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National Walkability Index
Methodology and User Guide

Acknowledgments

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I. Introduction

Across the United States, many neighborhoods are experiencing dramatic transformations. In large cities and small towns, parking lots, underused commercial properties, and former industrial sites are being replaced by condominiums, apartments, townhouses, and small-lot single-family homes. People are moving to these locations for the convenience of being able to walk from their homes to nearby train stations, restaurants, jobs, schools, and other community amenities.

Figure 1: The very walkable 16th Street Mall in Denver. Photo Credit: Amy Aletheia Cahill via Flickr

A 2015 survey by the National Association of Realtors and Portland State University found that 48 percent of respondents would prefer to live in communities containing houses that have small yards but are within easy walking distance of the community's amenities, as opposed to living in communities with houses that have large yards and require residents to drive to all amenities.[1]

Formerly vacant office buildings are being repurposed into mixed-use buildings, with apartments and condos on upper floors and office space and retail on lower floors. Companies of all sizes are choosing to locate in walkable downtown areas where their employees can get to work by transit, walking, biking, or driving shorter distances and can walk to local businesses during their lunch hour.[2,3] All of these changes demonstrate a growing demand for walkable communities.

The definition of walkability is simple: a walkable place is easy to walk around. Walkable communities come in various sizes and styles depending upon where they are located in the country; whether they are in a city, suburban area, or small town; and whether they have public transit. A walkable community in a small Northeastern village could look very different from a Southwestern city.

1 National Association of Realtors. "Millennials Favor Walkable Communities, Says New NAR Poll." Press release, Jul. 28, 2015. http://www.realtor.org/sites/default/files/reports/2015/nar-psu-2015-poll-press-release.pdf.
2 Smart Growth Online. "Smart Growth Principles." http://www.smartgrowth.org/smart-growth-principles. Accessed Jun. 28, 2016.
3 EPA. *Smart Growth and Economic Success: The Business Case.* 2013. https://www.epa.gov/smartgrowth/smart-growth-and-economic-success-business-case.

Walkable neighborhoods make it easier to walk to stores, jobs, and other places, which encourages people to be more active and can help them stay healthier. These individual benefits add up to more widespread public health benefits such as reduced obesity and diabetes rates.[4] When people choose to walk, bike, or take transit, they drive less, which reduces pollution from vehicles and improves human and environmental health.[5]

Additionally, compact, walkable neighborhoods can help conserve natural resources and reduce infrastructure costs because more spread-out areas need more land, roads, and utility lines per household.[6,7]

Walkable communities also encourage social interaction, which engenders a sense of community and improves people's mental health—when people are walking to the grocery store or movie theater, they might encounter neighbors or friends, and those types of interactions are far less common and less personal when people travel in automobiles.[8,9] A walkable community is safer for pedestrians because narrower streets with shorter crosswalks will reduce vehicle speed and increase pedestrian visibility.

WALKABILITY RESOURCES

Programs are available from all levels of government are in place to support more walkable built environments and communities. A few of these resources from federal agencies include:

Resources to Encourage and Promote Safe Bicycling and Walking from the US Department of Transportation
https://www.transportation.gov/mission/health/Encourage-and-Promote-Safe-Bicycling-and-Walking

Websites, guides, and campaigns from the Centers for Disease Control and Prevention and Department of Health and Human Services
https://www.cdc.gov/physicalactivity/walking/index.htm

Data and tools on physical activity from the National Cancer Institute of the National Institutes of Health
https://cancercontrol.cancer.gov/brp/hbrb/physical-activity

Smart Growth Technical Assistance from the US Environmental Protection Agency
https://www.epa.gov/smartgrowth/smart-growth-technical-assistance-programs

4 Glazier, R.H., et al. "Density, Destinations or Both? A Comparison of Measures of Walkability in Relation to Transportation Behaviors, Obesity and Diabetes in Toronto, Canada." *PLoS ONE* 9.1 (2014). http://www.journals.plos.org/plosone/article?id=10.1371/journal.pone.0085295.

5 Younger, M., et al. "The Built Environment, Climate Change, and Health: Opportunities for Co-Benefits." *Journal of Preventive Medicine* 35.1 (2008): 517-526.

