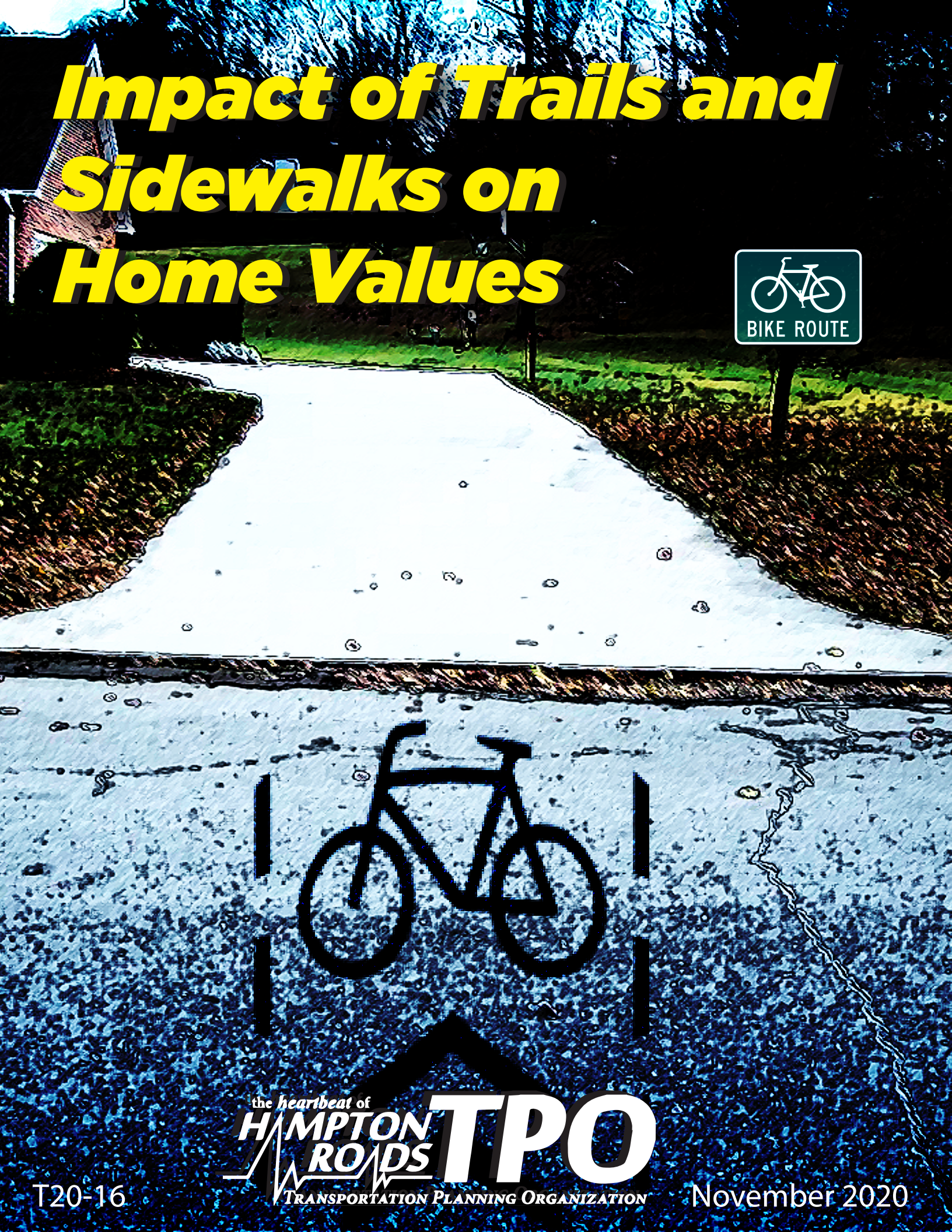
Impact of Trails and Sidewalks on Home Values



the heartbeat of HAMPTON ROADS TPO
TRANSPORTATION PLANNING ORGANIZATION

T20-16

November 2020

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IMPACT OF TRAILS AND SIDEWALKS ON HOME VALUES

PREPARED BY:

the heartbeat of HAMPTON ROADS TPO
TRANSPORTATION PLANNING ORGANIZATION

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TITLE
Impact of Trails and
Sidewalks on Home Values

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ABSTRACT
As a result of various benefits that trails have to offer to communities (social, aesthetic, health, recreational, alternative ways of transportation, reducing congestion), it can be argued that trails likely increase nearby property values and augment property tax revenues. However, negative externalities (invasion of privacy of residents adjacent to trails, strangers passing through the neighborhood, fear of increased noise, littering, trespassing, and vandalism) arguably could reduce property prices and the property tax base may be adversely affected.

The purpose of this report is to estimate the impact of trails on residential property values. With the help of the Project Steering Team, HRTPO staff selected a segment of the Virginia Capital Trail in James City County, obtained house characteristics data and sale data from James City County, and used a regression model to estimate the impact of the proximity of the Virginia Capital Trail segment in James City County on property values.

