Promoting Safe Walking and Cycling: Lessons from Europe and North America

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Walking and Cycling: 
the **MOST** sustainable transport modes

- **MOST environmentally friendly:**
  > Virtually no pollution at all
  > Almost no nonrenewable resources used

- **MOST equitable:**
  > Financially affordable by virtually everyone
  > Physically possible by all but the severely disabled

- **MOST economical:**
  > Minimal private and public costs
  > Although they take more time, they provide exercise that reduces medical costs and greatly extends our healthy life expectancy
WALKING AND CYCLING ARE HEALTHY!

• GREAT source of physical activity:
  • Both for daily travel and for recreation
  • Cheaper, easier, and more dependable than formal exercise routines
  • Can be integrated into daily lifestyle to achieve practical travel needs
### Share of Trips by Cycling and Walking

<table>
<thead>
<tr>
<th>Country</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA*</td>
<td>0.5</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Canada*</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Ireland*</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>UK</td>
<td>2</td>
<td>22</td>
<td>16</td>
</tr>
<tr>
<td>Belgium</td>
<td>8</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>France</td>
<td>16</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>Austria</td>
<td>21</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Norway</td>
<td>22</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Finland</td>
<td>22</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Sweden</td>
<td>23</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Germany</td>
<td>24</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>Netherlands</td>
<td>25</td>
<td>26</td>
<td>25</td>
</tr>
</tbody>
</table>

Bike Share of Trips in Selected cities in UK, Canada, USA, and Australia (2000-2009)

Bicycle Share of Work Commuters in the USA (2007) and Canada (2006)

Increase in Bike Share of Trips in Cities Around the World

Increase in Bike Share of Trips in Cities Around the World

Almost a quadrupling in cycling in Cambridge in past 10 years
Trends in Cycling to Work in 9 US and Canadian Cities

Bike Mode Share of Workers in 9 US and Canadian Cities

Spatial Variation in Bicycle Share of Work Commuters in New York City Area, 2005-2009

Spatial Variation in Bicycle Share of Work Commuters in Washington, D.C. Area, 2005-2009

Cycling rate in Cambridge NINE times higher than for Boston metro area

Variation in cycling rates among different towns in the Boston metro area

Source: Calculated by authors from American Community Survey, 2006-2010, US Census Bureau
Percent of workers WALKING to work as main means of travel, 2006-2010

Source: Map created by Metropolitan Area Planning Council from American Community Survey, U.S. Bureau of the Census
Percent of workers CYCLING to work as main means of travel, 2006-2010

Source: Map created by Metropolitan Area Planning Council from American Community Survey, U.S. Bureau of the Census
Lots of Potential for Increased Walking and Cycling:

Many daily trips in American and Canadian urban areas are short enough to walk or bike!

- ~27% of all trips in the U.S. were a mile or shorter in 2009
- ~41% of all trips were shorter than two miles
Share of Short Trips by Cycling and Walking

Percent of trips by cycling and walking

Trip distance category

- USA
- GER
- DK
- NL

- 0-2.5km
- 2.5km-<4.5km
- 4.5km-<6.5km
- 0-2.5km
- 2.5km-<4.5km
- 4.5km-<6.5km
- 0-2.5km
- 2.5km-<5km
- 5.0km-<7.5km

- Walking
- Cycling
Europeans cycle for many trip purposes
Women’s Share of Bike and Walk Trips in Europe and North America

<table>
<thead>
<tr>
<th>Country</th>
<th>Cycling</th>
<th>Walking</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>25%</td>
<td>52%</td>
</tr>
<tr>
<td>UK</td>
<td>27%</td>
<td>53%</td>
</tr>
<tr>
<td>Canada</td>
<td>30%</td>
<td>56%</td>
</tr>
<tr>
<td>Denmark</td>
<td>49%</td>
<td>55%</td>
</tr>
<tr>
<td>Germany</td>
<td>49%</td>
<td>56%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>56%</td>
<td>56%</td>
</tr>
</tbody>
</table>
Bicycle share of trips and percentage of female cyclists in large cities

Bicycle share of commuter trips and percentage of female cyclists by local government area in the Melbourne Metro Area

55% of all bike trips in Denmark are by women

Source: Susan Handy
Cycling for all ages
Make Walking and Cycling Safe for Everyone!

