

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

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**John Pucher, Rutgers University, and Ralph Buehler, Virginia Tech**

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

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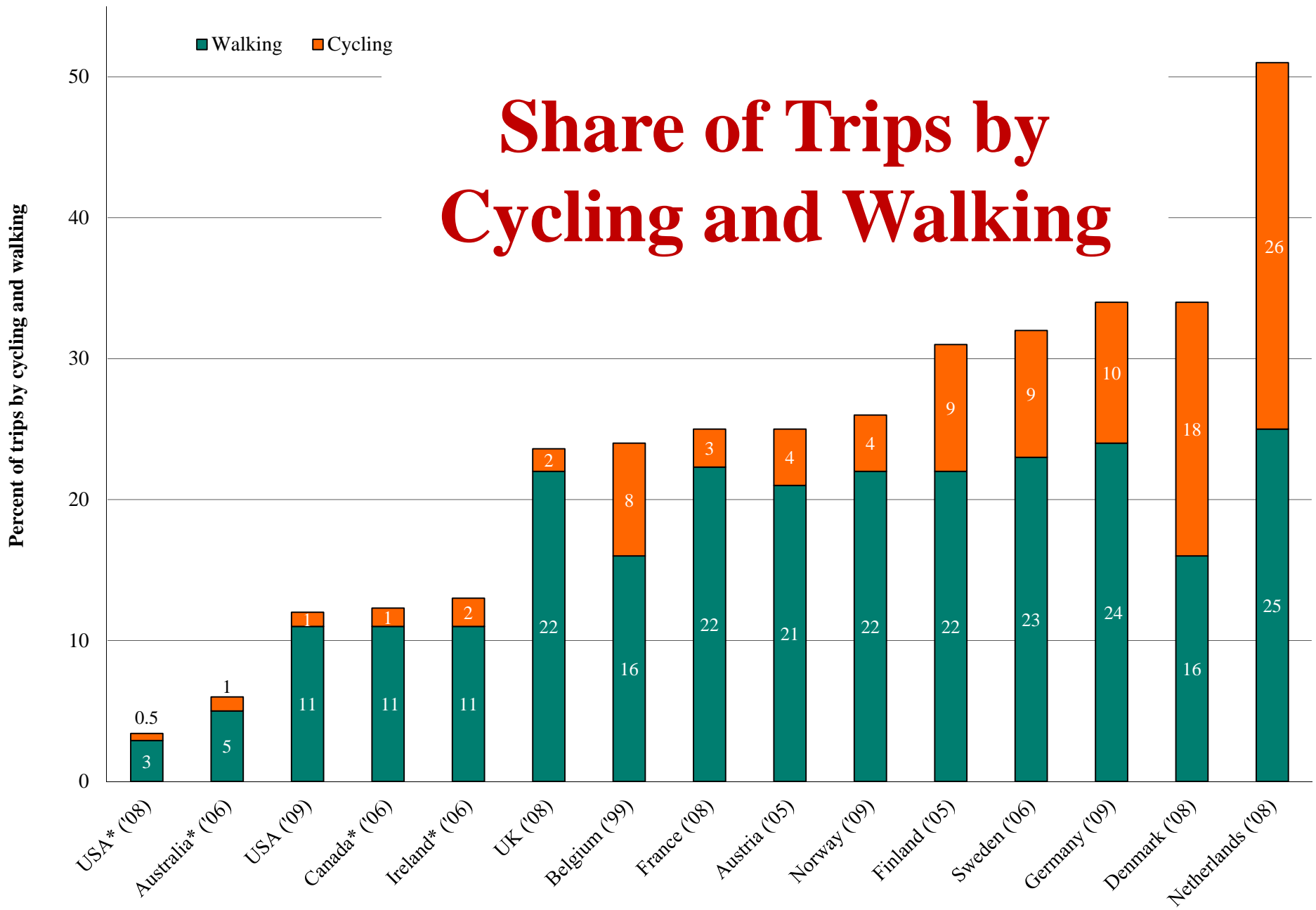
- **MOST environmentally friendly:**
  - > Virtually no pollution at all
  - > Almost no nonrenewable resources used
- **MOST equitable:**
  - > Financially affordable by virtually everyone
  - > Physically possible by all but the severely disabled
- **MOST economical:**
  - > Minimal private and public 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!**

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- **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**