PROJECT STEERING TEAM
This study was prepared by the Hampton Roads Transportation Planning Organization (HRTPO) with the help of the following steering committee:

Jamie Oliver	Isle of Wight County
Tom Leininger	James City County
Helen Gabriel	Suffolk
Paul Filion	Norfolk

ACKNOWLEDGMENT & DISCLAIMERS

Prepared in cooperation with the U.S. Department of Transportation (USDOT), Federal Highway Administration (FHWA), and Virginia Department of Transportation (VDOT). The contents of this report reflect the views of the Hampton Roads Transportation Planning Organization (HRTPO). The HRTPO is responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the FHWA, VDOT or Hampton Roads Planning District Commission. This report does not constitute a standard, specification, or regulation. FHWA or VDOT acceptance of this report as evidence of fulfillment of the objectives of this planning study does not constitute endorsement/approval of the need for any recommended improvements nor does it constitute approval of their location and design or a commitment to fund any such improvements. Additional project level environmental impact assessments and/or studies of alternatives may be necessary.

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The HRTPO assures that no person shall, on the ground of race, color, national origin, handicap, sex, age, or income status as provided by Title VI of the Civil Rights Act of 1964 and subsequent authorities, be excluded from participation in, be denied the benefits of, or be otherwise subject to discrimination under any program or activity. The HRTPO Title VI Plan provides this assurance, information about HRTPO responsibilities, and a Discrimination Complaint Form.

Contents

Executive Summary

The purpose of this study is to find the impact of trails and sidewalks on nearby home values in Hampton Roads. This study was requested by Jamie Oliver of Isle of Wight County and was included in the FY20 UPWP. A trail segment selected for this study was the Virginia Capital Trail (VCT) segment (in James City County) from Chickahominy River Bridge to Jamestown Settlement.

Trails may increase nearby property values due to various trail benefits to communities: social, aesthetic, health, recreational, alternative ways of transportation, reducing congestion and carbon footprint. On the other hand, negative aspects such as the invasion of privacy of residents adjacent to trails, fear of increased noise, littering, trespassing, and vandalism may reduce property prices. To better understand this, staff conducted a literature review of studies concerned with the impact of trail on property values. Most studies reviewed show a positive impact of trails on property values; one study reported that bike facilities lower property values, while one study reported no relationship between bike facilities proximity and property values.

Linear regression, in which a researcher finds the line that most closely fits the data, was used to infer the relationship between property values (dependent variable) and property characteristics/trail proximity (independent variables). Staff found that the proximity to trail variables were not statistically significant, i.e., we are not sure that proximity to the VCT influences property values. Considering that the literature shows a positive impact of trail proximity on home values, the above Virginia Capital Trail result may be due to any positive impact of the trail being negated by the negative impact of proximity to the John Tyler Highway adjacent to the trail.

Based on the regression results, staff cannot conclude that proximity to the Virginia Capital Trail impacts home value. Possible next steps include obtaining data from Suffolk or Norfolk to test the impact of the Seaboard Trail or Elizabeth River Trail (respectively).

Literature Review

Neighborhood walkability and trails have been promoted by transportation planners and policymakers to reduce carbon-intensive travel and encourage health and smart growth. The links between the former and the latter have been widely known. On the other hand, the relationship between trails and sidewalks (on the one hand) and residential property values (on the other hand) are still being explored and not fully understood.

Sidewalks

Urban sprawl, global warming and the health and social effects of an automobile-dominated transportation system have rekindled interest in sidewalks and walkability in the United States in the past 15 years. Researchers have often studied the impact of sidewalks on property value in conjunction with the impact of general walkability.

Research conducted by Sohn et al. (2012) shows that improving neighborhood sidewalk coverage can potentially lead to increased property values for single-family homes that will result in increased revenues from property taxes. However, results show that the largest home value (and tax) payoff will be in neighborhoods that already have sidewalks. The authors summarize "that allocating funding for pedestrian infrastructure and encouraging mixed-use developments in a neighborhood where walking is likely, will yield the greatest dividends for cities."

Li et al. (2015) reported that pedestrian infrastructure was found to be positively related to property values:

- Bus stops proximity contributed to an increase in rental multifamily residential property values
- Better sidewalk coverage was positively linked with increasing property values of rental multifamily residential and retail services uses.

The walkability index is a measure of how walkable an area is. The concept of a walkable neighborhood is the main parameter of modern urban theories. Experts argue that building walkable neighborhoods can relieve traffic congestion, air pollution, and the destruction of natural resources (Paumier, 2004).

Hess and Lombardi (2004), Handy (2005), Dorn (2004) and Shapiro et al. (2002) asserted that combining residential and commercial land uses in walkable neighborhoods will help produce affordable housing, cleaner air and water and lower car dependency. Other experts have doubted the viability of the walkable neighborhood. They argued that consumers do not care about such benefits, favoring more room, spacious yards, and the traditional car-oriented suburban development space, consumers are accustomed to auto-oriented suburban space.

