Wrestling with How to Measure Bicycling’s Benefits

Northwestern University
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University of Colorado
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Civilized Riding

The Dutch bicycle is increasingly imported to the United States and is starting to be seen on the streets of New York. In Amsterdam, bicycle to work in a suit and tie is as notable an act as drinking a cup of coffee. David Colman explains why this vehicle is so fashionably practical.

Related Article

"...it has everything you need to protect your clothes from the grime that invariably gets all over you..."
Fashion & Style

A Field Guide to the New York City Bicyclist

As bike lanes multiply around the city, cycling grows ever more popular and subcultures of riders coalesce around a style and a sensibility. A look at the two-wheeled traffic.

By Alex Williams
Bicyclists vs. Pedestrians: An Armistice

By ROBERT SULLIVAN

ONE of the great battlefields in the war between bicyclists and pedestrians in New York City is the Brooklyn Bridge. Pedestrians think all bicyclists are out-of-control maniacs; bicyclists — the majority, anyway — are just trying to avoid cars and not break a sweat. The stripe painted down the center of the elevated Brooklyn Bridge walkway, to separate bicyclists from pedestrians, has become a line in the sand. We need to erase that line once and for all.

There are various reasons for the battle of the Brooklyn Bridge. Brooklyn seems to sprout bike commuters, as do its vaguely do-it-yourself cultural attitudes that the real estate race has not yet destroyed. The walkway, meanwhile, is narrow. Thus, on any given day, we see on one side a herd of pedestrians, part tourists photographing the Statue of Liberty, part people walking to work — a volatile mix to begin with. On the other side of the line are two kinds of bicyclists, most pedaling peacefully, a few confusing bike commuting with driving rocket cars on the Bonneville Salt Flats. It’s a recipe for confusion and arguments, not to mention accidents.

Indeed, the Brooklyn Bridge is just one of several bike-pedestrian flash points in the city; skirmishes (and anti-bicyclist sentiment) have arisen on the Hudson River Greenway and on the Central Park and Prospect Park loops. But the Brooklyn Bridge battle, maybe because the bridge is iconic, is the most charged. The New York City Department of Transportation has experimented with lane sizes, signs and bollards, but with more people walking and more people biking (both good developments), chaos quite naturally ensues, in addition to shouting and calls, not for the banning of pedestrians — that would be wrong, everyone agrees — but for the banning of bicycles.
"BOSS, WHEN FUEL PRICES GO DOWN, WILL WE GO BACK TO USING OUR CORPORATE JET AGAIN?"
Investments in Bicycling
- Analyses of (Cost) Effectiveness
- Convenience: Access, destinations, land use
- Infrastructure (Hard): Design, built environment
- Safety: Perceived and real, by user type
- Programs (Soft): Marketing, education
- Incentives: Encouragement, education, culture

Levels and Trends of Bicycling
- By user type, purpose, etc.

Benefits of Bicycling

Return on Investment
- Benefits Analyses
  - Transportation
  - Health
  - Energy
  - Climate Change
  - Jobs
  - Social
  - Environmental
  - Economic Benefits

Data collection

Adapted from Gotschi, Rails to Trails
Expectations

Reality

Expectations

Reality
SEC. 1807. NONMOTORIZED TRANSPORTATION PILOT PROGRAM.

(a) ESTABLISHMENT.—The Secretary shall establish and carry out a nonmotorized transportation pilot program to construct, in the following 4 communities selected by the Secretary, a network of nonmotorized transportation infrastructure facilities, including sidewalks, bicycle lanes, and pedestrian and bicycle trails, that connect directly with transit stations, schools, residences, businesses, recreation areas, and other community activity centers:

(1) Columbia, Missouri.
(2) Marin County, California.
(3) Minneapolis-St. Paul, Minnesota.
(4) Sheboygan County, Wisconsin.

(b) PURPOSE.—The purpose of the program shall be to demonstrate the extent to which bicycling and walking can carry a significant part of the transportation load, and represent a major portion of the transportation solution, within selected communities.

(c) GRANTS.—In carrying out the program, the Secretary may make a grant of $6,250,000 per fiscal year for each of the communities set forth in subsection (a) to State, local, and regional governments.

(d) STATISTICAL INFORMATION.—In carrying out the program, the Secretary shall develop statistical information on changes in motor vehicle, nonmotorized transportation, and public transportation usage in communities participating in the program and assess how such changes decrease congestion and energy usage, increase the frequency of bicycling and walking, and promote better health and a cleaner environment.

(e) REPORTS.—The Secretary shall submit to Congress an interim report not later than September 30, 2007, and a final report not later than September 30, 2010, on the results of the program.