6 EPA, *Smart Growth and Economic Success: The Business Case*.

7 Norman, J., H. MacLean, and C. Kennedy. "Comparing High and Low Residential Density: Life-Cycle Analysis of Energy Use and Greenhouse Gas Emissions." *Journal of Urban Planning and Development* 10.1061 (2006): 10-21.

8 Leyden, K.M. "Social Capital and the Built Environment: The Importance of Walkable Neighborhoods." *American Journal of Public Health* 93 (2003): 1546-1551.

9 Umberson, D. and J.K. Montez. "Social Relationships and Health: A Flashpoint for Health Policy." *Journal of Health and Social Behavior* 51(Suppl) (2010): S54-S66.

Many community leaders and residents, as well as public health officials, planners, and other municipal staff, want to make communities more walkable because of these benefits. However, there are no universal tools that provide transparent insight into what makes a community walkable, which makes it challenging to analyze and compare communities' walkability.

To help fill this gap, EPA developed the National Walkability Index, a tool that measures the relative walkability of our nation's communities. Users can view the index on an online interactive map or download the data.[10] The dataset covers every block group[11] in the nation, providing a basis for comparing walkability from community to community. This dataset's universal coverage at the block group level makes it easy to use as input into scenario planning, modeling, and other community analysis. Other tools and datasets to explore walkability do not allow such easy incorporation into other analyses. Users can display the National Walkability Index data on a map or incorporate it as input into other calculations using GIS software, database software, or spreadsheets.

Figure 2: AARP sums up the road safety benefits that a walkable community can create: "A street that's made safer for an older adult to cross is also safer for a child, a parent pushing a stroller, a bicyclist, a jogger. In other words, a walkable community benefits everyone."

Source: AARP. "Walkability Archive: Reports, case studies, surveys and more." http://www.aarp.org/livable-communities/archives/info-2014/walkability.html. Accessed Jun. 28, 2016.

10 Links to the National Walkability Index's map and data are on EPA's "Smart Location Mapping" webpage at https://www.epa.gov/smartgrowth/smart-location-mapping#walkability.

11 A block group is a statistical division of a census tract. More information from U.S. Census Bureau. "Geographic Terms and Concepts - Block Groups." https://www.census.gov/programs-surveys/geography/about/glossary.html#par_textimage_4. Accessed Jun. 4, 2021.

II. Methodology

The National Walkability Index data are available at the block group level, a unit of census geography that is smaller than a census tract and larger than a census block.[12] Every block group in the United States is assigned a National Walkability Index score. The National Walkability Index is based on measures of the built environment that affect the probability of whether people walk as a mode of transportation: street intersection density, proximity to transit stops, and diversity of land uses.[13] Although numerous factors influence walking, these measures were chosen for the National Walkability Index because they can be measured using variables in the Smart Location Database (SLD),[14] which has nationwide data availability and consistency at the block group level. This limited set of variables also helps make the index simple and easy for a general audience to understand.[15]

The selected variables from the SLD are:

- Intersection density (SLD variable D3b): Higher intersection density is correlated with more walk trips.
- Proximity to transit stops (SLD variable D4a): Distance from population center to nearest transit stop in meters. Shorter distances correlate with more walk trips.
- Diversity of land uses
    - Employment mix (SLD variable D2b_E8MixA): The mix of employment types in a block group (such as retail, office, or industrial). Higher values correlate with more walk trips.
    - Employment and household mix (SLD variable D2a_EpHHm): The mix of employment types and occupied housing. A block group with a diverse set of employment types (such as office, retail, and service) plus many occupied housing units will have a relatively high value. Higher values correlate with more walk trips.

To determine the walkability scores, these variables were used to rank every block group in the United States. Each block group was assigned four ranked scores, one for each of the variables above. To score block groups, the block groups were placed into 20 quantiles by variable value (quantiles are groupings with equal numbers of records), each containing 5 percent of the total block groups. The block groups were then assigned a rank from 1 to 20 depending upon their quantile position. A ranked score of 1 was assigned to the block groups with the lowest relative values influencing walking, and a ranked score of 20 was assigned to the block groups with the highest relative values influencing walking, with intermediate scores in between.