Li et al. (2015) used the Street Smart Walk Score (SSWS) as the primary walkability measure and Sidewalk Density (SWD) as a supplemental measure. They analyzed 21,686 single-family home sale transactions between January 2010 and November 2012 and used the hedonic pricing method to estimate the impact of walkability on sale prices. Reported results show that "improving walkability through increased access to neighborhood amenities such as retail and shopping in car-dependent neighborhoods does not appear to increase property values; adding sidewalks in these neighborhoods leads to a minimal increase in property values." On the other hand, investments in neighborhood amenities such as retail and shopping and sidewalks will yield a higher increase of home prices in an already walkable neighborhood than in a car-dependent neighborhood.

Sohn et al. (2012) investigated the benefits of the walkable neighborhood via different land-use models using the hedonic pricing method. The assessed property value was used as a measure of economic value. Authors randomly selected by the sampling process:

- 2,289 single-family residential units,
- 837 samples of rental multifamily residential units
- 738 samples of retail service properties
- 586 samples of office parcels

Authors reported that "better sidewalk coverage in their neighborhood was positively related to increasing property values of rental multifamily residential and retail services uses."

Pivo et al. (2009) examined the effects of walkability on property values and investment returns. The authors used real estate performance information from the National Council of Real Estate Investment Fiduciaries (NCREIF) and walkability data from Walk Score, with ordinary least square regression analysis**.** On a 100-point scale, a 10-point increase in walkability increases property values between 5 and 8 percent, depending on the property type.

Guo et al. (2017) used the Ordinary Least Square regression model to measure the link between property's walk accessibility and property value. The authors used a dataset of 2,700 single-family residential properties selected for this study in the Eastern Adelaide region, Australia. Authors found that three properties walk accessibility variables (walk accessibility to education location, walk accessibility to a retail location, and walk accessibility to social and recreational locations) have a statistically significant correlation with the single-family residential property value per equivalent square meter, indicating that walk accessibility has a positive impact on property value.

Trails

Table 1 summarizes a literature review of studies concerned with the impact of trails on property values.

The majority of the reviewed studies that assessed the impact of trails on home values reported a positive impact.

However, some authors claim that invasion of privacy of residents adjacent to trails, strangers passing through the neighborhood, fear of increased noise, littering, trespassing, and vandalism could potentially lower the property values. Two papers reviewed report either a negative impact or no impact. A thesis by Szatmary (2014) asserts that bike facilities lower property values while Lindsey et al. (2016) state that there is no relationship between the proximity of trails and property values.

Name of the study/report	Author(s), year	Sample size	Data range	Methodology	Buffer	Policy Variable	Independent Variables	Results/findings
Omaha Recreational Trails: Their Effects on Property Values and Public Safety	Donald L. Greer, University of Nebraska at Omaha (2000)	149 houses	N/A	Telephone survey	One-block	Purchase decision	N/A	"The clear majority of residents (63.8%) who bought their homes after the construction of the trails reported that the trail had positively influenced their purchase decision"
Property Value/Desirability Effects of Bike Paths Adjacent to Residential Areas	David P. Racca, Amardeep Dhanju (2006)	909 properties	One year	Hedonic pricing model	Approximately 165 feet	Sale price	Parcel identification number, city, zip code, acreage of property, land value in $, building value in $, total assessment in $, latest sale price, latest sale date of property, year property was built, number of stories, total number of rooms, number of bedrooms, age of building at latest sale price	There is a positive impact of proximity to a bike path on property prices, controlling for the number of bedrooms, acres, land, buildings, total number of rooms, total assessment. The properties within the buffer of the bike path show a difference of at least $8,800
Property Values, Recreation Values, and Urban Greenways	Lindsey, et al. (2004)	9348 residential property transactions	One year (1999)	Hedonic price model	1/2 mile	Sale price	Structural variables: Square feet in structure, number of bathrooms in house, dummy variable for A/C, age, number of car bays in garage, dummy variables (basement, porch, lot less than 1/2 acre, lot less than 1 mile). Tax and neighborhood variables: Effective tax rate, median household income, employment accessibility index, etc. Dummy variables for distances from the trail	Some greenways, but not all, have positive impacts on property values. Location within one-half of the Monon Trail has a positive, significant effects on sales price

TABLE 1 Literature review of articles concerned with the impact of trails on property values (continued)
Source: HRTPO analysis of literature

