

A Health Impact Assessment of the George Road Complete Streets Implementation Plan



May 2017

HIA CONTRIBUTORS

HIA Research Team

Daragh A. Gibson, MSES, MPH, CPH, Florida Department of Health in Hillsborough County
Allison Nguyen, MPH, CHES, Florida Department of Health in Hillsborough County
Wade Reynolds, MA, AICP, Hillsborough Metropolitan Planning Organization
Michele Ogilvie, MA, Hillsborough Metropolitan Planning Organization
Veronica Varela, University of South Florida, Graduate Student Intern
Kate LeGrand, University of South Florida, Graduate Student Intern

HIA Advisory Council: Metropolitan Planning Organization's Bicycle Pedestrian Advisory Committee

Chris Bridges, Hillsborough County Public Works Department
Steve Cherpock, Hillsborough County Sheriff's Office
Jay Collins, Hillsborough County City-County Planning Commission
Linda Crescentini, Hillsborough Area Regional Transit Authority (HART)
Moises Hernandez, At Large
Richard Johnson, At Large
Lorraine Lyn, City of Temple Terrace
Scott MacLean, City of Tampa Police Department
John Marsh, City of Tampa Department of Transportation and Stormwater Services
Faye Miller, At Large
Tony Monk, At Large
David Payor, At Large
Karla Price, City of Tampa Parks and Recreation
Tina Russo, Hillsborough County Parks, Recreation and Conservation
Jim Shirk (Chair), At Large
JoAnna Swindell, At Large
Calvin Thornton, City of Tampa, Department of Transportation and Stormwater Services
Patrick Thorpe (Vice Chair), At Large
Alain Watson, Environmental Protection Commission of Hillsborough County

Subject Matter Experts

Jason Chilson, Hillsborough County Parks, Recreation and Conservation
Felicia Crosby-Rucker, Hillsborough County Homeless Services
Beth Derby, Hillsborough County Social Services
Neal Dwyer, Central Florida Behavioral Health Network
Artie Fryer, Hillsborough County Health Care Services
Lucy Gonzalez, Center for Urban Transportation Research
Dr. Leslene Gordon, Florida Department of Health in Hillsborough County
Cindy Hardy, Florida Department of Health in Hillsborough County
Richard Hartman, University of South Florida
Shawn Harvey, Head Start
Dr. Jacquelyn Jenkins, Hillsborough BOCC Head Start

Cynthia O. Keeton, Florida Department of Health in Hillsborough County
Dr. Marsha Lewis Brown, Northside Mental Health Center
LaVonne Malphus Nelson, Hillsborough BOCC Head Start
Brenda Mount, Hillsborough BOCC Head Start
Walter W. Niles, Florida Department of Health in Hillsborough County
Todd O’Hehir, Hillsborough County Sheriff’s Office
Pedro Parra, Hillsborough County City-County Planning Commission
Jim Shirk, Bicycle & Pedestrian Advisory Committee (BPAC)
Dr. Amy Stuart, University of South Florida
Calvin Thornton, City of Tampa, Department of Transportation and Stormwater Services
J. Lynn Walker-Rovira, Central Florida Behavioral Health Network
Alain Watson, Environmental Protection Commission (EPC) of Hillsborough County

Additional Contributors

Dr. Ayesha Johnson, Florida Department of Health in Hillsborough County
Steven Drake, Florida Department of Health in Hillsborough County
Dawn Krockta, Florida Department of Health in Hillsborough County
Hillsborough Metropolitan Planning Organization Board
Hillsborough Metropolitan Planning Organization Livable Roadways Committee
Hillsborough Metropolitan Planning Organization Transportation Disadvantaged Coordinating Board
Town ‘N’ Country Community Members

Special Thanks to MPO Consultants:



ACKNOWLEDGEMENTS

The Florida Department of Health in Hillsborough County (DOH-Hillsborough) and the Hillsborough Metropolitan Planning Organization (MPO) would like to thank the Bicycle Pedestrian Advisory Committee for serving as its Advisory Council, AECOM for providing us with data, information, and graphics from the George Road Implementation Plan to include in this report, the Subject Matter Experts who provided feedback on the data and assisted in determining the health impacts and making recommendations, the other MPO Committees, and the Board that provided vital feedback throughout the process. Also, a special thanks to the community members and stakeholders who provided their input on the proposed implementation plan.

Opinions expressed in this report are those of the authors and do not necessarily reflect the opinions of DOH-Hillsborough, the Hillsborough MPO, or any other individual stakeholders listed above.

TABLE OF CONTENTS

LIST OF TABLES IV

LIST OF FIGURES VI

LIST OF APPENDICES VIII

EXECUTIVE SUMMARY IX

INTRODUCTION 1

BACKGROUND ON HIA 6

SCREENING 8

SCOPING 8

ASSESSMENT 15

RECOMMENDATIONS AND REPORTING 70

MONITORING AND EVALUATION 72

CONCLUSION 77

REFERENCES 79

APPENDICES 86

LIST OF TABLES

| | |
|---|----|
| Table 1. Distribution of Race and Ethnicity in the Target Area..... | 10 |
| Table 2. Distribution of Poverty, Income and Educational Attainment in the Target Area | 12 |
| Table 3. Distribution of Sex, Age and Disability in the Target Area..... | 12 |
| Table 4. Distribution of Single Mother Households in the Target Area..... | 13 |
| Table 5. Distribution of Housing Type in the Target Area | 13 |
| Table 6. Distribution of Mode of Transportation to Work in the Target Area | 14 |
| Table 7. Summary of Proposed Improvements to the George Road Corridor..... | 20 |
| Table 8. Bicycle and Pedestrian Injuries and Deaths (Counts) in Hillsborough County 2010-2015..... | 25 |
| Table 9. Self-Reported Mental Health (Stress and Anxiety)..... | 39 |
| Table 10. Focus Group Participant Responses to Nature’s Effect on Health | 40 |
| Table 11. Distribution of Depression among Adults in Hillsborough County | 41 |
| Table 12. Distribution of Self-Reported Depression among Adults in Hillsborough County..... | 41 |
| Table 13. Distribution of Self-Reported Health Status | 43 |
| Table 14. Distribution of Weight among Adults in Hillsborough County, Florida | 44 |
| Table 15. Distribution of Diabetes in Hillsborough County, Florida | 45 |
| Table 16. Distribution of Cardiovascular Disease in Hillsborough County, Florida..... | 46 |
| Table 17. Distribution of Arthritis in Hillsborough County, Florida | 47 |
| Table 18. Major Causes of Death in Hillsborough County, Florida | 48 |
| Table 19. Age-Adjusted Death Rates of Cardiovascular Diseases, 3-Year Rolling Rates (per 100,000 population) | 49 |
| Table 20. National Ambient Air Quality Standards..... | 54 |
| Table 21. Distribution of Physical Activity among Adults in Hillsborough County, Florida, by Sex and Race/Ethnicity (2013) | 55 |

| | |
|--|----|
| Table 22. Distribution of Physical Activity among Adults in Hillsborough County, Florida, by Educational Attainment (2013)..... | 56 |
| Table 23. Distribution of Physical Activity among Adults in Hillsborough County, Florida by Income (2013) | 56 |
| Table 24. Heat-Related Hospital and Emergency Department Visits..... | 63 |
| Table 25. Heat-Related Emergency Department Visits | 64 |
| Table 26. Air Quality Index (AQI) by Number of Days and Pollutant Type for Hillsborough County, 2015..... | 67 |
| Table 27. Distribution of Asthma Indicators | 68 |
| Table 28. Health Impact Matrix Summary of Findings | 69 |
| Table 29. Process Evaluation Questions..... | 72 |
| Table 30. Impact Evaluation Questions..... | 73 |
| Table 31. Monitoring Plan | 76 |

LIST OF FIGURES

| | |
|--|----|
| Figure 1. Clifton Street | 2 |
| Figure 2. George Road Corridor Project Segments | 3 |
| Figure 3. Tampa Bay Area Regional Trail System..... | 4 |
| Figure 4. Phases of the HIA Process | 6 |
| Figure 5. Social Ecological Model of Health | 7 |
| Figure 6. Comprehensive Pathways Diagram | 9 |
| Figure 7. Distribution of English Language Fluency in the Target Population (Percentage of Households with at Least One Members Who Speaks English Less Than Very Well)..... | 11 |
| Figure 8. Priority Area A Pathway Diagram (Access to Safely Designed Roadways) | 16 |
| Figure 9. Segments of the George Road Corridor | 19 |
| Figure 10. Proposed Design Features for Segment 1..... | 22 |
| Figure 11. Proposed Design Features for Segment 2..... | 23 |
| Figure 12. Proposed Design Features for Segment 3..... | 24 |
| Figure 13. Bicycle and Pedestrian Crashes in the Target Area (2008-2015) | 26 |
| Figure 14. Example of Proposed Street Lighting | 28 |
| Figure 15. Example of Overgrown Brush..... | 28 |
| Figure 16. Example of Proposed Pedestrian Bridge Improvements..... | 29 |
| Figure 17. Self-Reported Perception of Neighborhood Safety | 30 |
| Figure 18. Counts of Violent and Non-Violent Crimes in the Target Area (2011-2015) | 31 |
| Figure 19. Map of Counts of Violent and Non-Violent Crimes (2011-2015) | 32 |
| Figure 20. Priority Area B Pathway Diagram (Access to Nature and Green Space) | 33 |
| Figure 21. Estimated Population within 500m Walking Distance and 1000m Biking Distance of the Trailways and Complete Streets Corridor..... | 37 |

| | |
|---|----|
| Figure 22. Percentage of Green Space in the Target Area..... | 38 |
| Figure 23. Distribution of Self-Reported Health Status as “Fair” or “Poor” by Sex, Race/Ethnicity and Age among Hillsborough County Adults | 42 |
| Figure 24. Distribution of Self-Reported Health Status as "Fair" or "Poor" by Income and Educational Attainment among Hillsborough County Adults | 43 |
| Figure 25. Priority Area C Pathway Diagram (Physical Activity) | 50 |
| Figure 26. Percentage of Tree Cover in the Target Area..... | 59 |
| Figure 27. Examples of Lack of Shade along the Corridor | 60 |
| Figure 28. Aerial Photo of HIA Target Area with Significant Shade Coverage Outlined in Red | 61 |
| Figure 29. Likelihood of Heat Disorders Based on Heat Index | 62 |
| Figure 30. Temperature and Precipitation in Tampa, Florida (2012)..... | 62 |
| Figure 31. Number of Unhealthy Air Quality Days per Year in Hillsborough County (1995-2015)..... | 65 |
| Figure 32. Number of Unhealthy Air Quality Days per Year in Hillsborough County by Pollutant (2000-2015)..... | 66 |

LIST OF APPENDICES

| | |
|--|----|
| Appendix A. George Road HIA Screening Checklist | 86 |
| Appendix B. George Road Screening Worksheet..... | 89 |
| Appendix C. Hillsborough County Air Quality Index, by Month (2015) | 90 |

EXECUTIVE SUMMARY

In August 2015, the Florida Department of Health in Hillsborough County (DOH-Hillsborough) presented Health Impact Assessments (HIAs) to the Hillsborough Metropolitan Planning Organization (MPO) as a tool that could be used to consider the health impacts of a proposed plan, project, program, or policy. The MPO identified the George Road Complete Streets Implementation Plan as a proposed plan that could be studied using an HIA. The DOH-Hillsborough and MPO decided to partner together on an HIA for this plan, which was intended to provide a safe bicycle and pedestrian connection between the Town 'N' Country Greenway and the Courtney Campbell Trail.

The target area for this HIA is the community surrounding the George Road Corridor in Town 'N' Country, an unincorporated area in Hillsborough County. Approximately 40,000 residents live in this diverse community. Among the residents, 47.3% are Hispanic/Latino, which is almost double the percentage of Hispanics/Latinos in Hillsborough County and in the State of Florida. In some areas along George Road, 50%-60% of the population live in a household that reports speaking English less than "very well". The poverty rate in the target area is lower than the County and State rates; however, it has a higher unemployment rate. Additionally, there is a higher proportion of residents without a high school education compared to County and State proportions.

The HIA process began in September 2015, with initial Screening meetings to determine the feasibility of conducting an HIA for the proposed Plan. Our Scoping process took place from October to December 2015. During the Scoping Phase, the research questions our team developed were:

- What would be the impact of the MPO executing the George Road Complete Streets Implementation Plan?
- How would executing the George Road Complete Streets Implementation Plan affect the health of the population within the targeted geographic location?
- Would the impacts cause undue burden or harm to vulnerable populations in the area (i.e. racial and ethnic minorities; people with movement-related disabilities; and people of lower socioeconomic status)?

To answer these research questions, it was determined that the HIA would examine how the George Road Complete Streets Implementation Plan would increase access to a complete street /active living system. The pathways considered for their impact on health were: access to safely designed roadways, access to nature and green space, and physical activity. The outcomes studied were:

- Access to regional trail system
- Risk of crime
- Crime-related incidents
- Bicycle and pedestrian injuries and deaths
- Stress levels

- Restorative benefits on health
- Good mental health and well-being
- Prevalence of chronic disease
- Premature mortality
- Exposure to outdoor air pollutants and irritants
- Asthma/respiratory disease exacerbations
- Exposure to heat
- Heat-related illness

The Assessment phase took place from November 2015 through April 2016. The assessment of health impacts included a literature review, primary data from the MPO consultant, AECOM, and secondary data sources. Additionally, stakeholders from the MPO Bicycle and Pedestrian Advisory Committee (BPAC) (the Advisory Council for the HIA), other MPO Committees, and local Subject Matter Experts (SMEs) were engaged for data and feedback.

| | |
|-----------------------|--|
| Primary Data | <ul style="list-style-type: none"> • Streetscape data of the George Road Connector, collected by AECOM • MPO Implementation Plan, prepared by AECOM |
| Secondary Data | <ul style="list-style-type: none"> • Literature review of peer-reviewed journal articles and grey literature • Community survey and focus group session results from a DOH-Hillsborough 2015 Parks and Recreation-Related HIA in the Town 'N' County area • Secondary data analysis of demographic, health determinant, health outcome, and complete streets-related data • Geographic Information Systems (GIS) mapping |

In March 2016, an overview of the HIA data and results were presented to SMEs for their consideration and review. During this discussion, the health impact predictions and preliminary recommendations were drafted. The likelihood and direction of the impact predictions were determined, in addition to the magnitude of the impact on both the local population and the regional trail users accessing the system. The health impact predictions included:

| Determinant / Outcome | Likelihood and Direction of Impact | Magnitude of Impact on Local Population and Regional Trail Users |
|--|---|---|
| Access to Safely Designed Roadways | Likely Increase | Significant |
| Bicycle / Pedestrian Injuries and Deaths | Likely Decrease | Moderate |
| Risk of Crime | Likely Decrease | Moderate |
| Crime-Related Incidents | Likely Decrease | Moderate |
| Access to Regional Trail System | Likely Increase | Significant |

| | | |
|------------------------------------|-----------------|--------------------|
| Access to Green Space/Nature | Likely Increase | Significant |
| Physical Activity Levels | Likely Increase | Significant |
| Stress Levels | Likely Decrease | Moderate |
| Restorative Benefit on Health | Likely Increase | Moderate |
| Chronic Disease | Likely Decrease | Moderate |
| Good Mental Health / Well-Being | Likely Increase | Moderate |
| Premature Mortality | Likely Decrease | Low |
| Exposure to Outdoor Air Pollutants | Likely Increase | Moderate |
| Asthma / Respiratory Disease | Likely Increase | Moderate |
| Exposure to Heat | Likely Increase | Moderate |
| Heat-Related Illness | Likely Increase | Moderate to Severe |

The SMEs used these impact predictions to help draft recommendations. The final recommendations are:

- Ensure design features (especially traffic calming features) comply with the Florida Department of Transportation (FDOT) Complete Streets Plan and match Hillsborough County's Complete Streets Resolution
- Reduce speed limit to 25 MPH in areas of George Road Corridor, except at Memorial Highway where it is 35 MPH; and/or during peak times, recommend certain zones (similar to school zones) have blinking lights and reduced speed
- Incorporate Crime Prevention Through Environmental Design (CPTED) principles
- Increase landscape plantings throughout the corridor focusing on species that are known to filter out specific pollutants
- Increase pedestrian-level lighting throughout the corridor to deter crime and encourage physical activity during early mornings and evenings
- Promote landscaping to increase shade cover uniformly throughout the corridor, by planting trees that are more allergy-friendly
- Along the trailways and throughout the corridor include:
 - Wayfinding signage; mileage markers to encourage physical activity; emergency signage/call boxes; garbage cans; dog bag dispensers/waste receptacles; signs with "scoop the poop"; park benches; drinking fountains
- Install a bathroom facility at Town 'N' Country Greenway where it connects with the George Road Corridor
- Market the George Road Corridor so residents are aware of the connector to the two trails (Town 'N' Country Greenway and Courtney Campbell Causeway Trail)
- Provide education on how to reduce heat-related illness and respiratory-related exacerbations (due to allergens and pollution)
- Conduct a bus stop environment and connectivity assessment
- Complete a pedestrian/bicyclist count annually before executing the complete streets plan along George Rd. and after to measure increase in use

- Consider a complete streets project to connect the west end of the Town 'N' Country Greenway with the Upper Tampa Bay Trail
- Look more holistically at transportation decisions and health; expand from individual impact (pedestrian/bicycle crashes) to community impact (chronic disease, mental health, asthma, etc.)
- Hillsborough Board of County Commissioners adopt a Complete Streets Policy (stronger than the current MPO resolution)
- MPO develop criteria to complete an HIA based on specific factors (e.g. cost of project, location, population affected, funding source for future MPO projects, plans, etc.) and draft a Health in All Policies Resolution
- Expand DOH-Hillsborough membership onto MPO's BPAC and Technical Advisory Committees

This HIA report will be posted on the DOH-Hillsborough and MPO websites. Final copies will be shared with all partners and stakeholders who were engaged throughout the process, the local library in Town 'N' Country, and homeowner associations. Other methods to communicate the HIA results may include creating executive summaries, factsheets, infographics, and media messaging.

The plan to monitor and evaluate this HIA is described in [Tables 29-31](#) of this report.

INTRODUCTION

Complete Streets

In 2004, the National Complete Streets Coalition launched a national movement to transform roadways into Complete Streets, which are streets designed with all users in mind. A complete street provides safe access for pedestrians, cyclists, transit users, and motorists; while improving the street network for all users by reducing the risk of accidents between user types. There are guiding principles for complete streets, however, a set of standards does not exist. As such, each complete street project should rely on the context of the community in which it is situated. Depending on the type of roadway, a complete street may include sidewalks, bike lanes, dedicated bus lanes, median improvements, island refuges, curb extensions, narrow travel lanes, roundabouts, landscaping, and other improvements that result in safer opportunities to walk, bike, or drive (Smart Growth America [SGA], 2016).

Complete streets improve access and provide choice in transportation mode for diverse groups including children, older adults, and individuals with disabilities (Sandt, Combs, & Cohn, 2016). Roadways designed in this manner help adults and individuals with disabilities to maintain their independence. Additionally, complete streets support walking and low-impact physical activity as part of a daily routine. Features of the built environment, such as sidewalks and bike facilities, help to support physical activity and active transportation by having non-motorized access to public transportation access points (Sandt et al., 2016).

The Complete Streets movement became more popular in the 1990s, and the term “complete streets” was formalized in the early 2000s by Barbara McCann and David Goldberg of the National Complete Streets Coalition (McCann, 2013). Complete streets address safety and walkability issues that resulted from social changes during the 20th century. Following the introduction of the automobile, personal vehicles became more popular, and later necessary as urban and suburban sprawl began and grew. Simultaneously, public transportation and walking were edged out. Many communities that were once walkable are not so today; as housing, jobs, and businesses spread to other areas, roads were widened, and vehicular speeds increased to accommodate more traffic. As transportation policies and practices shifted to reflect social interests, road landscapes changed, leaving many communities with roads that were unsafe to cross, lacking in sidewalks, and not well-connected to transit. Complete streets can restore access and improve safety for all users, so that pedestrians and bicyclists can safely use the roadway (McCann, 2013).

Complete Streets in Florida

Statewide, the Florida Department of Transportation (FDOT) is currently implementing a complete streets policy, which is expected to be completed in 2017. In Hillsborough County, Florida, the MPO and the City of Tampa passed complete streets resolutions in 2012. As of September 2016, there are no local policies in place that require complete street concepts in road design and redesign.

George Road Complete Streets Implementation Plan

With the completion of the Courtney Campbell Causeway Trail project in 2015, a new path for trail users was made available to cross Old Tampa Bay and connect to trails on both the Tampa and Pinellas County ends of the trail. The goal in Hillsborough County was to connect this new resource to the existing trail system in a way that enhances safety and creates opportunities to expand the system. As part of this effort, the MPO worked with AECOM to develop a connection from the Courtney Campbell Causeway Trail to the Upper Tampa Bay Trail. Four possible routes were examined during this process. A connection along George Road from the U-Path/Courtney Campbell Causeway to the Town 'N' Country Greenway, referred to as the George Road Corridor, was selected as the preferred option based on public input. However, there is still a missing connection between the Upper Tampa Bay Trail and the Town 'N' Country Greenway.

The Upper Tampa Bay Trail and the Courtney Campbell Causeway Trail are both somewhat isolated from the local residents who live closest to the trails. These trails are alongside major roads, with few connections to adjacent neighborhoods. The George Road Complete Street project was proposed to bridge this gap in the local trail system. [Figure 1](#) depicts the George Road Corridor and the connecting Town 'N' Country Greenway and Courtney Campbell Trail. [Figure 2](#) provides detail on the geographic boundaries of the George Road Corridor segments.

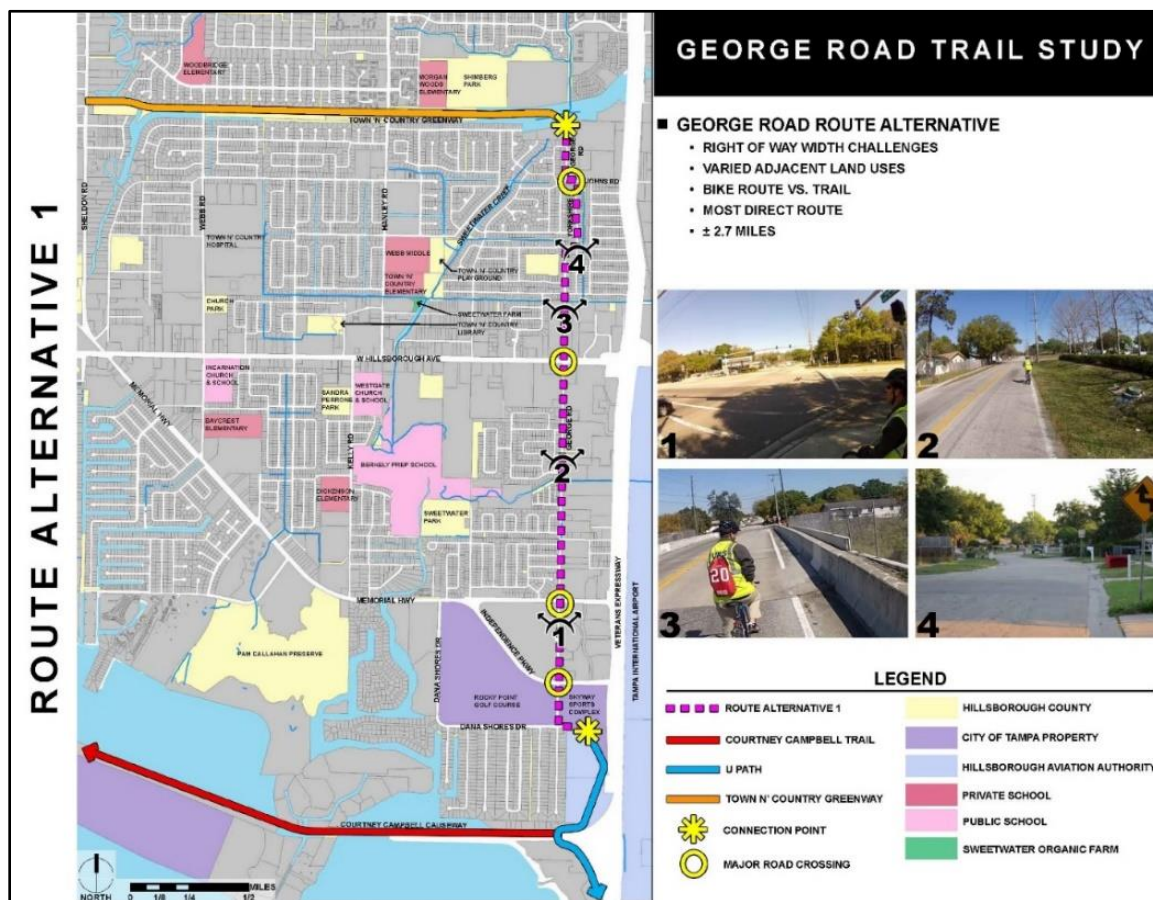


Figure 1. Clifton Street

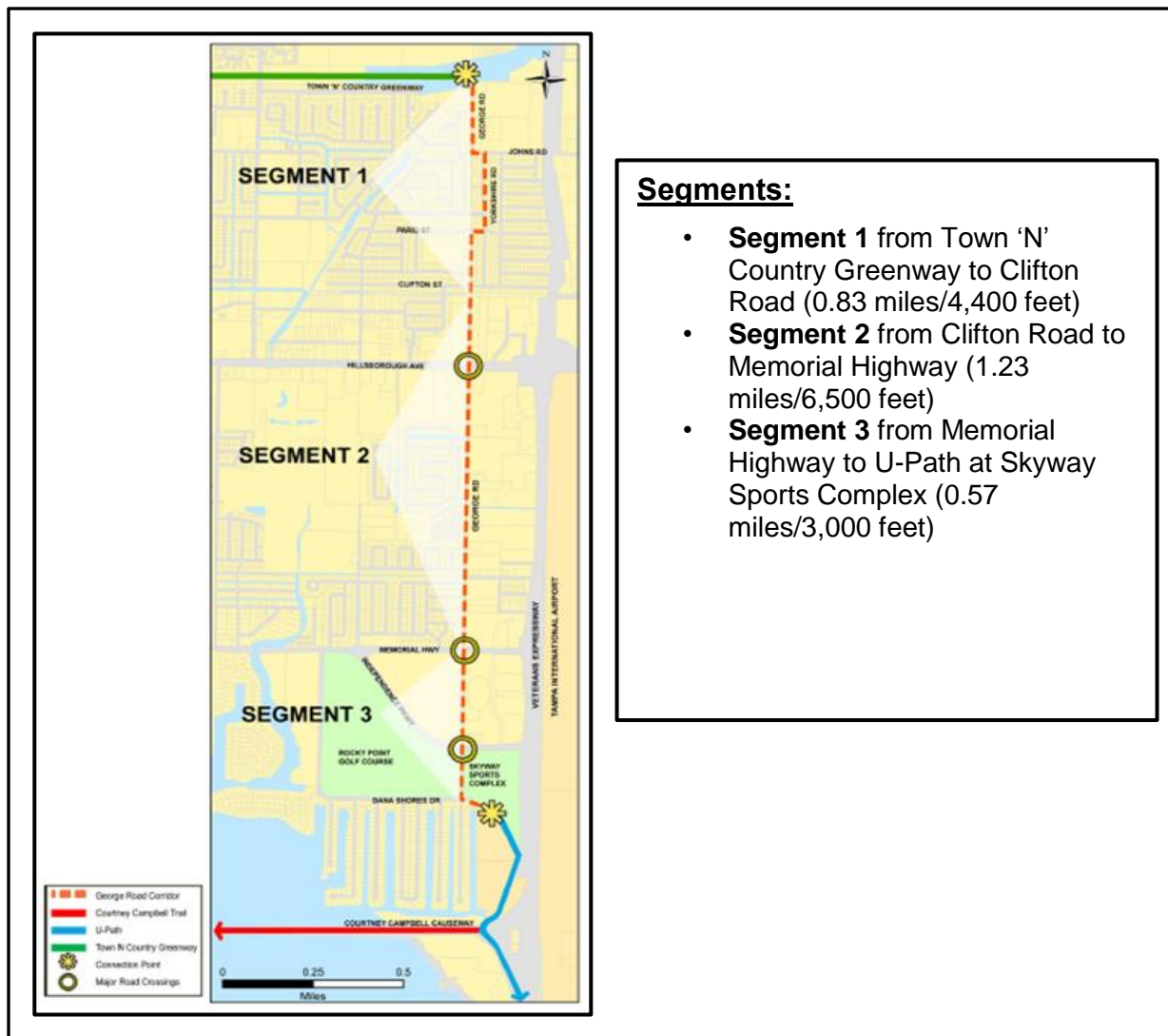


Figure 2. George Road Corridor Project Segments

The George Road Corridor connects major sections of the trail network between Hillsborough and Pinellas Counties. The Courtney Campbell Causeway Trail, which connects to the southern end of George Road through Skyway Park, runs west approximately 10 miles and crosses the bay to Pinellas County. The latest segment opened in 2015, which was the culmination of a 20-year planning process. On its western end in Pinellas County, the Courtney Campbell Causeway Trail will connect both north and south to new segments of the Pinellas Trail. The Pinellas Trail connects to the larger regional and state trail system. In [Figure 3](#), the red circle denotes the location of George Road and its connection to the larger system.

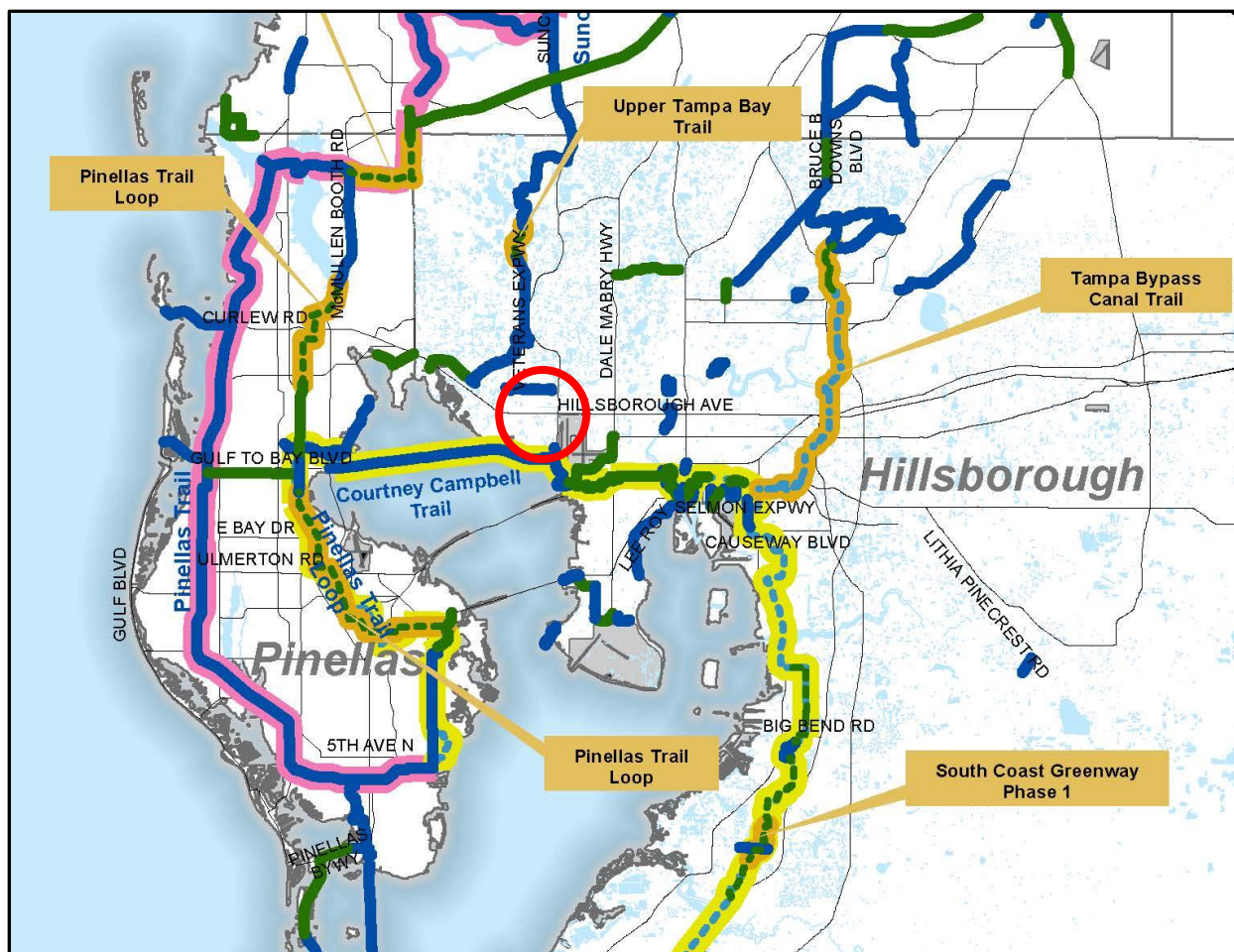


Figure 3. Tampa Bay Area Regional Trail System

Title VI Considerations

As a project of the MPO, the George Road Implementation Plan must comply with Title VI requirements. Under federal and state law, the MPO is required to assure that planning processes are conducted in accordance with all applicable requirements of Title VI of the Civil Rights Act of 1964 and the Title VI Assurance executed by each state. Title VI, in conjunction with the Presidential Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," and Executive Order 13166, "Improving Access to Services for Persons with Limited English Proficiency," seek to achieve three goals:

1. To avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations.
2. To ensure the full and fair participation by all potentially affected communities in the transportation decision-making process.
3. To prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations (U.S. Justice Department, 2016).