12 Block groups vary in size based on population density. In a dense urban area, a block group can be as small as one or two acres. In rural areas, block groups can encompass thousands of acres.

13 Ewing, R. and R. Cervero. "Travel and the Built Environment: a Meta-Analysis." *Journal of the American Planning Association* 76 (2010): 265–294.

14 The Smart Location Database, a dataset compiled by EPA, contains more than 90 variables describing transportation and land use characteristics at the block group level for the entire nation. See https://www.epa.gov/smartgrowth/smart-location-mapping#SLD.

15 The variable descriptions are simplified in this report to help make the National Walkability Index accessible to a general audience. Detailed information about these variables, including their original data sources and the methods used to construct them, are available in: EPA. *Smart Location Database Technical Documentation and User Guide*. 2021. https://www.epa.gov/smartgrowth/smart-location-database-technical-documentation-and-user-guide.

For example, if a block group has a relatively high value for street intersection density, it might receive a ranked score of 18 for that variable. If a block group has a relatively low value for employment and household mix, it might receive a ranked score of 3 for that variable.

The ranked scores were then weighted by the following formula:[16]

$$\text{Final National Walkability Index score} = \left(w/3\right) + \left(x/3\right) + \left(y/6\right) + \left(z/6\right)$$

Where w = block group's ranked score for intersection density

x = block group's ranked score for proximity to transit stops

y = block group's ranked score for employment mix

z = block group's ranked score for employment and household mix

The block groups are assigned their final National Walkability Index scores on a scale of 1 to 20 (Figure 3). The scores are categorized as follows:

	1 – 5.75	Least walkable
	5.76 – 10.5	Below average walkable
	10.51 – 15.25	Above average walkable
	15.26 – 20	Most walkable

16 The elasticities (magnitude of impact) of intersection density, land use mix, and proximity to transit were all significant and similar in magnitude (Ewing and Cervero 2010). To keep the methodology behind the National Walkability Index as simple as possible while still incorporating the known impact of the built environment on walkability, the variables were weighted as follows: 1/3 to each of the three categories of street intersection density, land use mix, and proximity to transit. The land use mix category was divided into two to account for the two different techniques of measurement; employment mix and employment and household mix were each weighted by 1/6.

