Availability of Street-Level Supports for Walking – US Virgin Islands, 2016

A report for the US Virgin Islands Department of Health

By the Centers for Disease Control and Prevention,
Physical Activity and Health Branch

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Executive Summary

The combined burden of chronic diseases and the high prevalence of physical inactivity in the United States Virgin Islands (USVI) pose significant public health concerns. In response, the USVI Department of Health requested assistance from the Centers for Disease Control and Prevention (CDC) to assess the prevalence of community design features in the USVI that support or inhibit physical activity and to recommend steps to improve walkability.

In May 2016, representatives from the CDC traveled to the USVI to provide the requested assistance. Volunteers from the USVI Department of Health were trained on appropriate administration of the modified Microscale Audit of Pedestrian Streetscape (MAPS-USVI) tool, and the tool was used to conduct observational audits of streets segments across the three main islands – St. Croix, St. John, and St. Thomas – over a three-week period.

Key informants from a variety of sectors were interviewed to identify existing supports for and barriers to physical activity in the USVI. Three themes emerged from these interviews: 1) Walkability supports in the USVI need improvement, 2) A limited number of community programs to promote physical activity are in place, and 3) Cross-sector collaboration helps drive existing initiatives in the USVI forward, and more is needed to promote walkability.

Audits were completed on 1,114 street segments, which covered a total of 94.6 kilometers. Of these audited street segments, 31.2% were on St. Croix, 11.9% were on St. John, and 56.9% were on St. Thomas. The majority of street length in the USVI (85.5%) was residential use only, and 3.1% had a mix of residential and commercial uses. Over three-quarters (78.2%) of street length had no walkable destinations. In terms of public transit, 10.7% of street length had at least one formal or informal bus stop present. When considering amenities at the formal bus stops, 39.1% had a bench and a covered shelter, and none had a bus schedule. Overall, 46.7% of street length had no lighting, 50.8% had some lighting, and 2.4% had ample lighting. A continuous sidewalk was present on 4.3% of street length, a non-continuous sidewalk was present on 7.0% of street length, and 88.6% of street length had no sidewalk. Bicycle lanes were not observed on any streets. Of the street length with a crossing, 15.8% had some kind of intersection control (e.g.,

stop sign, traffic light), 2.7% had pedestrian signalization (e.g., push buttons), and 6.2% had some crosswalk treatment (e.g., marking, high visibility striping).

Using the goals outlined in *Step It Up! The Surgeon General's Call to Action to Promote Walking and Walkable Communities* as a framework, the following are potential steps the USVI Department of Health could take in partnership with key stakeholders to improve walkability and promote walking in the USVI. In determining action steps and implementation strategies, issues such as feasibility, available resources, needs of different sectors, and acceptability in USVI communities could be considered.

Potential Action Steps:

1. **Make walking a territory-wide priority in the USVI.**
    - Convene and support an Active Living Coalition or similar cross-sector group to promote walking and walkable communities throughout the USVI.
    - Help mobilize cleanup efforts to make places where people walk safe and attractive.

2. **Design communities that make it safe and easy to walk for people of all ages and abilities.**
    - Facilitate collaboration between key sectors to identify priority areas and develop a long-term Community Action Plan that incorporates active design principles and specific policies to improve walkability using a public health perspective.
    - Strengthen existing informal relationships and create new partnerships with the Department of Public Works.
    - Improve traffic safety on streets and sidewalks and keep existing sidewalks and other places to walk free from hazards.
    - Design streets, sidewalks, and crosswalks that encourage walking for people of all ages and abilities.
    - Encourage the adoption or modification of community planning, land use, transportation, development, and zoning policies and plans that support walking for people of all ages and abilities.

3. **Promote programs and policies to support walking where people live, learn, work, and play.**
    - Encourage the implementation of Safe Routes to School or similar walk-to-school programs.
    - Provide USVI DOH employees access to facilities, locations, clubs and programs to support walking.
    - Encourage safe and convenient access for all users to community locations that support walking, such as walking trails, parks, recreational facilities, and college campuses.
    - Promote walking programs that address barriers and set up walking groups, buddy systems, and other forms of social support for walking.

4. **Provide information to encourage walking and improve walkability.**
    - Share findings of this project widely with local partners while also educating about walkability.
    - Facilitate interdisciplinary training for local decision-makers and staff of relevant partner agencies (e.g., Department of Public Works) on how they can promote walkability.
    - Apply for additional opportunities to receive training and technical assistance.

5. **Fill surveillance, research, and evaluation gaps related to walking and walkability.**
    - Make user-friendly data easily available to decision makers.
    - Continue repeated walkability audits on a regular basis (e.g., every 5 years).
    - Conduct surveillance on physical activity and chronic disease on a regular basis (e.g., Behavioral Risk Factor Surveillance System).
    - Include plans and resources for evaluation when planning interventions.

Introduction

The US Virgin Islands (USVI) is a United States territory located in the Caribbean Sea and consists of three main islands: St. Thomas, St. Croix, and St. John. The total population is approximately 106,000, with St. Thomas being the most populated island. St. John is the smallest island with most of its land a national park. Chronic diseases are a significant public health concern in the USVI. Although surveillance of chronic diseases is limited in this setting, the latest estimates from 2010 show that 5.3% of adults in the USVI (or approximately 5,600 individuals) reported a history of coronary heart disease and 9.1% of adults (or approximately 9,600 individuals) reported a history of diabetes (1).

One important behavioral risk factor that might contribute to the high prevalence of chronic diseases in the USVI is physical inactivity. Based on data from the 2010 Behavioral Risk Factor Surveillance System, the most recent year data were collected, 31.8% of adults in the USVI (or approximately 33,700 individuals) were inactive (1). This prevalence was among the highest of US states and territories in 2010, with only four states also having a prevalence of physical inactivity greater than or equal to 30% (Figure 1).

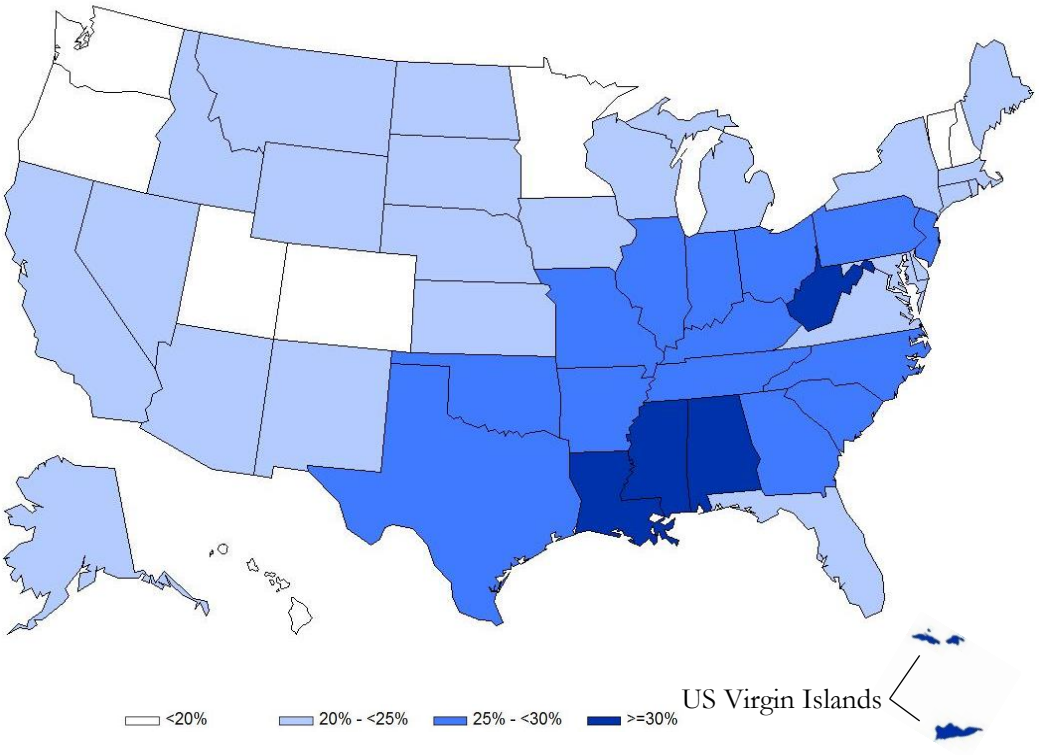


Figure 1. Prevalence of physical inactivity among US adults by state
Source: Behavioral Risk Factor Surveillance System, 2010. Data from the BRFSS website (2).

For substantial health benefits, Americans are encouraged to engage in levels of physical activity consistent with the *2008 Physical Activity Guidelines for Americans* (3). Regular physical activity reduces the risk of many chronic diseases such as coronary heart disease, stroke, some cancers, type 2 diabetes, osteoporosis, and depression, as well as risk factors for disease such as high blood pressure and high blood cholesterol (4). Physical activity also reduces the risk of premature death. Being physically active is one of the most important steps that people of all ages can take to improve their health (4).

One way people can incorporate physical activity into their lives is through walking (5). There are several factors that make walking a powerful public health strategy to promote physical activity. Walking does not require special skills, facilities, or expensive equipment, and it is an easy physical activity to begin and maintain as part of an active lifestyle (6). Walking is the most common form of physical activity for people across the United States (7, 8). In addition, walking can serve many purposes (9). People walk as a way to exercise, have fun, or get to school, work, or other nearby destinations. Strategies that make communities more walkable can also improve safety (10-12), promote social cohesion (13), benefit local economies (14, 15), and reduce air pollution (16, 17).

Step It Up! The Surgeon General's Call to Action to Promote Walking and Walkable Communities was released in September 2015 and calls on Americans to be physically active and on the nation to better support walking and walkability for people of all ages and abilities (5). One way to promote walking is by implementing community strategies that improve walkability where people live, learn, work, and play. Improving walkability means that communities are designed or enhanced to make it safe and easy to walk and that pedestrian activity is encouraged for all people (18).

Although walking is a common form of physical activity that most people can easily do, there are a number of known barriers that prevent more people from walking. One major barrier is the ways in which communities are designed and built that reduce their walkability (5). On average, people are willing to walk up to a half mile to reach a destination (19, 20). If everyday destinations like shops, schools, and restaurants are located too far from the home, people will be less likely to choose an active mode of transportation like walking (21-24). An inadequate public

transit system can also result in missed opportunities for walking, as most transit trips begin or end with walking (25). Physical barriers in the environment, such as poorly maintained sidewalks, can discourage walking particularly for people with disabilities (26). Understanding such barriers at the local level can help stakeholders and decision makers target strategies to improve walkability and promote walking.

The large burden of chronic diseases and physical inactivity in the USVI is an urgent public health concern. Suspecting that community design features in the USVI were not supportive of physical activity and walking, the US Virgin Islands Department of Health (USVI DOH) sought objective data to identify specific barriers to and supports for physical activity and develop action strategies to promote walking and walkable communities in the USVI.

This project was comprised of two main components, key informant interviews and a walkability audit. The objectives of this Epi-Aid were as follows:

1. To gather data on perceptions of walking and supports for walking in the USVI from key stakeholders;
2. To collect baseline data on community design features to describe the walkability of streets in the USVI; and
3. To provide potential action steps the USVI DOH can take to make walking a priority and improve walkability in the USVI.

Key Informant Interviews

Prior to the walkability audit, representatives of various sectors in the USVI (”key informants”) were interviewed to assist in understanding local perspectives regarding health, physical activity, and walkability. The interviews also contributed to the development of methods for the walkability audit, provided context for the walkability data collected, and facilitated collaboration between partners.

This project was determined by CDC to not require Institutional Review Board (IRB) review because data collection was solely for the purposes of public health practice.

Methods

Key informants were selected with assistance from colleagues at the USVI DOH. Influential individuals from a range of sectors who were knowledgeable about ongoing and future programs and policies were identified. To ensure that a wide variety of perspectives were heard, representatives of agencies who work with and advocate for children, the elderly, and people with disabilities were included. The individuals and agencies selected for interviews included the following:

- American Association of Retired Persons (AARP)
- Americans with Disability Act (ADA) Coordinator
- Community Running Advocate
- Department of Education
- Department of Health
- Department of Public Works
- Department of Sports, Parks and Recreation
- Local Policy Maker

A letter of invitation from the USVI DOH Commissioner was sent to each potential key informant (Appendix 1). Telephone interviews were scheduled between each key informant and two CDC team members and lasted 30-60 minutes in duration. Seven out of 8 key informants granted permission to have their interviews recorded.

An interview guide was developed to encompass questions on health and walkability in the USVI as well as questions specific to each agency (Appendix 2). A core set of questions was

posed to each key informant to assess current agency priorities; policies related to walking and walkability; perceived supports and barriers to walking and walkability; and sponsored community activities or programs related to health promotion. The interviews were flexible so that additional sector-specific questions could be added as appropriate and to maintain the flow of the conversation. Sector-specific questions were organized around the following topics related to transportation and urban planning, education, parks and recreation, and community health:

1. *Transportation, urban planning, public works, and zoning*
    - Policies or activities related to transportation and/or land use: specifically Complete Streets, smart growth design, master plans, and transportation enhancements
    - Connectivity of amenities and destinations in the community
    - Public transit accessibility
    - Safe walking and biking routes

2. *Education*
    - Policies related to physical education, recess, and playgrounds
    - Transportation and safe routes to school
    - Shared use of school facilities (gyms, running/walking tracks, multipurpose rooms)

3. *Parks and recreation*
    - Policies related to trails and open streets
    - Trails and street networks around or within parks
    - Park funding
    - Recreational programs, facilities, and indoor options

4. *Community health*
    - Policies or programs to increase walking (walking events and groups, community events)

Each recorded interview was transcribed. The transcripts were independently reviewed several times by two CDC staff members to identify categories of information that emerged across key informants. Key word searches were performed to locate additional quotes supporting each category. These categories were then conceptualized into overarching themes after further group discussion.

Results

The interview findings revealed varied perspectives on walkability in the USVI among key informants. Three overarching themes emerged:

1. Walkability supports in the USVI need improvement.

- There are select areas where residents go to walk because they have sidewalks and are perceived to be safe, including the Bypass around Christiansted on St. Croix (Figure 2), but not all residents have convenient access to safe places for walking or cycling.
- The territory lacks formal policies that support walkability, e.g. Complete Streets
- There are few sidewalks, and many existing ones are in need of repair and updating.
  - Sidewalks are primarily updated during restorations or added during new construction.
  - Modifications are needed in many areas to meet ADA specifications.
- It is difficult to obtain funding for community design improvements.

2. A limited number of community programs to promote physical activity are in place, including:
   - A wellness program for government employees sponsored by the Government Employees Service Commission.
   - A Zumba wellness program for the 50+ population sponsored by AARP.
   - Occasional community walks that are open to all and organized by the Fire Department ("Firewalkers").
   - Organized recreational activities for youth coordinated by the Department of Sports, Parks and Recreation, e.g. little leagues, basketball.
3. Cross-sector collaboration helps drive existing initiatives forward, and more is needed to promote walkability.
   - Multiple sectors currently support each other on several initiatives, including:
     - AARP works with disability rights groups to ensure accessibility of sidewalks.
     - AARP participates in the transportation advisory group.
     - ADA and Department of Public Works collaborate to ensure that accessibility guidelines are met.
     - ADA, Department of Public Works, and Department of Health work together to install water stations along walking trails.
     - Department of Public Works attends Department of Transportation trainings.
   - There is a need for improved engagement across sectors and increased awareness of physical activity and the role that different sectors can play in improving walkability.
     - Community design improvements in the USVI don't emphasize health concerns, but are most often achieved via efforts to improve accessibility for older adults or people with disabilities.

Figure 2. Image of the Bypass on St. Croix, a popular location for walking among USVI residents

Walkability Audit

Methods

Study Design and Sample Selection

This cross-sectional study relied on observational audits to evaluate the walkability of streets in the USVI. A two-stage sampling method was used to select a representative sample of street segments across the territory. A flow diagram of the sample selection process is included in Figure 3.

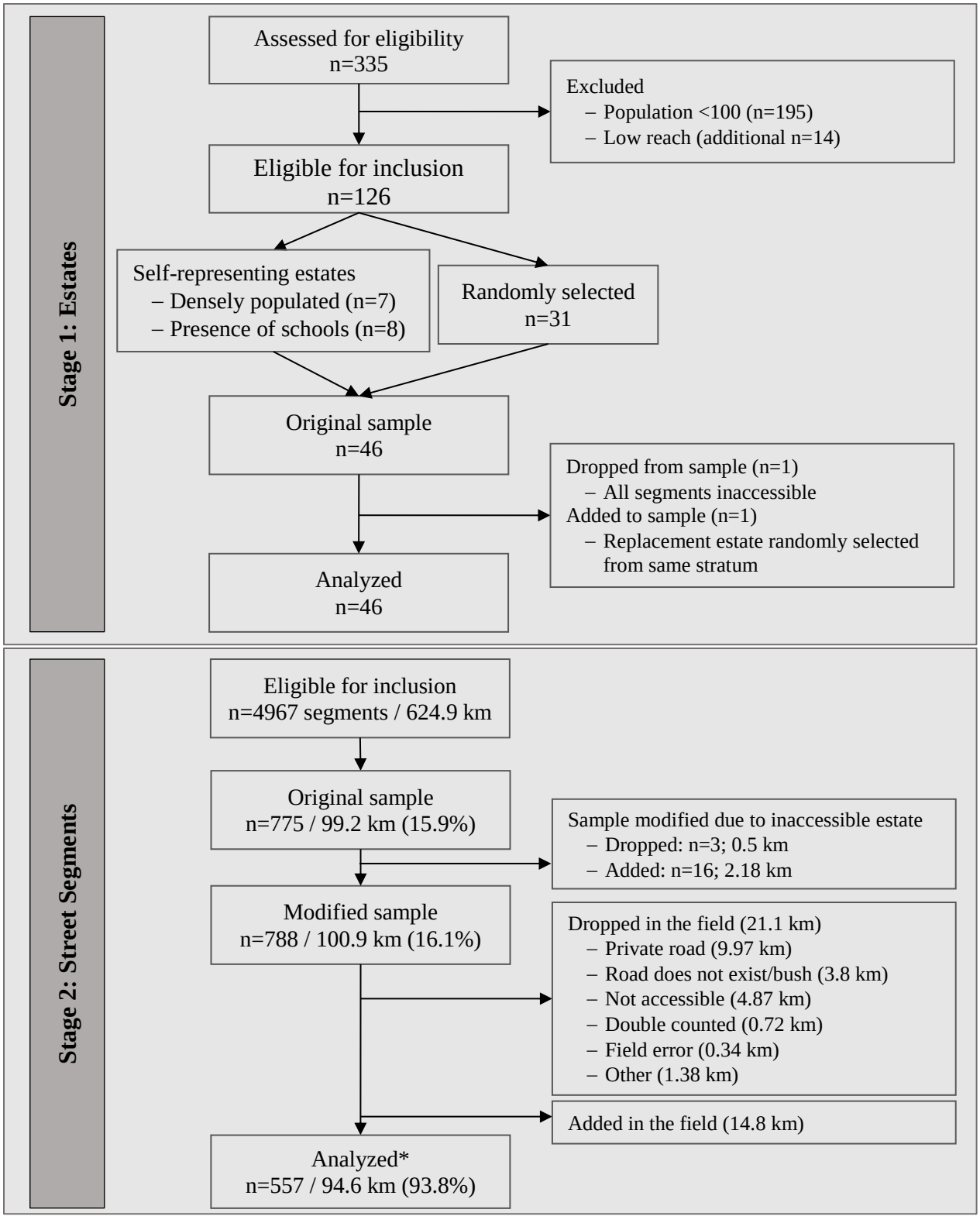
In the first stage, estates were selected using stratified random sampling. Estates are the smallest legal subdivisions of the USVI for which US Census data are published. The USVI are divided into 335 estates (Figure 4). Estates were excluded from the sampling frame if they had a population of <100 (n=195) or a low population reach (<45 people/km of pedestrian road, and not neighboring an estate with ≥45 people/km of pedestrian road; n=152, of which 138 had population <100). These exclusion criteria were employed to focus resources on areas where the majority of the population lived. A total of 126 estates were included in the sampling frame, which represented 93.3% of the total population.