George Road Health Impact Assessment

The DOH-Hillsborough and the MPO partnered together on a Health Impact Assessment (HIA) examining the impacts of the proposed complete streets plan for George Road. The MPO Bicycle and Pedestrian Advisory Committee (BPAC) was selected as the Advisory Council for the HIA. The HIA team also worked closely with consultants from AECOM. The MPO contracted with AECOM and Sprinkle Consulting to create the implementation plan.

HIAs consist of six phases, which include screening, scoping, assessment, recommendations, reporting, and monitoring/evaluation. The information in this report is organized by HIA phase and includes information compiled and analyzed from September 2015 through December 2016. The report sections include the following information:

- **Background:** information on HIAs and their importance
- **Screening:** information to demonstrate feasibility, the key decision, proposed health determinants and outcomes, and main stakeholders
- **Scoping:** final timeline, work plan, stakeholder analysis, research questions, pathways diagram, and metrics to be examined
- **Assessment:** results from primary and secondary data analysis and impact predictions
- **Recommendations and Reporting:** proposed recommendations and plan for the reporting and dissemination of the HIA results and report
- **Monitoring and Evaluation:** plan for monitoring and evaluating the HIA process and data indicators over time

BACKGROUND ON HIA

“Health Impact Assessment is a practice that aims to protect and promote health and to reduce inequities in health during a decision-making process” (Bhatia et al., 2014). HIA is a systematic process used to identify and assess the potential intended and unintended health effects of a proposed plan, project, program, or policy on a specific population. HIA considers how those effects are distributed across a population, whether certain subgroups would be disproportionately affected, and provides recommendations on ways to mitigate the effects. It includes six key phases as part of the standard process: screening, scoping, assessment, recommendations, reporting, and monitoring & evaluation (Bhatia et al., 2014), which are explained in greater detail in [Figure 4](#).

HIA incorporates the principles and values of democracy, equity, sustainable development, ethical use of evidence, and a comprehensive approach to health (Bhatia, 2011). “The goals of equity are to create conditions that allow all to reach their full potential, eliminating inequities on the basis of race, income, ability, geography, age, gender, immigration status, and sexual orientation, among others” (Quigley et al., 2006). Health equity occurs when all members of a community have fair opportunity to achieve their full health potential. Equity implies that no one should be “disadvantaged from achieving this potential,” and aims to reduce or eliminate unfair conditions (Bhatia, 2011).

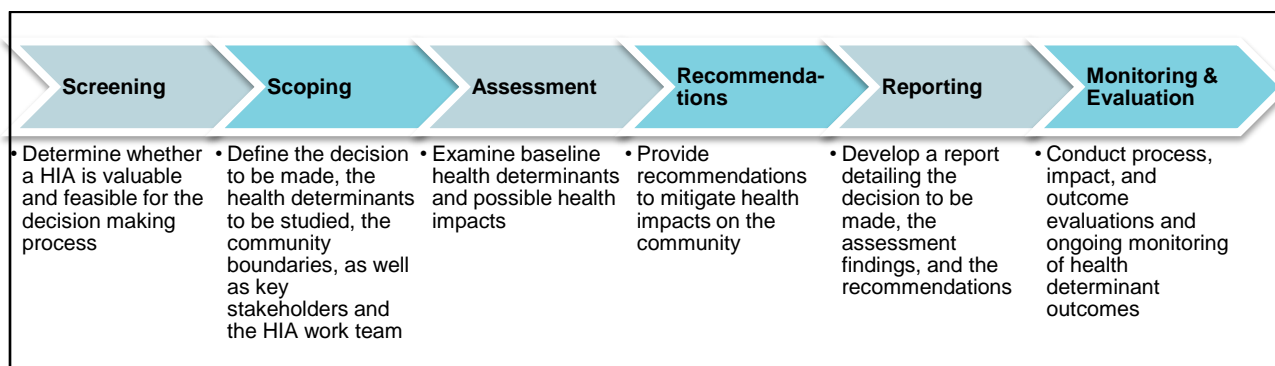


Figure 4. Phases of the HIA Process

Source: Bhatia et al., 2014

Following the core principle of a comprehensive approach to health, HIAs should be guided by the wider determinants of health (Bhatia, 2011). The social-ecological model ([Figure 5](#)) used in public health is a comprehensive approach that describes health as being broadly impacted by factors at the individual, interpersonal, community, and societal levels (United States Department of Health and Human Services [DHHS], 2011). In applying this model, the societal level can be further divided into organizational and policy levels, to understand their impact on health (Heinrich, Aki, Hansen-Smith, Fenton, & Maddock, 2011). Components within each of these levels are considered the social determinants of health, the conditions and factors where we live, work, learn, and play that impact our health outcomes. When these conditions are inequitable, health disparities among different groups (particularly racial and ethnic groups) will result (DHHS, 2011).

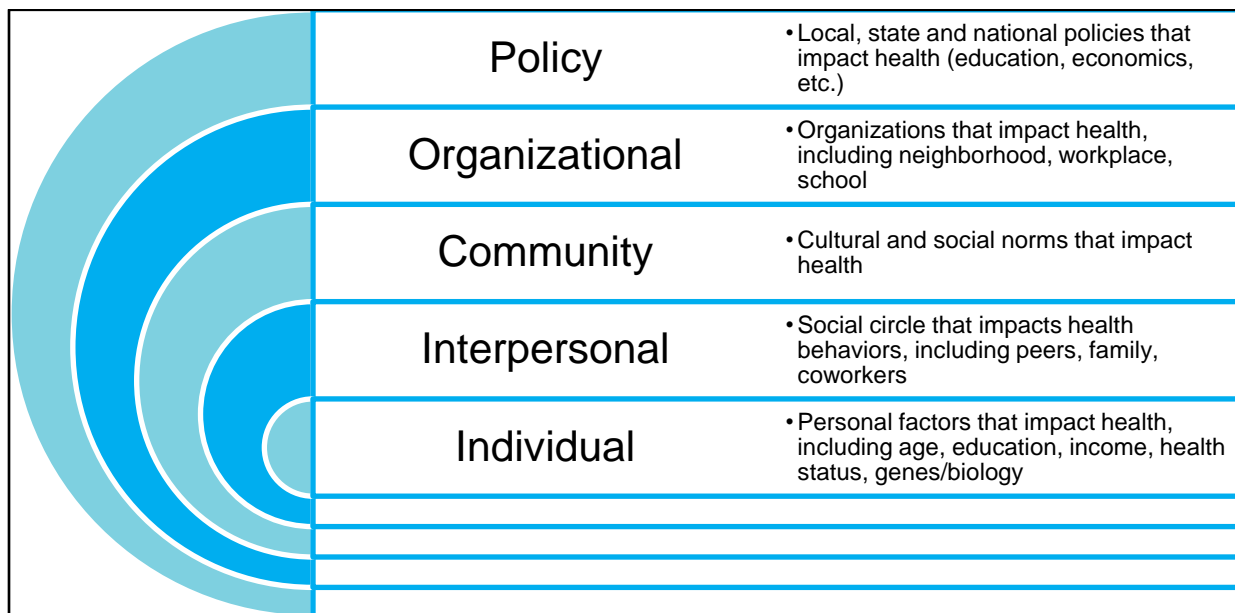


Figure 5. Social Ecological Model of Health
 Sources: DHHS, 2011; Heinrich, Aki, Hansen-Smith, Fenton, & Maddock, 2011

HIA considers which health determinants may be impacted by the proposed plan, project, program, or policy, and tries to predict how health will be impacted in immediate, intermediate and long-term outcomes (Quigley et al., 2006). Although the main focus of HIAs includes considering the health impacts and potential disparate impacts, equity and democracy play a larger role in the HIA practice.

“The HIA process itself is also an important instrument for building power in communities; for engaging community members in decisions that stand to affect their health and well-being; for integrating community knowledge, insights, and leadership into public decision-making processes; for building consensus around decisions; and for creating lasting relationships and collaborations across disparate constituencies” (Heller, Malekafzali, Todman, & Wier, 2013).

SCREENING

The purpose of the Screening phase is to determine the feasibility of conducting an HIA for a proposed plan, project, program, or policy. The Screening phase for the George Road HIA occurred in September 2015, when DOH-Hillsborough and the MPO met to determine the feasibility of conducting an HIA in Town 'N' Country for the George Road Corridor. The key decision for this HIA was whether or not to execute the MPO's George Road Complete Streets Implementation Plan. Appendices A and B include the screening worksheets that were completed as part of this phase. The key decision-makers for this HIA include the MPO Board.

SCOPING

Scoping defines the decision to be made, the health determinants and outcomes to be studied, the geographic boundaries, key stakeholders to include in the HIA, as well as the proposed work plan and timeline. The Scoping phase for the George Road HIA began in October 2015 and continued through December 2015. DOH-Hillsborough and the MPO met on several occasions to determine the goals, research questions, and specific health determinants and outcomes to examine in this HIA. During this time, a stakeholder analysis was completed, as well as the pathway diagram, work plan, and timeline for the project were drafted. [Figure 6](#) shows the pathway diagram, which demonstrates linkages between the determinants and outcomes selected for the HIA. The census tracts surrounding the George Road Corridor were included as the geographic scope of this HIA, and the target area's demographics are detailed in the Community Profile section of this report. The MPO's BPAC was selected to serve as the Advisory Council for the HIA.

The principal research questions for this HIA include:

- What is the impact of the MPO executing the George Road Complete Streets Implementation Plan?
- How would executing the George Road Complete Streets Implementation Plan affect the health of the population within the target geographic location?
- Would the impacts cause undue burden or harm to vulnerable populations in the area (i.e. racial and ethnic minorities; people with movement-related disabilities; people of lower socioeconomic status)?

The goals of the HIA include:

- Involve diverse stakeholders in the HIA process
- Introduce the relationship between equity and health
- Highlight the impact of a complete streets implementation plan on health
- Include health in the decision-making process of the proposed implementation plan
- Introduce the importance and utility of an HIA to the MPO Board and staff for use in future county plans, projects, programs, or policies

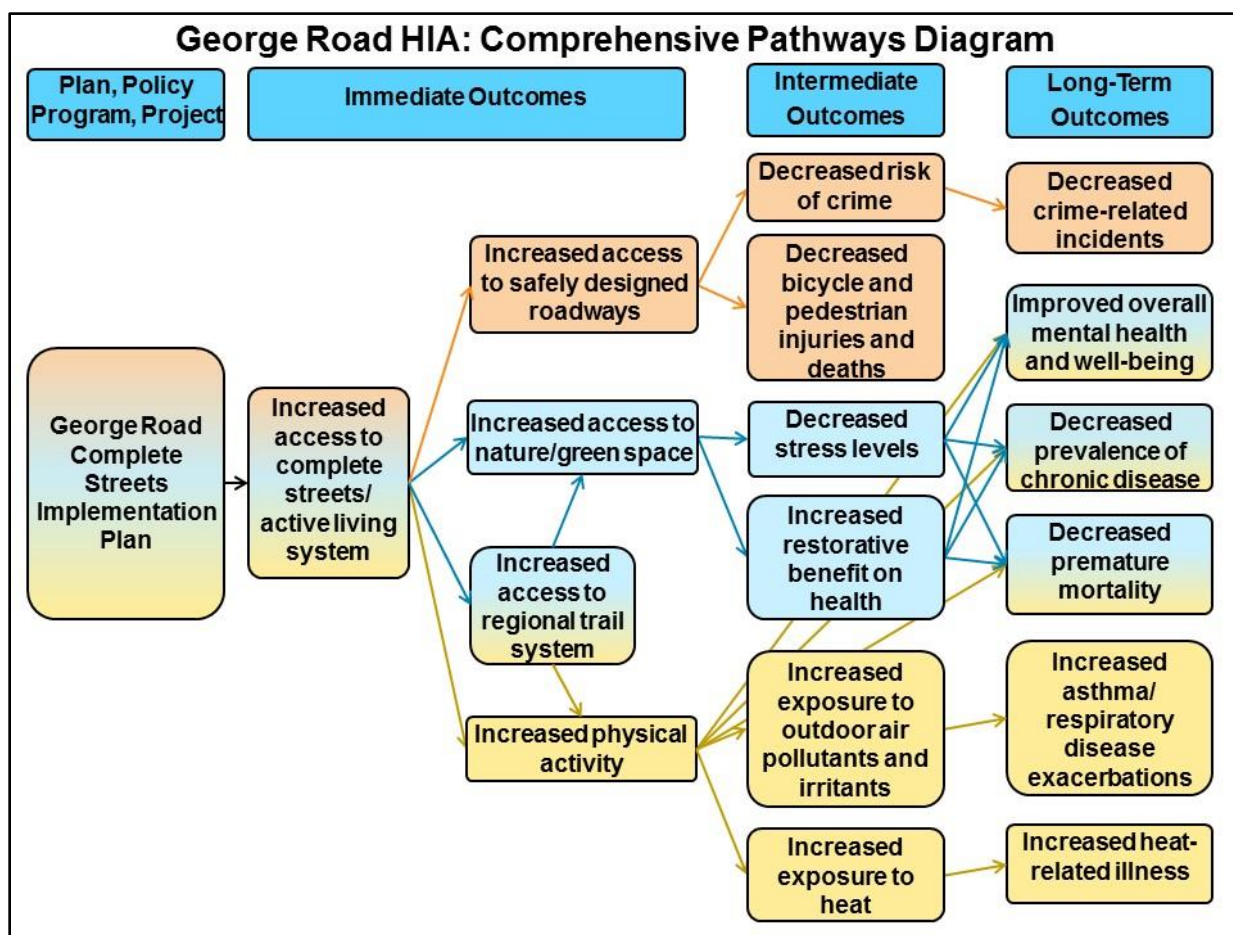


Figure 6. Comprehensive Pathways Diagram

Community Profile

Hillsborough County is located in West-Central Florida, and is home to approximately 1.3 million people (2015 U.S. Census estimates). Hillsborough County includes the City of Tampa as well as large, relatively dense, unincorporated suburban areas of the Tampa Metropolitan Area. George Road is within Town 'N' Country, an unincorporated area adjacent to the City of Tampa, and is home to concentrations of minority populations exceeding the percentages found elsewhere in the county.

The overall racial and ethnic distribution of the target area ([Table 1](#)) includes census tracts with a large percentage of Hispanic/Latino residents. The average percentage of Hispanic/Latino residents is 47.3% (range 30% - 60%), which is much higher than the percentage in Hillsborough County (25.7%) and the State of Florida (23.3%). The area also has a lower average percentage Black/African American (Non-Hispanic) population (6%) and a lower average percentage White (Non-Hispanic) population (42.3%) than the averages for the County or State. The target area also includes census tracts in which a high percentage of households have Limited English Language Proficiency, where 50% to 60% of the households have at least one member who speaks English less than "very well" ([Figure 7](#)).

Table 1. Distribution of Race and Ethnicity in the Target Area

| Census Tract | Total Population Count | % White (Non-Hispanic) | % Black (Non-Hispanic) | % Hispanic | % Other (Non-Hispanic) |
|--------------------------------------|------------------------|------------------------|------------------------|--------------|------------------------|
| Florida State | 19,361,792 | 56.6 | 15.4 | 23.3 | 4.8 |
| Hillsborough County | 1,279,668 | 52.4 | 15.7 | 25.7 | 6.4 |
| 12057011603 | 4,276 | 53.4 | 5.2 | 39.2 | 2.2 |
| 12057011605 | 6,377 | 31.1 | 4.5 | 62.0 | 2.3 |
| 12057011612 | 6,808 | 40.8 | 4.7 | 48.1 | 10.6 |
| 12057011613 | 5,590 | 40.4 | 6.8 | 51.5 | 1.3 |
| 12057011706 | 7,682 | 26.3 | 10.0 | 56.1 | 7.7 |
| 12057011708 | 3,982 | 56.2 | 5.0 | 30.2 | 8.7 |
| 12057011712 | 5,269 | 63.8 | 3.9 | 30.6 | 1.7 |
| TOTAL/AVERAGE FOR TARGET AREA | 39,984 | 42.3% | 6.0% | 47.3% | 5.2% |

Source: U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates

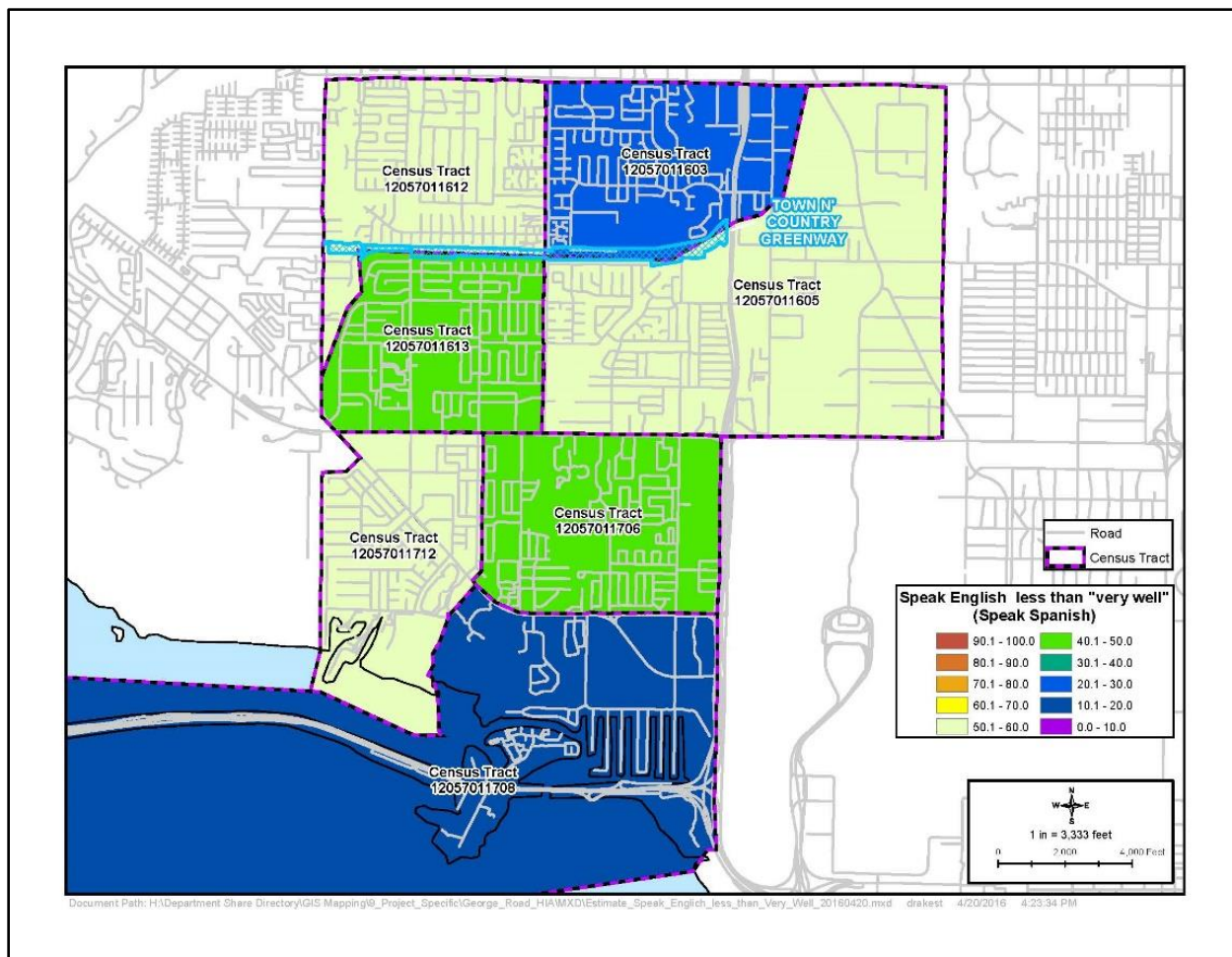


Figure 7. Distribution of English Language Fluency in the Target Population (Percentage of Households with at Least One Members Who Speaks English Less Than Very Well)

Source: U.S. Census Bureau, American Community Survey, 2013

The overall target area has a lower percentage of residents with an income below the poverty level (14.4%), compared to the County (17.2%) or State (16.7%), with a wide range from 6.6% to 22.4%. The median household income is higher in the target area (\$52,531) than the County (\$50,122) and the State (\$47,212). There is a transition from higher income residential areas close to the water, to lower income areas moving north through the target area. The target population has a higher proportion of adults aged twenty-five years or older with less than a high school education (15.7%) than the County (12.9%) and the State (13.5%). The distributions of poverty, household income, and education are summarized and displayed in [Table 2](#).

Table 2. Distribution of Poverty, Income and Educational Attainment in the Target Area

| Census Tract | % of People with Income Below Poverty Level | Median HH Income | % Adults ≥25 with < HS Education |
|--------------------------------------|---|------------------|----------------------------------|
| Florida State | 16.7 | \$47,212 | 13.5 |
| Hillsborough County | 17.2 | \$50,122 | 12.9 |
| 12057011603 | 6.6 | \$52,394 | 5.1 |
| 12057011605 | 14.8 | \$44,922 | 25.0 |
| 12057011612 | 14.0 | \$50,152 | 14.7 |
| 12057011613 | 22.4 | \$48,547 | 20.6 |
| 12057011706 | 15.1 | \$38,529 | 7.5 |
| 12057011708 | 7.4 | \$81,667 | 16.2 |
| 12057011712 | 16.2 | \$60,417 | 20.6 |
| TOTAL/AVERAGE FOR TARGET AREA | 14.4% | \$52,531 | 15.7% |

Source: U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates

Within the target area, the percentage of adults with a disability ranges from 5.1% to 17.2%, with an average of 11.0%, which is lower than the County (11.7%) and the State (13.2%) (Table 3). The male to female ratio is similar for the target area, the County and the State. In Hillsborough County, the median age in years is lower (36.2) than the State (41.2) but comparable to that in the target population (37.6) Table 3.

Table 3. Distribution of Sex, Age and Disability in the Target Area

| Census Tract | % Male | % Female | Median Age in Years | % Disability |
|--------------------------------------|--------------|--------------|---------------------|---------------|
| Florida State | 48.9 | 51.1 | 41.2 | 13.2 |
| Hillsborough County | 48.8 | 51.2 | 36.2 | 11.7 |
| 12057011603 | 50.7 | 49.3 | 40.4 | 9.8 |
| 12057011605 | 48.2 | 51.8 | 39.9 | 14.7 |
| 12057011612 | 49.5 | 50.5 | 39.8 | 10.7 |
| 12057011613 | 49.1 | 50.9 | 42.5 | 17.2 |
| 12057011706 | 51.7 | 48.3 | 32.2 | 7.9 |
| 12057011708 | 48.0 | 52.0 | 33.1 | 5.1 |
| 12057011712 | 51.6 | 48.4 | 35.9 | 10.7 |
| TOTAL/AVERAGE FOR TARGET AREA | 49.9% | 50.1% | 37.6 | 11.00% |

Source: U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates

In the target population, there is a higher percentage of single mother households (15.0%), with a few of the census tracts having a larger percentage than the average for the County (14.7%) and the State (13.9%) (See [Table 4](#)).

Table 4. Distribution of Single Mother Households in the Target Area

| Census Tract | # of Households | # of Single Mother Households | % Single Mother Households |
|--------------------------------------|-----------------|-------------------------------|----------------------------|
| State of Florida | 7,328,046 | 959,771 | 13.1 |
| Hillsborough County | 489,603 | 69,894 | 14.3 |
| 12057011603 | 1623 | 277 | 17.1 |
| 12057011605 | 2096 | 437 | 20.9 |
| 12057011612 | 2510 | 458 | 18.3 |
| 12057011613 | 1915 | 315 | 16.5 |
| 12057011706 | 3015 | 435 | 14.4 |
| 12057011708 | 1928 | 179 | 9.3 |
| 12057011712 | 2013 | 162 | 8.1 |
| TOTAL/AVERAGE FOR TARGET AREA | 15,100 | 2263 | 15.0% |

Source: U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates

The target area has a higher percentage of occupied housing units (89.4%) than the County (87.7%) and the State (79.7%), and a lower percentage of vacant housing units (10.0%) compared to the County (12.3%) and the State (20.3%). The percentage of renter occupied units is higher for the target area (40.9%) compared to the County (35.7%) and the State (27.0%), as shown in [Table 5](#).

Table 5. Distribution of Housing Type in the Target Area

| Census Tract | Total Housing Units | Occupied Housing Units% | Vacant Housing Units % | Owner Occupied % | Renter Occupied % |
|--------------------------------------|---------------------|-------------------------|------------------------|------------------|-------------------|
| State of Florida | 9,051,851 | 79.7 | 20.3 | 52.7 | 27.0 |
| Hillsborough County | 544,259 | 87.7 | 12.3 | 52.0 | 35.7 |
| 12057011603 | 1,648 | 98.5 | 1.5 | 79.6 | 18.9 |
| 12057011605 | 2,200 | 95.3 | 4.7 | 66.4 | 28.9 |
| 12057011612 | 2,625 | 95.6 | 4.4 | 61.9 | 33.7 |
| 12057011613 | 2,214 | 86.5 | 13.5 | 49.0 | 37.5 |
| 12057011706 | 3,515 | 85.8 | 14.2 | 27.7 | 58.1 |
| 12057011708 | 2,294 | 84.1 | 16.0 | 26.2 | 57.8 |
| 12057011712 | 2,391 | 84.2 | 15.8 | 46.1 | 38.1 |
| TOTAL/AVERAGE FOR TARGET AREA | 16,887 | 89.4% | 10.0% | 48.3% | 40.9% |

Source: U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates

In the target area, 87.5% of residents drive alone to work, compared to 80.3% in the County and 79.6% in the State. Further, public transportation use is lower in the target area (1.0%), compared to the County (1.5%) and the State (2.1%), as well as the percentage of residents who walk to work (1.1%), compared to 1.6% in the County, and 1.5% in the State, as shown in [Table 6](#).

Table 6. Distribution of Mode of Transportation to Work in the Target Area

| | % Drive Alone | % Carpool | % Public Transportation | % Walked | % Other Means |
|--------------------------------------|----------------------|------------------|--------------------------------|-----------------|----------------------|
| State of Florida | 79.6 | 9.6 | 2.1 | 1.5 | 2.2 |
| Hillsborough County | 80.3 | 9.2 | 1.5 | 1.6 | 2.1 |
| 12057011603 | 84.1 | 7.5 | 0.7 | 0.9 | 1.4 |
| 12057011605 | 81.6 | 9.5 | 3.0 | 0.8 | 0.6 |
| 12057011612 | 81.6 | 9.4 | 0.0 | 0.7 | 0.0 |
| 12057011613 | 72.8 | 12.4 | 0.0 | 2.5 | 1.0 |
| 12057011706 | 87.2 | 10.0 | 1.4 | 0.4 | 0.8 |
| 12057011708 | 78.4 | 6.3 | 1.7 | 0.5 | 3.3 |
| 12057011712 | 86.8 | 5.7 | 4.0 | 2.0 | 1.5 |
| TOTAL/AVERAGE FOR TARGET AREA | 87.5% | 9.2% | 1.0% | 1.1% | 1.2% |

Source: U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates

ASSESSMENT

Methods

During the Assessment phase, baseline health determinants and health impact predictions are examined. This phase began in November 2015 and continued through April 2016. The methods included: a literature review of peer-reviewed journal articles and grey literature; and secondary data analysis of demographic, health determinant, health outcome, complete streets-related data, and data from a 2015 Parks and Recreation HIA (community survey and focus group results) previously conducted in the Town 'N' Country area. Additionally, AECOM (the consulting company contracted by the MPO for the George Road Complete Streets Implementation Plan) collected primary data on the streetscape of the George Road Corridor to develop a draft of the implementation plan, which was reviewed and included in the HIA. Limited Geographic Information Systems (GIS) mapping was also included. The HIA team engaged other MPO committees beyond BPAC for their input, including the MPO Board, the Livable Roadways Committee, and the Transportation Disadvantaged Coordinating Board. In March 2016, a series of meetings took place with Subject Matter Experts (SMEs). At these meetings, the HIA results were presented to SMEs, who helped to identify gaps in data, determine health impacts, and draft recommendations. Feedback from the MPO Board, MPO Committees, and BPAC Advisory Council was incorporated throughout the Assessment phase.

Limitations and assumptions were considered during the HIA process. The limitations of the HIA included: various health factor and outcome indicators were only available at the county level and not at the census tract level; and the 2015 Parks and Recreation HIA survey results used as a secondary data source had a small sample size (n=173) and a convenience sampling method was used which increases the likelihood of a selection bias. An additional limitation of this HIA included the use of air quality data at the aggregate level for the entire county because a monitoring site does not exist within the HIA target area.

Results

Priority Pathway A: Access to Safely Designed Roadways

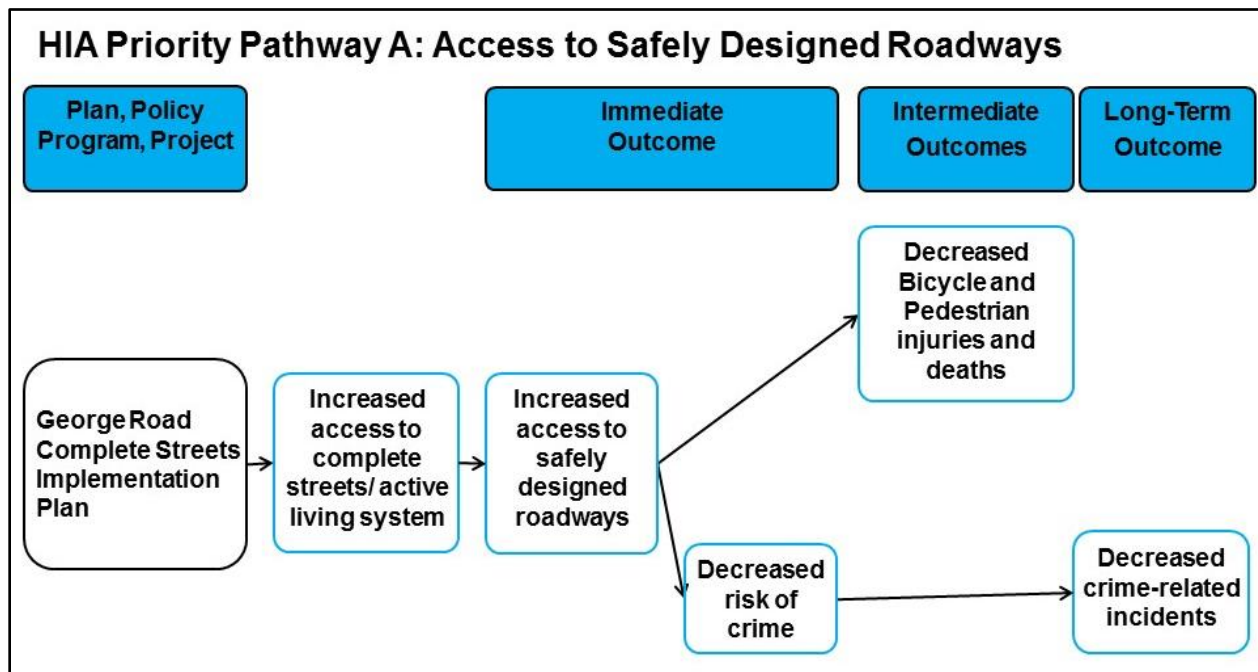


Figure 8. Priority Area A Pathway Diagram (Access to Safely Designed Roadways)

Rationale and Research Questions:

The rationale for pathway A is that the execution of the George Road Complete Streets Implementation Plan would provide increased access to complete streets and an active living system for those who live on or close to the George Road Corridor. Having access to a complete streets system would increase access to safely designed roadways, which can reduce the risk of crime and crime-related incidents. Access to safely designed roadways can also mitigate bicycle and pedestrian injuries and deaths by providing a safer environment for all types of mobility along the system.

