Identifying Candidate Streets for Conversion from One-Way to Two-Way
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ABSTRACT
For the benefit of the HRTPO member cities, HRTPO staff prepared this study to identify specific opportunities for converting one-way streets to two-way operation.

ACKNOWLEDGMENTS & 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.

Prepared with the assistance of a project steering team comprised of staff from Norfolk, Portsmouth, and Newport News.

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INTRODUCTION

Although, in the past, one-way operation was applied to various streets across the U.S., some cities have recently converted specific one-way streets to two-way operation and found benefits.

The purpose, therefore, of this study is to help our local governments by identifying one-way streets in Hampton Roads which may be suitable for conversion to two-way operation. During the preparation of the study, HRTPO staff met twice with staff from Newport News, Norfolk, and Portsmouth who had volunteered to provide feedback.

As a basis for identifying two-way candidates, HRTPO staff first explores the existing literature.
LITERATURE REVIEW

HRTPO staff reviews the one-way/two-way literature in two sections below:

1. Pros and Cons of Converting One-way Streets to Two-way
2. Methods of Identifying One-way Streets for Conversion

Pros and Cons of Converting One-way Streets to Two-way

The existing literature\(^1\) identifies several inter-related transportation issues affected by the choice of operating a street as one-way or two-way:

1. Capacity (and Level-of-Service)
2. Confusion (of driver)
3. Cost
4. Crime
5. Economics
6. Freedom (of movement)
7. Parking
8. Safety
9. Travel Time (and Speed)
10. Vehicle Miles Travelled (VMT)

The literature contains a mixture of data: some studies supporting conversion to two-way, some extolling the virtues of one-way operation. HRTPO staff summarized these data below by issue, listed alphabetically.

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\(^1\) See Bibliography at end of this document.
Capacity (and Level-of-Service)

Conventional wisdom appears to be that one-way streets have higher capacity per lane than two-way streets:
- According to the before-after study of a conversion project, “assumptions can be made that traffic efficiencies are typically gained by converting two-way streets to one-way operation.”
- ITE’s Traffic Engineering Handbook reads, “One-way streets…are generally used to reduce congestion and increase the capacity of the roadway network….”

Yet at least one study indicates otherwise. In the before-after study of the conversion of Hennepin and 1st Avenues in Minneapolis, the local department of public works found:
- While auto volumes were practically unchanged (down 2%), the number of “failing” (LOS E or F) intersections declined from four to two.

Confusion

One of the stated disbenefits of one-way operation is confusion of drivers:
- According to a TRB article: “…one-way networks are seen as confusing…”
- According to a consultant’s paper: “…the occasional visitors to downtown…are often confused and disoriented on encountering a one-way street network.”

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Cost

Several studies have reported estimated and actual costs of converting one-way streets to two-way operation. The pro-one-way paper by the Center for the American Dream of Mobility and Home Ownership (CAD)\(^7\) includes the following to demonstrate that one-way-to-two-way conversions are “costly”:

- “St. Petersburg estimates that restriping, signal changes, and other changes required to convert streets from one-way to two-way cost more than $140,000 per intersection;”
- “Conversion of nine one-way streets to two-way in downtown Austin is expected to cost $15 million;” [\$1.7m per street]
- “San Jose spent $15.4 million converting ten streets to two-way;” [\$1.5m per street]
- “A plan to turn a one-way couplet in Hamilton, Ontario to two two-way streets is estimated to cost CA$3.2 million (about US$2.0 million);” [\$1m per street]

Other studies, however, have shown lower costs:

- According to an article for Main Street America\(^8\), “In Greensboro, N.C….the estimate to convert one street was $30,000 per intersection.”
- In a feasibility study of the conversion of six one-way streets in Louisville\(^9\), a consultant estimated the proposed conversion of six streets (totaling 2.0 miles) to cost $2.2m ($400k per street; $1m per mile).
- In a before-and-after study of the conversion of a 1.25 mile couplet of two of the above Louisville streets (Brook Street and 1st Street, totaling 2.5 miles), Riggs and Gilderbloom\(^10\) reported a cost of $250,000, or $100,000 per mile.

Crime

In the aforementioned before-and-after study of the conversion of a 1.25 mile couplet of two Louisville streets—Brook Street and 1st Street—Riggs and Gilderbloom reported a 15% and 30% reduction in overall crime (respectively).\(^11\) The authors theorized that the reduction in speeds made “getaways” more difficult.

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\(^8\) *Converting One-Way Streets to Two-way*, by John D. Edwards, from Main Street Story of the Week, Main Street America (preservationnation.org), June 2002.


Economics

Commercial Property Values

One recent study saw positive economic impacts of converting one-way streets to two-way operation. According to an article for Main Street America\textsuperscript{12}:

“Perhaps the most important reason for changing the traffic flow of a downtown street is to improve the economic well-being of the commercial district. A survey of 25 towns and cities that have converted their main streets [to two-way operation] show that many have experienced significant reductions in vacant floor space after the conversion.”

“All of the communities surveyed reported positive results after converting their one-way streets to two-way traffic, and many reported substantial private investments stimulated by conversions that were coupled with streetscape projects. West Palm Beach, for example, reported $300 million in private investment in areas where city hall had invested $10 million in public funding.”