Name of the study/report	Author(s), year	Sample size	Data range	Methodology	Buffer	Policy Variable	Independent Variables	Results/findings
The Impact of Bicycle Facilities on Single Family Residential Property Values: Evidence from Alachua County, Florida	Kevin Szatmary, thesis, (2014)	50309 single family properties	N/A	Hedonic price model	Distances of 500 ft., 1,000 ft., 2,000 ft., 1/4 mile, 1/2 mile	Just (market) value	Parcel number, area of parcel in acres, amount of most recent sale, year of most recent sale, number of bedrooms, number of bathrooms, year structure was constructed, presence or absence of air condition and/or heating, total floor area of structure, distance to nearest applicable bicycle facility in meters	Bike facilities lower property value. For a distance of 1,000 feet the value of property increases by $4.20 for every foot one moves away from the facility. For 2,000 ft. the value of property increases by $1.62 for every foot one moves away from the facility. For 1/4 mile, property values increase in value by $3.66 for every foot one moves away. For 1/2 mile, property values increase $1.30 per foot
The Impact of Central Ohio Trails	Lindsey, et al. (2005)	46167 property sales	Three years (2011-2013)	Hedonic price analysis	Between 1/4 and 1/2 mile	Sale price	Number of bedrooms, neighborhood characteristics, access to trails, etc.	"No relationships between property values and proximity to trails were observed"
The Impact of Greenways on Property Values: Evidence from Austin, Texas	Nicholls, Crompton (2005)	700 property sales	Three years (1999-2001)	Hedonic price analysis	Bands: 0-1/4 miles, 1/4-1/2 miles, 1/2-3/4 miles, 3/4-1 miles, 1-5/4 miles	Sale price	Lot size, age of house at time of sale, heated area of house, number of stories, number of bedrooms, bathrooms, fireplaces, garages, location on greenbelt, view of greenbelt, distance to greenbelt entrance, greenbelt entrance within 1/2 mile etc. (for full list, consult the study)	Greenbelt adjacent to property is associated with significant value premiums in two of three neighborhoods. However, property with a view of the greenbelt, but not adjacent to it, saw no significance rise in value. Distance to the nearest greenbelt entrance had a statistically significant impact on sales price in one neighborhood.

TABLE 1 Literature review of articles concerned with the impact of trails on property values (continued)
Source: HRTPO analysis of literature

Name of the study/report	Author(s), year	Sample size	Data range	Methodology	Buffer	Policy Variable	Independent Variables	Results/findings
The Relative Impact of Trails and Greenbelts on Home Prices	Asaberre, Huffman (2007)	9710 sales observations	April 2001-March-2002	Hedonic framework	N/A	Sale price	Various dummy variables, house age, total number of bedrooms and bathrooms, size of the house in square feet, etc.	"The implication of this study is that while trails, and greenbelts per se, add to home value, the value of the home would be further enhanced when greenbelts are used to buffer trails thus enhancing greenways." The study shows that trails, greenbelts, and greenways add 2%, 4% and 5% to price premiums respectively
The Value of Trail Access on Home Purchases	Mogush, Krizek, Levinson (2005)	35002 home sales	One year (2001)	Hedonic price analysis	Radii of 10, 20, 50, 100, 200, 400, 800, and 1600 meters	Sale price	Number of bedrooms, bathrooms, finished square feet of floor space, size of lot, age of house, number of fireplaces, garage stalls, neighborhood accessibility, distance to nearest CBD, major highway, busy street, open space, bicycle lane, non-roadside bicycle trail, on-roadside bicycle trail, etc. For full list, consult the study	Study results suggest that off-street bicycle trails add value to home sale prices in the city, possibly because of its contribution to social livability. For other types of facilities in either city or suburb no positive or significant relationship is found, suggesting that urban planners and advocates need to be aware that the change in welfare is not necessarily positive for all homeowners
Understanding the Impact of Trails on Residential Property Value in the Presence of Spatial Difference	Parent, vom Hofe (2011)	1762 single-family residential properties	One year (2005)	Hedonic price model	10,000 feet	Assessed value	Market value of land, network distance between each property and the nearest trail, median household income, finished square footage of the house, age of house, lot size of the property, dummy variables (full basement, exterior brick wall, fireplace), gross tax rate by school district, shortest distance to Downtown Cincinnati	According to the study, access to Little Miami Scenic Trail has a significant impact on residential property values as long as properties lie within 10,000 feet network distance to one of the trail entrances. Study also states that: "for every foot a property is closely located to a trailhead its value would increase by $3.98"

TABLE 1 Literature review of articles concerned with the impact of trails on property values (continued)
Source: HRTPO analysis of literature

Highways

The proximity of John Tyler Highway to the VCT trail segment in James City County could have a negative impact on property values. Therefore, the staff conducted a literature review of studies that assessed the impact of highways on property values.

Carey (2011) prepared a case study for the Superstition Freeway (US60) corridor in Mesa and Gilbert, Arizona. This study attempted to estimate how freeway impacts are distributed among parcels at various distances from the freeway. An impact area was constrained to a strip of land extending ½ mile on either side of the freeway. The findings of the study were:

- Non-users see access benefits from the highway through changes in property values. Freeway construction may have an adverse impact on some properties, but overall, property values tend to increase with freeway development.
- The level of traffic on any major roads in the proximate area is a significant factor in determining adverse effects on property values. This could imply that regional traffic growth is more significant than the presence of a freeway.

A study by Neelawala et al. (2010) examined the impact of two major transport corridors on nearby property values: Everton Park to Kedron and the Everton Park to Albany Creek road corridors within Western Brisbane Transport Network in Australia. The authors used a Hedonic Property analysis of the spatial effects of externalities (pollutant emissions, noise, vibration, visual-aesthetics, community cohesion, equity and land use justice) on property values. The regression analysis using 630 observations from the two corridors covering nine suburbs exhibited increased property value by 2.82% more per kilometer distance from the existing road corridor. The regression results show that the magnitude of the impact varies according to the size of the corridor expansion, suggesting that the proposed larger corridor project has a more significant impact on property prices than the proposed smaller project.