III. The National Walkability Index in Action

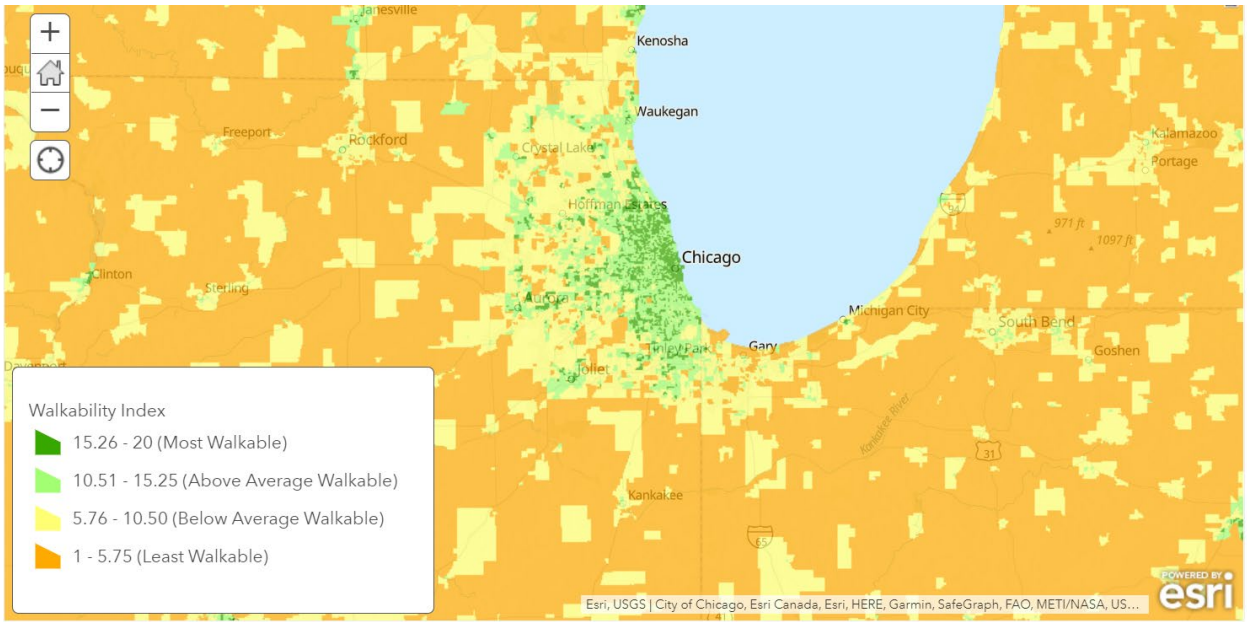


Figure 3: National Walkability Index for Chicago and surrounding region (index values 1-20).

Four examples demonstrate how to calculate the National Walkability Index. The examples illustrate the range of National Walkability Index scores and show how the index varies with the built environment. The examples are based on four block groups in the state of Virginia. Each example includes images that show the on-the-ground conditions of the block groups, tables that display the ranked scores and the final National Walkability Index score calculations.

The examples are:

A. Rural Area: National Walkability Index Score = 4.2
B. Suburban Residential Area: National Walkability Index Score = 9.5
C. Historic Main Street: National Walkability Index Score = 13.7
D. City Center/Suburban Town Center: National Walkability Index Score = 17.5

A. Rural Area: National Walkability Index Score = 1.2

This block group scores very low on the National Walkability Index and is not very walkable compared to other block groups in the surrounding region, though it is known for its ample outdoor recreation assets. This type of rural development pattern rarely has adequate infrastructure for pedestrians. Few destinations, such as stores, schools, or workplaces, are within walking distance, and therefore most of the 1,400 residents of this block group own vehicles.

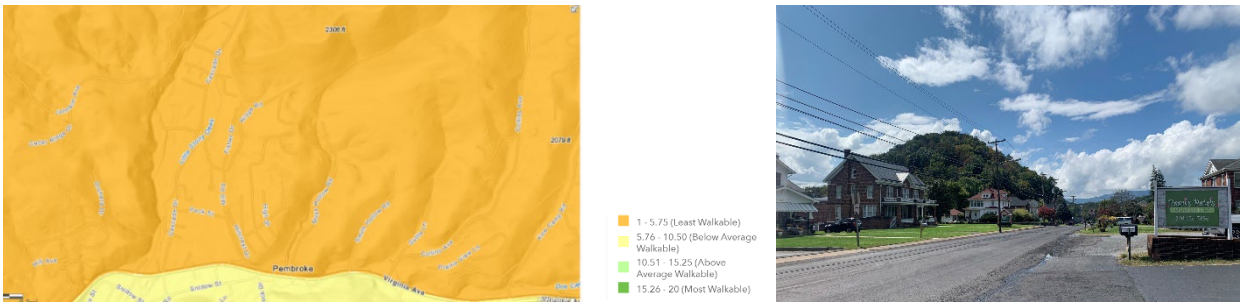


Figure 4. Walkability Index score shown on EPA NWI map viewer
Figure 5. Main street of community selected for EPA's Recreation Economy for Communities technical assistance

The raw data and ranked indicators are in the table below. Overall, this block group scores very low on all four indicators: it has no transit access and a spread-out street network, and even though there is a slight mix of businesses and households, the area is still relatively low-scoring in overall walkability.

	Associated Field from Smart Location Database	Ranked score
Block group ID: 510719302003 Pembroke, VA CBSA: Blacksburg-Christiansburg, VA	Intersection density: D3b	w = 2
	Proximity to transit stops (meters from population center to nearest transit stop): D4a	x = 1
	Employment Mix: D2b_E8MixA	y = 6
	Employment and household mix: D2a_EpHHm	z = 13

Calculations:

Final National Walkability Index score = $(^{w}/_{3}) + (^{x}/_{3}) + (^{y}/_{6}) + (^{z}/_{6})$

Final National Walkability Index score = $(^{12}/_{3}) + (^{1}/_{3}) + (^{16}/_{6}) + (^{13}/_{6})$ = **4.17**