(f) FUNDING.—

(1) AUTHORIZATION OF APPROPRIATIONS.—There is authorized to be appropriated to carry out this section, out of the
Minneapolis
Survey: City
Area: 55 sq.mi.
Population: 382,618

Sheboygan
Survey: County
Area: 514 sq.mi.
Population: 112,646

Marin
Survey: County
Area: 520 sq.mi.
Population: 247,552

Columbia
Survey: City
Area: 53 sq.mi.
Population: 84,531
**Beneficiary**

**To the USER (direct)**

**Mobility**
- Enhanced conditions
- Shorter travel

**Health**
- Increased physical activity
- Decreased health care

**Safety**
- Decreased accidents
- Increased comfort

**Cost**
- Lower overall transportation costs

**To the COMMUNITY (indirect)**

**Externalities**
- Decreased congestion
- Reduced pollution

**Livability**
- Increased open space
- Proximity to open space

**Fiscal**
- Lower infrastructure costs
- Increased economic activity
MOV: 49%
SOV: 38%
Walk: 9%
Transit: 3%
Bicycle: 0.8%
Inducing Cycling Use
The need to carry goods

Topography

Distance

Parking

Weather

Safety

Fun

Save the Environment

Fun
1. Initial considerations

If feasible

2. Trip barriers

If overcome

3. Destination barriers

If overcome

Decision to Bicycle

Family responsibility
Work requirements
Equipment

Weather
Geography
Adequate facilities
Traffic

Distance
Storage
Showers
Employer support

Equipment
Preferences
Time
Awareness
Why don’t people walk or cycle more for day-to-day trip purposes? What can a government do to increase such walking and cycling? This report presents the findings from an extensive literature review aiming to help professionals and researchers in the State of Victoria understand barriers to walking and cycling as well as infrastructure and policy supports for non-motorized transportation. The research team located almost 500 articles, papers, and reports assessing walking and cycling infrastructure, policies, programs, and models. We reviewed over 300 of them—those judged to be most relevant to the questions raised by the Walking and Cycling Branch of the Department of Infrastructure and rigorous in terms of their analysis and ability to draw robust conclusions.
<table>
<thead>
<tr>
<th>Citation</th>
<th>Mode</th>
<th>Issue</th>
<th>Lit.</th>
<th>Sample</th>
<th>Outcome Variable(s)</th>
<th>Key Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Krizek (2006b)</td>
<td>Bicycle</td>
<td>Infra.</td>
<td>Peer</td>
<td>90 Univ. of Minn. Employees participated in the winter survey and 91 in the summer.</td>
<td>Home value; Travel time commute was willing to spend in order to travel on particular facilities</td>
<td>&quot;These findings indicate that bicycle commuters in Minneapolis and St. Paul prefer bicycle lanes on existing streets over off-street bicycle trails, and also prefer them over streets that have no on-street parking but lack designated bicycle lanes&quot; (pg. 309).&lt;br&gt;&quot;Though proximity to bicycle facilities is valued different for different types, it actually significantly reduced home value in suburban locations&quot; (pg. 309).</td>
</tr>
<tr>
<td>Krizek and Johnson (2005)</td>
<td>Bicycle</td>
<td>Comm.</td>
<td>Peer</td>
<td>2000 Twin Cities Metropolitan Area Travel Behaviour Inventory (TBII) for 1,653 residents aged 20 years or older.</td>
<td>Bicycle and walking trips from home per day&lt;br&gt;Cyclist perceptions of comfort</td>
<td>&quot;We found that distances to retail and bicycle facilities are statistically significant predictors of choosing active modes of transport at close distances, but the relationships do not appear to be linear&quot; (pg. 33).&lt;br&gt;&quot;The findings suggest that discontinuities ending on the left side of the street, with increased distance of crossing intersections, having parking after the discontinuity, and wider width of the curb lanes are statistical elements that contribute to higher levels of discomfort&quot; (pg. 59).</td>
</tr>
<tr>
<td>Krizek et al. (2005)</td>
<td>Bicycle</td>
<td>Mode</td>
<td>Conf.</td>
<td>Secondary data from five surveys.</td>
<td>Desired amenities; Perceptions of safety; Commute mode choice; Travel time wishing to spend for certain facilities</td>
<td>&quot;Men are more than twice as likely to complete their trip by bicycle than women (0.666 vs. 0.256). Men are more likely to bicycle to work than women...and to bicycle for rest and relaxation...Conversely, women are more likely than men to ride a bicycle to school as a student...to do shopping and errands...and to visit friends and relatives&quot; (pg. 39).&lt;br&gt;&quot;Women are willing to travel more additional minutes than men for a preferred facility&quot; (pg. 39).</td>
</tr>
<tr>
<td>Krizek et al. (2007)</td>
<td>Bicycle</td>
<td>Infra.</td>
<td>Peer</td>
<td>1,956 individuals completed a survey given at 12 locations along a bicycle/ped. trail in the Minneapolis/St. Paul metropolitan area.</td>
<td>Distance of route travelled; Distance between chosen route and shortest route</td>
<td>&quot;The analysis demonstrates that a coherent distance decay pattern exists and that the decay function varies by trip purpose. Furthermore, we find that bicyclists travel on average, 67% longer in order to include the trail facility on their route&quot; (pg. 511).&lt;br&gt;&quot;Meanwhile, the difference in the number of intersections between the two routes has a positive impact on the difference in route length...Consequently, this model suggests that bicyclists are willing to endure a route with more intersections that also incorporates a trail segment&quot; (pg. 523).&lt;br&gt;&quot;Results indicate that children walk more in older neighborhoods with mature trees while they cycle more in newer neighborhoods with more sidewalks. Also, children who live on cul-de-sacs walk to school less than those who live on grid streets.&quot;&lt;br&gt;&quot;Contrary to the popular 2 mi walk zone guideline, the mean distance for walking in this study is .71 mi while the mean distance of cycling is .93 mi. (abstact).&quot;</td>
