

Benchmark Study Report on Biking and Walking Resources in Virginia
Part II
Relationship between Injuries, Deaths, and Locality Bicycle and Pedestrian Resources

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Bike Walk Virginia Benchmark Study

Executive Summary

The Study

There is growing support at local, state, and national levels for increased planning, legislation, and resources dedicated to alternative transportation and active lifestyles. BikeWalk Virginia set out to create a database reflecting those variables on local levels to help create a picture of the state of biking and walking across Virginia and to explore the relationship between resources, planning, and injuries. The organization realizes that data collections such as this have the potential to prompt conversations, encourage shifts in planning, and in general raise awareness of important topics.

The study consists of two parts. Part I reported data from all counties and cities between 2006 and 2009. Part II consists of a statistical analysis to assess the relationship between the current level of biking and walking resources and injuries to bicyclists and pedestrians involving motor vehicle collisions. The following report covers the findings from Part II.

The Need

Interest in biking and walking has grown in recent years and should continue to grow given the benefits to health, environment, reducing individual transportation costs, and decreasing roadway and parking congestion. Addressing the safety of non-motorized roadway users is an important part of planning and has a significant impact on an individual desire to participate in biking and walking.

Virginia crash statistics indicate significant need to improve safety for pedestrians and bicyclists in the state. In 2008 alone 1675 pedestrians were injured and 76 killed in vehicle/pedestrian crashes and 716 bicyclists were injured and 14 were killed (DMV, 2008).

Governor Kaine recognizes biking and walking as important components of Virginia's future. Through an Executive Order in 2008 he established a sub-cabinet structure to focus on community investment. One of the initiatives of this new structure was aimed to "invest in alternative transportation choices." In celebration of National Bike to Work Day on May 15, 2009, Governor Kaine said: "Today's events provide a great opportunity to encourage everyone to bike or even walk to work where appropriate. We all know the cost of energy will continue to increase, and we know our use of gasoline has a growing negative impact on our environment. We can combat both problems by using alternative transportation to commute to our jobs."

Similar actions were taken at the national level. Representative Jim Oberstar, Chairman of the U.S. House of Representatives Transportation and Infrastructure Committee also called for greater inclusion of non-motorized transportation options, (Convergence Partnership, 2009).

Methodology

Database and Virginia Active Transportation Index

BikeWalk Virginia developed a database of biking and walking resources by surveying all 39 cities, 95 counties and 157 incorporated towns. Data was collected between 2006 and 2008 then again in 2009. The surveys consistently asked localities 10 questions with a possible score of 11 total points (one question contained two answers). The final reports include data for 66 localities (of 39 cities, 95 counties, 134 localities for the state). Town data was limited therefore not included in the final reports. Data was not available for 68 localities of the 134 cities and counties surveyed.

A new measure, the Virginia Active Transportation Index (VATI) was developed to provide a comprehensive picture of biking and walking resources in each locality. For each “yes” answer, the locality received one point. A locality answering “yes” to all questions would receive a perfect score of “11”. Please see appendix C for survey questions.

Data Analysis

A statistical analysis was completed to evaluate the relationship between the Virginia Active Transportation Index (VATI) and injuries of bicyclists and pedestrians involving motor vehicle collisions. The analysis demonstrated a slight statistical significance. This finding suggested that there may be an inverse relationship: bike/ped injuries and fatalities related to motor vehicle collisions appeared to be slightly lower in localities that had higher VATI scores. Additional discussion on methodology is provided below.

Findings

Resources

The survey is the first of its kind in Virginia and it established a valid benchmark. Finding support that bike/ped planning and resources are insufficient across the state. Only three localities earned the highest possible Virginia Active Transportation Index score of 11 points: City of Alexandria, Arlington County, and City of Harrisonburg. A complete discussion of resources can be found in the body of Part I and below in the Part II report.

Safety

Researchers conducted an analysis to see if there was a relationship between the VATI and injuries of bicyclists and pedestrians involving motor vehicle collisions. The analysis demonstrated a slight statistical significance. As the VATI score increased, bicyclist and pedestrian injuries related to collisions with motor-vehicles fell. See figure 1.

