;17(1):300-310.
3. Paffenbarger R Jr., Kampert J, Lee I, Hyde R, Leung R, Wing A. Changes in physical activity and other lifeway patterns influencing longevity. *Med Sci Sports Exerc* 1994;26(7):857-65.
4. City of Seattle. Delridge Assessment—Background Analysis Report. Department of Planning and Development. December, 2014.
5. City of Seattle. Delridge Way SW – Bicycle Facilities (Map). Department of Transportation. April, 2015.
6. King County. King County City Health Profile - Seattle. Public Health, Seattle & King County. December, 2012.
7. Powell K, Blair S. The public health burdens of sedentary living habits: theoretical but realistic estimates. *Med Sci Sports Exerc* 1994;26:851-56.
8. Hu FB, Manson J, Stampfer M, et al. Diet, lifestyle, and the risk of type 2 diabetes mellitus in women. *N Engl J Med* 2001;345(11):790-7.
9. Hu F, Leitzmann M, Stampfer M, Colditz G, Willett W, Rimm E. Physical activity and television watching in relation to risk for type 2 diabetes mellitus in men. *Arch Intern Med* 2001;161(12):1542-8.
10. Allison D, Fontaine K, Manson J, Stevens J, VanItallie T. Annual deaths attributable to obesity in the United States. *JAMA* 1999;282(16):1530-38.
11. Bianchini F, Kaaks R, Vainio H. Overweight, obesity, and cancer risk. *Lancet Oncology* 2002;3(9):565-74.
12. Sesso H, Paffenbarger R, Jr., Lee I. Physical activity and coronary heart disease in men: The Harvard Alumni Health Study. *Circulation* 2000;102(9):975-80.
13. Hillson M, Panter J, Foster C, Jones A. The relationship between access and quality of urban green space with population physical activity. *Pub Hlth* 2006;120:1127-32.
14. Duncan M, Mummery K. Psychosocial and environmental factors associated with physical activity among city dwellers in regional Queensland. *Prev Med* 2005;40:363-72.
15. Berke E, Koepsell T, Moudon A, Hoskins R, Larson F. Association of the built environment with physical activity and obesity in older persons. *Am J Pub Hlth* 2007;97(3):486-92.
16. Bennett C, McNeill L, Wolin K, Duncan D, Puleo E, Emmons K. Safe to walk? Neighborhood safety and physical activity among public housing residents. *PLoS Med* 2007;4(10):1599-606.
17. Molnar B, Gormaker S, Bull F, Buka S. Unsafe to play? Neighborhood disorder and lack of safety predict reduced physical activity among urban children and adolescents. *Am J Hlth Promot* 2004;18(5):378-76.

18. Harrison R, Gemmell I, Heller R. The population effect of crime and neighbourhood on physical activity: an analysis of 15,461 adults. *J Epidemiol Comm Hlth* 2007;61(1):34-39.
19. Carver A, Timperio A, Crawford D. Playing it safe: the influence of neighbourhood safety on children's physical activity: a review. *Hlth Place* 2008;14(2):217-27.
20. Cradock A, Kawachi I, Colditz G, Gortmaker S, Buka S. Neighborhood social cohesion and youth participation in physical activity in Chicago. *Soc Sci Med* 2009;68(3):427-35.
21. Fish J, Ettner S, Ang A, Brown A. Association of perceived neighborhood safety with [corrected] body mass index. *Am J Pub Hlth* 2010;100(11):2296-303.
22. National Recreation and Park Association. Creating Mini-Parks for Increased Physical Activity. Issue Brief. 2012.

Disability Access & Wayfinding

1. King County City Health Profile Seattle. Seattle & King County Public Health. Dec. 2012. Web. 10 May 2015.
2. Kinne S. King County Adults Age 60+: Numbers by Neighborhood. Area Agency on Aging of Seattle and King County. 17 Jul. 2012. Web. 10 May 2015.
3. King County City Health Profile Seattle.
4. Youth Disability Screener. Seattle Quality of Life Group. University of Washington School of Public Health. 2011. Web. 10 May 2015.
5. Imrie R. Responding to the Design Needs of Disabled People. *Journal of Urban Design* 2000;5(2):199-219.
6. Clarke P, Ailshire JA, Bader M, Morenoff JD, House JS. Mobility Disability and the Urban Built Environment. *American Journal of Epidemiology* 2008;168(5):506-513.
7. Carmeli E, Coleman R, Omar HL, Brown-Cross D. Do we allow elderly pedestrians sufficient time to cross the street in safety? *Journal of Aging and Physical Activity* 2000;8(1):51-58.
8. Hirtle SC, Jonides J. Evidence of hierarchies in cognitive maps. *Mem Cogn* 1985;13(3):208-217.
9. May AJ, Ross T, Bayer SH, Tarkiainen MJ. Pedestrian navigation aids: information requirements and design implications. *Pers Ubiquit Comput* 2003;7:331-338.
10. Ibid.
11. Social Capital. UCLA Health Impact Assessment Clearinghouse Learning & Information Center. Web. 28 May 2015.

Gentrification

1. Bryson, Jeremy. The nature of gentrification. *Geography Compass* 2013; 7/ 8: 578-587.
2. Lin, Jefferey. Gentrification and transit in Northwest Chicago. *Journal of the Transportation Research Forum* 2002; 56 (4): 175-191.
3. Delridge Assessment - Background Analysis Report, City of Seattle, Department of Planning and Development, 2014.

4. Chaskin, Robert J. and Mark L. Joseph. 'Positive' gentrification, social control and the 'right to the city' in mixed income communities: Uses and expectations of space and place. *International Journal of Urban and Regional Research* 2013. 37 (2): 480-502.