</tr>
<tr>
<td>Kweon et al. (2006)</td>
<td>Bike</td>
<td>Infra.</td>
<td>Peer</td>
<td>186 parents from four school walk zones in College Station, TX participated.</td>
<td>Reported child travel mode to school</td>
<td>&quot;The analysis demonstrates that a coherent distance decay pattern exists and that the decay function varies by trip purpose. Furthermore, we find that bicyclists travel on average, 67% longer in order to include the trail facility on their route&quot; (pg. 511).&lt;br&gt;&quot;Meanwhile, the difference in the number of intersections between the two routes has a positive impact on the difference in route length...Consequently, this model suggests that bicyclists are willing to endure a route with more intersections that also incorporates a trail segment&quot; (pg. 523).&lt;br&gt;&quot;Results indicate that children walk more in older neighborhoods with mature trees while they cycle more in newer neighborhoods with more sidewalks. Also, children who live on cul-de-sacs walk to school less than those who live on grid streets.&quot;&lt;br&gt;&quot;Contrary to the popular 2 mi walk zone guideline, the mean distance for walking in this study is .71 mi while the mean distance of cycling is .93 mi. (abstact).&quot;</td>
</tr>
<tr>
<td>Landis (1999)</td>
<td>Bicycle</td>
<td>Model</td>
<td>Peer</td>
<td>Review of the Interaction Hazard Score (IHS) and Latent Demand Score (LDS) models.</td>
<td>Level of service</td>
<td>The IHS Model rates the on-road bicycling environment and interprets the rating as a level-of-service classification. The model is structurally agnostic and traffic variables to estimate perceived hazards from the bicyclists' perspective.</td>
</tr>
<tr>
<td>Landis et al. (1997)</td>
<td>Bicycle</td>
<td>Model</td>
<td>Peer</td>
<td>200 cyclists completed the 17 mile course in Tampa, FL.</td>
<td>Cyclists' assessment of roadway environment</td>
<td>This study proves conclusively that there is a statistically significant inverse relationship between pavement condition and the dependent variable BILOS&quot; (pg. 125).&lt;br&gt;&quot;Although there were no statistically significant differences found between the speed of motor vehicle traffic and perceived safety of partial or full separation, there were differences found between the speed of motor vehicle traffic and perceived safety of partial or full separation, and this is consistent with the findings of other studies&quot; (pg. 124).</td>
</tr>
<tr>
<td>Landis et al. (2001a)</td>
<td>Ped</td>
<td>Model</td>
<td>Peer</td>
<td>75 people participated in the FunWalk for Science event in Pensacola, FL.</td>
<td>Pedestrian ratings of safety/comfort</td>
<td>&quot;In general, the lateral separation between pedestrians and motor vehicles increases, the pedestrian's comfort or sense of safety also increases&quot; (pg. 55).&lt;br&gt;&quot;Similarly, the speed of motor vehicle traffic was confirmed as significantly affecting pedestrians' sense of safety. As speed increases, pedestrian discomfort increases&quot; (pg. 59).</td>
</tr>
</tbody>
</table>
YES!
<table>
<thead>
<tr>
<th>Topic</th>
<th>Mean (Standard Deviation)</th>
<th>Quantity</th>
<th>Depth</th>
<th>Quality</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic impacts of bicycling (the dollar value of increased bike trips, facilities,</td>
<td></td>
<td>1.66</td>
<td>1.36</td>
<td>2.00</td>
<td>1.43</td>
</tr>
<tr>
<td>Health benefits of bicycling (estimating the wide-ranging health benefits of bicycling,</td>
<td></td>
<td>2.27</td>
<td>1.55</td>
<td>1.93</td>
<td>2.00</td>
</tr>
<tr>
<td>Cost-benefit of bike facilities (translating the range of economic benefits and comparing</td>
<td></td>
<td>1.63</td>
<td>1.10</td>
<td>1.33</td>
<td>1.24</td>
</tr>
<tr>
<td>Effectiveness of bike-specific infrastructure, hard measures (the efficacy of</td>
<td></td>
<td>1.52</td>
<td>1.39</td>
<td>1.48</td>
<td>1.39</td>
</tr>
<tr>
<td>Effectiveness of programs and educational initiatives, soft measures (the</td>
<td></td>
<td>1.40</td>
<td>1.40</td>
<td>1.40</td>
<td>1.43</td>
</tr>
<tr>
<td>Singletrack and rail-trails (the value of natural surface trails, especially for recreation)</td>
<td></td>
<td>1.88</td>
<td>1.75</td>
<td>2.00</td>
<td>1.84</td>
</tr>
<tr>
<td>Demographics (who is bicycling)</td>
<td></td>
<td>2.88</td>
<td>2.40</td>
<td>2.61</td>
<td>2.61</td>
</tr>
<tr>
<td>Participation</td>
<td></td>
<td>2.67</td>
<td>1.86</td>
<td>2.37</td>
<td>2.20</td>
</tr>
<tr>
<td>Commuting and short trips (the specific potential of bicycling to replace commuting and</td>
<td></td>
<td>1.83</td>
<td>2.00</td>
<td>1.93</td>
<td>1.85</td>
</tr>
<tr>
<td>Environmental benefits (effects on increased air quality, decreased greenhouse gas emissions,</td>
<td></td>
<td>2.43</td>
<td>2.13</td>
<td>2.17</td>
<td>2.17</td>
</tr>
<tr>
<td>Influences on road congestion</td>
<td></td>
<td>1.10</td>
<td>1.00</td>
<td>1.20</td>
<td>1.10</td>
</tr>
<tr>
<td>Safety (on-street versus off-street facilities, intersections, effect of increased cycling rates on general</td>
<td></td>
<td>2.18</td>
<td>2.09</td>
<td>2.09</td>
<td>2.15</td>
</tr>
<tr>
<td>Children and bicycling (extent of children biking to school, impediments, efficacy of policy</td>
<td></td>
<td>2.00</td>
<td>1.39</td>
<td>1.94</td>
<td>1.75</td>
</tr>
</tbody>
</table>