Legislation related to safety was also deficient. Only thirty-one percent of responding localities have a law requiring persons 14 years or younger to wear a helmet when riding.

Recommendations

Consideration of biking and walking needs are an important part of transportation planning and should be included on multiple levels of the planning process. Data indicates that more planning and infrastructure can lead to fewer injuries and deaths of those who bike and walk.

Future research needs to explore the relationship between specific bike/ped resources and injuries. Additionally, analysis of individual localities could be beneficial in understanding what resources have the biggest impact on those locality types. Solutions for urban areas may not be appropriate to rural areas and vice-versa. Evaluation could include analyzing study data by population, density, and budget of localities.

Localities are advised to explore ways to increase dialogue about bike/ped needs in the planning processes and to consider multi-modal planning such as greenway development and complete streets designs. Greenway planning may provide safe and affordable opportunities that address multiple stakeholder needs and concurrently address transportation, environment, health, and safety.

**Benchmark Study Report on Biking and Walking Resources in Virginia:
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There is undeniable support for increased planning, legislation, and resources dedicated to alternative transportation and active lifestyles. National obesity and healthcare concerns are enough to drive these conversations without the added importance of environment and transportation issues.

BikeWalk Virginia recognized the need to evaluate the resources in Virginia for biking and walking, knowing that a database would serve as an important foundation to those conversations. Data collections have the potential to be the impetus for paradigm shifts in thinking which can lead to better planning for and development of Virginia's bicycle and pedestrian resources. This type of research has the potential to propel our state toward the successes that other states have already demonstrated.

Injury data and obesity rates supports that Virginians need to carefully evaluate the resources that are provided for biking and walking and look for ways to reduce risk and encourage participation. Improving safety can lead to greater numbers participating in active transportation and recreation which can benefit both the physical health and environmental health of the state.

Funding for the study was provided by a Department of Motor Vehicles Safety Grant. Surveys were sent to all 39 cities, 95 counties, and 157 incorporated towns in 2009. Previously existing data collected between 2006 and 2008 was used to fill in gaps on localities that did not respond in 2009. In total, the database used for this report included 66 responding cities and counties. Data was not available for 68 localities. Data collected on towns was limited and therefore discussion about towns was not included in the following report.

BikeWalk Virginia created the Virginia Active Transportation Index to allow additional evaluation, reporting, and mapping of study results. A glossary of terms used is included in Appendix A.

Virginia Active Transportation Index

Indices are often used in social and scientific research as a method to combine more than one individual measurement into an overall value that indicates a larger condition. An example from health research is the Overall Stress Index. Calculated by adding the answers to various questions about behavior, personality, and emotions, an Overall Stress Index number is used to represent the total cumulative stress an individual is experiencing (Stephoe and Wardle 1994). Similarly, the Virginia Active Transportation Index (VATI) is a reporting scale that BikeWalk Virginia used to report the number of resources in a locality based upon their answers to the survey.

For each bike or pedestrian element that was reported within the locality, the locality received one point on the VATI scale. Results were widely variable. The VATI score can be used to evaluate how broadly bike/ped initiatives are integrated into local government. Data is provided in Appendix D.

The following elements, each suggesting a level of commitment to bicycles and pedestrians, were included in the index: comprehensive transportation plan, bicycle plan, pedestrian plan, greenway plan, bicycle advisory committee, pedestrian advisory committee, greenway advisory committee, law requiring persons 14 and under to wear a helmet, paved bike trails, and striped bike lanes. Findings also

include identification of localities that reported receiving an Enhancement Grant from the Virginia Department of Transportation.

Findings

Response Rate

Cities and Counties

Of the 39 cities and 95 counties that were contacted data was collected for 66 localities, response rate of 49 percent. In this report the term “locality” is used to refer to either a city or a county. Existing data (prior to 2009) was used for 46 localities. Researchers were unable to gather data for 68 cities or counties even after multiple attempts and a period of years. Copies of communications are provided in Appendix B and C.