Specifically, the research questions include:

- What are the existing safety design features along the George Road Corridor, and how would these features change as a result of the complete streets implementation?
- What is the current prevalence of bicycle and pedestrian injuries and deaths in the target location, and how would this prevalence change as a result of the complete streets implementation?
- What are the current existing design features that mitigate risk of crime, and how would these change as a result of the complete streets implementation?

- What are the current levels of crime-related incidents in the target area, and how would these levels change as a result of the complete streets implementation?

Literature Review:

Complete streets are intended to provide safe access for all roadway users, including motor vehicles, bicyclists, and pedestrians; creating infrastructure that respects all users improves access and safety for all. In an evaluation of complete streets in Victoria, British Columbia, Litman (2010) reported that reversing the planning priorities from a primary focus on automobile traffic to a focus on pedestrian and bicycle users, resulted in improved public fitness and health (Litman, 2010). The interventions implemented to improve pedestrian safety included road diets that reduced the number of lanes, increased bicycle and pedestrian facilities, reduced speeds, and compact development types that improved pedestrian access.

In 2015, Smart Growth America (SGA) surveyed 37 different states, regions, and counties in the U. S. that have participated in Complete Street projects. Among those surveyed, 70% of the projects reported a reduction in collisions, and approximately 56% of these projects also reported a reduction in injuries resulting from collisions. These projects also reported an increase in pedestrian and bicycle traffic, with no change in motor vehicle traffic. Rates of collision and injury decreased despite the increase in pedestrian use, suggesting that the projects improved pedestrian safety (G. Anderson et al., 2015). In a review of evidence-based traffic engineering measures designed to reduce pedestrian-motor vehicle crashes, Retting, Ferguson, and McCart (2003), reported that the installation of roundabouts reduced pedestrian crashes by up to 75% (Retting, et al., 2003). This was partly due to the reduction of conflict points between pedestrians and vehicles. Additional engineering measures found to reduce pedestrian crashes included sidewalks, refuge islands, pedestrian barriers and fences, pedestrian overpasses, changes in pedestrian signal timing, traffic calming, bus stop relocation, increased roadway lighting, and crosswalk markings.

Crime Prevention Through Environmental Design (CPTED) seeks to reduce crime and opportunities for crime through interventions in the built and social environments. Strategies to support CPTED may include overt applications such as fencing and access control, as well as subtle interventions that delineate private space and provide opportunities for natural surveillance (Cozens, Saville, & Hillier, 2005). Jane Jacobs, one of the most influential urban planners of the 20th century, described three main qualities that a street must have in order to be considered a safety asset and to contribute towards a successful neighborhood. First, a clear delineation between public and private space; second, buildings must be oriented to allow for “eyes on the street” to provide passive surveillance; and third, there must be sufficient sidewalk activity to encourage building occupants to have a desire to watch street activity and thereby provide surveillance (Jacobs, 1961).

Other experts in the field have added to this idea by providing additional analysis on each of the three qualities described by Jacobs. Newman (1972) promoted a series of interventions for private spaces that delineate or limit access as well as provide opportunities for increased natural surveillance. Natural surveillance is “the capacity of the physical environment to provide surveillance opportunities for residents” (Newman, 1972).

Active streets for pedestrian and bicycle users also support an “eyes on the street” mentality, as espoused by Jane Jacobs. Green spaces allow opportunities for social integration and attract people to spend more time outdoors, therefore increasing the frequency and number of “eyes on the street”, and deterring criminal activity (Li, Zhang, & Li, 2015). Particularly in residential areas, the presence of people provides passive surveillance that discourages criminal activity. Perceived personal safety has a great impact on an individual’s wellbeing. Fear of crime can limit an individual’s activities and change their behaviors, even if actual crime rates in an area are low. For example, fear of crime can negatively impact a person’s health by reducing physical activity, which can affect physical and mental health, risk of disease, and cognitive function (Deniz, 2016). Fear of crime has been associated with negative physical and mental health outcomes, and a diminished quality of life (Jansson, Fors, Lindgren, & Wiström, 2013).

There are two main theories of why improved street lighting may cause a reduction in crime. The first suggests that improved lighting leads to increased surveillance of potential offenders (by improving visibility and by increasing the number of people on the street. This increased lighting therefore acts as a deterrent to potential offenders. The second suggests that improved lighting signals community investment in the area and that the area is improving, leading to increased community pride, community cohesiveness, and informal social control. The first theory predicts decreases in crime especially during the hours of darkness, while the second theory predicts decreases in crime during both daytime and nighttime (Farrington & Welsh, 2007).

Street lighting also provides a general sense of safety to pedestrians. Haans and de Kort (2012) define perceived personal safety as a person’s immediate sense of security, and an absence of anxiety of becoming victimized when traveling through a certain environment. The authors also reported that lighting is the most important factor affecting perceived safety in an environment (Haans & de Kort, 2012).

Finally, vegetation and landscaping can play a role in perceived safety. Removing view-blocking dense vegetation, especially shrubs and low-hanging trees, can reduce crime and the fear of crime (Sreetheran & van den Bosch, 2014). Other methods to reduce crime and improve perceived personal safety include having well maintained vegetation, by removing dense vegetation that doesn’t provide free sight between knee and eye height, causes shadows, may be potential hiding places, or that impedes movement in the environment (Jansson et al., 2013).

Determinant: Access to Safely Designed Roadways

Safely designed roadways play a key role in preventing bicycle and pedestrian injury and death. The existing George Road Corridor crosses major intersections and includes several points which can be dangerous for bicycle and pedestrian users. In order to improve the safety of the roadway and use it as a trail connector, a number of improvements are proposed, and outlined in [Table 7](#). These improvements are designed to allow for improved bicycle and pedestrian access and safety along the corridor and at intersections, which are where the majority of conflicts between pedestrians, bicycles, and motor vehicles occur. The George Road Complete Street project is

divided into three segments based on the changing nature of the road, as illustrated in [Figure 9](#). [Figures 10-12](#) provide examples of the proposed design elements along the three segments.

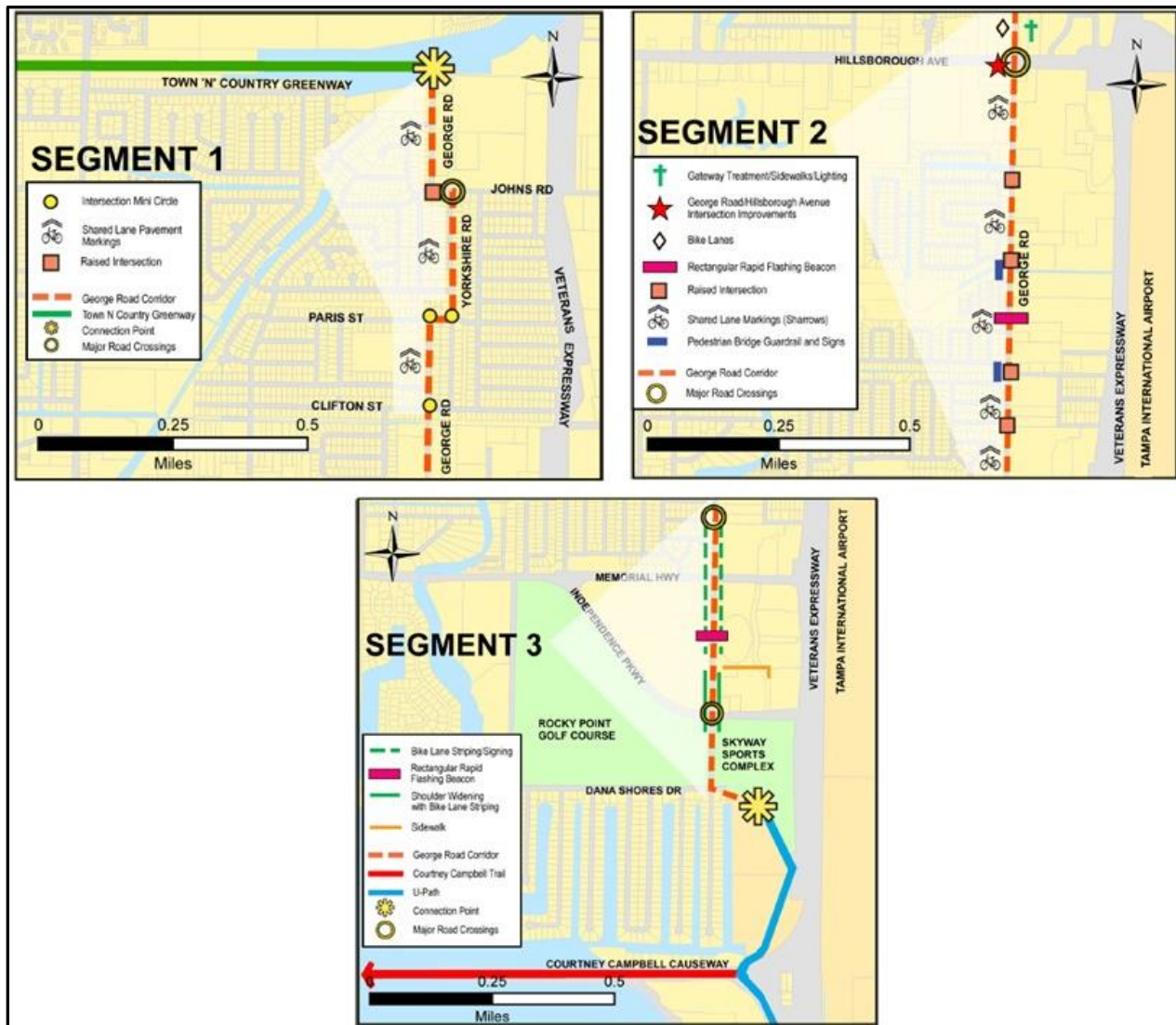


Figure 9. Segments of the George Road Corridor

Table 7. Summary of Proposed Improvements to the George Road Corridor

| Design Feature | Description | Corresponding Segment |
|--|---|-----------------------|
| Shared Use Markings (Sharrows) | <ul style="list-style-type: none"> On segments where there is not sufficient space on the roadway for a bicycle lane, a shared lane marking (sharrow) may be recommended. “Share the Road” signage may be used in conjunction with shared lane markings. | Segments 1, 2 |
| Mini Traffic Circles | <ul style="list-style-type: none"> Mini-traffic circles, similar to roundabouts, to reduce the speed at intersections. | Segment 1 |
| Raised Intersection | <ul style="list-style-type: none"> Raised intersections are similar to speed bumps and help to reduce speed. They also raise the height of pedestrians and bicyclists in the intersection, making them more visible to approaching drivers. | Segments 1, 2 |
| Drainage Inlets, Grates, and Utility Covers | <ul style="list-style-type: none"> During resurfacing and reconstruction of the roadway, these elements will be modified to allow for minimal conflict with non-motorized road users. | Segment 1 |
| Sidewalk Improvements | <ul style="list-style-type: none"> Current sidewalk gaps force pedestrians into the street or landscaped areas, creating unsafe conditions. Filling in these gaps and bringing sidewalks and crossings into compliance with the Americans with Disabilities Act will improve the safety for all users along the corridor. Sidewalks will have a minimum width of five feet and be buffered from the roadway by two feet. If a curb and gutter are present, these may count toward the buffer. | Segments 1, 3 |
| Intersection Crosswalk Striping | <ul style="list-style-type: none"> Improved crosswalks are proposed at all major intersections and at other currently un-signalized intersections. Adding signalization and crosswalk markings improves/provides visual cues to drivers to watch for people crossing the roadway. | Segments 1, 2, 3 |
| Landscaping Maintenance | <ul style="list-style-type: none"> Keeping landscaping well-trimmed will help to reduce potential locations for concealment and criminal activity as well as keep sidewalks clear for pedestrians. | Segments 1, 2 |
| Guardrails | <ul style="list-style-type: none"> Guardrails provide a more pedestrian-friendly barrier between pedestrians and traffic as well as providing safety from vehicles and slope hazards. | Segments 1, 2 |

| | | |
|--|---|------------------|
| Street Lighting | <ul style="list-style-type: none"> • Pedestrian-level lighting makes a pathway safer and more inviting by reducing potential hazards after daylight hours and improving the feeling of safety for users. | Segments 1,2 |
| Tree Planting | <ul style="list-style-type: none"> • Planting trees can provide shade along the street lessening the potential for heat-related illness. Trees are recommended to be of a type known to have a lower allergenic effect. | Segment 1 |
| Roadway Resurfacing | <ul style="list-style-type: none"> • Roadway resurfacing is proposed to improve hazardous conditions for pedestrians and bicyclists, such as exposed drainage facilities and potholes. | Segments 1, 2, 3 |
| Bike Lanes | <ul style="list-style-type: none"> • Where possible, separated bicycle lanes are proposed along with improved sidewalks. Separating users in this way reduces the chance of collisions with motor vehicles and improves safety for all users. | Segments 2, 3 |
| Gateway Treatment | <ul style="list-style-type: none"> • Gateway treatments for Town 'N' Country provide a sense of entry and community, identifying and welcoming users into a space. | Segment 2 |
| Raised Landscaped Medians | <ul style="list-style-type: none"> • Raised medians provide landscaping, which can improve the pedestrian or bicycling experience by providing additional green space and by beautifying the area. These medians also discourage turning movements that are not at intersections, and reduce the potential for collisions. | Segments 2, 3 |
| Rectangular Rapid Flashing Beacons | <ul style="list-style-type: none"> • Beacons are highly visible, flashing crosswalk signals that can either be installed at an intersection or mid-block. They are activated by pedestrians or bicyclists and flash, requiring motorists to stop and allow the pedestrian to cross. These are often combined with signage and pavement markings to warn cars that they are approaching the crossing. | Segments 2, 3 |
| Pedestrian Bridge Railing/ Warning Signs | <ul style="list-style-type: none"> • Railings are proposed at small bridges running over drainage canals to warn pedestrians of hazards adjacent to pedestrian bridges. | Segment 2 |
| Shoulders with Bike Lane Markings | <ul style="list-style-type: none"> • Shoulders with markings are not ideal but do provide a separated facility for bicyclists. These facilities are usually narrower in width than traditional bike lanes and do not generally have any buffer from traffic. | Segment 3 |
| New Sidewalk and Path Construction/ Improvement | <ul style="list-style-type: none"> • The new sidewalk and path construction south of Independence Parkway will lead along Skyway Park to the existing U-path trail on the south side of the park. | Segment 3 |
| Signal Upgrades at Intersections | <ul style="list-style-type: none"> • Signal upgrades will allow for activation by bicyclists and pedestrians and be improved to include modern signal devices. | Segment 3 |
| Speed Cushions/ Pillows | <ul style="list-style-type: none"> • Speed cushions are either speed humps or speed tables that include wheel cutouts to allow large vehicles, such as emergency or delivery vehicles, to | Segment 3 |

pass unaffected, while reducing passenger car speeds.

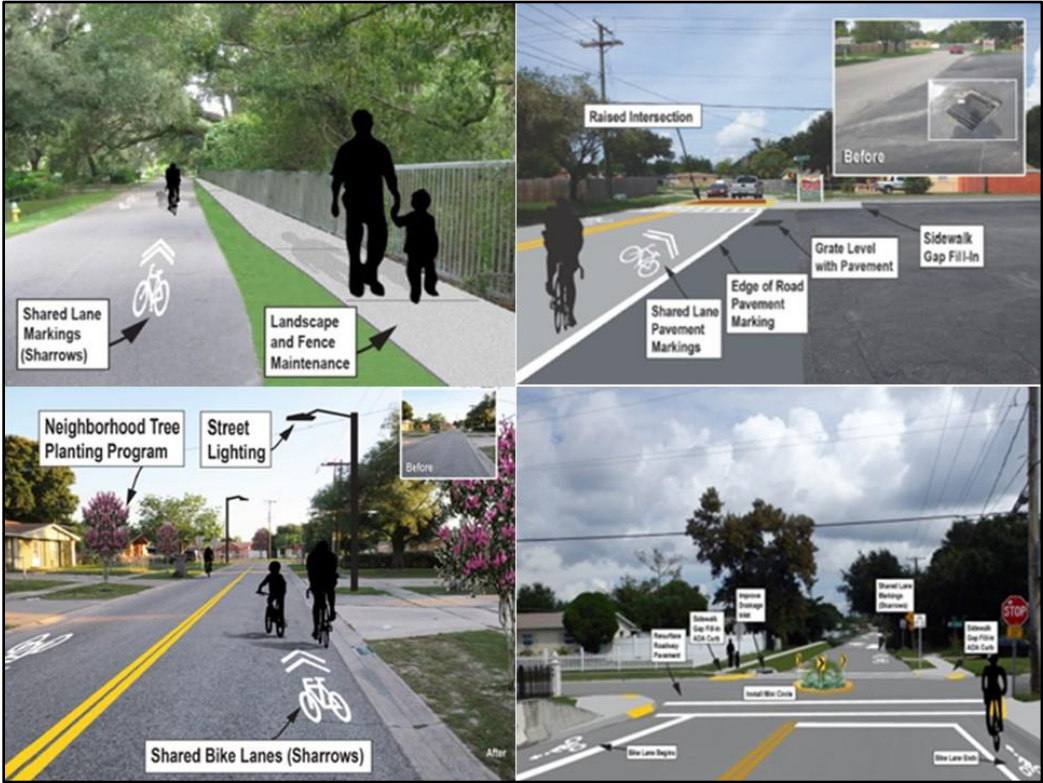


Figure 10. Proposed Design Features for Segment 1



Figure 11. Proposed Design Features for Segment 2

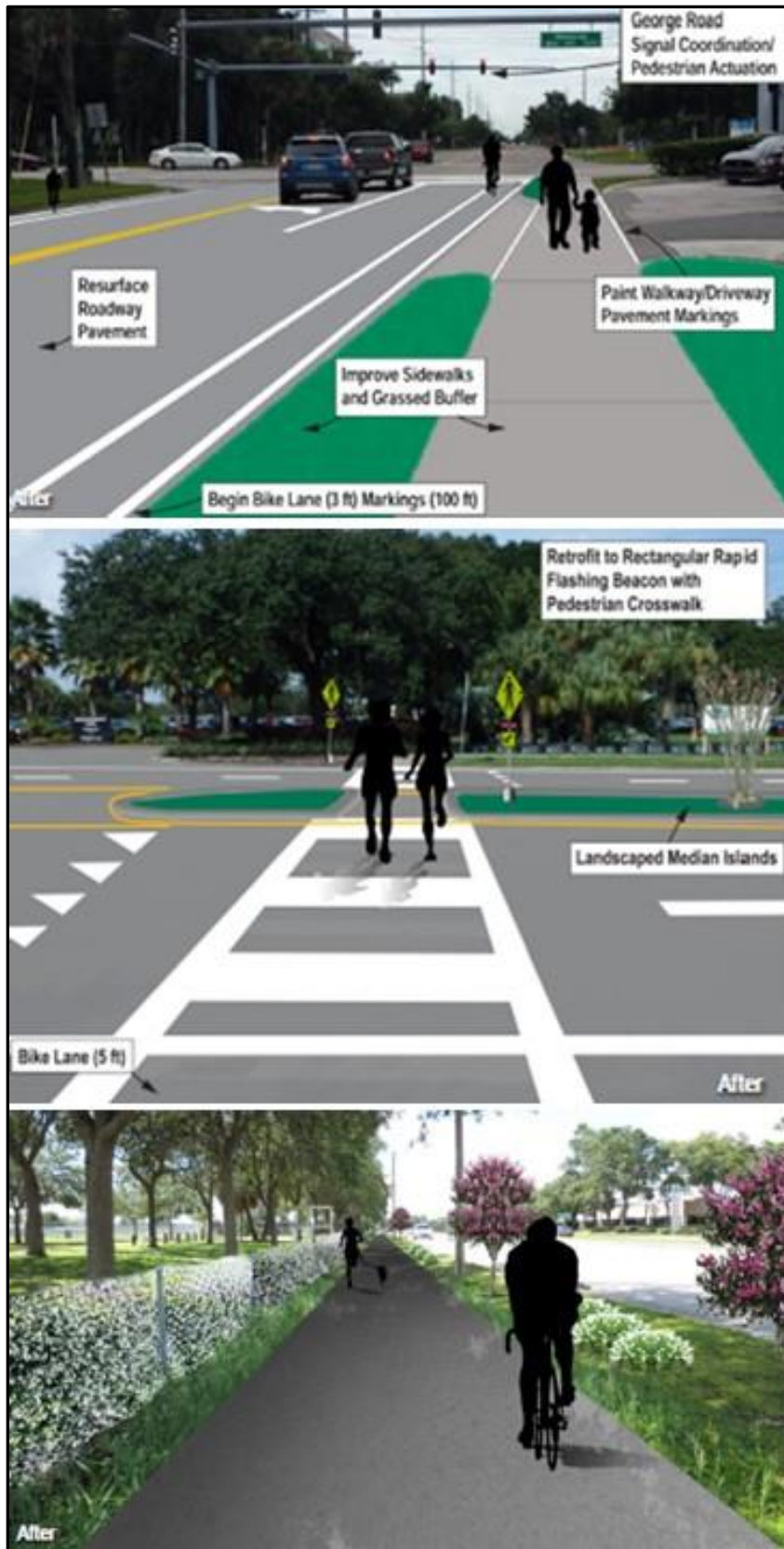


Figure 12. Proposed Design Features for Segment 3

Impact Prediction:

If the George Road Complete Streets Implementation Plan were executed, then there would be a likely increase in access to safely designed roadways, with a significant impact on both the local population and the regional trail users. The proposed design features for the complete streets plan would help to mitigate cut-through traffic that currently uses George Road as an alternate route, especially during rush hour (peak travel times). Implementation of the plan would convert the George Road corridor back to a neighborhood street, encouraging the local residents to view the corridor as an asset. This would make it easier for local residents and trail users to use the corridor for recreational activities and access local businesses and services. Community members who use the corridor out of necessity to access services and public transportation would have added benefit from increased access to safely designed roadways. Implementing the proposed design features along the George Road Corridor would provide a safer and more direct route for regional trail users. This will better ensure a safe route to connect the Town 'N' Country Greenway with the Courtney Campbell Causeway Trail. Vulnerable populations to benefit from the improvements in roadway design and safety include individuals with disabilities, of lower socioeconomic status, and older adults.

Intermediate Outcome: Bicycle and Pedestrian Injuries and Deaths

A lack of safely designed roadways can lead to an increase in bicycle and pedestrian injuries and deaths. There were a total of 221 pedestrian deaths and 58 bicyclist deaths in Hillsborough County between 2010 and 2015 ([Table 8](#)). The Tampa Bay region is ranked the second most dangerous in the country for pedestrians; and the Orlando, Tampa, Jacksonville, and Miami metropolitan areas were listed as the top four most dangerous cities for pedestrians in 2014 (SGA, 2014).

Table 8. Bicycle and Pedestrian Injuries and Deaths (Counts) in Hillsborough County 2010-2015

| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|------------------------------|------|------|------|------|------|------|
| Pedestrian Injuries | 469 | 463 | 539 | 485 | 568 | 574 |
| Pedestrian Fatalities | 41 | 32 | 33 | 32 | 34 | 49 |
| Bicycle Injuries | 371 | 350 | 470 | 482 | 513 | 329 |
| Bicycle Fatalities | 11 | 7 | 13 | 11 | 8 | 8 |

Source: Hillsborough County Crash Data Management System (2010-2015)

There have not been very many bicycle or pedestrian crashes (nine total) occurring along the George Road Corridor, which is one of the reasons it was chosen as the preferred route to connect the two trails. [Figure 13](#) shows crashes along the George Road Corridor and the HIA target area involving a pedestrian or a bicyclist for 2005-2015. Several crashes occurred close to the

intersection of Hillsborough Avenue and George Road. Improving the safety of this intersection, as well as the safety along the entire corridor, is essential to encouraging use of the corridor and the connecting trails. A larger study is under way for the Hillsborough Avenue crossing, and safety improvements at this location may be installed prior to the other improvements along the George Road Corridor. The proposed improvements previously described are designed to slow traffic, make bicyclists and pedestrians more visible, and allow for the safe movement of all modes of transportation along the corridor.

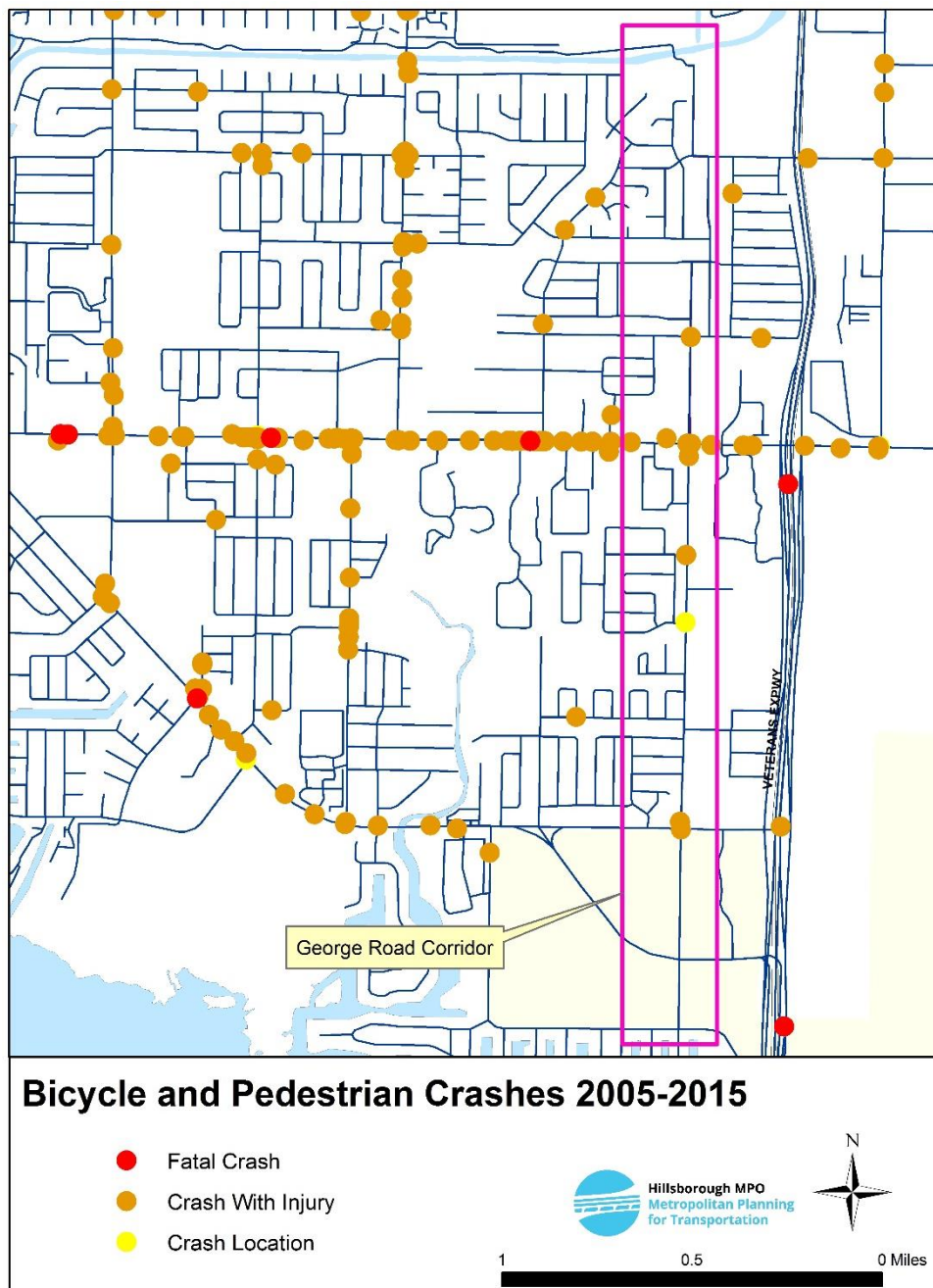


Figure 13. Bicycle and Pedestrian Crashes in the Target Area (2008-2015)

Fatal crashes are those in which a pedestrian or bicyclist was killed as a result of the crash. Along the George Road Corridor, between 2005 and 2015, there were nine crashes; none of which resulted in fatalities. There were, however, seven fatalities in the target area during that same time period within the target area. These were clustered on Memorial Highway and Hillsborough Avenue, as well as two which occurred on the Veteran's Expressway. [Figure 13](#) includes the fatality data for the area.

A crash with injuries is one that results in the serious injury of at least one of the parties, but does not result in any fatalities. [Figure 13](#) also includes crashes with injuries, which are mainly located on Memorial Highway and Hillsborough Avenue, and eight are along the George Road corridor with clusters on other north-south corridors including Webb road, Hanley Road, and Kelly Road.

Impact Prediction:

There is likely to be a decrease in pedestrian and bicyclist injuries and deaths as a result of executing the safety design features included in the George Road Complete Streets Implementation Plan. The plan introduces design features such as traffic calming and intersection improvements that will mitigate crashes, even with increased use by pedestrians and bicyclists. The traffic calming features aid in reducing cut-through traffic along the corridor. Reducing the number of vehicles on the corridor provides a safer corridor for the neighborhood to walk and bike, and for trail users to have access to a more safely designed connector.

Intermediate Outcome: Risk of Crime

Crime Prevention Through Environmental Design (CPTED) is a multidisciplinary approach to reduce crime and the risk of crime through interventions in the built and social environments. Adequate pedestrian-scale lighting ([Figure 14](#)) and proper upkeep of landscaping, such as eliminating overgrown brush ([Figure 15](#)), are two CPTED strategies incorporated into the Complete Streets Plan for George Road along Segments 1 and 2 of the corridor. Currently, no lighting is proposed for Segment 3 due to the limited right of way available for lighting improvements, but additional lighting may be warranted to reduce the risk of crime in this segment. Lighting, reduction in overgrown brush and shrubs, and properly designed pedestrian bridge crossings ([Figure 16](#)) can reduce opportunities for the concealment of individuals.



Figure 14. Example of Proposed Street Lighting



Figure 15. Example of Overgrown Brush

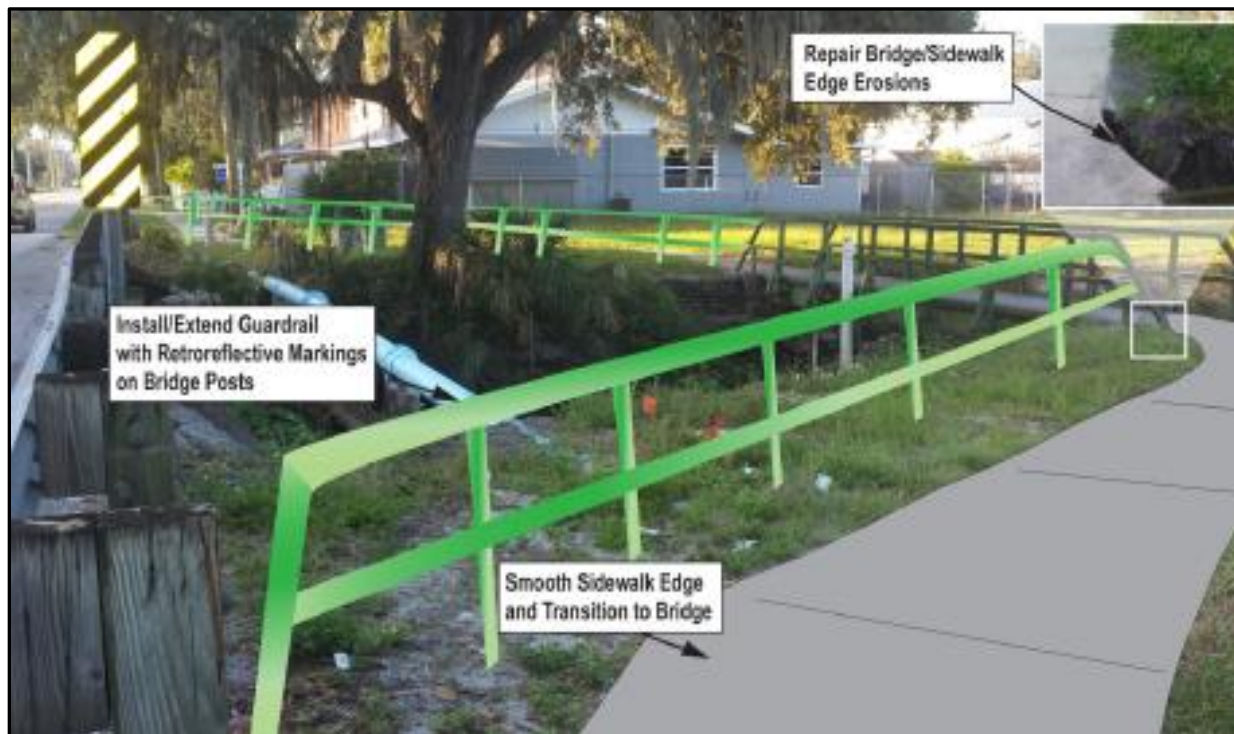


Figure 16. Example of Proposed Pedestrian Bridge Improvements

Improving access to safely designed roadways, by including CPTED strategies, will likely increase the volume of users on the corridor and users' perception of safety. Passive surveillance is enhanced and the number of eyes on the street increased which aid in reducing the risk of crime along the George Road Corridor. In 2015, residents from the target area responded to a survey conducted for a Parks and Recreation-related HIA (Florida Department of Health in Hillsborough County [DOH–Hillsborough], 2015). Results from this survey revealed that only 7.7% of respondents felt extremely safe, 47.1% felt quite safe, 33.5% felt slightly safe, 5.3% felt not at all safe, and 6.5% were unsure of how safe they felt. [Figure 17](#) illustrates the self-reported perception of neighborhood safety data.