AVG = 1.78

C-/D+
A HARD ROAD TO HOE!
Facilities Compared in Study

- Off Road
- Bike Lane, No Parking
- Bike Lane with Parking
- No Bike Lane, No Parking
- No Bike Lane with Parking
Imagine you commute to work by bicycle. If route 1 and route 2 are the only available options for your commute and your travel time on each route is as given below each video, which route would you use?

**Route 1**

40 Minutes

1

**Route 2**

20 Minutes

2

Your Choice

Travel Time for Route 1 gets longer or shorter based on selection.
Binomial Logit Model

\[ U_f = f (T, A, S, I) \]

- **T**: Additional time for Facility
- **A**: Attributes of Facility
- **S**: Season
- **I**: Individual Demographics
<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Image](82x218 to 164x327)</td>
<td>![Image](82x338 to 164x447)</td>
<td>![Image](178x98 to 259x207)</td>
<td>![Image](274x98 to 355x207)</td>
<td>![Image](370x98 to 451x207)</td>
</tr>
<tr>
<td></td>
<td>![Image](466x98 to 548x207)</td>
<td><img src="50x424" alt="Image" /></td>
<td><img src="79x268" alt="Image" /></td>
<td><img src="10x0" alt="Image" /></td>
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<tr>
<td></td>
<td><img src="65x629" alt="Image" /></td>
<td><img src="175x148" alt="Image" /></td>
<td><img src="259x207" alt="Image" /></td>
<td><img src="355x206" alt="Image" /></td>
</tr>
<tr>
<td></td>
<td><img src="1421x" alt="Image" /></td>
<td><img src="1600x" alt="Image" /></td>
<td><img src="1846x" alt="Image" /></td>
<td><img src="2314x" alt="Image" /></td>
</tr>
</tbody>
</table>
Assuming a 20 minute commute...

On-street bicycle lane
= 16.3 min ($3.26)

Not having a parking facility
= 8.9 min ($1.78)

Off-road improvement
= 5.2 min ($1.04)
Value of Livability
Hedonic Model

\[ P_h = f (S, N, L, A) \]

- \( P_h \) = Home Sale Price
- \( S \) = Structural Attributes
- \( N \) = Neighborhood Attributes
- \( L \) = Location and Accessibility
- \( A \) = Environmental Amenities
### Hypothesized Relationship with Home Value

<table>
<thead>
<tr>
<th>ON-STREET BICYCLE LANE</th>
<th>City Residents</th>
<th>Suburban Residents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>NON-ROAD SIDE BICYCLE TRAIL</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>ROAD-SIDE BICYCLE TRAIL</td>
<td>++</td>
<td>+</td>
</tr>
</tbody>
</table>
Sale Price ($) = f(S, N, L, A)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>t-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Environmental Amenities (A)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CITY: on-street bicycle lane (ln)</td>
<td>0.003950</td>
<td>0.002689</td>
<td>1.47</td>
</tr>
<tr>
<td>CITY: non-roadside bicycle trail (ln)</td>
<td>-0.007851</td>
<td>0.003732</td>
<td>-2.1*</td>
</tr>
<tr>
<td>CITY: roadside bicycle trail (ln)</td>
<td>0.022772</td>
<td>0.003777</td>
<td>6.03**</td>
</tr>
<tr>
<td>SUBURBS: on-street bicycle lane (ln)</td>
<td>0.003334</td>
<td>0.001272</td>
<td>2.62**</td>
</tr>
<tr>
<td>SUBURBS: non-roadside bicycle trail (ln)</td>
<td>0.003858</td>
<td>0.001325</td>
<td>2.91**</td>
</tr>
<tr>
<td>SUBURBS: roadside bicycle trail (ln)</td>
<td>0.010230</td>
<td>0.001419</td>
<td>7.21**</td>
</tr>
<tr>
<td>CITY: active open space (meters)</td>
<td>-0.000024</td>
<td>0.000012</td>
<td>-1.96*</td>
</tr>
<tr>
<td>CITY: passive open space (meters)</td>
<td>-0.000065</td>
<td>0.000007</td>
<td>-9.08**</td>
</tr>
<tr>
<td>SUBURBS: active open space (meters)</td>
<td>0.000006</td>
<td>0.000001</td>
<td>3.88**</td>
</tr>
<tr>
<td>SUBURBS: passive open space (meters)</td>
<td>-0.000028</td>
<td>0.000002</td>
<td>-12.86**</td>
</tr>
<tr>
<td><strong>Structural Attributes (S)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of bedrooms</td>
<td>0.033037</td>
<td>0.001570</td>
<td>21.05**</td>
</tr>
<tr>
<td>Number of bathrooms</td>
<td>0.079976</td>
<td>0.002018</td>
<td>39.63**</td>
</tr>
<tr>
<td>Homestead status</td>
<td>-0.027259</td>
<td>0.003481</td>
<td>-7.83**</td>
</tr>
<tr>
<td>Age of house (ln)</td>
<td>-0.092578</td>
<td>0.001759</td>
<td>-52.65**</td>
</tr>
<tr>
<td>Size of lot (square meters)</td>
<td>0.000003</td>
<td>0.000000</td>
<td>21.68**</td>
</tr>
<tr>
<td>Finished square feet of floor space</td>
<td>0.000168</td>
<td>0.000002</td>
<td>82.14**</td>
</tr>
<tr>
<td>Number of fireplaces</td>
<td>0.068749</td>
<td>0.001768</td>
<td>38.89**</td>
</tr>
<tr>
<td>Number of garage stalls</td>
<td>0.075257</td>
<td>0.001268</td>
<td>59.37**</td>
</tr>
<tr>
<td><strong>Location and Accessibility (L)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance to nearest major highway (meters)</td>
<td>0.000009</td>
<td>0.000001</td>
<td>10.35**</td>
</tr>
<tr>
<td>Distance to nearest CBD (ln)</td>
<td>-0.056065</td>
<td>0.006926</td>
<td>-8.09**</td>
</tr>
<tr>
<td>Home is on a busy street</td>
<td>-0.033351</td>
<td>0.005096</td>
<td>-6.54**</td>
</tr>
<tr>
<td><strong>Neighborhood Attributes (N)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standardized test score in school district</td>
<td>0.000160</td>
<td>0.000010</td>
<td>15.34**</td>
</tr>
<tr>
<td>Percent nonwhite in census tract</td>
<td>-0.004014</td>
<td>0.000183</td>
<td>-21.99**</td>
</tr>
<tr>
<td>Persons per household in census tract</td>
<td>0.038961</td>
<td>0.004481</td>
<td>8.7**</td>
</tr>
<tr>
<td>Constant</td>
<td>11.314800</td>
<td>0.0799571</td>
<td>141.51**</td>
</tr>
<tr>
<td>MLS Area (104 Categories)</td>
<td></td>
<td></td>
<td>59.97**</td>
</tr>
<tr>
<td>Number of observations: 35,002</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R-squared: 0.7920</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** Significant at p<0.01  
* Significant at p<0.05
### Effect of moving a median-priced home 400m closer to a facility