These estates were stratified by four variables (see Appendix 3 for additional details):

1) Island: St. Croix, St. John, or St. Thomas
2) Number of schools: 0, 1, 2, or 3
3) Population density (the number of residents per square mile): dense (>10 persons/acre) or sparse (≤10 persons/acre)
4) Population reach (the number of residents per kilometer of street length): high reach (≥45 persons/km of pedestrian road length) or neighboring a high reach estate

Fifteen of these estates were designated as self-representing primary sampling units (PSUs), or PSUs that were guaranteed to be included in the sample independent of the sampling design, because they met at least one of the following criteria: 1) Densely populated (n=7), 2) Located on St. Croix with 2 or more schools (n=1), or 3) Located on St. Thomas or St. John with any school (n=7).

Of the remaining 111 estates, a random sample was drawn from each stratum with size equal to the rounded up square root of the tabulated number of estates in that stratum. [For example, of the 28 estates in the stratum categorized as high reach, sparsely populated, with no schools on St. Croix, $\sqrt{28}=5.3\approx6$ estates were randomly selected as PSUs.] The "square root strategy" to determine sample sizes within strata was driven by the large disparities in the size of strata and the need to strike a balance between over- or under-sampling in the absence of any other metric, such as the expected strata-specific variance of key variables. This process added an additional 31 estates, bringing the total number of sampled estates to 46.



* Separate audits were completed for both sides of a street segment, making the final sample size n=1114 (557*2).

Figure 3. Flow diagram of the sample selection process

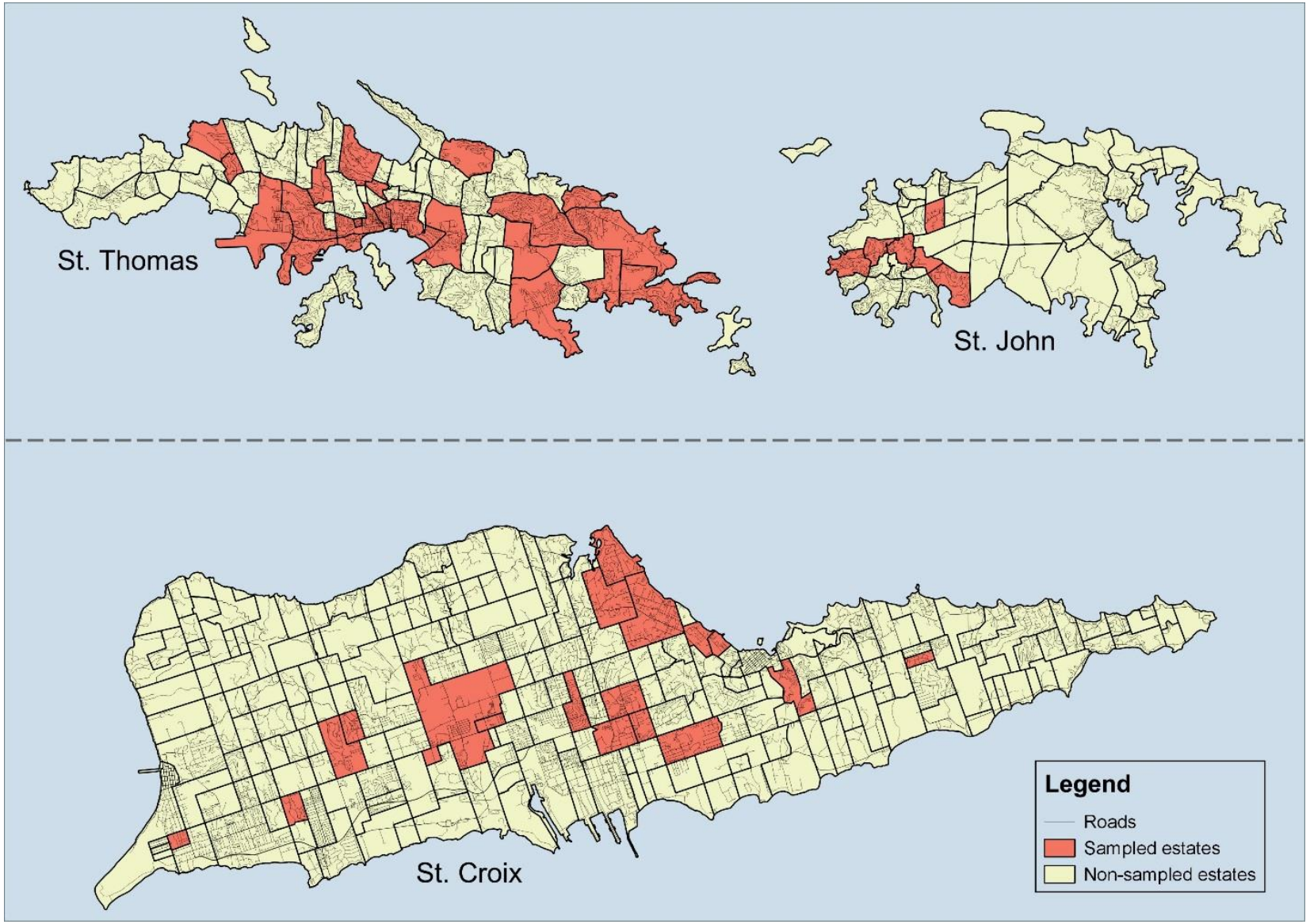


Figure 4. Map of estates in the three main U.S. Virgin Islands

In the second stage, street segments within sampled estates were selected. For this project, a street segment was defined as the length of road between two intersections (see Figure 5). The U.S. Census Bureau's 2015 TIGER/Line files were used to derive the sampling frame of street segments (27). In these files, each street segment is assigned a classification code to distinguish different street types. Streets classified as private roads and parking lots were excluded. The total length of the excluded street segments was 220.2 km (9.2% of the total 2377.4 km of street length in the TIGER file.) Thus, the sampling frame consisted of street segments categorized as secondary roads, local roads, city streets, trails, pedestrian trails or passageways, or alleys. Sampling was performed using R along with the package *rgdal* for processing geocoded data.

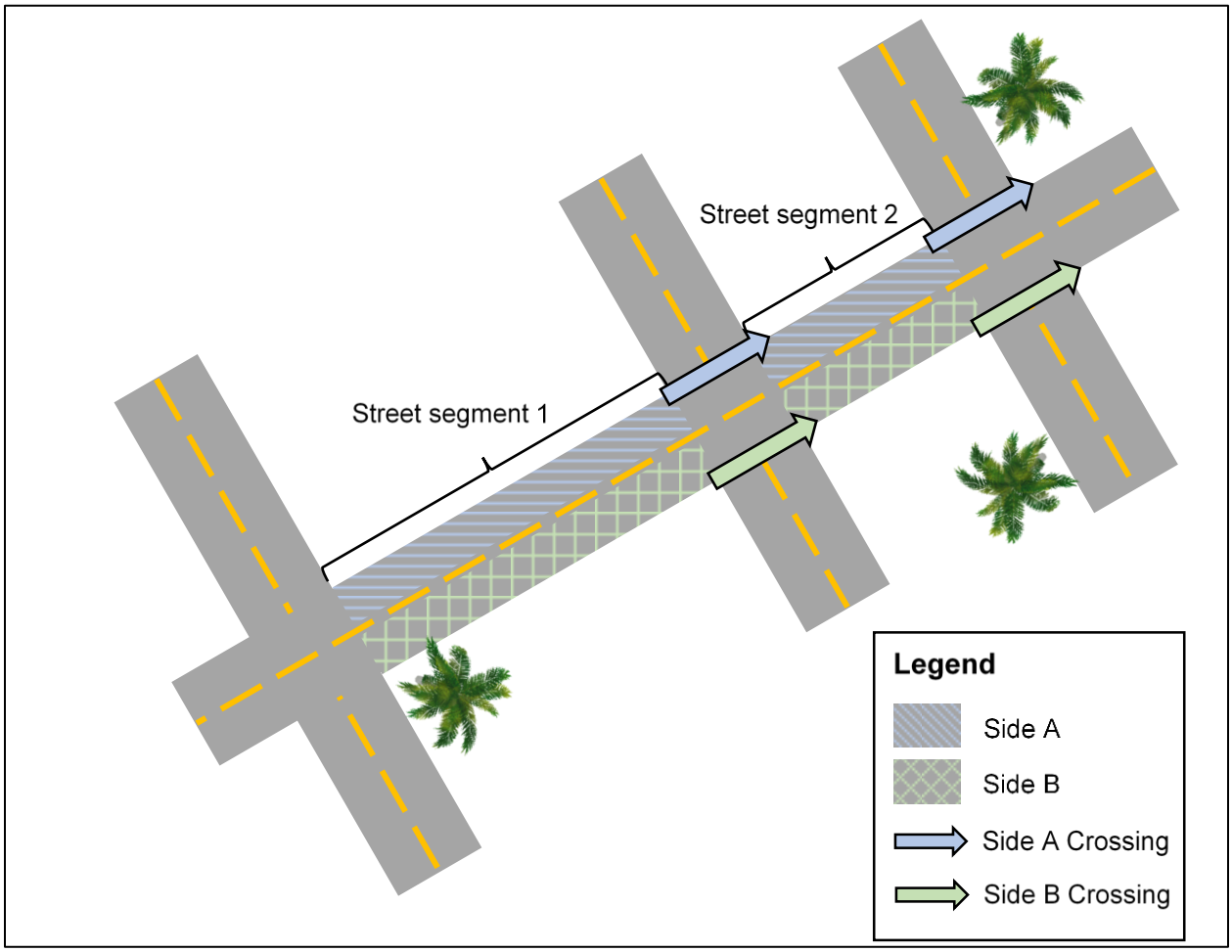


Figure 5. Image of adjoining street segments and their corresponding street crossings

Within each sampled estate, two "seed" segments were randomly selected. From each seed segment, an adjoining street segment was selected with random direction to create a route. Adjoining street segments were added to the route until the length of selected segments added up to approximately 15% of the total street length in the estate. If an adjoining segment was not available (e.g. dead end, estate boundary), a new seed segment was randomly selected and an additional route was created. Figure 6 depicts an example of adjoining street segments comprising two routes. The original sample consisted of 775 street segments, which covered 99.2 kilometers of street length (15.9% of the total street length in sampled estates).

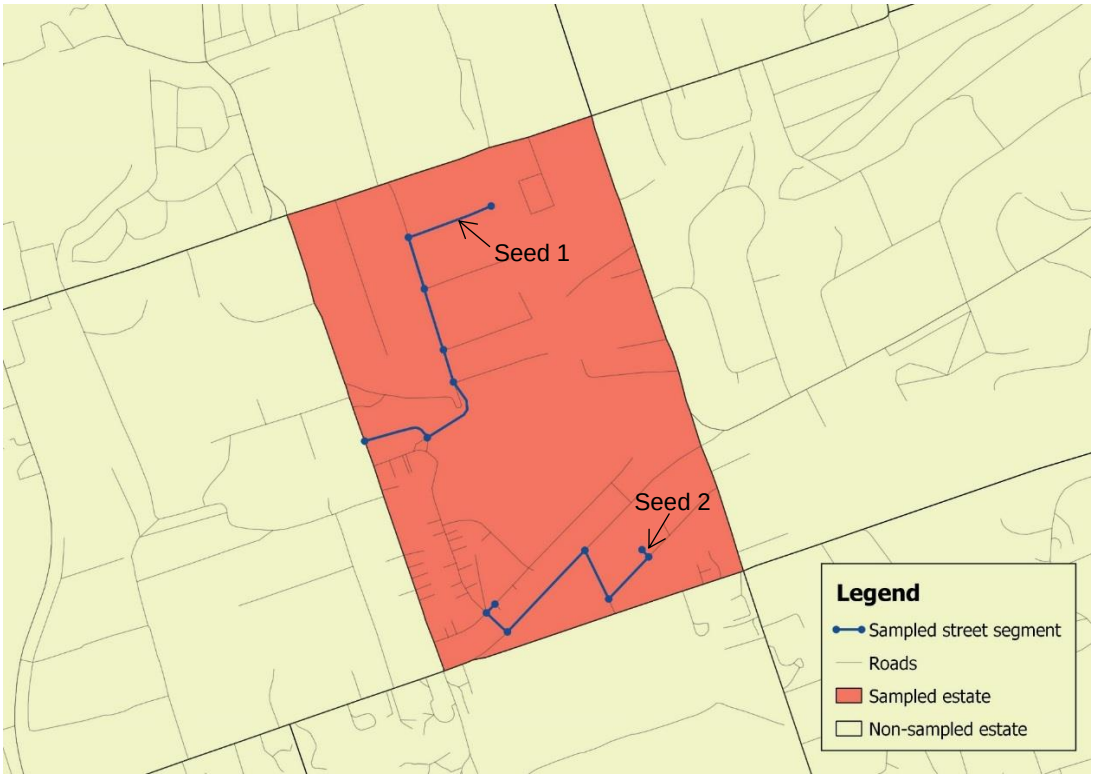


Figure 6. Map of sampled street segments (n=12) in a sampled estate using route-based methodology

The number of street segments (n=775) selected for auditing was not set a priori. Rather, the study team estimated that it would be feasible to complete audits on approximately 100 kilometers of street length with available resources in the allotted time frame. This equated to approximately 15% of the total street length in the 46 selected estates (629.4 km).

Audit Tool Selection

A literature review was conducted to identify existing tools for conducting observational audits of the built environment. Based on this review, several tools were identified, including the Built Environment Assessment Tool (28), the Irvine-Minnesota Inventory (29), the St. Louis checklist and analytic tools (30), and the Systematic Pedestrian and Cycling Environmental Scan (SPACES) instrument (31). Each was evaluated against the following criteria:

1) Content relevant to the setting and project goals
2) Feasible to complete given available resources and time constraints
3) Having a known point of contact who could provide assistance
4) Availability of training materials
5) Good reliability and validity of measures

After an in-depth review and evaluation of each tool, the Microscale Audit of Pedestrian Streetscapes (MAPS) was selected. The MAPS tool was developed by Active Living Research (ALR) (32, 33). MAPS assesses modifiable, microscale features of the environment relevant for physical activity and has been used in a variety of settings (criterion 1). An "abbreviated" version of the MAPS tool with 60 items was available (criterion 2). The developers of MAPS were willing to provide technical assistance to the study team as needed (criterion 3). A detailed MAPS training manual was available for our use, and the MAPS developers offered a training webinar for volunteer auditors (criterion 4). Studies have shown that the majority of MAPS items and subscales demonstrate moderate to excellent inter-rater reliability, and environmental attributes measured by MAPS are most strongly associated with transportation-related physical activity (criterion 5) (32, 34).

Based on input from colleagues at the USVI DOH, the MAPS-Abbreviated tool was adapted to maximize feasibility and relevance to the context of the USVI. Several locally relevant items were added (e.g. presence of beaches, ports and stray dogs), and other items were removed (e.g. building setback and height). The final MAPS-USVI tool included 46 items and consisted of six sections (see Appendix 4):

Section 1:	Land Use and Destinations	Section 4:	Sidewalk and Bike Path
Section 2:	Streetscape	Section 5:	Crossing
Section 3:	Aesthetics and Social	Section 6:	Comments

Training and Data Collection

Three CDC staff and 26 volunteers from the USVI DOH were trained to administer the MAPS-USVI tool. The three CDC staff were trained by ALR to be "gold standard" auditors. All USVI DOH volunteer auditors were required to participate in a training webinar presented by ALR. When the CDC team arrived in the USVI, they facilitated in-person refresher training workshops with volunteers on St. Croix and St. Thomas, followed by the completion of several practice audits in the field. The MAPS-Abbreviated training manual was updated to reflect modifications made to the tool and to incorporate pictures of the local context.

Data were collected in teams over a period of three weeks in May 2016. On each scheduled day of data collection, three teams of at least two trained observers (one or more USVI DOH volunteer plus one CDC staff per team) were assigned street segments for auditing. To be easily identified, all auditors wore red t-shirts displaying the logos of the USVI DOH and CDC and the goals of *Step It Up! The Surgeon General's Call to Action to Promote Walking and Walkable Communities* while in the field; shirts were provided by the USVI DOH. Maps of street segments were provided in paper and digital format to assist auditors in locating segments while in the field. Team members completed separate surveys for both sides of each sampled street segment, yielding two completed surveys for each audited segment. While the original MAPS tool includes several items that are assessed at the route-level (e.g. land use and destinations, street amenities, and aesthetic and social characteristics), for this project all items on the MAPS-USVI tool were assessed at the segment-level (see Figure 6 for a depiction of a route comprised of multiple adjacent street segments). Data were collected in paper format and then electronically entered into a database using an automated R program. Completed paper audits were scanned and electronically archived.

Inter-rater reliability was evaluated on 8.3% of audited street segments, with the second rating completed by an independent auditor within several days of the first. Inter-rater reliability was assessed for each individual item using the Cohen's κ-statistic for dichotomous and nominal variables and the weighted Cohen's κ-statistic for ordinal variables. Both measures were described using the following cutpoints: "good to excellent" (≥0.60), "moderate" (0.41–0.60), or "fair to poor" (≤0.40) (32, 35). Percent agreement was also calculated for all variables and was described using the following cutpoints: "good to excellent" (≥75%), "moderate" (60–74%), and "fair to poor" (<60%) (32, 35). These are the cutpoints that were used to assess reliability of the original MAPS tool (32). Appendix 5 includes results of the reliability tests for each dichotomous MAPS-USVI item, and Appendix 6 includes results for each nominal or ordinal item. The majority of items (60.3%) demonstrated good to excellent inter-rater reliability, 12.3% of items demonstrated moderate inter-rater reliability, and 27.4% demonstrated fair to poor inter-rater reliability. For percent agreement, 93% of items demonstrated good to excellent agreement, 3% demonstrated moderate agreement, and 4% demonstrated fair to poor agreement. Many items on the audit tool had a very low prevalence, which likely contributed to low reliability but high percent agreement (36).

Data Quality Assurance

Steps were taken to ensure high data quality at multiple stages of the project. During data collection, auditors reviewed all audit forms for completion before leaving a route and any missing responses were filled in. This resulted in very low percentages of missing data. Electronic scans of paper audit forms were processed to extract data using an automated program developed for this project in R. The program flagged ambiguities for manual verification and resolution by trained data entry specialists. This automated data entry process saved time and prevented potential errors associated with manual data entry. After data were entered and cleaned, data checks were performed including: ensuring that the database included a single entry for each completed audit form; verifying that values of each variable fell within the expected range; identifying observations for which more than one response option was selected for a single-answer question; and verifying skip patterns. If any discrepancies were noted, the paper audit form was referenced and corrections were made to the database when necessary.