Towns

The study also included surveying 157 incorporated towns in Virginia. Unfortunately only 35 percent (55 towns) responded to the survey.

Bicycle Resources and Pedestrian Resources

Responding locality data showed:

- 56 percent of responding localities have a bicycle plan
- 28 percent have a bicycle advisory committee
- 31 percent have a law requiring persons 14 years or younger to wear a helmet
- 24 percent of responding cities and counties have a pedestrian plan
- 18 percent have a pedestrian advisory committee (PAC)
- Of localities with pedestrian plans, over half are located in Northern Virginia, geographically north of Albemarle County
- 38 percent report having a general Transportation Advisory Committee

Northern Virginia has been particularly active in providing bicycle infrastructure. Arlington County has 25 miles of bike lanes and the City of Alexandria has 12.7 miles. In addition, Alexandria has incorporated 13.1 miles of paved bike trails within the city limits, while other roadways are marked with shared use lane indicators.

Arlington, Alexandria, and Fairfax City have incorporated both Pedestrian Plans and PACs, thus more fully integrating pedestrian issues into overall transportation flow. These cities experience heavy traffic and the assimilation of pedestrian planning represents a positive step toward establishing walking as a safe and worthwhile mode of travel. Researchers noted that pedestrian issues are not adequately addressed in the heavily trafficked Tidewater and Central Virginia regions.

VATI Locality Scores and Averages for Metropolitan Areas

A complete listing of VATI scores for each responding locality is provided in Appendix D. By combining adjacent cities and counties that provided data, it was possible to calculate an approximate Virginia Active Transportation Index score for the most populated regional areas.

Region	Average VATI Score
Charlottesville/Albemarle	8.5
Northern Virginia	8.2
Upper Shenandoah Valley	7.8
Tidewater	6.7
Roanoke/Salem	6.5
Southside Virginia	5.6
Counties Surrounding Richmond	4.0

In the Richmond Metro region no data was available for the City of Richmond, the state Capitol. The VATI scores for the three surrounding counties are:

Chesterfield County	5
Hanover County	4
Henrico County	3

Public Safety

One of the most important goals of transportation planning is to ensure public safety (VDOT 2009). In many local comprehensive plans this is done through implementing proper access and signage as well as strategies to regulate traffic flow. Successful transportation programs must provide for all modes of travel so that motor vehicle traffic does not compete with pedestrians, bicyclists and other non-motorized vehicles. Having defined bike/ped planning elements, bike/ped advisory committees, and public resources may effectively prevent injuries and injury-related deaths.

The Virginia Department of Health (VDH) provided the researchers with bicycle and pedestrian injury data for the five year period beginning in 2003 and ending in 2007. Data included every injury-related hospitalization or death incurred by a pedestrian or pedal cyclist during this time period.

The researchers hypothesized that specific attention to bicycling and pedestrian needs have the potential to reduce injury rates. In order to determine if injuries are indeed related to the existence of these elements, a comparison was completed evaluating the relationship between county and city wide injury rates (per 100,000 people) to the Virginia Active Transportation Index.

The Virginia Active Transportation Index, a numeric score, was assigned to each locality based upon their answers to survey questions reflecting the number of bike/ped elements present in each locality. A detailed description of the Virginia Active Transportation Index is included in the Glossary.

Figure 1 below shows the relationship between bike/ped injuries from Motor Vehicle Traffic (MVT) and the Virginia Active Transportation Index. Further information regarding the methodology by which this analysis was achieved is discussed below.

Data Collection from Virginia Department of Health Reporting System

The VDH Division of Injury and Violence Prevention developed an online database to which all injury-related hospitalizations and deaths are reported by Virginia hospitals. The injuries are categorized by their location, demographics of the patient, and the cause of the injury (VDH 2008).