Likewise, another study saw negative impacts of converting two-way streets to one-way operation. According to a TRB Circular\textsuperscript{13}:

“In our experience, most of these retailers prefer the exposure and accessibility offered by a location on a two-way street. This fact is supported by examples such as Vine Street in Cincinnati, where 40\% of businesses in this economically depressed downtown corridor closed after the street was converted from two-way to one-way.”

However, two articles about converting two-way streets to one-way told a different story:

- According to a 1972 ITE article\textsuperscript{14} by the Commissioner of the New York City Department of Traffic, “Land values on a pair of north-south Manhattan avenues [assumed therefore to be commercial streets] appreciated 57.5 percent in the fiscal year following conversion to one-way operation.”

\textsuperscript{12} Converting One-way Streets to Two-way, by John D. Edwards, from Main Street Story of the Week, Main Street America [preservationnation.org], June 2002.
According to a 1998 ITE article\textsuperscript{15} (referencing a 1995 ITE article), “Johnson reported that installing a one-way street network in place of a two-way system had \textbf{no identifiable effect upon business activity.}”

\textbf{Residential Property Values}

In the aforementioned before-and-after study of the 2011 conversion of a 1.25 mile couplet of two Louisville streets—Brook Street and 1st Street—Riggs and Gilderbloom\textsuperscript{16} calculated significant increases in property values for homes selling during 2013:

- “The average annual percentage growth rate for 1\textsuperscript{st} Street was 2.78 percent.”
- “The average annual percentage growth rate for Brook Street was 38.97 percent.” (Note: This annual rate appears to be unreliably high.)

Whereas, for an adjacent couplet of streets—2\textsuperscript{nd} Street and 3\textsuperscript{rd} Street—that remained one-way, property values were practically unchanged:

- “The average annual percentage growth rate for 2\textsuperscript{nd} Street was -0.38 percent...”
- For 3\textsuperscript{rd} Street, “The average annual percentage growth rate...was 0.44 percent.”


Freedom

One-way streets, by definition, reduce freedom of movement:

- According to a TRB Circular\(^\text{17}\), a one-way street system “often \textbf{forces drivers} to follow \textit{out-of-direction routes}…."

Parking

Given that low-volume one-way streets need only one travel lane—and two-way streets need at least two travel lanes—two-way operation would mean less room for parking on narrow streets.

Safety

Some studies have found safety benefits of converting one-way streets to two-way operation. In a before-after study of the conversion of Hennepin and 1st Avenues in Minneapolis, the local department of public works found:

- Bicycle crashes declined (12/year before, 0/year after) [Note: Even though “after” period length was only 6 months, dramatic decline appears significant.]
- Total crashes declined 9% [Note: Given 6 months “after” period, 9% is likely not statistically significant.]

In a before-and-after conversion study of Brook and 1st Streets in Louisville, researchers found:

- Reduction in crashes of 36% and 60% on the two streets (respectively) even though they experienced a 13% and 40% increase in traffic volumes (respectively).

However, other studies (particularly older ones) found one-way operation to be safer than two-way. Some found safety benefits from converting two-way streets to one-way. A Transportation Research Board (TRB) article summarized four studies (dated 1938, 1959, 1967, and 1972):

- “Most of the [before-and-after] studies report an accident decrease of 20 to 30 percent.”

A 1998 ITE article reiterated the findings of a 1959 ITE article:

- “…for New York City, Wiley found a 25 percent reduction in intersection pedestrian accidents at one-way street intersections after conversion from two-way operation.”

A paper by the Center for the American Dream of Mobility and Home Ownership (CAD) included the following references to two studies (dated 1950 and 1953, respectively):

- “Sacramento found 14 percent fewer accidents on streets converted to one-way operation…”
- “Portland found 51 percent fewer accidents at intersections and 37 percent fewer between intersections.”

The above CAD paper also found safety disbenefits from converting one-way streets to two-way:

- Summary of 1990 Denver study: “Accidents increased an average of 37 percent….”
- Summary of 1993 Indianapolis study: “After three years, accidents on that route had increased 33 percent.”
- Summary of 1996 Lubbock TX study: “…25 percent more accidents….”

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18 Hennepin Avenue and 1St Avenue Two-Way Conversion Evaluation Report, Dept. of Public Works, Minneapolis MN, July 2010, pages 14 and 15.
19 Before data: 5 years; after data: first year post-conversion.
Travel Time (and Speed)

One of the primary costs of transportation is the amount of time required for a person or piece of freight to travel from the starting point to the desired location. In a 1998 ITE article, civil engineer John Stemley re-iterated the findings of two New York City studies (1959 and 1972 ITE articles) showing that one-way streets reduce intersection delay. According to Stemley:

- “Use of one-way streets [via the signal progression allowed by one-way operation] is reported to reduce the number of stops by nearly two-thirds…”
- “Intersection delay has been found to be reduced by nearly 50 percent while overall trip time was reduced by 22 percent to 33 percent.”

Given that higher speeds are associated with higher noise and more impactful crashes, it’s important to note that one-way streets can reduce travel times (via reduction of stops) without any increase in between-intersection speeds. According to Cunneen and O’Toole, “Two-way streets suffer more delay and therefore have slower average [emphasis added] speeds than one-way streets, but not necessarily slower top [emphasis added] speeds.”