Study Area

The study area, initially, included two counties and one independent city in Hampton Roads: James City County, Suffolk, and the City of Norfolk.

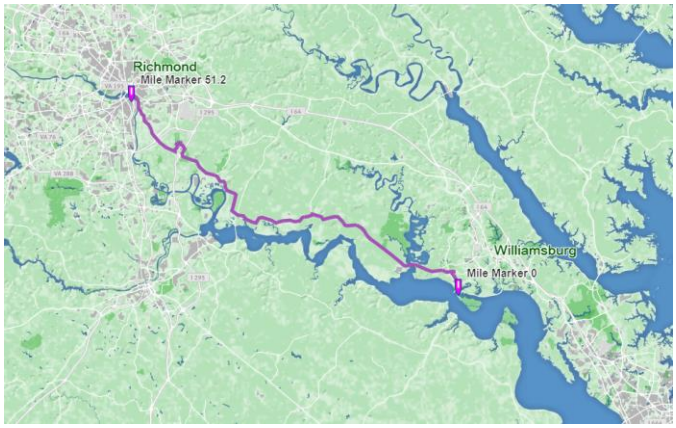
During the discussion with the members of the PST, one trail segment per locality was identified (marked in yellow):

- Elizabeth River Trail (Norfolk)
- Seaboard Trail (Suffolk)
- Virginia Capital Trail (VCT)

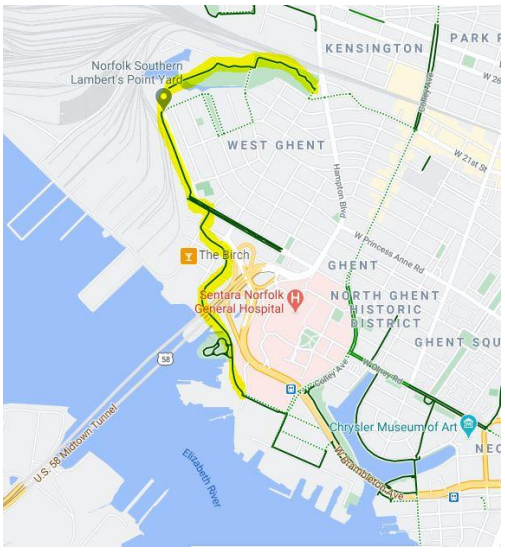
The staff received complete data from James City County, so the rest of the study is concerned with the Virginia Capital Trail segment in James City County. The James City County data went through a process of data preparation outlines above

The Virginia Capital Trail segment that was studied runs from Chickahominy River Bridge to Jamestown Settlement.

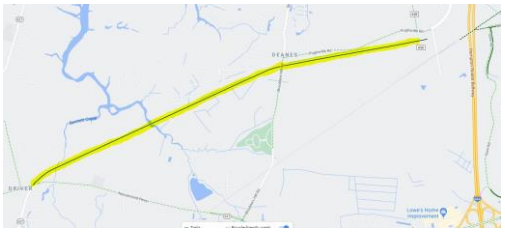
Map 1 shows the segment of the VCT and 381 houses in James City County. The next chapter outlines the process how this number was obtained.



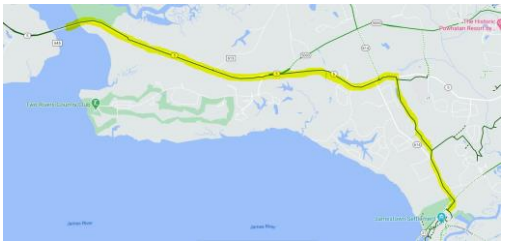
Virginia Capital Trail
Source: The Virginia Capital Trail Foundation



