Transforming Communities

To make healthy living easier

The Built Environment An Assessment Tool and Manual

(An Adaptation of MAPS)

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National Center for Chronic Disease Prevention and Health Promotion
Division of Community Health

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Unless otherwise indicated, all pictures in this document were taken by Kenneth Goodman.

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1. Introduction

A wide array of tools exists for measuring different features of the built environment, many of them well validated. These existing tools fall into three categories: 1) interview or self-administered questionnaires which primarily measure perceptions, 2) tools that collect archival (existing) data, often using GIS, and 3) systematic observation or audit tools (Brownson et al., 2009). It is often difficult for local program staff and evaluators to know which features of the built environment are most important to measure on the basis of the health behaviors and outcomes they are trying to affect. It is also difficult to know which tool(s) to choose to most accurately and feasibly assess those features.

The Built Environment Assessment Tool (BE Tool) (an adaptation of MAPS) (Appendix D) is a direct systematic observation data collection instrument for measuring the core features and quality of the built environment related to behaviors that affect health, especially behaviors such as walking, biking, and other types of physical activity. There are many aspects of the built environment. The built environment includes the buildings, roads, sidewalks, utilities, homes, transit, fixtures, parks and all other man-made entities that form the physical characteristics of a community. The built environment can impact human health by affecting rates of physical activity, air pollutants such as ozone and particulate matter that can exacerbate asthma and respiratory disease, and emissions of carbon dioxide that contributes to climate change.

The BE Tool was not designed to assess every aspect of the built environment. Rather the tool assesses a core set of features agreed upon by subject matter experts to be most relevant. The core features assessed in the BE Tool include: built environment infrastructure (e.g., road type, curb cuts/ramps, intersections/crosswalks, traffic control, transportation), walkability (e.g. sidewalk/path features, walking safety, aesthetics & amenities), bikeability (e.g., bicycle lane/path features), recreational sites and structures, and the food environment (e.g., access to grocery stores, convenience stores, farmers markets, etc). Additional questions or modules could be added by users if more detail about an aspect of the built environment, such as the nutrition environment or pedestrian environment, is desired.

This Manual (main section of this document) provides a brief overview on the importance of measuring and understanding the built environment, describes the training and management of data collectors (or raters) and data for the BE Tool, provides instructions for selecting and assessing street segments, and provides guidance on data management and analysis procedures. In addition, in the appendices can be found background on the development of the tool (Appendix A), the list of experts who contributed to the development of the tool (Appendix B), links to resources on source tools (Appendix C), the tool itself (Appendix C), instructions for using the tool (Appendix E), and a data coding and scoring table to guide analysis (Appendix F).

2. Measuring the Built Environment

This section provides some background on the built environment and why measuring the features of the built environment related to walking, biking, and other physical activity is relevant for public health work that seeks to reduce obesity and other types of physical activity.

2.1. Why Measure the Built Environment?

In an effort to improve health, many public health practitioners are shifting their focus from programs aimed at producing individual behavior change to those affecting entire communities. Public health practitioners understand that the choices people make are influenced by the environments in which they live. This includes policies and systems that impact their health, and the built environment in which they live. As a result, many public health practitioners have become interested in making improvements to the built environment to improve public health outcomes. They are broadening their partnerships to include local government leaders from a variety of disciplines (e.g., planning, transportation, infrastructure, parks and recreation) and nongovernmental entities (e.g., neighborhood associations, nonprofit community development groups, schools, businesses, and religious organizations).

Improving the built environment is a difficult process that involves a number of different stakeholders: elected officials who direct planners and engineers to plan land development; developers who choose whether and where to build houses, offices, and retail spaces; and concerned residents who help shape community decisions. Creating a healthy built environment means learning how the built environment can affect health; finding the many options available to make built environments healthier; and understanding which options are right for a particular community based on its needs and resources.

Measuring the built environment in a specific area can help to assess baseline conditions; assess needs and set priorities for improving the built environment; and collect measures over time to assess changes in the features of the built environment related to obesity and other negative health outcomes. The BE Tool facilitates direct observation of the built environment using objective measures. In determining whether an observational assessment tool to measure the built environment is the best use of your time and resources, it is a good idea to first collect as much existing information about the built environment as possible. This will help you to decide whether to conduct a more in-depth and detailed assessment through systematic observation.

2.2. Resources on the Built Environment and Health

This section describes a number of other resources you can use to learn more about the relationship between health and the built environment and what options are available to make the built environment healthier. It also provides some existing sources of data you may want to collect prior to using the BE Tool.

A number of resources explain the relationships between the built environment and health.

- A great place to start is with the Centers for Disease Control and Prevention (CDC)'s Healthy Places Web site. This site has links to over a dozen areas concerning healthy community design and public health issues such as physical activity, healthy food, and injury. It also includes healthy planning tools, links to related organizations, and relevant conferences and events.

- The American Public Health Association's Transportation Issues from the Public Health Perspective has a comprehensive number of resources related to how transportation may affect public health and health equity concerns.
- The Action Strategies Toolkit, by the Leadership for Healthy Communities, was written for local and state leaders and has a focus on policy improvements. It also includes information on how communities may be contributing to obesity levels and how they can help prevent obesity through improvements to transportation systems, healthy eating opportunities, and the built environment.
- New York City's Active Design Guidelines provide a manual for architects and urban designers of evidence-based strategies for creating healthier buildings, streets, and urban spaces that can encourage regular physical activity and healthy eating.
- American Planning Association (APA)'s Policy Guide on Community and Regional Food Planning describes recommendations that can increase opportunities for healthy eating for residents. Their Healthy Plan Making Report may also serve as a good informational resource.
- Creating a RoadMap for Producing & Implementing a Bicycle Master Plan provides strategies to plan, develop, and implement a bike master plan. It was developed by the National Center for Bicycling & Walking and the Active Living Resource Center.
- The US Department of Justice's Crime Prevention through Environmental Design Guidebook provides safety design measures in various types of locations such as schools, shopping districts, and downtowns.