However, after developing and applying a model for comparing one-way networks to two-way networks, Gayah and Daganzo found:

“Contrary to conventional wisdom and design handbooks, one-way networks are not always more efficient [time-wise] than two-way networks that allow left-turn movements. When average trip lengths are short, these two-way networks may be able to serve trips at a higher rate [per unit time] than one-way networks because the additional circuity in one-way networks offsets the more efficient intersection control.”

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Vehicle Miles Travelled (VMT)

One of the stated disbenefits of one-way operation is forced circuitous travel:

- According to a TRB article\(^\text{27}\), “…one-way networks…require vehicles to travel longer distances on average.”
- According to a TRB circular\(^\text{28}\), “Our experience shows that a one-way system usually yields approximately 120 to 160% of the turning movements when compared to a two-way system, and the travel distance between portal and destination is usually **20 to 50 percent greater** in a one-way street system.”

\(^{27}\) *Analytical Capacity Comparison of One-Way and Two-Way Signalized Street Networks*, by Vikash V. Gayah and Carlos F. Daganzo, Transportation Research Record No. 2301, TRB, Washington DC, 2012, page 76.

Conclusions from Review of One-Way/Two-Way Impacts in Literature

Conceptual Structure

Based on the above impacts from the literature—and understanding of transportation causes and effects—HRTPO staff developed the following chart of impacts and issues.

FIGURE 1 Impacts and Issues of Choice of Operation, One-Way or Two-Way
Source: Chart by Shirley.docx
Summary and Assessment of Impacts and Issues

The literature reviewed above contains conflicting evidence for converting one-way streets to two-way:

1. Capacity (and Level-of-Service)
   - Some authors wrote that one-ways have higher capacity per lane than two-ways, yet one author found the opposite.

2. Confusion (of driver)
   - Several authors sited the confusion of one-ways. Given that the vast majority of streets are two-way, this finding seems reasonable.

3. Cost
   - Depending on the point-of-view of the author—whether pro-one-way or pro-two-way—studies estimate conversion costs over a broad range: from $30,000-$140,000 per intersection, from $100,000-$1,000,000 per mile, and from $400,000-$1,700,000 per street.

4. Crime
   - Studying a couplet of streets converted to two-way operation, the research team found a 15% and 30% reduction in crime, respectively, for the two streets. More data is needed for conclusive evidence.

5. Economics
   - For commercial streets, some authors wrote that one-way operation is better than two-way operation, and some authors found the opposite. A study of a couplet of residential streets converted to two-way operation found significant annual post-conversion growth in property value. More data is needed to draw a conclusion.

6. Freedom (of movement)
   - One-way streets, by definition, reduce freedom of movement.

7. Parking
   - Given that low-volume one-way streets need only one travel lane—and two-way streets need two travel lanes at a minimum—two-way operation would mean less room for parking on narrow streets.

8. Safety
   - Some authors wrote that one-way operation is safer than two-way operation, and some authors found the opposite.

9. Travel Time (and Speed)
   - The literature indicates that one-way streets provide lower trip travel times (except for short trips), but—due to fewer stops—not necessarily higher between-intersection speeds.

10. Vehicle Miles Travelled (VMT)
    - One-way streets, by definition, require some circuitous travel, raising VMT.
According to the above literature review, although findings on capacity, cost, commercial values, and safety are mixed, and findings on crime and residential values are inconclusive:

<table>
<thead>
<tr>
<th>one-way streets (by definition)</th>
<th>provide more room for parking, and usually supply lower trip travel times, whereas</th>
</tr>
</thead>
<tbody>
<tr>
<td>two-way streets (by definition)</td>
<td>provide less confusion, more freedom, and lower VMT.</td>
</tr>
</tbody>
</table>
Methods of Identifying One-way Streets for Conversion

The literature includes varied methods—from simple to complex—for identifying one-way streets that are good candidates for conversion to two-way.

Pavement Width

Converting streets from one-way to two-way operation using the existing pavement width requires enough pavement for a minimum of two lanes (one in each direction) plus parking as desired.

The main source of recommended widths is *A Policy on Geometric Design of Highways and Streets*[^29] known as “the AASHTO green book” which “provides guidance based on established practices that are supplemented by recent research.”

Lane Width

According to the AASHTO green book:

- “Lane widths of…9 to 12 ft are generally used….” (page 4-7)
- “In urban areas where pedestrian crossings, right-of-way, or existing development become stringent controls on lane widths, the use of…11-ft lanes may be appropriate. Lanes…10 ft wide are acceptable on low-speed facilities, and lanes…9 ft wide may be appropriate on low-volume roads in rural and residential areas.” (pages 4-7, 4-8)

In addition, given that left-turners on two-way streets must deal with on-coming traffic, according to an article on the subject:

“Streets less than 22 feet wide are not good candidates for two-way operations; left-turn movements will cause congestion.”[^30]

[^30]: *Converting One-way Streets to Two-way*, by John D. Edwards, from Main Street Story of the Week, Main Street America [preservationnation.org], June 2002.
Parking Width

According to the AASHTO green book:

- “Curb parking on urban arterial streets is acceptable when the available through-traffic lanes can reasonably accommodate traffic demand.” (page 4-73)
- “…the desirable minimum width of a parking lane is…8 ft.” (page 4-73)
- “The desirable parking lane width on urban collectors is…8 ft to accommodate a wide variety of traffic operations and land uses.” (page 4-73)
- “On urban collector streets within residential neighborhoods…7 ft parking lanes have been successfully used. In fact, a total width of…36 ft, consisting of two travel lanes of…11 ft [totaling 22 ft] and parking lanes of…7 ft [totaling 14 ft], is frequently used.” (page 4-73)
- “A…26-ft wide roadway is the typical cross section used in many urban residential areas. This width assures one through lane even where parking occurs on both sides.” “Random intermittent parking on both sides of the street usually results in areas where two-way movement can be accommodated.” (page 4-74)