- Especially important for the young, the old, for anyone with disabilities, for the timid or risk-averse

- Women more sensitive to safety than men

- Safety of walking and cycling in the Netherlands, Denmark, and Germany helps explain high levels of walking and cycling there
Cyclist and Pedestrian Fatality and Injury Rates
Trends in Cyclist Fatalities

- USA
- UK
- Denmark
- Germany
- Netherlands
Trends in Pedestrian Fatalities
SAFETY IN NUMBERS

• As levels of cycling increase, injury and fatality rates per trip and per km traveled fall dramatically

• Thus, if we can increase cycling, it will almost inevitably be safer
Safety in Numbers: Cyclist fatality rate falls as cycling levels increase.

## Decreasing Crash Rate in Portland

<table>
<thead>
<tr>
<th>Year</th>
<th>Crashes</th>
<th>Crash Rate</th>
<th>Bridge Bicycle Traffic</th>
</tr>
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<tbody>
<tr>
<td>1991</td>
<td>100</td>
<td>0.01</td>
<td>500</td>
</tr>
<tr>
<td>1992</td>
<td>75</td>
<td>0.015</td>
<td>550</td>
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<tr>
<td>1993</td>
<td>100</td>
<td>0.015</td>
<td>600</td>
</tr>
<tr>
<td>1994</td>
<td>150</td>
<td>0.015</td>
<td>650</td>
</tr>
<tr>
<td>1995</td>
<td>200</td>
<td>0.015</td>
<td>700</td>
</tr>
<tr>
<td>1996</td>
<td>250</td>
<td>0.015</td>
<td>750</td>
</tr>
<tr>
<td>1997</td>
<td>300</td>
<td>0.015</td>
<td>800</td>
</tr>
<tr>
<td>1998</td>
<td>350</td>
<td>0.015</td>
<td>850</td>
</tr>
<tr>
<td>1999</td>
<td>400</td>
<td>0.015</td>
<td>900</td>
</tr>
<tr>
<td>2000</td>
<td>450</td>
<td>0.015</td>
<td>950</td>
</tr>
<tr>
<td>2001</td>
<td>500</td>
<td>0.015</td>
<td>1000</td>
</tr>
<tr>
<td>2002</td>
<td>550</td>
<td>0.015</td>
<td>1050</td>
</tr>
<tr>
<td>2003</td>
<td>600</td>
<td>0.015</td>
<td>1100</td>
</tr>
<tr>
<td>2004</td>
<td></td>
<td></td>
<td>1150</td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td></td>
<td>1200</td>
</tr>
</tbody>
</table>

*Note: The crash rate decrease is not shown in the diagram.*
Public Policies *Crucial* to Walking and Cycling

- Pro-car policies in European cities in 1950s and 1960s caused huge decline in walking and cycling
- Dramatic policy turn-around since 1970s to limit car use and promote cycling, walking, and public transport in Dutch, Danish, and German cities
Bridge in Freiburg BEFORE and AFTER reforms
Typical residential street in Freiburg BEFORE traffic calming reforms

Typical residential street in Freiburg AFTER traffic calming reforms
Cathedral Square in Freiburg BEFORE transport and urban planning reforms

Cathedral Square in Freiburg AFTER transport and urban planning reforms
Mass Ave Road Diet in 1996: road narrowing and improvement of ped/bike facilities

Before 1996

After 1996
Longfellow Bridge: Great view but abominable conditions for pedestrians and cyclists.
What this crossing *should* look like!

Improved crossing for pedestrians and cyclists on Longfellow Bridge
How to Encourage More Cycling and Walking while Improving Safety

• Better cycling and walking facilities
• Integration of walk/bike with public transport
• Traffic calming of residential neighborhoods
• Mixed-use zoning and improved urban design
• Restrictions on motor vehicle use
• Traffic education and Safe Routes to School
• Traffic regulations and enforcement
Lively pedestrian zone in Québec City

Source: Marie Demers
Safe and pleasant “Shared Street” at Harvard Square

Source: City of Cambridge
Pedestrian zones in downtown Boston

Photos: David Loutzenheiser
Car-free Broadway in New York City

Times Square

Herald Square
High Line in New York City

...from an abandoned freight line to a popular promenade...
Room for pedestrians, cyclists, and cars on this complete street

Source: Ralph Fertig
Santa Barbara coastal path: Safe and attractive both for cyclists and pedestrians

Conversion of two car lanes to bike path and wider sidewalk

Source: Ralph Fertig
Bikeway in Muenster, Germany with separate walkways on both sides
Minuteman Trail
north of Boston
Second most popular recreational trail in the country

Source: City of Cambridge
Bike paths in Dutch cities make it safe and comfortable for all to bike: including women, children, and seniors
One-way cycle track in The Hague

Source: Peter Furth
Raised crossing carries a two-way cycle track across a minor street at an intersection in Delft.