Access to Social Services

1. Gulliford, Martin, et al. "What Does 'Access to Health Care' mean?" *Journal of health services research & policy* 7.3(2002): 186-88.
2. Vohra, Rini, et al. "Access to Services, Quality of Care, and Family Impact for Children with Autism, Other Developmental Disabilities, and Other Mental Health Conditions." *Autism* 18.7 (2014): 815-26.
3. Syed, S.T.; Gerber, B.S.; Sharp, L.K. "Traveling Towards Disease: Transportation Barriers to Health Care Access." *J Community Health*. 2013 October; 38(5) 976-993.
4. Robert Wood Johnson Foundation (2013, Mar). "Why Does Education Matter So Much to Health?" Retrieved from <http://www.rwjf.org/en/library/research/2012/12/why-does-education-matter-so-much-to-health-.html>.

Employment

1. City of Seattle, "Delridge Assessment - Background Analysis Report," Department of Planning and Development, 2014.
2. City of Seattle, "Priority Hire, Local Hiring for City Construction Projects" <http://www.seattle.gov/council/issues/priorityhire/default.html>
3. McKee-Ryan, Frances M., et al. "Psychological and Physical Well-Being During Unemployment: A Meta-Analytic Study," *Journal of Applied Psychology*, 2005, Vol. 90, No. 1, 53-76.

Food Access

1. Carney P. A., Hamada J. L., Rdesinski R., Sprager L., Nichols K. R., Liu B. Y., Pelayo J., and Shannon J. Impact of a community gardening project on vegetable intake, food security and family relationships: a community-based participatory research study. *Journal of Community Health*, 37, 4, 874-81, January 2011.
2. Whelan A., Wrigley N., Warm D., and Cannings E. Life in a food desert. *Urban Studies*, 39:2083-2100.
3. Maria Elisa Christie. Kitchenspace, fiestas, and cultural reproduction in mexican houselot gardens. *Geographical Review*, 94(3):368-390, 2004.
4. King County. King county city health profile - seattle. PDF, December 2012.
5. David Goldberg. North delridge action plan. Microsoft PowerPoint, March 2015.
6. Reynolds John. Are you living in a food desert. PDF, 2005.
7. Grauel K. and Chambers K. J. Food deserts and migrant farmworkers: Assessing food access in oregon's willamette valley. *Journal of Ethnobiology*, 34(2):228-250, July 2014.
8. Morland K., Wing S., Diez Roux A. V., and Poole C. Neighborhood characteristics associated with the location of food stores and food service places. *American Journal of Preventive Medicine*, 22:23-29, 2002.

9. Morland K., Diez Roux A. V., and S Wing. Supermarkets, other food stores, and obesity. *American Journal of Preventive Medicine*, 30:333–339, 2006.
10. Morton L. and Blanchard T. Starved for access: Life in rural america’s food deserts. PDF, 2007.
11. Guy Clifford M. and Gemma David. Measuring physical access to ‘healthy foods’ in areas of social deprivation: A case study in cardiff. *International Journal of Consumer Studies*, 28(3):222–234, 2004.
12. City of Seattle. Comprehensive plan. future lane use map. PDF, May 2013.
13. City of Seattle. Seattle’s comprehensive plan. neighborhood planning element. PDF, 2013.
14. City of Seattle. Delridge assessment - background analysis report. PDF, December 2014.
15. World Health Organization. Diet, nutrition and the prevention of chronic diseases. PDF, 2003.
16. Kaufman P. R., MacDonald J., Lutz S., and D Smallwood. Do the poor pay more for food? item selection and price differences affect low-income household food costs. *Agricultural Economics Report 34065*, 1997.
17. Richards R. and Smith C. The impact of homeless shelters on food access and choice among homeless families in minnesota. *Journal of Nutrition Education and Behavior*, 38(2):96–105, 2006.
18. Walker Renee, Craig Fryer, James Butler, Christopher Keane, Andrea Kriska, and Jessica Burke. Factors influencing food buying practices in residents of a low-income food desert and a low-income food oasis. *Journal of Mixed Methods Research*, 5(3):247–267, 2011.
19. City of Seattle. Seattle Women and Food Access - Learning from Women in Delridge. PDF, March 2014.

Education

1. Onzima R. Parents’ Socio-Economic Status And Pupils Educational Attainment: Case Study Of St. Jude Primary School In Malabatown Council-Uganda | Robert Onzima - Academia.edu. http://www.academia.edu/407935/parents_socio-economic_status_and_pupils_educational_attainment_case_study_of_st._jude_primary_school_in_malabatown_council-uganda. Accessed May 15, 2015.
2. Seattle Public Schools. Seattle Public Schools - Growth Boundaries-Maps by year: 2015. <http://www.seattleschools.org/modules/cms/pages.phtml?sessionid=c563dc7bab22e9c1922c379e7490aagf&pageid=322613&sessionid=c563dc7bab22e9c1922c379e7490aagf>. Accessed May 15, 2015.
3. Seattle Colleges (2015). Our Locations. Retrieved from: <http://www.seattlecolleges.com/district/district/locations.aspx?pg=South>.
4. Southwest Youth and Family Services (n.d.). Mission - SWYFS. Retrieved from <http://www.swyfs.org/what-we-do/mission/>.
5. Johnnie McKinley Associates L. Community Needs Assessment of Seattle Head Start, ECEAP, & Step Ahead Preschool Programs. 2014. <http://www.seattle.gov/Documents/Departments/OFE/AboutTheLevy/EarlyLearning/SeattleCommunityNeedsAssessment2014byJMA082514.pdf>. Accessed May 15, 2015.
6. Shankar J, Ip E, Khalema E, et al. Education as a social determinant of health: issues facing indigenous and visible minority students in postsecondary education in Western Canada. *Int J Environ Res Public Health*. 2013;10(9):3908–3929. doi:10.3390/ijerph10093908.