Traffic- Rule of Thumb

Some analysts use traffic rules-of-thumb to judge the merits of conversion. Given the conventional wisdom of one-way operation rendering higher capacity than two-way operation, one-way streets with large traffic volumes may not be good candidates for conversion. According to an article for Main Street America (MSA)31:

“If traffic volumes exceed 15,000 vehicles per day (vpd) on each of the one-way streets and if there are numerous cross streets with no suitable parallel or bypass routes, the conversion to two-way may increase congestion to unacceptable levels…."

Traffic- modeling

Other analysts use off-the-shelf simulation models to judge the merits of conversion. Consultants Walker, Kulash, and McHugh note that one can run TRAF-NETSIM software for each subject scenario (one-way, two-way) to calculate system VMT and delay for each, and then use those results to compare the two scenarios.32 ENTRAN used TransModeler software to

31 Converting One-way Streets to Two-way, by John D. Edwards, from Main Street Story of the Week, Main Street America (preservationnation.org), June 2002.
estimate the “traffic impacts associated with converting one-way streets in the downtown [Louisville] system to two-way traffic.”

Still other researchers have developed complex models for comparing the capacity of one-way networks to two-way networks. Gayah and Daganzo\textsuperscript{34} propose measuring the relative tripserving capacity of each network ($C_i$) in this manner:

$$C_i = \left[ \frac{N_i^T G_i^T + N_i^L G_i^L}{N_i C} \right] s_i = \left[ \frac{N_i^T g_i^T + N_i^L g_i^L}{N_i} \right] s_i$$

where:

$C_i$ = relative tripserving capacity of each network;
$N_i^T$ and $N_i^L$ = total number of through and left-turn lanes, respectively, available for discharge in one direction for network $i$;
$N_i$ = total number of wide lanes that would be available in idealized network using same space;
$G_i^T$ and $G_i^L$ = green time available per cycle for through and left-turning vehicles, respectively, to discharge;
$C$ = length of signal cycle;
$s_i$ = ratio of saturation flows at intersection in network $i$ compared with idealized network;
$g_i^T$ and $g_i^L$ = fraction of green time per cycle available for through and left-turn movements; and
$\alpha_i$ = ratio of average trip lengths in network $i$ compared with idealized network.

Chiu, Zhou, and Hernandez\textsuperscript{35} propose using “multiple resolution simulation and assignment” (MRSA) approach for “estimating the traffic impact” of conversions. MRSA “entails a logical integration of two traffic simulation assignment methods with different traffic simulation resolutions and traffic assignment capabilities, as well as one origin-destination (OD) demand estimation procedure.”

Finally, Zargari and Taromi\textsuperscript{36} propose using genetic algorithms to optimize the configuration of one-way and two-way streets in a network based on minimizing the total travel time for all users.

\textsuperscript{33} Downtown Louisville Two-Way Street Study, by ENTRAN, for Downtown Development Corporation, Oct. 2009, pages 1 and 3.
\textsuperscript{34} Analytical Capacity Comparison of One-Way and Two-Way Signalized Street Networks, by Vikash V. Gayah and Carlos F. Daganzo, Transportation Research Record No. 2301, TRB, Washington DC, 2012, page 77.
Conclusion from Literature Review

Given the above literature review, although one-way streets usually supply lower trip travel times, it appears reasonable for the cities of Hampton Roads to pursue less confusion, more freedom, and lower VMT by converting one-way streets to two-way operation where reasonable traffic volume and adequate pavement width exists.
ONE-WAY CANDIDATES FOR TWO-WAY OPERATION IN HAMPTON ROADS

Method Used in This Study to Identify Candidates for Two-way Operation

Based on the above literature review, HRTPO staff identified one-way street candidates for two-way operation by executing the following steps:

First, HRTPO staff identified the existing one-way streets in Hampton Roads:

- Started with a search of Google Maps
- Examined VDOT data indicating one-way vs. two-way operation, ignoring adjacent pairs (of interstates and arterials with medians), ramps, circles, and forked terminals.
- Finalized list using Google Maps’ street view (e.g. one-way signage, direction signs facing, etc.)

HRTPO staff mapped the resulting one-way street segments (approx. 170) on the following pages, and listed them in a four-page table in a following section.
All of the one-way streets found in Chesapeake are located in South Norfolk.
FIGURE 3 One-Way Streets in Hampton
Source: one-way.mxd

All of the one-way streets found in Hampton are located in Meadow Brook.
The one-way streets found in Newport News are in the East End and Downtown/NNS\textsuperscript{37} areas.