2.3. Existing Information on the Built Environment

Before you commit the time it will take to complete a systematic observational assessment of the built environment, you might want to spend a little time researching your community's built environment and learning more about both the policies that shape it and how well it is providing an environment for its residents to live healthy lifestyles. You will probably be interested in policies related to physical activity and infrastructure that supports people walking, biking, or having space to play or exercise in parks and recreation areas. You also may be interested in policies related to healthy food access, for example, promotion of healthy food; government procurement guidelines to ensure healthy foods are served in public agencies; incentive programs to bring in grocery stores or add fresh fruits and vegetables to corner stores; or restrictions on fast food restaurants near schools.

Most land use policies are set at the local level because of the many unique characteristics that shape different parts of the country. Typically, transportation policies are set at the local, state, and national levels because the transportation system crosses jurisdictional lines to link communities together.

The kinds of policies in place, and how comprehensive they may be, will depend on the location. Cities tend to have more regulations than counties because they have more people living in close proximity. Further, the political climate and history of regulation also will determine whether particular plans or policies are required or not. Public sector Web sites will provide relevant policy documents to help you learn more about the policy landscape in your community.

A **comprehensive plan** is a visioning document that lays out a community's expectations for future growth, its priorities for development, and its goals to achieve that vision. It usually has a 20- to 30-year horizon. The goals are detailed in a **land development or zoning code**, which may include any requirements for parks, open space, sidewalks, or bike

infrastructure in new development. It may have permitting information for farmers markets that specifies in which zoning districts they may be placed. You also may find a **transportation plan** that describes how the road network will accommodate future growth. The plan is likely to include language that shows the level of priority of walking and bicycling in new infrastructure. A city may also have a **Complete Streets policy** or **food access policy** that covers additional areas related to public health. Incentive programs like matching funds for using the Supplemental Nutrition Assistance Program (SNAP) or Special Supplemental Nutrition Program for Women, Infants and Children (WIC) at farmers markets may be listed on the Web site as well, possibly in a community development or economic development department.

There are a number of different Web sites you may want to review. If you are in an incorporated city, you may want to start with its Web site. You also may review your county's Web site. A larger urbanized area may have a Metropolitan Planning Organization (MPO) that has the authority to set plans. If you are interested in active transportation, review any transportation plans that a regional or state transportation agency may have. A few other good sources of information include the following:

- County Health Rankings include detailed health information down to the county level.
- Walkscore shows how walkable an address, neighborhood, or community is, based on the number of amenities such as restaurants, groceries, and parks that are in walking distance. It also provides a bike score, which measures the available bike infrastructure (lanes, trails), and geographic features such as hills, destinations, and road connectivity, along with the number of bike commuters in an area.
- USDA Food Access Research Atlas allows user to map food deserts down to the census tract and show where residents may be experiencing lack of healthy food options.
- USDA Farmers Market Search will show you where farmers markets are located in your community and whether they accept SNAP or WIC payments.

3. Management and Training of Raters

This section describes methods for coordinating, managing, and training data collectors (raters), as well as methods for maintaining inter-rater reliability.

3.1. Coordination and Management of Data and Raters

To coordinate data collection, the assignment of street segments to raters, and tracking the progress of data collection, create a management database in Epi-Info, Excel or Access. Some suggestions for fields in the database are:

- Segment ID
- Census tract or block group
- Street name
- Intersection street names
- Zoning
- Primary direction of street segment
- Assigned to rater? (yes/no)
- Rater # assigned to
- Rated? (yes/no)
- Date rated
- Complete? (yes/no)
- Inter-rater reliability assignments
    - » Rater
    - » Assigned?
    - » Completed?
- Comments

This database can be used to track overall data collection, assign segments to raters, track progress, and track inter-rater reliability procedures. The data collection manager may want to have a map of the entire area that is being assessed, with all segments to be assessed marked, and use that map to visually track what has been rated and what still needs to be completed.

3.2. Training of Raters

Raters can be anyone with interest in the topic and an understanding of the importance of the reliability and consistency of data collection. Training of raters is very important for building a level of understanding about the built environment, particularly those features that will be assessed using the tool, and how to carry out all aspects of data collection. Training also should include in-field training that consists of supervised data collection, and a certain number of practice runs, with an inter-rater reliability test at the end of training. Appendix E contains an instruction guide with pictures to help

raters complete the tool. Currently, CDC does not provide training for the BE Tool. However, additional information on the training and certification of raters, and additional pictures of built environment features, can be found in the MAPS manual available at this Website: http://sallis.ucsd.edu/measure_maps.html.

Step 1: The first step of training should be classroom training on the project goal, overall purpose for measuring the built environment, description of the area to be measured and why, all to set the stage for why the rater will be collecting data on the built environment. This puts the project and data collection tasks into context and helps the rater go into the field with a good understanding of the purpose. This also helps the rater to answer questions from anyone he or she encounters while collecting data.

Step 2: The second step of training also should be in-office, consisting of an in-depth description of each built environment feature the tool measures and how to use the tool to measure it. The use of pictures and other media should be used to reinforce understanding of these features. This in-office step also should include a description of how raters will carry out the following tasks:

- Being assigned street segments to rate and preparing the tools prior to going into the field
- Walking a street segment and using the tool
- Recording and managing field data
- Managing the completed tools and delivering them to the data collection manager
- Handling inter-rater reliability

Step 3: The third step of training should be in-field practice sessions, directly supervised by the data collection manager or trainer. This step should consist of allowing the rater to complete all the preparatory steps in-office before going into the field; finding assigned street segments; and completing at least one tool for a variety of types of street segments (e.g., commercial, residential, rural). The supervisor should discuss all aspects of the tool and procedures during the practice runs, since this is not a test of the rater's abilities, but instead is still part of learning.