How Safe from Crime do you Consider Your Neighborhood to Be?

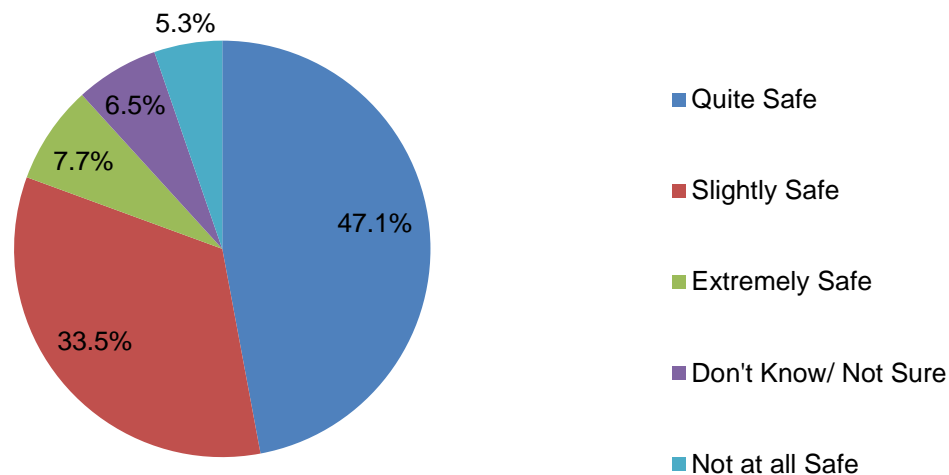


Figure 17. Self-Reported Perception of Neighborhood Safety

Source: Parks and Rec HIA Community Survey, 2015

Focus group sessions were also conducted with Town 'N' Country residents in 2015 for the Recreation HIA (DOH–Hillsborough, 2015). A key theme that emerged was related to safety and security issues in the area, which were deterrents to park use. Participants expressed that they were afraid to go to the parks alone to exercise due to the poor upkeep of certain parks and trails, an overall lack of police presence, and an overall lack of people utilizing the parks.

Impact Prediction:

Based on the improvements outlined in the George Road Complete Street Plan, it is expected that the overall risk of violent and non-violent crime will likely decrease. The various CPTED measures, such as improved lighting, will increase nighttime visibility on the road and thereby discourage both violent and non-violent crime. The risk of crime decreases as additional lighting increases the chances of detection by passersby or neighbors. Using the George Road Corridor to link the Courtney Campbell Causeway Trail and Town 'N' Country Greenway should increase non-motorized traffic along the corridor and assist in deterring crime. Lighting, eyes on the street, a more walkable community, and other factors would reduce the risk of crime, while increasing people's perception of safety.

Long-Term Outcome: Crime-Related Incidents

Violent and non-violent crimes are concerns in many communities throughout the country. Violent crimes are those that involve force or threat of force, specifically forcible rape, aggravated assault, and robberies (home invasion, carjacking, person robbery, and business robbery). Non-Violent crimes can also play a major role in how safe people feel in their neighborhoods. Non-Violent crimes are property and drug-related offenses which do not involve a threat of harm or an actual

attack upon a victim, such as burglary, larceny (theft), and drugs. Non-Violent crimes can degrade the feeling of safety in a neighborhood, and some crimes may introduce the opportunity for additional criminal activity in an area. [Figure 18](#) displays the total counts for violent and non-violent crimes in the police grids that include the HIA target area between 2011 and 2015. [Figure 19](#) is a map of these data plotted against the target area and along the George Road Corridor.

| HILLSBOROUGH COUNTY SHERIFF'S OFFICE | | | | | |
|---|-------------|-------------|-------------|-------------|-------------|
| GEORGE ROAD AREA GRIDS/COMPLETE STREETS HIA | | | | | |
| CRIME REPORTS/TRAFFIC CRASHES | | | | | |
| OFFENSE TYPE | 2011 | 2012 | 2013 | 2014 | 2015 |
| AGGRAVATED ASSAULT | 13 | 5 | 9 | 6 | 9 |
| BATTERY-AGGRAVATED | 22 | 11 | 4 | 12 | 10 |
| BURGLARY - ARMED | 4 | 5 | 2 | 3 | 5 |
| BURGLARY BUSINESS | 9 | 6 | 9 | 9 | 4 |
| BURGLARY RESIDENCE | 102 | 60 | 49 | 49 | 52 |
| BURGLARY WITH ASSAULT/BATTERY | 4 | 2 | 0 | 0 | 0 |
| BUSINESS ROBBERY | 3 | 1 | 1 | 3 | 0 |
| CARJACKING | 0 | 1 | 0 | 0 | 0 |
| CRIMINAL MISCHIEF | 71 | 67 | 62 | 77 | 81 |
| DRUG TRAFFICKING/DELIVERY | 9 | 6 | 6 | 5 | 16 |
| DRUGS/NARCOTICS | 41 | 70 | 52 | 53 | 67 |
| DUI (DRIVING UNDER INFLUENCE) | 25 | 19 | 17 | 23 | 19 |
| GRAND THEFT - ALL OTHER | 59 | 50 | 9 | 16 | 14 |
| HOME INVASION | 2 | 0 | 1 | 3 | 0 |
| PERSON - ROBBERY | 8 | 7 | 7 | 9 | 5 |
| PETIT THEFT - ALL OTHER | 46 | 40 | 5 | 18 | 16 |
| RAPE/FORCIBLE | 1 | 2 | 2 | 5 | 4 |
| SEX OFFENSE | 9 | 14 | 12 | 4 | 6 |
| THEFT FROM A BUILDING | 9 | 12 | 22 | 16 | 7 |
| THEFT FROM A VEHICLE | 63 | 50 | 51 | 45 | 37 |
| THEFT OF BICYCLE | 0 | 1 | 16 | 18 | 12 |
| THEFT MOTOR VEHICLE PARTS | 23 | 35 | 25 | 18 | 28 |
| THEFT VEHICLE & OTHER MOBILE | 29 | 28 | 22 | 15 | 24 |
| TRESPASS MISDEMEANOR | 7 | 6 | 15 | 4 | 3 |
| TOTAL | 559 | 498 | 398 | 411 | 419 |
| TRAFFIC CRASHES | 367 | 411 | 408 | 514 | 518 |
| BICYCLE RELATED | 5 | 3 | 4 | 8 | 4 |
| PEDESTRAIN RELATED | 2 | 9 | 5 | 6 | 5 |

Offense data from HCSO Crime Search
Traffic Data from Signal 4

Copyright © 2015 Hillsborough County Sheriff's Office
All rights reserved. No part of this document may be reproduced without written permission.

Figure 18. Counts of Violent and Non-Violent Crimes in the Target Area (2011-2015)

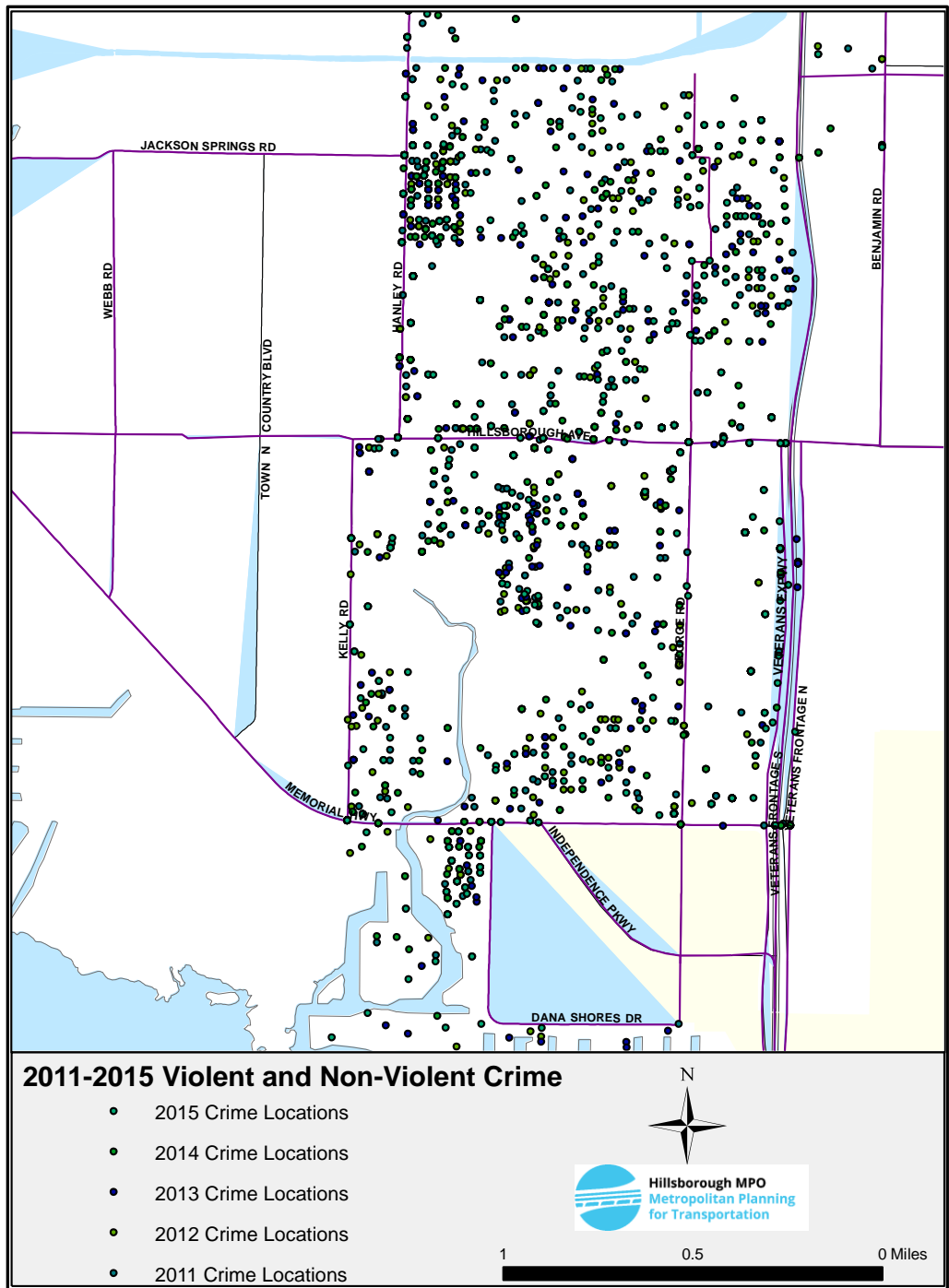


Figure 19. Map of Counts of Violent and Non-Violent Crimes (2011-2015)

Impact Prediction:

Additional lighting, a greater number of people using the corridor, and the elimination of unsafe roadway design features, are expected to reduce the number of crimes committed along the George Road Corridor, Town 'N' Country Greenway, and connector to the Courtney Campbell Causeway Trail.

Priority Pathway B: Access to Nature and Green Space

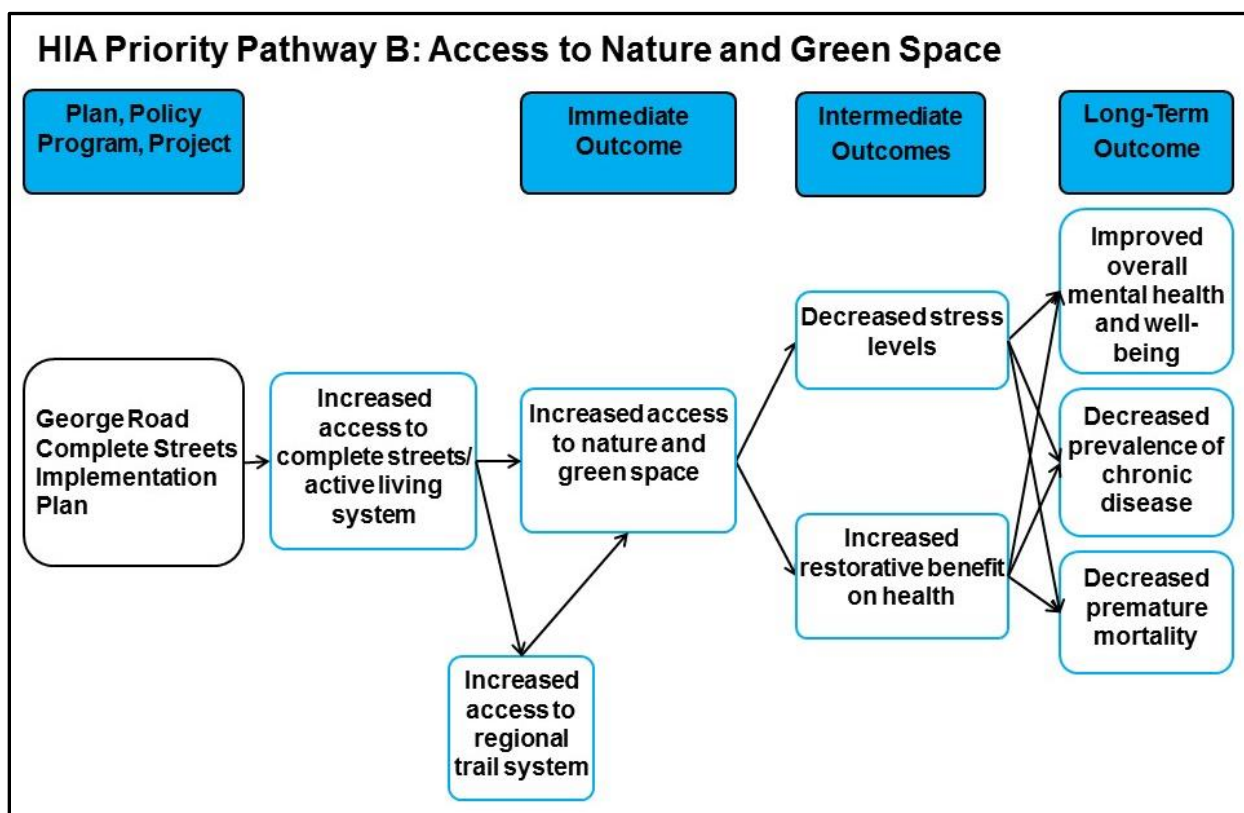


Figure 20. Priority Area B Pathway Diagram (Access to Nature and Green Space)

Rationale and Research Questions:

As shown in [Figure 20](#) above, executing the George Road Complete Streets Implementation Plan will increase access to an active living system along the George Road Corridor. Having access to the corridor will allow for easier access to the regional trail system, as well as increased exposure to nature and green space, which can in turn decrease stress levels and increase the restorative benefit of nature on human health. Decreased stress levels and the restorative benefit of nature can improve mental health and well-being outcomes, and decrease the prevalence of chronic disease and premature mortality.

The research questions include:

- How accessible are the Town 'N' Country (TNC) Greenway and the Courtney Campbell Causeway Trail, and how would this accessibility change as a result of the complete streets implementation?
- How much green space and tree coverage exist in the target area?
- What are the current levels of stress in residents of the target location, and how would these levels change as a result of the complete streets implementation?
- What effect does nature have on residents in the TNC area, and how would this effect change as a result of the complete streets implementation?

- What are the current prevalence of mental health disease and measures of well-being among residents in the target location, and how would these change as a result of the complete streets implementation?
- What is the current prevalence of chronic disease, and how would this prevalence change as a result of the complete streets implementation?
- What are the rates of premature mortality, and how would these rates change as a result of the complete streets implementation?

Literature Review:

In a 2013 survey of Urban Land Institute members, survey respondents ranked active transportation as the best way to link health and the built environment (Shreeve, 2014). Maas, Vereij, Groenewegen, de Vries, & Spreeuwenberg (2006) reported that “the percentage of green space in people's living environment has a positive association with the perceived general health of residents.” This can be particularly important in underserved communities where safe access to parks and other green spaces may be limited by the fear of crime or physical barriers such as high-capacity roadways (Maas et al., 2006). The National Regional Planning Council [NRPC] (2014) cites some of the benefits of complete streets, especially for vulnerable populations, as opportunities for physical activity, safety from traffic, access to parks, decreased exposure to air pollutants, and opportunities for social cohesion (NRPC, 2014). As part of their complete parks playbook, the California Center for Public Health Advocacy advocates complete streets policies to improve and ensure equitable access to parks for all community members (Dohm, 2015). The National Recreation and Parks Association [NRPA] (2010) states that persons living within half a mile of a park, or within walking distance, are more likely to participate in physical activity at parks than those living one or more miles away (NRPA, 2010); and, residents living within 500 meters of a park or trail system are more likely to use the facility (Crompton & Walker, 2012; Nicholls, 2004).

Urban environments can improve population health by being a location for physical activity (Romagosa, Eagles & Lemieux, 2015), and green spaces in urban environments are important restorative environments for community residents and visitors (Van den Berg et al., 2016). Van den Berg et al. (2016) conducted a cross sectional study assessing the association between the amounts of time spent in green spaces and different mental health outcomes, including feelings of depression and nervousness. The study reported that increased time visiting green spaces was positively correlated with better self-reported scores of mental health and vitality (Van den Berg et al., 2016).

Researchers have reported that the number of areas designated as green or open space in a community were associated with the levels of physical activity among community members (Romagosa et al., 2015). Interacting with nature offers a myriad of benefits to an individual's health, which include increasing self-esteem and mood, reducing anger, and improving overall psychological wellbeing. It has been hypothesized that interaction with the natural environment can be restorative and contribute to reducing mental fatigue (Keniger, Gaston, Irvine, & Fuller, 2013). Mental fatigue has been found to impair emotion regulation, increase the perception of

physical effort, and can reduce the motivation to engage in physical activity (Mantler & Logan, 2015).

Increased exposure to green space in a community can help to decrease stress levels. Research has reported lower levels of cortisol, a stress related hormone, in residents living in neighborhoods with more green space (Roe et al., 2013). Other studies measuring cortisol have reported similar results; higher levels among participants with more exposure to urban environments, compared to lower levels among participants with more exposure to natural green spaces (Beil & Hanes, 2013). Other biological markers associated with stress have also been reported to improve after interacting with nature. These include: improved blood pressure, heart rate variability, and lower levels of systemic inflammation (Mantler & Logan, 2015). Keniger et al. (2013) published a review article on studies exploring the benefits of interacting with nature including one by Yamaguchi, Deguchi and Miyazaki (2006) conducted in China, which reported that exercising in nature may have greater benefits than exercising in urban environments (Keniger et al., 2013; Yamaguchi et al., 2006). The latter study measured salivary amylase activity as an indicator of stress in healthy males before and after exercise, and compared the levels for exercise done in both a forest and in an urban environment (Keniger et al., 2013; Yamaguchi et al., 2006). The results demonstrated that enzyme activity was significantly lower after exercise in a forest compared to exercise in an urban environment (Keniger et al., 2013; Yamaguchi et al., 2006).

In their review article, Mantler and Logan (2015) concluded that increasing residential distance from green spaces or having limited green space around homes, was associated with higher self-reported levels of stress and poorer mental and general health (Mantler & Logan, 2015). Additional studies have reported that interaction with nature promotes shorter recovery times after surgery and better pain control. Interaction with nature was also associated with the prevention of chronic diseases such as hypertension as well as a reduction in disease morbidity (Romagosa et al., 2015).

Access to green space can also impact perceived personal health status. A higher percentage of green space in the area where you live could lead to better “perceived general health,” especially among persons of lower socioeconomic status, youth, and older adults (Maas et al., 2006). A longitudinal study conducted by Alock, White, Wheeler, Fleming, and Depledge (2014) reported that individuals who relocated to residential areas with more green space had better mental health outcomes following their move. Self-reported mental health scores continued to improve each of the three years after participants moved to green areas. Similarly, individuals who moved into areas with less green spaces showed poorer mental health scores over time (Alock et al., 2014).

In another study, Maas et al. (2009) reported lower clusters of coronary heart disease, asthma, COPD, anxiety, depression, and other musculoskeletal and digestive disorders among individuals living in areas denser in green space. The effect for some conditions was even more positive for youth, older adults, and for persons of lower socioeconomic status (Maas et al., 2009). Mortality may also be impacted by exposure to green space. Mitchell and Popham (2008) reported lower mortality rates from circulatory diseases in communities with more green space, and the research

also suggested that green space promotes good health and reduces certain health inequities (Mitchell & Popham, 2008).

Access to green space within urban environments can increase social cohesion. Green spaces facilitate interactions among individuals thereby fostering social empowerment, enhancing interactions and ultimately promoting social cohesion and support. Social cohesion can help to decrease crime and violent behavior, as well as to improve the overall mental health and wellbeing of those in the community (Keniger et al., 2013).

Determinant: Access to Local Trail System

The George Road Complete Street Corridor will connect the Town 'N' Country Greenway on the north and the Courtney Campbell Causeway Trail on the south. The Corridor enables residents in the area to have access to an active living system, which promotes easier access to the local trails for recreational use. Living in closer proximity to parks and trailways has been shown to increase utilization rates. Residents living within half a mile are more likely to use the park or trail system. Access points to the trails and Corridor were analyzed to determine the percentage of the target area population that lived within 500 meters walking distance. Subject Matter Experts involved in this HIA recommended expanding this diameter to 1,000 meters to account for bicyclists living in the area. [Figure 21](#) includes a map of the target area and the percentage of residents living within 500 and 1,000 meters from an access point to the George Road Corridor, the Town 'N' Country Greenway, or Courtney Campbell Causeway Trail. The percentages of residents living within 500 and 1,000 meters of an access point are 17.5% and 41.2% respectively.

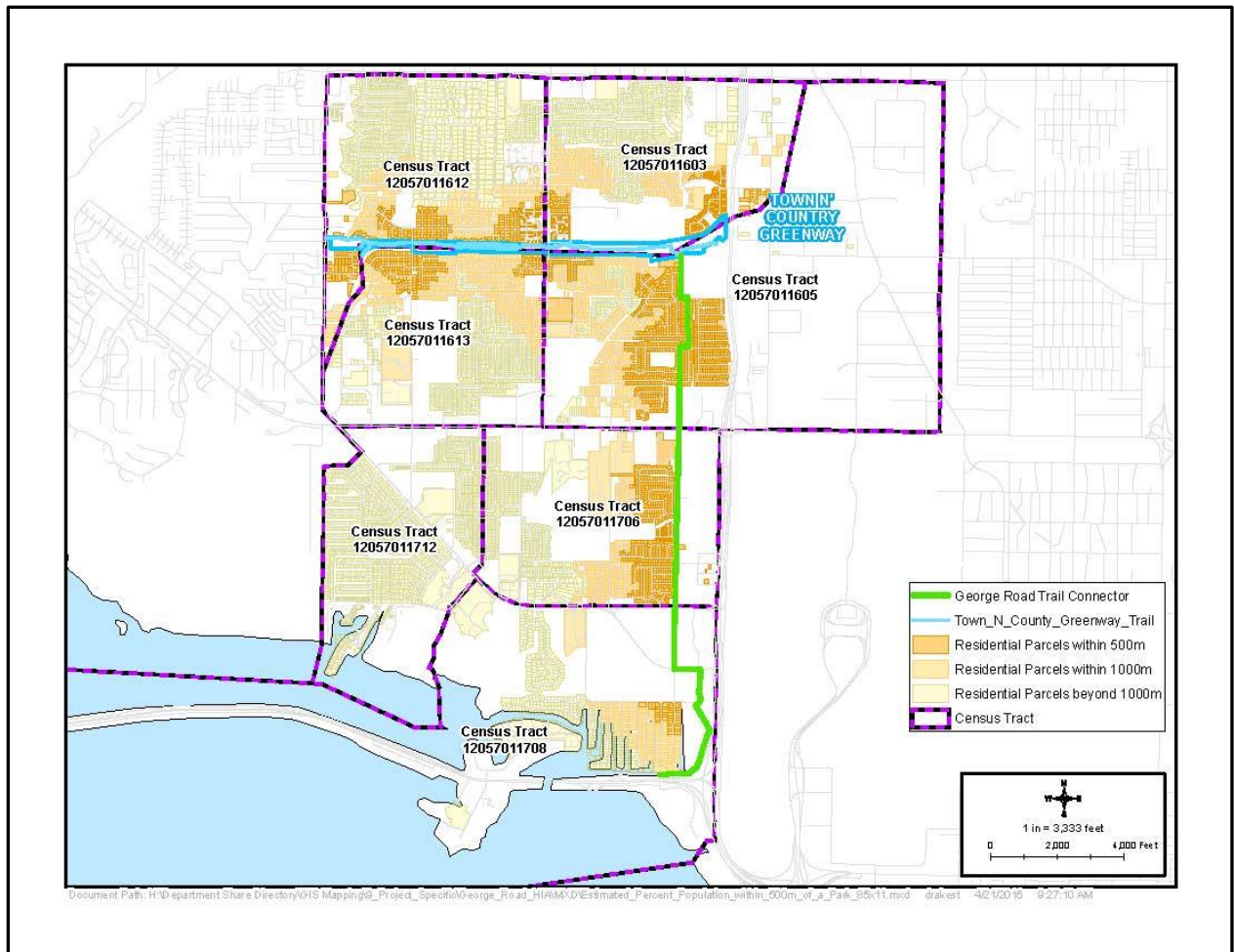


Figure 21. Estimated Population within 500m Walking Distance and 1000m Biking Distance of the Trailways and Complete Streets Corridor

Source: Florida Department of Revenue, Hillsborough County Residential Units, 2014

Impact Prediction:

There is a high likelihood that access to the local trail system will increase for those who live within walking and biking distance of the corridor and trailways as a result of executing the George Road Complete Streets Implementation Plan. With trail connections on each end of the George Road Corridor, residents can more easily access the trail system for recreational and physical activity purposes. The active living system created along the George Road Corridor would allow for increased access to the trailways for people with movement-related disabilities. For regional trail users, access to the trailways system is predicted to increase should a safely designed corridor exist to connect the two trailways to the greater regional and statewide trailway system.

Determinant: Access to Nature and Green Space

Having access to a safely designed active living system along the George Road Corridor allows for increased access to the local trailways and exposure to nature and greenspace. The United States Environmental Protection Agency's EnviroAtlas defines green space as land that is

covered by vegetation, which includes trees, lawns, gardens, crop land, and forested wetlands. [Figure 22](#) includes a map depicting the available green space in the target area in Town 'N' Country. Along the George Road Corridor, approximately 41%-60% of the area is covered in green space and approximately 61%-80% along the Town 'N' Country Greenway. The Skyway Park is located at the southern end of the corridor, providing another opportunity for local residents and regional trail users to access nature. A U-path connects the Skyway Park with the Courtney Campbell Trail, providing access to public waterfront parks along the trail.

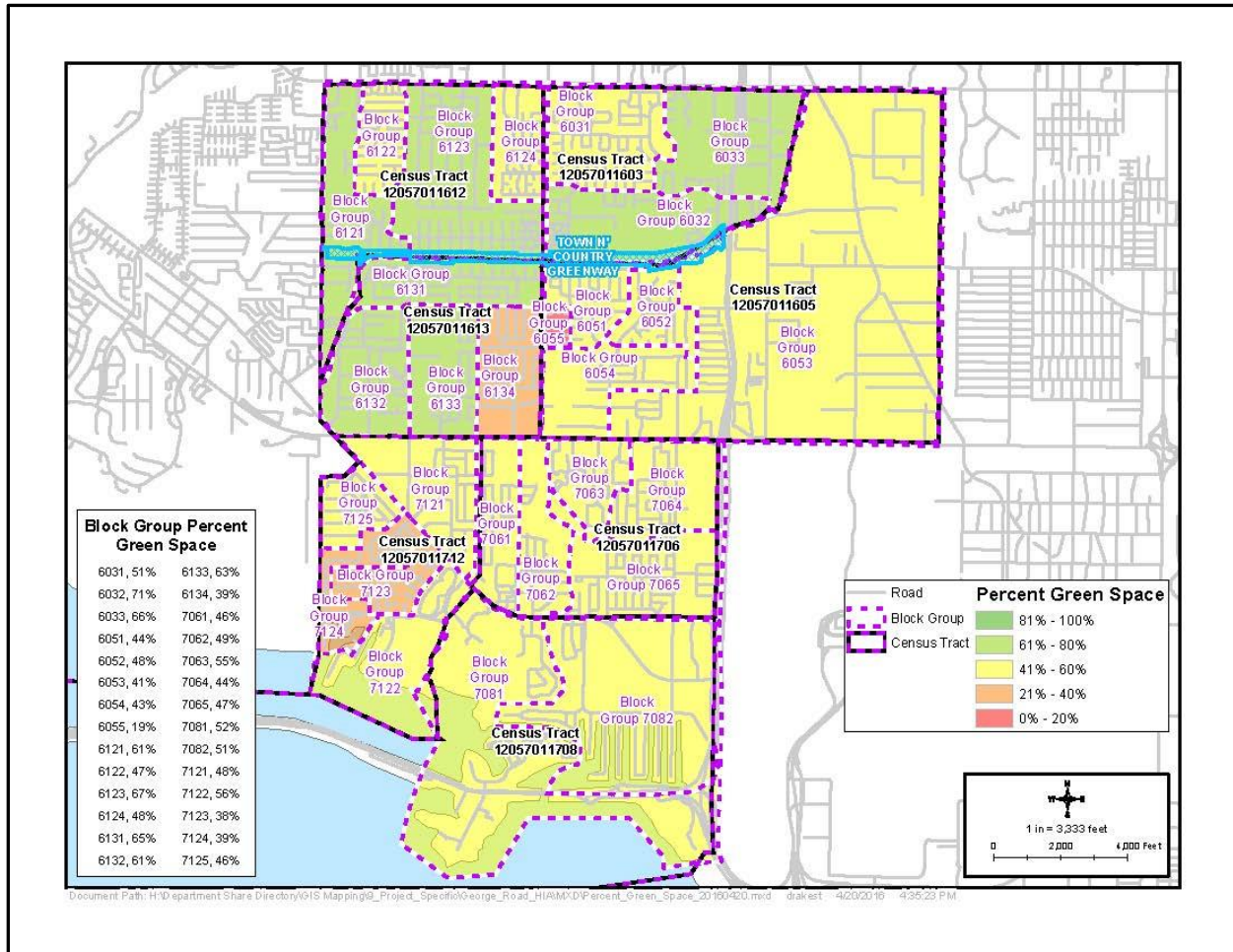


Figure 22. Percentage of Green Space in the Target Area

Impact Prediction:

Executing the George Road Complete Streets Implementation Plan would increase awareness of the existence of the corridor and the connecting trailways as an area for recreational activity and a safer means of accessing local services and businesses. Increased use of the corridor and the trailways by local residents, especially for those that live within 1,000 meters of the access points, would increase their exposure to nature and green space as a result of utilizing the active living system.