\textsuperscript{37} Newport News Shipbuilding
Although concentrated in certain neighborhoods, Norfolk’s one-way streets can be found in many different neighborhoods.
FIGURE 6  One-Way Streets in Portsmouth
Source: one-way.mxd

The one-way streets found in Portsmouth are in the eastern part of the city, Downtown and in Effingham Plaza near the Norfolk Naval Shipyard.
FIGURE 7 One-Way Streets in Suffolk
Source: one-way.mxd

All of the one-way streets found in Suffolk are in the Downtown area.
Both of the one-way streets found in Virginia Beach are at the oceanfront.
The only one-way street found in Williamsburg (Boundary Street, between Richmond Road and Prince George Street) is near the Historic Area.
Secondly (i.e. following the above first step of locating the set of one-way streets), HRTPO staff applied the following criteria—based in part on the above review of literature—to that set to identify candidates for two-way operation:

- Lacking fatal flaw (e.g. serving as on-ramp)
- Lacking excessive traffic volume (<15k vpd)
- Having pavement width adequate to serve two lanes (one in ea. dir.) plus existing parking

HRTPO staff considered the following to have pavement width adequate for being a candidate for two-way operation:
- Streets with 2 or more existing (one-way) lanes
- Streets with 1 existing (one-way) lane but with adequate existing pavement width (based on table below)

**TABLE 1 Minimum Pavement Width for Consideration as Candidate for Two-Way Operation** (one lane in each direction)
Source: pavement width.xlsx

<table>
<thead>
<tr>
<th>Roadway Functional Class</th>
<th>Local</th>
<th>Collector</th>
<th>Arterial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parking</td>
<td>lanes</td>
<td>parking</td>
<td>total</td>
</tr>
<tr>
<td>None</td>
<td>9'x2</td>
<td>0</td>
<td>18 (1)</td>
</tr>
<tr>
<td>On One Side</td>
<td>9'x2</td>
<td>7</td>
<td>25 (1)</td>
</tr>
<tr>
<td>On Both Sides</td>
<td>9'x2</td>
<td>7'x2</td>
<td>32 (1)</td>
</tr>
</tbody>
</table>

Table Footnotes
(1) Calculations by HRTPO staff based on AASHTO and Edwards documents (below).
(2) *Converting One-way Streets to Two-way*, by John D. Edwards, Main Street Story of the Week, Main Street America, June 2002.
FIGURE 10  Method of Identifying Candidates for Two-way Operation
Source: Flowchart by Shirley.docx

Candidates for Two-Way Operation

Execution of the above steps resulted in a table of one-way streets with identification of candidates for two-way operation.