<table>
<thead>
<tr>
<th></th>
<th>City Residents</th>
<th>Suburban Residents</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ON-STREET BICYCLE LANE</strong></td>
<td>n.s.</td>
<td>$364</td>
</tr>
<tr>
<td><strong>NON-ROAD SIDE BICYCLE TRAIL</strong></td>
<td>$510</td>
<td>$240</td>
</tr>
<tr>
<td><strong>ROAD-SIDE BICYCLE TRAIL</strong></td>
<td>$2,272</td>
<td>$1,059</td>
</tr>
</tbody>
</table>
Thursday, August 28, 2003

Friends, foes of Nobsco rail trail take up sides

By Jennifer Lengart
Washington Post Staff Writer

A special meeting on Leesburg's long-proposed bicycle-trail network Wednesday attracted more than 150 residents, all of them glad for a gathering devoted solely to airing their views in opposition or support.

About eight miles of the 17-mile loop, a kind of beltway that would meet the Washington & Old Dominion Trail north and south of Leesburg, has been in the works for several years. Supporter say it would improve access to the trail, connecting the town to nearby paths. Opponents say it would infringe on private property and disrupt the serene environment.

One resident who spoke in support was Jennifer Lengart, who said she's been riding the trail for about five years.

The trail, which would run through several neighborhoods, would provide a safe route for cyclists and walkers, she said.

But another resident, Mary Brown, said she's against the proposal because it would cut through her backyard.

She said she enjoys the peace and quiet of her backyard, and she's concerned that the trail would bring noise and pollution.

Supporters say the trail would actually benefit the community by improving access to the trail, which is currently off-limits to cyclists and walkers.

The meeting was held on Monday at the Leesburg Civic Center. City officials said they were happy with the turnout.

The next steps are unclear, as the city is still in the planning stages. A preliminary report is expected to be ready in September, and a final report is expected in December.

The meeting was the first in a series of public hearings to be held in the area. The next one is scheduled for September 11.
Environmental / CO$_2$ Savings
SURVEY QUESTION:
What would you have done if you hadn’t walked/cycled for this trip? (Check One)
  o Driven
  o Used bus or light rail
  o Cycled/walked (whichever not currently doing)
  o Would not have made the trip at all
  o Would have made the trip at a later time
  o Combined it with other travel at a later time
  o Other: _______________________

<table>
<thead>
<tr>
<th></th>
<th>Total respondents (n=301)</th>
<th>% said they would have driven</th>
<th>% of trips by ped/bike</th>
<th>% of daily CO₂e emissions owing to ped/bike substitution (high)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denver</td>
<td>76</td>
<td>18</td>
<td>4.3 to 9.4</td>
<td>1.7 %</td>
</tr>
<tr>
<td>Boulder</td>
<td>84</td>
<td>47</td>
<td>4.3 to 17.6</td>
<td>8 %</td>
</tr>
<tr>
<td>Littleton</td>
<td>65</td>
<td>38</td>
<td>4.3 to 4.3</td>
<td>1.6 %</td>
</tr>
<tr>
<td>Davis</td>
<td>76</td>
<td>26</td>
<td>4.6 to 19.7</td>
<td>5.1 %</td>
</tr>
</tbody>
</table>

Assumptions:  Average Trip Length: 3.3 miles (avg trip distance in US Cities)
Average fuel efficiency of US passenger vehicle fleet: 20.2 mpg (BTS, 2008)
Gallons of gasoline to CO₂e: 9.3 kg CO₂e/Gallon (ICLEI, 2009)
Wrap Up
1. High hopes
2. We *can* do it
How much do bicycle facilities cost? Can we quantify their benefits? In what cases do estimates of benefits outweigh costs?