7. Center for Community Health and Evaluation (2015). Group Health Community Health Needs Assessment: 2013-2015. Retrieved from <https://www1.ghc.org/static/pdf/public/about/community-assessment-2013.pdf>.
8. Washington Department of Health (2013). Social and Economic Determinants of Health. Retrieved from <http://www.doh.wa.gov/Portals/1/Documents/5500/Context-SED2013.pdf>.
9. North Karelia Project. Heart Attack Prevention. <http://www.epi.umn.edu/cvdepi/study-synopsis/north-karelia-project/>. Accessed May 14, 2015.
10. SDOT (2013, Jun). Seattle Bicycle Master Plan. Retrieved from http://www.seattle.gov/transportation/bikemaster_materials.htm.
11. Washington State Department of Health P and CHD. Office of Healthy Communities Description. 2013:2. <http://www.doh.wa.gov/Portals/1/Documents/Pubs/140-010-PCH-OHCBrief.pdf>. Accessed October 6, 2014.
12. City of Seattle, Department of Transportation (n.d.) "Safe Routes to School." Retrieved from <http://www.seattle.gov/transportation/saferoutes.htm>.

Community & Mental Health

1. World Health Organization. (2003). Investing in mental health. Retrieved from who.int/mental_health.
2. Chapman, D. P., Perry, G. S., & Strine, T. W. (2005). The vital link between chronic disease and depressive disorders. Preventing Chronic Disease. Retrieved from http://www.cdc.gov/pcd/issues/2005/jan/04_0066.htm
3. Seattle and King County Assessment, Policy Development & Evaluation Unit (2012) King county city health profile seattle.

Social Capital

1. Forrest, R., & Kearns, A. (2001). Social cohesion, social capital and the neighbourhood. *Urban studies*, 38(12), 2125-2143.
2. Ziersch, A. M., Baum, F. E., MacDougall, C., & Putland, C. (2005). Neighbourhood life and social capital: the implications for health. *Social science & medicine*, 60(1), 71-86.
3. Leyden, K. M. (2003). Social capital and the built environment: the importance of walkable neighborhoods. *American journal of public health*, 93(9), 1546-1551.
4. City of Seattle, Department of Planning and Development and Development (2014, Dec). Delridge Assessment - Background Analysis Report (Draft).
5. Kritsotakis, G., Vassilaki, M., Melaki, V., Georgiou, V., Philalithis, A. E., Bitsios, P., ... & Koutis, A. (2013). Social capital in pregnancy and postpartum depressive symptoms: A prospective mother-child cohort study (the Rhea study). *International journal of nursing studies*, 50(1), 63-72.
6. Carpiano, R. M. (2007). Neighborhood social capital and adult health: an empirical test of a Bourdieu-based model. *Health & place*, 13(3), 639-655.
7. Communities Count (2012). "Social Cohesion: Summary & Data Highlights." Retrieved from: <http://www.communitiescount.org/index.php?page=social-cohesion>.
8. Hu, F., Hu, B., Chen, R., Ma, Y., Niu, L., Qin, X., & Hu1, Z. (2014). A systematic review of social capital and chronic non-communicable diseases. *BioScience Trends*, 8(6), 290-296.

9. Sander, T., & Lowney, K. (2006). Social capital building toolkit (version 1.2). *Cambridge, MA: John F Kennedy School of Government, Harvard University.*
10. Clark, C. J., Guo, H., Lunos, S., Aggarwal, N. T., Beck, T., Evans, D. A., ... & Everson-Rose, S. A. (2011). Neighborhood cohesion is associated with reduced risk of stroke mortality. *Stroke, 42*(5), 1212-1217.
11. Kim, E. S., Park, N., & Peterson, C. (2013). Perceived neighborhood social cohesion and stroke. *Social Science & Medicine, 97*, 49-55.
12. Murayama, H., Fujiwara, Y., & Kawachi, I. (2012). Social capital and health: a review of prospective multilevel studies. *Journal of Epidemiology, 22*(3), 179-187.
13. Muckenhuber, J. M., Dorner, T. E., Burkert, N., Groschädl, F., & Freidl, W. (2015). Low Social Capital as a Predictor for the Risk of Obesity. *Health & Social Work, 40*(2), e51-e58.
14. Choi, M., Mesa-Frias, M., Nüesch, E., Hargreaves, J., Prieto-Merino, D., Bowling, A., ... & Casas, J. P. (2014). Social capital, mortality, cardiovascular events and cancer: a systematic review of prospective studies. *International journal of epidemiology, 43*(6), 1895-1920.
15. Uphoff, E. P., Pickett, K. E., Cabieses, B., Small, N., & Wright, J. (2013). A systematic review of the relationships between social capital and socioeconomic inequalities in health: a contribution to understanding the psychosocial pathway of health inequalities. *Int J Equity Health, 12*, 54.
16. Putnam, R. D. (1995). Bowling alone: America's declining social capital. *Journal of democracy, 6*(1), 65-78.
17. Van Hooijdonk, C., Droomers, M., Deerenberg, I. M., Mackenbach, J. P., & Kunst, A. E. (2008). The diversity in associations between community social capital and health per health outcome, population group and location studied. *International Journal of Epidemiology, 37*(6), 1384-1392.
18. Eicher, C., and I. Kawachi. "Social Capital and Community Design." *Making Healthy Places: Designing and Building for Health, Well-Being, and Sustainability* Eds. Dannenberg, Andrew L, Howard Frumkin and Richard J Jackson: Island Press: Washington, DC, 2011.
19. Bassett, Emma, and Spencer Moore. "Mental Health and Social Capital: Social Capital as a Promising Initiative to Improving the Mental Health of Communities." *Current Topics in Public Health*. Ed. Rodriguez-Morales, AJ. 2013.
20. KU Workgroup for Community Health and Development. Section 8. Identifying Community Assets and Resources. In: Community Tool Box. Retrieved from <http://ctb.ku.edu/en/table-of-contents/assessment/assessing-community-needs-and-resources/identify-community-assets/main>
21. Tomita, A. & Burns, J. K. (2013). A multilevel analysis of association between neighborhood social capital and depression: Evidence from the first South African National Income Dynamics Study. *Journal of Affective Disorders, 144* (1-2). Retrieved from <http://www.sciencedirect.com/science/article/pii/S0165032712004600>
22. McPherson et al. (2014). The association between social capital and mental health and Behavioural problems in children and adolescents: an integrative systematic review. *PMC Psychology, 2*(7). Retrieved from <http://www.biomedcentral.com/2050-7283/2/7>

