Vinton Major Corridors Bicycle & Pedestrian Accommodations

Prepared by the REGIONAL commission

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1.0 Introduction

The Vinton major corridors of Gus Nicks Boulevard, Washington Avenue, Virginia Avenue, Hardy Road, Bypass Road, Pollard Avenue, Lee Avenue, and Walnut Avenue (Figure 1) serve several modes of traffic—automobile, freight, transit, bicycle, and pedestrian. The present study assesses bicycle and pedestrian accommodations on Vinton major corridors and suggests treatments that can improve accommodations.

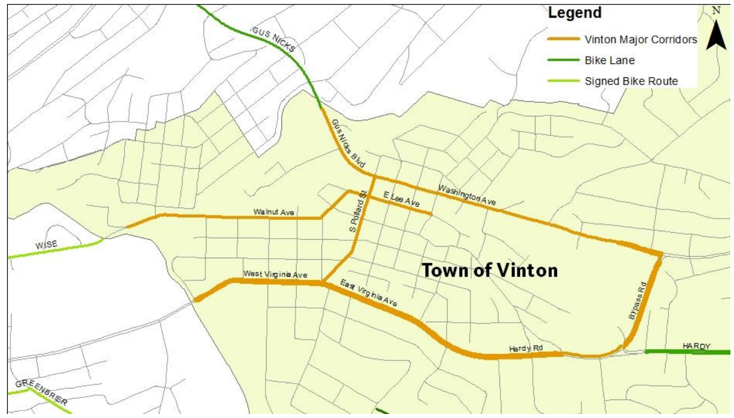

FIGURE 1. BICYCLE ACCOMMODATIONS FOR VINTON MAJOR CORRIDORS

2.0 Bicycling

Recreational bicyclists may choose to bicycle on greenways and lightly traveled roads, but transportation bicyclists have fewer options to reach jobs and services, and must often travel on hostile roads. Streets with heavy commercial traffic are problematic because they contain businesses and destinations bicyclists need to visit, but have intimidating and dangerous traffic conditions such as multiple lanes, fast traffic, high traffic volume, and many turning vehicles, all of which are difficult for bicyclists to navigate safely and comfortably. The dangers of such conditions are not limited to bicyclist perception, but affect traffic safety for motorists as well. Of the 51 crashes in 2015 in Vinton, 78% were on 4-lane commercial streets, including 13 injury crashes, 25 property damage only crashes, and 1 traffic fatality on or near roads in the commercial loop (Figure 2, top panel).

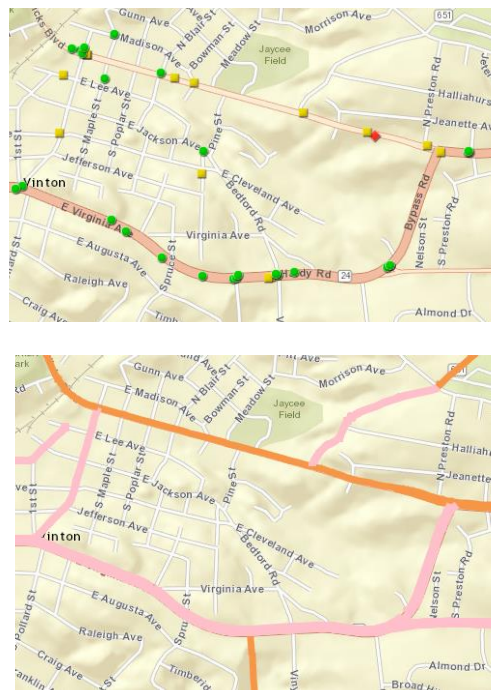

FIGURE 2. TOP PANEL: CRASHES IN 2015 ON ROADS IN THE VINTON COMMERCIAL LOOP. GREEN DOTS = PROPERTY DAMAGE; YELLOW SQUARES = INJURY; RED DIAMOND = FATALITY. SOURCE: VDOT.
BOTTOM PANEL: PRIORITY (ORANGE) AND VISION (PINK) BIKE ACCOMMODATIONS. SOURCE: REGIONAL BIKEWAY PLAN.

The Regional Bikeway Plan, adopted in 2005 and updated in 2012, identified major corridors in Vinton for bicycle accommodations (Figure 1) and recommended bicycle accommodations on three entrances to Vinton from Roanoke and on the commercial loop (Figure 2, bottom panel). The three Roanoke-to-Vinton entrances are Gus Nicks Boulevard - Washington Avenue, Wise Avenue - Walnut Avenue/ Lee Avenue, and Dale Avenue – Virginia Avenue. The roads that make up the commercial loop are

Virginia Avenue, Hardy Road, Bypass Road, and Washington Avenue. Pollard Street closes the loop with a north-south connection on the west.

Creating safer passage for bicyclists has the positive effect of improving safety for all traffic. New York City had a chance to study this effect after implementing 7 miles of protected bike lanes and found that all traffic injuries declined after protected bike lanes were installed, and the effect was most pronounced on motor vehicles occupants (Figure 3). This unexpected effect occurred because traffic speeds decreased while, paradoxically, traffic times also decreased—even though fewer people were speeding, overall, traffic moved faster and everyone reached their destinations more quickly yet at slower speeds. Reducing traffic speeds has a pronounced effect on reducing both the number and severity of crashes. All travelers are thus protected by reduced traffic speeds as well as designated space.