If your community is considering building a new bicycle facility you can use this tool to estimate costs, the demand in terms of new cyclists, and measured economic benefits (e.g., time savings, increased livability, decreased health costs, a more enjoyable ride, decreased pollution).

http://www.bicyclinginfo.org/bikecost/
1. High hopes
2. We *can* do it
3. Take increased care with assumptions
1. High hopes
2. We *can* do it
3. Take care with methods/assumptions
4. We don’t know a lot
5. Varied appeal
1. High hopes
2. We can do it
3. Take care with methods/assumptions
4. We don’t know a lot
5. Varied appeal
6. Endless excuses
7. Build it --- will likely come
8. Moral suasion?
1. High hopes
2. We *can* do it
3. Take care with methods/assumptions
4. We don’t know a lot
5. Varied appeal
6. Endless excuses
7. Build it --- will *likely* come
8. Moral suasion?
9. Intensive and extensive margins
Intensive & Extensive Margins

- Frequent Participants: 3%
- Fence Sitters: 60%
- Could Care Less: 37%

Really appreciate bicycle facilities

Do not care or are opposed to them
1. High hopes
2. We *can* do it
3. Take care with methods/assumptions
4. We don’t know a lot
5. Varied appeal
6. Endless excuses
7. Build it --- will *likely* come
8. Moral suasion?
9. Intensive and extensive margins
10. Good things (likely) come with time
OP-ED CONTRIBUTOR

Bicyclists vs. Pedestrians: An Armistice

By ROBERT SULLIVAN

ONE of the great battlefields in the war between bicyclists and pedestrians in New York City is the Brooklyn Bridge. Pedestrians think all bicyclists are out-of-control maniacs; bicyclists — the majority, anyway — are just trying to avoid cars and not break a sweat. The stripe painted down the center of the elevated Brooklyn Bridge walkway, to separate bicyclists from pedestrians, has become a line in the sand. We need to erase that line once and for all.

There are various reasons for the battle of the Brooklyn Bridge. Brooklyn seems to sprout bike commuters, as do its vaguely do-it-yourself cultural attitudes that the real estate race has not yet destroyed. The walkway, meanwhile, is narrow. Thus, on any given day, we see on one side a herd of pedestrians, part tourists photographing the Statue of Liberty, part people walking to work — a volatile mix to begin with. On the other side of the line are two kinds of bicyclists, most pedaling peacefully, a few confusing bike commuting with driving rocket cars on the Bonneville Salt Flats. It’s a recipe for confusion and arguments, not to mention accidents.

Indeed, the Brooklyn Bridge is just one of several bike-pedestrian flash points in the city: skirmishes (and shouting and calls, not for the banning of pedestrians — that would be wrong, everyone agrees — but for the banning of bicycles.)
Wrestling with How to Measure Bicycling’s Benefits

Northwestern University
8 October 2009

Kevin J. Krizek
University of Colorado
www.kevinjkrizek.org
Problems with benefit cost studies
Separated bicycle facilities $\neq$ Increased cycling

Separated bicycle facilities $\neq$ Increased safety

Separated bicycle facilities $\approx$ Perceived safety $\approx$ Increased bicycle use $\approx$ Increased safety in numbers
European Cycling Infrastructure: Approach to Supermarket Bicycle Parking, Houten, NL
Mobile Mechanic Program

New this season, our bike station staff is reaching out to the campus, providing mobile mechanic services. Our mobile mechanics will come to your office or dorm and fix your bicycle! Equipped with all the tools and parts necessary, mobile mechanics can complete almost any repair. This service is available for registered bicycles only. More information on bicycle registration here.

In order to complete the most requests possible, please limit your service request to on-campus locations only.

Some of the repairs we'll do:

- Flat tires
- Shifting adjustments
- Braking adjustments
- Cable repair
- Chain repair
- Small parts replacement*

Request a Mobile Mechanic
(Weekdays, 9 am - 5 pm)

First Name: Last Name:
Sunday Cycling Day, Bogota, Columbia
6. Key Take-away Points
High Hanging Fruit

Things that have been studied
- Provide varied facilities/infrastructure for varied users
- Bring origins and destinations closer together
- Make alternatives to NMT more expensive or inconvenient e.g. reduce parking availability
- Systematic data collection exercises

Things that have not been studied
- The importance of considering the whole cycling network—creating a hierarchy of paths (primary and secondary)
- One size does not fit all
6. Key Take-away Points

Low Hanging Fruit

Things that have been studied
- Special populations—targeting hard and soft interventions. For cycling this includes people beyond young males.
- Make alternatives to NMT more expensive or inconvenient e.g. reduce parking availability

Things that have not been studied
- Redundancy is OK
- Minimizing gaps in the network
- Prioritize areas and remedy as part of the development/redevelopment process
Quantifying the potential benefits of cycling: evaluation & implications of US cycling strategies