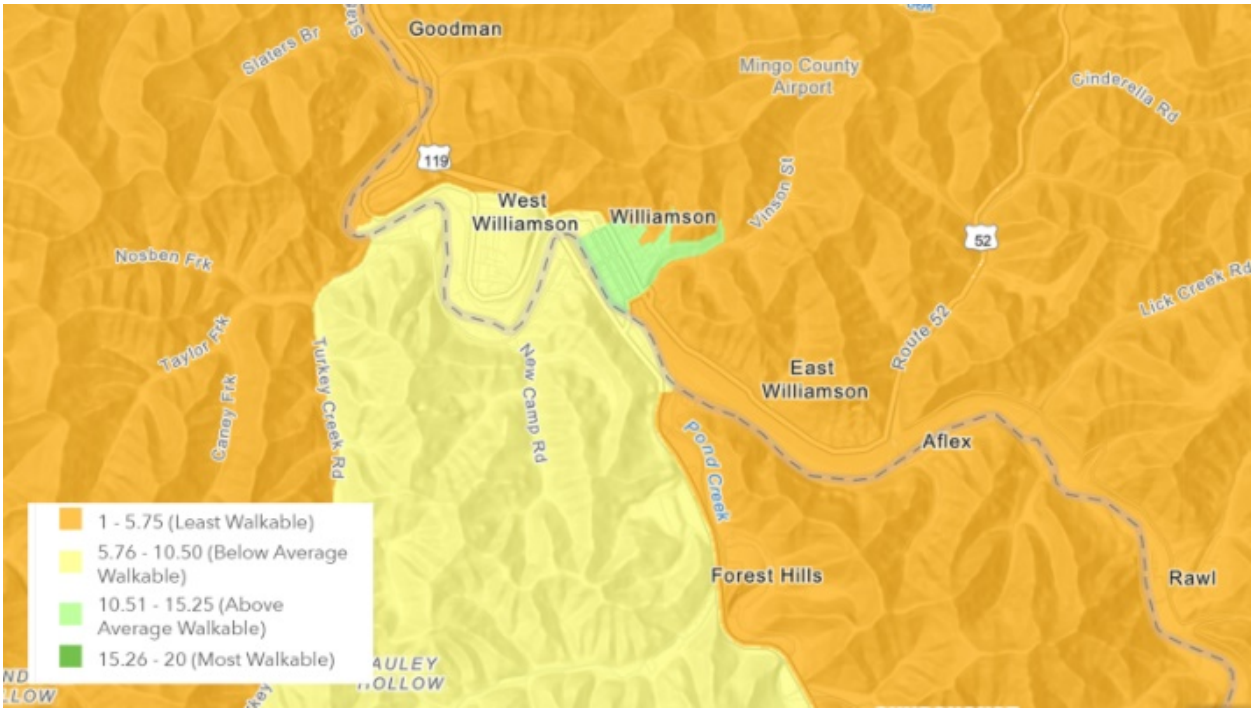


Figure 6. Walkability Index score shown on EPA NWI map viewer

The National Walkability Index can be used in rural areas to identify walkable areas such as main streets or historic downtowns. While rural census tracts can be large in size, the block group scale of the Index allows users to identify smaller areas that standout for their regions. Some of the most walkable block groups in the United States are located in towns like Williamson, West Virginia, which is surrounded by less walkable areas, but offers a mix of households, jobs, density, and transit that is rated highly among others in its county. Learn more about Williamson's participation in EPA Local Foods, Local Places technical assistance program and their efforts to transform a vacant building in downtown Williamson into the Health Innovations Hub (the HUB), offering fresh, healthy food, services, in a walkable, accessible location.

Figure 7. View of downtown Williamson, WV from EPA's Local Foods, Local Places video (2017)

B. Suburban Residential Area: National Walkability Index Score = 8.3

This block group in Loudoun County, Virginia illustrates a below-average walkability score in a typical inner suburban neighborhood. This block group has single-family and multifamily housing with an average street intersection density and very low land use mix values.

The lack of access to transit is the deciding factor in the National Walkability Index score for this block group, when ranked among others in the Washington DC metropolitan region. A neighborhood like this one might have adequate sidewalks and other infrastructure that lets people walk safely, though 82% of households have two or more vehicles. Therefore, the National Walkability Index score is lower despite good access to employment and services and average street intersection density.