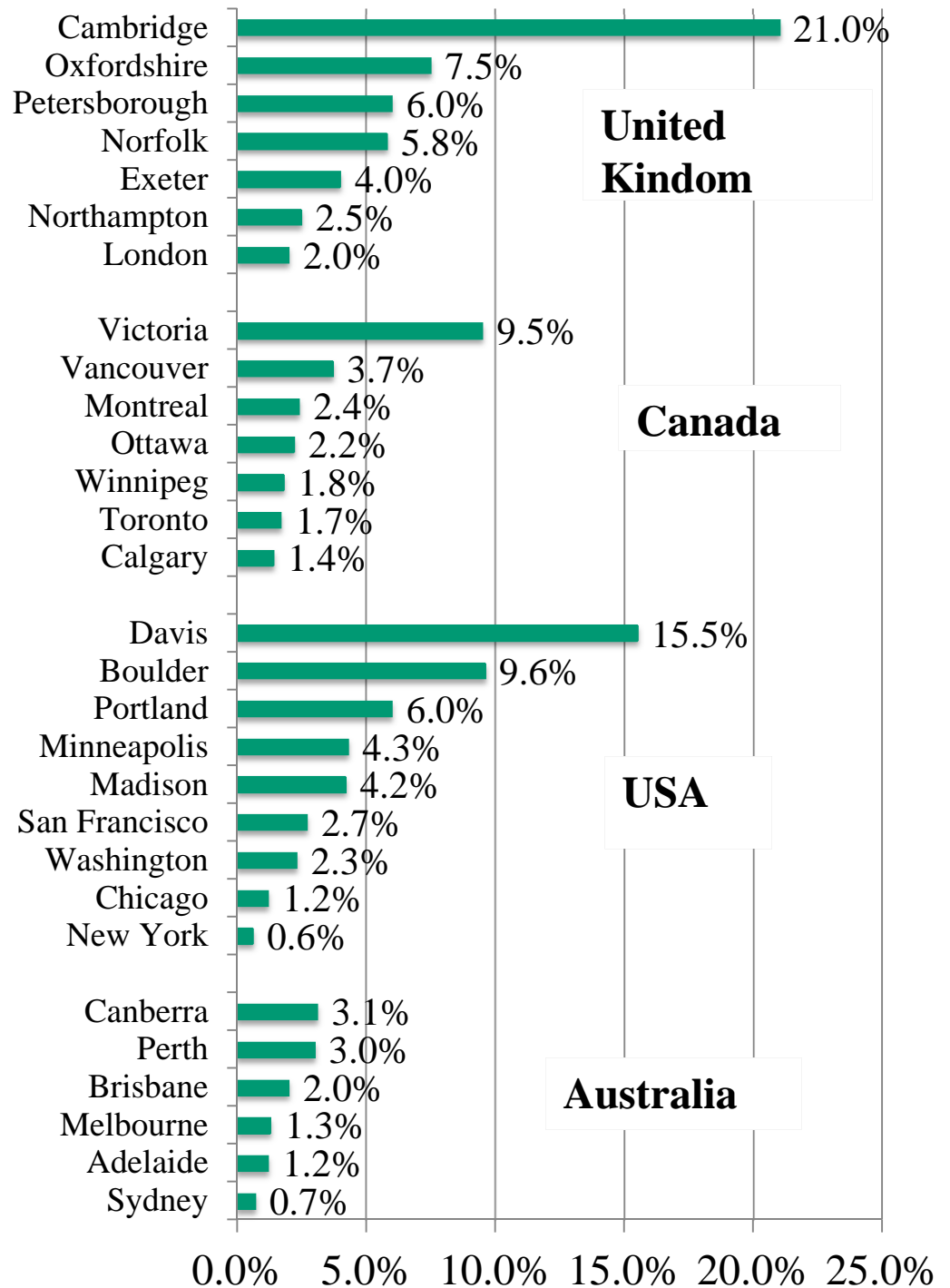
# Share of Trips by Cycling and Walking



Source: Pucher and Buehler, *City Cycling*, MIT Press, 2012

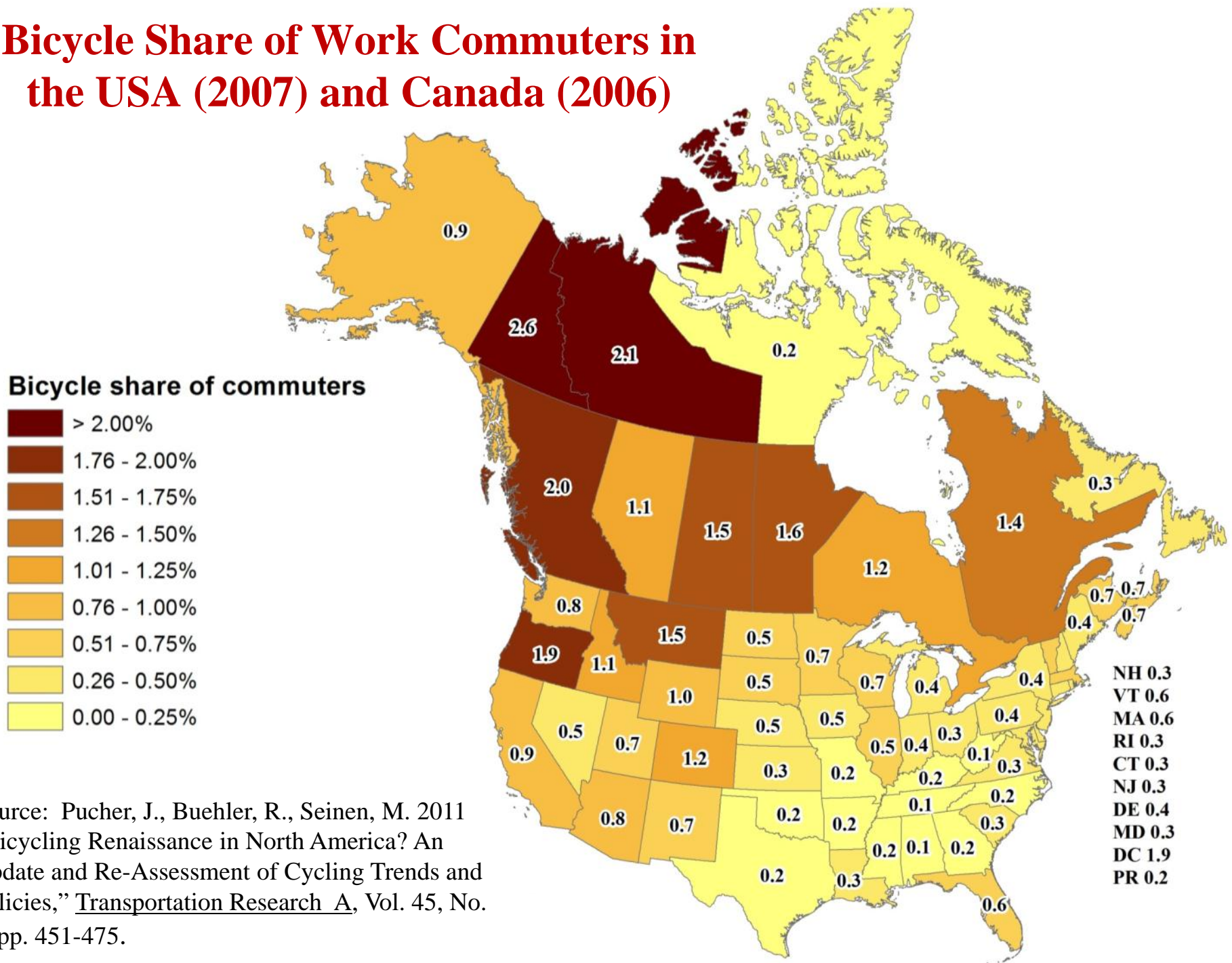


# Bike Share of Trips in Selected cities in UK, Canada, USA, and Australia (2000-2009)



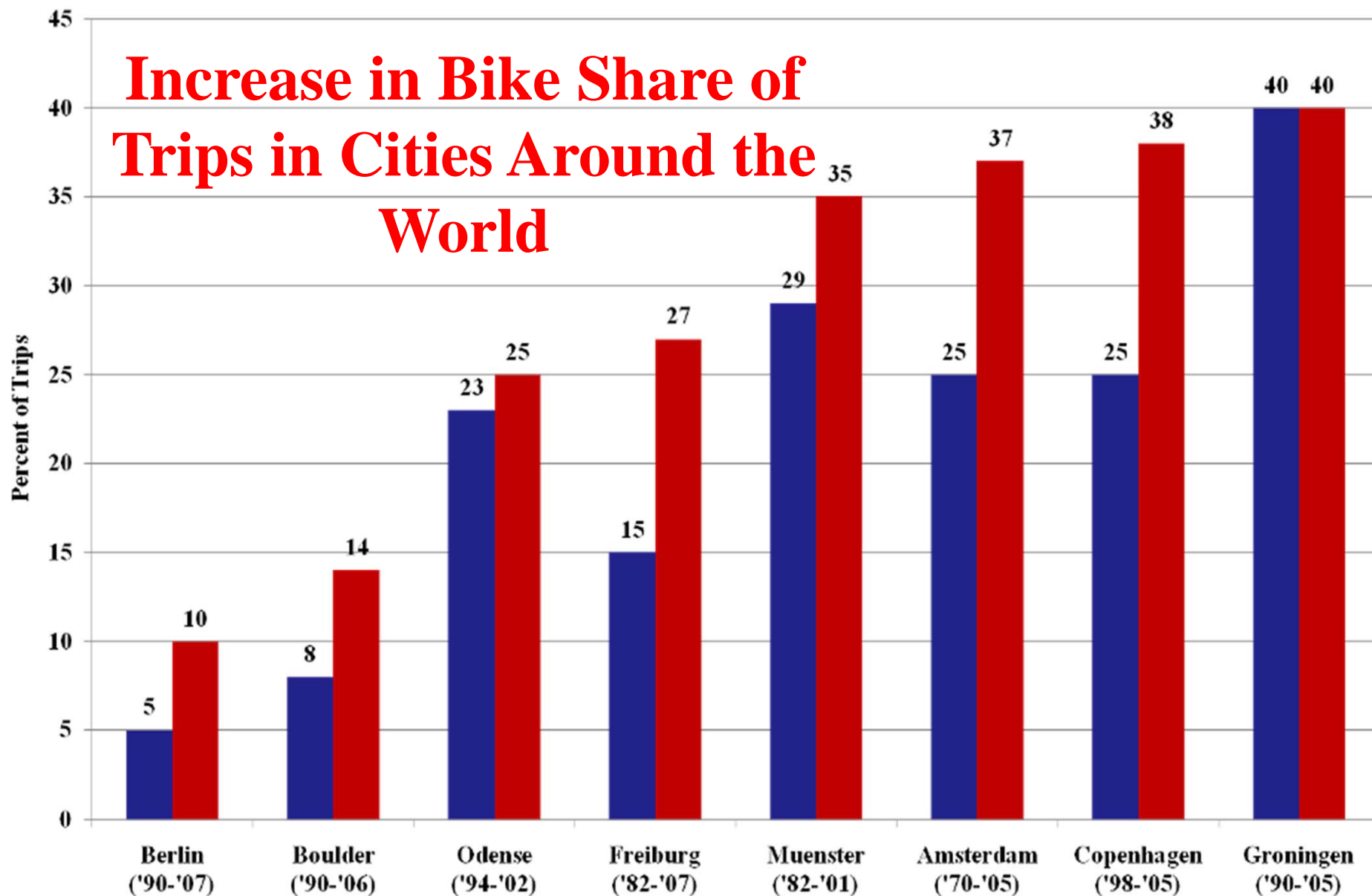