TABLE 2  One-way Streets and Candidates for Two-way Operation
Source: one-way.xlsx
[table shown on following pages]
<table>
<thead>
<tr>
<th>City</th>
<th>Neighborhood</th>
<th>Facility Name</th>
<th>From (directionally)</th>
<th>To (directionally)</th>
<th>Traffic Volume &gt;15k vpd?</th>
<th>Functional Class</th>
<th>2+ Lanes Exist?</th>
<th>Google Maps</th>
<th>Parking Based on</th>
<th>Pavement Width, ft</th>
<th>Minimum Pavement Width, ft (for one lane each direction)</th>
<th>Candidate Pavement Width, ft of ex. lanes, pave. width</th>
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</thead>
<tbody>
<tr>
<td>Chesapeake</td>
<td>South Norfolk</td>
<td>18th Street</td>
<td>B Street</td>
<td>D Street</td>
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<td>22</td>
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<td>Neighborhood</td>
<td>Facility Name</td>
<td>From (directionally)</td>
<td>To (directionally)</td>
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<td>Traffic Volume &gt;15k ypd?</td>
<td>Functional 2+ Lanes</td>
<td>Pavement Width, in (for one lane each direction, based on fatal flaw, ypd, ft of ex. Parking Minimum Pavement Width, ft)</td>
<td>Candidate? based on fatal flaw, ypd, ft of ex. Parking Minimum Pavement Width, ft</td>
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<tr>
<td>City</td>
<td>Neighborhood</td>
<td>Facility Name</td>
<td>From (directionally)</td>
<td>To (directionally)</td>
<td>Traffic Volume &gt;15k vpd?</td>
<td>Functional Class</td>
<td>2+ Lanes (based on existing)</td>
<td>Pavement Width, ft</td>
<td>Minimum Pavement Width, ft (for one lane each direction; based on fatal flaw, vpd, # of ex. lanes, pave.)</td>
<td></td>
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<td>Etheridge Avenue</td>
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<td>24</td>
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<td>yes (2+ ex. lanes)</td>
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<td>24</td>
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<td>Norfolk</td>
<td>Park Place</td>
<td>Fawn Street</td>
<td>27th Street</td>
<td>23rd Street</td>
<td>n.a.</td>
<td>no</td>
<td>Local no</td>
<td>24</td>
<td>Both sides 32</td>
<td>no (pave. width)</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>Park Place</td>
<td>Gazel Street</td>
<td>27th Street</td>
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<td>20</td>
<td>One side 25</td>
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<td>Newport Avenue</td>
<td>38th Street</td>
<td>n.a.</td>
<td>no</td>
<td>Local no</td>
<td>24</td>
<td>Both sides 32</td>
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<td>Michigan Avenue</td>
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<td>Michigan Avenue</td>
<td>Gosnold Avenue</td>
<td>38th Street</td>
<td>n.a.</td>
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<td>Local no</td>
<td>24</td>
<td>Both sides 32</td>
<td>no (pave. width)</td>
<td></td>
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<tr>
<td>City</td>
<td>Neighborhood</td>
<td>Facility Name</td>
<td>From (directionally)</td>
<td>To (directionally)</td>
<td>&quot;Fatal Flaw&quot;</td>
<td>Traffic Volume &gt;15k vpd?</td>
<td>Functional Class</td>
<td>2+ Lanes (based on existing?)</td>
<td>Pavement Width,incl gutter, ft (based on Google Maps)</td>
<td>Parking (existing)</td>
<td>Candidate? (based on fatal flaw, vpd, ft of ex. lanes, pave. width)</td>
<td>Minimum Pavement Width, ft (for one lane each direction, based on fatal flaw, vpd, ft of ex. lanes, pave. width)</td>
</tr>
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<td>----------------------------------------------------------</td>
<td>-------------------</td>
<td>----------------------------------------------------------------</td>
<td>----------------------------------------------------------------</td>
</tr>
<tr>
<td>Norfolk</td>
<td>Tidewater Gardens</td>
<td>Chapel Street</td>
<td>Charlotte Street</td>
<td>Mariner Street</td>
<td>n.a.</td>
<td>no</td>
<td>Local</td>
<td>no</td>
<td>20 One side 25 no (pave. width)</td>
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<td>n.a.</td>
<td>26 Both sides 32 no (pave. width)</td>
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<td>Holt Street</td>
<td>Reilly Street</td>
<td>Chapel Street</td>
<td>n.a.</td>
<td>no</td>
<td>Local</td>
<td>no</td>
<td>10 None 18 no (pave. width)</td>
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<td>Tidewater Gardens</td>
<td>Mariner Street</td>
<td>Holt Street (mid-block)</td>
<td>Holt Street (end-block)</td>
<td>n.a.</td>
<td>no</td>
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<td>no</td>
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<td>Mariner Street</td>
<td>Holt Street</td>
<td>Walkie Street</td>
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<td>Mariner Street</td>
<td>Virginia Street</td>
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<td>Kenmore Drive</td>
<td>Virginia Drive</td>
<td>Virginia Drive</td>
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<td>no</td>
<td>26 Both sides 32 no (pave. width)</td>
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<td>West Ghent</td>
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<td>Redgate Avenue</td>
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<td>Collector</td>
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<td>Weyanoke Street</td>
<td>Old Brandon Avenue</td>
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<td>Little Bay Avenue</td>
<td>Ocean View Avenue</td>
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<td>Olde Towne</td>
<td>Glasgow Street</td>
<td>Middle Street</td>
<td>Crawford Street</td>
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<td>Local</td>
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<td>King Street</td>
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<td>Local</td>
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<td>Chestnut Street</td>
<td>Effingham Street</td>
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<td>20 None 18 no (pave. width)</td>
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<td>Godwin Street</td>
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<td>North Street</td>
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<td>London Street</td>
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<td>30 Both sides 32 no (pave. width)</td>
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<td>Peninsula Avenue</td>
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<td>Queen Street</td>
<td>Effingham Street</td>
<td>Crawford Street</td>
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<td>North Street</td>
<td>Sandpiper Drive</td>
<td>Constitution Avenue</td>
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<td>Local</td>
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<td>16 None 18 no (pave. width)</td>
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<td>North Street</td>
<td>Chesapeake Avenue</td>
<td>Constitution Avenue</td>
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<td>Local</td>
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<tr>
<td>Portsmouth</td>
<td>Shipyard</td>
<td>5th Street</td>
<td>Edwards Street</td>
<td>Madison Street</td>
<td>n.a.</td>
<td>no</td>
<td>Local</td>
<td>no</td>
<td>36 One side 25 yes (pave. width)</td>
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<td></td>
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<td>Shipyard</td>
<td>5th Street</td>
<td>Madison Street</td>
<td>Portsmouth Boulevard</td>
<td>n.a.</td>
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<td>Local</td>
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<td>36 Both sides 32 yes (pave. width)</td>
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<td>Shipyard</td>
<td>Madison Street</td>
<td>Port Center Parkway</td>
<td>7th Street</td>
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<td>Local</td>
<td>no</td>
<td>36 Both sides 32 yes (pave. width)</td>
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<tr>
<td>Suffolk</td>
<td>Downtown</td>
<td>Clay Street</td>
<td>Finney Avenue</td>
<td>Market Street</td>
<td>n.a.</td>
<td>no</td>
<td>Local</td>
<td>no</td>
<td>18 Both sides 32 no (pave. width)</td>
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<td>Downtown</td>
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<td>Market Street</td>
<td>Washington Street</td>
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<td>Local</td>
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<td>19 Both sides 32 no (pave. width)</td>
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<td>Market Street</td>
<td>Washington Street</td>
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<td>Local</td>
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<td>19 One side 25 no (pave. width)</td>
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<td>Downtown</td>
<td>Pender Street</td>
<td>Washington Street</td>
<td>Spring Street</td>
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<td>16 Both sides 32 no (pave. width)</td>
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<td>Washington Street</td>
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<td>Finney Avenue</td>
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<td>Collector</td>
<td>no</td>
<td>27 One side 28 no (fatal flaw)</td>
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<td>Downtown</td>
<td>Saratoga Street</td>
<td>Market Street</td>
<td>Freemason Street</td>
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<td>Local</td>
<td>no</td>
<td>24 One side 25 no (pave. width)</td>
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<tr>
<td>Virginia Beach</td>
<td>Oceanfront</td>
<td>21st Street</td>
<td>Parks Avenue</td>
<td>Atlantic Avenue</td>
<td>from I-264 no Arterial</td>
<td>yes</td>
<td>2-4 lanes Both sides 42 no (fatal flaw)</td>
<td></td>
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<td>Virginia Beach</td>
<td>Oceanfront</td>
<td>22nd Street</td>
<td>Atlantic Avenue</td>
<td>Parks Avenue</td>
<td>to I-264 no Arterial</td>
<td>yes</td>
<td>2-4 lanes Both sides 42 no (fatal flaw)</td>
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<td>Downtown</td>
<td>Boundary Street</td>
<td>Richmond Road</td>
<td>Prince George Street</td>
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<td>Local</td>
<td>no</td>
<td>26 Both sides 32 no (pave. width)</td>
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</table>
Findings