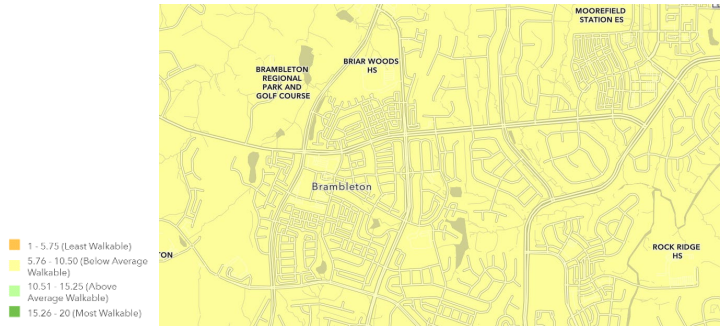


Figure 8. Suburban street in Loudoun **County, VA, Photo credit: SDobie Flickr https://www.flickr.com/photos/sdobie/36378005110**
Figure 9. Walkability Index score shown on EPA NWI map viewer

Block group ID: 511076110253 Brambleton, VA CBSA: Washington-Baltimore-Arlington-DC-MD-VA-WV-PA	**Associated Field from Smart Location Database**	**Ranked score**
	Intersection density: D3b	w = 11
	Proximity to transit stops (meters from population center to nearest transit stop): D4a	x = 1
	Employment Mix: D2b_E8MixA	y = 18
	Employment and household mix: D2a_EpHHm	z = 15

Calculations:

Final National Walkability Index score = $\left({}^{w}/_{3}\right) + \left({}^{x}/_{3}\right) + \left({}^{y}/_{6}\right) + \left({}^{z}/_{6}\right)$

Final National Walkability Index score = $\left({}^{11}/_{3}\right) + \left({}^{1}/_{3}\right) + \left({}^{18}/_{6}\right) + \left({}^{15}/_{6}\right) =$ **8.3**

C. Historic Main Street/Downtown: National Walkability Index Score = 13.7

This block group is an interesting example of a development patterns existing all over the United States in which historic and longstanding Main Street areas still function as effective downtowns for resident's daily needs and entertainment preferences. Staunton's Main Street area is very walkable—it has shops lining the street, sidewalks, and other pedestrian amenities. While the design and density scores are highly ranked for the surrounding county, the resulting National Walkability Index score is lowered by the transit ranking, although the ranked scores for the other three variables are high.

Figure 11. Staunton, VA's Main Street

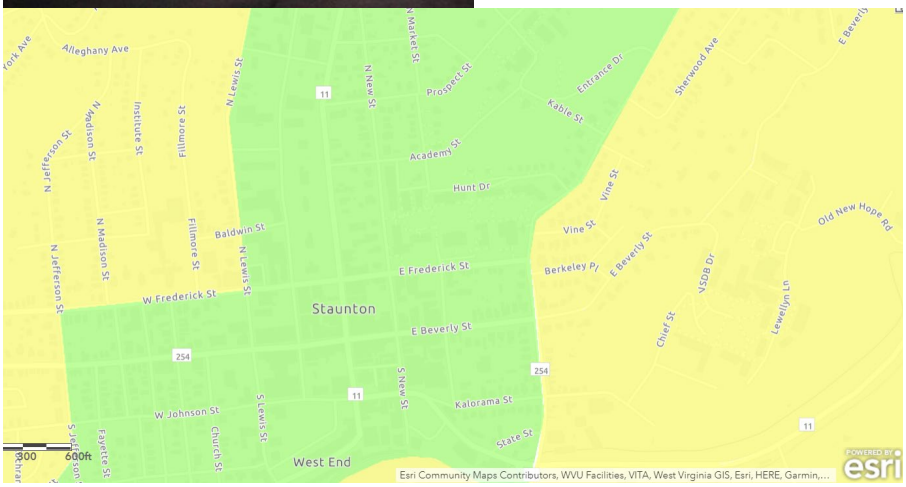
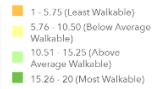