Aesthetics & Green Space

1. Beatley, Timothy. *Biophilic Cities: Integrating Nature into Urban Design and Planning*. Island Press, 2011.

2. Sullivan, WC., and C. Chang. "Mental Health and the Built Environment." *Making Healthy Places: Designing and Building for Health, Well-Being, and Sustainability* Eds. Dannenberg, Andrew L, Howard Frumkin and Richard J Jackson: Island Press: Washington, DC, 2011.
3. Frumkin, H., and J. Fox. "Contact with Nature." *Making Healthy Places: Designing and Building for Health, Well-Being, and Sustainability* Eds. Dannenberg, Andrew L, Howard Frumkin and Richard J Jackson: Island Press: Washington, DC, 2011.
4. Hopkins, Whitney. "Nature in View, Nature in Design: Reconnecting People with Nature through Design." *Nature and Cities*. 2015.
5. Kellert, Stephen R, Judith Heerwagen, and Martin Mador. *Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life*. John Wiley & Sons, 2011.
6. Design for Health. 2007. *Planning Information Sheet: Influencing Mental Health with Comprehensive Planning and Ordinances*. Version 2.0. http://designforhealth.net/wp-content/uploads/2012/12/BCBS_ISHealthCompPlanning_o82307.pdf
7. Sharp, Joanne, Venda Pollock, and Ronan Paddison. "Just Art for a Just City: Public Art and Social Inclusion in Urban Regeneration." *Urban Studies* 42.5-6 (2005): 1001-23.
8. United States Environmental Protection Agency (2015, June). "Indoor Air." Retrieved from <http://cfpub.epa.gov/eroe/index.cfm?fuseaction=list.listBySubTopic&ch=46&s=343>.

Art & Community Aesthetics

1. Argyle, Elaine, and Gillie Bolton. "Art in the Community for Potentially Vulnerable Mental Health Groups." *Health Education* 105.5 (2005): 340-54.
2. Wandell, Brian, et al. "Arts and Cognition Monograph: Training in the Arts, Reading, and Brain Imaging " The Dana Foundation <http://www.dana.org/Publications/ReportDetails.aspx?id=44246#sthash.E79tE5nG.dpuf> (2008).
3. Dinehart, Laura, and Louis Manfra. "Associations between Low-Income Children's Fine Motor Skills in Preschool and Academic Performance in Second Grade." *Early Education & Development* 24.2 (2013): 138-61.
4. Semenza, Jan C. "The Intersection of Urban Planning, Art, and Public Health: The Sunnyside Piazza." *American Journal of Public Health* 93.9 (2003): 1439-41.
5. Madyaningrum, Monica E, and Christopher Sonn. "Exploring the Meaning of Participation in a Community Art Project: A Case Study on the Seeming Project." *Journal of Community & Applied Social Psychology* 21.4 (2011): 358-70.
6. Ball, Kylie, et al. "Perceived Environmental Aesthetics and Convenience and Company Are Associated with Walking for Exercise among Australian Adults." *Preventive Medicine* 33.5 (2001): 434-40.
7. Sharp, Joanne, Venda Pollock, and Ronan Paddison. "Just Art for a Just City: Public Art and Social Inclusion in Urban Regeneration." *Urban Studies* 42.5-6 (2005): 1001-23.
8. Argyle, Elaine, and Gillie Bolton. "Art in the Community for Potentially Vulnerable Mental Health Groups." *Health Education* 105.5 (2005): 340-54.

9. Wandell, Brian, et al. "Arts and Cognition Monograph: Training in the Arts, Reading, and Brain Imaging " The Dana Foundation
<http://www.dana.org/Publications/ReportDetails.aspx?id=44246#sthash.E79tE5nG.dpuf>
(2008).
10. Dinehart, Laura, and Louis Manfra. "Associations between Low-Income Children's Fine Motor Skills in Preschool and Academic Performance in Second Grade." *Early Education & Development* 24.2 (2013): 138-61.
11. Semenza, Jan C. "The Intersection of Urban Planning, Art, and Public Health: The Sunnyside Piazza." *American Journal of Public Health* 93.9 (2003): 1439-41.
12. Madyaningrum, Monica E, and Christopher Sonn. "Exploring the Meaning of Participation in a Community Art Project: A Case Study on the Seeming Project." *Journal of Community & Applied Social Psychology* 21.4 (2011): 358-70.
13. Ball, Kylie, et al. "Perceived Environmental Aesthetics and Convenience and Company Are Associated with Walking for Exercise among Australian Adults." *Preventive Medicine* 33.5 (2001): 434-40.
14. Sharp, Joanne, Venda Pollock, and Ronan Paddison. "Just Art for a Just City: Public Art and Social Inclusion in Urban Regeneration." *Urban Studies* 42.5-6 (2005): 1001-23.
15. Seattle Department of Transportation (n.d.) "SDOT Art Plan Implementation." Retrieved from http://www.seattle.gov/transportation/artplan_implementation.htm