The above three steps can be completed via a one-on-one process (supervisor and rater) or as a group (supervisor and group of trainees).

Step 4: The next step in training is to assign the raters a set of street segments to assess and send them out on their own to do it. This may best be done as a group, so that each can complete tools for a street segment, and then discuss the ratings (and any variations) as a group, onsite. They can then move to another street segment and repeat the process. At the end of this step, the raters should turn in all of their completed tools to the data collection manager, who will review them to identify variations in assessments, and rate the level of inter-rater agreement.

Step 5: Finally, raters should be sent out individually to assigned street segments to complete the tool. Again, this also can be done for different types of streets, such as commercial, residential, or rural. The data collection supervisor can then assign those same segments to either the trainer or someone who has completed training, to assess the same segments for the purpose of inter-rater reliability testing. If the level of inter-rater agreement is not sufficient, the supervisor or trainer can sit down with the rater to discuss what he or she got wrong and how to correctly measure it. When a rater is trained and achieves a predetermined rate of inter-rater reliability, he or she is ready to be a rater in the project. Ongoing inter-rater reliability checks also should be completed at set times and amounts throughout the project period.

3.3. Inter-Rater Reliability

Inter-rater reliability audits should be conducted periodically throughout the data collection period. Once raters are trained, inter-rater reliability audits should be conducted on approximately 10% of all segments he or she rates. Inter-rater reliability audits should take place no more than 1 week after original data collection occurred.

Each rater should complete the same number of inter-rater reliability audits. The data collection manager should select street segments completed by a rater, and assign those segments to a second trained rater to complete a new audit of the segment. The auditor should complete a tool for the same segment completed by the first rater, and the data collection manager should review it for level of agreement or variation. The manager should sit down with the rater (and auditor) to discuss areas of agreement or variation, and make sure that any clarifications are provided so that the rater and auditor would complete the tool in the same way in the future. Feedback on inter-rater reliability audits should be provided to the raters as soon as possible, so that any mistakes or misunderstandings about procedures or definitions can be clarified.

4. Segment Selection and Field Procedures

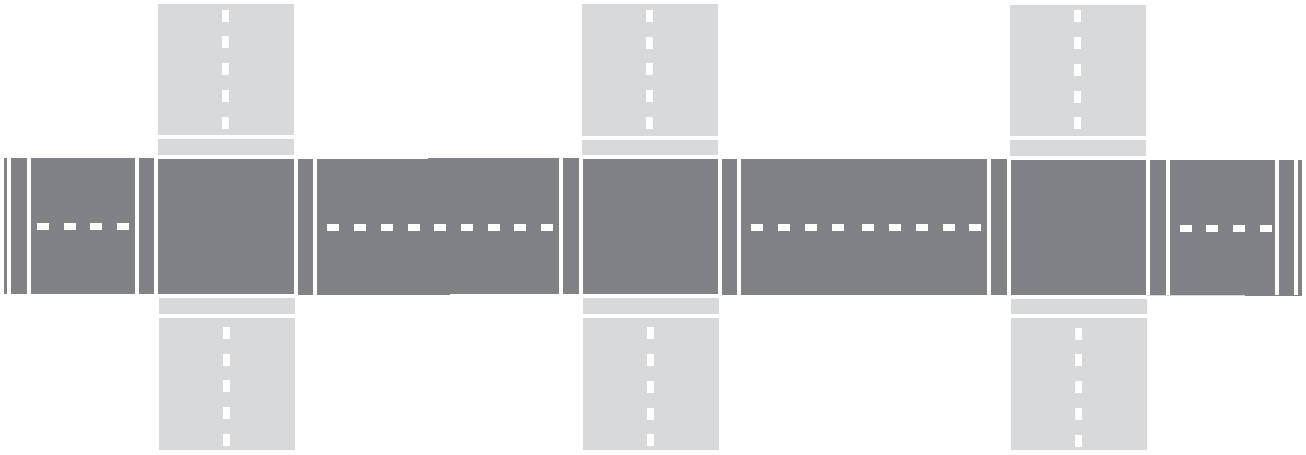
This section describes the steps in the process of identifying and selecting street segments to assess, and measuring each street segment, as well as suggestions for field preparation and personal safety.