Cycling towards a Sustainable City
Incheon Bike Expo
September 2009
<table>
<thead>
<tr>
<th>Mobility</th>
<th>Health</th>
<th>Safety</th>
<th>Externalities</th>
<th>Livability</th>
<th>Fiscal</th>
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</thead>
<tbody>
<tr>
<td>-enhanced</td>
<td>-increased physical</td>
<td>-decreased accidents</td>
<td>-decreased congestion</td>
<td>-proximity to</td>
<td>-increased</td>
</tr>
<tr>
<td>conditions</td>
<td>activity</td>
<td>-increased comfort</td>
<td>-pollution</td>
<td>recreational</td>
<td>economic activity</td>
</tr>
<tr>
<td>-shorter</td>
<td>-decreased health</td>
<td></td>
<td></td>
<td>amenities</td>
<td>-decreased</td>
</tr>
<tr>
<td>travel</td>
<td>care costs</td>
<td></td>
<td></td>
<td></td>
<td>taxes</td>
</tr>
<tr>
<td>distance</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Community Livability Benefits

- Preservation of open space
- Quality of life benefits being near recreation facilities and options
- Increased option value

<table>
<thead>
<tr>
<th>Mobility</th>
<th>Health</th>
<th>Safety</th>
<th>Externalities</th>
<th>Livability</th>
<th>Fiscal</th>
</tr>
</thead>
</table>

Beneficiary

To the User (direct)

To the Community (indirect)
• Are individuals paying more for the option of using bicycle trails?
Figure 1  Walking and bicycling in 68 California cities in 2000.

Figure 2  Walking and bicycling in 47 Danish towns in 1993–96.

Figure 3  Bicycling in 14 European countries in 1998.

Figure 4  Walking and bicycling in eight European countries in

Motorized: 39.2% to 40.5%
Transit: 29.2% to 33.9% to 31.7% to 35.2%
Cycling: 6.6% to 6.6% to 9.5% to 13.4%
Walking: 25.0% to 21.2% to 21.5% to 10.9%

UWV (Umweltverbund): 60.8% to 61.7% to 62.7% to 59.5%

Source: City of Muenster
Success Also Has Its Costs

Sendai, Japan
4. Hard Measures
What They Are and What We Know

• Community design (density, distances, aspects of street pattern/network)—matters a great deal for adult pedestrians
• Pedestrian infrastructure—some importance; footpaths or sidewalks matter for children
• Bicycle facilities—important for different kinds of users / environments
• Bottom line: different users need different environmental supports
4. Hard Measures
Separated Bicycle Facilities

• Preferred by some, confused by many
2. Bicycling vs. Walking

Cyclists Vary by Type

A: Experienced / competent on street
B: Less regular / uncomfortable with traffic
C: Inexperienced / risk averse (e.g., children, elderly)
## 2. Bicycling vs. Walking

Studies That Exist Vary Dramatically in How they Measure Walking

<table>
<thead>
<tr>
<th>Outcome Variables Differ in Type</th>
<th>Outcome Variables Differ by Period</th>
<th>Outcome Variable Differ by Instrument</th>
<th>Outcome Variable Differ by Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking</td>
<td>Time:</td>
<td>Diary</td>
<td>Total trips</td>
</tr>
<tr>
<td>• For transportation</td>
<td>• Last 1, 2, 7 day(s), last month, last year</td>
<td>• Survey—phone, mail, intercept</td>
<td>• Trips over x distance</td>
</tr>
<tr>
<td>• To work</td>
<td>• Typical day, week, month, year</td>
<td>• Observation of walkers in a site</td>
<td>• Including trips that start and end in the same place</td>
</tr>
<tr>
<td>• To shops</td>
<td>• Before move/after move</td>
<td>• Pedometer</td>
<td>• And more</td>
</tr>
<tr>
<td>• With a purpose</td>
<td>• Each with different levels of reliability</td>
<td>• Accelerometer</td>
<td></td>
</tr>
<tr>
<td>Total walking</td>
<td></td>
<td>• GPS</td>
<td></td>
</tr>
<tr>
<td>Total trips</td>
<td></td>
<td>• Each processed in different ways, prompts etc</td>
<td></td>
</tr>
<tr>
<td>For exercise</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total physical activity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>And more</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. Soft Measures
What They Are and What We Know

- Pricing of alternatives e.g. automobile costs, taxation
- Policies e.g. convenience/cost of parking
- Promotional campaigns/social marketing e.g. safe routes to school (mostly), TravelSmart, walking clubs, educational programs, information packets, counselling

- Some studies show no effect but others show changes in behavior of key populations e.g. sedentary children, older people, employees
- Evaluation has mainly focused on reductions of driving
- Follow up of walking/cycling behavior has been at most 12 months after the intervention
Place with considerable infrastructure but poor community design (density, destinations, route options), Twin Cities, Minnesota
1. Key Questions
Our Task, Our Approach

- Sift through and evaluate existing literature—a review of over 300 articles (out of over 450 located)
- Uncover the evidence base
- Our lens is as researchers and our perspective is at the “tree top” level

- Key sorting variables:
  - Mode
  - Outcome variable (e.g., commute)
  - Key findings
  - Type of study
  - Population
  - Location
1. Key Questions
Main Findings

- Successful places use multiple strategies
- Small / specific interventions have small / indeterminate impact