Measures

Categorical measures were created for each item on the MAPS-USVI tool. For some sections, multiple items were combined to create additional variables and subscales, using the documentation provided by the original developers of MAPS as a guide. Appendix 7 includes a more detailed description of the following calculated variables and subscales:

- Land use mix (Residential only, Commercial only, Mixed use)
- All destinations (0, 1, 2+)
- Shops (0, 1+)
- Restaurants and entertainment (0, 1+)
- Institutions and services (0, 1+)
- Outdoor public recreation (0, 1+)
- Formal transit stop (0, 1+)
- Any formal or informal transit stop (None, At least one)
- Any transit amenities (None, At least one)
- Any traffic calming features (None, At least one)
- Aesthetics and social features:
  - Poorly maintained buildings (100% well maintained, 0–99% well maintained)
  - Well maintained landscaping (0–99% well maintained, 100% well maintained)
  - Any graffiti (None, A little or more)
  - Any litter (None, A little or more)
- Aesthetics and social subscales:
  - Positive aesthetic and social subscale (range: 0 to 4)
    - A higher score indicates better conditions
  - Negative aesthetic and social subscale (range: 0 to 4)
    - A higher score indicates worse conditions
  - Overall aesthetic and social subscale (range: -4 to 4)
    - Calculated by subtracting the negative subscale from the positive subscale
- Sidewalk quality features (Figures 7 and 8):
  - Sidewalk continuity (Not continuous, Continuous)
  - Any buffer (None, Buffer or street parking, Buffer and street parking)
  - Shade from trees or awnings (Little, Some, A lot)
  - Poorly maintained sidewalk (No major trip hazards, ≥1 major trip hazards)
  - Any permanent obstructions (None, One or more)
  - Any temporary obstructions (None, One or more)
- Sidewalk quality subscales:
  - Positive sidewalk quality subscale (range: 0 to 7)
    - A higher score indicates better quality
  - Negative sidewalk quality subscale (range: 0 to 3)
    - A higher score indicates worse quality
  - Overall sidewalk quality subscale (range: -3 to 7)
    - Calculated by subtracting the negative subscale from the positive subscale

- Any intersection control (None, At least one)
- Any signalization (None, At least one)
- Any crosswalk treatment (None, At least one)

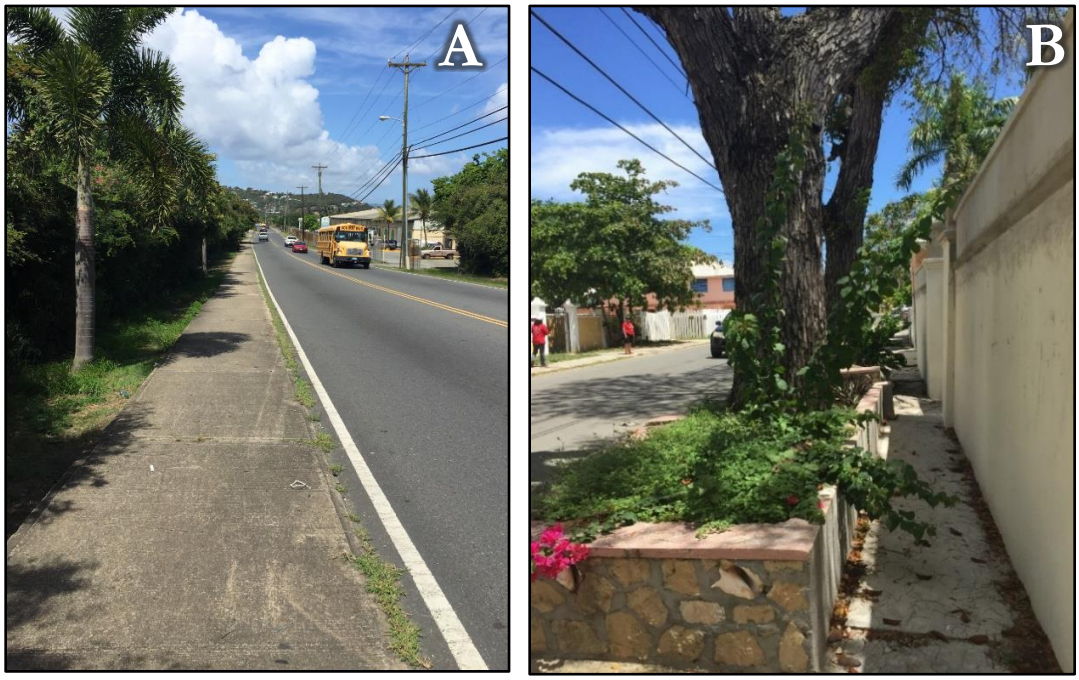


Figure 7. Images of (A) continuous and 3-5 feet wide sidewalk and (B) sidewalk with a buffer and shade from trees

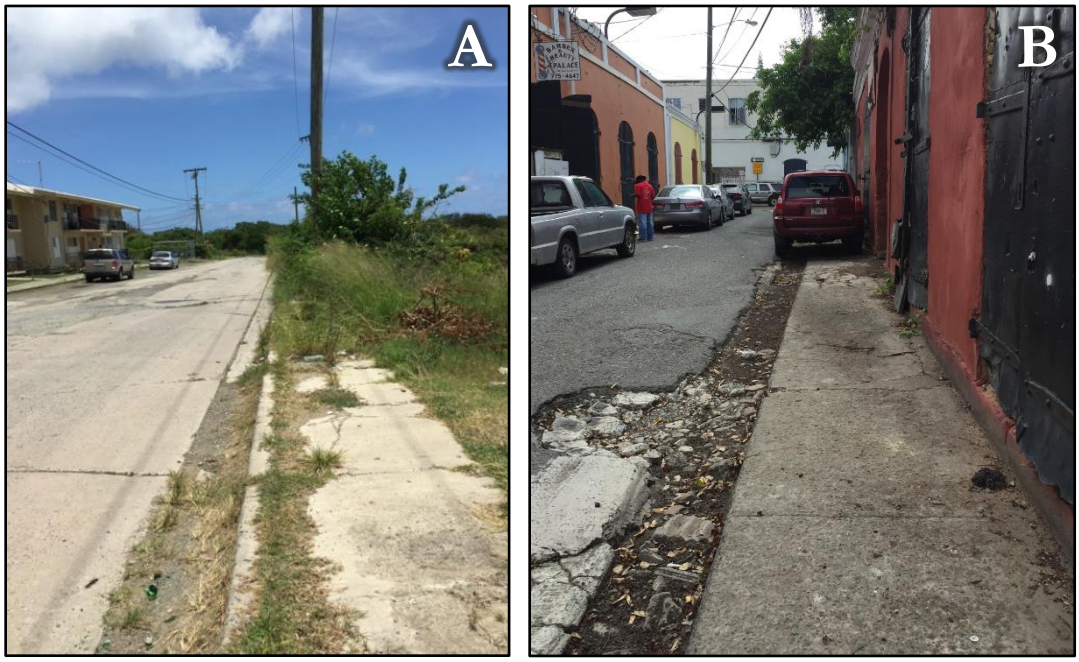


Figure 8. Images of (A) sidewalk with trip hazards and permanent obstructions and (B) sidewalk with temporary obstruction

Statistical Analysis

Statistical analyses were performed using the SAS callable SUDAAN Version 9.2 to account for the complex sampling design (Research Triangle Park, NC). Because the two sides of each sampled street segment (right and left) were audited separately, the street segment side was the unit of analysis; in other words, two observations for each street segment were included in the final sample. For each variable, descriptive characteristics (e.g. proportions or mean values) were calculated along with 95% confidence intervals (CIs). Raw and weighted values are reported.

Length-based weights were constructed to account for the following factors:

a) probability of estate selection and percentage of total street length audited per estate,
b) length (km) of each street segment,
c) percentage of street length found to be "out-of-scope" and,
d) post-stratification to ensure weights add up to the total street length in the sampling frame.

Additional details on the procedures to construct these weights are included in Appendix 8. Results weighted by segment length can be interpreted as follows:

- The proportion of road length in the sampling frame with a given feature present;
- The mean score across road length in the sampling frame.

Sample

In total, audits were completed on 1,114 street segments (Table 1). During data collection, 21.1 kilometers of originally sampled street length were not audited for the following reasons: street was private (10.0 km), street did not exist (3.8 km), street was not accessible (4.9 km), street was included twice in the sample (0.7 km), field error (0.3 km), and other unknown reasons (1.4 km) (Figure 3). An additional 14.8 kilometers of street length were added to the sample in the field; this resulted from following the field protocol of auditing a street segment to the nearest intersection, which occasionally required extending a segment beyond the GIS-derived endpoint. Thus, our final audited sample covered a total of 94.6 kilometers of street length, which was 93.8% of street length in the modified sample (Figure 3). Of the 1,114 audited street segments,

31.2% were on St. Croix, 11.9% were on St. John, and 56.9% were on St. Thomas. These segments were weighted to represent the 1,156 kilometers of street length covered in the sampling frame, of which 52.1% was on St. Croix, 5.3% was on St. John, and 42.6% was on St. Thomas.

Results

Throughout the following section, results are referenced from Tables 2-7. These tables are organized by each section of the audit tool (i.e., land use and destinations; streetscape; aesthetics and social; sidewalks and bike paths; and crossings). Tables titled "a" provide the results obtained directly for each item on the audit tool. Tables titled "b" provide the accompanying calculated variables for that section. Where relevant, tables titled "c" provide the accompanying calculated subscales for that section.

Land Use and Destinations

Communities with a mix of land uses, such as when residences are located close to places like schools, restaurants, or parks, encourage walking because people are more likely to walk to a destination if it is close to their home (37, 38). The majority (85.5%) of street length in the USVI was residential use only, and 3.1% had a mix of residential and commercial uses (Table 2b). Different residential uses included single family houses (64.2%), multi-unit homes (28.9%), apartments or condominiums (7.5%), and apartments above street retail (0.6%) (Table 2a). In terms of destinations, over three-quarters (78.2%) of street length had no walkable destinations (Table 2b). When one or more destination was present, the prevalence ranged from 6.0% of street length having restaurants and entertainment to 11.1% having institutions and services. Public beaches were accessible on 4.2% of street length (Table 2a). Shopping centers were infrequently observed, with 0.1% of street length having an open-air market, 0.7% having a shopping mall, and 1.7% having a strip mall (Table 2a). Additional data on land use and destinations can be found in Tables 2a and 2b.

Key Results: Land Use and Destinations

- 85.5% of street length was **residential use only**.
- 3.1% of street length had a **mix of residential and commercial uses**.
- 78.2% of street length had **no walkable destinations**.
- 4.2% of street length had access to **public beaches**.

Streetscape

The streetscape includes features of the roadway that have been shown to influence walking, including road width, access to public transit, traffic calming features, lighting, and amenities. The majority of street length (94.4%) had two traffic lanes (Table 3a). In terms of public transit, 10.7% of street length had at least one formal or informal transit stop (Table 3b). Formal transit stops were accessible on 4.8% of street length (Table 3b) and informal places to catch transit were accessible on 8.8% of street length (Table 3a). When considering amenities at formal transit stops, 39.1% had a bench, 39.1% had a covered shelter, and none had a bus schedule available.

In the USVI, 72.5% of street length had no traffic calming features (Table 3b). Speed humps were the most common traffic calming feature, present on approximately a quarter of street length (23.9%) (Table 3a). Other traffic calming features included traffic calming signs (4.4%), traffic calming circles (0.1%), and speed tables (0.1%). No curb extensions were observed.

In terms of street lighting, 46.7% of street length in the USVI had no lighting, 50.8% had some lighting, and 2.4% had ample lighting (Figure 9). Most (92.1%) of the street length had no street amenities, which included building overhangs for shelter, trash bins, benches or other places to sit, bicycle racks, information booths, or hawkers/peddler/carts. The prevalence of individual street amenities ranged from 0% of street length having bicycle racks, lockers, compounds, or docking stations to 3.1% having trash bins. Additional data on streetscape features can be found in Tables 3a and 3b.

Key Results: Streetscape

- 10.7% of street length had at least one formal or informal **bus stop** present.
    - **Formal** bus stops: 4.8% of street length.
    - **Informal** bus stops: 8.8% of street length.
- Among street length with a formal bus stop, 39.1% had a **bench and shelter** and none had a bus **schedule** available.
- 72.5% of street length had no **traffic calming features**.
    - 23.9% of street length had **speed humps**.
- 46.7% of street length had no **lighting**, 50.8% had some lighting, and 2.4% had ample lighting.

Figure 9. Examples of none (A), some (B), and ample (C) street lighting.

Aesthetics and Social

Relating to aesthetic and social characteristics of the environment, positive and negative attributes that impact walkability were assessed. In terms of positive attributes, 28.6% of street length had pleasant hardscape features, which could include art or fountains, 45.4% had softscape features like gardens, 18.3% of street length had well maintained landscaping on 100% of its length, and 41.0% of street length had natural bodies of water (Tables 4a and 4b). In terms of negative attributes, 58.6% of street length had less than 100% of its buildings well maintained, 5.2% of street length had stray or unleashed dogs present, 3.9% of street length had a little or

more graffiti, and 52.6% of street length had a little or more litter. The mean positive aesthetics and social subscale score was 1.33 and the mean negative aesthetics and social subscale score was 1.20, resulting in an overall mean aesthetics and social subscale score of 0.15 (Table 4c). Additional data on aesthetics and social characteristics can be found in Tables 4a, 4b, and 4c.

Key Results: Aesthetics and Social

- Positive attributes
  - 28.6% of street length was found to have pleasant **hardscape** features which could include art or fountains.
  - 45.4% had **softscape** features like gardens.
  - 18.3% of street length had **well maintained landscaping** on 100% of its length.
  - 41.0% of street length had **natural bodies of water**.
- Negative attributes
  - 58.6% of street length had less than 100% of its **buildings well maintained**.
  - 5.2% of street length had **stray dogs**.
  - 3.9% of street length had a little or more **graffiti**.
  - 52.6% of street length had a little or more **litter**.
- The overall mean score on the aesthetics and social subscale was 0.15.

Sidewalks and Bike Paths

The presence of a continuous network of sidewalks and bike paths makes it easier and safer for people to use more active modes of transportation, like walking and bicycling. On the MAPS-USVI audit tool, a sidewalk was categorized as "continuous" if it extended the entire length of an audited street segment and "not continuous" if it only covered part of the street length or had large gaps. In the USVI, 4.3% of street length had a continuous sidewalk, 7.0% had a sidewalk that was not continuous, and 88.6% had no sidewalk (Table 5a). Among street length with a sidewalk, 6.4% had a majority of sidewalk that was greater than 5 feet in width and 10.5% had a buffer separating the sidewalk from the roadway. One or more major trip hazards were identified

on 29.0% of street length with a sidewalk (Table 5b). In addition, one or more permanent obstructions (e.g. signs, kiosks, and shops) were identified on 3.3% of street length with a sidewalk and one or more temporary obstructions (e.g. trash cans, parked cars, shops) were identified on 28.4% of street length with a sidewalk. The mean positive sidewalk quality subscale score was 2.75 and the mean negative sidewalk quality subscale score was 0.61, resulting in an overall mean sidewalk quality subscale score of 2.16 (Table 5c). Across the USVI, bicycle lanes were not observed on any streets and bicycle signage was present on 0.1% of street length (Table 5a). Additional data on sidewalks and bike paths can be found in Tables 5a, 5b, and 5c.

Key Results: Sidewalks and Bike Paths

- 4.3% of street length had a **continuous sidewalk**, 7.0% had a sidewalk that was not continuous, and 88.6% had no sidewalk.
- Among street length with a sidewalk,
    - 6.4% had a majority of sidewalk that was greater than 5 feet in **width.**
    - 10.5% had a **buffer** present separating the sidewalk from the roadway.
- The overall mean score on the **sidewalk quality** subscale was 2.16.
- **Bicycle lanes** were not identified on any streets.
- 0.1% of street length had **bicycle signage**.

Crossings

The audit assessed the quality of street crossings when present at the end of each segment. See Figure 5 for an example of two adjoining segments and their corresponding street crossings. Almost half (47.9%) of street segments had a street crossing (Table 6a). Of the street length with a crossing, 15.8% had some kind of intersection control (Table 6b). This ranged in prevalence from 0% having traffic circles to 9.5% having stop signs (Table 6a). None of the crossings took place on an overpass, underpass, or bridge. Of the street length with a crossing, 2.7% had pedestrian signalization (Table 6b), ranging from 0% having a countdown signal or bicycle signal to 2.7% having push buttons (Table 6a). In terms of accessibility, 6.1% had pre-crossing ramps and 6.7% had post-crossing ramps that lined up with the crossing. Tactile paving was

present on 1.3% and any form of crosswalk treatment was identified on 6.2% (Table 6b), with marked crosswalks present on 6.1% and high visibility striping present on 2.6% (Table 6a). Additional details regarding crossing data can be found in Tables 6a and 6b.

Key Results: Crossings

- 47.9% of street segments had an **intersection crossing**.
- Among intersection crossings,
    - 15.8% had some kind of **intersection control**.
    - 2.7% had **pedestrian signalization**.
    - 6.2% had some **crosswalk treatment**.

Figure 10. Example of a street crossing with intersection control, pedestrian signalization, a marked crosswalk, and high visibility striping.

Limitations and Strengths

The results of this project are subject to at least three limitations. First, GIS data were used to generate the sampling frame of roads. This technology allowed the sample to be drawn remotely; however, in the field, teams found that approximately 19% of road length in the original sample did not exist or was private or inaccessible. Second, some of the measures on the audit tool are subjective and may have been interpreted differently by different auditors. To minimize the impact of this, definitions were developed for each item on the tool and each auditor underwent multiple training sessions and conducted practice audits. Moreover, the MAPS is a validated tool and most of its items have demonstrated moderate to excellent agreement in this setting and in previous studies (32). Third, the weighting procedure makes several assumptions that cannot be verified. Although routes were randomly selected, weights were constructed using individual segment length. Thus, it was assumed that there were no confounding factors in generalizing from a route-based sampling strategy to length-based weighted results. Certain types of segments may have been more likely to be included in the sample as part of a route (e.g. those that were more centrally located among a cluster of streets), but it is not possible to test whether such segments differed from others. Moreover, the weights assume that environmental features were uniformly distributed or accessible along the length of each street segment; this was likely not always true, particularly for features located at a single point (e.g. transit stop) on street segments that were longer in length. However, this is unlikely to significantly bias our findings, since the majority of street segments in our sample were relatively short in length; the median length was 0.11 kilometers (0.07 miles) and 98.6% of street segments were less than 0.8 kilometers (0.5 miles) long.

There were also a number of strengths. First, this project demonstrated how collaboration between multiple sectors can be leveraged to promote walking and walkability in a local context. Data collection was made possible by the combined expertise and resources provided by the CDC, Active Living Research, and the USVI Department of Health. The involvement of local key informants from a variety of sectors strengthened the project's methods and provided context for data interpretation and development of practical recommendations. A second strength was the use of a comprehensive and validated audit tool, which allowed the team to more accurately estimate the prevalence of a wide range of community design features related to physical activity

in the USVI. Third, this was one of the first walkability audits to be implemented at such a large magnitude, producing representative estimates across a state or territory (39). Moreover, it was the first to be done in a US territory, providing valuable data for an area with limited resources available for conducting health-related surveillance. Finally, the data collected in this project provide a benchmark upon which partners in the USVI can build and set goals for improvement.