4.1. Identifying Street Segments to Assess

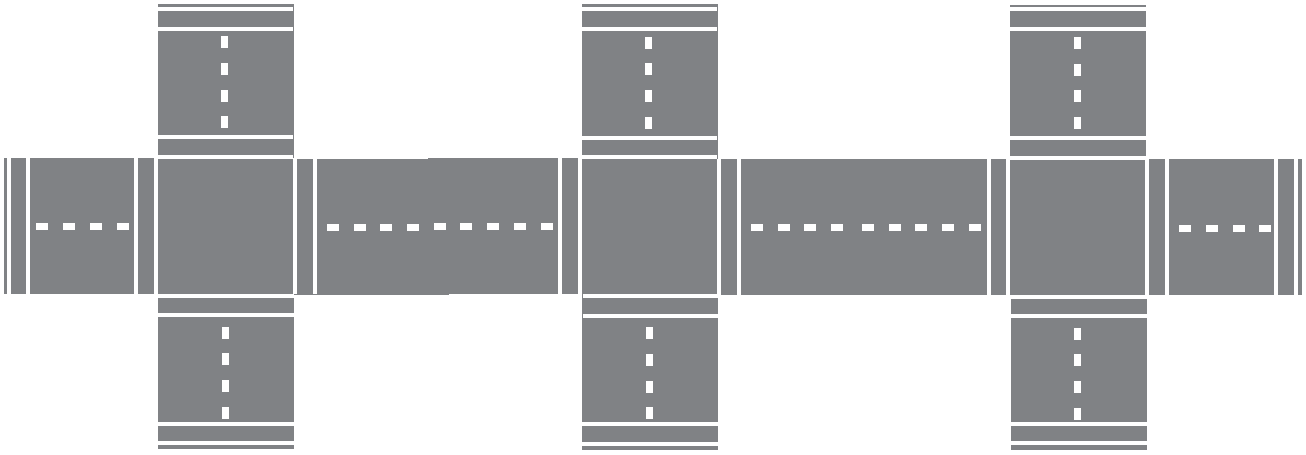
Deciding which street segments to assess with the BE Tool depends on your purpose for assessing the built environment. If your goal is to get a general picture of the built environment in a geographic area, then you should select a sample of street segments that best represents that area. If your goal is to conduct a built environment needs assessment, or to collect baseline data in an area where a built environment intervention is planned, then it is best to select street segments that represent the streets and areas where the intervention will take place. If the location of an intervention is not yet determined, it is advisable to use existing data to determine the area or areas where built environment improvements would have the most impact. These can be areas with populations in the most need of good walking environments, such as areas with the lowest car ownership, areas with the highest number of pedestrian or bicycle crashes with motor vehicles, and/or areas with the highest levels of poverty, and/or areas with highest obesity rates. You may then want to use the BE Tool to assess street segments in those areas.

If your interest is in a particular commercial corridor, then the best use of the tool may be to assess all street segments along that corridor. This may consist of assessing the street segments on the main street of the corridor, or could be supplemented by also assessing the first segment of the cross streets on either side of the main street of the corridor, to get a more detailed picture of the full segment.

Commercial Corridor

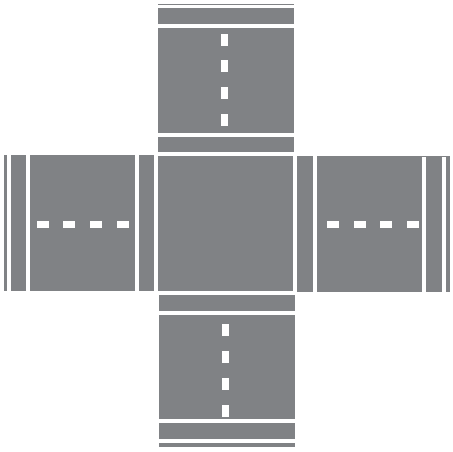


Commercial Corridor (with Cross Streets)



If your interest is in the built environment around an intersection (or set of intersections), then you may want to use the tool for each segment around the intersection. By doing this, you will assess the intersection, all crossings around the intersection, and the street segments leading to the intersection. For a 4-way intersection, four separate tools would be used, with the questions on intersection geometry and intersection control overlapping.

4-way Intersection



If the goal is to assess the built environment in a particular area, neighborhood, block group, census tract, zip code, or school catchment area, then selecting street segments to assess will depend on the goal of your effort. If the area has a commercial zone, it may be best to use the tool to assess the built environment along the main commercial corridor (and cross-street segments). You may then want to select other street segments in the geographic area, to get a better picture of the built environment in that area. This can be done by selecting specific routes from one part of the area to another (e.g., from a residential part of the area to a commercial corridor or school zone); by randomly selecting a designated number of segments in the area; by selecting segments that represent different typologies in the area (e.g., residential, commercial, mixed use); or by measuring all segments in the area (which may be time and resource intensive). If you are interested in assessing the area around a school, you could select street segments either by assessing all street segments in a one-quarter mile radius of the school, or by measuring segments along routes from residences to the school.

Sampling Street Segments

- All segments along commercial corridor
- All segments around an intersection
- Segments along routes
- Segments around schools
- Random selection of segments in an area
- Segments that represent typologies
- All segments in an area

The selection of street segments for observational assessment should start with a map of the area under consideration. This can be done by printing a Google map of the area, by using GIS, or by using a hard-copy map of the area. On the actual map printout, select and indicate the street segments to be assessed by marking them with a pen or highlighter. Assign each segment a unique ID number. Before assigning a rater to any set of street segments, create a list of the segments for the rater to assess, with ID number, street name, and cross streets that define the segment. Also, mark whether the street is predominately east-west or north-south in its orientation. If using GIS or other databases, you also may indicate the length of each segment and its zoning.

All of this information can be given to the rater as a list or table. Either the data collection manager or each rater should prepopulate a tool for each street segment to be assessed, with the information about each segment—segment ID, street name, segment length, primary direction, cross street names, and so forth—prior to going into the field. If a rater is going to be assessing multiple street segments along a corridor, it is helpful for the list of segments to be rated, and the prepopulated tools, to be provided in the order in which they should be rated.