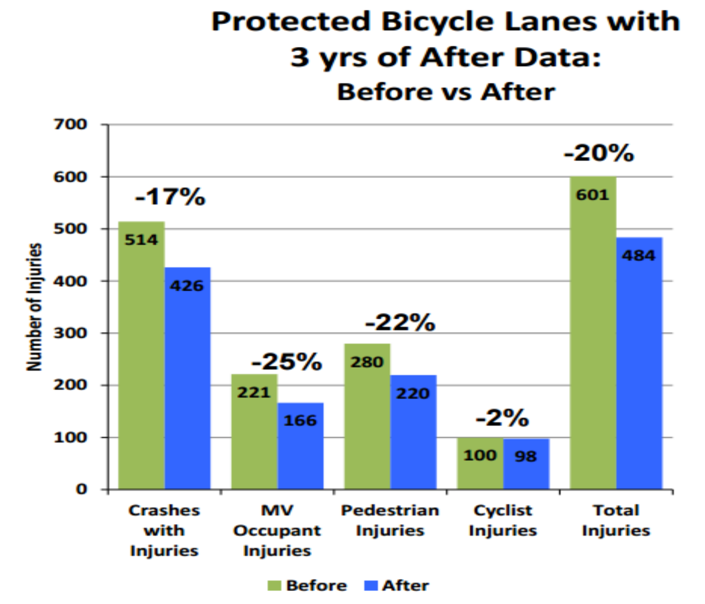

FIGURE 3. NEW YORK CITY OBSERVED A DECREASE IN INJURIES FOR ALL TYPES OF TRAFFIC AFTER INSTALLING PROTECTED BIKE LANES. SOURCE: NYDOT

2.1 Current Bicycle Accommodations

2.2 Methods

The Bicycle Compatibility Index (BCI), developed by the USDOT, was used to assess bicycling accommodations on the corridors. BCI was validated by having bicyclists observe videos of various road conditions and rate how comfortable they would feel bicycling in those situations. The use of videos to rate bicyclist comfort was validated in a pilot study. BCI is a reliable predictor of the comfort level of bicyclists (R^2 = 0.89). A limitation of BCI is that it was developed in 1998, and cannot factor in newer bicycle accommodations. Another limitation is that it does not address intersections.

BCI considers the following factors:

- Number of lanes
- Curb lane width
- Bicycle lane presence and width
- Speed limit
- Traffic speeds

- Traffic volume
- Percent large trucks
- On-street parking

Lane width, traffic speed, traffic volume, and on-street parking have the greatest impact on BCI.

The four corridors studied were Walnut Avenue/ Lee Avenue, Pollard Street, Virginia Avenue/ Hardy Road/ Bypass Road, and Washington Avenue (Table 1). On each corridor, lane widths were measured at various points. Posted speed limits were observed, and 9 mph added to estimate actual travel speeds. Data on average annual daily traffic (AADT) and

TABLE 1. CORRIDORS STUDIED

Corridor	From	To	Locations measured
Walnut Avenue	Glade Creek	Lee Avenue	Glade Creek, 2nd Street
Lee Avenue	Walnut Avenue	Blair Street	Walnut Avenue, Maple Street
Pollard Street	Washington Street	Virginia Avenue	Jackson Avenue
Virginia Avenue	West city limit	Hardy Road	Maple Street
Hardy Road	Virginia Avenue	McDonald Street	Spruce Street, Bedford Road, Nelson Street
Bypass Road	Hardy Road	Washington Avenue	River Park Shopping Center
Washington Avenue	Bush Drive	Gus Nicks Boulevard	Marshall Avenue, Mountain View, Poplar Street
Gus Nicks Boulevard	Washington Avenue	Glade Creek	Glade Creek

TABLE 2. BCI OF CORRIDORS STUDIED

Location	BCI	Level of Service	Bicycle Compatibility Level
Walnut Avenue – Glade Creek to 4th Street	2.08	B	Very High
Walnut Avenue - 4th Street to Lee Avenue	3.22	C	Moderately High
Lee Avenue	4.67	E	Very Low
Pollard Street - Virginia to Jackson (southbound)	3.99	D	Moderately Low
Pollard Street - Virginia to Jackson (northbound)	4.39	D	Moderately Low
Pollard Street - Jackson to Washington (southbound)	4.05	D	Moderately Low
Pollard Street - Jackson to Washington (northbound)	4.44	E	Very Low
Virginia Avenue - West City Limit to Pollard (eastbound)	5.63	F	Extremely Low
Virginia Avenue - West City Limit to Pollard (westbound)	5.17	E	Very Low
Virginia Avenue - Pollard to Clearview (eastbound)	4.87	E	Very Low
Virginia Avenue - Pollard to Clearview (westbound)	4.72	E	Very Low
Hardy Road – Clearview to Bypass	4.11	D	Moderately Low
Hardy Road – Bypass to East City Limit	4.11	D	Moderately Low
Bypass Road	4.16	D	Moderately Low
Washington Avenue – East City Limit to Gus Nicks Boulevard	5.09	E	Very Low
Gus Nicks Boulevard – Washington Avenue to West City Limit	4.97	E	Very Low

% heavy trucks were provided by VDOT. Corridors were divided into segments to assess changing conditions throughout the corridor, including bike lanes, traffic volume, posted speed limits, and lane widths.