Source: Pucher, J., Buehler, R. (eds.), *City Cycling*. Cambridge, MA: MIT Press, 2012

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



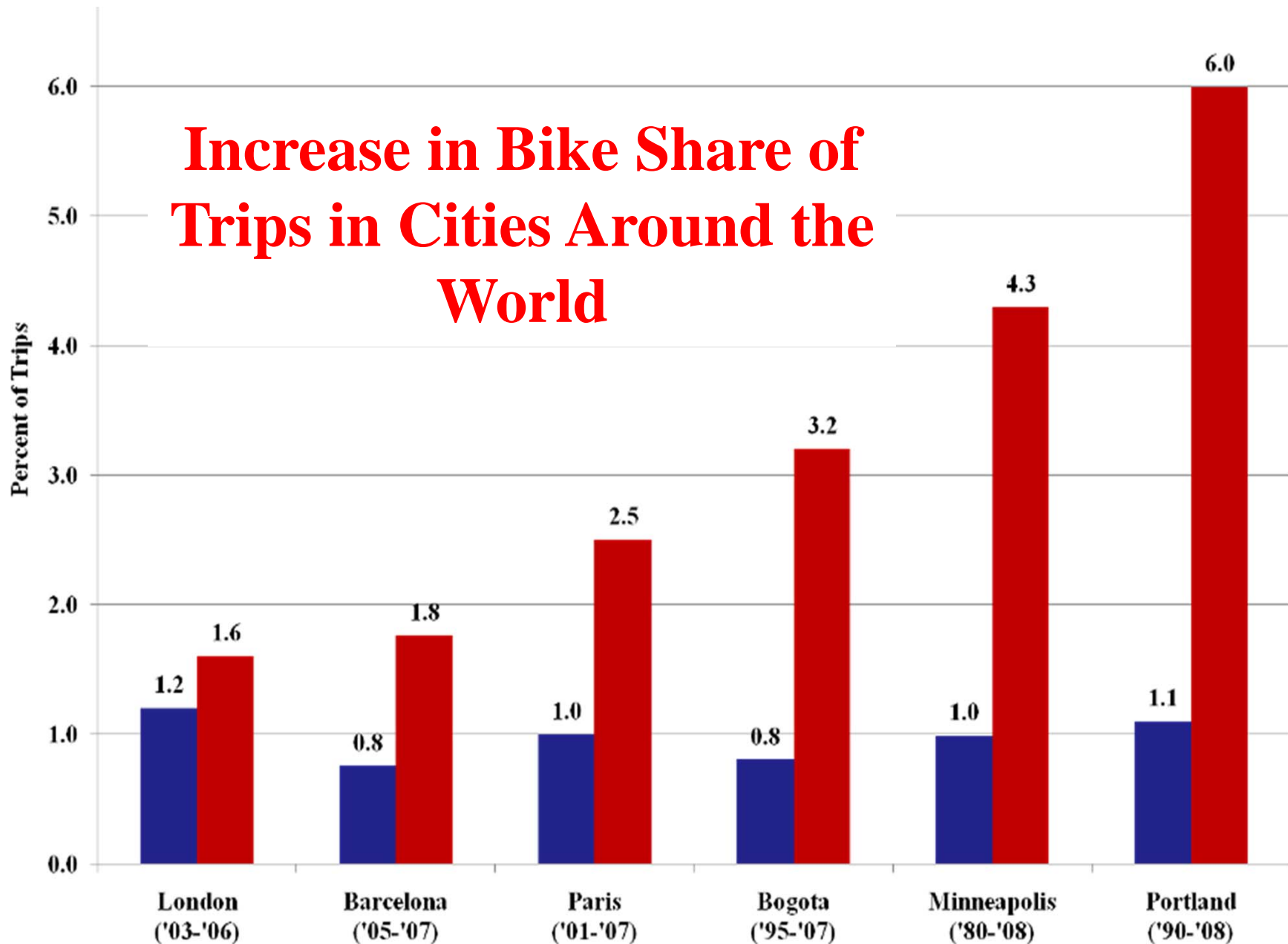
Source: Pucher, J., Buehler, R., Seinen, M. 2011 "Bicycling Renaissance in North America? An Update and Re-Assessment of Cycling Trends and Policies," *Transportation Research A*, Vol. 45, No. 6, pp. 451-475.