Environmental Health

1. Hoorman JJ, de Moraes Sa JC, Reeder R. *The Biology of Soil Compaction*. The Ohio State University Extension; 2009:1-7. <http://ohioline.osu.edu/sag-fact/pdf/0010.pdf>.
2. US EPA. Combined Sewer Overflows (CSO) Home. <http://water.epa.gov/polwaste/npdes/cso/>. Accessed May 29, 2015.
3. Delridge Combined Sewer Overflow (CSO) Retrofit - SEPA Determination of Non-Significance (DNS) - Seattle Department of Planning and Development. <http://web1.seattle.gov/dpd/luib/Notice.aspx?BID=849&NID=15935>. Accessed May 21, 2015.
4. Delridge Sewer--Seattle Public Utilities. <http://www.seattle.gov/util/environmentconservation/projects/delridgesewerimprovement/>. Accessed May 21, 2015.
5. KingStat Environmental Indicators and Performance Measures- King County. <http://your.kingcounty.gov/dnrp/measures/2012/indicators/hs-surface-water.aspx>. Accessed May 29, 2015.
6. Mental Health :: Green Cities: Good Health. https://depts.washington.edu/hhwb/Thm_Mental.html. Accessed May 29, 2015.
7. Large-scale Soil Amendment: Surveying | Site Selection | Preparation | Swales. *One Community*. <http://www.onecommunityglobal.org/soil-amendment/>. Accessed May 29, 2015.
8. Delridge neighborhood in Seattle, Washington (WA), 98106, 98126 subdivision profile - real estate, apartments, condos, homes, community, population, jobs, income, streets. <http://www.city-data.com/neighborhood/Delridge-Seattle-WA.html>. Accessed May 21, 2015.

9. Local Hazardous Waste Management Program in King County.
<http://www.hazwastehelp.org/default.aspx>. Accessed May 29, 2015.
10. West Seattle scene: Salmon spotted in Longfellow Creek.
<http://westseattleblog.com/2013/11/west-seattle-scene-salmon-spotted-in-longfellow-creek/>. Accessed May 16, 2015.
11. Meyer J., Kaplan L., Newbold J., et al. *Where Rivers Are Born: The Scientific Imperative for Defending Small Streams and Wetlands*. Sierra Club and American Rivers; 2003:1-24.
<http://criticalzone.org/christina/publications/pub/meyer-et-al-2003-where-rivers-are-born-the-scientific-imperative-for-defend/>.
12. *Community Revitalization Resulting from Stormwater Management Strategies - Case Studies*. Hamilton County Planning and Development; 2011.
13. Wild TC, Bernet JF, Westling EL, Lerner DN. Deculverting: reviewing the evidence on the "daylighting" and restoration of culverted rivers: Deculverting: reviewing the evidence. *Water Environ J*. 2011;25(3):412-421. doi:10.1111/j.1747-6593.2010.00236.x.
14. Mahler BJ, Metre PCV, Crane JL, Watts AW, Scoggins M, Williams ES. Coal-Tar-Based Pavement Sealcoat and PAHs: Implications for the Environment, Human Health, and Stormwater Management. *Environ Sci Technol*. 2012;46(6):3039-3045. doi:10.1021/es203699x.
15. Browne E, Kelley M, Zhou G-D, et al. In situ biomonitoring of juvenile Chinook salmon (*Onchorhynchus tshawytscha*) using biomarkers of chemical exposures and effects in a partially remediated urbanized waterway of the Puget Sound, WA. *Environ Res*. 2010;110(7):675-683. doi:10.1016/j.envres.2010.06.007.
16. Exposure to Common Pollutant in Womb Might Lower IQ - US News. *US News World Rep*.
<http://health.usnews.com/health-news/family-health/womens-health/articles/2009/07/20/exposure-to-common-pollutant-in-womb-might-lower-iq>. Accessed May 21, 2015.
17. Perera FP, Tang D, Wang S, et al. Prenatal polycyclic aromatic hydrocarbon (PAH) exposure and child behavior at age 6-7 years. *Environ Health Perspect*. 2012;120(6):921-926. doi:10.1289/ehp.1104315.
18. Prenatal exposure to polycyclic aromatic hydrocarbons and cognitive dysfunction in children. *CCCEH.org*. <http://ccceh.org/scientific-papers/prenatal-exposure-to-polycyclic-aromatic-hydrocarbons-and-cognitive-dysfunction-in-children>. Accessed May 21, 2015.
19. US EPA. Erosion, Sediment and Runoff Control for Roads and Highways.
http://water.epa.gov/polwaste/nps/road_runoff.cfm. Accessed May 21, 2015.
20. Augusto S, Gonzalez C, Vieira R, Máguas C, Branquinho C. Evaluating sources of PAHs in urban streams based on land use and biomonitors. *Environ Sci Technol*. 2011;45(8):3731-3738. doi:10.1021/es1036332.
21. Person, D (2013, Sept). The Duwamish River's Deadly Catches. *Seattle Weekly*. Retrieved from <http://www.seattleweekly.com/home/948747-129/river-duwamish-fish-seattle-cleanup-epa>.
22. Delridge Natural Drainage--Seattle Public Utilities.
<http://www.seattle.gov/util/EnvironmentConservation/Projects/DrainageSystem/DelridgeNaturalDrainage/index.htm>. Accessed May 19, 2015.