Many corridors scored Very Low and Moderately Low for Bicycle Compatibility Index (Table 2). Recent improvements have raised the score of Walnut Avenue from Moderately Low in 2010 to Very High and Moderately High today. Raw data is shown in **TABLE 3**.

TABLE 3. RAW DATA FOR BICYCLE COMPATIBILITY INDEX

Location	Geometric & Roadside Data					Traffic Operations Data				Parking Data		
Midblock Identifier (Route/Intersecting Streets, Segment Number, Link Number, Etc.)	No. of Lanes (one direction)	Curb Lane Width (ft)	Bicycle Lane Width (ft)	Paved Shoulder Width (ft)	Residential Development (y/n)	Speed Limit (mi/h)	85th %tile Speed (mi/h)	AADT	Large Truck % (HV)	Parking Lane (y/n)	Occupancy (%)	Time Limit (minutes)
Walnut - Glade Ck to 4th St Eastbound	1	12	5	0	n	25	34	5800	1%	n	0%	0.0
Walnut - 4th St to Lee Ave Eastbound	1	15	0	0	n	25	34	5800	1%	n	0%	0.0
Lee Ave Eastbound	1	10	0	0	n	25	34	4800	1%	y	33%	120.0
Pollard St Southbound Virginia to Jackson	1	12	0	0	n	25	34	5400	1%	y	25%	120.0
Pollard St Northbound Virginia to Jackson	1	9	0	0	n	25	34	5400	1%	y	25%	120.0
Pollard St Southbound Jackson to Washington	1	12	0	0	n	25	34	5900	1%	y	25%	120.0
Pollard St Northbound Jackson to Washington	1	9	0	0	n	25	34	5900	1%	y	25%	120.0
Virginia Ave West City Limit to Pollard - Eastbound	2	9	0	0	n	35	44	24000	2%	n	0%	0
Virginia Ave West City Limit to Pollard - Westbound	2	12	0	0	n	35	44	24000	2%	n	0%	0
Virginia Ave Pollard to Clearview - Eastbound	2	12	0	0	n	35	44	21000	1%	n	0%	0
Virginia Ave Pollard to Clearview - Westbound	2	13	0	0	n	35	44	21000	1%	n	0%	0
Bypass Rd	2	13	0	0	n	35	44	14000	1%	n	0%	0
Hardy Rd Virginia to Bypass	2	12	0	0	n	35	44	11000	1%	n	0%	0
Hardy Rd east of Bypass	2	10	5	0	n	35	44	22000	1%	n	0%	0
Gus Nicks City Limit to Pollard	2	12	0	0	n	35	44	21000	2%	n	0%	0
Washington Ave Pollard to Bypass	2	11	0	0	n	35	44	22000	1%	n	0%	0
Washington Ave east of Bypass	2	11	0	0	n	35	44	22000	1%	n	0%	0
After recommended treatment	1	12	5	0	n	25	34	5800	1%	n	0%	0
Walnut - Glade Ck to 4th St Eastbound	1	12	5	0	n	25	34	5800	1%	n	0%	0
Walnut - 4th St to Lee Ave Eastbound	1	11	5	0	n	25	34	5800	1%	n	0%	0
Lee Ave Eastbound	1	10	5	0	n	25	34	4800	1%	y	25%	120
Pollard St Southbound Virginia to Jackson	1	12	5	0	n	25	34	5400	1%	n	0%	0
Pollard St Northbound Virginia to Jackson	1	9	0	0	n	25	34	5400	1%	y	25%	120
Pollard St Southbound Jackson to Washington	1	12	0	0	n	25	34	5900	1%	y	25%	120
Pollard St Northbound Jackson to Washington	1	9	0	0	n	25	34	5900	1%	y	25%	120
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Virginia Ave West City Limit to Pollard - Westbound	2	11	5	0	n	35	44	24000	2%	n	0%	0
Virginia Ave Pollard to Clearview - Eastbound	2	11	5	0	n	35	44	21000	1%	n	0%	0
Virginia Ave Pollard to Clearview - Westbound	2	11	5	0	n	35	44	21000	1%	n	0%	0
Hardy Rd Virginia to Bypass	2	11	5	0	n	35	44	11000	1%	n	0%	0
Bypass Rd	2	13	0	0	n	35	44	14000	1%	n	0%	0
Hardy Rd Virginia to Bypass	2	12	0	0	n	35	44	11000	1%	n	0%	0
Hardy Rd east of Bypass	2	10	5	0	n	35	44	22000	1%	n	0%	0
Gus Nicks City Limit to Pollard	2	12	0	0	n	35	44	21000	2%	n	0%	0
Washington Ave Pollard to Bypass	2	11	0	0	n	35	44	22000	1%	n	0%	0
Washington Ave east of Bypass	2	11	0	0	n	35	44	22000	1%	n	0%	0

2.3 Recommended Bicycle Accommodations

The recommendations are tailored to the type of corridor. Recommendations include treatments between intersections and treatments of intersections. Corridors can be categorized as downtown commercial streets and commercial throughways.