## Increase in Bike Share of Trips in Cities Around the World



Source: Pucher et al, "Infrastructure, Programs, and Policies to Increase Bicycling," *Preventive Medicine*, Jan 2010, Vol. 50, S.1, pp. S106-S125.

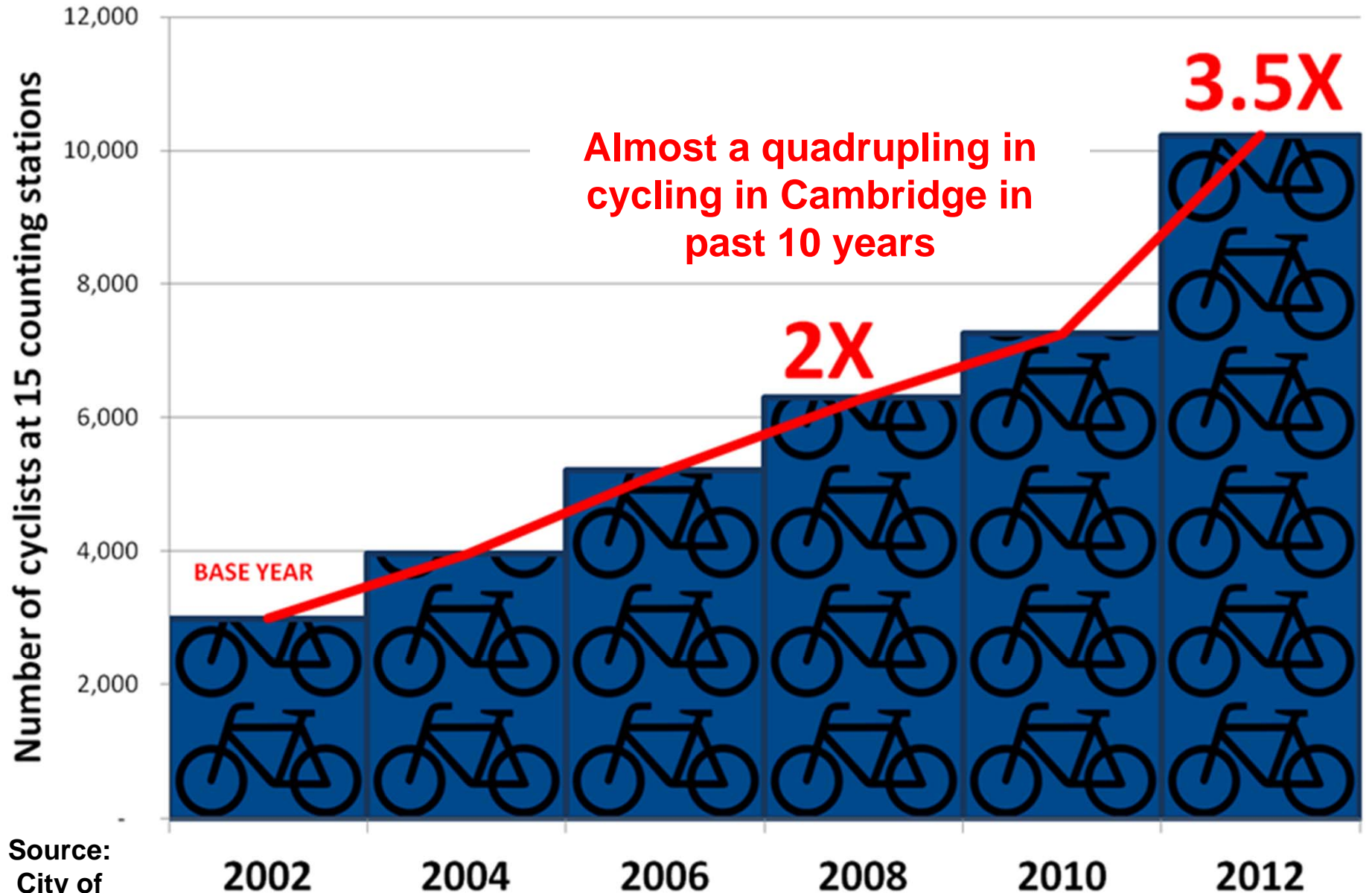
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Source: Pucher et al, "Infrastructure, Programs, and Policies to Increase Bicycling," *Preventive Medicine*, Jan 2010, Vol. 50, S.1, pp. S106-S125.