Figure 12. Walkability Index score shown on [EPA NWI map viewer]



Block group ID: 517900001001 Staunton, VA CSA: Harrisonburg-Staunton CSA	**Associated Field from Smart Location Database**	**Ranked score**
	Intersection density: D3b	w = 20
	Proximity to transit stops (meters from population center to nearest transit stop): D4a	x = 1
	Employment Mix: D2b_E8MixA	y = 20
	Employment and household mix: D2a_EpHHm	z = 20

Calculations:

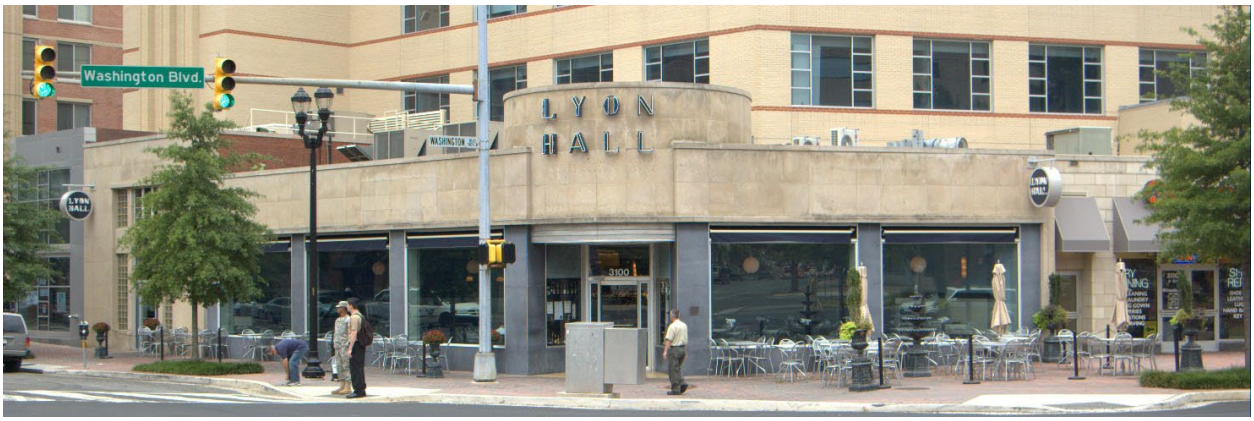
Final National Walkability Index score = $({}^{w}/_{3}) + ({}^{x}/_{3}) + ({}^{y}/_{6}) + ({}^{z}/_{6})$

Final National Walkability Index score = $({}^{20}/_{3}) + ({}^{1}/_{3}) + ({}^{20}/_{6}) + ({}^{20}/_{6}) =$ **13.7**

D. City Center/Suburban Town Center: National Walkability Index Score = 17.5

This is one of the high-scoring block groups in the Washington, D.C. metropolitan area, which presents many highly ranked groups given the mix of uses, transit systems, and intersection density found in many parts of the region. In Arlington County, Virginia, while the density and diversity of uses in the broader area is high, neighborhoods are kept in scale through adaptive reuse of key historic buildings and programming. For example one of several metro station entrances used in creative ways to promote walking and cycling includes a farmers market offering for locally-sourced produce within easy reach for transit riders.

Figures 13, 14, and 15. Various parts of Arlington County. Photo credit: Arlington County https://www.flickr.com/photos/arlingtonva



Block group ID: 510131015003 Arlington, VA CBSA: Washington-Baltimore-Arlington-DC-MD-VA-WV-PA	Associated Field from Smart Location Database	Ranked score
	Intersection density: D3b	w = 19
	Proximity to transit stops (meters from population center to nearest transit stop): D4a	x = 19
	Employment Mix: D2b_E8MixA	y = 13
	Employment and household mix: D2a_EpHHm	z = 16

Calculations:

Final National Walkability Index score = $({}^{w}/_{3}) + ({}^{x}/_{3}) + ({}^{y}/_{6}) + ({}^{z}/_{6})$

Final National Walkability Index score = $({}^{19}/_{3}) + ({}^{19}/_{3}) + ({}^{13}/_{6}) + ({}^{16}/_{6}) =$ **17.5**