2.3.1 High bicycle compatibility road

Walnut Avenue scored high for bicycle compatibility, "Very High" for the 500-foot stretch that has bike lanes from Glade Creek to 4th Street (Figure 4, top panel), and "Moderately High" for the remainder of the street. The low level of traffic, low speed limit, and wide lanes make it a comfortable road to bicycle. As Walnut Avenue crosses into Roanoke and becomes Wise Avenue, it is a signed bike route. The new Glade Creek Greenway connects the Walnut Avenue bike lane to the Tinker Creek Greenway.

FIGURE 4. TOP: WALNUT AVENUE HAS A BIKE LANE FOR 500 FEET WHICH CONNECTS THE NEW GLADE CREEK GREENWAY. BOTTOM: LEE AVENUE FACING EAST.

With 15-foot lanes, low traffic speed, and low traffic volume, the segment of Walnut Avenue from 4th Street to Lee Avenue can accommodate bicycle lanes.

TABLE 4. DOWNTOWN COMMERCIAL STREETS VS. COMMERCIAL THROUGHWAYS

Downtown commercial	Commercial throughways
Slow traffic speeds	Fast traffic speeds
Moderate traffic volume	High traffic volume
On-street parking	No on-street parking
Narrow lanes	Wide lanes

2.3.2 Downtown commercial streets

FIGURE 5. ADVISORY BIKE LANE ON POTOMAC GREENS DRIVE IN ALEXANDRIA, VA

The remaining streets that scored “Moderately Low” to “Extremely Low” are downtown commercial streets and commercial throughways (Table 4). The characteristics of the two categories call for different types of bicycle accommodations. Narrow lanes and on-street parking on Lee Avenue and Pollard Street make them less compatible for bicycling, but the slow traffic speeds are safer for bicyclists (Figure 4, bottom panel). The greatest threats to bicyclists are 1) the many points of conflict at intersections and 2) ‘dooring’, or car doors opening into a bicyclist’s path, from on-street parking.

Lee Avenue could benefit from advisory bike lanes, bike lanes that are contained within the travel lane (Figure 5). Motorists may legally encroach the advisory bike lane, yielding to bicyclists. Advisory bike lanes have dashed lines, instead of solid. Centerline removal is often done in conjunction with advisory bike lanes to calm traffic, reduce crashes, and encourage motorists to move to the left to pass bicyclists. The League of American Bicyclists encourages advisory bike lanes and removal of center lines.

Pollard Street could benefit from assessing parking occupancy, replacing on-street parking with bike lanes where parking is underutilized, and installing advisory bike lanes where on-street parking is retained.

FIGURE 6. BULB-OUTS AT THE INTERSECTION OF GRANDIN ROAD SW AND WESTOVER AVENUE SW IN ROANOKE, VA.

Intersections on Lee Avenue and Pollard Street would benefit from ‘bulb-outs’ (Figure 6), curb extensions which narrow the roadway. Bulb-outs benefit safety for all road users—pedestrians, bicyclists, and motorists—because vehicles slow down to make turns in the tighter intersections. They further benefit pedestrian safety by reducing the distance to cross the street.

2.3.3 Commercial throughways

The commercial throughways are a logical part of the Regional Bikeway Plan because they connect to roads with current or future bike accommodations (Figure 1). Gus Nicks Boulevard in Roanoke has bike lanes until it enters Vinton and becomes Washington Avenue (Figure 1). While Dale Avenue, which enters from Roanoke and becomes Virginia Avenue in Vinton, does not have bike accommodations, it is, like Virginia Avenue, on the vision list of the Regional Bikeway Plan (Figure 2, right panel). As Hardy Road continues to the west from Bypass Road, it gains 1.1 miles of bike lane (the first bike lane in the Roanoke Valley) (Figure 1).

FIGURE 7. VIRGINIA AVENUE (TOP), BYPASS ROAD (MIDDLE), AND WASHINGTON AVENUE (BOTTOM).

Virginia Avenue, Hardy Road, Bypass Road, and Washington Avenue scored low because of high traffic speeds and high traffic volumes. Hardy Road and Bypass Road have half the traffic volume of Virginia Avenue or Washington Avenue, and thus scored “Moderately Low” instead of “Very Low” or “Extremely Low”. These streets are all 4-lane, 2 lanes in each direction. Virginia Avenue, Hardy Road, and Bypass Road have a median that becomes a left turn lane at intersections (Figure 7, top and middle panels). A strength of these streets is that the median is wide and features trees, which has a traffic calming effect, controls turning movements, and provides a pedestrian refuge. Washington Avenue does not have a center median (Figure 7, bottom panel).

The National Association of City Transportation Officials (NACTO) recommends lane widths of 10 feet as more appropriate for urban areas than the wider traffic lanes appropriate for higher speed roads[1]. Narrowing the 12- and 13-foot lanes on Virginia Avenue, Hardy Road, and Bypass Road to 10-foot lanes would slow traffic speeds and leave 4 to 6 feet on each side for bike lanes.

FIGURE 8. PROTECTED BIKE LANE ON SOUTH EADS STREET IN ARLINGTON, VA.