# Cambridge Bicycle Counts 2002-2012

## Combined AM/PM Peak Hour

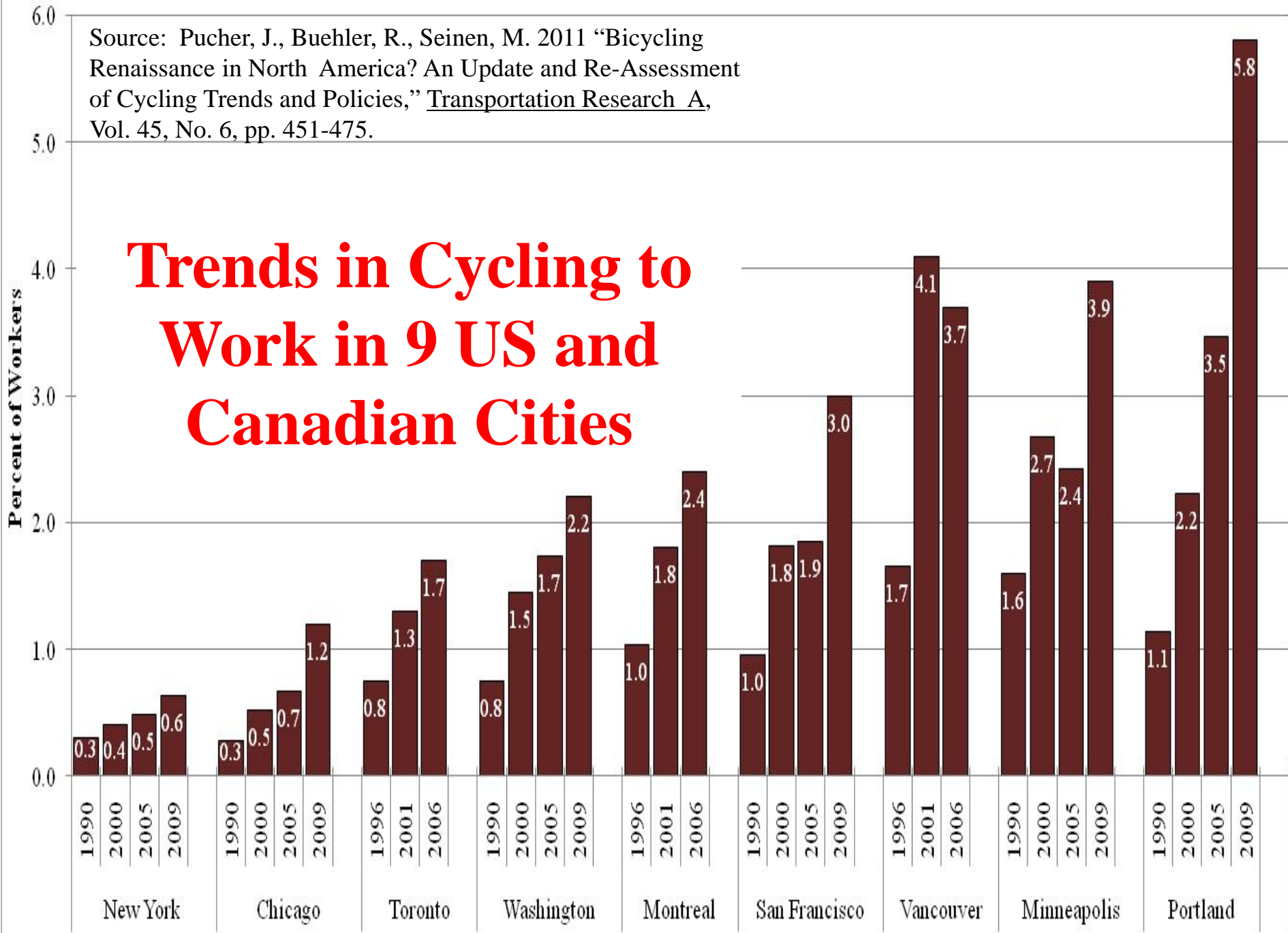


Source:  
City of  
Cambridge



Source: Pucher, J., Buehler, R., Seinen, M. 2011 “Bicycling Renaissance in North America? An Update and Re-Assessment of Cycling Trends and Policies,” *Transportation Research A*, Vol. 45, No. 6, pp. 451-475.