Potential Action Steps

Based on the findings presented above, the following are potential steps that the USVI DOH could take in partnership with key stakeholders to improve walkability and promote walking in the territory. These recommendations have been structured using the five goals outlined in *Step It Up! The Surgeon General's Call to Action to Promote Walking and Walkable Communities* as a framework (5). In determining action steps and implementation strategies, issues such as feasibility, available resources, needs of different sectors, and acceptability in USVI communities could be considered.

Goal 1. Make walking a territory-wide priority in the USVI

To help make the USVI more walkable, it will be integral for the USVI DOH to facilitate collaboration with key partners from different sectors such as public works. The process of making communities more walkable often requires policy levers, planning mechanisms, and resource allocation that fall beyond the jurisdiction of public health. Therefore, the role of the USVI DOH in this effort will primarily be to convene partners, to educate key stakeholders, and to collect, interpret, and disseminate relevant data. By inviting representatives from multiple sectors to participate in the key informant interviews as part of this project, the USVI DOH has already started making progress towards mobilizing partners. Results from the key informant interviews also identified the need for more cross-sector collaboration to promote walkability, as well as increased awareness of physical activity in general and the role that different sectors can play in improving walkability. The USVI DOH can continue to play a role in forming and convening partnerships to help mobilize community and cross-sector collaboration to implement many of the recommendations that follow.

In addition, residents of the USVI can also help make the territory more walkable in a variety of ways. For example, this audit found that some litter was present on over half of the street length in the USVI. To address this issue, the USVI DOH can help organize group cleanup efforts and residents of the USVI can volunteer to clean up places where people walk in their neighborhoods.

To address Goal 1, the USVI DOH can work with key partners to:

- Convene and support an Active Living Coalition or similar cross-sector group to promote walking and walkable communities throughout the USVI.
- Help mobilize cleanup efforts to make places where people walk safe and attractive.

Goal 2. Design communities that make it safe and easy to walk for people of all ages and abilities

Designing streets, sidewalks, and communities that encourage pedestrian activity will make it safer and easier for all users in the USVI to walk and wheelchair roll. From this audit, several design features of existing streets and sidewalks were identified as potential opportunities to enhance safety for walkers and promote walking. As an important first step, these data can be shared with stakeholders and decision makers to help inform the prioritization and planning of strategies to improve walkability. To help facilitate these changes in the USVI, it will be essential for the DOH to collaborate closely with key partners in relevant sectors. Together, a cross-sector group can identify priority areas and develop a long-term Community Action Plan that incorporates active design principles and specific policies to improve walkability. The USVI DOH can support this collaborative effort by providing data and evidence using a public health perspective.

Streets in the USVI can be designed to provide safe and easy places that encourage walking for people of all ages and abilities (40, 41). Almost three quarters of street length in the USVI had no traffic calming features and few crossings had any kind of intersection control, signalization, or crosswalk treatment. Traffic safety in the territory can be enhanced by using design features that decrease vehicle speeds and increase the number of safe pedestrian crossings (11, 42, 43). In addition, over one quarter of street length had temporary obstructions and few crossings had ramps. Sidewalks and streets in the USVI can be better designed to address barriers for all users including people with disabilities (5). The USVI and communities within the territory can adopt policies, such as Complete Streets (41, 44, 45), that support the routine design and operation of

streets that are safe for pedestrians and other users regardless of age, ability, or mode of transport.

In addition to street design, regular maintenance of sidewalks in the USVI can improve their quality and safety. Poorly maintained sidewalks with cracks, holes, or uneven surfaces pose tripping hazards. In the USVI, trip hazards were identified on 29.0% of street length with a sidewalk. Other hazards, such as overgrown vegetation and storm runoff, may force pedestrians into high-speed traffic. Permanent and temporary obstructions were commonly identified on sidewalks in the USVI. Keeping sidewalks free from hazards is an important long-term commitment to ensure the safety of those who use them. The aesthetic appeal of sidewalks can also be improved through the use of street lighting and landscaping (e.g., street trees, planters) (46). This audit identified that approximately half of street length in the USVI had no street lights or softscape features such as gardens, illustrating opportunities for improving the aesthetic appeal of streets for walkability.

To promote walking, communities can create plans and zoning policies that encourage residential areas to be located within walking distance of stores, jobs, schools, or similar locations, as well as develop an adequate public transit system. With little street length in the USVI being mixed use and less than a quarter of street length having walkable destinations, opportunities exist for improved community design that promotes walking. Developers can be encouraged to build residences, worksites, schools, parks, businesses, shopping districts, and health care facilities within walking distance of each other (37, 38). Ensuring residents are connected to destinations through an adequate public transit system is also an important element of community design, since use of public transit is associated with increased walking (23, 47-53). Formal transit stops were accessible on less than 5% of street length in the USVI, highlighting the potential for improved access to public transit.

The USVI DOH can share the findings from this audit with relevant stakeholders to encourage their involvement. For example, partners from public works can help keep existing sidewalks and other places to walk free from hazards. Other key partners can assist by implementing lighter, quicker, cheaper (LQC) projects to reclaim public spaces for pedestrian use (54). Results

presented in this report can help identify starting points for such pilot projects. Examples of LQC projects include temporary curb extensions and marked crosswalks in Austin, Texas (Figure 10) and a pop-up protected bikeway in Oakland, California that was implemented on Bike to Work Day (Figure 11). Such short term projects can help generate community buy-in for more permanent projects or policies in the future.

To address Goal 2, the USVI DOH can work with key partners to:

- Facilitate collaboration between key sectors to identify priority areas and develop a long-term Community Action Plan that incorporates active design principles and specific policies to improve walkability using a public health perspective.
- Strengthen existing informal relationships and create new formal partnerships with the Department of Public Works.
- Improve traffic safety on streets and sidewalks and keep existing sidewalks and other places to walk free from hazards.
- Design streets, sidewalks, and crosswalks that encourage walking for people of all ages and abilities.
- Encourage the adoption or modification of community planning, land use, development, and zoning policies and plans that support walking for people of all ages and abilities.

Figure 10. Example of a lighter, quicker, cheaper project with curb extensions and marked crosswalks in Austin, Texas (55)

Figure 11. Example of a lighter, quicker, cheaper project with a pop-up protected bikeway in Oakland, California (56)

Goal 3. Promote programs and policies to support walking where people live, learn, work, and play

Programs and policies that support walking are essential components of a comprehensive approach to promoting walking and walkable communities. While information about the existence of policies and programs in the USVI that support walking was not collected as part of the audit, several key informants spoke about the importance of community programs to encourage walking. One of the overarching themes identified from these interviews was that only a limited number of community programs to promote physical activity and walking are in place and that more are needed.

Schools offer an ideal environment to promote physical activity among children throughout the day. Despite this, few programs currently exist in the USVI, particularly those that emphasize activity outside the regular school day. Schools can provide opportunities for students to walk through walk-to-school programs such as Safe Routes to School. In addition, schools can promote walking among community residents through formal shared use agreements that make school gyms, playgrounds, sport fields, and tracks available after school, on weekends, and during the summer (57, 58).

Employers such as the USVI DOH can implement worksite health programs that promote physical activity and walking among their employees. Currently, a wellness program exists for USVI government employees. As part of such wellness programs, worksites can provide access to places to walk, and they can implement programs and policies that encourage and make it possible for employees to walk and be physically active (59). Low-cost options, like promoting walking meetings, walking breaks, and the use of stairs and nearby paths, can be used by most worksites to increase access.

Other community locations and organizations can also promote walking. Existing programs in the USVI, such as the Firewalkers and the recreational activities coordinated by the Department of Sports, Parks and Recreation, are model examples and additional efforts should be encouraged

to meet community needs. Locations and organizations can provide access to safe places, such as walking trails, indoor facilities, parks, and playground. Organizations can also provide access to walking programs. These programs can accommodate a range of interests and abilities. For example, organizations can offer programs that are specifically designed for people with arthritis who may be concerned about how to safely be physically active (60-62).

To address Goal 3, the USVI DOH can work with key partners to:

- Encourage the implementation of Safe Routes to School or similar walk-to-school programs.
- Provide USVI DOH employees access to facilities, locations, clubs and programs to support walking.
- Encourage safe and convenient access for all users to community locations that support walking, such as walking trails, parks, recreational facilities, and college campuses.
- Promote walking programs that address barriers and set up walking groups, buddy systems, and other forms of social support for walking.

Goal 4. Provide information to encourage walking and improve walkability

The USVI DOH can provide information to encourage walking and improve walkability in a variety of ways. The findings from this project can be shared widely with local partners in an effort to increase knowledge about walkability in the territory. Results of this project have already been shared with multiple USVI decision makers, including three DOH Assistant Commissioners who expressed interest in using the collected data to facilitate change. Sharing these data more broadly with additional sectors and decision makers will raise awareness about barriers to walkability in the territory and facilitate collaboration.

Interdisciplinary training can serve to educate local partners about how they can promote walking through their own professional roles. For example, urban and regional planners can be trained to analyze and use physical activity and health data to inform the design of more

walkable communities (63, 64). Public health professionals can also be educated on the principles of transportation and city planning, as well as the availability and use of data resources from multiple disciplines (65, 66). The USVI DOH is working with the CDC to plan a Walkability Institute that will bring together professionals and decision makers from several sectors, including public works, transportation and transit authority, education, parks and recreation, travel and tourism, and elected officials. Attendees will be trained on the development and implementation of tools and policies for creating more walkable communities across the territory. Beyond this, additional opportunities for professional training and education may be pursued, such as the America Walks Walking College (67) and Smart Growth America's free technical assistance workshops (68).

To address Goal 4, the USVI DOH can work with key partners to:

- Share findings of this project widely with local partners while also educating about walkability.
- Facilitate interdisciplinary training for local decision-makers and staff of relevant partner agencies (e.g., Department of Public Works) on how they can promote walkability.
- Apply for additional opportunities to receive training and technical assistance.

Goal 5. Fill surveillance, research, and evaluation gaps related to walking and walkability

To improve the walkability of communities, decision makers need information to help them plan, implement, and evaluate strategies. Through this project, the USVI DOH has collected valuable information to aid in this process and help support proposed strategies. These data can be shared widely with local partners. Given the large volume of data presented in this report, developing more concise communications products such as one-pagers that are potentially more effective with partners and decision makers may warrant consideration.

Surveillance of physical activity, chronic diseases, and walkability provides useful data to plan, implement, and evaluate public health practice. These data can also be used to support decisions about how to allocate resources and to evaluate various intervention strategies. This project collected important baseline data on walkability in the USVI. However, ongoing surveillance would be beneficial to monitor environmental supports for physical activity over time. This could be done through repeated walkability audits on a semi-regular basis (e.g., every 5 years) which could be scaled for feasibility purposes based on local needs and priorities. In addition, surveillance of physical activity and chronic diseases provides information on the behavioral and health impacts of environmental supports. The Behavioral Risk Factor Surveillance System (BRFSS) monitors both physical activity and chronic disease status and was last conducted in the USVI in 2010. Plans are currently underway to resume its implementation in the territory, which is an important surveillance effort.

During the planning and implementation of strategies intended to promote walking, evaluation findings can help decision makers identify and correct problems in a continuous improvement cycle. Evaluation results are also often needed to maintain funding and justify the continued existence of a program. As the USVI DOH pursues strategies for improving walkability with key partners, it will be important to evaluate these initiatives.

To address Goal 5, the USVI DOH can work with key partners to:

- Make user-friendly data easily available to decision makers.
- Continue repeated walkability audits on a regular basis (e.g., every 5 years).
- Conduct surveillance on physical activity and chronic disease on a regular basis (e.g., Behavioral Risk Factor Surveillance System).
- Include plans and resources for evaluation when planning interventions.

Key Recommendations: 5 Goals

1. Make walking a territory-wide priority in the USVI.
2. Design communities that make it safe and easy to walk for people of all ages and abilities.
3. Promote programs and policies to support walking where people live, learn, work, and play.
4. Provide information to encourage walking and improve walkability.
5. Fill surveillance and evaluation gaps related to walking and walkability.

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Acknowledgements:

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Disclaimer

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Tables

Table 1. Characteristics of Street Segment Sample, US Virgin Islands, 2016

	Unweighted				Weighted by Street Length	
	n*	**%**	**km†**	**%**	**n§**	**%**
Total	1114	100	94.6	100	1156	100
Island						
St. Croix	348	31.2	34.6	36.6	602	52.1
St. John	132	11.9	7.7	8.2	61	5.3
St. Thomas	634	56.9	52.3	55.3	492	42.6
Population density						
Low	702	63.0	69.2	73.2	911	78.8
Medium	96	8.6	8.0	8.5	136	11.8
High	316	28.4	17.4	18.4	109	9.4
Population reach						
High	892	80.1	65.5	69.2	810	70.1
Neighboring	222	19.9	29.1	30.8	345	29.9
Number of schools						
0	588	52.8	51.6	54.6	850	73.6
1	360	32.3	24.5	25.9	208	18.0
2	110	9.9	11.1	11.8	70	6.1
3	56	5.0	7.3	7.7	27	2.4

* Represents the unweighted number of audited street segments.
† Represents the unweighted number of kilometers of audited street length.
§ Weighted to represent the number of kilometers of street length in the sampling frame.

Table 2a. Prevalence of Land Use and Destination Features among Street Segments, US Virgin Islands, 2016

	Unweighted (n = 1,114)			Weighted by Street Length (n = 1,156)		
	n*	**%†**	**(95% CI)**	**n§**	**%†**	**(95% CI)**
Land use						
Residential	905	81.4	(79.0–83.6)	988	85.6	(77.2–91.2)
Commercial	207	18.6	(16.4–21.0)	166	14.4	(8.8–22.8)
Types of residential use¶						
Single family houses	611	54.8	(51.9–57.8)	742	64.2	(55.0–72.5)
Multi-unit homes	293	26.3	(23.8–29.0)	334	28.9	(19.8–40.1)
Apartments or condominiums	92	8.3	(6.8–10.0)	87	7.5	(4.4–12.4)
Apartments above street retail	13	1.2	(0.7–2.0)	7	0.6	(0.2–1.6)
N/A	303	27.2	(24.7–29.9)	250	21.7	(15.2–29.9)
Destinations						
Fast food restaurant						
0	1087	97.7	(96.6–98.4)	1116	96.9	(93.8–98.4)
1	21	1.9	(1.2–2.9)	30	2.6	(1.1–5.8)
2+	5	0.4	(0.2–1.1)	6	0.5	(0.2–1.6)
Sit-down restaurant						
0	1058	95.1	(93.6–96.2)	1101	95.4	(92.1–97.3)
1	46	4.1	(3.1–5.5)	44	3.8	(2.0–7.2)
2+	9	0.8	(0.4–1.5)	10	0.8	(0.4–1.9)
Grocery/supermarket						
0	1103	99.2	(98.5–99.6)	1140	99.1	(98.2–99.5)
1	9	0.8	(0.4–1.5)	11	0.9	(0.5–1.8)
2+	0	0.0	--	0	0.0	--
Convenience store						
0	1089	97.8	(96.8–98.6)	1122	97.1	(95.3–98.2)
1	24	2.2	(1.4–3.2)	34	2.9	(1.8–4.7)
2+	0	0.0	--	0	0.0	--
Café or coffee shop						
0	1104	99.3	(98.6–99.6)	1149	99.4	(98.4–99.8)
1	8	0.7	(0.4–1.4)	6	0.6	(0.2–1.6)
2+	0	0.0	--	0	0.0	--
Bank or credit union						
0	1101	98.9	(98.1–99.4)	1140	98.7	(96.8–99.4)
1	12	1.1	(0.6–1.9)	16	1.3	(0.6–3.2)
2+	0	0.0	--	0	0.0	--

Table 2a. (*Continued)* Prevalence of Land Use and Destination Features among Street Segments, US Virgin Islands, 2016

	Unweighted (n = 1,114)			Weighted by Street Length (n = 1,156)		
	n*	**%†**	**(95% CI)**	**n§**	**%†**	**(95% CI)**
Hotel						
0	1100	98.8	(98.0–99.3)	1141	98.7	(97.2–99.4)
1	13	1.2	(0.7–2.0)	15	1.3	(0.6–2.8)
2+	0	0.0	--	0	0.0	--
Drugstore/pharmacy						
0	1107	99.6	(98.9–99.8)	1132	98.1	(94.4–99.4)
1	4	0.4	(0.1–1.0)	9	0.7	(0.3–1.8)
2+	1	0.1	(0.0–0.6)	13	1.1	(0.2–8.2)
Health-related professional						
0	1092	98.2	(97.2–98.8)	1123	97.2	(93.9–98.7)
1	11	1.0	(0.5–1.8)	21	1.9	(0.6–6.0)
2+	9	0.8	(0.4–1.5)	11	1.0	(0.4–2.6)
Entertainment						
0	1100	98.9	(98.1–99.4)	1150	99.5	(98.7–99.8)
1	9	0.8	(0.4–1.5)	4	0.4	(0.1–1.1)
2+	3	0.3	(0.1–0.8)	2	0.1	(0.0–0.4)
Other service						
0	1023	92.0	(90.2–93.5)	1043	90.6	(84.9–94.2)
1	54	4.9	(3.7–6.3)	51	4.4	(2.3–8.2)
2+	35	3.1	(2.3–4.4)	58	5.0	(2.8–8.8)
Other retail						
0	1041	93.7	(92.1–95.0)	1078	93.7	(88.0–96.8)
1	44	4.0	(3.0–5.3)	53	4.6	(2.4–8.8)
2+	26	2.3	(1.6–3.4)	19	1.7	(0.7–4.0)
Places of worship						
0	1073	96.6	(95.3–97.5)	1110	96.4	(94.0–97.9)
1	35	3.2	(2.3–4.4)	39	3.4	(2.0–5.6)
2+	3	0.3	(0.1–0.8)	2	0.2	(0.0–1.3)
School						
0	1073	96.4	(95.1–97.4)	1119	97.1	(94.6–98.5)
1	40	3.6	(2.6–4.9)	33	2.9	(1.5–5.4)
2+	0	0.0	(0.0–0.0)	0	0.0	(0.0–0.0)

Table 2a. (*Continued)* Prevalence of Land Use and Destination Features among Street Segments, US Virgin Islands, 2016

	Unweighted (n = 1,114)			Weighted by Street Length (n = 1,156)		
	n*	**%†**	**(95% CI)**	**n§**	**%†**	**(95% CI)**
Indoor recreation						
0	1100	98.9	(98.1–99.4)	1124	98.0	(95.7–99.1)
1	11	1.0	(0.5–1.8)	19	1.7	(0.8–3.7)
2+	1	0.1	(0.0–0.6)	4	0.3	(0.0–2.5)
Outdoor pay recreation						
0	1106	99.5	(98.8–99.8)	1138	99.0	(97.1–99.7)
1	5	0.4	(0.2–1.1)	10	0.8	(0.2–2.8)
2+	1	0.1	(0.0–0.6)	2	0.2	(0.0–1.2)
Public park						
0	1070	96.6	(95.3–97.5)	1112	96.5	(94.0–98.0)
1	33	3.0	(2.1–4.2)	33	2.9	(1.6–5.2)
2+	5	0.5	(0.2–1.1)	7	0.6	(0.1–3.1)
Trail						
0	1097	98.8	(98.0–99.3)	1138	98.9	(97.5–99.5)
1	9	0.8	(0.4–1.6)	12	1.0	(0.5–2.2)
2+	4	0.4	(0.1–1.0)	1	0.1	(0.0–0.9)
Port						
0	1105	99.5	(98.8–99.8)	1153	99.9	(99.4–100)
1	6	0.5	(0.2–1.2)	2	0.1	(0.0–0.6)
2+	0	0.0	--	0	0.0	--
Beach						
Yes, with access	13	1.2	(0.7–2.0)	49	4.2	(1.3–13.1)
Yes, but without access	3	0.3	(0.1–0.8)	8	0.7	(0.1–3.4)
No, no beach	1098	98.6	(97.7–99.1)	1099	95.1	(86.8–98.3)
Pedestrian street or zone						
Yes	30	2.7	(1.9–3.8)	28	2.4	(1.3–4.2)
No	1081	97.3	(96.2–98.1)	1126	97.6	(95.8–98.7)
Shopping centers¶						
Shopping mall	4	0.4	(0.1–1.0)	8	0.7	(0.2–1.9)
Strip mall	21	1.9	(1.2–2.9)	19	1.7	(0.9–3.0)
Open-air market	2	0.2	(0.0–0.7)	2	0.1	(0.0–0.8)
None of the above	1085	97.4	(96.3–98.2)	1128	97.6	(96.0–98.5)

Abbreviations: CI = Confidence Interval

* Represents the unweighted number of street segments. Columns may not add up to the total n = 1,114 due to missing data.