The Roanoke Valley Area Metropolitan Planning Organization 2005 Regional Bikeway Plan, updated in 2012, identifies these roads as priority and vision for bicycle accommodations, without identifying the specific accommodation. Basic bike lanes have limited effect on the BCI. The traffic volume on Virginia Avenue is so high that even adding bike lanes only brings these roads up to “Moderately Low”. “Moderately High” is considered the minimum BCI for casual bicyclists. A protected bike lane[2] or buffered bike lane would be preferable, with physical barriers such as plastic bollards (Figure 8). This could be the first protected bike lane in the Roanoke Valley, just as Hardy Road had the first bike lanes in the Roanoke Valley.

NACTO recommends 6-foot bike lanes but specifies a minimum of 3 feet. NACTO also specifies 18” buffers for protected bike lanes. Where the lanes are current 13 feet wide, there is sufficient space for an 18” buffer and a 4-foot bike lanes. But where there is not as much space, a narrower buffer and a 3-foot bike lane, while not ideal, could be an inexpensive compromise.

FIGURE 9. ILLUSTRATIVE BICYCLE BOULEVARD ROUTE.

Washington Avenue is a complex situation because the 11-foot lanes are not as wide as on the other roads. Reducing the travel lanes to 10 feet yields only 2 feet per side, which is insufficient for bike lanes (protected or otherwise) given the volume and speed of traffic. A 2-foot shoulder might provide comfort, if not improved safety, for brave or desperate bicyclists, but it is far from a satisfactory solution. Signage for bike routes or “Bicyclist May Use Full Lane” (the preferred option over “Share the Road” signs) may have a slight positive effect on bicyclist comfort or safety. Washington Avenue carries too much traffic for a 4-to-3 lane conversion, but a 4-to-3 lane conversion with a center turn lane that becomes a reversible travel lane at peak

[1] National Association of City Transportation Officials, Urban Street Design Guide, 2013. http://nacto.org/publication/urban-street-design-guide/street-design-elements/lane-width/

[2] “Protected bike lane” is the preferred term (People for Bikes). NACTO uses the term “one-way protected cycle tracks”.

hours of the day, flowing west in the morning and east in the evening, is a creative approach that could be tried. In conjunction with this, restricting turn access at peak hours could improve Washington Avenue. These treatments would improve the street for pedestrians as well, who can use the center turn lane as an unprotected pedestrian refuge when crossing.

A bicycle boulevard could provide comfortable east-west travel across Vinton, paralleling Virginia Avenue, Hardy Road, Bypass Road, and Washington Avenue (Figure 9). A bicycle boulevard is a continuous route that may consist of multiple types of accommodations, such as advisory bike lanes on a low-speed, low-traffic street, a bike path, or a route through a parking lot (Figure 10). The three key elements of a bicycle boulevard are:

- Distinct visual identity
- Safe, convenient crossings
- Bicycle priority

With a bicycle boulevard providing a comfortable east-west route, bicycle accommodations are still critical on commercial streets to provide bicycle access to the many businesses and destinations on these streets.

Virginia Avenue west of Pollard Street has a similar situation as Washington Avenue, with enough space for only a 1-foot shoulder. Virginia Avenue is in the Comprehensive Plan to be widened to 6 lanes, which is an opportunityt to implement bicycle accommodations. Protected bike lanes at least 6 feet wide would have the greatest impact on bicyclist safety and comfort.

FIGURE 10. BIKE BOULEVARDS WITHOUT (TOP) AND WITH (BOTTOM)

In addition to providing bicycle accommodations, changing the speed and traffic volume on a road affects bicyclist comfort and safety. The commercial throughways carry an uncomfortably high volume of traffic. According to the Vinton Comprehensive Plan, these are main routes for commuters passing through Vinton. However, to our knowledge a detailed study has not been conducted, which could reveal opportunities for managing traffic on the corridor.

2.3.4 Intersections

Intersections on busy corridors create dozens of points of possible conflict and can be barriers for bicyclists. A protected bike lane with a poorly designed intersection can put bicyclists in a dangerous situation. Common intersection problems include right-hook, where a right-turning vehicle collides with a bicyclist on the right that is proceeding straight, and a left-hook, where a driver waiting to turn left perceives a gap in traffic but fails to see the bicyclist in that gap as she makes the left turn. Several cities in the US successfully implemented "protected intersections" for protected bike lanes[3] in the past 2 years (Figure 11). The four elements of a protected intersection are:

- Corner refuge island
- Forward stop bar for bicyclists
- Setback bike and pedestrian crossing
- Bicycle friendly signal phasing

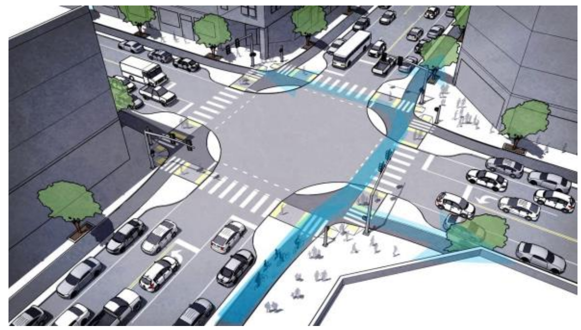

FIGURE 11. PROTECTED INTERSECTION. SOURCE: PROTECTEDINTERSECTION.COM

Roundabouts are another way to improve the safety of an intersection for bicyclists and pedestrians, because they naturally slow traffic. Roundabouts should be designed to accommodate pedestrian travel. Roundabouts can cause issues for bicyclists if the expected movement is not clear. Merging with other traffic is the safest way to move bicycles through a roundabout, but this is intimidating to most bicyclists. For this reason, protected intersections may be preferred over roundabouts, depending on context. The effect of recommended treatments on BCI for each corridor is summarized in Table 5.