23. *Healthy Bugs = Healthy Streams Stream Bugs Tell An Important Story*. Kitsap County Surface and Stormwater Management Promoting Clean Runoff Through Knowledge and Assistance; :1-12. http://www.kitsapgov.com/sswm/pdf/7047-Healthy_Bugs.pdf.
24. Erosion and sediment control. <http://www.kingcounty.gov/property/permits/info/SpecialInterest/ConstructionIndustry/ErosionControl.aspx>. Accessed May 29, 2015.
25. Lloyd DS. Turbidity as a Water Quality Standard for Salmonid Habitats in Alaska. *North Am J Fish Manag.* 1987;7(1):34-45. doi:10.1577/1548-8659(1987)7<34:TAAWQS>2.0.CO;2.
26. How to Measure TSS and Turbidity | A Citizen's Guide to Understanding and Monitoring Lakes and Streams | Water Quality Program | Washington State Department of Ecology. <http://www.ecy.wa.gov/programs/wq/plants/management/joysmanual/4tss.html>. Accessed May 29, 2015.
27. Stream Total Suspended Solids and Turbidity | Chapter 3 | A Citizen's Guide to Understanding and Monitoring Lakes and Streams | Water Quality Program | Washington State Department of Ecology. <http://www.ecy.wa.gov/programs/wq/plants/management/joysmanual/streamtss.html>. Accessed May 21, 2015.
28. WHO | Ambient (outdoor) air quality and health. <http://www.who.int/mediacentre/factsheets/fs313/en/>. Accessed May 25, 2015.
29. Criteria Air Pollutants. <http://www.pscleanair.org/airquality/airqualitybasics/airpollutants/Pages/default.aspx>. Accessed May 25, 2015.
30. *State of the Air 2011*. American Lung Association <http://www.lung.org/assets/documents/publications/state-of-the-air/state-of-the-air-2011-report.pdf>.
31. *King County City Health Profile Seattle*. Public Health Seattle and King County; 2012:1-10.
32. Stress + pollution = health risks for low-income kids — Environmental Health News. <http://www.environmentalhealthnews.org/ehs/news/2012/pollution-poverty-and-people-of-color-stress-day-3>. Accessed May 25, 2015.
33. BAAQMD - Wood Smoke. <http://www.baaqmd.gov/Divisions/Compliance-and-Enforcement/Wood-Smoke/Wood-Smoke.aspx>. Accessed May 25, 2015.
34. ARCHIVED - Acid Rain FAQ - Air - Environment Canada. <https://www.ec.gc.ca/air/default.asp?lang=En&n=7E5E9F00-1#ws2CoE1270>. Accessed May 25, 2015.
35. US EPA. Near Roadway Air Pollution and Health. <http://www.epa.gov/otaq/nearroadway.htm>. Accessed May 25, 2015.
36. US EPA. Learn about Lead. <http://www2.epa.gov/lead/learn-about-lead#effects>. Accessed May 25, 2015.
37. Getting to know LEED: Building Design and Construction (BD+C) | U.S. Green Building Council. <http://www.usgbc.org/articles/getting-know-lead-building-design-and-construction-bdc>. Accessed May 25, 2015.

38. *Status of Research on Potential Mitigation Concepts to Reduce Exposure to Nearby Traffic Pollution*. California Environmental Protection Air Resources Board; 2012.
<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.348.7275&rep=rep1&type=pdf>.
39. Pollution From Construction. <http://www.sustainablebuild.co.uk/PollutionFromConstruction.html>. Accessed May 25, 2015.
40. Maslow's Hierarchy of Needs. *Simply Psychol*. <http://www.simplypsychology.org/maslow.html/>. Accessed December 10, 2014.
41. Housing | Health Impact Assessments - UCLA SPH. <http://www.hiaguide.org/sectors-and-causal-pathways/pathways/housing>. Accessed May 16, 2015.
42. Krieger J, Higgins DL. Housing and health: time again for public health action. *Am J Public Health*. 2002;92(5):758-768.
43. Affordable Housing - CPD - HUD.
http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/affordablehousing/. Accessed May 29, 2015.
44. Codes and Rules - Seattle Department of Planning and Development.
<http://www.seattle.gov/dpd/codesrules/>. Accessed May 19, 2015.
45. Animals, bugs and pests. <http://www.kingcounty.gov/healthservices/health/ehs/animals.aspx>. Accessed May 19, 2015.
46. Krieger JW, Takaro TK, Song L, Weaver M. The Seattle-King County Healthy Homes Project: A Randomized, Controlled Trial of a Community Health Worker Intervention to Decrease Exposure to Indoor Asthma Triggers. *Am J Public Health*. 2005;95(4):652-659. doi:10.2105/AJPH.2004.042994.

Noise

1. Berglund, Birgitta, Thomas Lindvall, and World Health Organization. *Community Noise*. Center for Sensory Research, Stockholm University and Karolinska Institute Stockholm, 1995.
2. Chang, Ta-Yuan, et al. "Road Traffic Noise Frequency and Prevalent Hypertension in Taichung, Taiwan: A Cross-Sectional Study." *Environmental Health* 13.1 (2014): 37.
3. Hammer, Monica S, Tracy K Swinburn, and Richard L Neitzel. "Environmental Noise Pollution in the United States: Developing an Effective Public Health Response." *Environ Health Perspect* 122.02 (2014): 115-19.
4. Fritschi, Lin, et al. *Introduction[Burden of Disease from Environmental Noise: Quantification of Healthy Years Life Lost in Europe]*. World Health Organisation, 2012.
5. Stansfeld, S.A. and Matheson, M.P. (2003) Noise pollution: non-auditory effects on health. *Br Med Bull* 68(1):243-257. Retrieved from: <http://bmb.oxfordjournals.org/content/68/1/243.full>
6. Sleep and Mental Health. (2009, July 1). Harvard Mental Health Letter. Harvard Health Publications. Retrieved from: http://www.health.harvard.edu/newsletter_article/Sleep-and-mental-health
7. WSDOT - Traffic Noise. (2015). Retrieved from <http://www.wsdot.wa.gov/Environment/Air/TrafficNoise.htm>.

8. SDOT (n.d.). "Community Notification for City Construction Projects: A Guide for Seattle's Elected Officials." Retrieved from <http://www.seattle.gov/transportation/pdf/Final%20Gde%20Elected%20Revised.pdf>.