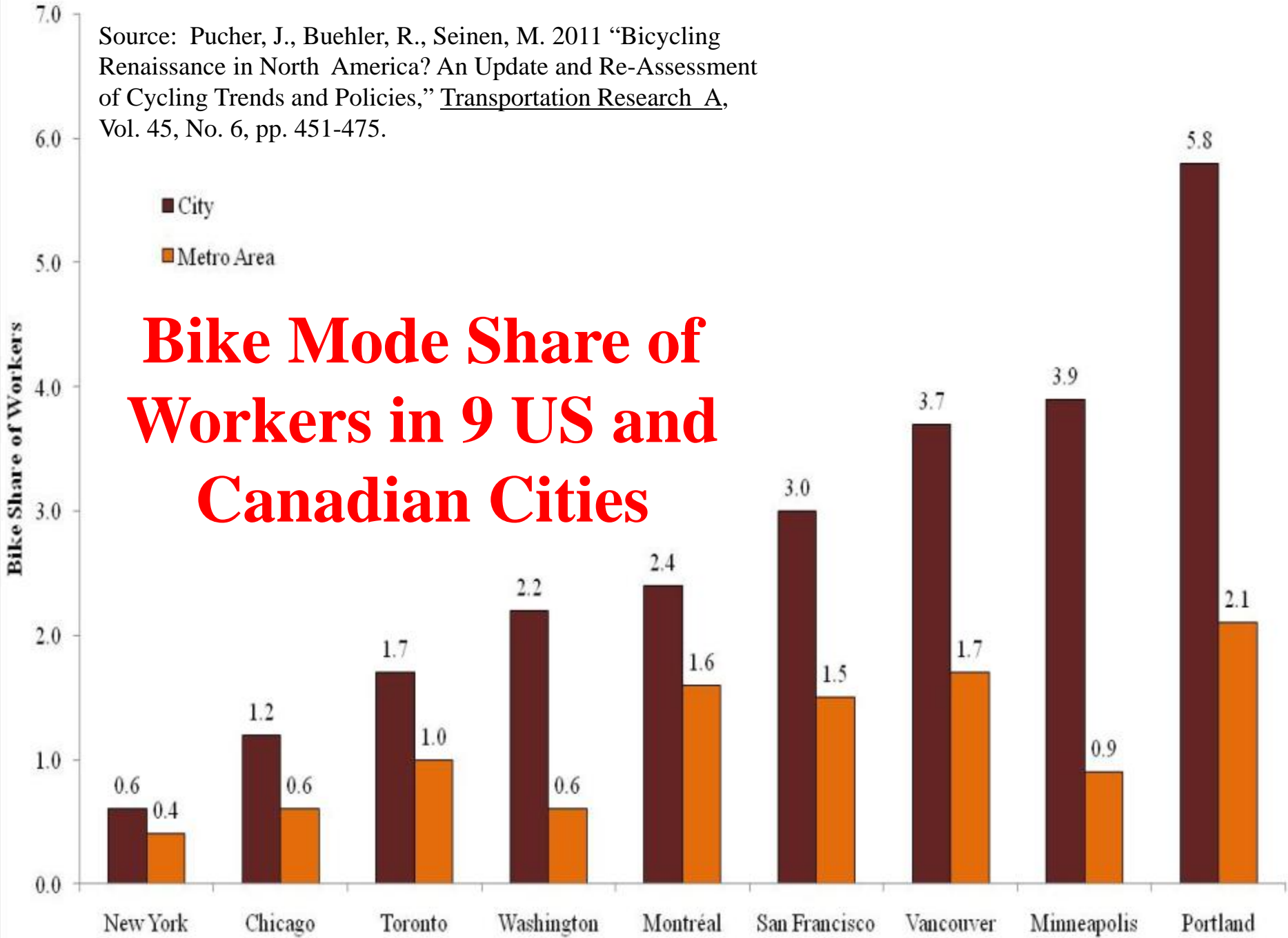
# Trends in Cycling to Work in 9 US and Canadian Cities



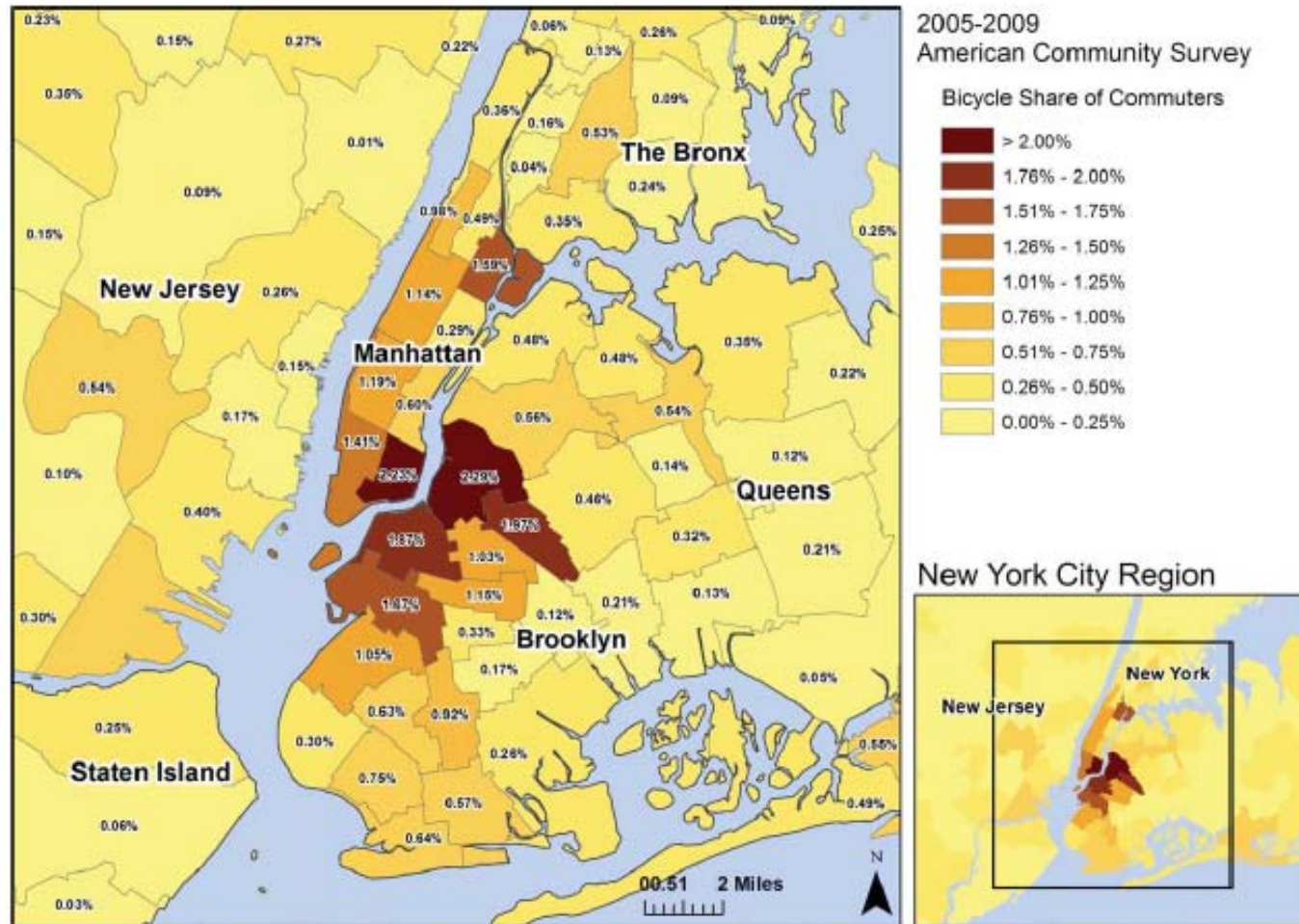


Source: Pucher, J., Buehler, R., Seinen, M. 2011 “Bicycling Renaissance in North America? An Update and Re-Assessment of Cycling Trends and Policies,” Transportation Research A, Vol. 45, No. 6, pp. 451-475.