TABLE 5. RECOMMENDED TREATMENTS TO IMPROVE BCI

Location	Bicycle Compatibility Level	Recommended Treatment	Bicycle Compatibility After Treatment
Walnut Street – Glade Creek to 4th Street	Very High	Maintain striping	Very High
Walnut - 4th Street to Lee Avenue	Moderately High	Convert wide lanes to narrow lanes plus bike lanes	Moderately High
Lee Avenue	Very Low	Advisory bike lanes Remove center line	Moderately High
Pollard Street	Moderately Low	Replace parking with bike lanes	Moderately High
Virginia Avenue - West City Limit to Pollard	Extremely Low	10-foot travel lanes and 6-foot protected bike lanes	Moderately High*
Virginia Avenue - Pollard to Clearview	Very Low	10-foot travel lanes and 6-foot protected bike lanes	Moderately High*
Hardy Road – Clearview to Bypass	Moderately Low	10-foot travel lanes and protected bike lanes	Moderately High*
Hardy Road – East of Bypass	Moderately Low	10-foot travel lanes and protected bike lanes	Moderately Low*

[3] People for Bikes. America's First Protected Intersection Is Open in Davis - And Working Like a Charm, 2015. http://www.peopleforbikes.org/blog/entry/americas-first-protected-intersection-is-open-in-davis-and-working-like-a-c

Bypass Road	Moderately Low	10-foot travel lanes and protected bike lanes	Moderately High*
Washington Avenue – East of Bypass**	Very Low	10-foot travel lanes, sharrows, and 2-foot shoulders	Moderately Low
Washington Avenue – West of Bypass**	Very Low	10-foot travel lanes, sharrows, and 2-foot shoulders	Moderately Low
Gus Nicks Boulevard	Very Low	10-foot travel lanes and bike lanes	Moderately Low*

*BCI does not account for protected or buffered bike lanes. The effect may be greater than indicated with the BCI tool.

**Recognizing that the constraints of Washington Avenue are problematic, a Bike Boulevard could provide an alternative east-west route.

3.0 Pedestrian Accommodations

Pedestrians are best accommodated through separated facilities such as sidewalks, but intersections pose special challenges for pedestrians. Pedestrian accommodations often go hand in hand with accommodations for people with disabilities. Designs should accommodate slower pedestrian speeds, wheels on wheelchairs or strollers, and visual and hearing impairments.

3.1 Current pedestrian accommodations

Sidewalks are present on 73% of the major corridors (Table 6). Most sidewalks are in good condition and present on both sides of the street. It is clear that more recent efforts compliant with ADA requirements have improved walkability. Furthermore, for the most part utility poles and other uses do not block sidewalks.

TABLE 6. SIDEWALKS ON VINTON MAJOR CORRIDORS

Street	Sidewalk (miles)	No sidewalk (miles)
Virginia Avenue	0.5	
Hardy Road	0.4	0.5
Bypass Road		0.4
Washington Avenue	0.9	0.3
Pollard Street	0.4	
Lee Avenue	0.3	

3.2 Recommendations for pedestrian accommodations

3.2.1 Missing sidewalk

Areas of road lacking sidewalk, such as Bypass Road, have informal natural surface paths, where people have worn a trail into the grass adjacent to the road, indicating a need for sidewalk.

3.2.2 Curb ramps

A major issue with many of the sidewalks in the study area is the lack of curb ramps (Figure 12). The Americans with Disabilities Act (ADA) requires curb ramps. Of the 32 intersections of roads that have sidewalks, there are 60 curb ramps and 17 missing curb ramps. Virginia Avenue and the older sidewalks on Walnut Avenue pre-dating ADA do not have curb ramps, while the newer sidewalks on Washington Avenue do have curb ramps (Figure 12).

FIGURE 12. TOP: SIDEWALK WITHOUT (LEFT) AND WITH (RIGHT) A CURB RAMP. BOTTOM: LOCATIONS OF CURB RAMPS ON BUS ROUTES IN VINTON.

3.2.3 Spacing of pedestrian crossings

On commercial throughways, crossing the street can be challenging as there may not be a sufficient break in traffic for a long time. With fast traffic speeds, it is difficult to judge when the break in traffic is large enough to permit crossing. The grassy median on most of the commercial throughways helps able-bodied, alert adults cross safely, but is not a safe option for everyone. There are four segments of commercial throughway that exceed ¼ mile between stoplights, on Virginia Avenue, Bypass Road, and Washington Avenue. HAWK signals can provide additional crossing opportunities for pedestrians on commercial throughways (Figure 13). HAWK signals are pedestrian-activated lights that are green until a pedestrian pushes the call button. At that point, the light cycles through a series of yellow and red blinking and solid phases that stop traffic and allow the pedestrian to cross.