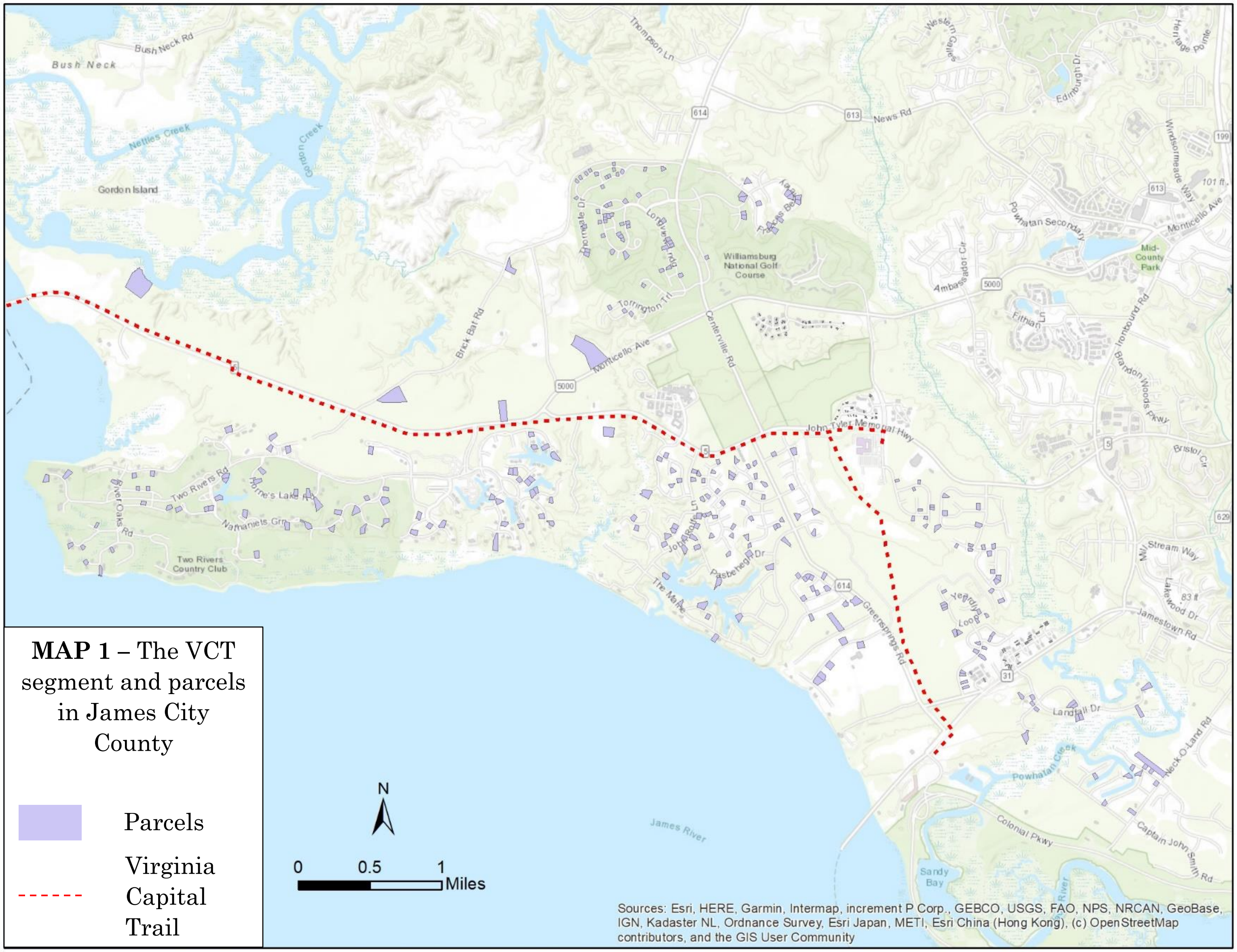
Elizabeth River Trail segment (Norfolk)
Source: Google maps



Seaboard Trail segment (Suffolk)
Source: Google maps



Virginia Capital Trail segment (James City County)
Source: Google maps



MAP 1 – The VCT segment and parcels in James City County

Data Preparation

Data preparation is an essential step before processing and analysis. It involves reformatting data, making corrections to data, cleaning and transforming the data. Cleaning up the data is traditionally the most time-consuming part of the data preparation process, but it is crucial for removing faulty data entries. Important steps include:

- Removing extraneous data and outliers
- Filling in missing values
- Conforming data to a standardized pattern
- Deleting incomplete or illogical data entries

Requested data included:

- Last sale data
- House characteristics (square footage, etc.)
- Assessed value
- Lat., Long. (if available)
- GIS layer

Variables included in the initial database that was sent to HRTPO Staff are:

- *Stories* – Structure stories
- *Age* – Structure age (years)
- *FinSize* – Structure finished square footage
- *NumRms* – Structure room count
- *NumBdRms* – Structure bedroom count
- *Num2Baths* – Structure half bath count
- *Num3Baths* – Structure full bath count
- *CentrlAC* – Structure central air conditioning (Yes=1/No=0)
- *BsmtFin* – Structure finished basement square footage
- *AttGarSF* – Attached garage square footage
- *DetGarSF* – detached garage square footage
- *AttCpSF* – Attached carport square footage
- *EnclPSF* – Enclosed porch square footage
- *OpenPSF* – Open porch square footage
- *DeckSF* – Deck square footage 9+
- *Other* – Other structure square footage
- *Sale1Amt* – Most recent sale amount

Another variable needed for the regression model is a variable calculated by HRTPO staff in ArcMap: NearDist, representing the distance from the property (parcel) to the nearest trail segment in feet.

Recent sales were analyzed (1-3-2018 thru 10-18-2019). Entries with 0 values for variables *Stories, Sale1Amt,* and *FinSize* were deleted from the dataset. Variables *DetGarSF, AttCpSF* were deleted from the dataset because they had no data. Moreover, staff removed records with 0 values for *Age* variable because, for some of these, the purchase covered the lot only (no house). Finally, 381 data entries remained.

The staff calculated descriptive statistics for James City County data, shown in Table 2. Descriptive statistics of the regression variables are essential to show the spread of variables around their corresponding mean values. A high variation of values can be observed for the *Finished Squared Foot* variable. The *Age* variable shows a variation between 3 years and 54 years.