† Percentages may not add up to 100% due to rounding.
§ Weighted to represent the number of kilometers of street length in the sampling frame. Columns may not add up to the total n = 1,156 due to missing data.
¶ Column percentages may add up to more than 100% because multiple response options were possible.

Table 2b. Calculated Land Use and Destination Features among Street Segments, US Virgin Islands, 2016

	Unweighted (n = 1,114)			Weighted by Street Length (n = 1,156)		
	n*	**%†**	**(95% CI)**	**n§**	**%†**	**(95% CI)**
Land use mix						
Residential only	905	81.2	(78.8–83.4)	988	85.5	(77.1–91.1)
Commercial only	162	14.5	(12.6–16.7)	133	11.5	(6.4–19.9)
Mixed use	47	4.2	(3.2–5.6)	35	3.1	(1.9– 4.8)
All destinations						
0	838	77.0	(74.4–79.4)	877	78.2	(71.6–83.6)
1	179	16.5	(14.4–18.8)	148	13.2	(9.8–17.5)
2+	71	6.5	(5.2–8.2)	97	8.6	(5.8–12.7)
Shops						
No	1025	92.5	(90.8–3.9)	1055	92.1	(86.2–95.6)
Yes	83	7.5	(6.1–9.2)	91	7.9	(4.4–13.8)
Restaurants and entertainment						
No	1041	93.9	(92.3–95.1)	1081	94.0	(89.9–96.5)
Yes	68	6.1	(4.9–7.7)	69	6.0	(3.5–10.1)
Institutions and services						
No	1005	90.5	(88.7–92.1)	1022	88.9	(83.3–92.8)
Yes	105	9.5	(7.9–11.3)	127	11.1	(7.2–16.7)
Outdoor public recreation						
No	1043	94.5	(93.0–95.7)	1048	91.4	(85.1–95.2)
Yes	61	5.5	(4.3–7.0)	99	8.6	(4.8–14.9)

Abbreviations: CI = Confidence Interval

* Represents the unweighted number of street segments. Columns may not add up to the total n = 1,114 due to missing data.

† Percentages may not add up to 100% due to rounding.

§ Weighted to represent the number of kilometers of street length in the sampling frame. Columns may not add up to the total n = 1,156 due to missing data.

Table 3a. Prevalence of Streetscape Features among Street Segments, US Virgin Islands, 2016

	Unweighted (n = 1,114)			Weighted by Street Length (n = 1,156)		
	n*	%†	(95% CI)	n§	%†	(95% CI)
Number of traffic lanes present						
0	20	1.8	(1.2–2.8)	19	1.6	(0.5–5.5)
1	95	8.5	(7.0–10.3)	25	2.1	(0.9–5.1)
2	971	87.2	(85.1–89.0)	1091	94.4	(89.9–97.0)
3	4	0.4	(0.1–1.0)	1	0.1	(0.0–0.8)
4	22	2.0	(1.3–3.0)	14	1.2	(0.5–2.9)
5	2	0.2	(0.0–0.7)	6	0.5	(0.1–3.6)
6	0	0.0	--	0	0.0	--
7+	0	0.0	--	0	0.0	--
Percentage of road parking allowed on						
1-25%	124	11.2	(9.4–13.1)	100	8.7	(5.2–14.3)
26-50%	71	6.4	(5.1–8.0)	50	4.3	(2.9–6.3)
51-75%	92	8.3	(6.8–10.0)	100	8.7	(5.3–13.8)
76-100%	397	35.7	(32.9–38.6)	394	34.1	(22.4–48.2)
None	415	37.3	(34.5–40.2)	507	43.9	(31.2–57.5)
N/A	13	1.2	(0.7–2.0)	3	0.3	(0.1–1.1)
Number of public transit stops						
0	1070	96.2	(94.9–97.2)	1098	95.2	(92.0–97.1)
1	36	3.2	(2.3–4.5)	47	4.1	(2.3–7.2)
2+	6	0.5	(0.2–1.2)	9	0.7	(0.3–1.7)
Features at transit stops¶ **						
Bench	13	31.0	(18.5–47.0)	22	39.1	(25.7–54.4)
Covered shelter	13	31.0	(18.5–47.0)	22	39.1	(25.7–54.4)
Schedule	0	0.0	--	0	0.0	--
None of the above	29	69.0	(53.0–81.5)	34	60.9	(45.6–74.3)
Informal places to catch transit						
Yes	74	6.7	(5.4–8.3)	100	8.8	(5.2–14.7)
No	1031	93.3	(91.7–94.6)	1030	91.2	(85.3–94.8)
Traffic calming features¶						
Traffic calming signs	44	3.9	(3.0–5.3)	51	4.4	(2.8–6.8)
Traffic calming circles	4	0.4	(0.1–1.0)	1	0.1	(0.0–0.6)
Speed tables	4	0.4	(0.1–1.0)	1	0.1	(0.0–0.5)
Speed humps	166	14.9	(12.9–17.1)	277	23.9	(15.1–35.7)
Curb extension	1	0.1	(0.0–0.6)	0	0.0	(0.0–0.2)
Roll-over curb	59	5.3	(4.1–6.8)	65	5.7	(2.7–11.7)
None of the above	860	77.2	(74.6–79.6)	787	68.1	(56.8–77.6)

Table 3a (*Continued)*. Prevalence of Streetscape Features among Street Segments, US Virgin Islands, 2016

	Unweighted (n = 1,114)			Weighted by Street Length (n = 1,156)		
	n*	**%†**	**(95% CI)**	**n§**	**%†**	**(95% CI)**
Street lights						
None	575	51.9	(48.9–54.8)	537	46.7	(39.3–54.3)
Some	518	46.8	(43.8–49.7)	584	50.8	(42.9–58.7)
Ample	15	1.4	(0.8–2.2)	28	2.4	(0.7–8.2)
Street amenities¶						
Building overhangs for shelter	37	3.3	(2.4–4.6)	23	2.0	(1.0–3.9)
Trash bins	43	3.9	(2.9–5.2)	36	3.1	(1.9–5.0)
Benches or other places to sit	32	2.9	(2.0–4.0)	35	3.0	(1.7–5.3)
Bicycle racks, lockers, compounds, docking stations	0	0.0	--	0	0.0	--
Kiosks/information booths	1	0.1	(0.0–0.6)	3	0.3	(0.0–2.0)
Hawkers/shops/carts	20	1.8	(1.2–2.8)	23	1.9	(0.8–4.5)
None of the above	1013	90.9	(89.1–92.5)	1064	92.1	(88.6–94.5)

Abbreviations: CI = Confidence Interval

* Represents the unweighted number of street segments. Columns may not add up to the total n = 1,114 due to missing data.

† Percentages may not add up to 100% due to rounding.

§ Weighted to represent the number of kilometers of street length in the sampling frame. Columns may not add up to the total n = 1,156 due to missing data.

¶ Column percentages may add up to more than 100% because multiple response options were possible.

** Reported only for street segments with a public transit stop (n = 42).

Table 3b. Calculated Streetscape Features among Street Segments, US Virgin Islands, 2016

	Unweighted (n = 1,114)			Weighted by Street Length (n = 1,156)		
	n*	**%†**	**(95% CI)**	**n§**	**%†**	**(95% CI)**
Formal transit stop						
None	1070	96.2	(94.9–97.2)	1098	95.2	(92.0–97.1)
At least one	42	3.8	(2.8–5.1)	56	4.8	(2.9–8.0)
Any formal or informal transit stop						
None	1009	91.3	(89.5–92.8)	1009	89.3	(83.5–93.2)
At least one	96	8.7	(7.2–10.5)	121	10.7	(6.8–16.5)
Any transit amenities¶						
None	29	69.0	(53.7–81.1)	34	60.9	(45.6–74.3)
At least one	13	31.0	(18.9–46.3)	22	39.1	(25.7–54.4)
Any traffic calming						
No	903	81.3	(78.9–83.5)	834	72.5	(61.3–81.4)
At least one	208	18.7	(16.5–21.1)	317	27.5	(18.6–38.7)

Abbreviations: CI = Confidence Interval

* Represents the unweighted number of street segments. Columns may not add up to the total n = 1,114 due to missing data.

† Percentages may not add up to 100% due to rounding.

§ Weighted to represent the number of kilometers of street length in the sampling frame. Columns may not add up to the total n = 1,156 due to missing data.

¶ Reported only for street segments with a formal transit stop (n = 42).

Table 4a. Prevalence of Aesthetic and Social Features among Street Segments, US Virgin Islands, 2016

	Unweighted (n = 1,114)			Weighted by Street Length (n = 1,156)		
	n*	%†	(95% CI)	n§	%†	(95% CI)
Hardscape features						
Yes	280	25.2	(22.8–27.9)	330	28.6	(22.6–35.4)
No	830	74.8	(72.1–77.2)	823	71.4	(64.6–77.4)
Natural bodies of water						
Yes	379	34.1	(31.4–37.0)	471	41.0	(29.7–53.2)
No	732	65.9	(63.0–68.6)	680	59.0	(46.8–70.3)
Softscape features						
Yes	490	44.2	(41.3–47.2)	520	45.4	(34.7–56.6)
No	618	55.8	(52.8–58.7)	624	54.6	(43.4–65.3)
Percentage of buildings well maintained						
0%	55	5.0	(3.8–6.4)	34	3.0	(1.7–5.2)
1–49%	175	15.8	(13.7–18.0)	185	16.0	(11.3–22.2)
50–99%	422	38.1	(35.2–41.0)	458	39.7	(31.5–48.4)
100%	457	41.2	(38.3–44.1)	477	41.4	(31.7–51.8)
Percentage of landscaping well maintained						
0%	217	19.6	(17.3–22.0)	145	12.5	(8.9–17.4)
1–49%	343	31.0	(28.3–33.7)	338	29.3	(23.0–36.6)
50–99%	388	35.0	(32.3–37.9)	459	39.8	(31.4–48.9)
100%	160	14.4	(12.5–16.6)	211	18.3	(10.4–30.3)
Extent of graffiti/tagging						
None	1061	96.0	(94.7–97.0)	1103	96.1	(93.2–97.8)
A little (present)	33	3.0	(2.1–4.2)	34	3.0	(1.6–5.6)
Some (very noticeable)	10	0.9	(0.5–1.7)	9	0.8	(0.3–2.2)
A lot (overwhelming)	1	0.1	(0.0–0.6)	2	0.2	(0.0–1.0)
Extent of litter						
None	499	45.1	(42.2–48.1)	545	47.4	(35.9–59.1)
A little (present)	421	38.1	(35.2–41.0)	415	36.1	(27.4–45.8)
Some (very noticeable)	138	12.5	(10.7–14.6)	149	13.0	(9.0–18.5)
A lot (overwhelming)	48	4.3	(3.3–5.7)	41	3.5	(2.0–6.2)
Stray or unleashed dogs						
Yes	48	4.3	(3.3–5.7)	59	5.2	(2.9–9.2)
No	1057	95.7	(94.3–96.7)	1073	94.8	(90.8–97.1)

Table 4a. (*Continued*) Prevalence of Aesthetic and Social Features among Street Segments, US Virgin Islands, 2016

	Unweighted (n = 1,114)			Weighted by Street Length (n = 1,156)		
	n*	**%†**	**(95% CI)**	**n§**	**%†**	**(95% CI)**
Anyone walking						
Yes	266	24.1	(21.6–26.7)	190	16.5	(11.6–23.0)
No	839	75.9	(73.3–78.4)	959	83.5	(77.0–88.4)

Abbreviations: CI = Confidence Interval

* Represents the unweighted number of street segments. Columns may not add up to the total n = 1,114 due to missing data.

† Percentages may not add up to 100% due to rounding.

§ Weighted to represent the number of kilometers of street length in the sampling frame. Columns may not add up to the total n = 1,156 due to missing data.

Table 4b. Calculated Aesthetic and Social Features among Street Segments, US Virgin Islands, 2016

	Unweighted (n = 1,114)			Weighted by Street Length (n = 1,156)		
	n*	**%†**	**(95% CI)**	**n§**	**%†**	**(95% CI)**
Well-maintained landscaping						
Less than 100% well maintained	948	85.6	(83.4–87.5)	943	81.7	(69.7–89.6)
100% well maintained	160	14.4	(12.5–16.6)	211	18.3	(10.4–30.3)
Poorly-maintained buildings						
Less than 100% well maintained	652	58.8	(55.9–61.7)	677	58.6	(48.2–68.3)
100% well maintained	457	41.2	(38.3–44.1)	477	41.4	(31.7–51.8)
Any graffiti						
None	1061	96.0	(94.7–97.0)	1103	96.1	(93.2–97.8)
A little or more	44	4.0	(3.0–5.3)	45	3.9	(2.2–6.8)
Any litter						
None	499	45.1	(42.2–48.1)	545	47.4	(35.9–59.1)
A little or more	607	54.9	(51.9–57.8)	605	52.6	(40.9–64.1)

Abbreviations: CI = Confidence Interval

* Represents the unweighted number of street segments. Columns may not add up to the total n = 1,114 due to missing data.

† Percentages may not add up to 100% due to rounding.

§ Weighted to represent the number of kilometers of street length in the sampling frame. Columns may not add up to the total n = 1,156 due to missing data.

Table 4c. Aesthetics and Social Subscales among Street Segments, US Virgin Islands, 2016

		Unweighted (n = 1,114)		Weighted by Street Length (n = 1,156)	
	Range	**Mean**	**(95% CI)**	**Mean**	**(95% CI)**
Aesthetics and Social Subscales					
Positive[*]	0 to 4	1.18	(1.11–1.25)	1.33	(1.03–1.63)
Negative[†]	0 to 4	1.21	(1.16–1.27)	1.20	(0.99–1.41)
Overall[§]	-4 to 4	-0.03	(-0.13–0.07)	0.15	(-0.34–0.63)

Abbreviations: CI = Confidence Interval

[*] The following features contributed to the positive subscale: hardscape features, natural bodies of water/ocean views, softscape features, and well-maintained landscaping.

[†] The following features contributed to the negative subscale: poorly maintained buildings, graffiti, litter, and stray or unleashed dogs.

[§] Overall subscale = Positive subscale – Negative subscale

Table 5a. Prevalence of Sidewalk and Bike Path Features among Street Segments, US Virgin Islands, 2016

	Unweighted (n = 1,114)			Weighted by Street Length (n = 1,156)		
	n*	%†	(95% CI)	n§	%†	(95% CI)
Presence of a sidewalk						
Yes, sidewalk is continuous	87	7.8	(6.4–9.6)	50	4.3	(2.4–7.9)
Yes, sidewalk is not continuous	84	7.6	(6.1–9.3)	81	7.0	(4.4–11.2)
No	941	84.6	(82.4–86.6)	1023	88.6	(81.9–93.1)
Width of majority of the sidewalk¶						
<3 feet	53	31.2	(24.7–38.5)	33	25.9	(14.0–42.8)
3–5 feet	100	58.8	(51.3–66.0)	87	67.7	(53.0–79.6)
>5 feet	17	10	(6.3–15.5)	8	6.4	(2.4–15.7)
Buffer¶						
Yes	30	18.1	(12.9–24.7)	13	10.5	(5.3–19.6)
No	136	81.9	(75.3–87.1)	114	89.5	(80.4–94.7)
Major trip hazards¶						
None	128	75.3	(68.3–81.2)	91	71.0	(59.7–80.2)
One	17	10	(6.3–15.5)	18	13.7	(7.0–25.0)
A few	16	9.4	(5.8–14.8)	10	7.6	(3.5–15.8)
Many	9	5.3	(2.8–9.9)	10	7.7	(2.2–24.1)
Permanent obstructions¶						
None	161	94.7	(90.1–97.2)	125	96.7	(92.0–98.7)
One	6	3.5	(1.6–7.6)	3	2.3	(0.8–6.5)
A few	2	1.2	(0.3–4.6)	0	0.3	(0.1–0.8)
Many	1	0.6	(0.1–4.1)	1	0.7	(0.1–5.2)
Temporary obstructions¶						
None	127	75.1	(68.1–81.1)	92	71.6	(51.0–85.9)
One	13	7.7	(4.5–12.8)	10	7.9	(4.2–14.3)
A few	22	13	(8.7–19.0)	21	16.2	(7.0–33.3)
Many	7	4.1	(2.0–8.4)	5	4.3	(1.8–9.8)
Trees within 5 feet of sidewalk¶						
0	75	44.1	(36.8–51.7)	40	31.1	(18.0–48.1)
1–2	32	18.8	(13.6–25.4)	24	19.0	(12.5–27.7)
3–5	35	20.6	(15.2–27.3)	27	21.1	(12.7–33.0)
6–10	18	10.6	(6.8–16.2)	22	17.2	(10.4–27.1)
11–20	9	5.3	(2.8–9.9)	13	9.9	(5.2–17.9)
21+	1	0.6	(0.1–4.1)	2	1.8	(0.2–13.1)

Table 5a. (*Continued*) Prevalence of Sidewalk and Bike Path Features among Street Segments, US Virgin Islands, 2016

	Unweighted (n = 1,114)			Weighted by Street Length (n = 1,156)		
	n*	%†	(95% CI)	n§	%†	(95% CI)
Percentage of sidewalk covered by trees¶						
0–25%	131	77.5	(70.6–83.2)	99	76.9	(66.4–84.9)
26–50%	25	14.8	(10.2–21.0)	17	13.4	(8.1–21.2)
51–75%	7	4.1	(2.0– 8.4)	7	5.1	(2.3–10.8)
76–100%	6	3.6	(1.6– 7.7)	6	4.7	(1.8–11.8)
Percentage of sidewalk covered by awnings¶						
0–25%	150	90.4	(84.8–94.0)	120	94.7	(87.9–97.8)
26–50%	6	3.6	(1.6–7.8)	3	2.2	(0.8–6.1)
51–75%	4	2.4	(0.9–6.3)	2	1.9	(0.4–9.4)
76–100%	6	3.6	(1.6–7.8)	1	1.2	(0.2–5.2)
Number of driveways						
0	378	34.4	(31.7–37.3)	232	20.5	(16.1–25.6)
1–2	401	36.5	(33.7–39.4)	354	31.3	(24.9–38.5)
3–5	197	17.9	(15.8–20.3)	287	25.4	(19.5–32.2)
6+	122	11.1	(9.4–13.1)	258	22.8	(16.3–31.1)
Informal path						
Yes	90	8.1	(6.7–9.9)	85	7.4	(5.1–10.6)
No	1018	91.9	(90.1–93.3)	1065	92.6	(89.4–94.9)
Covered or air conditioned place to walk						
Yes	8	0.7	(0.4–1.4)	6	0.5	(0.1–2.2)
No	1100	99.3	(98.6–99.6)	1144	99.5	(97.8–99.9)
Bicycle lane or zone						
Yes, on the sidewalk	0	0.0	--	0	0.0	--
Yes, separated from traffic by marked line	0	0.0	--	0	0.0	--
Yes, separated from traffic by raised curb	0	0.0	--	0	0.0	--
Yes, separated from traffic by buffer	0	0.0	--	0	0.0	--
No	1110	100.0	--	1153	100.0	--
Signs or sharrows indicating bicycle use						
Yes	1	0.1	(0.0–0.6)	1	0.1	(0.0–0.5)
No	1108	99.9	(99.4–100)	1144	99.9	(99.5–100)

Abbreviations: CI = Confidence Interval

* Represents the unweighted number of street segments. Columns may not add up to the total n = 1,114 due to missing data.