Figure 13. HAWK signal in Billings, Montana

3.2.4 Crosswalks

There are just three marked crosswalks on any of the corridors in this study. Only one intersection with a stoplight has a marked crosswalk. Pollard Street has marked crosswalks at the intersection with Lee Avenue and a marked crosswalk mid-block connecting the library and the police station (Figure 15). Marked crosswalks like those on Pollard Street and Lee Street are appropriate for downtown intersections. Pedestrian crossing of commercial throughways requires additional treatments. The Federal Highway Administration recommends continental crosswalk marking over parallel markings because they are more visible to motorists[4] (Figure 14).

3.2.5 Pedestrian signals

Audible countdown pedestrian signals should be installed at every stoplight in the study corridor with consideration of placement of the call button for ADA accessibility.

[4] Designing Sidewalks and Trails for Access, Federal Highway Administration. https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/sidewalk2/sidewalks208.cfm

3.2.6 Long crossing distances

Design elements of protected intersections important for pedestrian safety include bulb-outs that reduce the distance the pedestrian needs to cross, setback pedestrian crossings, mid-street pedestrian refuge islands, and prioritized pedestrian signal phasing that give pedestrians a head-start. The grassy medians on Virginia Avenue, Hardy Road, and Bypass Road provides pedestrian refuges that facilitate midblock crossings by able-bodied, alert adults. Bulb-outs and setback pedestrian crossings reduce the risk of right-turning vehicles colliding with pedestrians and place pedestrians in a more visible location.

FIGURE 15. TOP: MARKED CROSSWALK AT WASHINGTON AVENUE AND POLLARD STREET BOTTOM: MARKED CROSSWALK AT POLLARD STREET AND LEE AVENUE

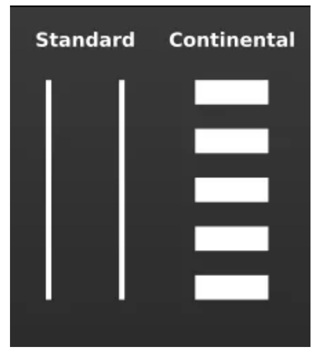

FIGURE 14. STANDARD VS. CONTINENTAL CROSSWALK MARKINGS.

3.2.7 Access management

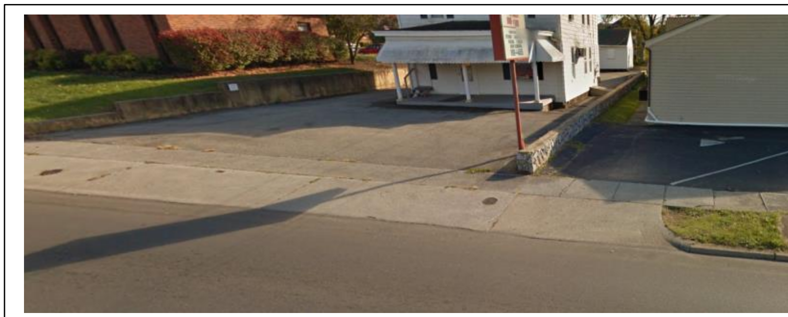

FIGURE 16. ACCESSES ON VIRGINIA AVENUE THAT COULD BE CONSOLIDATED.

Entrances to parking lots and driveways can be dangerous places for pedestrians. When the transition from sidewalk to driveway is not well integrated, the route can become impassable for wheelchair users. Along the commercial throughways of Virginia Avenue, Hardy Road, Bypass Road, and Washington Avenue there are 134 access points to businesses and homes. The excessive number of accesses is cited in the Vinton Area Corridors Plan with a call for access management. Access points can be consolidated or even eliminated (Figure 16).

3.2.8 Narrow or congested sidewalks

The National Association of City Transportation Officials (NACTO) recommends 8-12 foot sidewalks in downtown and commercial areas, with two-foot buffer between the sidewalk and moving traffic. Virginia Avenue has the buffer but narrow sidewalks. Parts of Washington Avenue have wider sidewalks but no buffer. A bike lane can serve as the buffer.

Sidewalks with obstacles such as parked cars force pedestrians, particularly mobility impaired, onto the streets. Parking on South Pollard Street contributes to motor vehicle congestion and delays, according to the Vinton Area Corridors Plan, which calls for reducing or eliminating parking.

3.2.9 Difficult intersections

Intersections of roads that come together at an angle and intersections of more than two roads are challenging for pedestrians to navigate. Eliminating access from 1st Street to Virginia Avenue would simplify that intersection which also has Pollard Street intersecting with Virginia Avenue.

3.2.10 Transit and schools

Many pedestrians are also transit users, and transit users are also pedestrians. There are 27 bus stops directly on the corridors in this study. Prioritizing sidewalks serving these stops and the nearby intersections is important for an effective and accessible transit service.

Schools are often targets for pedestrian improvements, and the federal Safe Routes to Schools program has enabled many cities and counties to improve pedestrian accommodations. William Byrd Middle School and High School near Washington Avenue and the Wolf Creek Greenway and WE Cundiff Elementary School on Hardy Road, also near the Wolf Creek Greenway, are opportunities for projects that could be eligible for Safe Routes to School funding.