For this study the cause of the injury, called the *mechanism*, was used. Researchers extracted all the bike/ped injuries occurring in the past five years from this comprehensive database. For a complete list of all mechanisms, consult the web based reporting system at <http://www.vahealth.org/CIVP/VOIRS/injuryRates.aspx>.

The following mechanisms were included in the research for this study.

- Motor Vehicle Traffic (MVT) pedal cyclist: injury sustained by a person riding a bicycle resulting from a collision with a motor vehicle.
- Pedal cyclist, other: an injury sustained by a person riding a bicycle due to any other causes
- Motor Vehicle Traffic (MVT) pedestrian: injury sustained by a pedestrian resulting from a collision with a motor vehicle
- Pedestrian, other: an injury sustained by a pedestrian for any other reason

Analysis consisted of the unintentional injuries caused by the above mechanisms for all ages, all sexes, all races, and sorted by the locality in which they occurred.

Injury Rate Calculation

For each locality, the researchers totaled the number of injury-related hospitalizations and deaths that occurred from 2003 to 2007. Results included only those injuries that were reported using the four mechanisms described above.

The sum indicated total bike/ped injuries within the five year period. Using annual census estimates, the researchers added the estimated population from each year in 2003 through 2007 to reach a total population for the five year period.

Total bike/ped injuries was divided by total population and multiplied by 100,000 people. For the MVT injury rate analysis, analysis was based only on two of the previous four mechanisms; pedestrian and pedal cyclist's injuries that did not also list MVT involvement were excluded.

Statistical Analysis

Linear regression was used to examine the relationship between injury rates and Virginia Active Transportation Index. Two separate analyses were conducted: in the first analysis Virginia Active Transportation Index was used as the explanatory variable and injury rate (using injuries sustained from all four mechanisms) were used as the response variable. In the second analysis, Virginia Active Transportation Index was used as the explanatory variable and MVT injury rate was used as the

response variable and only included injuries sustained by the following two mechanisms: MVT pedal cyclist and MVT pedestrian. Non-responding localities were excluded from the analysis. All variables were statistically analyzed using JMP statistical software (SAS Institute Inc., Cary, NC 2008).

Of the 4210 reported injuries, 64 percent were directly related to collisions with motor vehicles. The remaining 36 percent were not related to motor vehicles and included causes such as pedal striking or simply falling.

Since bike/ped plans and resources are typically oriented toward traffic safety, the researchers wished to determine if Virginia Active Transportation Index may be related to bike/ped injuries resulting from motor vehicle crashes. The figure below shows the correlation between Virginia Active Transportation Index and the number of motor vehicle crashes with bicyclists and pedestrians.