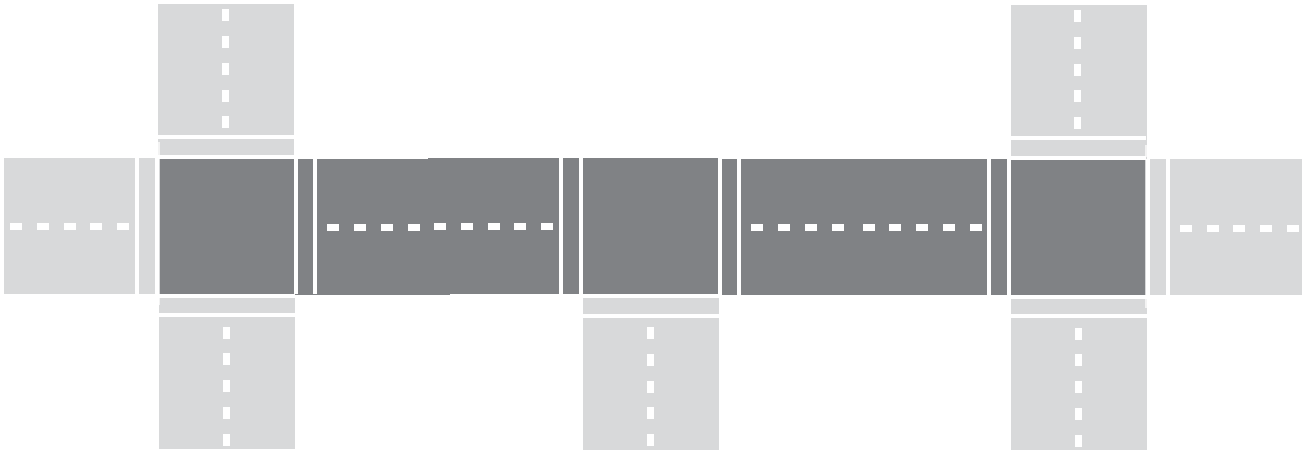
If using the tool to measure a rural area where the road may extend for miles without intersections, you can break the road(s) that you will assess into one-half mile segments and use a separate tool for each one. In this case, you may want to start at an intersection and walk the half-mile segment, but not complete the items for Intersection 2. You may then use only the street segment section of additional tools for each half-mile segment that does not have an intersection at either end.

4.2. How to Measure Entire Segments

The BE Tool measures entire street segments. This includes both sides of the street and the intersections at both ends. In some cases, it may be more appropriate to consider a street segment end-point not as a street intersection, but where a significant change in pedestrian infrastructure happens (e.g., discontinuity of a sidewalk, signaled cross walk). In either case, the segments can easily be pieced together by software if GPS coordinates at each street segment end-point are recorded.

If you decide to define the street segment end-point as a place where a significant change in pedestrian infrastructure happens and it does not contain an intersection, then you would not complete the section of the BE Tool that refers to intersections.

If there is a T-intersection between two four-way intersections on a street segment, then a separate tool should be completed for each side of the T intersection (see graphic).



Each side of the street along a segment is a block face, and for many features the BE Tool collects information separately for each block face. This is useful for assessing whether features such as sidewalks and bike lanes are on one or both sides of the street, as well as differences in their size or quality on each side. A compass will be useful for confirming the direction of the street (N-S or E-W), which end of the segment intersections 1 and 2 are located, and the compass direction of each block face.

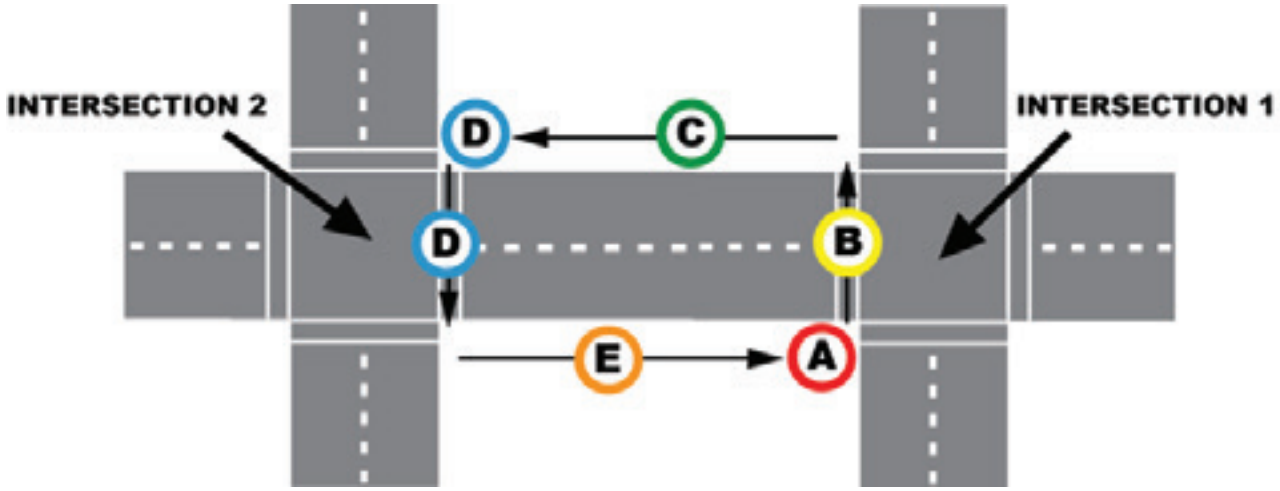
A. To measure a street segment, the rater should stand at one end of the segment at the intersection. This will be Intersection 1 in the BE Tool. The first thing to assess is the geometry of the intersection, and the type of intersection control (e.g., stop sign, traffic signal, traffic circle). These measures should apply to the entire intersection, and would be the same if taken from any corner.

B. Although the intersection may have crossings on all four sides, it is the crossing from one block face of the street segment to the other that you will assess with the tool. You will complete the questions in the tool that cover the crossing, crosswalk features, and curb cuts. For some of these questions, there are sub-questions for pre- and post-crossing, so that you will assess the crossing on both sides of the street. Be sure to indicate which side of the street the pre- and post-crossing are on. After completing this section, you will be on the opposite block face of the street segment.

C. It is at this point that you will assess what is found along the street segment. For some questions, your responses will address the entire street on both sides, while for others the responses have been split in a table format so that you can assess each block face separately. Be sure to confirm which side of the street you are on for those items so that you can indicate it on the tool, and complete the appropriate responses. Answer all of the questions relating to either the full street segment or to the side you are on. You can do this while walking the segment.