Unpaved Driveway (0,1)		*Waterfront w View of Large Water (0,1)*		*Other Natural Waterfront (0,1)*		*Other Waterfront (lake, marsh, canal) (0,1)*	
Mean	0	Mean	0	Mean	0	Mean	0
Standard Error	0	Standard Error	0	Standard Error	0	Standard Error	0
Median	0	Median	0	Median	0	Median	0
Mode	0	Mode	0	Mode	0	Mode	0
Standard Dev.	0.3	Standard Dev.	0.1	Standard Dev.	0.1	Standard Dev.	0.2
Sample Var.	0.1	Sample Var.	0	Sample Var.	0	Sample Var.	0.1
Range	1	Range	1	Range	1	Range	1
Minimum	0	Minimum	0	Minimum	0	Minimum	0
Maximum	1	Maximum	1	Maximum	1	Maximum	1
Sum	33.0	Sum	7	Sum	3	Sum	23
Count	381	Count	381	Count	381	Count	381

Acreage up to 2 acres		*Acreage in Excess of 2 acres*		*Large Lot (2+ acres) (0,1)*		*Age, years*	
Mean	0.4	Mean	0.06	Mean	0.02	Mean	20.9
Standard Error	0	Standard Error	0.03	Standard Error	0.01	Standard Error	0.5
Median	0.3	Median	0	Median	0	Median	19
Mode	0	Mode	0	Mode	0	Mode	18
Standard Dev.	0.3	Standard Dev.	0.6	Standard Dev.	0.13	Standard Dev.	9.8
Sample Var.	0.1	Sample Var.	0.3	Sample Var.	0.02	Sample Var.	96.2
Range	2	Range	8	Range	1	Range	51
Minimum	0	Minimum	0	Minimum	0	Minimum	3
Maximum	2	Maximum	8	Maximum	1	Maximum	54
Sum	142.8	Sum	21	Sum	7	Sum	7,966
Count	381	Count	381	Count	381	Count	381

Finished Square Footage		*Half Baths*		*Finished Basement Square Footage*		*Open Porch Square Footage*	
Mean	2,635.1	Mean	0.8	Mean	25.0	Mean	109.3
Standard Error	59.9	Standard Error	0.0	Standard Error	9.0	Standard Error	8.6
Median	2,485	Median	1	Median	0	Median	41
Mode	1,210	Mode	1	Mode	0	Mode	0
Standard Dev.	1,169.2	Standard Dev.	0.5	Standard Dev.	176.4	Standard Dev.	167.7
Sample Var.	1,367,010.6	Sample Var.	0.3	Sample Var.	31,114.1	Sample Var.	28,109.2
Range	6,849	Range	3	Range	1,574	Range	1,187
Minimum	1,160	Minimum	0	Minimum	0	Minimum	0
Maximum	8,009	Maximum	3	Maximum	1,574	Maximum	1,187
Sum	1,003,957	Sum	298	Sum	9,515	Sum	41,641
Count	381	Count	381	Count	381	Count	381

Other Square Footage	
Mean	67.2
Standard Error	9.8
Median	0
Mode	0
Standard Dev.	192.0
Sample Var.	36,882.1
Range	1,553
Minimum	0
Maximum	1,553
Sum	25,587
Count	381

TABLE 2 Descriptive statistics for independent variables
Source: HRTPO analysis of data

In the following chapter, the regression analysis applied to the James City County data is presented.

Regression

Regression analysis is a well-known statistical procedure used to infer relationships between a dependent variable Y and p independent variables X. Regression estimates Y in terms of X using n observations. Via linear regression, the most common regression form, a researcher finds the line that most closely fits the data according to specific mathematical criteria. Linear regression can be expressed as follows:

$$Y = \beta_0 + \beta_1 x_1 + \cdots + \beta_p x_p$$

where $\beta_0, \beta_1, \beta_p$ are the regression coefficients estimated by the ordinary least square method.

The policy variable is the distance from home to Virginia Capital Trail, while control variables are home characteristics. Initial regression produced coefficients indicating that proximity to trail decreased home value. Given that the literature review shows a positive impact of trail proximity on home values, staff examined (in the field) key houses which generated these results – i.e., houses which sold for much less than expected (based on characteristics, excluding distance to the trail), and houses which sold for much more than expected – looking for missing as-yet-unmeasured characteristics may explain the low or high values.

This list of key houses was prepared by running the regression without the distance variable, calculating residuals (the difference between the actual sale price and modeled sale price), identifying those homes with the highest residuals and those homes with the lowest residuals.

Based on the field visit, the staff did the following:

- Subdivided the *Waterfront* variable into the following binary variables:
  - *Waterfront with View of Large Water*
  - *Other Natural Waterfront*
  - *Other Waterfront – lake, marsh, canal*
- Subdivided the *Acreage* variable, assuming, for example, that the half-acre difference between ¼ and ¾ acres is more valuable than the half-acre difference between 5¼ and 5¾ acres:
  - *Acreage up to 2 acres*
  - *Acreage in Excess of 2 acres*
- Included more variables from James City County's real estate database ("JCC Parcel Data"):
  - Type of house (single-family detached vs. single-family attached vs. condo)
  - School district
  - Note: these variables proved not to statistically explain sales price, so staff dropped them from future regressions

Following these adjustments, regression still produced coefficients indicating that proximity to trail decreased home value. In response, staff examined in the field the 9 houses within ¼ mile of the trail, looking for more as-yet-unmeasured characteristics, which may explain the lower value of these houses.