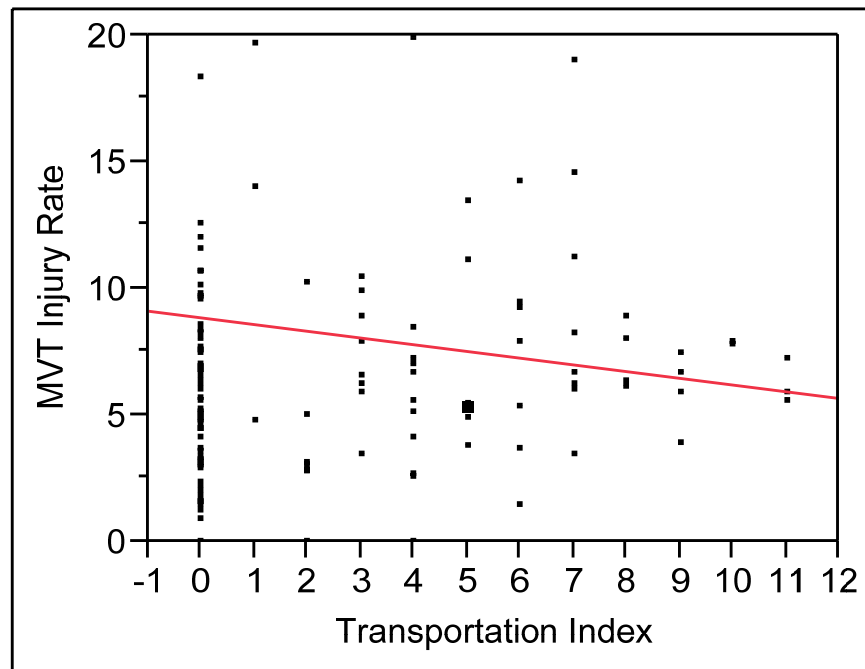


Figure 1. Relationship between motor vehicle crash related injury rate and Virginia Active Transportation Index (VATI), as defined by how many bike/ped elements are incorporated into a transportation plan, versus the motor vehicle traffic (MVT) related injury rate of bicyclists and pedestrians per 100,000 of a locality's population.

By using only motor vehicle traffic (MVT) related injuries of bicyclists and pedestrians, the researchers were able to accurately evaluate the relationship of resources with safety of bicyclists and pedestrians. The above figure shows a mild correlation between Virginia Active Transportation Index and MVT injuries where higher transportation indices are associated with lower MVT injury rates. Although the relationship is merely suggestive ($r^2 = 0.040$, $P = 0.14$), it approaches statistical significance. Analysis of all bicycle and pedestrian injury types, not just MVT accidents was also completed, see figure 2, and is discussed later in this report.

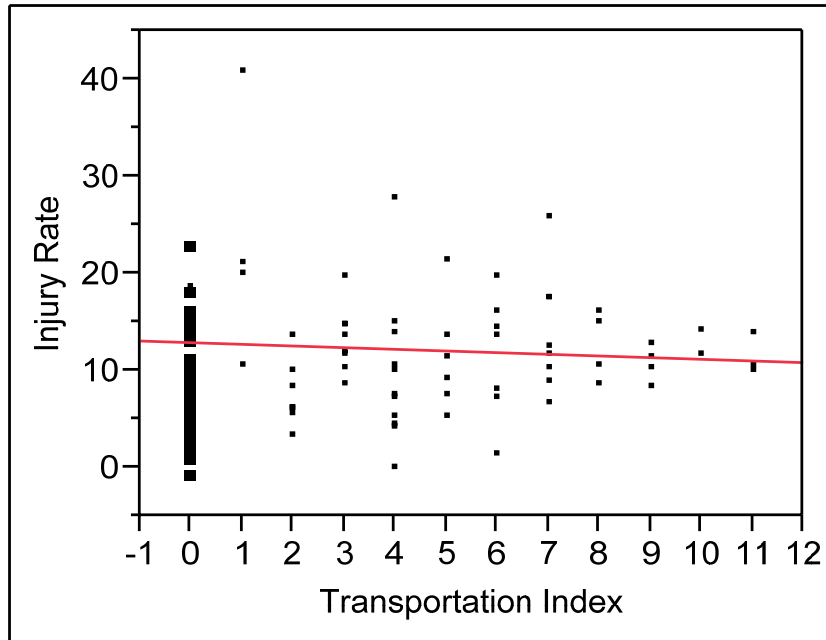


Figure 2. Relationship between Injury rate and Virginia Active Transportation Index, as defined by how many bike/ped elements are incorporated into a locality’s transportation resources, versus the injury rater per 100,000 of a locality’s population for all bicycle and pedestrian related injuries (including causes no associated with motor vehicles).

Statistical analysis indicated that the injury rate of all bicycle and pedestrian injuries from all causes (including causes not associated with motor vehicles) is not related to a locality’s Virginia Active Transportation Index ($r^2=0.005$, $P=0.56$).

The analysis suggested that bike/ped planning elements may be helpful in preventing certain types of injuries, those related to MVT. Although Virginia Active Transportation Index did not seem to be a valuable predictor of total injury rates, there was mild evidence that localities with a higher Virginia Active Transportation Index scores sustained fewer injuries in which cyclists and pedestrians collided with motor vehicles.