D. You should end up at the intersection on the other end of the street segment from where you started. Complete the questions about the intersection itself, and about the crossing to the opposite side of the street (the block face you started on, but at the opposite end). Follow the same procedures as you did at the other end.

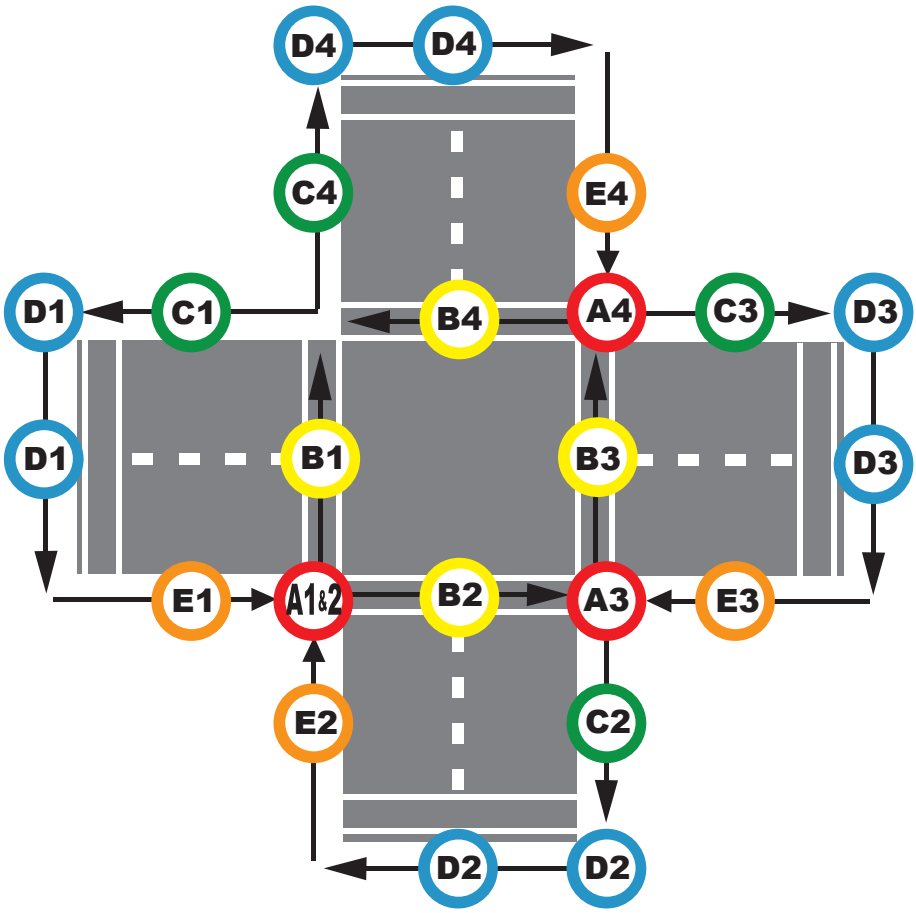
E. Finally, walk that block face of the street segment and go back through the middle part of the tool to complete any questions in which the responses are separated by side of the street (items 25-28, 32-34, 38-50, and 52-61). When you have completed all sections and questions, you should end up back at the spot where you started (point A in the diagram above). You have assessed an entire street segment.



Complete every segment you have started. Don't start rating a segment unless you have enough time to complete it in one session. Once you have completed a segment, review the tool again and fill in any blank fields before leaving or moving on to another segment.

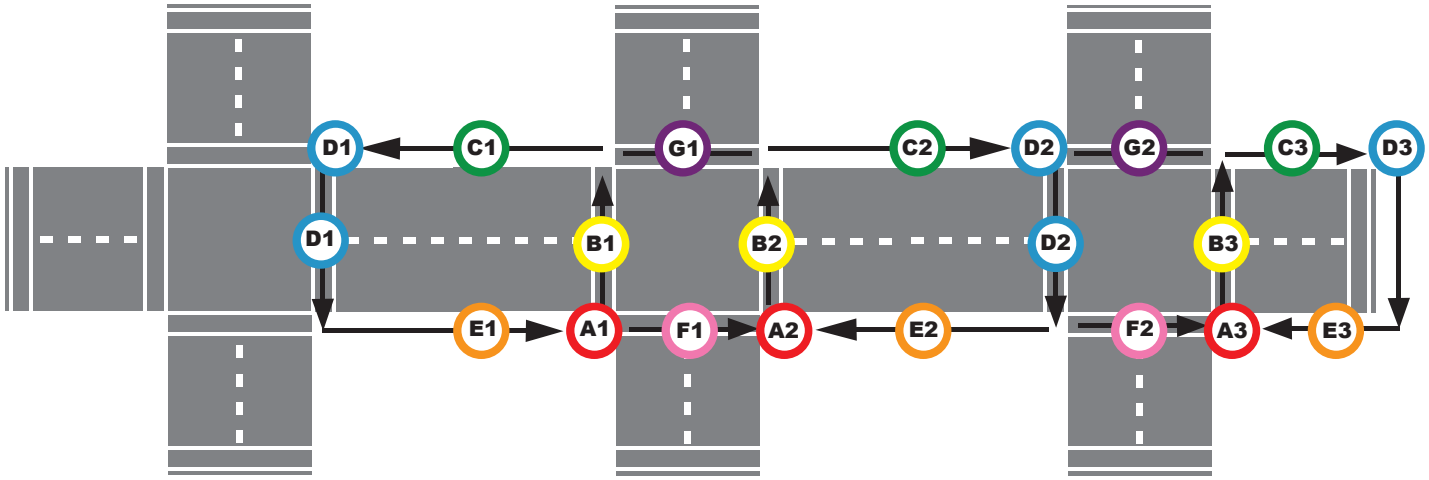
Moving to the Next Street Segment

There are options for moving on to the next street segment to measures, based on whether you are assessing a corridor with or without cross streets. If including cross streets in your assessment, the steps (A-E) described above would be repeated in the following fashion:



F. If the goal is to assess a corridor without including the cross streets, you will want to complete a separate pedestrian crossing section of the tool (Questions 68-78) when moving from one segment to the next (Step F), and then start a new tool.