† Percentages may not add up to 100% due to rounding.

§ Weighted to represent the number of kilometers of street length in the sampling frame. Columns may not add up to the total n = 1,156 due to missing data.

¶ Reported only for street segments with a sidewalk (n = 171).

Table 5b. Calculated Sidewalk and Bike Path Features among Street Segments, US Virgin Islands, 2016

	Unweighted (n = 1,114)			Weighted by Street Length (n = 1,156)		
	n*	**%†**	**(95% CI)**	**n§**	**%†**	**(95% CI)**
Sidewalk						
No	941	84.4	(82.4–86.6)	1023	88.6	(81.7–93.1)
Yes	171	15.4	(13.4–17.6)	132	11.4	(7.0–18.1)
Sidewalk continuity¶						
Not continuous	84	49.1	(41.7–56.6)	81	61.8	(51.5–71.2)
Continuous	87	50.9	(43.4–58.3)	50	38.2	(28.8–48.5)
Any buffer¶						
None	95	58.3	(50.6–65.6)	77	60.9	(46.3–73.8)
Either a buffer or street parking	54	33.1	(26.3–40.7)	45	35.3	(22.4–50.7)
Both a buffer and street parking	14	8.6	(5.1–14.0)	5	3.8	(1.5–9.2)
Shade from trees or awnings¶						
Little (0 trees and <25% shade)	65	39.2	(32.0–46.8)	38	30.3	(17.4–47.3)
Some (1–10 trees or 26–75% shade)	54	32.5	(25.8–40.0)	51	40.4	(30.0–51.6)
A lot (11+ trees and/or 76–100% shade)	47	28.3	(22.0–35.6)	37	29.3	(20.4–40.2)
Poorly-maintained sidewalk¶						
No major trip hazards	128	75.3	(68.3–81.2)	91	71.0	(59.7–80.2)
One or more major trip hazards	42	24.7	(18.8–31.7)	37	29.0	(19.8–40.3)
Permanent obstructions¶						
None	161	94.7	(90.1–97.2)	125	96.7	(92.0–98.7)
One or more	9	5.3	(2.8–9.9)	4	3.3	(1.3–8.0)
Temporary obstructions¶						
None	127	75.1	(68.1–81.1)	92	71.6	(51.0–85.9)
One or more	42	24.9	(18.9–31.9)	37	28.4	(14.1–49.0)

Abbreviations: CI = Confidence Interval

* Represents the unweighted number of street segments. Columns may not add up to the total n = 1,114 due to missing data.

† Percentages may not add up to 100% due to rounding.

§ Weighted to represent the number of kilometers of street length in the sampling frame. Columns may not add up to the total n = 1,156 due to missing data.

¶ Reported only for street segments with a sidewalk (n = 171).

Table 5c. Sidewalk Quality Subscales among Street Segments with a Sidewalk, US Virgin Islands, 2016

		Unweighted (n = 1,114)		Weighted by Street Length (n = 1,156)	
	Range	**Mean**	**(95% CI)**	**Mean**	**(95% CI)**
Sidewalk Quality Subscales[*]					
Positive[†]	0 to 7	2.77	(2.52–3.03)	2.75	(2.47–3.03)
Negative[§]	0 to 3	0.55	(0.43–0.67)	0.61	(0.37–0.84)
Overall[¶]	-3 to 7	2.23	(1.96–2.51)	2.16	(1.81–2.52)

Abbreviations: CI = Confidence Interval

[*] Reported only for street segments with a sidewalk (n = 171).

[†] The following features contributed to the positive subscale: continuity along the segment, greater than 5 feet in width, buffer present, and shade from trees or awnings.

[§] The following features contributed to the negative subscale: major trip hazards, temporary obstructions, and permanent obstructions.

[¶] Overall subscale = Positive subscale – Negative subscale

Table 6a. Prevalence of Crossing Features among Street Segments, US Virgin Islands, 2016

	Unweighted (n = 1,114)			Weighted by Street Length (n = 1,156)		
	n*	%†	(95% CI)	n§	%†	(95% CI)
Presence of a crossing						
Yes	489	43.9	(41.0–46.9)	554	47.9	(43.0–52.9)
No	480	43.1	(40.2–46.1)	450	39.0	(35.0–43.1)
N/A (e.g. cul-de-sac)	144	12.9	(11.1–15.0)	152	13.1	(9.4–18.0)
Intersection control¶ **						
Yield signs	8	1.6	(0.8–3.3)	9	1.6	(0.6–4.1)
Stop signs	52	10.7	(8.2–13.8)	52	9.5	(5.1–16.8)
Traffic signal	20	4.1	(2.7–6.3)	28	5.1	(2.0–12.5)
Traffic circle	1	0.2	(0.0–1.4)	0	0.0	(0.0–0.3)
Crossing aid	1	0.2	(0.0–1.4)	2	0.4	(0.0–2.5)
Cross guard	3	0.6	(0.2–1.9)	1	0.2	(0.0–1.1)
None of the above	408	83.8	(80.2–86.8)	464	84.2	(74.4–90.7)
Overpass, underpass, or bridge**						
Yes	0	0.0	--	0	0.0	--
No	484	100.0	--	549	100.0	--
Signalization¶ **						
Pedestrian walk signs	6	1.2	(0.6–2.7)	9	1.6	(0.5–4.5)
Push buttons	9	1.8	(1.0–3.5)	15	2.7	(1.1–6.5)
Countdown signal	0	0.0	--	0	0.0	--
Bicycle signal	0	0.0	--	0	0.0	--
None of the above	479	98.2	(96.5–99.0)	538	97.3	(93.5–98.9)
Pre-crossing curb**						
Ramp lines up with crossing	33	7.0	(5.0–9.6)	32	6.1	(2.6–13.7)
Ramp does not line up with curb	7	1.5	(0.7–3.1)	4	0.8	(0.3–2.0)
No ramp	434	91.6	(88.7–93.8)	488	93.1	(85.9–96.8)
Post-crossing curb**						
Ramp lines up with crossing	34	7.2	(5.2–9.9)	35	6.7	(2.9–14.8)
Ramp does not line up with curb	5	1.1	(0.4–2.5)	6	1.1	(0.4–2.7)
No ramp	436	91.8	(89.0–93.9)	485	92.2	(84.4–96.3)
Tactile paving**						
Yes	4	0.9	(0.3–2.2)	7	1.3	(0.3–5.5)
No	466	99.1	(97.8–99.7)	507	98.7	(94.5–99.7)

Table 6a. (*Continued*). Prevalence of Crossing Features among Street Segments, US Virgin Islands, 2016

	Unweighted (n = 1,114)			Weighted by Street Length (n = 1,156)		
	n*	**%†**	**(95% CI)**	**n§**	**%†**	**(95% CI)**
Crosswalk treatment¶ **						
Marked crosswalk	32	6.5	(4.7–9.1)	34	6.1	(2.7–13.2)
High visibility striping	21	4.3	(2.8–6.5)	15	2.6	(1.2–5.6)
Curb extension	1	0.2	(0.0–1.4)	0	0.1	(0.0–0.5)
Raised crosswalk	0	0.0	--	0	0.0	--
Different material than road	0	0.0	--	0	0.0	--
None of the above	455	93.0	(90.4–95.0)	519	93.8	(86.8–97.2)
Protected refuge**						
Yes	6	1.3	(0.6–2.8)	5	1.0	(0.2–4.8)
No	473	98.7	(97.2–99.4)	525	99.0	(95.2–99.8)

Abbreviations: CI = Confidence Interval

* Represents the unweighted number of street segments. Columns may not add up to the total n = 1,114 due to missing data.

† Percentages may not add up to 100% due to rounding.

§ Weighted to represent the number of kilometers of street length in the sampling frame. Columns may not add up to the total n = 1,156 due to missing data.

¶ Column percentages may add up to more than 100% because multiple response options were possible.

** Reported only for street segments with a crossing (n = 489).

Table 6b. Calculated Crossing Features among Street Segments, US Virgin Islands, 2016

	Unweighted (n = 1,114)			Weighted by Street Length (n = 1,156)		
	n*	**%†**	**(95% CI)**	**n***	**%†**	**(95% CI)**
Any intersection control¶						
None	408	83.8	(80.2–86.8)	464	84.2	(74.4–90.7)
At least one	79	16.2	(13.2–19.8)	87	15.8	(9.3–25.6)
Any signalization¶						
None	479	98.2	(96.5–99.0)	538	97.3	(93.5–98.9)
At least one	9	1.8	(1.0–3.5)	15	2.7	(1.1–6.5)
Any crosswalk treatment¶						
None	455	93.0	(90.4–95)	519	93.8	(86.8–97.2)
At least one	34	7.0	(5.0–9.6)	35	6.2	(2.8–13.2)

Abbreviations: CI = Confidence Interval

* Represents the unweighted number of street segments. Columns may not add up to the total n = 1,114 due to missing data.

† Percentages may not add up to 100% due to rounding.

§ Weighted to represent the number of kilometers of street length in the sampling frame. Columns may not add up to the total n = 1,156 due to missing data.

¶ Reported only for street segments with a crossing (n = 489).

Appendices

Appendix 1: Letter of Invitation Template

GOVERNMENT OF
THE VIRGIN ISLANDS OF THE UNITED STATES

VIRGIN ISLANDS DEPARTMENT OF HEALTH

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RE: CDC conducting study for a Virgin Islands Healthy Lifestyle Built Environmental Audit

In February 2016, a team from the Centers for Disease Control and Prevention in Atlanta will be coming to the US Virgin Islands to assist the Virgin Islands Department of Health in conducting a survey on the level of walkability and bicycle riding ability of our roads and sidewalks. The purpose of this audit is to provide baseline data on the walkability and bicycle riding ability of our territory, and identify opportunities to promote physical activity.

Chronic diseases, including heart disease, stroke, and diabetes, are a significant source of morbidity and mortality in the USVI. Contributing to this high prevalence in the USVI is physical inactivity. In fact, less than 40% of adults in the territory meet the aerobic physical activity guideline. The built environment includes all of the physical parts of where we live and work (e.g., streets, open spaces, and infrastructure). The built environment is known to influence a person's level of physical activity. For example, inaccessible or nonexistent sidewalks and bicycle or walking paths contribute to sedentary habits, which in turn lead to poor health outcomes.

To address this important health issue, the CDC team will be providing technical assistance in our effort to conduct an audit of the built environment across the territory. Teams will be deploying to visually inspect a representative sample of street segments. The data collected will be instrumental to informing future programs and policies.

Certainly, the development and implementation of such policies requires the vital collaboration of partners beyond traditional health agencies. As such, we are seeking your input before CDC's arrival as a key informant in this area.

If your schedule permits, we would appreciate 30-60 minutes of your time to participate in a telephone interview with the CDC team to better understand your agency's current policy environment towards health and the built environment. This information will be vital in informing both the data we collect and how it is used.

Please let us know if you are available and we will schedule a time. Alternatively, we would appreciate it if you could please identify an alternative person within your agency.

Thank you for your assistance in this effort.

Sincerely,

Juan Figueroa-Serville
Acting Commissioner

Appendix 2: Key Informant Interview Guide

Introduction

Good morning/afternoon. My name is (NAME). Thank you for speaking with me today regarding physical activity in the Virgin Islands. I am working on a project with the USVI Department of Health and you were identified you as a key stakeholder in the community who could help us gather some baseline information for our project.

USVI has a high burden of chronic diseases, like heart disease and obesity. A major contributing factor is physical inactivity, as less than 40% of adults in the territory are getting the recommended amount of activity. We know that the physical environment can positively or negatively impact physical activity, but little is known about what barriers exist in the USVI specifically with regards to the built environment and whether these might be contributing to the low levels of physical activity.

In February, my colleagues and I will be traveling to the USVI to assist the Department of Health with a baseline assessment of the built environment. The goals of this project will be to 1) evaluate the walkability of streets in the territory, and 2) identify opportunities for improvement that could help increase physical activity and prevent NCDs. Prior to the assessment, we would like to ask you a few questions regarding your role (your agency's role) in built environment decisions and the perspective on the current climate around these issues.

What agency do you work for? What are your roles and responsibilities?

I. GENERAL QUESTIONS

Topic: Agency priorities

- What are the current priorities for your agency?
- Does your agency consider health in any of its policies? Can you provide examples?
  - Is it a primary consideration? Secondary?
  - Why do you think it is ranked that way?
- What benefits does a focus on health provide? (For example: injury prevention, community development, social cohesion, economics)

Topic: Policies related to walking and walkability

- Is walking a consideration for your agency?
- Has your agency implemented any policies or projects to improve walking or walkability of the territories?
- Is your agency planning any additional policies or projects with the goal of improving walking and walkability?
- What needs or supports would help to increase awareness or action? (for example: technical assistance, training, staffing, funding, speaking to local officials, connecting with experts in the field)
- Who are the key partners that your agency works with to conduct this type of work?

Topic: activities or programs in the community related to health promotion (if time permits)

- What activities does your agency conduct within the community that help promote walking and walkability?
- What other supports for walking, hiking, and biking currently exist on the islands?
  - Do you feel they are sufficient?
  - Why or why not?
- Thinking of the islands…do you think they are walkable? Are they easy to get around on foot?
  - If so, what supports are in place? (Are there sidewalks, bike paths, and pedestrian-friendly environments to support physical activity?)
  - If not, what is missing? What would be needed to make them more walkable?

II. AGENCY-SPECIFIC QUESTIONS

Sector: Transportation, urban planning, public works, zoning

- What policies or activities related to transportation and/or land use currently exist that are intended to improve or facilitate physical activity?
- Do any policies currently exist that indirectly impact physical activity (unintentionally improve or facilitate physical activity)?
- How did they come about? What was the rationale for the policies or activities?
- Describe the connectivity of amenities and destinations in your community— for example: banks, grocery stores, retail shops (are they adequately connected or in close enough proximity to one another and to people's homes?).
- Are these amenities accessible by public transit, safe walking or biking from people's homes? Or, do you have to drive to do errands?
- Does public transit exist? If so, what kinds? Is it accessible and convenient?

Now, I am going to ask you about a few questions about specific policies, whether you are aware of them and if they exist in USVI:

1. *Complete Streets* policies consider the needs of all users in all transportation modes incorporating walking, bicycling, public transportation, and driving on the same street.
   - What benefits does it bring (could it bring) to the USVI and what would be needed to increase these types of policies/programs in the USVI?
2. *Smart Growth Design* communities are designed with being active as the focus. Communities are connected with street patterns that make it easy to walk or bike to destinations. Developers try to locate essential services like schools and stores closer to homes to encourage walking and provide green spaces for recreation.
   - What benefits do they bring (could they bring) to the USVI and what would be needed to increase these types of policies/programs in the USVI?
3. *Master plans:* a comprehensive community plan incorporating the following:
   - Parks and recreation
   - Transportation
   - Bike and pedestrian pathways

    - Street connectivity
    - Mixed land development
  - Do they exist? If so, how does the policy process work? Who does the planning? Who funds the plans? How are funds allocated? Who has control?

4. *Transportation Enhancements* activities offer funding opportunities to help expand transportation choices in communities, including pedestrian and bicycle infrastructure and safety programs.
    - What benefits do they bring (could they bring) to the USVI and what would be needed to increase these types of policies/programs in the USVI?
    - Who has the right of way? Who owns the roads? What are the legalities around property ownership?
    - Are there street networks, abandon alleyways?

- What future policies are in the pipeline?
- What policies are still needed?
- What barriers do you see for implementing these policies in the USVI?
  - If you had the needed financial resources, how would you carry out the work? Is anything else needed?
- What strategies do you suggest to overcome them?
- What supports are needed for success?

Sector: Education

- What work is occurring around support of physical education, recess, play grounds, safe routes to school and/or shared use of space?
  - How did this work come about? What was the rationale for the work or specific policies?
  - How accessible are your school facilities to the public? Do you need agreements for use by the public to occur (are there current agreements)?
    - *Shared Use of School Facilities* agreements allow schools to share their physical activity facilities (gyms, running/walking tracks, multipurpose rooms) with the community for recreation and exercise opportunities.
  - How do kids currently get to school? Bus? Parents? Walking? Percentage of each mode? What dangers exist?
    - *Safe Routes to School* enable more children to safely walk and bike to school. Community leaders prioritize the safety of these routes and are working to reduce traffic congestion and improve health and the environment.
- What future policies are in the pipeline?
- What policies are still needed?
- What barriers do you see for these policies?
- What strategies do you suggest to overcome them?
- What supports are needed for success?

Sector: Parks and Recreation

- What work or policies exist with the objective of increasing or improving existing trails? How did they come about? What was the rationale for the policies?
  - Is there an open streets policy? Or an opportunity to take streets offline or discourage traffic on roads at certain times?
    - *Recreational Trails Program (RTP)* provides funds to the states to develop and maintain recreational trails and trail-related facilities for both non-motorized and motorized recreational trail uses. Federal transportation funds benefit recreation including hiking, bicycling, in-line skating, equestrian use, and cross-country skiing.
  - Are there street networks around or within parks? Are there trails?
  - How do you get funding for parks? How do you access funding? Are you a part of the US Parks Service?
  - Are there recreational programs, facilities, or indoor options?
  - Do parks and recreational areas advertise or promote walking and related activities?
    - Billboards or other media, signage on length or direction of trails, walking or hiking events
    - How does the parks system use health in messages? For example no smoking policies.
- What future policies are in the pipeline?
- What policies are still needed?
- What barriers do you see for these policies?
- What strategies do you suggest to overcome them?
- What supports are needed for success?

Sector: Regional health, Academics, Senior Center/Office for the Aging (AARP), Policy Makers

- What policies or activities exist with the objective of increasing walking? (for example: walking events, walking groups, community events)
- How did they come about? What was the rationale for the policies?
  - How does your agency play a role? How could you be more visible? What supports do you need?
- What future policies are in the pipeline?
- What policies are still needed?
- What barriers do you see for these policies?
- What strategies do you suggest to overcome them?
- What supports are needed for success?