The Virginia Active Transportation Index is intended to be an indication of the extent to which cities and counties have integrated bike/ped issues into overall transportation planning. A high Virginia Active Transportation Index indicates that a locality is using a variety of methods to continually introduce bike/ped issues to planning, which we believe leads to a more inclusive integration among cycling, walking and driving. The data, while only slightly statistically significant, indicates that comprehensive strategies (in which advisory groups and funding routes complement the formal planning process) may improve public safety more effectively than stand-alone resources.

Further exploration of relationships among specific bike/ped elements and locality resources is planned. Evaluating crashes and resources by density, population, and available financial resources may provide better insight into effective means of improving safety.

Recommendations

This study provided a starting point for discussion about bicycle and pedestrian resources in Virginia. Ongoing data collection should continue and occur minimally every two years.

The relationship between planning and infrastructure for bike/ped transportation and injuries should be an ongoing conversation between planning organizations and health organizations. Data indicated that bike/ped planning and infrastructure results in fewer deaths and injuries that result from motor vehicle collisions with cyclists and pedestrians. While the statistical significance from this dataset was small it warrants further exploration and discussion.

A primary goal of transportation planning is to provide safe means of transit for citizens with diverse needs and desires. Biking and walking should be part of that planning. Too many localities are leaving safety for these modes of transportation out of the planning picture.

Further analysis of injury and fatality data should occur. Better understanding is an important component of improving safety. Research on helmet ordinances and related injury data could provide incentives to get communities engaged in potentially life saving helmet programs.

Committees specific to biking and walking should become a part of the transportation planning process for each Virginia city, county, and town. Localities should consider greenway planning to provide transportation alternatives. Greenways and other design solutions are emerging as growing component of transportation planning across the state. This is an exciting development as greenways can be an economical means of addressing multiple user group needs, sometimes provide wildlife corridors, and aid in reducing storm-water runoff. Further research of greenways and their benefits could be useful to planning organizations.

Having safer and more accessible biking and walking will impact not only the health of citizens and the environment, but will provide affordable transportation and can reduce roadway congestion in the Commonwealth. We cannot ignore these important facts.

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Appendix A: Glossary

Bicycle Advisory Committee (BAC): A group that meets regularly to discuss local or regional issues that affect the bicycling community. This group should have a relationship with local government or town council in which the BAC may provide information or advice to governing committees or bodies. This group should have a mechanism for public input.

Bicycle Plan: Any document recognized by local government that outlines strategies for the current and future development of bicycle laws, infrastructure, events, or outreach. A bicycle plan may be a subsection within an overarching transportation plan.

Bike/ped: An abbreviation used to describe something that relates to bicycle and pedestrian issues.

GIS: Geographical Information Systems. A mapping software used to show the locations where cities and counties have adopted bike/ped elements listed in Bike Walk Virginia's survey.

Greenway: Open space corridors that can be managed for conservation, recreation, and/or alternative transportation. Greenways often follow natural or existing land or water features such as ridgelines, stream valleys, rivers, canals, utility corridors, abandoned rail lines and others. Although each greenway is unique, most connect recreational, natural, cultural, and/or historic areas. Some greenways are designed for people to use for recreation and non-motorized transportation, while others are designed for wildlife, biodiversity and scenic beauty. Greenways may be publicly or privately owned.

Locality: A city or a county.

Motor Vehicle Traffic (MVT): Cars, trucks or any other fast moving vehicle requiring a paved surface for travel.

Pedestrian Advisory Committee (PAC): A group that meets regularly to discuss and advise governing bodies on issues that affect the walking community. This group should have a relationship with local government or town council in which the PAC may provide information or advice to governing committees or bodies. This group should also have a mechanism for public input.

Pedestrian Plan: Any document recognized by local government that outlines strategies for the current and future development of pedestrian laws, infrastructure, events, or outreach. A pedestrian plan may be a subsection within an overarching transportation plan.

Transportation Advisory Committee: A group that meets regularly to discuss and advise governing bodies on issues affecting transportation. Although a transportation advisory committee (TAC) does not specifically target alternative transportation but may encourage inclusion of such topics.