3.2.11 Traffic volume and speed, destination density

Similar to bicycle comfort and safety, changing the speed and traffic volume on a road affects pedestrian comfort and safety, and a study might reveal opportunities for traffic management to reduce traffic volumes. While safe, comfortable, and convenient routes enables people to walk, people still don’t generally walk unless there is closeby destination. Zoning codes that promotes destination density, such as reduced or eliminated parking minimums, mixed use development, and reduced or eliminated setback requirements, has a strong impact on walkability. Smart Growth America is a good resource for this topic.

4.0 Implementation

Many of the recommendations for bicycle accommodations are low-budget striping modifications that can be incorporated into repaving efforts (Table 7). Pedestrian accommodations at and between intersections are more costly traffic signals and concrete (Table 8 and Table 9). Cost estimates were not available for protected intersections (Figure 11), which include elements detailed in Table 8 and thus are likely to have comparable costs.

TABLE 7. BICYCLE ACCOMMODATIONS

Street	From	To	Length	Treatment	Estimate
Walnut Street	4th Street	Lee Avenue	0.4 miles	Narrow the lanes, add bike lanes	$4,224
Lee Avenue	Pollard Street	Blair Street	0.2 miles	advisory bike lanes, remove center stripe	$2,112
Pollard Street	Lee Avenue	Virginia Avenue	0.3 miles	Replace parking with bike lanes	$3,168
Virginia Avenue	west city limit	Pollard Street	0.4 miles	10-ft travel lanes, 6-ft protected bike lanes (widen road)	N/A*
Virginia Avenue	Pollard Street	Chestnut	0.3 miles	narrow lanes to 10 ft, protected bike lanes	$3,168
Hardy Road	Chestnut	Bypass Road	0.6 miles	narrow lanes to 10 ft, protected bike lanes	$6,336
Hardy Road	Bypass Road	Wolf Creek	0.6 miles	narrow lanes to 10 ft, protected bike lanes	$6,336
Bypass Road	Hardy Road	Washington Avenue	0.4 miles	narrow lanes to 10 ft, protected bike lanes	$4,224
Washington Avenue	Bypass Road	Wolf Creek	0.5 miles	Reversible 4-to-3 lane conversion, shoulders, sharrows	$5,280
Washington Avenue	Bypass Road	Pollard Street	0.9 miles	Reversible 4-to-3 lane conversion, shoulders, sharrows	$9,504
Gus Nicks Boulevard	Pollard Street	city limit	0.3 miles	10-ft travel lanes, bike lanes	$3,168
Bike Boulevard	River Park	city access road	1000 feet	multiuse path	$44,223
Bike Boulevard	River Park	north access road	250 feet	signage, pavement marking	$2,367
access road	River Park	Bypass Road	870 feet	signage, pavement marking	$8,239
city access road	east end	Mansard Square Drive	600 feet	multiuse path	$26,534
Mansard Square Drive	City Access Road	Pine Street	870 feet	signage, pavement marking	$8,239

Parking lot route	Pine Street	Blair Street	1050 feet	signage, pavement marking	$9,943

*Incorporate into road widening

TABLE 8. PEDESTRIAN INTERSECTION TREATMENTS

Street	Intersection	Need	Priority	Cost Estimate
Virginia Avenue	PFG	Crosswalks (2), pedestrian signal		$58,000
Virginia Avenue	3rd Street	Crosswalks (4), pedestrian signal	Transit access	$136,000
Virginia Avenue	1st Street	Crosswalks (4), pedestrian signal, roundabout		$1,966,000
Virginia Avenue	Chestnut Street	Crosswalks (3), HAWK signal		$131,000
Hardy Road	Niagara Road	Crosswalks (3), pedestrian signal, ped refuges (2)		$117,000
Hardy Road	Vinyard Road	Crosswalks (4), pedestrian signal, ped refuges (2)		$156,000
Hardy Road	Bedford Road	Crosswalks (4), HAWK signal, ped refuges (2)	Transit access	$183,000
Hardy Road	Bypass Road	Crosswalks (4), pedestrian signal		$116,000
Bypass Road	River Park	Crosswalks (3), HAWK signal, ped refuges (2)		$171,000
Bypass Road	Washington Avenue	Crosswalks (3), pedestrian signal, ped refuges (2)		$127,000
Washington Avenue	Mountain View Road	Crosswalks (3), pedestrian signal, ped refuges (2)		$127,000
Washington Avenue	Meadow Street	HAWK signal, ped refuges (2)	Has crosswalk	$135,000
Washington Avenue	Blair Street	Crosswalks (4), pedestrian signal, ped refuges (2)	Transit access	$156,000
Washington Avenue	Poplar Street	Crosswalks (4), pedestrian signal, ped refuges (2)	Transit access	$156,000
Washington Avenue	Pollard Street	HAWK signal, ped refuges (2)		$135,000
Gus Nicks Boulevard	Omar Avenue	Crosswalks (3), HAWK signal, ped refuges (2)	Transit access	$171,000

TABLE 9. OTHER PEDESTRIAN IMPROVEMENTS

Other	Length	Units	Cost Estimate
Missing sidewalk	1.2	miles	$254,400
Curb ramps	17	Each	$68,000
Widen narrow sidewalks	1.0	mile @ 1' width	$43,000

Relevant funding mechanisms include:

- Regional Surface Transportation Program
- Highway Safety Improvement Program

- Transportation Alternatives Program (which include Safe Routes to School)
- SmartScale