Based on this field visit:

- Thinking that houses near the end of cul-de-sacs are more desirable because they have lower traffic volume in front of them, staff prepared a "Near End of cul-de-sac, (0,1)" variable (using Google Maps). This proved not to be statistically significant.
- Prepared an "Unpaved Driveway (0,1)" variable (using Google maps). This also did not have significance at the standard 0.05 level.
- Noticing that several of the 9 houses had large lots, staff prepared a "Large Lot (2+ acres) (0,1)" variable.

Regression of this database produced coefficients indicating that proximity to trail did not have a statistically-valid impact on home value.

Final Results and Discussion

This chapter presents the final results of the regression analysis for the James City County data in Tables 3 and 4. First, regression statistics are shown in Table 3.

Regression Statistics	
Multiple R	0.94
R Square	0.89
Adjusted R Square	**0.89**
Standard Error	89,906
Observations	381

TABLE 3 Regression Statistics
Source: HRTPO analysis of JCC and HRTPO data

The first three rows in Table 3 represent different variation of the correlation coefficient R. The Adjusted R Square is the R Square adjusted for the existence of multiple dependent variables. Having a maximum value of 1.00, the 0.89 value (bolded) indicates that the model fits the data very well.

Table 4 exhibits values of coefficients, standard error and P-value for independent variables. The shading cells represent the variables statistically significant at 95% level (P<0.05).

Dependent Variables	*Coefficients*	*Standard Error*	*P-value*
Intercept	$26,199	$19,502	0.18
Unpaved Driveway (0,1)	-$15,275	$20,796	0.46
Waterfront w View of Large Water (0,1)	$618,879	$38,036	0.00
Other Natural Waterfront (0,1)	$494,659	$58,139	0.00
Other Waterfront (lake, marsh, canal) (0,1)	$22,654	$22,367	0.31
Acreage up to 2 acres	$69,876	$24,649	0.00
Acreage in Excess of 2 acres	$26,951	$11,970	0.02
Large Lot (2+ acres) (0,1)	-$271,707	$66,533	0.00
Age, years	-$2,010	$645	0.00
Finished Square Footage	$122	$7	0.00
Half Baths	$35,337	$10,402	0.00
Finished Basement Square Footage	$71	$27	0.01
Open Porch Square Footage	$242	$33	0.00
Other Square Footage	$141	$29	0.00
Distance to VCT <0.25mi vs. 1mi+ (0,1)	-$32,702	$34,988	0.35
Distance to VCT 0.25-0.50mi vs. 1mi+ (0,1)	$9,484	$22,787	0.68
Distance to VCT 0.50-1mi vs. 1mi+ (0,1)	-$4,107	$10,637	0.70

TABLE 4 Values of Coefficients, Standard Error and P-value
Source: HRTPO analysis of JCC and HRTPO data

Coefficients of the independent variables tell us how much the dependent variable is expected to increase (if the coefficient is positive) or decrease (if the coefficient is negative) when that independent variable increases by one (Table 4). For example, considering *Age, Years*, all other things being equal, a 9-year-old house is expected to have a sale price $2,010 less than an 8-year-old house. Another example is: if the *Finished Square Footage* increases by a foot, the sale price will increase by $122.

The standard error of the coefficients is an estimate of the standard deviation of the coefficients.

The P-values help determine whether the relationships that one observes in the sample also exist in the larger population. The P-value for each independent variable tests the null hypothesis that the variable does not correlate with the dependent variable. For our regression model, the variables that have a P-value of equal or lower than 0.05 (i.e., less than a 5% chance that they are not significant) are considered statistically significant:

- *Waterfront w View of Large Water (0,1)*
- *Other Natural Waterfront (0,1)*
- *Acreage up to 2 acres*
- *Acreage in Excess of 2 acres*
- *Large Lot (2+ acres)*
- *Age, years*
- *Finished Square Footage*
- *Half Baths*
- *Finished Basement Square Footage*
- *Open Porch Square Footage*
- *Other Square Footage*

The remaining independent variables have a P-value greater than 0.05, making us unsure of the direction (positive, negative) in which they impact sales price, if at all. Importantly, variables depicting distances to the trail are not statistically significant. Therefore, the above Virginia Capital Trail data shows that proximity to trail does not have a statistically-valid impact on home values.

Given that the literature shows a positive impact of trail proximity—and negative impact of highway proximity—on home values, the above Virginia Capital Trail data may show that proximity to the trail has no statistically-valid impact on home value because any positive impact of the trail is negated by a negative impact of proximity to John Tyler Highway.

In conclusion, based on the above regression, staff cannot conclude that proximity to the Virginia Capital Trail impacts home value. Possible next steps include obtaining data from Suffolk or Norfolk to test the impact of the Seaboard Trail or Elizabeth River Trail (respectively).

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