G. In order to assess all crossings on the street corridor, you will also want to repeat another pedestrian crossing section of the tool for the corridor crossing on the other side of the street (Step G). See the graphic below for how to use the tool to assess a street corridor without including cross streets.



As represented in the above graphics, assessing an intersection will require completing four BE Tools and assessing the corridor as shown above would require three BE Tools plus extra crossing sections for F1, G1, F2, and G2. When moving from one segment to the next, either as a corridor or as intersections, some sections of the tool will not need to be repeated. By completing one tool you will have already assessed the intersection geometry and controls, and will not need to repeat that assessment for the same intersection. For example, when assessing the segments around an intersection, A1 is sufficient for assessing the intersection, and A2-4 would be unnecessary to repeat. For the corridor, A1 assesses the intersection so that it is not necessary to repeat it in A2, while D2 assesses the next intersection so that A3 is not necessary. In these cases, you may either repeat the intersection questions so they can be combined later, or make a note that it is already assessed in Segment ID#_____.

4.3. Personal Safety

- Check weather conditions before going to your assigned segments and prepare for adverse weather conditions, as appropriate.
- Conduct all observations during daylight.
- If you feel uncomfortable or unsafe, leave immediately and, if necessary, call the police to report a dangerous situation.
- If there is no safe place to walk, conduct the observation from a vehicle, or find a safe vantage point.

4.4. Field Preparation Checklist

- Budget 30–45 minutes for each segment.
- At the end of your shift, submit all of your tools and maps and discuss your work and any questions with your supervisor.

The following items are necessary to bring into the field:

- Map(s) with assigned street segments clearly marked
- List of assigned street segments
- Copies of the tool (with identifying information for each segment prepopulated)
- Clip board, note paper, pen/pencil

The following items are suggested to bring into the field:

- Compass
- Tape measure
- Level
- Stop watch
- Comfortable clothes and shoes
- Water and snacks
- Cell phone
- Camera
- Sun protection and hat
- Traffic safety vest
- As few other personal belongings as possible

5. Data Coding, Scoring and Interpretation

5.1. Data Coding and Scoring

As noted elsewhere, DCH found the MAPS tool (http://sallis.ucsd.edu/measure_maps.html) to be the best source for questions, response options, and well-developed scoring guidance to address BE Tool expert panel recommendations. DCH, in turn, organized the BE Tool to align with MAPS structure and scoring system for which documentation can be found at the above link. This alignment enabled DCH to adopt MAPS variable naming conventions for the large number of BE Tool items adopted from MAPS. The data scoring and analysis of the BE Tool is also designed to fit within the MAPS scoring structure so that the tools produce comparable data. The BE Tool Data Coding and Scoring Table provided in Appendix F provides recommended variable names, coding rules and a scoring approach. The table also includes MAPS variable names (where applicable) to enable users to cross-reference BE Tool and MAPS items and facilitate the use of MAPS scoring syntax for analyses.

Coding and scoring for non-MAPS items. As summarized in Appendix A, a relatively small number of the 81 BE Tool items were adopted from non-MAP Tools including the PRC-HAN, Analytic Audit, QPAT, and BRAT-DO tools. Please refer to Appendix C for web links to each of these tools and related coding and scoring resources. DCH also applied the MAPS variable nomenclature to these non-MAPS items. These variable names (along with coding and scoring recommendations) are also included in the Data Coding and Scoring Table (Appendix F). For example, when items related to Crossings are non-MAP items and do not appear on the MAPS Tool. The variable name became C1_B12 "C" indicates the item is assessing Crossing; "1" is the crossing at first Intersection (as a means to differentiate between 2 crossings in a segment); "B" is included as a reminder that the variable is for an item appearing on the BE Tool; and "12" indicates the item number on the BE Tool.

Revised response format to increase flexibility. While items appearing on the BE Tool are largely a subset of the MAPS Tool, the response format for some of these items is more similar to those for the PRC-HAN Tool where the response format allows for separate assessment and scoring of the walkability and bikeability (e.g., sidewalks, bike lanes, curb cuts) of each side of a street segment. The BE Tool adopts the PRC-HAN response format to allow for separate or combined scores for each side of a street segment. For those BE Tool items with modified MAPS response format, each side of the street can be assigned a separate score using MAPS guidance. However, the BE Tool also provides the option to have a single score for the two-sided street segment. For example, an item that measures the presence of sidewalks might receive a higher score for having sidewalks on both sides of the street than for having them only on one or the other side, which in turn would receive a higher score than if no sidewalks are present. These combined scores can be found in Appendix F.

Getting Started

Step 1. Refer to the MAPS Tool data coding and scoring information. Many of the items selected by the Subject Matter Expert Panel for this built environment assessment instrument were adopted from MAPS. Please refer to Appendix A to determine which items were adopted from MAPS and for a description of any modifications to assessment items resulting from expert panel recommendations during the instrument development process. To help you use the BE Tool, we provided a BE Tool Data Coding and Scoring Table in Appendix F, with coding and scoring recommendations for each item. Also, to reduce redundancy and improve comparability with built environment studies, users of the BE

Instrument are referred to the MAPS scoring system for the adopted items. The MAPS data coding and scoring system is well developed and validated (Cain, Millstein, & Geremia, 2012; Millstein, et al., 2013) and is available to the public (http://sallis.ucsd.edu/Documents/Measures_documents/MAPS%20Manual_v1_010713.pdf). The psychometrics of the items and subscales used in the MAPS tool are described in detail in their manual referenced above.