Appendix 3: Number of Estates in Sampling Frame, by Stratum

Sparse				
		St. Croix	St. John	St. Thomas
High reach	0	28	5	26
	1	11	1**	3**
	2	0	0	2**
	3	0	0	0
Neighbor	0	25	3	12
	1	1	0	1**
	2	0	0	0
	3	1**	0	0
Dense				
		St. Croix	St. John	St. Thomas
High reach	0	1*	0	3*
	1	0	0	2*
	2	0	0	1*
	3	0	0	0
Neighbor	0	0	0	0
	1	0	0	0
	2	0	0	0
	3	0	0	0

Legend

- Island
- Number of schools
- Population density (persons/mi^2)
- Population reach (persons/km of street length)

* Self-representing PSUs based on population density (St. Croix: Golden Rock; St. Thomas: Honduras, Anna's Fancy, Demarara, Queen's Quarter, King's Quarter and Anna's Retreat)
** Self-representing PSUs based on presence of school(s)

Appendix 4: Microscale Audit of Pedestrian Streetscapes, Modified for USVI Epi-Aid (MAPS-USVI)

Segment ID: _____ Barcode: _____ Auditor ID: _____ Date: _____ Start Time: _____ End Time: _____

Section 1: Land Use/Destinations

1. Type of land use
   O Residential O Commercial

2. What types of residential uses? *Check all that apply.*
   ☐ Single family houses
   ☐ Multi-unit homes (duplex, 4-plex, row house)
   ☐ Apartments or condominiums
   ☐ Apartments above street retail
   ☐ N/A

3. How many of the following types of non-residential destinations are present?

a. Fast food restaurant (*national or local chain, primarily sells burgers, fried chicken, pizza, Mexican, Chinese, etc.*)
   O 0 O 1 O 2+

b. Sit-down restaurant
   O 0 O 1 O 2+

c. Grocery/supermarket
   O 0 O 1 O 2+

d. Convenience store (*may also be gas station*)
   O 0 O 1 O 2+

e. Cafe or coffee shop
   O 0 O 1 O 2+

f. Bank or credit union
   O 0 O 1 O 2+

g. Hotel
   O 0 O 1 O 2+

h. Drugstore/pharmacy
   O 0 O 1 O 2+

i. Health-related professional (*e.g. doctor's office*)
   O 0 O 1 O 2+

j. Entertainment (*e.g. movie theatre, arcade*)
   O 0 O 1 O 2+

k. Other service (*e.g. salon, lawyer, accountant, realtor, laundry/dry cleaner, commercial mailing service*)
   O 0 O 1 O 2+

l. Other retail (*e.g. books, clothing, hardware*)
   O 0 O 1 O 2+

m. Places of worship (*e.g. church, synagogue, mosque*)
   O 0 O 1 O 2+

n. School
   O 0 O 1 O 2+

o. Indoor recreation (*e.g. community center, commercial gyms*)
   O 0 O 1 O 2+

p. Outdoor pay recreation (*e.g. pool, golf course*)
   O 0 O 1 O 2+

q. Public park *(not including beach)*
   O 0 O 1 O 2+

r. Trail
   O 0 O 1 O 2+

s. Port
   O 0 O 1 O 2+

4. Is there a beach?
   O Yes, with access
   O Yes, but without access
   O No, no beach

5. Is there a pedestrian street or zone?
   O Yes O No

6. Shopping centers. *Check all that apply*
   ☐ Shopping mall ☐ Strip mall
   ☐ Open-air market ☐ None of the above

Section 2: Streetscape

7. How many traffic lanes are present *(include traffic and turn lanes; choose most predominant)*
   O 0 *(pedestrian street or zone)*
   O 1 O 2 O 3 O 4 O 5 O 6 O 7+

8. What percentage of the road is parking allowed on?
   O 1-25% O 26-50% O 51-75% O 76-100%
   O None O N/A

9. Number of public transit stops
   O 0 O 1 O 2+

10. What is available at the transit stops? (*Only count benches that users could easily be identified by bus drivers as waiting to ride the bus) Check all that apply.*
    ☐ Bench ☐ Covered shelter ☐ Schedule
    ☐ None of the above ☐ N/A

11. Are there informal places to catch transit?
    O Yes O No

12. What traffic calming features are present outside of the intersections? *Check all that apply.*
    ☐ Traffic calming signs ☐ Traffic calming circles
    ☐ Speed tables ☐ Speed humps
    ☐ Curb extension ☐ Roll-over curbs
    ☐ None of the above

13. Are street lights installed on your side of the street?
    O None
    O Some (*e.g. overhead street lights on utility poles with wide spacing*)
    O Ample (e.g. regularly spaced lampposts)

14. Presence of street amenities. *Check all that apply.*
    ☐ Building overhangs that provide shelter from inclement weather in public space (i.e. sidewalk)
    ☐ Trash bins (public)
    ☐ Benches or other places to sit
    ☐ Bicycle racks, lockers, compounds, docking stations
    ☐ Kiosks/information booths
    ☐ Hawkers/shops/carts
    ☐ None of the above

Section 3: Aesthetics and Social

15. Are there pleasant hardscape features, such as fountains, sculpture, or art (public or private)?
    O Yes O No

16. Are there natural bodies of water?
    O Yes O No

17. Are there softscape features such as gardens or landscaping (e.g. designated viewpoints, retaining walls, parks)?
    O Yes O No

Appendix 4: (*Continued*) Microscale Audit of Pedestrian Streetscapes, Modified for USVI Epi-Aid (MAPS-USVI)

Segment ID: _____ Barcode: _____ Auditor ID: _____ Date: _____ Start Time: _____ End Time: _____

18. What percentage of buildings are well maintained?
O 0 O 1-49% O 50-99% O 100%

19. What percentage of landscaping is well maintained?
O 0 O 1-49% O 50-99% O 100%

20. Rate the extent of graffiti/tagging (not murals)
O None O A little (present)
O Some (very noticeable) O A lot (overwhelming)

21. Rate the extent of litter
O None O A little (present)
O Some (very noticeable) O A lot (overwhelming)

22. Presence of stray or unleashed dogs?
O Yes O No

23. Presence of anyone walking?
O Yes O No

Section 4: Sidewalk and Bike Path

24. Is a sidewalk present?
O Yes, sidewalk is continuous
O Yes, sidewalk is not continuous
O No, no sidewalk

25. What is the width of the majority of the sidewalk?
O <3ft O 3-5ft O >5ft O N/A

26. Is a buffer present?
O Yes O No O N/A

27. Are there poorly maintained sections of the sidewalk that constitute major trip hazards? *(e.g. heaves, misalignment, cracks, overgrowth)*
O None O One O A few O Many O N/A

28. Are there permanent obstructions on the sidewalk? *(e.g. signs, kiosks, shops)*
O None O One O A few O Many O N/A

29. Are there temporary obstructions on the sidewalk? *(e.g. trash cans, parked cars, carts)*
O None O One O A few O Many O N/A

30. How many trees exist within 5 feet of either side of the sidewalk (can be in buffer or setback; also count trees that are more than 5 feet away if they provide shade for the sidewalk)?
O 0 O 1-2 O 3-5 O 6-10 O 11-20 O 21+ O N/A

31. What percentage of the length of the sidewalk is covered by trees?
O 0-25% O 26-50% O 51-75% O 76-100% O N/A

32. What percentage of the length of the sidewalk is covered by awnings or other overhead coverage?
O 0-25% O 26-50% O 51-75% O 76-100% O N/A

33. How many driveways are there (not alleys)?
O 0 O 1-2 O 3-5 O 6+

34. Is there an informal path (shortcut) which connects to something else?
O Yes O No

35. Is there a covered or air conditioned place to walk along the street or connecting buildings (not a mall)?
O Yes O No

36. Is there a bicycle lane or zone?
O Yes, on the sidewalk
O Yes, separated from traffic by a marked line
O Yes, separated from traffic by a raised curb
O Yes, separated from traffic by a buffer (plantings, parked cars, fencing, etc)
O No

37. Are there signs or sharrows indicating bicycle use?
O Yes O No

Section 5: Crossing

38. Is a crossing present?
O Yes O No O N/A

39. Intersection control. *Check all that apply.*
☐ Yield signs ☐ Stop signs
☐ Traffic signal ☐ Traffic circle
☐ Crossing aid ☐ Cross guard
☐ None of the above ☐ N/A

40. Does the crossing take place on an overpass, underpass, or bridge?
O Yes O No O N/A

41. Signalization. *Check all that apply.*
☐ Pedestrian walk signals ☐ Push buttons
☐ Countdown signal ☐ Bicycle signal
☐ None of the above ☐ N/A

42. Pre-crossing curb
O Ramp lines up with crossing
O Ramp does not line up with crossing
O No ramp
O N/A

43. Post-crossing curb
O Ramp lines up with crossing
O Ramp does not line up with crossing
O No ramp
O N/A

44. Is tactile paving provided at curbs?
O Yes O No O N/A

45. Crosswalk treatment. *Check all that apply.*
☐ Marked crosswalk ☐ High visibility striping
☐ Curb extension ☐ Raised crosswalk
☐ Different material than road
☐ None of the above ☐ N/A

46. Is a protected refuge present?
O Yes O No O N/A

Section 6: Comments

47. Any comments for this segment?
O Yes O No

48. Comments:

Appendix 5: Results of Inter-Rater Reliability Tests for Dichotomous Items on the MAPS-USVI Audit Tool

	Agreement		Cohen's κ	
Item Number	**%**	**Rating**	**κ**	**Rating**
q1	95.6	Good to excellent	0.809	Good to excellent
q2_1	80.4	Good to excellent	0.600	Moderate
q2_2	91.3	Good to excellent	0.744	Good to excellent
q2_3*	92.4	Good to excellent	0.494	Moderate
q2_4**	100.0	Good to excellent	-	-
q5**	100.0	Good to excellent	-	-
q6_shopping mall**	98.9	Good to excellent	0.000	Fair to poor
q6_strip mall*	98.9	Good to excellent	0.883	Good to excellent
q6_open air market**	100.0	Good to excellent	-	-
q6_none*	98.9	Good to excellent	0.903	Good to excellent
q10_bench**	100.0	Good to excellent	-	-
q10_shelter**	100.0	Good to excellent	-	-
q10_schedule**	100.0	Good to excellent	-	-
q10_none*	96.7	Good to excellent	0.389	Fair to poor
q11*	92.3	Good to excellent	0.195	Fair to poor
q12_signs*	100.0	Good to excellent	1.000	Good to excellent
q12_circles**	100.0	Good to excellent	-	-
q12_speed tables**	100.0	Good to excellent	-	-
q12_speed humps	90.2	Good to excellent	0.727	Good to excellent
q12_curb extensions**	98.9	Good to excellent	0.000	Fair to poor
q12_roll-over curbs*	93.5	Good to excellent	0.367	Fair to poor
q12_none	85.9	Good to excellent	0.658	Good to excellent
q14_1*	98.9	Good to excellent	0.883	Good to excellent
q14_2*	95.7	Good to excellent	0.581	Moderate
q14_3*	96.7	Good to excellent	0.711	Good to excellent
q14_4**	100.0	Good to excellent	-	-
q14_5**	100.0	Good to excellent	-	-
q14_6*	94.6	Good to excellent	0.272	Fair to poor
q14_7*	93.5	Good to excellent	0.631	Good to excellent
q15	69.6	Moderate	0.234	Fair to poor
q16	88.0	Good to excellent	0.709	Good to excellent
q17	77.2	Good to excellent	0.549	Moderate

Appendix 5: (*Continued*) Results of Inter-Rater Reliability Tests for Dichotomous Items on the MAPS-USVI Audit Tool

	Agreement		Cohen's κ	
Item Number	**%**	**Rating**	**κ**	**Rating**
q22*	91.3	Good to excellent	-0.043	Fair to poor
q23	74.7	Moderate	0.251	Fair to poor
q26	96.7	Good to excellent	0.811	Good to excellent
q34*	88.0	Good to excellent	-0.063	Fair to poor
q35*	97.8	Good to excellent	0.655	Good to excellent
q36**	100.0	Good to excellent	-	-
q37**	100.0	Good to excellent	-	-
q39_yield sign*	100.0	Good to excellent	1.000	Good to excellent
q39_stop sign	94.6	Good to excellent	0.641	Good to excellent
q39_traffic signal*	100.0	Good to excellent	1.000	Good to excellent
q39_traffic circle**	100.0	Good to excellent	-	-
q39_crossing aid**	100.0	Good to excellent	-	-
q39_crossing guard*	98.9	Good to excellent	0.000	Fair to poor
q39_none	83.7	Good to excellent	0.655	Good to excellent
q40**	85.9	Good to excellent	-	-
q41_walk signal*	100.0	Good to excellent	1.000	Good to excellent
q41_push buttons*	100.0	Good to excellent	1.000	Good to excellent
q41_countdown signal**	100.0	Good to excellent	-	-
q41_bicycle signal**	100.0	Good to excellent	-	-
q41_none	85.9	Good to excellent	0.717	Good to excellent
q44**	82.8	Good to excellent	-	-
q45_marked*	98.9	Good to excellent	0.852	Good to excellent
q45_high visibility*	98.9	Good to excellent	0.795	Good to excellent
q45_curb extension**	100.0	Good to excellent	-	-
q45_raised**	100.0	Good to excellent	-	-
q45_different material**	100.0	Good to excellent	-	-
q45_none	84.8	Good to excellent	0.692	Good to excellent
q46*	97.3	Good to excellent	0.654	Good to excellent

* Frequency of attribute is <10% or >90%.
** Frequency of attribute is 100% or 0%.

Appendix 6: Results of Inter-Rater Reliability Tests for Nominal and Ordinal Items on the MAPS-USVI Audit Tool

	Agreement		Weighted Cohen's κ	
Item Number	**%**	**Rating**	**κ**	**Rating**
q3a	97.8	Good to excellent	0.662	Good to excellent
q3b	96.7	Good to excellent	0.562	Moderate
q3c	98.9	Good to excellent	0.000	Fair to poor
q3d**	100.0	Good to excellent	-	-
q3e**	100.0	Good to excellent	-	-
q3f	95.7	Good to excellent	0.483	Moderate
q3g	100.0	Good to excellent	1.000	Good to excellent
q3h**	98.9	Good to excellent	0.000	Fair to poor
q3i	97.8	Good to excellent	-0.011	Fair to poor
q3j**	100.0	Good to excellent	-	-
q3k	95.7	Good to excellent	0.530	Moderate
q3l	96.7	Good to excellent	0.861	Good to excellent
q3m	98.9	Good to excellent	0.795	Good to excellent
q3n	98.9	Good to excellent	0.795	Good to excellent
q3o	96.7	Good to excellent	0.389	Fair to poor
q3p**	100.0	Good to excellent	-	-
q3q	96.7	Good to excellent	0.555	Moderate
q3r**	98.9	Good to excellent	0.000	Fair to poor
q3s**	100.0	Good to excellent	-	-
q4**	100.0	Good to excellent	-	-
q7	97.8	Good to excellent	0.827	Good to excellent
q8	50.0	Fair to poor	0.247	Fair to poor
q9	100.0	Good to excellent	1.000	Good to excellent
q13	84.4	Good to excellent	0.689	Good to excellent
q18	52.2	Fair to poor	0.256	Fair to poor
q19	45.1	Fair to poor	0.398	Fair to poor
q20	96.7	Good to excellent	0.483	Moderate
q21	38.5	Fair to poor	0.227	Fair to poor
q24	95.7	Good to excellent	0.866	Good to excellent
q25	92.4	Good to excellent	0.813	Good to excellent
q27	95.7	Good to excellent	0.886	Good to excellent
q28	96.7	Good to excellent	0.899	Good to excellent

Appendix 6: (*Continued*) Results of Inter-Rater Reliability Tests for Nominal and Ordinal Items on the MAPS-USVI Audit Tool

	Agreement		Weighted Cohen's κ	
Item Number	**%**	**Rating**	**κ**	**Rating**
q29	95.3	Good to excellent	0.882	Good to excellent
q30	92.4	Good to excellent	0.845	Good to excellent
q31	96.7	Good to excellent	0.929	Good to excellent
q32	96.7	Good to excellent	0.890	Good to excellent
q33	73.6	Moderate	0.748	Good to excellent
q38	83.7	Good to excellent	0.747	Good to excellent
q42	84.8	Good to excellent	0.740	Good to excellent
q43	82.6	Good to excellent	0.679	Good to excellent

** Frequency of attribute is 100% or 0%.

Appendix 7: Calculated Measures and Subscales

Name of Calculated Measure/Subscale	Description and Original Question(s)	Response Options
Land use mix	Combined residential uses (q2) and commercial destinations (q3a – q3p)	Residential only Commercial only Mixed use
All destinations	Sum of all destination types (q3a – q3s, q4)	0 1 2+
Shops	Sum of grocery/supermarket (q3b), convenience store (q3d), and other retail (q3l)	0 1+
Restaurants and entertainment	Sum of fast food restaurant (q3a), sit-down restaurant (q3b), café or coffee shop (q3e), and entertainment (q3j)	0 1+
Institutions and services	Sum of bank or credit union (q3f), drugstore/pharmacy (q3h), health-related professional (q3i), and other service (q3k)	0 1+
Outdoor public recreation	Sum of public park (q3q), trail (q3r), and accessible beaches (q4)	0 1+
Formal transit stop	Dichotomized number of public transit stops (q9)	None At least one
Formal or informal transit stop	Dichotomized presence of formal transit stop (q9) and/or informal places to catch transit (q11)	None At least one
Any transit amenities	Dichotomized presence of any transit amenities, including bench, covered shelter, and schedule (q10)	None At least one
Any traffic calming	Dichotomized presence of any traffic calming features, including signs, traffic circles, speed tables, speed humps and curb extensions (q12)	None At least one
Aesthetic and Social Features		
Poorly-maintained buildings	Dichotomized building maintenance (q18)	0 = 100% well maintained 1 = Less than 100% well maintained
Well-maintained landscaping	Dichotomized landscaping maintenance (q19)	0 = Less than 100% well maintained 1 = 100% well maintained
Any graffiti	Dichotomized graffiti (q20)	0 = None 1 = A little or more
Any litter	Dichotomized litter (q21)	0 = None 1 = A little or more

Appendix 7: (*Continued*) Calculated Measures and Subscales

Name of Calculated Measure/Subscale	Description and Original Question(s)	Response Options
Aesthetics and Social Subscales		
Positive	Sum of hardscape features (q15), natural bodies of water (q16), softscape features (q17), and well-maintained landscaping	Range: 0 to 4
Negative	Sum of poorly-maintained buildings, any graffiti, any litter, and stray dogs (q22)	Range: 0 to 4
Overall	Positive aesthetics and social subscale – Negative aesthetics and social subscale	Range: -4 to 4
Sidewalk Quality Features		
Sidewalk continuity	Dichotomized continuity of sidewalk (q24)	0 = Not continuous 1 = Continuous
Sidewalk width	Recoded sidewalk width (q25)	0 = <3 feet 1 = 3–5 feet 2 = >5 feet
Any buffer	Trichotomized presence of sidewalk buffer (q26) and/or any street parking (q8)	0 = No 1 = Either buffer or street parking 2 = Both a buffer and street parking
Shade from trees or awnings	Sum of sidewalk trees (q30: 0=0 trees, 1=1–10 trees; 2=11+ trees), tree coverage (q31: 0=0–25%, 1=26–75%, 2=76–100%), and awning coverage (q32: 0=0–25%, 1=26–75%, 2=76–100%)	0 = Little (0 trees and <25% shade) 1 = Some (1–10 trees or 26–75% shade) 2 = A lot (11+ trees and/or 76–100% shade)
Poorly-maintained sidewalk	Dichotomized sidewalk maintenance (q27)	0 = No major trip hazards 1 = One or more major trip hazards
Any permanent obstructions	Dichotomized presence of any permanent obstructions (q28)	0 = None 1 = One or more
Any temporary obstructions	Dichotomized presence of any temporary obstructions (q29)	0 = None 1 = One or more

Appendix 7: (*Continued*) Calculated Measures and Subscales

Name of Calculated Measure/Subscale	Description and Original Question(s)	Response Options
Sidewalk Quality Subscales		
Positive	Sum of sidewalk continuity, recoded sidewalk width, any buffer, and shade from trees or awnings	Range: 0 to 7
Negative	Sum of poorly-maintained sidewalk, any permanent obstructions, and any temporary obstructions	Range: 0 to 3
Overall	Positive sidewalk quality subscale – Negative sidewalk quality subscale	Range: -3 to 7
Any intersection control	Dichotomized presence of any intersection control, including yield signs, stop signs, traffic signal, traffic circle, crossing aid, and cross guard (q39)	None At least one
Any signalization	Dichotomized presence of any signalization, including pedestrian walk signals, push buttons, countdown signal, and bicycle signal (q41)	None At least one
Any crosswalk treatment	Dichotomized presence of any crosswalk treatment, including marked crosswalk, high visibility striping, curb extension, raised crosswalk, and different material than road (q45)	None At least one

Appendix 8: Procedures for Calculating Weights

Each audited street segment in the USVI Audit dataset was assigned a weight to provide representative estimates of street length across the sampling frame. The weights were created in four steps:

Step 1:	The initial combined weight was calculated.
Step 2:	Adjustment for the length of each individual segment was made.
Step 3:	Adjustment for the percentage of street segments that were found to be out-of-scope were made (e.g. non-response).
Step 4:	Adjustments for post-stratification were made so that weights matched the adjusted total street length in the sampling frame.