Intermediate Outcome: Stress Levels

Spending time in and living near green space has been shown to reduce stress. In surveys conducted in the Town 'N' Country area in 2015, residents were asked to self-report how many days on average they feel stressed, worried, nervous or anxious. Among respondents, 59.0% reported feeling stressed or anxious two or more days each week ([Table 9](#)).

Table 9. Self-Reported Mental Health (Stress and Anxiety)

| N=173 | 0-1 days a week | 2-4 days a week | 5-6 days a week | 7 days a week |
|---|-----------------|-----------------|-----------------|---------------|
| How many days a week do you feel stressed, worried, nervous, or anxious? | 41.0% | 27.8% | 17.3% | 13.9% |

Source: DOH-Hillsborough: Parks and Rec HIA Community Survey, 2015

Impact Prediction:

There would be a likely moderate decrease in stress levels overtime for persons using the George Road Corridor or connecting trailways, due to increased exposure to nature and green space, as well as an immediate significant reduction in stress levels while exposed to the green space/nature. Being out on the corridor or on the trailways provides an opportunity for individuals to interact with the natural environment and experience its stress-reducing effects. Additionally, a safely designed streetscape provides a less stressful walking environment by providing safer sidewalks, safer crossings, increased social connections with neighbors and family utilizing the system, a decreased risk of crime, and adequate lighting to see and be seen. Vulnerable populations who would benefit from nature's stress reducing effects include: individuals with heart disease and diabetes (i.e. chronic diseases), single-parent households, older adults, care-takers, people of lower socioeconomic status, and individuals who experience higher rates and/or more frequent stress and anxiety.

Intermediate Outcome: Restorative Benefits on Health

The connection between exposure to nature and its restorative benefit on human health has been well documented. In order to capture this restorative benefit effect, focus groups were conducted in the Town 'N' Country area in 2015 as part of a Parks and Recreation-related HIA which also examined the restorative benefits of nature on health. Focus group participants were asked how it makes them feel to be outside in nature. All participants' comments were positive, and the responses indicated that nature contributed positively to their physical and mental health. [Table 10](#) includes a few key responses from the focus group sessions that provide a description of the effect nature has on health.

Table 10. Focus Group Participant Responses to Nature’s Effect on Health

| Focus Group Participant Responses (Question: <i>How does it make you feel to be outside in nature?</i>) |
|--|
| • Good! |
| • Wonderful |
| • Being in nature makes you healthy and feel good |
| • Nature helps me a lot |
| • It is good to be around the ecology, flora, fauna, etc. |
| • It makes me feel happy and content |
| • Good because you are getting healthy (mind and body) |
| • I love it! |
| • It makes you feel good because you interact with nature, breathe pure air, can have a picnic, etc. |
| • Everything that one does outside in fresh air is good for health |

Source: Parks and Rec HIA Focus Group Results, 2015

Impact Prediction:

There would be a likely moderate increase in the restorative benefit on health for those who consistently use the George Road Corridor or connecting trailways. By accessing the corridor and trailway system, users are exposed to nature and its restorative benefit effects over time. This impact would be greater for individuals with pre-existing chronic diseases, single-parent households, older adults, care-takers, lower socioeconomic status, and individuals who suffer from poorer overall health status.

Long-Term Outcome: Overall Mental Health and Well-Being

Exposure to nature has been shown to improve mental health and well-being, including depression and overall health status, in addition to being physically active within green spaces. Depression, the most common mental health illness in the United States, is used by healthcare and public health practitioners as an indicator of mental health. In Hillsborough County, 18.1% of adults reported being told by a doctor that they have a depressive disorder. A higher prevalence is observed among White Non-Hispanics (18.6%) and Hispanics (18.2%) as compared to Black Non-Hispanics (15.5%). Additionally, females reported a higher prevalence of diagnosed depressive disorder overall (23.3%) as compared to males (12.6%), and the highest prevalence reported in Hillsborough County was among White Non-Hispanic females (28.9%). [Table 11](#) includes the percentage of adults who have been diagnosed with a depressive disorder by race, ethnicity, and sex for Hillsborough County and the State. In addition, results from a survey ([Table 12](#)) conducted with residents in the Town ‘N’ Country area for a Parks and Recreation-related HIA in 2015 demonstrated that 31.8% of respondents reported feeling sad, irritated, hopeless or unhappy (an indicator for depression) two or more days each week.

Table 11. Distribution of Depression among Adults in Hillsborough County

| | Florida (%) | Hillsborough County (%) | White (Non-Hispanic) (%) | Black (Non-Hispanic) (%) | Hispanic (%) |
|---|-------------|-------------------------|--------------------------|--------------------------|--------------|
| Adults Who Have Ever Been Told They Have a Depressive Disorder | 16.8 | 18.1 | 18.6 | 15.5 | 18.2 |
| Female | 21.2 | 23.3 | 28.9 | 16.8 | 18.6 |
| Male | 12.1 | 12.6 | 7.7 | 13.9 | 17.8 |

Source: Florida CHARTS, 2013

Table 12. Distribution of Self-Reported Depression among Adults in Hillsborough County

| N=170 | 0-1 days a week | 2-4 days a week | 5-6 days a week | 7 days a week |
|---|------------------------|------------------------|------------------------|----------------------|
| How many days a week do you generally feel sad, irritated, hopeless, or unhappy? | 68.2% | 19.4% | 6.5% | 5.9% |

Source: Parks and Rec HIA Community Survey, 2015

Healthy People 2020 defines Health-Related Quality of Life as “a multi-dimensional concept that includes domains related to physical, mental, emotional, and social functioning” (Healthy People 2020 [HP 2020], 2016). It goes beyond direct measures of population health, life expectancy, and causes of death, and focuses on the impact health status has on quality of life. A related concept of quality of life is well-being, which assesses the positive aspects of a person’s life, such as positive emotions and life satisfaction (HP 2020, 2016).

In Hillsborough County, 19.8% of the population reported their overall health as poor or fair, with females, Hispanics, and adults over 65 years reporting the highest rates when compared to their counterparts. Twenty-one percent (21.0%) of females reported their health as poor or fair compared to 18.6% of males. For racial and ethnic groups, Hispanics reported having a poorer overall health (28.9% reported poor or fair health) than White Non-Hispanics (19.4%) and Black Non-Hispanics (12.3%). Age also contributed to overall health. Adults aged 65 years and older had the highest percentage (30.8%) who ranked their health as poor or fair, among all age categories.

The distribution of self-reported overall health also differed by education level and income. Almost 46% of adults with less than a high diploma ranked their health as either poor or fair compared to 13.8% of adults with some level of college education. Additionally, 42.4% of adults earning less than \$25,000 reported poorer health than adults with higher incomes. [Figures 22 and 24](#), and [Table 13](#) contain the data related to self-reported health status.

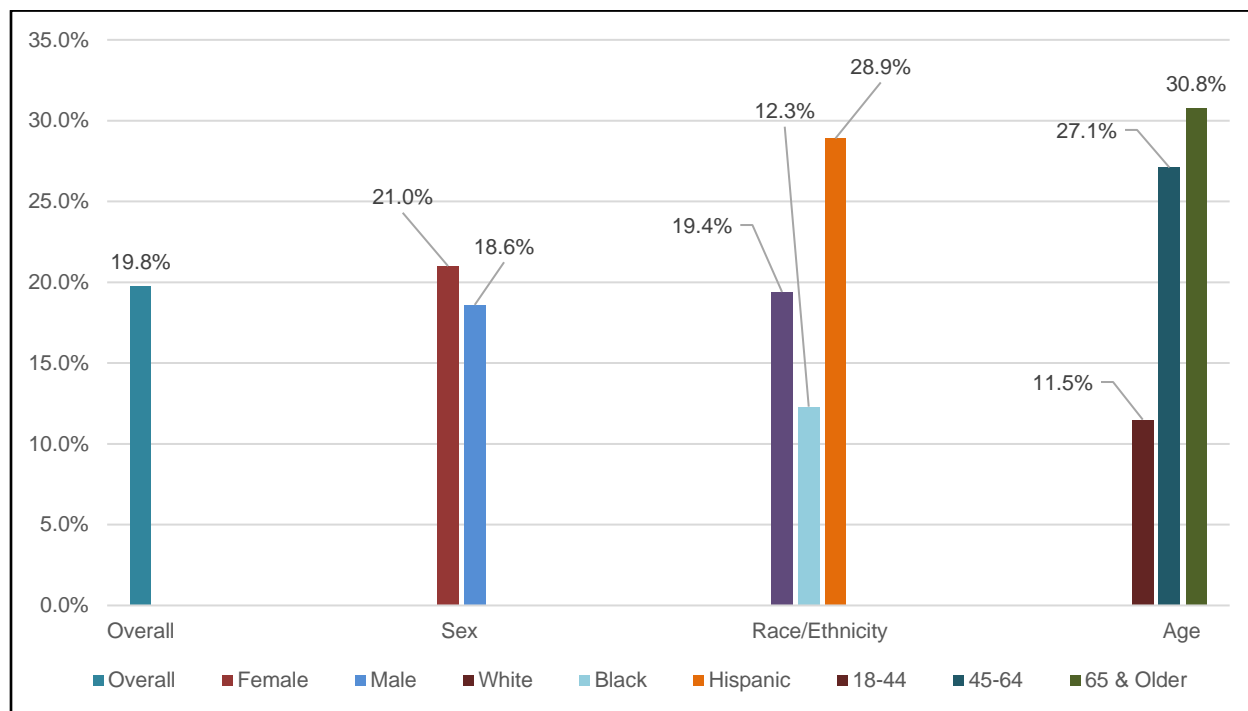


Figure 23. Distribution of Self-Reported Health Status as “Fair” or “Poor” by Sex, Race/Ethnicity and Age among Hillsborough County Adults

Source: Florida CHARTS, 2013

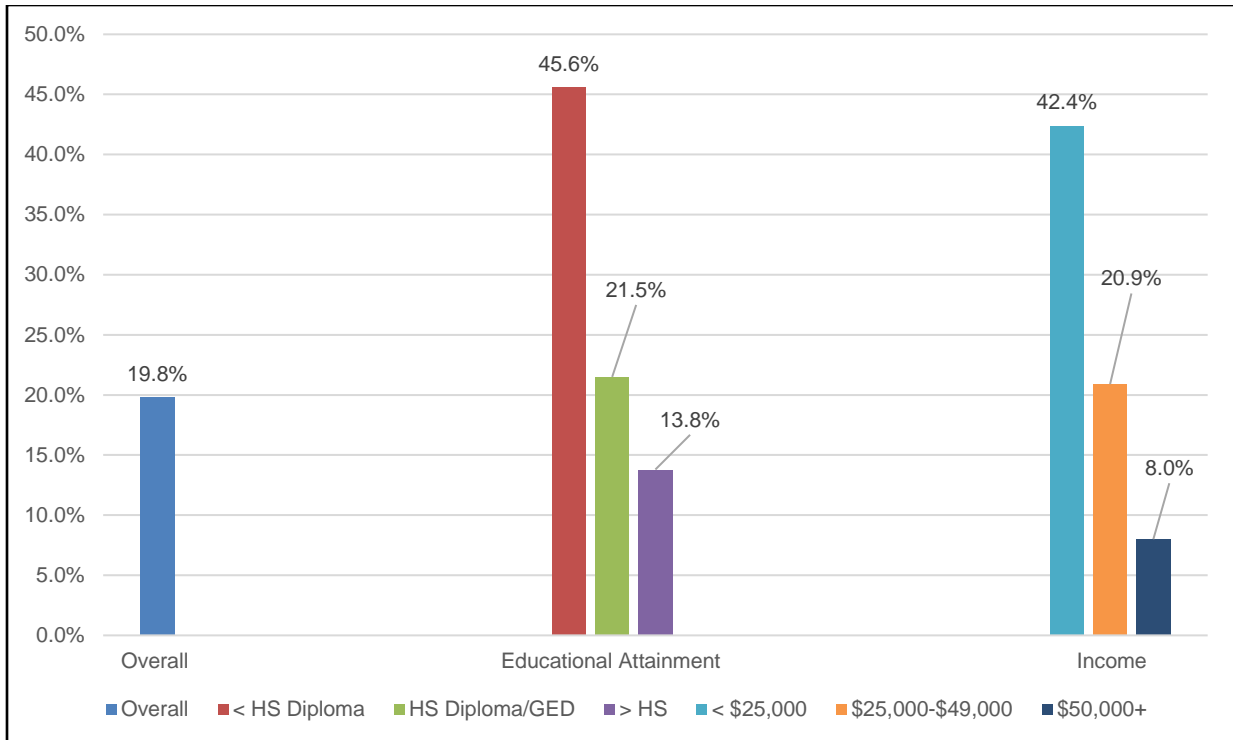


Figure 24. Distribution of Self-Reported Health Status as "Fair" or "Poor" by Income and Educational Attainment among Hillsborough County Adults

Source: Florida CHARTS, 2013

The Community Survey conducted in Town 'N' Country in 2015 also included questions related to health. Respondents were asked to report on their mental and physical health. For mental health, 12.9% of overall respondents rated their mental health as poor or fair, while 14.0% reported their physical health as poor or fair ([Table 13](#)).

Table 13. Distribution of Self-Reported Health Status

| | Poor | Fair | Good | Very Good | Excellent |
|--|------|-------|-------|-----------|-----------|
| In general, how would you rate your mental health, including mood and ability to think? (N=171) | 1.8% | 11.1% | 26.9% | 33.3% | 26.9% |
| In general, how would you rate your physical health, including ability to carry out daily activities? (N=171) | 4.7% | 9.4% | 34.5% | 26.9% | 24.6% |

Source: Parks and Rec HIA Community Survey, 2015

Impact Prediction:

There would be a likely moderate increase in positive mental health outcomes and well-being/quality of life at both the individual level for people accessing the corridor and trails, and a moderate impact on the surrounding community. At the individual level, the exposure to green space, increased physical activity, and spending time outdoors would contribute to positive mental health outcomes. The surrounding community would experience increased connectedness and social cohesion from more members interacting on the corridor and trailways. The populations that would benefit the most from increased social connections and exposure to nature include: Hispanics, older adults (especially those with movement-related disabilities), individuals with chronic health conditions and/or mental health disorders, single-parent households, care-takers, and residents of lower socioeconomic status.

Long-Term Outcome: Chronic Disease Prevalence

Nature’s restorative and stress-reducing effects can also have an effect on chronic disease outcomes, especially when paired with physical activity in the outdoors. [Tables 14-17](#) contain data related to weight, diabetes, cardiovascular disease, and arthritis for adults in Hillsborough County. Only 31.0% of adults are at a healthy weight, although this is significantly lower among males (25.3%), and lowest among Black Non-Hispanics (18.3%). A greater percentage of Black Non-Hispanic females (55.6%) are overweight, compared to 38.2% of adults in Hillsborough County. Obesity is highest among Black Non-Hispanic males at 46.7%, compared to 29.3% of adults in Hillsborough County.

Table 14. Distribution of Weight among Adults in Hillsborough County, Florida

| | Florida (%) | Hillsborough County (%) | White (Non-Hispanic) (%) | Black (Non-Hispanic) (%) | Hispanic (%) |
|---|-------------|-------------------------|--------------------------|--------------------------|--------------|
| Adults Who Have a Healthy Weight | 35.0 | 31.0 | 33.5 | 18.3 | 32.0 |
| Female | 41.4 | 36.8 | 39.5 | 19.2 | 35.2 |
| Male | 28.4 | 25.3 | 27.4 | 17.4 | 28.8 |
| Adults Who Are Overweight | 36.4 | 38.2 | 38.1 | 45.4 | 35.8 |
| Female | 30.0 | 33.1 | 31.0 | 55.6 | 29.8 |
| Male | 42.9 | 43.2 | 45.4 | 35.3 | 41.7 |
| Adults Who Are Obese | 26.4 | 29.3 | 26.5 | 35.9 | 30.3 |
| Female | 25.3 | 27.8 | 26.7 | 25.1 | 31.6 |
| Male | 27.5 | 30.8 | 26.3 | 46.7 | 29.0 |

Source: Florida CHARTS, 2013

In Hillsborough County, 12.4% of adults have ever been told they have diabetes, with Hispanics experiencing the highest prevalence (17.6%) compared to White and Black Non-Hispanics (10.0% and 13.7% respectively). Hispanic females experience the highest prevalence (18.1%) when sex and race/ethnicity are considered. In Hillsborough County 7.0% of adults have been diagnosed with pre-diabetes, with White Non-Hispanics having the highest prevalence (8.2%) as compared to Black Non-Hispanics (6.2%) and Hispanics (4.0%). Black Non-Hispanic females reported the highest prevalence of pre-diabetes overall at 9.9%. [Table 15](#) displays this data.

Table 15. Distribution of Diabetes in Hillsborough County, Florida

| | Florida (%) | Hillsborough County (%) | White (Non-Hispanic) (%) | Black (Non-Hispanic) (%) | Hispanic (%) |
|--|-------------|-------------------------|--------------------------|--------------------------|--------------|
| Adults Who Have Ever Been Told They Have Diabetes | 11.2 | 12.4 | 10.0 | 13.7 | 17.6 |
| Female | 10.1 | 11.1 | 7.4 | 14.5 | 18.1 |
| Male | 12.3 | 13.7 | 12.7 | 12.9 | 17.1 |
| Adults Who Have Ever Been Told They Have Pre-Diabetes | 7.1 | 7.0 | 8.2 | 6.2 | 4.0 |
| Female | 7.1 | 7.1 | 8.0 | 9.9 | 3.6 |
| Male | 7.4 | 6.7 | 8.4 | 2.1 | 4.5 |

Source: Florida CHARTS, 2013

In Hillsborough County, 36.3% of adults have ever been told they have hypertension, with White Non-Hispanics experiencing the highest prevalence (41.0%) compared to Black Non-Hispanics and Hispanics (38.9% and 28.1% respectively). White Non-Hispanic males and Black Non-Hispanic females experience the highest prevalence (42.8% and 41.9% respectively). Among adults in the County 10.5% have ever been told they had coronary heart disease, heart attack, or stroke, with White Non-Hispanics having the highest prevalence (12.1%) compared to Black Non-Hispanics (10.1%) and Hispanics (8.7%). Black Non-Hispanic males reported the highest prevalence of coronary disease, heart attack or stroke overall at 15.8%. [Table 16](#) displays this data.

Table 16. Distribution of Cardiovascular Disease in Hillsborough County, Florida

| | Florida (%) | Hillsborough County (%) | White (Non-Hispanic) (%) | Black (Non-Hispanic) (%) | Hispanic (%) |
|---|-------------|-------------------------|--------------------------|--------------------------|--------------|
| Adults Who Have Ever Been Told They Have Hypertension | 34.6 | 36.3 | 41.0 | 38.9 | 28.1 |
| Female | 32.1 | 34.8 | 39.3 | 41.9 | 26.9 |
| Male | 37.2 | 37.9 | 42.8 | 35.3 | 29.5 |
| Adults who ever been told they had coronary heart disease, heart attack, or stroke | 10.3 | 10.5 | 12.1 | 10.1 | 8.7 |
| Female | 8.8 | 11.0 | 14.3 | 5.1 | 9.8 |
| Male | 11.9 | 10.0 | 9.8 | 15.8 | 7.6 |

Source: Florida CHARTS, 2013

Hillsborough County adults have a lower prevalence (22.8%) of arthritis, gout, lupus, or fibromyalgia than compared to the State of Florida (26.0%). White Non-Hispanics have a higher prevalence (29.0%) than Black Non-Hispanics (17.0%) and Hispanics (16.4%) in the County. White Non-Hispanic females have the highest percentage of adults who have ever been diagnosed (39.2%) as compared to males and females of all other racial and ethnic groups. [Table 17](#) displays this data.

Table 17. Distribution of Arthritis in Hillsborough County, Florida

| | Florida (%) | Hillsborough County (%) | White (Non-Hispanic) (%) | Black (Non-Hispanic) (%) | Hispanic (%) |
|---|-------------|-------------------------|--------------------------|--------------------------|--------------|
| Adults who have ever been told they had some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia | 26.0 | 22.8 | 29.0 | 17.0 | 16.4 |
| Female | 29.8 | 28.7 | 39.2 | 19.1 | 18.0 |
| Male | 22.0 | 16.5 | 18.3 | 14.6 | 14.6 |

Source: Florida CHARTS, 2013

Impact Prediction:

There would be a likely moderate decrease in chronic disease outcomes (overweight, obesity, diabetes, heart disease, and arthritis) as a result of using the corridor and trailways on a consistent basis and experiencing nature's restorative health benefits. Exposure to nature has been found to decrease self-reported negative health outcomes as well as biological markers of stress and inflammation in the body, such as cortisol and salivary amylase levels. The vulnerable populations that would experience greatest improvements in chronic disease outcomes include Black Non-Hispanics and Hispanics, who experience higher prevalence of some chronic disease when compared to White Non-Hispanics. In addition, older adults, single-parent households, caretakers, and residents of lower socioeconomic status would also experience greater improvements in chronic disease outcomes.

Long-Term Outcome: Premature Mortality

Premature mortality is defined as the years of potential life lost before age 75 per 100,000, or deaths that could have been prevented. According to the Robert Wood Johnson Foundation 2016 County Health Rankings, the 3-year average number of deaths in Hillsborough County for 2011-2013 was 13,468, and the age-adjusted years of potential life lost rate was 6,900 per 100,000 population, which was higher than the State rate (6,800 per 100,000). The top ten major causes of death in the County for 2014 included: cancer, heart disease, chronic lower respiratory disease, unintentional injuries, stroke, diabetes, Alzheimer's disease, suicide, septicemia, and chronic liver disease/cirrhosis, with cancer and heart disease accounting for 44.4% of the total deaths ([Table 18](#)).

Table 18. Major Causes of Death in Hillsborough County, Florida

| Cause of Death | Deaths | Percent of Total Deaths | Crude Rate Per 100,000 | Age-Adjusted Death Rate Per 100,000 | 3-Year Age-Adjusted Death Rate Per 100,000 |
|-------------------------------------|--------|-------------------------|------------------------|-------------------------------------|--|
| All Causes | 9,950 | 100.0 | 763.7 | 745.8 | 748.3 |
| Cancer | 2,227 | 22.4 | 170.9 | 163.9 | 166.8 |
| Heart Disease | 2,193 | 22.0 | 168.3 | 163.7 | 169.1 |
| Chronic Lower Respiratory Disease | 594 | 6.0 | 45.6 | 45.2 | 44.2 |
| Unintentional Injuries | 574 | 5.8 | 44.1 | 43.4 | 45.6 |
| Stroke | 460 | 4.6 | 35.3 | 34.8 | 33.7 |
| Diabetes Mellitus | 309 | 3.1 | 23.7 | 22.6 | 22.1 |
| Alzheimer's Disease | 275 | 2.8 | 21.1 | 21.3 | 21.7 |
| Suicide | 185 | 1.9 | 14.2 | 13.7 | 13.0 |
| Septicemia | 171 | 1.7 | 13.1 | 12.7 | 12.8 |
| Chronic Liver Disease and Cirrhosis | 153 | 1.5 | 11.7 | 10.5 | 10.2 |
| Pneumonia/Influenza | 152 | 1.5 | 11.7 | 11.6 | 11.5 |
| Kidney Disease | 148 | 1.5 | 11.4 | 11.1 | 11.0 |
| Parkinson's Disease | 103 | 1.0 | 7.9 | 8.2 | 7.5 |
| Homicide | 67 | 0.7 | 5.1 | 5.1 | 5.4 |
| AIDS/HIV | 57 | 0.6 | 4.4 | 4.0 | 4.4 |

Source: Florida CHARTS, 2014

The age-adjusted death rate per 100,000 population (3-year rolling rates) from coronary heart disease was higher among males (138.8) compared to females (102.5) in Hillsborough County. Deaths from heart disease were highest among Black Non-Hispanics (181.7) and males (214.9), compared to adults in Hillsborough County (169.1). Deaths due to stroke were highest among Black Non-Hispanics (44.1) compared to Hillsborough County (33.7). In addition, deaths caused by diabetes were highest among Black Non-Hispanics, at a rate of 42.3; and higher among males (28.0) compared to females (17.7). Currently, there is no data available to examine premature mortality disparities by sex within each racial and ethnic group. [Table 19](#) displays the data described above.

Table 19. Age-Adjusted Death Rates of Cardiovascular Diseases, 3-Year Rolling Rates (per 100,000 population)

| | Florida | Hillsborough County | White (Non-Hispanic) (%) | Black (Non-Hispanic) (%) | Hispanic (%) |
|-------------------------------|---------|---------------------|--------------------------|--------------------------|--------------|
| Coronary Heart Disease | 100.9 | 102.5 | 104.2 | 96.3 | 77.4 |
| Female | 74.5 | 74.0 | -- | -- | -- |
| Male | 133.2 | 138.8 | -- | -- | -- |
| Heart Disease | 154.5 | 169.1 | 168.8 | 181.7 | 125.2 |
| Female | 119.9 | 132.0 | -- | -- | -- |
| Male | 196.2 | 214.9 | -- | -- | -- |
| Stroke | 32.1 | 33.7 | 32.6 | 44.1 | 27.4 |
| Female | 31.6 | 33.2 | -- | -- | -- |
| Male | 32.2 | 33.8 | -- | -- | -- |
| Diabetes | 19.6 | 22.1 | 19.3 | 42.3 | 21.2 |
| Female | 15.4 | 17.7 | -- | -- | -- |
| Male | 24.7 | 28.0 | -- | -- | -- |

Source: Florida CHARTS, 2012-2014

Impact Prediction:

Increased exposure to green space and nature will decrease stress levels, provide a restorative benefit on health, and improve chronic disease and mental health outcomes, which can lead to decreased risk for premature mortality. Being physically active outside and increased opportunities for social connectedness also help to mitigate premature mortality. Hillsborough

County males and Black Non-Hispanics would benefit the most from a reduced risk of premature mortality due to their higher mortality rates as compared to other populations.

Priority Pathway C: Physical Activity

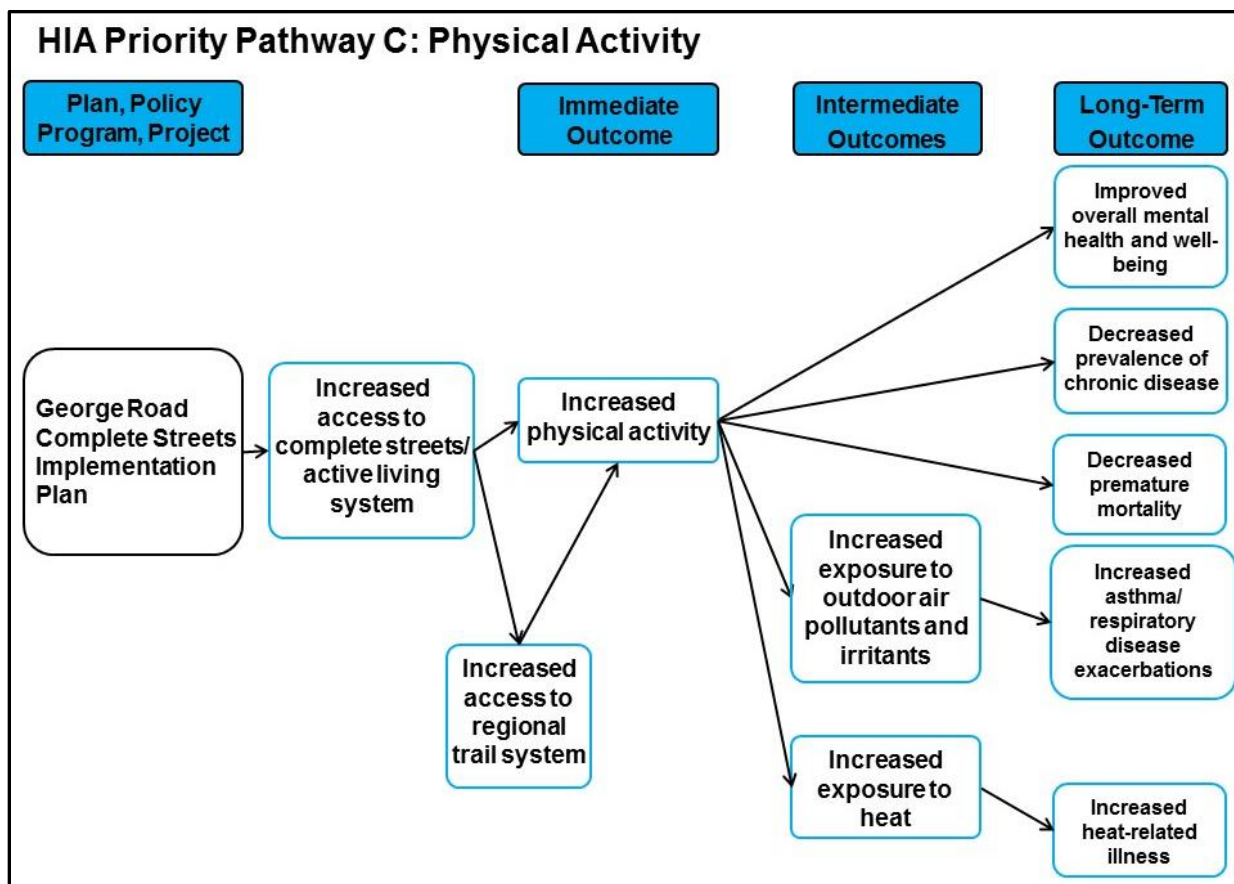


Figure 25. Priority Area C Pathway Diagram (Physical Activity)

Rationale and Research Questions:

As shown in [Figure 25](#) above, executing the George Road Complete Streets Implementation Plan would increase access to a complete streets corridor for active living and to the regional trail system. Having access to these systems would increase physical activity in those who use the complete streets corridor and/or the trailways. An increase in physical activity, especially outside in a natural environment, can improve overall mental health and well-being, chronic disease prevalence, and premature mortality. However, by being out using the system, whether for recreational activities or active transportation, residents would be exposed to outdoor air pollutants and heat. Exposure to outdoor air pollutants and heat can exacerbate asthma and other respiratory diseases as well as heat-related illness if proper mitigation measures are not taken.

The research questions include:

- How physically active are residents, and how would the physical activity levels change as a result of the complete streets implementation?
- What are the current rates of mental health disease and well-being, and how would these rates change as a result of the complete streets implementation?
- What are the current rates of chronic disease, and how would these rates change as a result of the complete streets implementation?
- What are the current rates of premature mortality, and how would these rates change as a result of the complete streets implementation?
- What are the current rates of heat-related illness and how would these rates change as a result of the complete streets implementation?
- What are the current levels of air pollutants in the vicinity?
- What are the current rates of asthma and asthma-related hospitalizations, and how would these rates be affected by the complete streets implementation?

Literature Review:

It is well established that physical activity promotes longevity and is beneficial for health (CDC, 2011; CDC, 2015b; American Heart Association [AHA], 2015). Access to an active living system can improve a community's health through promoting physical activity and recreational activity while reducing poor health outcomes. An active living system that is used for commuting can help to reduce cardiovascular risk by 11%, increase daily steps, and increase time spent walking (American Public Health Association, 2010). Researchers have correlated communities that report higher rates of walking and cycling to work with more daily physical activity and lower rates of obesity and diabetes (Pucher, Buehler, Bassett, & Dannenberg, 2010). Cycling and walking have been recognized as an important means to promote health since they are the most common forms of physical activity as well as active transport. An increase of one-hundred minutes of cycling per week, reduces the mortality risk by 10% when compared to non-cyclists (Schepers et al., 2015). An increase of one-hundred and sixty-eight minutes of walking per week, reduces the risk of early mortality by approximately 11% (Schepers et al., 2015).

Physical activity increases longevity, decreases risk of chronic conditions, and improves mental health and well-being (AHA, 2015). For individuals with diabetes, physical activity is not only beneficial for weight loss and management, but it can also help control blood glucose levels and blood pressure, as well as improve cholesterol levels. Additionally, regular physical activity helps to reduce the risk of heart disease and nerve damage, by improving blood flow and other heart problems (CDC, 2016). It is also beneficial for arthritis, as activity helps to reduce pain, improve physical function, and in turn improves quality of life and mental health (DHHS, 2008).