Step 2. Refer to the BE Tool Data Coding and Scoring Table for non-MAPS items. A smaller number BE Tool items selected by the Subject Matter Expert Panel were adopted from other assessment instruments. This was necessary to assess other domains and specific characteristics of the built environment not addressed by MAPS. Please refer to Appendix A of the Built Environment Assessment Tool Manual to identify the original instrument an item was adopted from and a description of any modifications to items. Appendix F provides an approach you can use to code each of these items. For more detailed coding and scoring information on non-MAPS items, please refer to the original instruments these items were selected from.

Step 3. Factors to consider. The following are some factors to consider as you code and score your results.

- *Items were selected from other existing instruments.* Therefore, it is not possible to guarantee any individual item (or group of items) will have the same psychometric properties as the original instrument from which the item was adopted. However, we are confident the level and quality of SME input resulted in a content valid instrument. We plan to refine it over time and in ways that incorporate user feedback.
- *Users are referred to original instruments for detailed coding and scoring guidance.* DCH has included a data coding and scoring approach in Appendix F to help ensure that data collection is systematic. We are referring users to the original instrument documentation from which items were adopted for more detailed coding and scoring information. This has a number of advantages. First, instruments from which items were adopted have made a wide variety of resources freely available to support their use. Second, referring potential BE Tool users to the original instruments for guidance helps ensure that users have access to detailed documentation. Third, as a federal government entity, we are minimizing duplication as a matter of good stewardship of public funds. Finally, in this way, we help ensure that users are more fully informed regarding the content of the original instruments that, in some cases, may better meet their specific assessment needs.
- *Some items and response options were revised.* Any modifications to items adopted from other instruments were made with considerable thought. Modifications to items are found in Appendix A.
- *The BE Tool is not organized by MAPS sections including route, segment, and crossing.* While this is important to consider when referencing the original MAPS documentation, DCH determined this was a necessary change to increase the tool's feasibility. Specifically, the tool is organized in a way that reflects how a rater would walk a street segment on both sides of a street and allows for crossing at both ends. While we acknowledge the built environment may not be structured this way, the BE Tool is flexible enough to enable users to tailor their rating approach to meet their needs.

5.2. Interpreting the Data

The information collected from the BE Tool can be examined in a variety of ways depending on how you plan to use the data. This can be done using overall segment scores, descriptive analyses, or a combination of both.

The overall segment score sums all ratings for all features assessed using the BE Tool. The overall segment score may

be helpful in identifying street segment that are less walkable and safe than others, and providing a high-level picture of where built environment disparities exist. This could be helpful to decision makers from a broad perspective as they consider what neighborhoods, communities or streets to focus on making built environment improvements. While the overall segment scores can paint a broad picture, they should not be your only source of information for making decisions because the overall segment scores weights all features assessed equally. This could be slightly mis-leading since not all built environment features are equal in terms of which may be more important to address than others if you want to make a street or community safe and walkable.

For this reason, we suggest you also use descriptive analyses. Descriptive analyses might include the frequency of the presence and absence of specific items / features measured by the assessment, average ratings of features, how much variability there is in these ratings, and so on. This could be examined for an individual segment or for a group of segments depending on your interest. The descriptive analysis can help with interpretation of overall segment scores or sub-scale scores which sum or average multiple features by highlighting the feature(s) with the highest or lowest rating. Descriptive analyses can help decision makers understand exactly what features are being grouped together and to consider where caution may be most warranted in using overall segment or sub-scale scores to drive local decisions and considering the features of your particular built environment. When a score appears to be surprising or counterintuitive, looking back at the descriptive analysis can help everyone better understand what in the ratings may account for these findings. Overall, the descriptive steps are important for making meaning from the data in a way that is sensitive to your local context. They will help you better understand where it may be helpful, for example, to use frequencies, totals, or average ratings of individual features of the built environment to inform local decision making and where calculating an overall score that compiles information from multiple features makes sense.

5.3. Evidence-based Approaches to Promote Safe and Active Built Environments

Environmental and policy approaches, such as community and street design, are intended to provide opportunities, support, and cues to help people be more physically active. The Guide to Community Preventive Health (http://www.thecommunityguide.org/pa/environmental-policy/index.html)provides a good starting place to understand what environmental and policy approaches are shown to be effective in increasing physical activity.

According to the Guide to Community Preventive Services increases in physical activity can be achieved by:

- improving the design of communities – this includes having residences in close proximity to stores, having well-connected, safe, and attractive sidewalks or paths between destinations, shorter blocks, and more intersections (Berrigan, Pickle and Dill, 2010; Heath et al, 2006; McCormack and Shiell, 2011; Saelens and Handy, 2008; Schulz et al, 2013; The Guide to Community Preventive Services, 2014).
- improving the design of streets – this includes improved street lighting, landscaping, traffic calming, sidewalks and features that separate walkers from motor vehicles, and increasing the number of safe pedestrian crossings (Berrigan, Pickle and Dill, 2010; Heath et al, 2006; Karsch, Hedlund, Tison and Leaf, 2012; Laplante and McCann, 2008; National Complete Streets Coalition, 2010; Pollack et al, 2014; Retting, Ferguson and McCartt, 2003; The Guide to Community Preventive Services, 2014; U.S. Department of Transportation Federal Highwy Administration).

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