Step 1: Calculating the initial combined weight

Each segment was assigned an initial combined weight that accounted for the probability of a PSU being selected from a stratum and the percentage of street length in a PSU that was audited:

$$\text{Initial combined weight} = \frac{1}{\text{Probability of PSU selection X Initial segment weight}}$$

where

$$\text{Probability of PSU selection} = \frac{\text{\# selected PSUs in stratum}}{\text{Total \# of PSUs in stratum}}$$

and

$$\text{Initial segment weight} = \frac{\text{Total length of audited segments in PSU}}{\text{Total street length in PSU}}$$

Step 2: Adjustment for length of each audited segment

This initial combined weight was then adjusted for the length of each individual audited segment. Segment lengths were calculated in QGIS using TIGER Files and GPS points captured in the field.

$$\text{Adjusted weight}_{length} = \text{Initial combined weight} * \text{Length of street segment}$$

Step 3: Adjustment of total street length in sampling frame for "out-of-scope" percentage

The post-stratification weights were adjusted for the percentage of audited street length in each stratum that was found to be "out-of-scope." A street segment was classified as "out-of-scope" if auditors arrived at the segment and found that the street either did not exist (e.g. bush), was a driveway or other private road (e.g. gated community inaccessible to public), or was inaccessible for some other reason (e.g. under construction, fenced off). This stratum-specific percentage ranged from 0% to 33.6%.

Within each stratum, the percentage of sampled street length classified as out-of-scope was calculated as follows:

$$\%\ \text{out-of-scope} = \frac{\text{Sampled street length out-of-scope}}{\text{Total sampled street length}} * 100$$

Within each stratum, the total street length in the sampling frame was then adjusted by this out-of-scope percentage as follows:

$$\text{Adjusted street length in sampling frame} = \text{Total street length} * (1 - \%\ \text{out-of-scope})$$

Step 4: Adjustment for post-stratification

In the final step, a post-stratification factor was applied to individual segment weights to generate weighted counts that added up to the adjusted total street length in the sampling frame (1155.92 km).

Within each stratum, a post-stratification factor was calculated as follows:

$$\text{Post-stratification factor} = \frac{\text{Adjusted street length in sampling frame}}{\sum_{j=1}^{n} \text{Adjusted length-based weight}_j}$$

where j = audited street segment

For each audited street segment, the final weight was calculated as follows:

$$\text{Final weight}_{length} = \text{Adjusted weight}_{length} * \text{Post– stratification factor}$$

Since our dataset includes two observations per segment (right and left sides), the final length-based weights were halved and equivalent half-weights were assigned to the right and left side of each audited segment.

Appendix 9: Glossary of Terms

Term	Definition
Street segment	Length of street between two intersections 
Estate	Legal subdivision in the US Virgin Islands recognized by the US Census Bureau
Population reach	Number of residents per km of street length, calculated at the estate level
Population density	Number of residents per square mile, calculated at the estate level
Route	String of adjacent street segments selected for auditing. A route-based sampling methodology was used to make it easier for auditors to locate segments in the field, but each street segment in a route was audited separately.
Pedestrian street or zone	A street that only allows pedestrian traffic and is closed to vehicles. 

Traffic calming features	Infrastructure that is intended to reduce vehicle speeds and improve driver and pedestrian safety. 
Hardscape features	Examples include fountains, sculpture, or public or private art.   
Softscape features	Examples include gardens, landscaping, designated viewpoints, retaining walls, or parks.  

Sidewalk buffer	Physically separates pedestrians on a sidewalk from the closest lane of moving vehicles. Examples include grass, shrubs, trees, parking meters, or telephone poles that are closely spaced.   
Sharrows	Painted arrows on street lanes that indicate shared use between automobiles and bicycles 
Tactile paving	Textured ground surface that acts as a visual and/or physical cue to assist pedestrians in locating curb ramps. 

High visibility striping	Striping on the crosswalk that is more visible to drivers than simple parallel lines, usually indicated by ladder or diagonal striping or unique coloring. 
Curb extension	Used for traffic calming, curb extensions are comprised of an angled narrowing of the roadway and a widening of the sidewalk. 
Protected refuge	Protected area in the middle of an intersection where pedestrians can safely pause before crossing the second half of a larger intersection.

References

1. Xu F, Town M, Balluz LS, Bartoli WP, Murphy W, Chowdhury PP, et al. Surveillance for certain health behaviors among states and selected local areas - United States, 2010. *MMWR Surveill Summ*. 2013;62(1):1-247.
2. Centers for Disease Control and Prevention. BRFSS 2010 Survey Data and Documentation 2014 [Available from: https://www.cdc.gov/brfss/annual_data/annual_2010.htm.]
3. U.S. Department of Health and Human Services. *2008 Physical Activity Guidelines for Americans*. Washington, DC: U.S. Department of Health and Human Services; 2008.
4. Physical Activity Guidelines Advisory Committee. *Physical Activity Guidelines Advisory Committee Report, 2008*. Washington, DC: U.S. Department of Health and Human Services, 2008.
5. U.S. Department of Health and Human Services. *Step It Up! The Surgeon General's Call to Action to Promote Walking and Walkable Communities*. Washington, DC: U.S. Department of Health and Human Services, Office of the Surgeon General, 2015.
6. Lee IM, Buchner DM. The importance of walking to public health. *Med Sci in Sport Exer*. 2008;40(suppl 7):S512-S8.
7. Watson KB, Frederick GM, Harris CD, Carlson SA, Fulton JE. U.S. adults' participation in specific activities, Behavioral Risk Factor Surveillance System—2011. J Phys Act Health. 2015;12(suppl 1):S3-S10.
8. Centers for Disease Control and Prevention. Vital signs: walking among adults — United States, 2005 and 2010. *MMWR Morbid Mortal W Rept*. 2012;61(31):595-601.
9. Paul P, Carlson SA, Carroll DD, Berrigan D, Fulton JE. Walking for transportation and leisure among U.S. Adults — National Health Interview Survey 2010. J Phys Act Health. 2015;12(suppl 1):S62-S9.
10. Karsch HM, Hedlund JH, Tison J, Leaf WA. *Review of Studies on Pedestrian and Bicyclist Safety, 1991-2007*. Washington, DC: National Highway Traffic Safety Administration, 2012 Report No. DOT HS 811 614.
11. Pollack KM, Bailey MM, Gielen AC, Wolf S, Auld ME, Sleet DA, et al. Building safety into active living initiatives. *Prev Med*. 2014;69(suppl 1):S102-S5.
12. Johns Hopkins Center for Injury Research and Policy, New York City Department of Health and Mental Hygiene, Society for Public Health Education. *Active Design Supplement: Promoting Safety.* Version 2. 2013.
13. Leyden KM. Social capital and the built environment: the importance of walkable neighborhoods. *Am J Public Health*. 2003;93(9):1546-51.
14. U.S. Environmental Protection Agency. *Smart Growth and Economic Success: Benefits for Real Estate Developers, Investors, Businesses and Local Governments*. Washington, DC: U.S. Environmental Protection Agency, 2012.

15. U.S. Environmental Protection Agency. *Smart Growth and Economic Success: Strategies for Local Governments.* Washington, DC: U.S. Environmental Protection Agency, 2014 Contract No.: EPA 231-R-14-001.

16. Frank L, Engelke P. Multiple impacts of the built environment on public health: walkable places and the exposure to air pollution. *Int Reg Sci Rev*. 2005;28(2):193-216.

17. Federal Highway Administration. *Nonmotorized Transportation Pilot Program: Continued Progress in Developing Walking and Bicycling Networks*. Washington, DC: Federal Highway Administration, U.S. Dept of Transportation, 2014.

18. Federal Highway Administration. *A Resident's Guide for Creating Safe and Walkable Communities.* Washington, DC: Federal Highway Administration, U.S. Dept of Transportation, 2008 FHWA-SA-07-016.

19. Schlossberg M, Agrawal AW, Irvin K, Bekkouche VL. *How Far, By Which Route, and Why? A Spatial Analysis of Pedestrian Preference.* San Jose, CA: Mineta Transportation Institute, 2007 MTI Report 06-06.

20. Yang Y, Diez-Roux AV. Walking distance by trip purpose and population subgroups. *Am J Prev Med*. 2012;43(1):11-9.

21. McCormack GR, Shiell A. In search of causality: a systematic review of the relationship between the built environment and physical activity among adults. *Int J Behav Nutr Phys Act.* 2011;8:125.

22. Bauman AE, Bull FC. *Environmental Correlates of Physical Activity and Walking in Adults and Children: A Review of Reviews*. London, England: National Institute of Health and Clinical Excellence, 2007.

23. Ewing R, Cervero R. Travel and the built environment: a meta-analysis. *J Am Plann Assoc.* 2010;76(3):265-94.

24. Saelens BE, Handy SL. Built environment correlates of walking: a review. *Med Sci Sport Exer.* 2008;40(suppl 7):S550-S66.

25. Litman T. *Evaluating Public Transportation Health Benefits*. Victoria, Canada: Victoria Transport Policy Institute, 2015.

26. Rimmer JH, Riley B, Wang E, Rauworth A, Jurkowski J. Physical activity participation among persons with disabilities: barriers and facilitators. *Am J Prev Med*. 2004;26(5):419-25.

27. U.S. Census Bureau. 2015 TIGER/Line Shapefiles (machine-readable data files) 2015 [updated January 1, 2015. Available from: https://www.census.gov/geo/maps-data/data/tiger-line.html.]

28. Centers for Disease Control and Prevention, Division of Community Health. The Built Environment Assessment Tool and Manual 2015 [updated July 12, 2015. Available from: https://www.cdc.gov/nccdphp/dch/built-environment-assessment/pdfs/builtenvironment-v3.pdf].

29. Day K, Boarnet M, Alfonzo M, Forsyth A. The Irvine-Minnesota inventory to measure built environments: development. *Am J Prev Med*. 2006;30(2):144-52.

30. Brownson RC, Hoehner CM, Brennan LK, Cook RA, Elliott MB, McMullen KM. Reliability of two instruments for auditing the environment for physical activity. *J Phys Act Health*. 2004;1(3):191-208.

31. Pikora TJ, Bull FC, Jamrozik K, Knuiman M, Giles-Corti B, Donovan RJ. Developing a reliable audit instrument to measure the physical environment for physical activity. *Am J Prev Med*. 2002;23(3):187-94.

32. Millstein RA, Cain KL, Sallis JF, Conway TL, Geremia C, Frank LD, et al. Development, scoring, and reliability of the Microscale Audit of Pedestrian Streetscapes (MAPS). *BMC Public Health*. 2013;13:403.

33. Active Living Research. Microscale Audit of Pedestrian Streetscapes (MAPS) 2015 [Available from: http://activelivingresearch.org/microscale-audit-pedestrian-streetscapes].

34. Cain KL, Millstein RA, Sallis JF, Conway TL, Gavand KA, Frank LD, et al. Contribution of streetscape audits to explanation of physical activity in four age groups based on the Microscale Audit of Pedestrian Streetscapes (MAPS). *Soc Sci Med*. 2014;116:82-92.

35. Landis JR, Koch GG. The measurement of observer agreement for categorical data. *Biometrics*. 1977;33(1):159-74.

36. Sim J, Wright CC. The kappa statistic in reliability studies: use, interpretation, and sample size requirements. *Phys Ther*. 2005;85(3):257-68.

37. Sugiyama T, Neuhaus M, Cole R, Giles-Corti B, Owen N. Destination and route attributes associated with adults' walking: a review. *Med Sci Sport Exer*. 2012;44(7):1275-86.

38. McCormack GR, Giles-Corti B, Bulsara M. The relationship between destination proximity, destination mix and physical activity behaviors. *Prev Med*. 2008;46(1):33-40.

39. Maddock JE, Ramirez V, Zhang M, Brunner IM, Heinrich KM. A statewide observational assessment of the pedestrian and bicycling environment in Hawaii, 2010. *Prev Chron Dis*. 2012;9.

40. Smart Growth America. National Complete Streets Coalition website [Available from: http://www.smartgrowthamerica.org/complete-streets].

41. Laplante J, McCann B. Complete Streets: we can get there from here. *ITE Journal*. 2008:24-8.

42. Federal Highway Administration. Resource materials. Resource sheet 7: engineering solutions to improve pedestrian safety. In: *A Resident's Guide for Creating Safe and Walkable Communities*. Washington, DC: Federal Highway Administration, U.S. Dept of Transportation; 2008.

43. Retting RA, Ferguson SA, McCartt AT. A review of evidence-based traffic engineering measures designed to reduce pedestrian-motor vehicle crashes. *Am J Public Health*. 2003;93(9):1456-63.

44. McCann B, Rynne S. *Complete Streets: Best Policy and Implementation Practices.* Chicago, IL: American Planning Association Advisory Service, 2010.

45. Smart Growth America. National Complete Streets Coalition website. Complete Streets A to Z [Available from: http://www.smartgrowthamerica.org/complete-streets/a-to-z].

46. New York City Department of City Planning, New York City Department of Design and Construction, New York City Department of Health and Mental Hygiene, New York City Department of Transportation. *Active Design: Shaping the Sidewalk Experience.* New York, NY: City of New York; 2013.

47. Lachapelle U, Frank L, Saelens BE, Sallis JF, Conway TL. Commuting by public transit and physical activity: where you live, where you work, and how you get there. *J Phys Act Health*. 2011;8(suppl 1):S72-S82.

48. Lachapelle U, Frank LD. Transit and health: mode of transport, employer-sponsored public transit pass programs, and physical activity. *J Public Health Policy*. 2009;30(suppl 1):S73-S94.

49. Wener RE, Evans GW. A morning stroll: levels of physical activity in car and mass transit commuting. *Environ Behav*. 2007;39(1):62-74.

50. Brown BB, Werner CM. A new rail stop: tracking moderate physical activity bouts and ridership. *Am J Prev Med*. 2007;33(4):306-9.

51. Freeland AL, Banerjee SN, Dannenberg AL, Wendel AM. Walking associated with public transit: moving toward increased physical activity in the United States. *Am J Public Health*. 2013;103(3):536-42.

52. Besser LM, Dannenberg AL. Walking to public transit: steps to help meet physical activity recommendations. *Am J Prev Med*. 2005;29(4):273-80.

53. Hoehner CM, Brennan Ramirez LK, Elliott MB, Handy SL, Brownson RC. Perceived and objective environmental measures and physical activity among urban adults. *Am J Prev Med*. 2005;28(suppl 2):105-16.

54. Project for Public Spaces. The lighter, quicker, cheaper transformation of public spaces [Available from: https://www.pps.org/reference/lighter-quicker-cheaper/].

55. Poon L. Polka dots help pedestrians reclaim space in Austin 2016 [updated January 3, 2017. Available from: http://www.citylab.com/design/2016/01/polka-dots-help-pedestrian-reclaim-space-in-austin/433749/].

56. Campbell D. Road to protected bike lanes 2014 [Available from: https://bikeeastbay.org/news/road-protected-bike-lanes].

57. Choy LB, McGurk MD, Tamashiro R, Nett B, Maddock JE. Increasing access to places for physical activity through a joint use agreement: a case study in urban Honolulu. *Prev Chronic Dis*. 2008;5(3):1-8.

58. ChangeLab Solutions. Shared Use website: ChangeLab Solutions Law & Policy for the common good; [Available from: http://changelabsolutions.org/childhood-obesity/joint-use].

59. Matson-Koffman DM, Brownstein JN, Neiner JA, Greaney ML. A site-specific literature review of policy and environmental interventions that promote physical activity and nutrition for cardiovascular health: what works? *Am J Health Promot.* 2005;19(3):167-93.

60. Centers for Disease Control and Prevention. Physical Activity for Arthritis Fact Sheet website [Available from: http://www.cdc.gov/arthritis/pa_factsheet.htm].

61. Centers for Disease Control and Prevention. Physical Activity and Arthritis Overview website. [Available from: http://www.cdc.gov/arthritis/pa_overview.htm].

62. Arthritis Foundation. Walk with Ease Program website [Available from: http://www.arthritis.org/living-with-arthritis/tools-resources/walk-with-ease/].

63. Lyons W, Morse L, Nash L, Strauss R. *Statewide Transportation Planning for Healthy Communities.* Washington, DC: Federal Highway Administration, U.S. Dept of Transportation, 2014 DOT-VNTSC-FHWA-14-01.

64. Lyons W, Peckett H, Khurana M, Nash L. *Metropolitan Area Transportation Planning for Healthy Communities.* Washington, DC: Federal Highway Administration, U.S. Dept of Transportation, 2012 DOT-VNTSC-FHWA-13-01.

65. Association of Schools and Programs of Public Health. Public Health Trends and Redesigned Education. Blue Ribbon Public Health Employers' Advisory Board: Summary of Interviews. Washington, DC: Association of Schools and Programs of Public Health, 2013.

66. National Network of Public Health Institutes, Centers for Disease Control and Prevention, Georgia Institute of Technology. *Public Health and Community Design Cross-Sectoral Workforce Development Final Report.* Atlanta, GA: Georgia Institute of Technology, 2013.

67. America Walks. The Walking College Website [Available from: http://americawalks.org/walkingcollege/].

68. Smart Growth America.. Free Technical Assistance Workshops [Available from: https://smartgrowthamerica.org/work-with-us/apply-for-our-free-technical-assistance/].