Physical activity may mitigate cardiovascular disease by preventing or reducing plaque build-up in the arteries, improving HDL levels, reducing blood pressure, and increasing blood flow and oxygen supply to cells in the body (Myers et al., 2015; Swift et al., 2013). It also helps to mitigate diabetes by helping to transport glucose to cells and improving the body's ability to receive or

process insulin (Colberg et al., 2016; Swift et al., 2013). Individuals with osteoarthritis and/or osteoporosis can benefit from increased physical activity as it may help with the production of synovial fluid, which is needed to lubricate joints during movement and helps to build bone mass (Rochette, Duché, & Merlin, 2015). Individuals who are obese can expend energy through physical activity which helps to burn calories when active and also when in a resting state, by raising metabolic activity through increased muscle mass (Egan & Zierath, 2013). Physical activity causes the body to release norepinephrine, dopamine, serotonin, endorphins and enkephalins, which in turn help to improve mood and promote mental health (Stenman & Lilja, 2013). An increase in core body temperature during activity can help to improve muscle tension. Additionally, the social interaction, improved self-efficacy, and having a break from daily stress promoted by regular physical activity, can also improve mental health (DHHS, 1999). Urban green spaces have been associated with increased levels of physical activity such as walking and cycling. It is well established that physical activity reduces the risk of cardiovascular disease, obesity, mental health problems, anxiety, as well as stress. The size of urban green spaces has an impact on physical activity levels, with larger urban green spaces allowing for higher levels (Akpınar, 2016).

Physical inactivity contributes to 3.2 million deaths annually worldwide (Taylor, 2014). It also increases the risk of obesity, cardiovascular disease, and many other chronic health conditions. More than one third of the adult population in the U.S. is obese. As reported by Jennings and Gaither (2015), the CDC considers proximity to parks to be an important community feature in health promotion; since green spaces promote physical activity, which in turn reduces obesity (Jennings & Gaither, 2015).

Outdoor physical activity can increase the risk of heat and sun exposure, with the potential for both short-term and long-term adverse health outcomes (World Health Organization, 2003). Green spaces can help reduce the risk of heat-related illness by not only providing shade to those who are using the area but by also undergoing evapotranspiration. Evapotranspiration in green spaces can help decrease air temperatures and regulate the temperatures of the surrounding community (Jennings & Gaither, 2015).

Heat-related illness is a set of preventable conditions that can be divided into three types: heat cramps, heat exhaustion, and heat stroke (CDC, 2015a; DHHS, n.d.). Heat-related illness occurs when the body's temperature control system is overloaded by hot and humid conditions that challenge cardiovascular compensatory mechanisms. Milder forms of heat-related illness (heat cramps and heat exhaustion) are associated with an elevated core temperature but one that is still below 104°F (40°C) (Becker & Stewart, 2011). Heat exhaustion can develop after several days of exposure to high temperatures and inadequate replacement of fluids. Some of the warning signs of heat exhaustion include: heavy sweating, paleness, muscle cramps, fatigue, weakness, dizziness, headache, fainting, nausea, and vomiting. If left untreated, heat exhaustion can progress to heat stroke. Heat cramps are muscle pains/spasms that usually occur in the abdomen, arms or legs. Heat cramps occur as a result of dehydration and depletion of electrolytes (Becker & Stewart, 2011). Heat cramps can occur on their own or as a symptom of heat exhaustion (CDC, 2015a; DHHS, n.d.). Heat stroke occurs once the body's core temperature

reaches 104°F (40°C), this causes cellular damage which may lead to organ damage, organ failure and even death. Heat stroke is also associated with disturbances in the central nervous system (Becker & Stewart, 2011). Warning signs of heat stroke include: red, hot, and dry or moist skin; a rapid and strong pulse; throbbing headache; dizziness; nausea; confusion; and loss of consciousness (CDC, 2015a; DHHS, n.d.).

Spending time outdoors also increases exposure to air pollution, with the potential to exacerbate respiratory illness, especially among persons with a pre-existing health condition (Gilmour, Jaakkola, London, Nel, & Rogers, 2006; Wells, Dearborn & Jackson, 2012). Pollutants directly emitted from motor vehicles are found in higher concentrations near major roads. These pollutants include Particulate Matter (PM), Carbon Dioxide (CO₂), Nitrogen Oxides (NO_x), and Benzene (C₆H₆) (United States Environmental Protection Agency [EPA], n.d.). Individuals who live, work, or attend school near major roads have an increased risk of developing health problems. The highest concentrations of roadway pollutants occur directly on or downwind of the roadway (EPA, n.d.). The areas most affected by roadway pollutants are areas that are approximately 0.2-0.3 miles from the highway (American Lung Association, 2013). There is extensive evidence showing an association between PM, ground level Ozone (O₃), Nitrogen Oxides, and Sulfur Oxides with respiratory diseases as well as other health problems. These include: asthma, cardiovascular disease, reduced lung function, preterm and low birth weight infants, as well as premature death (EPA, n.d.).

The EPA sets health-based National Ambient Air Quality Standards (NAAQS) for six outdoor air pollutants: Particulate Matter (PM_{2.5} and PM₁₀), ground level Ozone (O₃), Nitrogen Oxides (NO_x), Sulfur Oxides (SO_x), Carbon Monoxide (CO), and Lead (Pb). These are the six main air pollutants considered to be harmful to public health and the environment. Standards are measured in parts per million (ppm) by volume, parts per billion (ppb) by volume, and micrograms per cubic meter of air (µg/m³). These standards are required under the Clean Air Act. There are two types of air quality standards. The first are Primary standards, which provide public health protection, including protecting the health of at-risk populations such as children, the elderly, and those with asthma. The second are Secondary standards which provide public welfare protection including protection against decreased visibility and harm to animals, vegetation, and buildings. The standards are presented in [Table 20](#) (EPA, 2016).

Research suggests that the health benefits of being active outside outweigh the potential harm caused by increased exposure to outdoor air pollutants. In a study analyzing over 52,000 individuals in two of Denmark's most polluted cities, researchers found that exercise helped to reduce the risk of premature mortality, and that exposure to Nitrogen Dioxide did not lessen the benefits of activity (Z. Anderson et al., 2015). These results were consistent with previous literature reporting that the health benefits of physical activity outweighed the risks associated with exposure to air pollution (Averett, 2015).

Table 20. National Ambient Air Quality Standards

| Pollutant | | Primary/ Secondary | Averaging Time | Level | Form |
|-------------------------------------|-------------------|-----------------------|-------------------------|------------------------|---|
| Carbon Monoxide (CO) | | primary | 8 hours | 9 ppm | Not to be exceeded more than once per year |
| | | | 1 hour | 35 ppm | |
| Lead (Pb) | | primary and secondary | Rolling 3 month average | 0.15 µg/m ³ | Not to be exceeded |
| Nitrogen Dioxide (NO ₂) | | primary | 1 hour | 100 ppb | 98th percentile of 1-hour daily maximum concentrations, averaged over 3 years |
| | | primary and secondary | 1 year | 53 ppb | Annual Mean |
| Ozone (O ₃) | | primary and secondary | 8 hours | 0.070 ppm | Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years |
| Particle Pollution (PM) | PM _{2.5} | primary | 1 year | 12.0 µg/m ³ | annual mean, averaged over 3 years |
| | | secondary | 1 year | 15.0 µg/m ³ | annual mean, averaged over 3 years |
| | | primary and secondary | 24 hours | 35 µg/m ³ | 98th percentile, averaged over 3 years |
| | PM ₁₀ | primary and secondary | 24 hours | 150 µg/m ³ | Not to be exceeded more than once per year on average over 3 years |
| Sulfur Dioxide (SO ₂) | | primary | 1 hour | 75 ppb | 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years |
| | | secondary | 3 hours | 0.5 ppm | Not to be exceeded more than once per year |

Source: Table copied from EPA, 2016

Immediate Outcome: Physical Activity

Having access to trailways and complete streets systems should reduce the levels of sedentarism by promoting physical activity. Hillsborough County and the State of Florida have similar percentages of adults who are sedentary (28.0% & 27.7%, respectively), but within Hillsborough County, there are disparities by sex, race, ethnicity, income, and education level. Hispanics living in Hillsborough County are the most sedentary (31.9% of adults) when compared to White Non-Hispanics (26.8%) and Black Non-Hispanics (25.9%). Sedentarism is higher among females (33.6%) compared to males (21.7%) in Hillsborough County. Sedentarism is highest among Hispanic females (38.2%) followed by Black Non-Hispanic females (36.3%) and White Non-Hispanic females (29.2%). Rates were comparable for White Non-Hispanic males (24.1%) and Hispanic males (24.2%). Rates were not available for Black Non-Hispanic males. Levels of sedentarism decrease as socioeconomic status improves. [Tables 21-23](#) display the data related to physical activity for the county.

Approximately half (51.8%) of the adults living in Hillsborough County meet the aerobic activity recommendations. This percentage is 46.3% among Hispanics, 55.3% among Black Non-Hispanics and 53.9% among White Non-Hispanics. Physical activity levels vary by educational attainment, with 28.1% of adults who have less than a high school degree meeting the aerobic activity recommendations, compared to 57.5% of adults with greater than a high school education. Physical activity levels also vary by annual income with 41.7% of adults who earn less than \$25,000 meeting the aerobic recommendations compared to 63.7% of adults who earn greater than \$50,000.

Table 21. Distribution of Physical Activity among Adults in Hillsborough County, Florida, by Sex and Race/Ethnicity (2013)

| | Florida | Hillsborough County | White (Non-Hispanic) | Black (Non-Hispanic) | Hispanic |
|--|---------|---------------------|----------------------|----------------------|----------|
| Adults Who Are Sedentary | 27.7% | 28.0% | 26.8% | 25.9% | 31.9% |
| Female | 30.0% | 33.6% | 29.2% | 36.3% | 38.2% |
| Male | 25.3% | 21.7% | 24.1% | - | 24.2% |
| Adults Who Meet Aerobic Recommendations | 50.2% | 51.8% | 53.9% | 55.3% | 46.3% |
| Female | 48.6% | 48.0% | 52.4% | 44.1% | 47.4% |
| Male | 52.0% | 56.3% | 55.7% | - | 44.9% |

Source: Florida CHARTS, 2013 (-) Information not available

Table 22. Distribution of Physical Activity among Adults in Hillsborough County, Florida, by Educational Attainment (2013)

| | Hillsborough County | < High School | High School/ GED | More than High School |
|--|---------------------|---------------|------------------|-----------------------|
| Education Level | | | | |
| Adults Who Are Sedentary | 28.0% | 56.2% | 30.3% | 20.3% |
| Adults Who Meet Aerobic Recommendations | 51.8% | 28.1% | 52.3% | 57.5% |

Source: Florida CHARTS, 2013

Table 23. Distribution of Physical Activity among Adults in Hillsborough County, Florida by Income (2013)

| | Hillsborough County | < \$25K | \$25K-49K | \$50K+ |
|--|---------------------|---------|-----------|--------|
| Income Level | | | | |
| Adults Who Are Sedentary | 28.0% | 38.4% | 32.6% | 16.8 |
| Adults Who Meet Aerobic Recommendations | 51.8% | 41.7% | 48.1% | 63.7% |

Source: Florida CHARTS, 2013

Impact Prediction:

A significant increase in physical activity is likely predicted for those who use the corridor and trailway system on a consistent basis. The George Road Complete Streets Implementation Plan would provide access to a safely designed roadway that promotes active living and physical activity via recreational opportunities and utilizing the corridor to access services and transportation. Seasonal variation that occurs in the weather would likely impact the use of the system (i.e. higher temperatures, rainy weather, differences in the amount of daylight), as well as day (i.e. weekday, weekend) and time (i.e. daytime, evening) differences. Additionally, there are multiple corporate parks along George Road that would benefit from a complete streets corridor by giving employees access to safer routes to walk for leisure, or to access other services, restaurants, and buildings in the immediate area. Physical activity levels are predicted to increase more among individuals with disabilities and of lower socioeconomic status, as well as among Hispanics and older adults.

Long-Term Outcome: Overall Mental Health and Well-Being

Participating in physical activity positively affects mental health and well-being by altering brain chemistry, in reducing symptoms of anxiety and depression, decreasing stress levels, and improving mood (see [Pathways B & C](#)). Exercising outside has been shown to have an even greater effect on mental health and mood than exercising indoors or in less natural environments. Mental health status and well-being data for the county and the Town 'N' Country area are presented [Tables 11-13](#) and [Figures 23-24](#).

Impact Prediction:

There would be a likely moderate increase in positive mental health outcomes and well-being at both the individual level for people accessing the corridor and trails, and a moderate impact on the surrounding community. At the individual level, physical activity helps positively alter brain chemistry by releasing chemicals that improve mood, decrease stress levels, and help to reduce symptoms of anxiety and depression. At the community level, the interaction among community members using the corridor would increase connectedness and social cohesion. The populations that would most benefit from improved mental health and well-being are: Hispanics, older adults, especially those with movement-related disabilities, individuals with chronic health conditions and/or mental health disorders, single-parent households, care-takers, and residents of lower socioeconomic status.

Long-Term Outcome: Chronic Disease Prevalence

Research has demonstrated the link between physical activity and the prevention of chronic disease (see [Pathways B & C](#)). Chronic disease prevalence data for the county is presented in [Tables 14-17](#).

Impact Prediction:

There would be a likely moderate decrease in chronic disease outcomes (diabetes, overweight, obesity, heart disease, and arthritis) as a result of increased physical activity levels in an outdoor environment. Physical activity can help individuals to self-manage chronic disease symptoms, by improving blood pressure, HDL cholesterol, and blood glucose levels, increasing blood flow, and reducing plaque build-up in arteries. Black Non-Hispanics and Hispanics, who experience higher prevalence of some chronic diseases compared to White Non-Hispanics, would experience greater benefits from increased physical activity. Additionally, older adults, single-parent households, care-takers, and residents of lower socioeconomic status would also experience improvements in chronic disease outcomes.

Long-Term Outcome: Premature Mortality

Being sedentary increases an individual's risk for chronic disease and premature mortality (see [Pathways B & C](#)). Premature mortality data is presented in [Tables 18 & 19](#).

Impact Prediction:

There would be a likely low decrease in premature mortality as a result of increased physical activity levels. Physical activity supports biological improvements in blood pressure, HDL levels, blood glucose levels, and blood flow, which help to prevent and manage chronic disease. This in turn can lead to a decreased risk of premature mortality. Men and Black Non-Hispanics would benefit the most from a reduced risk of premature mortality.

Intermediate Outcome: Exposure to Heat

Exposure to heat is one concern with any outdoor recreation activity in Florida. During the summer months, temperatures and the heat index can rise to levels that may be unhealthy for outdoor activity, especially for those with pre-existing health conditions and other vulnerable populations that may lack access to air conditioned environments at home or in the work place.

Greater tree coverage in the target area can help to reduce the urban heat island effect by reducing the ambient temperature. [Figure 26](#) displays the Percent Tree Coverage by Census Block for the target area in Town 'N' Country. The Town 'N' Country Greenway, has the highest percentage of tree coverage in area, with sections having between 21% and 60% tree coverage. Segment 1 of the George Road Corridor contains between 0% and 40% tree coverage. Segments 2 and 3 have even less tree coverage, with at most 20% coverage. Overall, the target area is lacking in adequate tree coverage, especially along the roadways and sidewalks on the George Road Corridor. [Figure 27](#) presents examples of inadequate tree coverage along the roadways and sidewalks of the corridor. [Figure 28](#) is an aerial view of the target area that demonstrates an overall lack of tree coverage along the Greenway and the corridor, with areas outlined in red that have significant tree coverage to provide shade areas for users of the complete streets corridor. The George Road Complete Street Implementation Plan includes a residential tree planting program to increase tree coverage and shade along the corridor and mitigate exposure to heat.

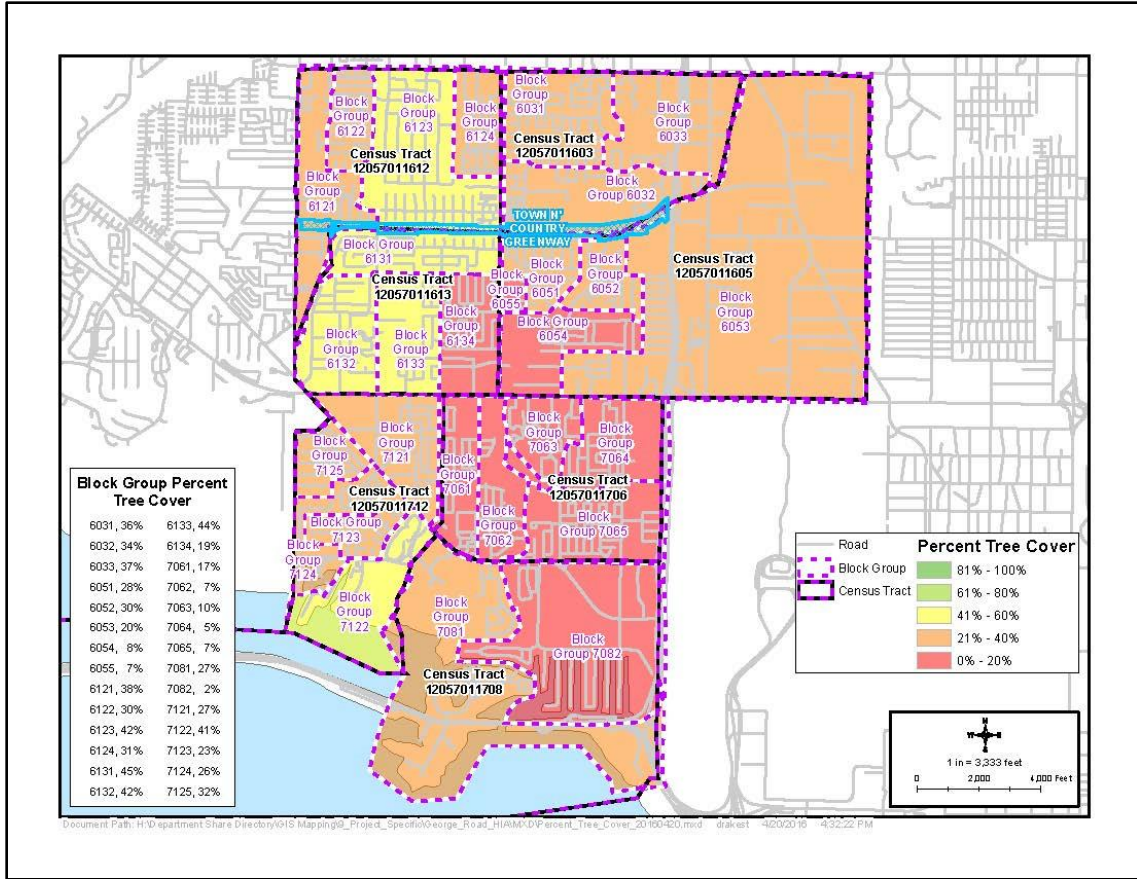


Figure 26. Percentage of Tree Cover in the Target Area



Figure 27. Examples of Lack of Shade along the Corridor

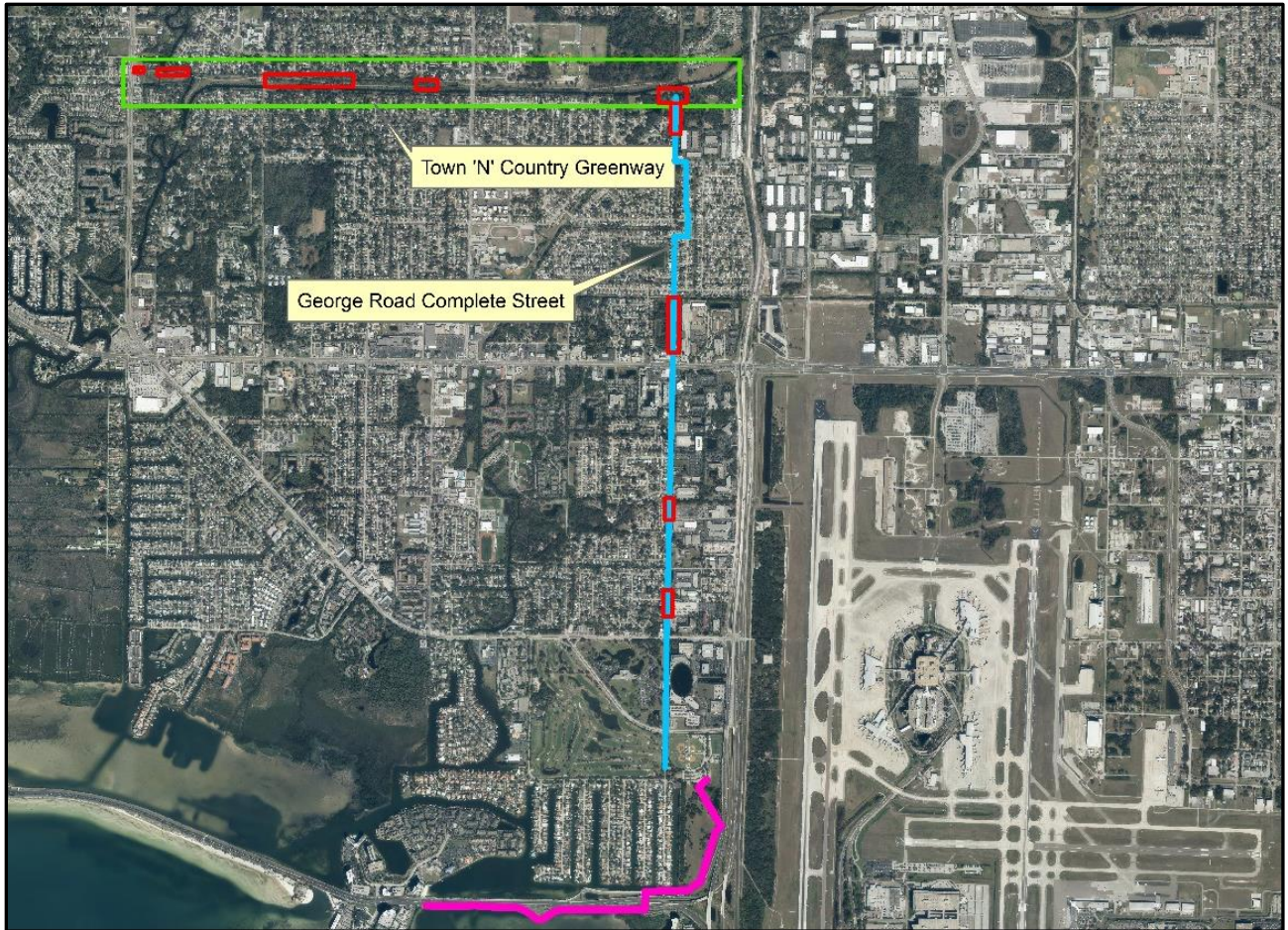


Figure 28. Aerial Photo of HIA Target Area with Significant Shade Coverage Outlined in Red

The heat index is a combination of temperature and relative humidity and is a measure of how hot it feels outside. [Figure 29](#) is a heat index chart showing heat index temperatures, which are based on ambient temperature and relative humidity. [Figure 30](#) includes temperatures for Tampa, Florida for 2012 and also shows record temperatures (in pink). This coupled with high humidity can create days with dangerous heat indices. On days with a high heat index, people are more likely to experience heat-related illness, and it is considered to be dangerous or extremely dangerous for prolonged exposure or if participating in strenuous activity. The temperature in the area is high for several months of the year, especially during the hurricane season, when precipitation is increased. Based on these factors, and many areas along the corridor having low tree coverage, heat-related illness is a concern for the George Road area.

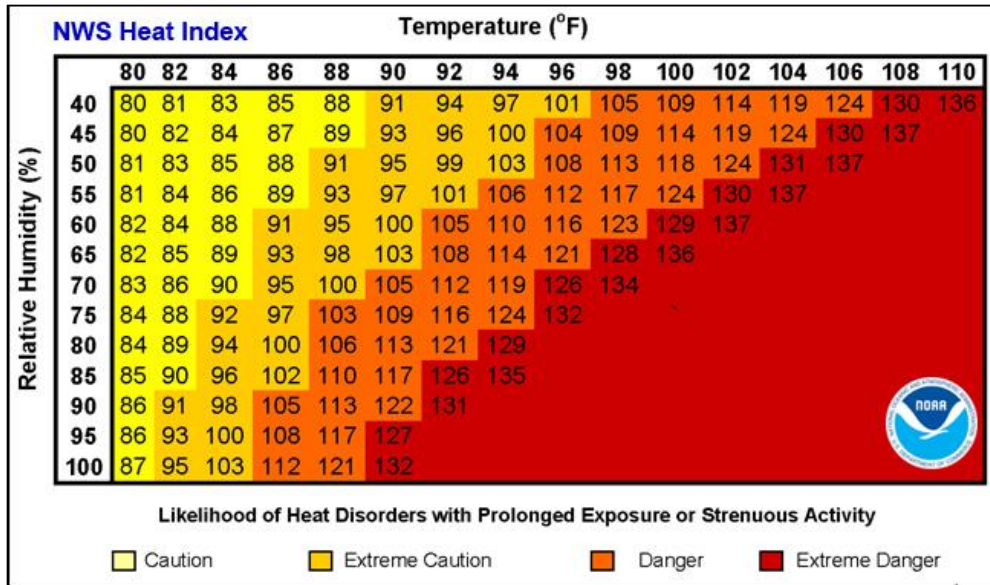


Figure 29. Likelihood of Heat Disorders Based on Heat Index

Source: National Weather Service, n.d.

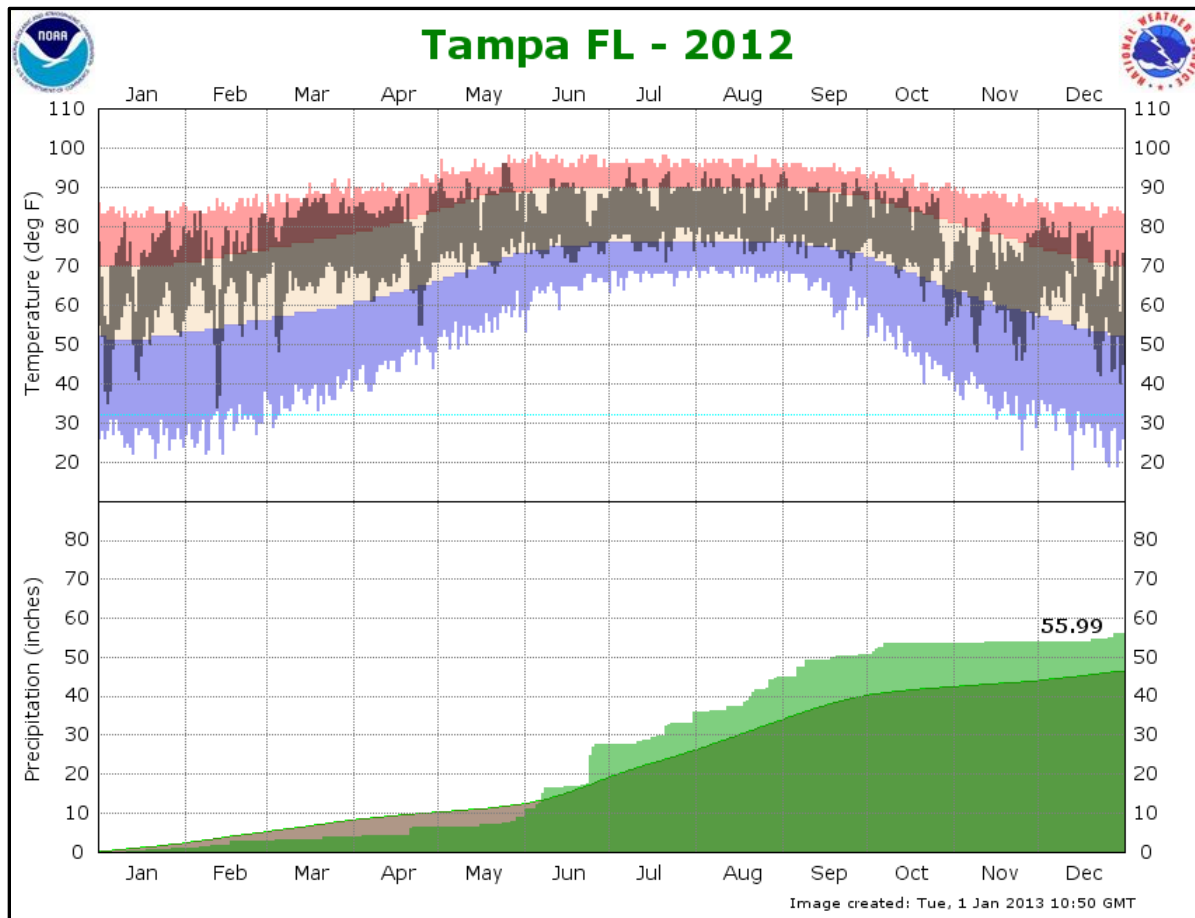


Figure 30. Temperature and Precipitation in Tampa, Florida (2012)

Source: NOAA, 2013

Impact Prediction:

One impact of creating a more inviting atmosphere for physical activity is that there would be a likely greater risk of exposure to heat for those using the George Road Corridor and the connecting trailways. High temperatures during the summer months, paired with high amounts of precipitation increase exposure to dangerous levels of heat. Additionally, tree coverage for the area is low, and many areas along the corridor, Town 'N' Country Greenway and the Courtney Campbell Causeway Trail are lacking in shade tree coverage. To mitigate the risk of heat exposure, tree planting is proposed along the corridor, especially along the northern segment.

Long-Term Outcome: Heat-Related Illness

Heat-related illness occurs when individuals are exposed to extreme heat, resulting in heat cramps, heat exhaustion, and heat stroke. In severe cases it can lead to death. Many individuals require hospitalization or treatment for heat-related illness. In recent years, 2012-2014, Hillsborough County has experienced higher rates of heat-related hospitalizations and emergency department Visits compared to the State. In 2014 ([Table 24](#)), the age-adjusted heat-related hospitalizations and emergency department visit rate was the highest it has been since 2005. Heat-related hospitalizations were almost twice as high in the County (6.05 per 100,000) compared to the State (3.76 per 100,000). The 2009-2013 crude 5-year heat-related emergency department visit rate for Zip Code 33634 was higher (23.40 per 100,000) than the County (18.52) and the State (19.22) as shown in [Table 25](#).

Table 24. Heat-Related Hospital and Emergency Department Visits

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|------|------|-------|------|------|------|------|------|------|------|
| Heat-related hospitalizations during summer months, age adjusted rate per 100,000 | | | | | | | | | | |
| Florida | 2.9 | 2.4 | 2.9 | 2.2 | 3.1 | 4.2 | 3.5 | 3.10 | 2.8 | 3.8 |
| Hillsborough County | 2.3 | 2.4 | 2.4 | 1.9 | 3.1 | 3.9 | 3.1 | 4.6 | 2.9 | 6.1 |
| Heat-related emergency department visits during summer months, age adjusted rate per 100,000 (including transfer to hospitals) | | | | | | | | | | |
| Florida | 22.3 | 18.1 | 19.64 | 14.6 | 18.8 | 24.6 | 22.1 | 18.6 | 18.0 | 23.2 |
| Hillsborough County | 24.1 | 19.4 | 18.3 | 13.3 | 17.7 | 22.6 | 20.7 | 19.2 | 19.4 | 25.9 |

Source: Florida Environmental Public Health Tracking Network

Table 25. Heat-Related Emergency Department Visits

| Heat-Related Emergency Department Visits, 5-Year Crude Rate per 100,000 Population (Rate by Zip Code, All Genders, All Races, All Ethnicities, All Ages) | | | |
|--|------------------|------------------|------------------|
| | 2007-2011 | 2008-2012 | 2009-2013 |
| Florida | 18.9 | 18.6 | 19.2 |
| Hillsborough County | 18.1 | 17.6 | 18.5 |
| Zip Code 33634 | 14.5 | 13.8 | 23.4 |

Source: Florida Environmental Public Health Tracking Network

Impact Prediction:

There would be a likely possible increase in heat-related illness associated with encouraging physical activity, especially during the summer months when temperatures and relative humidity are elevated. Vulnerable populations are at a higher risk of heat-related illness, especially those with pre-existing health conditions and those with a lack of awareness of the effects of exposure to heat and heat-related illness. Exercising in areas along the trailways and the corridor with less shade coverage could increase the incidence of heat-related illness. The Courtney Campbell Causeway Trail has little to no shade, however, there are benefits due to its proximity to water and small urban heat island effect. Heat-related illness can be mitigated by staying hydrated while exercising, seeking shaded areas, exercising during morning and evening hours, and limiting strenuous outdoor physical activity during times when the heat index is higher.