# Bike Mode Share of Workers in 9 US and Canadian Cities

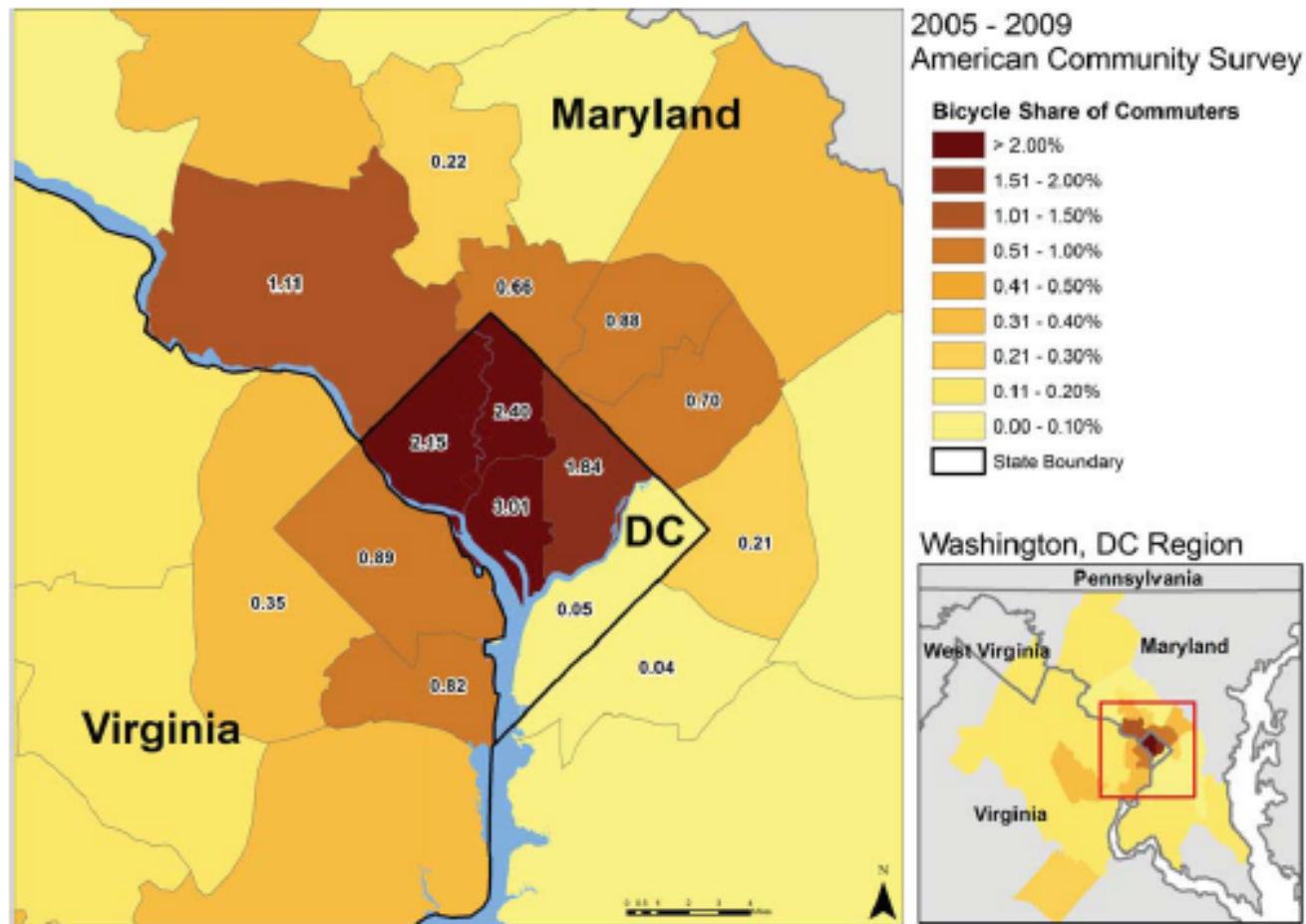


# Spatial Variation in Bicycle Share of Work Commuters in New York City Area, 2005-2009

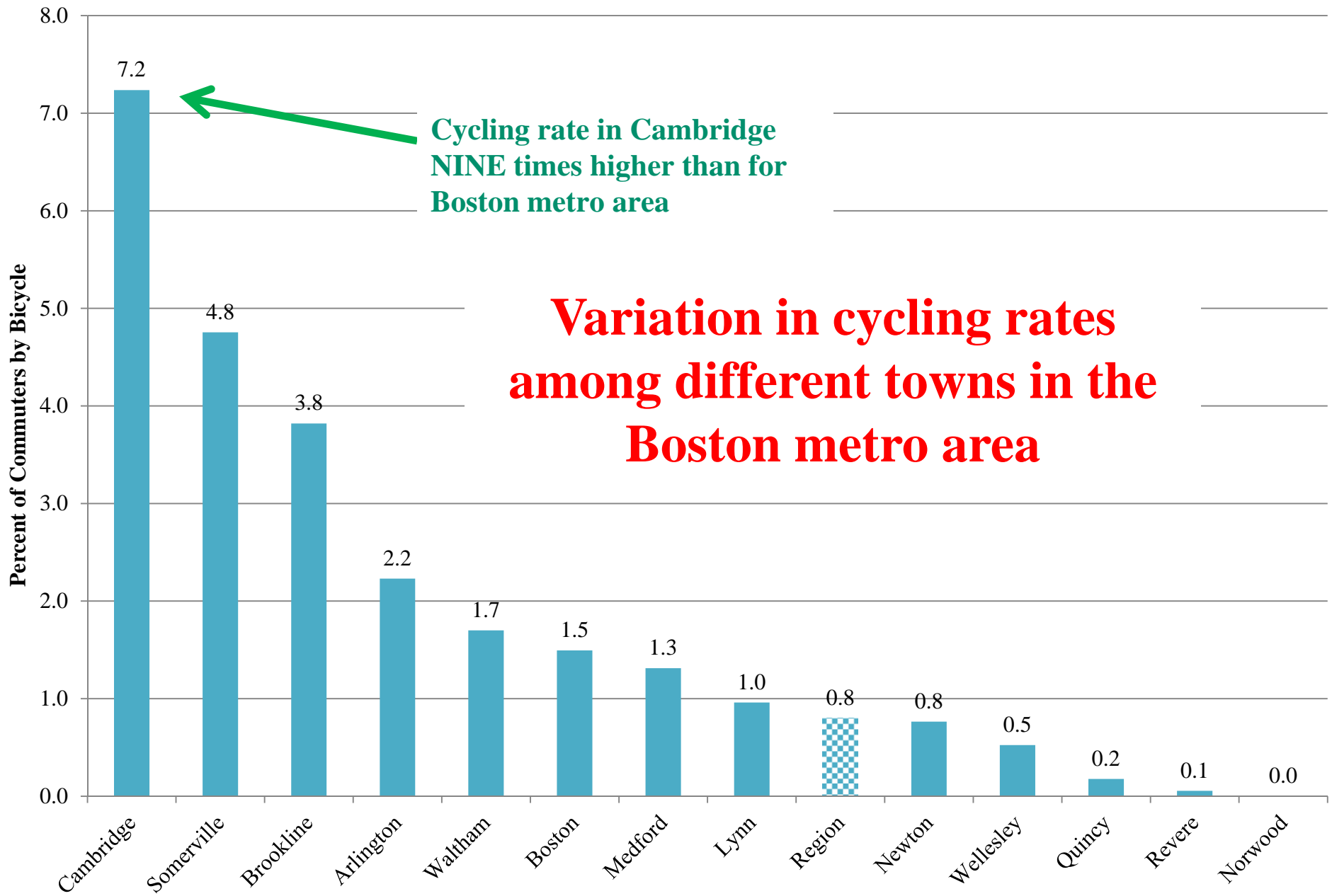


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# Spatial Variation in Bicycle Share of Work Commuters in Washington, D.C. Area, 2005-2009