Execution of the HRTPO staff methodology resulted in approximately 40 of the region’s one-way streets—all in Newport News, Norfolk, and Portsmouth—being identified as candidates for two-way operation, representing almost one-fourth of the existing one-way segments, as shown below.

**TABLE 3 One-way Streets Meeting Criteria for Candidates for Two-way Operation**

<table>
<thead>
<tr>
<th>City</th>
<th>Neighborhood</th>
<th>Facility Name</th>
<th>From (directionally)</th>
<th>To (directionally)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newport News</td>
<td>NNS/Downtown</td>
<td>29th Street</td>
<td>West Avenue</td>
<td>Warwick Boulevard</td>
</tr>
<tr>
<td>Newport News</td>
<td>NNS/Downtown</td>
<td>30th Street</td>
<td>Warwick Boulevard</td>
<td>West Avenue</td>
</tr>
<tr>
<td>Newport News</td>
<td>NNS/Downtown</td>
<td>32nd Street</td>
<td>Washington Avenue</td>
<td>Warwick Boulevard</td>
</tr>
<tr>
<td>Newport News</td>
<td>NNS/Downtown</td>
<td>33rd Street</td>
<td>Warwick Boulevard</td>
<td>Washington Avenue</td>
</tr>
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<td>NNS/Downtown</td>
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<td>Warwick Boulevard</td>
<td>Washington Avenue</td>
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<td>38th Street</td>
<td>Washington Avenue</td>
<td>Warwick Boulevard</td>
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<td>NNS/Downtown</td>
<td>42nd Street</td>
<td>Huntington Avenue</td>
<td>Washington Avenue</td>
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<td>NNS/Downtown</td>
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<td>Washington Avenue</td>
<td>Warwick Boulevard</td>
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<td>Warwick Boulevard</td>
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<td>Washington Avenue</td>
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<td>Huntington Avenue</td>
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<td>Huntington Avenue</td>
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<td>Huntington Avenue</td>
<td>Warwick Boulevard</td>
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<td>I-64 Ramp</td>
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<td>Duffys Lane</td>
</tr>
<tr>
<td>Norfolk</td>
<td>Park Place</td>
<td>26th Street</td>
<td>Hampton Boulevard</td>
<td>27th Street</td>
</tr>
<tr>
<td>Norfolk</td>
<td>Park Place</td>
<td>26th Street</td>
<td>26th Street</td>
<td>Hampton Boulevard</td>
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<tr>
<td>Portsmouth</td>
<td>Olde Towne</td>
<td>King Street</td>
<td>Chestnut Street</td>
<td>Effingham Street</td>
</tr>
<tr>
<td>Portsmouth</td>
<td>Shipyard</td>
<td>5th Street</td>
<td>Edwards Street</td>
<td>Madison Street</td>
</tr>
<tr>
<td>Portsmouth</td>
<td>Shipyard</td>
<td>5th Street</td>
<td>Madison Street</td>
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</tr>
<tr>
<td>Portsmouth</td>
<td>Shipyard</td>
<td>6th Street</td>
<td>Portsmouth Boulevard</td>
<td>Madison Street</td>
</tr>
<tr>
<td>Portsmouth</td>
<td>Shipyard</td>
<td>Madison Street</td>
<td>Port Center Parkway</td>
<td>7th Street</td>
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</tbody>
</table>
In Newport News, HRTPO staff found several candidates for two-way operation in the NNS/Downtown area.
In Portsmouth, HRTPO staff found several candidates for two-way operation in Effingham Plaza (near Norfolk Naval Shipyard) but only one block downtown (King Street, between Chestnut and Effingham Streets).
The HRTPO methodology revealed four two-way candidates downtown:

- York Street
- Charlotte Street
- Market Street
- Randolph Street
The HRTPO methodology revealed three two-way candidates in central Norfolk:

- Llewellyn Street
- 26th Street
- 27th Street

When considering any change to 26th and 27th Streets, note that these streets have bike lanes.
The HRTPO methodology revealed three two-way candidates in northern Norfolk:

- A short segment of Granby Street at Ocean View
- Ocean Avenue
- Bay Avenue

**Caveat**

HRTPO staff provides the above identification of candidates for two-way operation as a **starting point** for discussion with traffic engineering and other applicable stakeholders. For example, given the path of light rail in Norfolk, conversion of Charlotte Street (between Butte Street and Monticello Avenue) to two-way operation would require coordination with HRT.

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38 Note: The portion of Bay Avenue from I-64 to Granby Street is considered a Collector and therefore did not pass the width test for two-way operation (see database above).
Focal Areas

Although limited to one research team in the above literature review, Riggs and Gilderbloom found higher home values and lower crime after one-way conversions to two-way operation. Consequently, in case our local government clients wish to focus their conversion efforts in high-crime and/or low-home-value areas, HRTPO staff overlaid the candidate conversion locations with home values and crime statistics.