Walking
- Travel walking is affected by distance, density, but also pricing and access to public transportation; just making it more attractive isn’t enough
- Perceptions matter
- Pricing of alternatives matter to (some) pedestrians

Bicycling
- Separated facilities are perceived as safer and superior by specific populations of cyclists
- Those who stand to benefit (due to the low cost of cycling), do it the least
- Different environments demand distinctly different treatments
Evidence-Based Practice


• Expanded beyond the individual e.g. business

• Needs careful assessment of research as there are often:
  – Few studies on a topic
  – Studies looking at only part of the picture
  – Studies that define key variables differently
  – Limitations to data and analysis
  – Publications bias—studies that find effects are more likely to be published than those that find no/inconclusive effects
Evidence-Based Practice
This is Hard to Do Yourself

- Medline is one of the major journal databases
- Type “urban” into Medline abstract > 74,130 journal articles
- Type “city” and get 50,809
- Type “rural” and get 65,252
- Type “urban planning” and get 109, some quite specialized e.g. “From nightlife conventions to daytime hidden agendas: dynamics of urban sexual territories in the South of France”
- Need for a guide to locate and assess studies
Evidence-Based Practice
Some Evidence is Better than Others

Good Evidence
- Evidence from dozens of studies converges on the finding that seeing green lowers stress and that some kinds of environments support travel walking

Conflicting Evidence or Evidence that Counts Common Beliefs
- It isn’t clear that environments can increase overall physical activity (there are few studies that actually measure this and most find no effect) or that one type of environment is clearly better for social capital

Complicated Methods
- Some problems due to misuse of fancy statistics and differing definitions of key variables across studies.
  - E.g. high density in one study is low in another
2. Walking vs. Bicycling

Key Differences

- Participants, range/scale, speed, infrastructure, trip purpose, safety concerns, key barriers, interface with autos/transit

Walking + Public Transportation, St. Louis
Bicycling share of short trips in the Netherlands, Denmark, Germany, UK, and USA (2000-2005)

Sources: Danish Ministry of Transport (2007); Netherlands Ministry of Transport (2006); Department for Transport (2005); U.S. Department of Transportation (2003); German Federal Ministry of Transport (2003)
Source: Pucher and Buhler 2008
Bicycling share of trips by age group in the Netherlands, Denmark, Germany, UK and USA (2000-2002)

Sources: Department for Transport (2007); Danish Ministry of Transport (2005); Statistics Netherlands (2005); German Federal Ministry of Transport (2003); U.S. Department of Transportation (2003)
What is the basis for our recommendations?

- Peer reviewed literature
- Government reports
- “Other” publications
- Personal observation
- Informal discussions
- Observed assertions from others
- News items and other publicity
Source: http://strans.org/graph.html
<table>
<thead>
<tr>
<th></th>
<th>Urban</th>
<th>Rural</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Child</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Cyclist running stop sign</td>
<td>1-Motorist turning left</td>
</tr>
<tr>
<td>2</td>
<td>Cyclist exiting residential driveway</td>
<td>2-Motorist overtaking unseen cyclist</td>
</tr>
<tr>
<td>3</td>
<td>Cyclist riding on sidewalk turning to exit driveway</td>
<td>3-Motorist turning left</td>
</tr>
<tr>
<td>4</td>
<td>Cyclist on sidewalk hit by motorist exiting driveway</td>
<td>4-Motorist restarting from stop sign</td>
</tr>
<tr>
<td>5</td>
<td>Cyclist running stop sign</td>
<td>5-Motorist exiting commercial drive</td>
</tr>
<tr>
<td><strong>Adult</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Motorist turning left</td>
<td>1-Motorist overtaking unseen cyclist</td>
</tr>
<tr>
<td>2</td>
<td>Traffic light changed too quickly</td>
<td>2-Motorist overtaking too closely</td>
</tr>
<tr>
<td>3</td>
<td>Motorist turning right</td>
<td>3-Motorist turning left</td>
</tr>
<tr>
<td>4</td>
<td>Motorist restarting from stop sign</td>
<td>4-Motorist restarting from stop sign</td>
</tr>
<tr>
<td>5</td>
<td>Cyclist swerving around obstruction</td>
<td>5-Cyclist swerving around obstruction</td>
</tr>
</tbody>
</table>

Source: adapted from Forester 1993, p 269
Muenster, Germany
VI) Conclusions
10 Take-away Points

1. Myriad reasons why people **DO NOT** cycle (the built environment is just one).
2. (most) **PROGRAMS are CHEAP**, but the effects are largely unknown
3. Identifying **TARGET MARKETS** is **DIFFICULT**.
4. All bicycle facilities are **NOT CREATED EQUAL**.
5. Different facilities have **VARIED APPEAL** for varied populations in varied cultures across varied settings.
6. Asserted benefits exist, but **MOST ARE OVERSTATED**
7. (most) Facilities, over the long term, **WILL LEAD to USE**.
8. With increased **USE**, comes increased **SAFETY**
9. Enhanced facilities are likely to be appreciated by **ONLY a FEW**.
10. Preferences, lifestyles, and attitudes **TRUMP ALL ELSE**.
intersection: special green light phases
left turn lane for bicycles
induction-loop for bicycles
colored pavement
intersection: the bicycle floodgate
intersection: the bicycle floodgate
intersection: the bicycle floodgate