Raised crossing, pavement markings, and good signage increase safety of cycle tracks at intersections
Advisory bicycle lanes on a two-way street in Delft, Netherlands
## Dutch bicycle facility selection matrix

<table>
<thead>
<tr>
<th>Lane Configuration</th>
<th>Average daily traffic (vehicles / day)</th>
<th>Street type and speed limit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Urban local street</td>
</tr>
<tr>
<td>2-way traffic with no centerline</td>
<td>≤ 2500</td>
<td>mixed traffic$^1$</td>
</tr>
<tr>
<td></td>
<td>2000 to 3000</td>
<td>bike lane$^2$ or cycle track$^3$</td>
</tr>
<tr>
<td></td>
<td>3000 to 5000</td>
<td>bike lane or cycle track</td>
</tr>
<tr>
<td></td>
<td>&gt; 4000</td>
<td>bike lane or cycle track</td>
</tr>
<tr>
<td>2 lanes (1+1)</td>
<td>any</td>
<td>bike lane or cycle track</td>
</tr>
<tr>
<td>4 lanes (2 + 2) or more</td>
<td>any</td>
<td>(does not exist)</td>
</tr>
</tbody>
</table>

Almost 100km of 2-way cycle tracks in Montreal

Separation from traffic via bollards and parked cars

Separation from traffic via concrete barriers

Photo: Peter Furth

Photo: Velo Quebec
Provision of cycle track at this key underpass in Montreal: On the way down...

Photo: Velo Quebec
... and here on their way back up

Source: Vélo Québec
Bi-directional cycle track and bike sharing near metro station in Montréal

Source: Vélo Québec
• 250 mi of new bike lanes and paths since 2005
• doubling in bike trips
• halving of cyclist fatalities from 28 to 14

Traffic-protected cycle track on 9th Avenue, NYC
Cycle Track on Pennsylvania Avenue in Washington Connects the White House with the Capitol
Protected bike lanes (cycle tracks) on Vassar St and Concord Ave in Cambridge
Planned cycle track and pedestrian improvements on Western Ave, Cambridge

Source: City of Cambridge
Why not remove the parked cars and create safe, protected cycle tracks?
Trend in Bike Paths and Lanes per 100,000 Population in Nine Large North American Cities, 2000-2010

Kilometers of Lanes and Paths per 100,000 Population

Crucial to provide river crossings for cyclists

Bike bridge over Yarra River in Melbourne, Australia

Bike bridge over Ems River in Muenster, Germany
About 20,000 daily bike trips over Portland bridges
Crucial provisions for cyclists and pedestrians on bridges even during construction as here in Montreal

Source: Velo Quebec
1,100 km of bicycling facilities in Berlin plus 3,800 km of traffic calmed streets = 10% bike share of all trips
Special traffic signals and signs give priority to cyclists.
Four-way all-green signal for cyclists in Portland

How to Use the New Bicycle Signal

1. TO GET A GREEN LIGHT
Place your bicycle on the marking on the sidewalk, with your wheels directly on the lines.

2. When the bicycle signal here is green...

3. ...cyclists can cross the intersection as shown here.

Bike sensor in pavement
Superb bike crossing at busy intersection in Montreal

Source: Velo Quebec
Red bike lanes for intersection crossings, connected with red brick sidepaths on both sides of every road

Sources: City of Muenster
Bike boxes and advance stop lines
Green wave for *cyclists* in Odense, Denmark

Troels Andersen, “Cycling in Odense, Denmark”

Raised curb protects bike path from cars

Express bikeways for commuters

Bike speed indicators
Accommodation of cyclists at intersections in Cambridge

Source: City of Cambridge
Protected left-turn lane for cyclists crossing Mass Ave to reach Church St. and Brattle St.
Then the cyclist can safety cross Mass Ave to continue onto Church Street or turn right onto Mass Ave going outbound.