Traffic Safety

1. 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>.
2. Washington Traffic Safety Commission. (2013). Automated Speed Enforcement Pilot Project Evaluation. Retrieved from: http://wtsc.wa.gov/wp-content/uploads/dlm_uploads/2015/03/Automated-Speed-Enforcement-Pilot_2012.pdf
3. Washington Traffic Safety Commission. 2014. Driver Attitudes, Knowledge, and Awareness Survey 2012. Retrieved from: http://wtsc.wa.gov/wp-content/uploads/dlm_uploads/2014/10/AKA2012.pdf
4. Monash University Accident Research Centre, Transport Accident Commission. 2008. The Impact of lowered speed limits in urban and metropolitan areas. Retrieved from: <http://www.monash.edu.au/miri/research/reports/muarc276.pdf>
5. Washington Traffic Safety Commission. 2003. Evaluation of "Targeted Pedestrian Enforcement." Retrieved from: http://wtsc.wa.gov/wp-content/uploads/dlm_uploads/2014/11/eval-of-targeted-ped-enf-final-report.pdf
6. Seattle Department of Transportation. 2015. Pedestrian Crossing Flags. Retrieved from: http://www.seattle.gov/transportation/pedpolicy_pedcrossingflags.htm
7. Wolfson, Howard. 2011. Office of the Mayor of New York, NY. Bike Lanes Memorandum. New York, NY. Retrieved from: http://www.nyc.gov/html/om/pdf/bike_lanes_memo.pdf
8. Harris A, Reynolds C, Winters M, Cripton P, Shen H, Chipman M, Cusimano M, Babul S, Brubacher J, Friedman S, Hunte G, Monro M, Vernich L, Teschke K. Comparing the effects of infrastructure on bicycling injury at intersections and non-intersections using a case–crossover design. *Inj Prev* 2013;19:303-310
9. Loukaitou-Sideris, a. (2006). Is it Safe to Walk?1 Neighborhood Safety and Security Considerations and Their Effects on Walking. *Journal of Planning Literature*, 20, 219–232.
10. Kuo, F. E., & Sullivan, W. C. (2001). Environment and Crime in the Inner City: Does Vegetation Reduce Crime? *Environment and Behavior*, 33(3), 343–367.
11. Jacobs, J. (1961). *The Death and Life of Great American Cities*. New York: Random House.
12. Crowe, T. D., & Louisville, N. C. P. I. U. of. (2000). *Crime Prevention Through Environmental Design: Applications of Architectural Design and Space Management Concepts* (p. 333). Butterworth-Heinemann. Retrieved from <https://books.google.com/books?hl=en&lr=&id=prgIS7CHgF8C&pgis=1>

Crime & Crime Prevention

1. Safety » North Delridge Neighborhood Council. Available at: <http://www.ndnc.org/?cat=3>. Accessed May 28, 2015.
2. Booth J, Ayers S, Marsiglia F. Perceived neighborhood safety and psychological distress: Exploring protective factors. *J Sociol Soc Welf*. 2011;39(4):137–156.
3. Loukaitou-Sideris a. Is it Safe to Walk?1 Neighborhood Safety and Security Considerations and Their Effects on Walking. *J Plan Lit*. 2006;20:219–232. doi:10.1177/0885412205282770.
4. Kuo FE, Sullivan WC. Environment and Crime in the Inner City: Does Vegetation Reduce Crime? *Environ Behav*. 2001;33(3):343–367. doi:10.1177/0013916501333002.
5. Jacobs J. *The Death and Life of Great American Cities*. New York: Random House; 1961.

6. Crowe TD, Louisville NCPIU of. *Crime Prevention Through Environmental Design: Applications of Architectural Design and Space Management Concepts*. Butterworth-Heinemann; 2000:333. Available at: <https://books.google.com/books?hl=en&lr=&id=prglS7CH9F8C&pgis=1>. Accessed April 23, 2015.
7. King County Community Health Indicators. Available at: <http://www.kingcounty.gov/healthservices/health/data/indicators.aspx>. Accessed May 14, 2014.
8. North Delridge, Seattle, WA Crime Rates & Statistics. Available at: <http://www.areavibes.com/seattle-wa/north+delridge/crime/>. Accessed May 28, 2015.
9. FBI . Uniform Crime Reporting. Available at: <http://www.fbi.gov/about-us/cjis/ucr>. Accessed May 28, 2015.
10. Delridge, Seattle, WA - Lifestyle and Demographics - Realtor.com®. Available at: http://www.realtor.com/local/Delridge_Seattle_WA/lifestyle. Accessed May 28, 2015.
11. Proposed North Delridge store draws top Seattle spot in marijuana-retailer license lottery. Available at: <http://westseattleblog.com/2014/05/proposed-north-delridge-store-draws-top-seattle-spot-in-marijuana-retailer-license-lottery/>. Accessed May 28, 2015.
12. Comparison of liquor retail store density for Western states | Washington Policy Center. Available at: <https://www.washingtonpolicy.org/blog/post/comparison-liquor-retail-store-density-western-states>. Accessed May 28, 2015.
13. Drug Policy Alliance. *Marijuana legalization in Colorado after one year of retail sales and two years of decriminalization.*; 2015.
14. Glaeser EL, Sacerdote B. Why Is There More Crime in Cities? *J Polit Econ*. 1999;107(S6):S225–S258. doi:10.1086/250109.
15. Huang, C. C., Laing, D., & Wang, P. (2004). CRIME AND POVERTY: A SEARCH-THEORETIC APPROACH*. *International Economic Review*, 45(3), 909-938.
16. Assessment Policy Development and Evaluation Unit. *King county city health profile: Seattle*. Seattle, WA: Public Health- Seattle King County; 2012.
17. Fotios S, Unwin J, Farrall S. Road lighting and pedestrian reassurance after dark: a review. *Light Res Technol*. 2014;1–21. doi:10.1177/1477153514524587.
18. Mair JS, Mair M. Violence prevention and control through environmental modifications. *Annu Rev Public Health*. 2003;24:209–225. doi:10.1146/annurev.publhealth.24.100901.140826.
19. Cozens P. Public health and the potential benefits of Crime Prevention Through Environmental Design. *NSW Public Heal Bull*. 2008;18:232–237.
20. Erickson H. Public Art: More than Just a “Picture on the Wall”— a Vehicle for Crime Prevention. *From Blight to Bright*. 2005. Available at: <http://livable.org/livability-live/474-public-art-more-than-just-a-picture-on-the-wall-a-vehicle-for-crime-prevention>. Accessed May 13, 2015.
21. Partners for Livable Communities. Crime Prevention Through Public Art - CPTED and Public Art. 2010. Available at: http://www.cptedsecurity.com/public_art.htm. Accessed May 19, 2015.
22. Willoughby MJ. Neighbourhood level impact of crime on community health outcomes. 2012. Available at: <http://ir.canterbury.ac.nz/handle/10092/8440>. Accessed May 27, 2015.