Virginia Active Transportation Index: The number of bike/ped elements present in their transportation plan. Cities or counties received a 1 if they answered yes to a question in our survey. An example of a question is as follows: Does your locality have a transportation element in its comprehensive plan? If the answer is yes, they received one point. If the answer is no, they received 0 points for that question. We asked if the locality has adopted the following elements: a bicycle plan, a pedestrian plan, a greenway plan, a bicycle advisory committee, a pedestrian advisory committee, a transportation advisory committee, a helmet ordinance, at least .5 miles of bike trails, at least .5 miles of striped bike lanes. We

also asked if the locality received an enhancement grant for use toward transportation development/infrastructure. To create the index we calculated the sum of ones and zeroes; the maximum Virginia Active Transportation Index a locality could receive is a value of 12.

Appendix B: Survey

BIKEWALK VIRGINIA SURVEY

1. Does your locality have a transportation element in its Comprehensive Plan? Yes No
2. Has your locality adopted a Bicycle Plan? Yes No
3. Has your locality adopted a Pedestrian Plan? Yes No
4. Has your locality adopted a Greenway Plan? Yes No
5. Does your locality have a Bicycle Advisory Committee? Yes No
6. Does your locality have a Pedestrian Advisory Committee? Yes No
7. Does your locality have a Transportation Advisory Committee? Yes No
8. Does your locality have an ordinance requiring persons fourteen?
years of age or younger to wear a helmet when riding a bike? Yes No
9. Has your locality received any Enhancement Grant(s)? Yes No
If so, what is the approximate dollar amount? \$_____
10. Your locality has:
 - a. _____ miles of trails
 - b. _____ miles of striped bike lanes
11. Please write any comments or any clarifications referencing any question(s) above.

Locality Phone:

Person Completing Survey Email:

Please mail in enclosed envelope or fax to BikeWalk Virginia

Appendix C: Letter to Localities

To Whom It May Concern:

BikeWalk Virginia is a statewide non-profit organization that promotes biking and walking for health, environmental, and economic benefits. As part of a general study to better understand the extent of municipal transportation plans, we are conducting a survey of all Virginia localities with regard to bicycling and pedestrian programs. This study is being managed by BikeWalk Virginia with collaboration by the Virginia Department of Health (VDH), the Virginia Department of Transportation (VDOT) and the Department of Motor Vehicles (DMV).

Attached is a very short survey designed to highlight the alternative travel programs that may be included in your locality's transportation plan, if applicable. Please note that even if your town does not have a comprehensive plan that includes transportation, we encourage you to participate since it is our mission to advocate for funding and public policy where current resources are limited.

Please take several minutes to complete the survey and email this document as well as any questions to this contact address: XXXXXXXXX . I am also available to talk by phone: XXXXXXXXX. We will use our findings as a public resource that promotes the use of bike trails and encourages the adoption of bicycle and pedestrian projects. I wish to emphasize that this study is quite valuable to the Commonwealth; information gathered here will assist in the development of baseline transportation data applicable to current and future research regarding public safety as well as the expansion of novel transportation strategies.

Your cooperation in this effort is much appreciated.

Locality	Transp. Plan	Bike Plan	Ped Plan	Greenway Plan	BAC	PAC	TAC	Helmet	Grant(s)	Trails	Lanes	V.A.T. Index
Franklin Co												0
Frederick Co												0
Fredericksburg	1	1	0	0	0	0	0	0	1	1	0	4
Galax												0
Giles Co												0
Gloucester Co	1	0	0	0	0	0	0	0	1	1	0	3
Goochland Co												0
Grayson Co												0
Greene Co												0
Greensville Co												0
Halifax Co												0
Hampton	1	0	0	0	0	0	1	1	1	1	1	6
Hanover Co	1	0	0	0	0	0	1	0	1	1	0	4
Harrisonburg	1	1	1	1	1	1	1	1	1	1	1	11
Henrico Co	1	0	0	0	0	0	0	0	1	1	0	3