Source: Cara Seiderman
Traffic Calming of Residential Neighborhoods

• Speed limited *by law* to 30km per hour (19mph) or less

• *Physical measures* that force cars to slow down:
  • Road narrowing, zigzag routing, chicanes
  • Raised intersections and crosswalks
  • Traffic circles
  • Speed humps and bumps
  • Mid-block closures and artificial dead-ends
  • Bulb-outs at intersections and crosswalks, with sidewalk widening
Why Traffic Calming Saves Lives

Speed kills!

Figure 1.1  Probability of fatal injury for a pedestrian colliding with a vehicle

Curb extensions, protective bollards, raised crosswalks, refuge islands

Traffic calming increases pedestrian visibility and slows down cars

Source: Cara Seiderman

Source: Jeff Rosenblum
Convenient bike cut-thru for cyclists
Traffic calming in Québec City and Montreal

Cheap, easy, and very effective traffic diverters
Traffic Calming in Freiburg, Germany
Cheap, easy, fast, and effective improvement in cycling and walking safety
Bike Boulevards in Portland

Traffic calming turns these streets into bikeways

Fotos: Jonathan Maus
BIKE TRANSIT INTEGRATION
Over 50,000 buses in the USA now come equipped with bike racks
Bike on LRT in NJ and Minneapolis

Photo: Metro Transit

Photo: John Boyle
Bikes on Caltrain in San Francisco

Photo: San Francisco Bicycling Coalition
Bike Station next to main train station in Muenster, Germany

Photo: Peter Berkeley
Bike Station next to Union Station in Washington, D.C.

Photo: Ralph Buehler
Bike-transit integration at Alewife Station on Red Line

300 bike parking spaces in two cages
Main form of bike-transit integration in Europe for decades
Conversion of Car Parking to Bike Parking
Easy bike rentals at Dutch transit stations

Bikesharing in Paris and Berlin

Photo: Peter Berkeley

Photo: German Railways
Nice Ride in Minneapolis

Hubway Bikeshare in Cambridge, Boston, Somerville, and Brookline

Over 20 bike sharing systems in North America

Capital Bikeshare in Washington, DC
Traffic Education

• Improved motorist training, with much more emphasis on how to avoid endangering pedestrians and cyclists

• Compulsory traffic safety lessons for all school children by the age of 10, with testing by traffic police on actual traffic test courses, to ensure safe and defensive walking and cycling by an early age (as in the Netherlands and Germany)
German traffic laws generally favor cyclists and pedestrians over motorists.
Most German and Dutch children take cycling lessons by the 3rd or 4th grade and must pass a police-administered cycling safety test!
Bike path leads directly to school in NL
Bike Training for Children in New Jersey
Cycling training course for adults in Vancouver

You are never too old to learn!!!
Summer Streets in New York City attracts 200,000 participants on Saturdays in August.
Somerstreets in Somerville

Source: City of Somerville
Fun bike rides for kids and parents

Source: Cara Seiderman
Guided Bicycle Tours for Seniors

Troels Andersen, “Cycling in Odense, Denmark”
CONCLUSIONS

• Walking and cycling are the most sustainable means of getting around our cities

• Broad range of environmental, social, economic, and health benefits

• Many ways to increase walking and cycling while making them safer

• Lots of daily trips in American cities are short enough to cover by walking or cycling

• Many cities in Europe and some in North America show what is possible and offer superb examples to follow
Forthcoming book with MIT Press

http://citycyclingbook.wordpress.com

About the authors:

http://policy.rutgers.edu/faculty/pucher/

http://ralphbu.wordpress.com
Measures to Increase Cycling

1. Provide a comprehensive package of integrated measures
2. Build a network of integrated bikeways with intersections that facilitate cycling
3. Provide good bike parking at key destinations and public transport stations
4. Implement bike sharing programs
5. Provide convenient information and promotional events
6. Introduce individualized marketing to target specific groups
7. Improve cyclist education and expand bike to school programs
8. Improve motorist training, licensing, and traffic enforcement
9. Restrict car use through traffic calming, car-free zones, and less parking
10. Design communities to be compact, mixed-use, and bikeable
Implementation Strategies

1. Publicize both individual and societal benefits
2. Ensure citizen participation at all stages of planning and implementation
3. Develop long-range bike plans and regularly update them
4. Implement controversial policies in stages
5. Combine incentives for cycling and disincentives for car use
6. Build alliances with politicians, cycling organizations, and other bike friendly groups
7. Coordinate bike advocacy and planning through local, regional, and national organizations