Intermediate Outcome: Exposure to Outdoor Air Pollutants

Motor vehicles emit various pollutants that are harmful to human health and are found in higher concentrations near major roads. The George Road Corridor is located close in proximity to the Veterans Expressway and other major roadways in the area. Additionally, the Tampa International Airport is within a half-mile of the corridor. Although the amount of anthropogenic air pollutants fluctuates yearly, the variability in air quality is partially due to meteorological conditions. Hotter and drier years may lead to more days with high ozone concentrations or increased levels of PM_{2.5} (fine particulates). Similarly, the more weather fronts moving through the county, or breezy conditions, help to better disperse air pollution.

[Figure 31](#) displays the number of unhealthy air quality days in Hillsborough County for the time period between 1995 and 2015. The number of unhealthy air quality days per year has fluctuated over the last twenty years from a high of 13 during 1996, 1999, and 2011 to a low of zero in 2002. Particulate Matter contributed to unhealthy air quality days between 2004 and 2007, and unhealthy days caused by Ozone (O₃) pollution have shown a steady decline since 2011. When considered by pollution source ([Figure 32](#)), Sulfur Dioxide (SO₂) caused the largest number of

unhealthy air quality days. The National Ambient Air Quality Standard (NAAQS) for Sulfur Dioxide (SO₂) was revised in 2010 to be more protective of public health, and consequently, this directly caused an increase in the number of occurrences when SO₂ levels exceeded the revised standard. As a result, a spike in unhealthy air quality days due to SO₂ was observed. The air monitoring network in Hillsborough County consists of seven sites, with the aggregate of those samples going into air quality reporting. The figures and table below provide examples of the type of data derived from this type of monitoring.

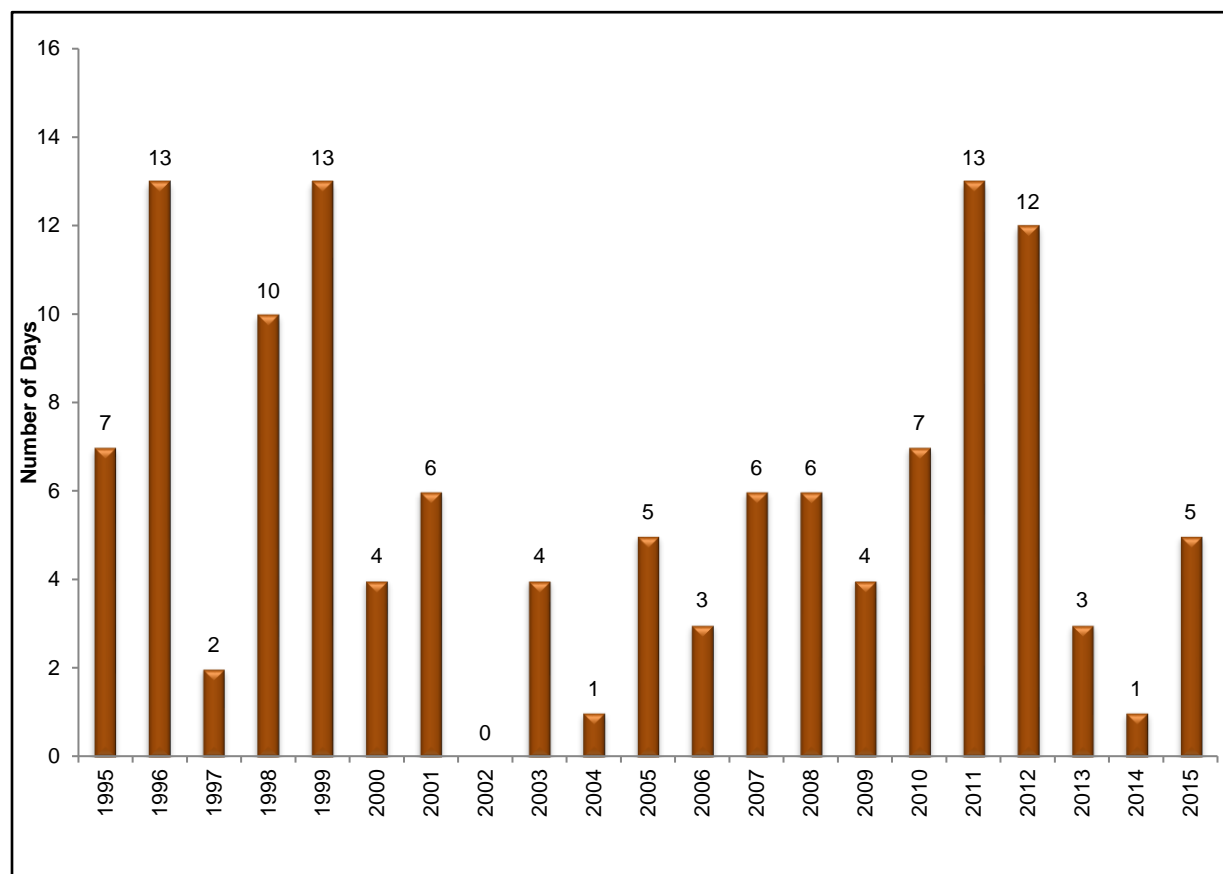


Figure 31. Number of Unhealthy Air Quality Days per Year in Hillsborough County (1995-2015)

Source: Environmental Protection Commission of Hillsborough County, Air Management Division, 2016

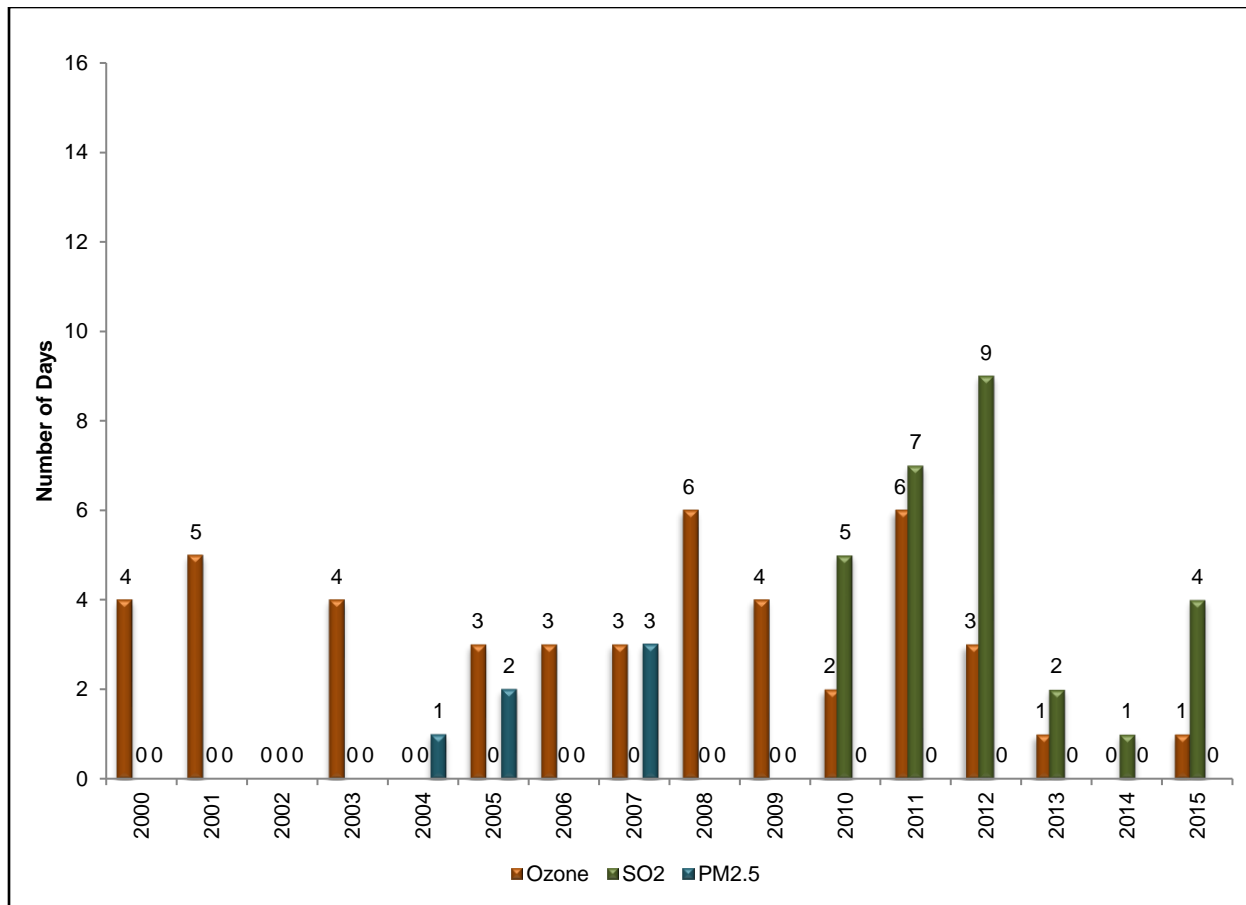


Figure 32. Number of Unhealthy Air Quality Days per Year in Hillsborough County by Pollutant (2000-2015)

Source: Environmental Protection Commission of Hillsborough County, Air Management Division, 2016

Exposure to elevated levels of outdoor air pollutants can exacerbate preexisting health problems and lead to new ones for sensitive groups. [Table 26](#) includes the Air Quality Index (AQI) by number of days and pollutant type for Hillsborough County. Approximately two-thirds (239) of the days in 2015 were considered to be good air quality days. These are days with an AQI of 50 or below. The main pollutants during these days were Ozone (O₃) and Particulate Matter (PM_{2.5}). During 2015, 121 days were considered to have moderate air quality, with an AQI of 51-100. The moderate days were primarily due to the concentrations of Ozone and Fine Particulate Matter in the air, however Sulfur Dioxide (SO₂) did contribute to nine days that were rated as moderately healthy days. There were a total of five days that the AQI was considered to be unhealthy for sensitive groups (AQI of 101-150). [Appendix C](#) includes detailed AQI data by month for Hillsborough County during 2015. The five days in which the AQI was considered to be unhealthy for sensitive groups occurred once each month from January to May. The day in April was due to O₃ concentrations (highest AQI reported in 2015), while the other four days were due to SO₂. There were no days classified as unhealthy, very unhealthy, or hazardous in 2015. The month with the highest number of days with a good AQI was December (30 of 31 days).

Table 26. Air Quality Index (AQI) by Number of Days and Pollutant Type for Hillsborough County, 2015

| Number of days | Good | Moderate | Unhealthy for sensitive groups | Unhealthy | Very unhealthy | Hazardous |
|-------------------|------|----------|--------------------------------|-----------|----------------|-----------|
| AQI Values | <=50 | 51-100 | 101-150 | 151-200 | 201-300 | >301 |
| O ₃ | 108 | 45 | 1 | 0 | 0 | 0 |
| PM _{2.5} | 130 | 65 | 0 | 0 | 0 | 0 |
| PM ₁₀ | 0 | 0 | 0 | 0 | 0 | 0 |
| SO ₂ | 1 | 9 | 4 | 0 | 0 | 0 |
| CO | 0 | 0 | 0 | 0 | 0 | 0 |
| NO ₂ | 0 | 2 | 0 | 0 | 0 | 0 |
| Totals | 239 | 121 | 5 | 0 | 0 | 0 |

Source: Florida Department of Environmental Protection, Florida Air Monitoring and Assessment System, 2016

Impact Prediction:

It is possible that there will be a likely increase in exposure to outdoor air pollutants and irritants for bicyclists and pedestrians who access the George Road Corridor or the connecting trailways due to their proximity to major roadways. A moderate impact is expected because of the inherent exposure to more pollutants emitted by vehicles from the nearby Veterans Expressway and the Tampa International Airport. In many cases, vehicles and other sources emit precursors to other pollutants which then undergo a chemical reaction with heat and sunlight to become smog. More complex air pollution modeling and analysis was not included in this Health Impact Assessment.

Long-Term Outcome: Asthma/Respiratory Disease Exacerbations

Exposure to outdoor air pollutants can exacerbate asthma and other respiratory disease symptoms. The prevalence of asthma in Hillsborough County is 15.1% among adults, with Hispanics having the highest prevalence (21.2%), followed by Black Non-Hispanics (17.1%) and White Non-Hispanics (12.3%). Hispanic females (24.8%) and Black Non-Hispanic males (23.9%) have the highest prevalence. There are also disparities across income and level of educational attainment. Among adults earning less than \$25,000 a year, 25.0% reported being told they had asthma, while the rate was 17.8% among those earning between \$25,000 and \$49,999, and 9.9% among adults earning more than \$50,000 a year. Less than one-third (29.3%) of adults with less than a high school diploma, one-eighth (12.4%) of those with a high school education, and 13.6% of those with more than a high school education, reported ever being told they had asthma. There were approximately 1072 per 100,000 hospitalizations from or with asthma in Hillsborough County. Black Non-Hispanics had the highest hospitalization rate (2397.5 per 100,000) compared to Hispanics (1087.4) and White Non-Hispanics (858.2). [Table 27](#) displays a summary of the health status related to asthma in the County.

Table 27. Distribution of Asthma Indicators

| | Florida | Hillsborough | White (Non-Hispanic) | Black (Non-Hispanic) | Hispanic |
|---|---------|--------------|----------------------|----------------------|----------|
| Adults Who Have Ever Been Told They Have Asthma* | 13.5% | 15.1% | 12.3% | 17.1% | 21.2% |
| Female | 15.5% | 15.9% | 14.2% | 11.0% | 24.8% |
| Male | 11.5% | 14.3% | 10.2% | 23.9% | 17.1% |
| Age-Adjusted Hospitalizations From or With Asthma (per 100,000)+ | 805.8 | 1072.0 | 858.2 | 2397.5 | 1087.4 |

Source: *Florida CHARTS, 2013; +Florida CHARTS, 2012-2014

Impact Prediction:

Exposure to outdoor air pollutants, especially ozone and particulate matter, would likely increase asthma exacerbations in those with pre-existing respiratory disease, increasing the risk of asthma attacks and possible emergency department visits and hospitalizations. This increase is expected to be moderate among persons accessing the corridor and connecting trailways. Mitigation strategies can include providing education to local residents to increase awareness of the best times to exercise outside based on levels of air pollutants and allergens in the area to reduce respiratory illness exacerbations, encouraging tree planting with species that are allergy-friendly and that filter out air pollution, and providing park benches and drinking fountains along the corridor and trailway systems to allow opportunities for resting and staying adequately hydrated.

Matrix of Predicted Health Impacts

The Impact Predictions for each determinant or outcome included in the three pathways are summarized in [Table 28](#). Meetings with the HIA Research Team and Subject Matter Experts were held to determine the impact predictions for each health determinant and outcome examined in the HIA.

Table 28. Health Impact Matrix Summary of Findings

| Determinant/ Outcome | Likelihood, Direction, and Magnitude of Impact |
|---|--|
| Access to Safely Designed Roadways | Likely increase, with a significant impact on local population users and regional trail users |
| Bicycle/Pedestrian Injuries and Deaths | Likely decrease, with a moderate impact on local population users and regional trail users |
| Risk of Crime | Likely decrease, with a moderate impact on local population users and regional trail users |
| Crime-Related Incidents | Likely decrease, with a moderate impact on local population users and regional trail users |
| Access to Regional Trail System | Likely increase, with a significant impact on local population users and regional trail users |
| Access to Green Space/Nature | Likely increase, with a significant impact on local population users and regional trail users |
| Physical Activity Levels | Likely increase, with a significant impact on local population users and regional trail users |
| Stress Levels | Likely decrease, with a moderate impact on local population users and regional trail users |
| Restorative Benefit on Health | Likely increase, with a moderate impact on local population users and regional trail users |
| Chronic Disease | Likely decrease, with a moderate impact on local population users and regional trail users |
| Good Mental Health/Well- Being | Likely increase, with a moderate impact on local population users and regional trail users |
| Premature Mortality | Likely decrease, with a low impact on local population users and regional trail users |
| Exposure to Outdoor Air Pollutants | Likely increase, with a moderate impact on local population users and regional trail users |
| Asthma/Respiratory Disease | Likely increase, with a moderate impact on local population users and regional trail users |
| Exposure to Heat | Likely increase, with a moderate impact on local population users and regional trail users |
| Heat-Related Illness | Likely increase, with moderate to severe impact on local population users and regional trail users |

RECOMMENDATIONS AND REPORTING

Recommendations based on the assessment are made and included in the report detailing the decision to be made and the findings of the assessment. An overview of the HIA methods and the full results were presented to Subject Matter Experts in March 2016. At these meetings, recommendations to mitigate the negative health outcomes and to promote the positive health outcomes were discussed in detail. These recommendations were also presented to various MPO Committees for their feedback.

Reporting of this HIA will include posting this document on DOH-Hillsborough and the MPO's website, in addition to sharing electronic and hard copies with all partners involved. Copies of the report will also be distributed to the local library in Town 'N' Country. Other methods to communicate the HIA results include creating executive summaries, factsheets/infographics, media messaging, etc. The final report will also be presented to the MPO Board and various committees.

Recommendations to Mitigate Bicycle and Pedestrian Injuries/Fatalities and Risk/Incidents of Crime

- Increase lighting along the corridor
- Incorporate Crime Prevention Through Environmental Design (CPTED) principles
- Increase wayfinding along the corridor
- Ensure design features (especially traffic calming features) comply with the FDOT Complete Streets Plan and match with Hillsborough County's Complete Street Ordinance
- Reduce speed limit to 25 MPH in areas of the George Road Corridor, except at Memorial Highway where it is 35 MPH; and/or during peak times, recommend certain zones (similar to school zones) have blinking lights and reduced speed
- Conduct a bus stop environment and connectivity assessment
- Repeat pedestrian count at Hillsborough Avenue and George Road in the future to determine the need for a grade separated pedestrian crossing at the intersection.

Recommendations to Improve Access to Nature and Green Space and Increase Physical Activity

- Install pedestrian-level street lights to encourage physical activity in the early morning/evenings
- Promote landscaping to increase shade cover
- Along the trailways and throughout the corridor include:
 - Wayfinding signage; mileage markers to encourage physical activity; emergency signage/call boxes; garbage cans; dog bag dispensers/waste receptacles; signs with "scoop the poop"; park benches; drinking fountains
- Install a bathroom facility at Town 'N' Country Greenway where it connects with George Road Corridor
- Market the George Road Corridor so residents are aware of the connector to the two trails (Town 'N' Country Greenway and Courtney Campbell)

- Complete a pedestrian/bicyclist count annually before executing the complete streets plan along George Rd. and after to measure increase in use of the corridor
- Consider a complete streets project to connect the west end of the Town 'N' Country Greenway with the Upper Tampa Bay Trail

Recommendations to Mitigate Respiratory Disease Exacerbation and Heat-Related Illness

- Encourage planting of shade trees that are more allergy-friendly and plant trees uniformly throughout corridor
- Increase landscape plantings throughout the corridor focusing on species that are known to filter pollution
- Provide education on how to reduce respiratory-related exacerbations (due to allergens and pollution) and heat-related illness
- Install drinking fountains and park benches throughout the corridor

Additionally, Public Health SMEs included some policy related recommendations.

Policy-Related Recommendations

- Look more holistically at transportation decisions and health; expand from individual impact (crashes) to community impact (chronic disease, mental health, asthma, etc.)
- Hillsborough Board of County Commissioners should adopt a binding Complete Streets Policy (stronger than the current MPO resolution)
- Develop screening criteria for the MPO to complete future HIAs based on specific factors i.e. cost of project, location, population affected, funding source for future MPO projects, plans, etc. and consider developing a Health in All Policies Resolution to include HIA screening process
- Expand DOH-Hillsborough membership onto MPO's BPAC and Technical Advisory Committee

MONITORING AND EVALUATION

Process Evaluation Plan

An HIA Process Evaluation will occur at the conclusion of the HIA to determine how well the process was carried out, if the correct partners were involved, to identify the lessons learned and unanticipated outcomes. DOH-Hillsborough and the MPO will conduct this evaluation. [Table 29](#) includes the process evaluation questions that were discussed with the HIA Research Team. Additionally, an online survey will be sent to stakeholders requesting their feedback on key questions. The evaluation questions included in [Table 29](#) were adapted from various resources located on the UCLA HIA Clearing House Learning & Information Center, the UCLA School of Public Health HIA Project, and the Human Impact Project, available at:

- http://www.ph.ucla.edu/hs/health-impact/training/pdfs/Module6_Evaluation_notes.pdf;
- <http://www.hiaguide.org/methods-resources/methods/phases-hia-4-reportingevaluation>;
- <http://www.humanimpact.org/new-to-hia/tools-and-resources/#hiamonitoreval>

Table 29. Process Evaluation Questions

| Questions |
|--|
| Was the HIA consistent with the Work Plan and Time Line completed during the scoping phase? How much time was spent on the HIA? By whom (not just those who conducted HIA)? |
| Who was involved in each phase of the HIA and why? Were there others who should have been involved and why? |
| What were the associated financial costs (e.g., salaries, travel, expenses)? |
| Were vulnerable groups or their representatives involved with the HIA? What efforts were taken to involve affected populations in the HIA process? Were these efforts successful? |
| Did we have all the data sources needed? Was routine data on vulnerable groups readily available and accessible? |
| Did the impacts identify the differential distributions across different population groups, not just impact on vulnerable groups? |
| Were stakeholders given an opportunity to review the findings and comment? |
| Did recommendations include actions to address any differential distribution of impacts? |
| Did the HIA identify evidence-based health-promoting design solutions, mitigations, or alternatives? Did the HIA provide analysis of the effectiveness and feasibility of these recommendations? |
| Were efforts to mitigate potentially negative effects of the proposed plan, project, program, or policy concentrated on the impacts of the largest magnitude? If not, why? |
| Were recommendations prioritized by the HIA steering committee? If not, why? What process was used? |
| How and when were recommendations delivered to decision makers? |
| Was the HIA decision-making process transparent? How so? If not, what do you recommend to better ensure transparency? |
| Were there any unanticipated outcomes that resulted? What are the outcomes to date as a result of the HIA process? |

| |
|---|
| To what extent were the goals of the HIA achieved? |
| What were the strengths of the HIA process? |
| What were the weaknesses or gaps of the HIA process? |
| What did those involved think about the process and what changes would they make if they were to do it again? |

Impact Evaluation Plan

An impact evaluation will be conducted by the MPO to determine whether or not the proposed HIA recommendations were implemented by decision-makers. A timeframe for the impact evaluation is yet to be determined. [Table 30](#) includes the plan for evaluating these recommendations.

Table 30. Impact Evaluation Questions

| Recommendation | Monitoring Lead | Partners | Level of Implementation | Date Adopted/ Completed |
|--|---------------------------------------|---|--|--------------------------------|
| Incorporate CPTED Crime Prevention Through Environmental and Landscaping Design | Hillsborough County (HC) Public Works | HC Parks, Recreation and Conservation | <input type="checkbox"/> Fully Adopted <input type="checkbox"/> Partially Adopted <input type="checkbox"/> Not Adopted | |
| Ensure design features (especially traffic calming features) comply with the FDOT Complete Streets Plan and match Hillsborough County's Complete Street Ordinance | HC Public Works | MPO, Florida Department of Transportation (FDOT), HC Parks, Recreation and Conservation | <input type="checkbox"/> Fully Adopted <input type="checkbox"/> Partially Adopted <input type="checkbox"/> Not Adopted | |
| Reduce speed limit to 25 MPH in areas of the George Road Corridor, except at Memorial where it is 35 MPH; and/or during peak times, recommend Zones (similar to school zones) with blinking lights and reduced speed | HC Public Works, FDOT | | <input type="checkbox"/> Fully Adopted <input type="checkbox"/> Partially Adopted <input type="checkbox"/> Not Adopted | |
| Conduct a bus stop environment and connectivity assessment | HART | HC, MPO | <input type="checkbox"/> Fully Adopted <input type="checkbox"/> Partially Adopted <input type="checkbox"/> Not Adopted | |

| | | | | |
|---|-----------------|---------------------------------------|--|--|
| Install pedestrian-level street lights to increase physical activity in the early morning/evenings | HC Public Works | | <input type="checkbox"/> Fully Adopted <input type="checkbox"/> Partially Adopted <input type="checkbox"/> Not Adopted | |
| Along the trailways and throughout the corridor include: wayfinding signage; mileage markers to encourage physical activity; emergency signage/call boxes; garbage cans; dog bag dispensers/ waste receptacles; signs with “scoop the poop”; park benches; drinking fountains | HC Public Works | MPO | <input type="checkbox"/> Fully Adopted <input type="checkbox"/> Partially Adopted <input type="checkbox"/> Not Adopted | |
| Install bathroom facility at the Town ‘N’ Country Greenway where it connects with the George Road Corridor | HC Public Works | HC Parks, Recreation and Conservation | <input type="checkbox"/> Fully Adopted <input type="checkbox"/> Partially Adopted <input type="checkbox"/> Not Adopted | |
| Market the George Road Corridor so residents are aware of the connector to the two trails (Town ‘N’ Country Greenway and Courtney Campbell) | HC Public Works | MPO | <input type="checkbox"/> Fully Adopted <input type="checkbox"/> Partially Adopted <input type="checkbox"/> Not Adopted | |
| Complete a pedestrian/bicyclist count annually before executing the complete streets plan along George Rd. and after to measure increase in use | HC Public Works | MPO | <input type="checkbox"/> Fully Adopted <input type="checkbox"/> Partially Adopted <input type="checkbox"/> Not Adopted | |
| Consider complete street project to connect west end of Town ‘N’ Country Greenway with Upper Tampa Bay Trail | MPO | HC Public Works | <input type="checkbox"/> Fully Adopted <input type="checkbox"/> Partially Adopted <input type="checkbox"/> Not Adopted | |

| | | | | |
|---|----------------------|-----------------------|--|--|
| Encourage planting of shade trees that are more allergy-friendly; plant trees uniformly/symmetrically throughout corridor; plant trees that are known to filter out specific pollutants | HC Public Works | | <input type="checkbox"/> Fully Adopted <input type="checkbox"/> Partially Adopted <input type="checkbox"/> Not Adopted | |
| Provide education on how to reduce heat-related illness and respiratory-related exacerbations (due to allergens and pollution) | DOH-Hillsborough | | <input type="checkbox"/> Fully Adopted <input type="checkbox"/> Partially Adopted <input type="checkbox"/> Not Adopted | |
| Look more holistically at transportation decisions and health; expand from individual impact (crashes) to community impact (chronic disease, mental health, asthma, etc.) | MPO/DOH-Hillsborough | | <input type="checkbox"/> Fully Adopted <input type="checkbox"/> Partially Adopted <input type="checkbox"/> Not Adopted | |
| That BOCC adopt a Complete Streets Policy (stronger than MPO resolution) | BOCC | MPO, DOH-Hillsborough | <input type="checkbox"/> Fully Adopted <input type="checkbox"/> Partially Adopted <input type="checkbox"/> Not Adopted | |
| Develop screening criteria for MPO to complete future HIAs based on specific factors and consider developing a Health in All Policies Resolution to include the HIA screening process | MPO | DOH-Hillsborough | <input type="checkbox"/> Fully Adopted <input type="checkbox"/> Partially Adopted <input type="checkbox"/> Not Adopted | |
| Expand DOH-Hillsborough membership onto MPO's BPAC and Technical Advisory Committees | MPO | DOH-Hillsborough | <input type="checkbox"/> Fully Adopted <input type="checkbox"/> Partially Adopted <input type="checkbox"/> Not Adopted | |

Outcome Evaluation Plan

Finally, an outcome evaluation will be conducted once the George Road Complete Streets Implementation Plan is executed. Monitoring will occur based on the availability of data to measure changes in immediate, intermediate, and long-term outcomes examined in this HIA. [Table 31](#) contains the indicators that will be monitored, the data source/collection method, monitoring lead, and frequency of monitoring for the outcome evaluation.

Table 31. Monitoring Plan

| Monitoring Indicators | Data Source/Collection Method | Monitoring Lead | Frequency |
|---------------------------------------|--|---|------------------|
| Demographics | U.S. Census Bureau | MPO/DOH-Hillsborough | Every 3 years |
| Crashes | Crash Data Management System | HC Sheriff | Ongoing |
| Injuries | Crash Data Management System | HC Sheriff | Ongoing |
| Fatalities | Crash Data Management System | HC Sheriff | Ongoing |
| Violent and Non-Violent Crimes | | HC Sheriff | Ongoing |
| Depression | Florida CHARTS | DOH-Hillsborough | Every 3 years |
| Overall Health Fair or Poor | Florida CHARTS | DOH-Hillsborough | Every 3 years |
| Obesity/Overweight | Florida CHARTS | DOH-Hillsborough | Every 3 years |
| Diabetes | Florida CHARTS | DOH-Hillsborough | Every 3 years |
| Cardiovascular Disease | Florida CHARTS | DOH-Hillsborough | Every 3 years |
| Arthritis | Florida CHARTS | DOH-Hillsborough | Every 3 years |
| Physical Activity | Florida CHARTS | DOH-Hillsborough | Every 3 years |
| Premature Mortality | Florida CHARTS | DOH-Hillsborough | Every 3 years |
| Asthma | Florida CHARTS | DOH-Hillsborough | Every 3 years |
| Air Pollution | Monitoring Data | Environmental Protection Commission (EPC) | Ongoing |
| Trail Users | Counts | HC Parks, Recreation and Conservation | Yearly |
| Heat Index | National Weather Service | To be determined | To be determined |
| Heat-Related Illness | Florida Environmental Public Health Tracking Network | DOH-Hillsborough | Every 3 years |

CONCLUSION

The purpose of the George Road Complete Street HIA was to examine the improvements proposed for the corridor, assess their impact on the surrounding population including health outcomes, and provide recommendations to mitigate any negative health effects, while promoting the positive ones. The [pathways](#) considered for their health impact were access to safely designed roadways, access to nature and green space, access to the regional trail system, and physical activity.

The Town 'N' Country area intersects with major arterial roads and is adjacent to the Tampa International Airport, making it a central destination for the region. Creating livable roadways in this context is particularly important to those who live there, due to the barriers created by high volume roadways surrounding the area. Creating streets that consider the pedestrian first and result in safer spaces for all road users, are key components of complete streets. This model of road design is becoming more popular throughout the State and country as the needs of pedestrians, bicyclists, and persons with disabilities are considered in the transportation planning process.

The outcomes predicted by persons having increased access to safely designed roadways include a decreased risk of: crime, crime-related incidents, and bicycle and pedestrian injuries. The decreased risk of crime stems from three major factors: additional lighting, additional 'eyes on the street', and fewer potential concealment locations. While these impacts are predicted to be moderate, they show the value of complete streets on human lives. Hillsborough County consistently ranks poorly in the nation for having large numbers of pedestrian deaths. Improving access to non-motorized transportation, especially for vulnerable populations, is critical to reducing the tragic loss of life experienced in the County.

Increased access to nature and green space is predicted to result in decreased stress levels and an increased restorative benefit on health for users of the George Road Corridor and connecting trailways. In the long term, these effects can lead to improvements in mental health and well-being, the prevalence of chronic disease, and premature mortality.

The original purpose of the George Road Complete Street project was to connect two multi-use trails. Increasing access to these trails and a complete streets corridor is predicted to result in increased physical activity for those using the system. Increased and consistent physical activity, especially in an outdoor or natural environment can improve mental health, well-being, and chronic disease outcomes. However, there is potential for increased exposure to heat and outdoor air pollutants and irritants. Increased heat exposure can cause heat-related illness and exacerbations of asthma and other respiratory disease. Various recommendations are included in the report to help mitigate these negative health effects.

In addition to the practical recommendations and analysis of this project, the value of the George Road HIA is in the increased collaboration between health and transportation planning practitioners. The HIA was important in demonstrating the impacts of a complete streets implementation plan on health by highlighting the health benefits and consequences of a county transportation plan. Increased collaboration between health and transportation planning sectors make it possible for health to be considered in the planning process when new transportation investments are considered.