Crime Statistics

Of the three cities with candidates for two-way operation, Newport News provided crime geography, as shown below.

![FIGURE 16 Two-Way Operation Candidates and 2016 Crime in Newport News](source: one-way.mxd)

The area with candidate streets (NNS/downtown) appears to have relatively low crime.
Home Value Statistics

HRTPo staff extracted home values by block group\(^{39}\) from the 2015 US Census.

![Map of Two-Way Operation Candidates and Homes Valued Less than $100,000 (2015) in Newport News](image)

**FIGURE 17** Two-Way Operation Candidates and Homes Valued Less than $100,000 (2015) in Newport News

Source: one-way.mxd

The area with candidate streets (NNS/downtown) appears to have relatively few homes valued below $100,000.

\(^{39}\) Note that the mapping software randomly distributes the applicable dots across the area of the subject block group. Therefore, the home locations shown are approximate.
None of the two-way candidate streets in Portsmouth appear to have many homes valued below $100,000.
None of the two-way candidate streets in downtown Norfolk appear to have many homes valued below $100,000.\textsuperscript{40}

\textsuperscript{40} The housing data being tallied per block group, i.e. exact location unknown, the mapping software randomly spreads the dots across each block group.
26th and 27th Streets appear to have a moderate number of homes valued below $100,000.
FIGURE 21  Two-Way Operation Candidates and Homes Valued Less than $100,000 (2015) in Northern Norfolk

Source: one-way.mxd

The density of homes valued below $100,000 on Ocean and Bay Avenues appear to be similar to that of surrounding areas.
CONCLUSION AND NEXT STEPS

Given the literature reviewed above, although one-way streets usually supply lower trip travel times, it appears reasonable for the cities of Hampton Roads to pursue less confusion, more freedom, and lower VMT by converting one-way streets to two-way operation where reasonable traffic volume and adequate pavement width exists. Using a methodology it developed, HRTPO staff identified one-way streets in Hampton Roads that—based largely on pavement width—are candidates for conversion to two-way operation.

The roughly 40 candidate conversion segments are presented by HRTPO staff to the HRTPO member cities for them to use, determining which (if any) they wish—after review by applicable departments, agencies, and landowners—to convert to two-way operation.

As they review candidate segments, cities may refer to the Cost section (in the literature review above) for aid in estimating the cost of specific conversions.
BIBLIOGRAPHY


Converting One-way Streets to Two-way, by John D. Edwards, from Main Street Story of the Week, Main Street America (preservationnation.org), June 2002.


COMMENTS AND RESPONSES

HRTPO staff posted this document for public comments from June 7 thru June 21. The following comments were received from Eric Stringfield (VDOT) via 21 June 2017 letter:

Identifying Candidate Streets for Conversion from One-Way to Two-Way (Draft)

- A portion of the one-way streets identified in the study are minor and principal arterials which carry large volumes of traffic and provide a high level of mobility during peak hours. By converting these roadways, capacity could be diminished leading to lower levels of operation and greater traffic impacts to the surrounding roadway network. We recommend that all arterial roadways be removed from consideration.

- Some of the one-way streets provide access to the interstate and other Corridors of Statewide Significance. The “couplet” streets in Newport News, for instance provide access to I-664 and the 21st/22nd Streets in Virginia Beach provide access to I-264. We recommend that all one-way streets that connect to interstates and Corridors of Statewide Significance also be removed from consideration.

- Please consider how bicycle and pedestrian facilities might be impacted by these conversions. Portions of 26th and 27th Streets in Norfolk have bike lanes.

- It may not be necessary to include an analysis of the crime and property value impacts of the proposed conversions. This information is generally unrelated to improving mobility and could serve to stereotype and negatively stigmatize the communities that you’ve selected. It may be more productive to analyze the environmental and social justice impacts of your recommendations using available demographic information.

Responses

- Concerning “large volumes”, based on the literature, HRTPO staff considered only roads with less than 15,000 vpd as candidates for two-way operation in the draft and final documents.

- Based on the above VDOT comment, HRTPO staff removed all one-way streets that join an interstate from consideration as candidates for two-way conversion. This removed 25th – 28th, 34th, and 35th Streets in Newport News from consideration as candidates.

- Based on the above VDOT comment, a note concerning the existing bike lanes on 26th and 27th Streets in Norfolk was added to the document (below the map showing these streets as candidates for conversion to two-way operation).
We agree that lower crime and higher property values are different impacts from the primary impact on which this study focuses—the freedom of movement of two-way streets. However, given the positive crime and property value impacts reported in the literature review for Louisville, we are providing the crime and home value data as a service to the localities.

- Note that the removal of 25th through 28th Streets as candidates (per your second comment) has significantly changed the Newport News crime/candidate map.

- To reflect the concerns expressed in your comment, we have reworded the introduction to the crime and home values section as follows:

  - “Although limited to one research team in the above literature review, Riggs and Gilderbloom found higher home values and lower crime after one-way conversions to two-way operation. Consequently, in case our local government clients wish to focus their conversion efforts in high-crime and/or low-home-value areas, HRTPO staff overlaid the candidate conversion locations with home values and crime statistics.”