23. Sandberg S, Paton JY, Ahola S, et al. The role of acute and chronic stress in asthma attacks in children. *Lancet*. 2000;356(9234):982–7. doi:10.1016/S0140-6736(00)02715-X.
24. Thoits P a. Stress and health: major findings and policy implications. *J Health Soc Behav*. 2010;51 Suppl:S41–S53. doi:10.1177/0022146510383499.
25. Krieger N, Davey Smith G. “Bodies count,” and body counts: social epidemiology and embodying inequality. *Epidemiol Rev*. 2004;26(1):92–103. doi:10.1093/epirev/mxho09.
26. Steptoe A, Feldman PJ. Neighborhood problems as sources of chronic stress: Development of a measure of neighborhood problems, and associations with socioeconomic status and health. *Ann Behav Med*. 2001;23(3):177–185. doi:10.1207/S15324796ABM2303_5.
27. Baum A, Garofalo JP, Yali AM. Socioeconomic Status and Chronic Stress: Does Stress Account for SES Effects on Health? *Ann N Y Acad Sci*. 1999;896(1):131–144. doi:10.1111/j.1749-6632.1999.tb08111.x.
28. Doyle S, Kelly-Schwartz A, Schlossberg M, Stockard J. Active Community Environments and Health: The Relationship of Walkable and Safe Communities to Individual Health. *J Am Plan Assoc*. 2006;72(1):19–31. doi:10.1080/01944360608976721.
29. Gose M, Plachta-Danielzik S, Willié B, Johannsen M, Landsberg B, Müller MJ. Longitudinal influences of neighbourhood built and social environment on children’s weight status. *Int J Environ Res Public Health*. 2013;10(10):5083–96. doi:10.3390/ijerph10105083.
30. Brown HS, Pérez A, Mirchandani GG, Hoelscher DM, Kelder SH. Crime rates and sedentary behavior among 4th grade Texas school children. *Int J Behav Nutr Phys Act*. 2008;5:28. doi:10.1186/1479-5868-5-28.
31. Gómez JE, Johnson BA, Selva M, Sallis JF. Violent crime and outdoor physical activity among inner-city youth. *Prev Med (Baltim)*. 2004;39(5):876–81. doi:10.1016/j.ypmed.2004.03.019.

Disaster Response & Resilience

1. Washington State Department of Natural Resources. Geologic Hazards Overview. <http://www.dnr.wa.gov/ResearchScience/Topics/GeologicHazardsMapping/Pages/geologic_hazards.aspx>. Accessed 5/17/2015.
2. Slope Stability Maps - Coastal Zone Atlas; King County 1979.
3. Frankel AD, Stephenson WJ, Carver DL, Williams RA, Odum JK, Rhea S. Seismic hazard maps for Seattle, Washington, incorporating 3D sedimentary basin effects, nonlinear site response, and rupture directivity. 2007. 77 p.
4. Lifelines and earthquake hazards in the greater Seattle area. Olympia, WA: Washington Division of Geology and Earth Resources; 2012.
5. Washington State Department of Ecology. 2011. Flood Plain Management: Flooding in Washington State. <http://www.ecy.wa.gov/programs/sea/floods/flooding_wa_state.html>. Accessed 5/17/2015.
6. Washington State Emergency Management Division. 2010. Risk Maps: High Risk to Flooding. Accessed 5/17/2015.
7. Q3 Flood Data, King, WA. Washington, DC: Federal Emergency Management Agency; 1996.

8. Pringle PT. Volcanic hazards in Washington - A growth management perspective. *Washington Geology* 1994;22(2):25-33.
9. Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future. Committee on Sea Level Rise in California Oregon and Washington, Board on Earth Sciences and Resources, Ocean Studies Board, Division on Earth and Life Studies, National Research Council, editors: National Academies Press; 2012.
10. Major D, Dubovsky B, Byrd B. Redefining Disaster, Preparedness, and Resilience. *Foundations: Stanford Social Innovation Review*; 2015.
11. Zoraster RM. Vulnerable populations: Hurricane Katrina as a case study. *Prehosp Disaster Med* 2010;25:74-8.
12. Wolshon B. Evacuation planning and engineering for Hurricane Katrina. *The Bridge; Linking Engineering and Society* 2006;36(1):1844-1846.
13. Russell G. Nagin Orders First-Ever Mandatory Evacuation of New Orleans. *The Times-Picayune* August 28, 2005.
14. US Department of Homeland Security. Nationwide Plan Review Phase 1 Report - A Report to Congress on the First Phase of the Nationwide Plan Review. Required by the 2006 Department of Homeland Security (DHS) Appropriations Act. Washington, D.C. 2006.
15. Naghawi H, Wolshon B. Operation of multimodal transport system during mass evacuations. *Canadian Journal of Civil Engineering* 2014;42(2):81-88.

Monitoring & Evaluation

1. The HIA Process. <http://www.pewtrusts.org/en/about/news-room/news/2014/08/28/the-hia-process>. Accessed May 26, 2015.
2. CDC Module 6 - Evaluation. http://www.ph.ucla.edu/hs/health-impact/training/pdfs/Module6_Evaluation_notes.pdf. Accessed May 27, 2015.
3. Choosing the Right Evaluation Questions. http://www.wcasa.org/file_open.php?id=1045. Accessed May 27, 2015.
4. Evaluation Briefs No 4. February 2009 Developing Process Evaluation Questions - brief4.pdf. <http://www.cdc.gov/healthyyouth/evaluation/pdf/brief4.pdf>. Accessed May 27, 2015.
5. Bekker MPM, Putters K, van der Grinten TED. Evaluating the impact of HIA on urban reconstruction decision-making. Who manages whose risks? *Environ Impact Assess Rev*. 2005;25(7-8):758-771. doi:10.1016/j.eiar.2005.07.008.