REFERENCES

- Akpinar, A. (2016). How is quality of urban green spaces associated with physical activity and health? *Urban Forestry & Urban Greening*, 16, 76–83.
- Alock, I., White, M., Wheeler, B., Fleming, L., & Depledge, M. (2014). Longitudinal effects on mental health of moving to greener and less green urban areas. *Environmental Science & Technology*, 48, 1247-1255.
- American Heart Association. (2015). *Physical activity improves quality of life*. Retrieved February 11, 2016, from http://www.heart.org/HEARTORG/HealthyLiving/PhysicalActivity/%20StartWalking/Physical-activity-improves-quality-of-life_UCM_307977_Article.jsp#.WHZ9qf4zXVI
- American Lung Association. (2013). Disparities in the impact of air pollution. *State of the Air 2013*. Retrieved from <http://www.stateoftheair.org/2013/health-risks/health-risks-disparities.html?referrer=https://www.google.com/>
- American Public Health Association. (2010). *Active transportation: Benefitting health, safety and equity*. Retrieved February 8, 2016, from http://www.apha.org/~media/files/pdf/topics/transport/apha_active_transportation_fact_sheet_2010.ashx
- Anderson, G., Searfoss, L., Cox, A., Schilling, E., Seskin, S., & Zimmerman, C. (2015). Safer streets, stronger economies: Complete streets project outcomes from across the United States. *Institute of Transportation Engineers*, 85 (6), 29-36.
- Anderson, Z., de Nazelle, A., Mendez, M., Garcia-Aymerich, J., Hertel, O., Tjonneland, A., Nieuwenhuijsen, M. (2015). A study of the combined effects of physical activity and air pollution on mortality in elderly urban residents: The Danish diet, cancer, and health cohort. *Environmental Health Perspectives*, 123 (6), 557-563.
- Averett, N. (2015). Exercising in polluted areas: Study suggest benefits outweigh the health risks of NO2 exposure. *Environmental Health Perspectives*. 123 (6), A 158.
- Becker, J., & Stewart, L. (2011). *Heat-related illness*. Retrieved from <http://www.aafp.org/afp/2011/0601/p1325.html#sec-1>
- Beil, K., & Hanes, D. (2013). The influence of urban natural and built environments on physiological and psychological measures of stress: a pilot study. *International Journal of Environmental Research and Public Health*, 10 (4), 1250-1267.

- Bhatia R. (2011). *Health impact assessment: A guide for practice*. Oakland, CA: Human Impact Partners
- Bhatia, R., Farhang, L., Heller, J., Lee, M., Orenstein, M., Richardson, M., & Wernham, A. (2014) *Minimum Elements and Practice Standards for Health Impact Assessment: Version 3*. Retrieved from <http://hiasociety.org/wp-content/uploads/2013/11/HIA-Practice-Standards-September-2014.pdf>
- Centers for Disease Control and Prevention. (2011). *Strategies to prevent obesity and other chronic diseases: The CDC guide to strategies to increase physical activity in the community*. Retrieved from http://www.cdc.gov/obesity/downloads/PA_2011_WEB.pdf
- Centers for Disease Control and Prevention. (2015a). *Extreme Heat* Retrieved December 13, 2016 from <https://www.cdc.gov/disasters/extremeheat/index.html>
- Centers for Disease Control and Prevention. (2015b) *Physical activity and health*. Retrieved from <http://www.cdc.gov/physicalactivity/basics/pa-health/index.htm>
- Centers for Disease Control and Prevention. (2016). *Be active!* Retrieved June 8, 2016 from <http://www.cdc.gov/diabetes/managing/beactive.html>
- Colberg, S. R., Sigal, R. J., Yardley, J E., Riddell, M. C., Dunstan, D. W. Dempsey, P. C., ... & Tate, D. F. (2016). Physical activity/exercise and diabetes: a Position Statement of the American Diabetes Association. *Diabetes Care*, 39(11), 2065–2079.
- Cozens, P.M., Saville, G., & Hillier, D., (2005),"Crime prevention through environmental design (CPTED): a review and modern bibliography", *Property Management*, 23(5), 328–356. <http://dx.doi.org/10.1108/02637470510631483>
- Crompton, J., & Walker, J. R. (2012). The relationship of household proximity to park use. *Journal of Park and Recreation Administration*, 30(3), 52–63
- Deniz, D. (2016). Improving perceived safety for public health through sustainable development. *Procedia - Social and Behavioral Sciences*, 216, 632–642.
- Dohm, D. & McLaughlin, L. (2015). *Complete Parks Playbook*. ChangeLab Solutions. Retrieved from <http://www.changelabsolutions.org/publications/complete-parks>
- Egan, B., & Zierath, J. R. (2013). Exercise metabolism and the molecular regulation of skeletal muscle adaptation. *Cell metabolism*, 17(2), 162-184.

- Farrington, D. P. & Welsh, B. (2007). Improved Street Lighting and Crime Prevention. *Swedish National Council on Crime Prevention*. Retrieved from:
https://www.google.com/url?sa=t&rct=i&q=&esrc=s&source=web&cd=4&ved=0ahUKEwUpNGs6a3RAhWKOCYKHeFSB3MQFggUMAM&url=http%3A%2F%2Fwww.crim.cam.ac.uk%2Fpeople%2Facademic_research%2Fdavid_farrington%2Fflightsw.pdf&usq=AFQjCNHq-xpCDLDPgeU_vCtUpOscp8wHUQ&sig2=mVJCSn_drtrtS5_lskc81wA&cad=rja
- Florida Department of Health in Hillsborough County. (2015). *Parks and Recreation HIA*
- Gilmour, M.I., Jaakkola, M.S., London, S.J., Nel, A.E., & Rogers, C.A. (2006). How exposure to environmental tobacco smoke, outdoor air pollutants, and increased pollen burdens influences the incidence of asthma. *Environmental Health Perspectives*, 114, 624-633.
- Haans, A., & de Kort, Y. A. W. (2012). Light distribution in dynamic street lighting: Two experimental studies on its effects on perceived safety, prospect, concealment, and escape. *Journal of Environmental Psychology*, 32(4), 342–352.
- Healthy People 2020. (2016). Health-Related Quality of Life and Well-Being.
<https://www.healthypeople.gov/2020/about/foundation-health-measures/Health-Related-Quality-of-Life-and-Well-Being>
- Heinrich, K., Aki, N., Hansen-Smith, H., Fenton, M. & Maddock, J. (2011). A comprehensive multi-level approach for passing safe routes to school and complete street policies in Hawaii. *Journal of Physical Activity and Health*, 8(1), S135-140.
- Heller, J., Malekafzali, S., Todman, L., & Wier, M. (2013). *Promoting equity through the practice of health impact assessment*. Oakland, CA: PolicyLink. Retrieved February 1, 2016 from
<http://www.policylink.org/find-resources/library/promoting-equity-through-health-impact-assessments>
- Jacobs, J. (1961). *The Death and Life of Great American Cities*. New York: Random House.
- Jansson, M., Fors, H., Lindgren, T., & Wiström, B. (2013). Perceived personal safety in relation to urban woodland vegetation: A review. *Urban Forestry & Urban Greening*, 12(2), 127–133.
- Jennings, V., & Gaither, C. (2015). Approaching environmental health disparities and green spaces: An ecosystem services perspective. *International Journal of Environmental Research and Public Health*, 12(2), 1952–1968.

- Keniger, L., Gaston, K., Irvine, K., & Fuller, R. (2013). What are the benefits of interacting with nature? *International Journal of Environmental Research and Public Health*, 10(3), 913-935.
- Li, X., Zhang, C., & Li, W. (2015). Does the visibility of greenery increase perceived safety in urban areas?: Evidence from the place pulse 1.0 dataset. *ISPRS International Journal of Geo-Information*, 4(3), 1166–1183.
- Litman, T. (2010). *Evaluating public transportation health benefits*. Retrieved from http://www.vtpi.org/tran_health.pdf
- Maas, J., Vereij, R., de Vries, S., Spreeuwenberg, P., Schellevis, F. & Groenewegen, P. (2009). Morbidity is related to a green living environment. *Journal of Epidemiology & Community Health*, 63, 967-973.
- Maas, J., Vereij, R., Groenewegen, P., de Vries, S. & Spreeuwenberg, P. (2006). Green space, urbanity, and health: How strong is the connection? *Journal of Epidemiology & Community Health*, 60, 587:592.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2566234/>
- Mantler, A., & Logan, A. C. (2015). Natural environments and mental health. *Advances in Integrative Medicine*, 2(1), 5–12.
- McCann, B. (2013). *Completing Our Streets - The Transition to Safe and Inclusive Transportation Networks*. Washington: Island Press.
- Mitchell, R. & Popham, F. (2008). Effect of exposure to natural environment on health inequalities: An observational population study. *The Lancet*, 372(9650),1655-1660.
- Myers, J., McAuley, P., Lavie, C. J., Despres, J. P., Arena, R., & Kokkinos, P. (2015). Physical activity and cardiorespiratory fitness as major markers of cardiovascular risk: their independent and interwoven importance to health status. *Progress in cardiovascular diseases*, 57(4), 306-314.
- National Recreation and Parks Association. (2010). *The benefits of physical activity provided by park and recreation services: The scientific evidence*. Retrieved from <https://www.nrpa.org>
- National Regional Planning Council. (2014). *A Health in All Policies Approach to Complete Streets Ordinances*. Retrieved from www.nashuarpc.org/download_file/1341/

- Newman, O. (1973). *Defensible Space: Crime Prevention Through Urban Design*. New York: Macmillan.
- Nicholls, S. (2004). Measuring the Impact of Parks on Property Values; new research show that green spaces increase the value of nearby housing. *Parks and Recreation*, 39(2), 24-32.
- Pucher, J., Buehler, R., Bassett, D. R., & Dannenberg, A. L. (2010). Walking and cycling to health: A comparative analysis of city, state, and international data. *American Journal of Public Health*, 100(10), 1986-1992.
- Quigley, R., den Broeder, L., Furu, P., Bond, A., Cave, B., & Bos, R. (2006). *Health impact assessment international best practice principles: Special publication series no. 5*. Retrieved February 20, 2016, from http://www.iaia.org/uploads/pdf/SP5_3.pdf
- Retting, R. A., Ferguson, S.A., & McCartt, A.T. (2003). A review of evidence-based traffic engineering measures designed to reduce pedestrian-motor vehicle crashes. *American Journal of Public Health*, 93, 1456-1463
- Rochette, E., Duché, P., & Merlin, E. (2015). Juvenile idiopathic arthritis and physical activity: possible inflammatory and immune modulation and tracks for interventions in young populations. *Autoimmunity reviews*, 14(8), 726-734.
- Roe, J., Thompson, C., Aspinall, P., Brewer, M., Duff, E., Miller, D., & Clow, A. (2013). Green space and stress: Evidence from cortisol measures in deprived urban communities. *International Journal of Environmental Research and Public Health*, 10, 4086-4103.
- Romagosa, F., Eagles, P. F. J., & Lemieux, C. J. (2015). From the inside out to the outside in: Exploring the role of parks and protected areas as providers of human health and well-being. *Journal of Outdoor Recreation and Tourism*, 10, 70–77.
- Sandt, L., Combs, T., & Cohn, J. (2016). *Pursuing Equity in Pedestrian and Bicycle Planning*. U.S. Department of Transportation. Federal Highway Administration. Retrieved from http://www.fhwa.dot.gov/environment/bicycle_pedestrian/resources/equity_paper/
- Schepers, P., Fishman, E., Beelen, R., Heinen, E., Wijnen, W., & Parking, J. (2015). The mortality impact of bicycle paths and lanes related to physical activity, air pollution exposure and road safety. *Journal of Transport & Health*, 2 (4), 460–473.
- Shreeve, E. (2014). *Open Spaces and Active Transportation*. *Urbanland*. Retrieved from <http://urbanland.uli.org/planning-design/open-spaces-and-active-transportation/>

- Smart Growth America. (2014). *Dangerous by design 2014*. Retrieved from: <https://smartgrowthamerica.org/resources/dangerous-by-design-2014/>
- Smart Growth America. (2016). *What are complete streets?* Retrieved from <https://smartgrowthamerica.org/program/national-complete-streets-coalition/what-are-complete-streets/>
- Sreetheran, M., & van den Bosch, C. C. K. (2014) A socio–ecological exploration of fear of crime in urban green spaces – A systematic review. *Urban Forestry & Urban Greening*, 13(1), 1–18.
- Stenman, E., & Lilja, Å. (2013). Increased monoaminergic neurotransmission improves compliance with physical activity recommendations in depressed patients with fatigue. *Medical hypotheses*, 80(1), 47-49.
- Swift, D. L., Lavie, C. J., Johannsen, N. M., Arena, R., Earnest, C. P., O’Keefe, J. H., ... & Church, T. S. (2013). Physical activity, cardiorespiratory fitness, and exercise training in primary and secondary coronary prevention. *Circulation Journal*, 77(2), 281-292
- Taylor, D. (2014). Physical activity is medicine for older adults. *Postgraduate medical journal*, 90(1059), 26-32
- United States Department of Health and Human Services, & Center for Disease Control and Prevention. (n.d.). *Recognizing, preventing and treating heat-related illness*. Retrieved from http://www.cdc.gov/nceh/hsb/extreme/Heat_Illness/index.html
- United States Department of Health and Human Services. (1999). The effects of physical activity on health and disease. In *Physical Activity and Health: A Report of the Surgeon General*. Retrieved June 8, 2016, from <http://www.cdc.gov/nccdphp/sgr/index.htm>
- United States Department of Health and Human Services. (2008). Additional considerations for some adults. *2008 Physical Activity Guidelines for Americans*. Retrieved June 8, 2016 from <http://health.gov/paguidelines/guidelines/>
- United States Department of Health and Human Services (2011). Principles of community engagement (2nd ed.) Atlanta (GA): Clinical and Translational Science Awards Consortium Community Engagement Key Function Committee Task Force on the Principles of Community Engagement. https://www.atsdr.cdc.gov/communityengagement/pdf/PCE_Report_508_FINAL.pdf
- United States Environmental Protection Agency. (n.d.). *How mobile source pollution affects your health*. Retrieved from <https://www3.epa.gov/otaq/nearroadway.htm>

United States Environmental Protection Agency. (2016b, March 22). *NAAQS table*. Retrieved from <https://www.epa.gov/criteria-air-pollutants/naaqs-table>

United States Department of Justice. (2016). Federal Coordination and Compliance Section. Retrieved from <https://www.justice.gov/crt/fcs/TitleVI-Overview>

Van den Berg, M., van Poppel, M., van Kamp, I., Andrusaityte, S., Balseviciene, B., Cirach, M., Maas, J. (2016). Visiting green space is associated with mental health and vitality: A cross-sectional study in four European cities. *Health & Place*, 38, 8–15.

Wells, E.M., Dearborn, D.G., & Jackson, L.W. (2012). Activity change in response to bad air quality: National health and nutrition examination survey, 2007-2010. *PLoS ONE*, 7(11), e50526.

World Health Organization. (2003). Sun, heat and cold. In *Guidelines for Safe Recreational Water Environments, Volume 1: Coastal and Fresh Waters*. Geneva, Switzerland: World Health Organization. Retrieved from <http://apps.who.int/iris/bitstream/10665/42591/1/9241545801.pdf>

APPENDICES

Appendix A. George Road HIA Screening Checklist

| Essential Screening Questions | Yes/No/ Unknown | Supporting Facts/Rationale |
|--|--------------------|--|
| <p>Value of and need for HIA <i>Does the decision have the potential to affect, directly or indirectly (positively or negatively) health outcomes via environmental or social determinants of health?</i></p> | <p>Yes</p> | <p>Key Decision: The execution of the George Road Complete Streets Implementation Plan.</p> <p>Decision-Makers: Metropolitan Planning Organization (MPO) Board, community members in target area</p> <p>Research Questions: What is the impact of the MPO executing the George Road Complete Streets Implementation Plan?</p> <p>How would executing the George Road Complete Streets Implementation Plan affect the health of the population within the targeted geographic location, especially racial and ethnic minorities, people with movement-related disabilities, people of lower socioeconomic status, or people with limited English language proficiency?</p> <p>Environmental and Social Determinants of Health: Access to safely designed roadways, access to regional trail system, access to nature/green space, access to physical activity opportunities</p> <p>Intermediate Outcomes: Risk of crime, pedestrian and bicycle injuries and deaths, stress levels, restorative benefit on health, exposure to outdoor air pollutants/irritants, exposure to heat</p> <p>Long-Term Health Outcomes: Crime-related incidents, mental health and well-being, prevalence of chronic disease, premature mortality, asthma/respiratory disease exacerbations, heat-related illness</p> |
| <p><i>Could these impacts create or exacerbate social disparities?</i></p> | <p>No</p> | <p>Should reduce disparities in access to trailways and active transportation system for recreation, transportation, and active living</p> |
| <p><i>Are the proposal's impacts to health potentially significant in terms of the number of people impacted and/or the magnitude, breadth, or immediacy of impacts?</i></p> | <p>Yes</p> | <p>A large percentage of the population in the county reside in this geographic area (TNC). There is a high percentage of people who are transportation disadvantaged. There should be both an individual impact on health for those</p> |

| | | |
|---|-----------------------|---|
| | | using the complete streets/trailway system, but also a community impact related to reduction in air pollution. |
| <i>Are the health impacts unknown, uncertain, or controversial?</i> | To some extent | Health impacts can be predicted based on the literature regarding access to a complete streets system, a safely designed roadway, nature, and physical activity opportunities. Air Pollutant levels and effects on respiratory disease are harder to predict without modeling current cars on the road, emissions, etc. |
| <i>Could HIA recommendations potentially improve the impact that the plan, project, program, or policy has on health?</i> | Yes | Improved access in a number of areas and social factors, and also a significant number of people would be affected by the proposed recommendations. It would also have an effect statewide because the George Rd. Connector would connect to a statewide trail system |
| Feasibility of conducting an HIA <i>Are the leadership, resources, and technical capacity available to conduct an analysis?</i> | Yes | The MPO Director and Director of Community Health at the Health Department are on board to work together to complete an HIA. Sufficient resources and technical capacity are available to conduct an analysis. Research team includes members from the MPO and DOH-Hillsborough. The MPO has contracted with AECOM to draft the Implementation Plan, and the MPO's Bicycle and Pedestrian Advisory Committee will serve as the Steering Committee for this HIA. Various Subject Matter Experts will also be engaged in the process. The County Health Department will facilitate the HIA. Technical Capacity/Resources: DOH-Hillsborough: HIA, TA and facilitation, health data (County and TNC-level data), surveys and focus groups administration and analysis, Spanish language MPO: GIS, long-range planning expertise, access to data (land use, crash, transit network and usage, demographic) |
| <i>Do data and research methods exist to analyze health impacts of concern associated with this decision?</i> | Yes | Secondary data (FLCHARTS, Census Tract, MPO/Planning Commission, Parks and Rec data, EPA EnviroAtlas, hospital data, HART transit data) Literature reviews, primary (surveys, focus groups, interviews, observational methods), secondary data collection, extrapolation of data, GIS |
| <i>Which stakeholders have interest and/or capacity to participate in an HIA (scoping, research, communication)?</i> | Yes | MPO, DOH-Hillsborough, Planning Commission, Hillsborough County Public Works, Tampa and Hillsborough County Parks and Rec, AECOM, BPAC, USF, USF graduate student, HOA leaders, community members |

| | | |
|--|------------|---|
| Receptiveness of the decision-making process <i>Is there a pending decision regarding the plan, project, program, or policy?</i> | Yes | There are current recommendations drafted for the George Road Complete Streets Implementation Plan; a detailed proposal is pending and will be informed by the HIA. |
| <i>Has a final decision about the proposal been made?</i> | No | Pending based on the results of the HIA, recommendations from the consultants, and planned community meeting(s)/input |
| <i>Are there policy/legal requirements mandating the consideration of direct and/or indirect health impacts?</i> | Yes | FDOH State Improvement Plan (Health in All Policies and the Built Environment); Title 6; complete streets resolution |
| <i>Is there sufficient time and is it feasible to analyze the project before a decision is made?</i> | Yes | The timeline to complete the recommendations for the HIA in June 2016. |
| <i>Are stakeholders requesting an HIA to inform the decision-making process?</i> | Yes | MPO is requesting the HIA |
| <i>Is the decision-making process open to HIA and/or recommendations for changes to design, mitigations, and alternatives?</i> | Yes | The HIA is intended to inform the design, mitigations, and alternatives for the project/implementation plan |

Adapted from: FDOH Healthiest Weight and Florida Institute for Health Innovation HIA-Screening Checklist

Appendix B. George Road Screening Worksheet

| Will the Option Have an Impact On | Possible Impact | Explanation/ Information Required |
|---|-----------------|--|
| 1. The creation of income and/or wealth? <i>Will specific income groups or communities be impacted positively or negatively?</i> | No | Low-income populations and people with mobility-related disabilities will have increased access to active transportation and public transit, however this will not create income or wealth necessarily |
| 2. The distribution of income and/or wealth? <i>Will specific income groups or communities be impacted positively or negatively?</i> | No | |
| 3. Employment opportunities for individuals and/or communities? <i>What is the impact on the nature and distribution of jobs and/or working conditions?</i> | Yes | Access to active transportation and public transportation could increase employment opportunities |
| 4. Learning opportunities, particularly for young people and/or unemployed? <i>Will training/education support tomorrow's jobs?</i> | Yes | Through access to transit and trail networks (i.e. the library, Jackson Springs Rec Center (Teen Center)) |
| 5. Healthier beginnings for children? <i>This includes meeting their basic physical needs, building self-esteem and developing a sense of connectedness with others.</i> | Yes | Access to safe physical activity/recreational opportunities and social engagement opportunities |
| 6. The number and quality of healthy personal connections, such as those with friends, families, colleagues and community groups (as distinct from professional support services)? <i>Will it segregate or isolate individuals or groups?</i> | Yes | Will connect and integrate the community to each other and surrounding areas |
| 7. Physical safety and security among individuals and communities? | Yes | Purpose is to improve physical safety and security of bicyclists and pedestrians |
| 8. People's sense of control over their own lives in the decision making affecting their income, working and living conditions, support systems, local government programs, services and/or resources? | Yes | Improving access to services and opportunities |
| 9. Physical and/or mental health? | Yes | Provision of recreational facilities and social engagement/physical activity opportunities improves physical and mental health |
| 10. The provision of fair equitable and respectful access to government programs, services and or/resources? | Yes | Infrastructure/built environment |
| 11. The environment? <i>Will the environmental changes affect health?</i> | Yes | By increasing access to recreational opportunities and green space |

(Adapted from the Appendix 1: British Columbia Health Impact Assessment Checklist, British Columbia Ministry of Health, Vancouver, Canada)

Appendix C. Hillsborough County Air Quality Index, by Month (2015)

| Day | January | February | March | April | May | June | July | August | September | October | November | December |
|-----|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| 1 | 44 PM _{2.5} | 41 O ₃ | 34 PM _{2.5} | 46 O ₃ | 111 SO ₂ | 45 O ₃ | 80 PM _{2.5} | 52 PM _{2.5} | 35 PM _{2.5} | 60 SO ₂ | 35 PM _{2.5} | 37 PM _{2.5} |
| 2 | 48 PM _{2.5} | 37 PM _{2.5} | 43 PM _{2.5} | 58 O ₃ | 97 O ₃ | 38 PM _{2.5} | 73 PM _{2.5} | 60 PM _{2.5} | 50 PM _{2.5} | 40 PM _{2.5} | 47 PM _{2.5} | 28 PM _{2.5} |
| 3 | 38 PM _{2.5} | 44 PM _{2.5} | 45 PM _{2.5} | 61 O ₃ | 77 O ₃ | 44 O ₃ | 66 PM _{2.5} | 63 PM _{2.5} | 40 O ₃ | 28 O ₃ | 47 PM _{2.5} | 37 PM _{2.5} |
| 4 | 32 PM _{2.5} | 45 PM _{2.5} | 32 PM _{2.5} | 49 O ₃ | 54 O ₃ | 93 O ₃ | 58 PM _{2.5} | 76 PM _{2.5} | 53 PM _{2.5} | 46 SO ₂ | 51 PM _{2.5} | 41 PM _{2.5} |
| 5 | 36 PM _{2.5} | 37 O ₃ | 33 PM _{2.5} | 50 O ₃ | 46 O ₃ | 48 O ₃ | 58 PM _{2.5} | 76 PM _{2.5} | 61 O ₃ | 31 O ₃ | 28 PM _{2.5} | 37 O ₃ |
| 6 | 36 PM _{2.5} | 43 PM _{2.5} | 46 PM _{2.5} | 47 O ₃ | 61 O ₃ | 47 O ₃ | 44 O ₃ | 62 PM _{2.5} | 45 O ₃ | 44 O ₃ | 39 O ₃ | 38 O ₃ |
| 7 | 60 SO ₂ | 44 O ₃ | 40 PM _{2.5} | 41 O ₃ | 64 O ₃ | 47 O ₃ | 52 PM _{2.5} | 47 PM _{2.5} | 35 PM _{2.5} | 54 O ₃ | 39 PM _{2.5} | 41 PM _{2.5} |
| 8 | 47 PM _{2.5} | 44 O ₃ | 41 O ₃ | 43 O ₃ | 84 O ₃ | 61 O ₃ | 65 PM _{2.5} | 36 O ₃ | 27 PM _{2.5} | 64 O ₃ | 30 PM _{2.5} | 43 O ₃ |
| 9 | 55 PM _{2.5} | 51 PM _{2.5} | 40 O ₃ | 52 PM _{2.5} | 93 O ₃ | 51 O ₃ | 69 PM _{2.5} | 50 O ₃ | 59 PM _{2.5} | 46 O ₃ | 28 PM _{2.5} | 42 PM _{2.5} |
| 10 | 67 PM _{2.5} | 81 SO ₂ | 54 NO ₂ | 41 PM _{2.5} | 60 PM _{2.5} | 35 PM _{2.5} | 71 O ₃ | 74 O ₃ | 57 PM _{2.5} | 81 SO ₂ | 28 O ₃ | 48 PM _{2.5} |
| 11 | 43 PM _{2.5} | 52 PM _{2.5} | 40 PM _{2.5} | 37 PM _{2.5} | 76 PM _{2.5} | 47 PM _{2.5} | 56 PM _{2.5} | 51 O ₃ | 38 PM _{2.5} | 44 O ₃ | 55 PM _{2.5} | 54 PM _{2.5} |
| 12 | 28 PM _{2.5} | 54 PM _{2.5} | 43 PM _{2.5} | 38 PM _{2.5} | 50 PM _{2.5} | 58 PM _{2.5} | 48 PM _{2.5} | 35 PM _{2.5} | 29 PM _{2.5} | 47 O ₃ | 53 PM _{2.5} | 36 PM _{2.5} |
| 13 | 27 O ₃ | 60 PM _{2.5} | 33 O ₃ | 33 PM _{2.5} | 47 O ₃ | 55 PM _{2.5} | 87 O ₃ | 35 PM _{2.5} | 35 PM _{2.5} | 49 PM _{2.5} | 57 PM _{2.5} | 31 O ₃ |
| 14 | 48 PM _{2.5} | 62 PM _{2.5} | 30 PM _{2.5} | 33 O ₃ | 45 O ₃ | 42 PM _{2.5} | 39 PM _{2.5} | 39 O ₃ | 77 O ₃ | 49 O ₃ | 45 O ₃ | 33 PM _{2.5} |
| 15 | 54 PM _{2.5} | 101 SO ₂ | 37 O ₃ | 38 PM _{2.5} | 51 PM _{2.5} | 54 PM _{2.5} | 34 PM _{2.5} | 39 O ₃ | 42 PM _{2.5} | 90 O ₃ | 40 O ₃ | 44 PM _{2.5} |
| 16 | 35 PM _{2.5} | 57 PM _{2.5} | 77 O ₃ | 48 PM _{2.5} | 47 PM _{2.5} | 64 O ₃ | 32 O ₃ | 25 O ₃ | 27 PM _{2.5} | 48 O ₃ | 45 PM _{2.5} | 46 PM _{2.5} |
| 17 | 51 PM _{2.5} | 39 O ₃ | 54 O ₃ | 33 PM _{2.5} | 36 PM _{2.5} | 54 O ₃ | 33 O ₃ | 29 PM _{2.5} | 27 O ₃ | 58 O ₃ | 40 PM _{2.5} | 30 PM _{2.5} |
| 18 | 39 O ₃ | 43 O ₃ | 93 O ₃ | 62 PM _{2.5} | 77 O ₃ | 54 PM _{2.5} | 34 O ₃ | 38 PM _{2.5} | 41 PM _{2.5} | 48 PM _{2.5} | 48 PM _{2.5} | 37 PM _{2.5} |
| 19 | 51 PM _{2.5} | 59 SO ₂ | 89 PM _{2.5} | 56 PM _{2.5} | 47 O ₃ | 51 PM _{2.5} | 35 PM _{2.5} | 30 PM _{2.5} | 40 O ₃ | 44 O ₃ | 38 PM _{2.5} | 35 O ₃ |
| 20 | 57 PM _{2.5} | 48 PM _{2.5} | 97 O ₃ | 37 PM _{2.5} | 50 PM _{2.5} | 44 PM _{2.5} | 35 PM _{2.5} | 32 PM _{2.5} | 41 O ₃ | 43 O ₃ | 33 PM _{2.5} | 37 O ₃ |
| 21 | 111 SO ₂ | 54 PM _{2.5} | 54 PM _{2.5} | 84 O ₃ | 44 O ₃ | 42 O ₃ | 39 PM _{2.5} | 61 PM _{2.5} | 83 NO ₂ | 38 O ₃ | 35 PM _{2.5} | 35 PM _{2.5} |
| 22 | 58 PM _{2.5} | 38 PM _{2.5} | 42 PM _{2.5} | 119 O ₃ | 74 O ₃ | 67 O ₃ | 43 PM _{2.5} | 58 O ₃ | 80 O ₃ | 42 O ₃ | 27 PM _{2.5} | 28 PM _{2.5} |
| 23 | 35 PM _{2.5} | 29 O ₃ | 38 PM _{2.5} | 52 PM _{2.5} | 74 O ₃ | 48 PM _{2.5} | 37 PM _{2.5} | 51 O ₃ | 49 PM _{2.5} | 40 O ₃ | 39 O ₃ | 33 PM _{2.5} |
| 24 | 56 SO ₂ | 37 PM _{2.5} | 54 O ₃ | 53 PM _{2.5} | 35 PM _{2.5} | 39 O ₃ | 33 O ₃ | 44 O ₃ | 77 O ₃ | 38 O ₃ | 39 O ₃ | 36 PM _{2.5} |
| 25 | 42 O ₃ | 60 PM _{2.5} | 64 O ₃ | 63 PM _{2.5} | 41 PM _{2.5} | 39 O ₃ | 37 O ₃ | 80 O ₃ | 44 O ₃ | 33 PM _{2.5} | 40 O ₃ | 33 PM _{2.5} |
| 26 | 39 O ₃ | 43 PM _{2.5} | 54 PM _{2.5} | 70 PM _{2.5} | 55 PM _{2.5} | 49 O ₃ | 40 O ₃ | 41 PM _{2.5} | 34 O ₃ | 39 O ₃ | 40 O ₃ | 29 O ₃ |
| 27 | 69 SO ₂ | 43 PM _{2.5} | 101 SO ₂ | 55 PM _{2.5} | 48 O ₃ | 37 PM _{2.5} | 35 O ₃ | 33 O ₃ | 26 O ₃ | 26 PM _{2.5} | 40 O ₃ | 34 O ₃ |
| 28 | 75 PM _{2.5} | 32 O ₃ | 72 SO ₂ | 39 O ₃ | 54 O ₃ | 35 PM _{2.5} | 39 O ₃ | 41 O ₃ | 48 PM _{2.5} | 31 O ₃ | 40 O ₃ | 30 O ₃ |
| 29 | 55 PM _{2.5} | | 51 PM _{2.5} | 47 O ₃ | 61 O ₃ | 43 PM _{2.5} | 43 O ₃ | 50 PM _{2.5} | 22 PM _{2.5} | 41 O ₃ | 38 O ₃ | 30 PM _{2.5} |
| 30 | 59 PM _{2.5} | | 77 O ₃ | 92 SO ₂ | 47 O ₃ | 60 PM _{2.5} | 41 O ₃ | 33 O ₃ | 40 PM _{2.5} | 71 O ₃ | 37 O ₃ | 32 PM _{2.5} |
| 31 | 56 PM _{2.5} | | 51 O ₃ | | 44 O ₃ | | 31 PM _{2.5} | 35 PM _{2.5} | | 38 PM _{2.5} | | 37 PM _{2.5} |

Note: The Air Quality Index posted for the current day uses data from midnight to the current hour only. 24 hour calculations are not included until 18 hours of the day have passed. The calculation cannot be complete until midnight.

Source: Florida Department of Environmental Protection, Florida Air Monitoring and Assessment System (2016)