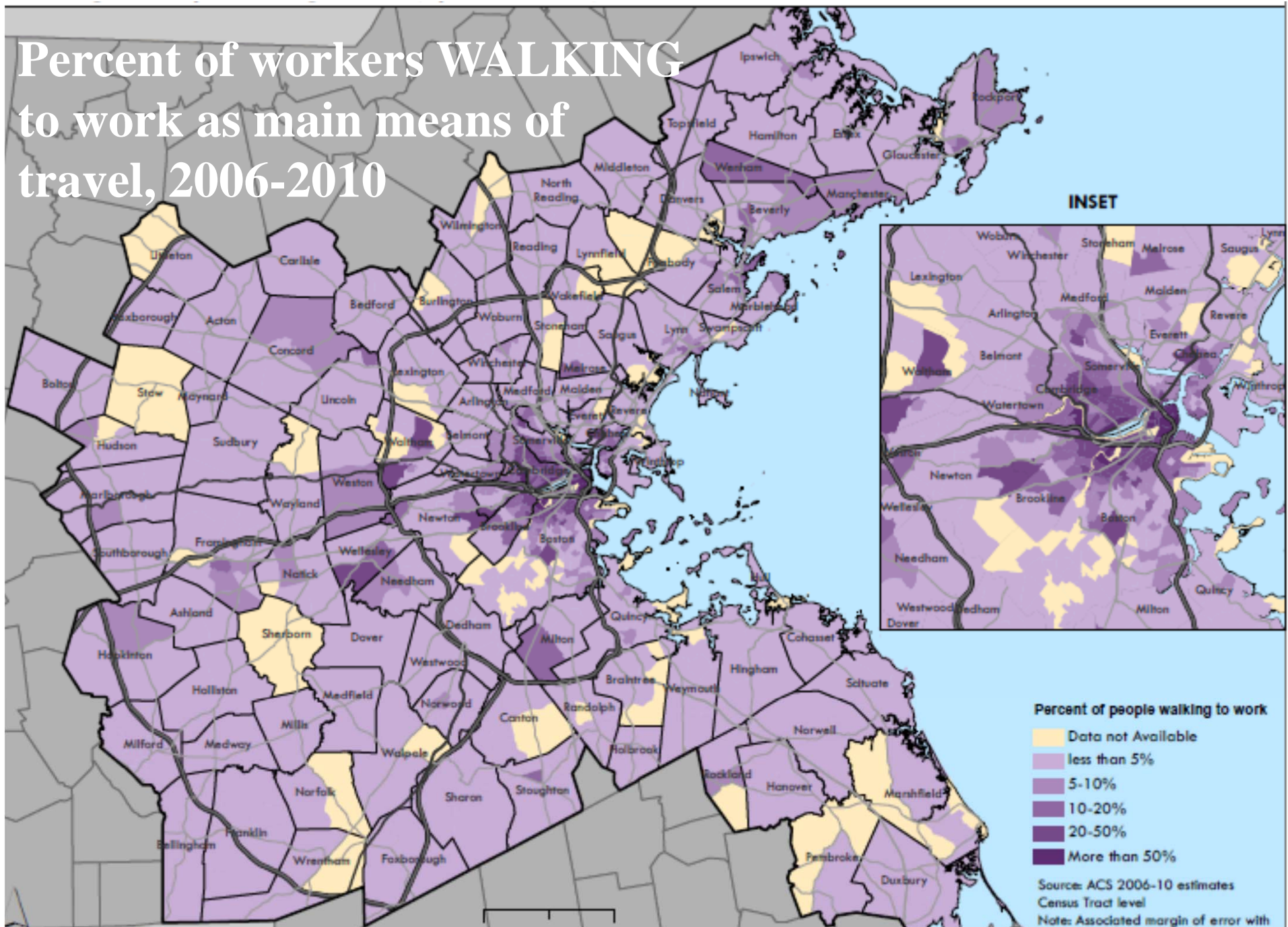
Pucher, J., Buehler, R., Seinen, M. 2011 "Bicycling Renaissance in North America? An Update and Re-Assessment of Cycling Trends and Policies," Transportation Research A, Vol. 45, No. 6, pp. 451-475.



**Source: Calculated by authors from American Community Survey, 2006-2010, US Census Bureau**



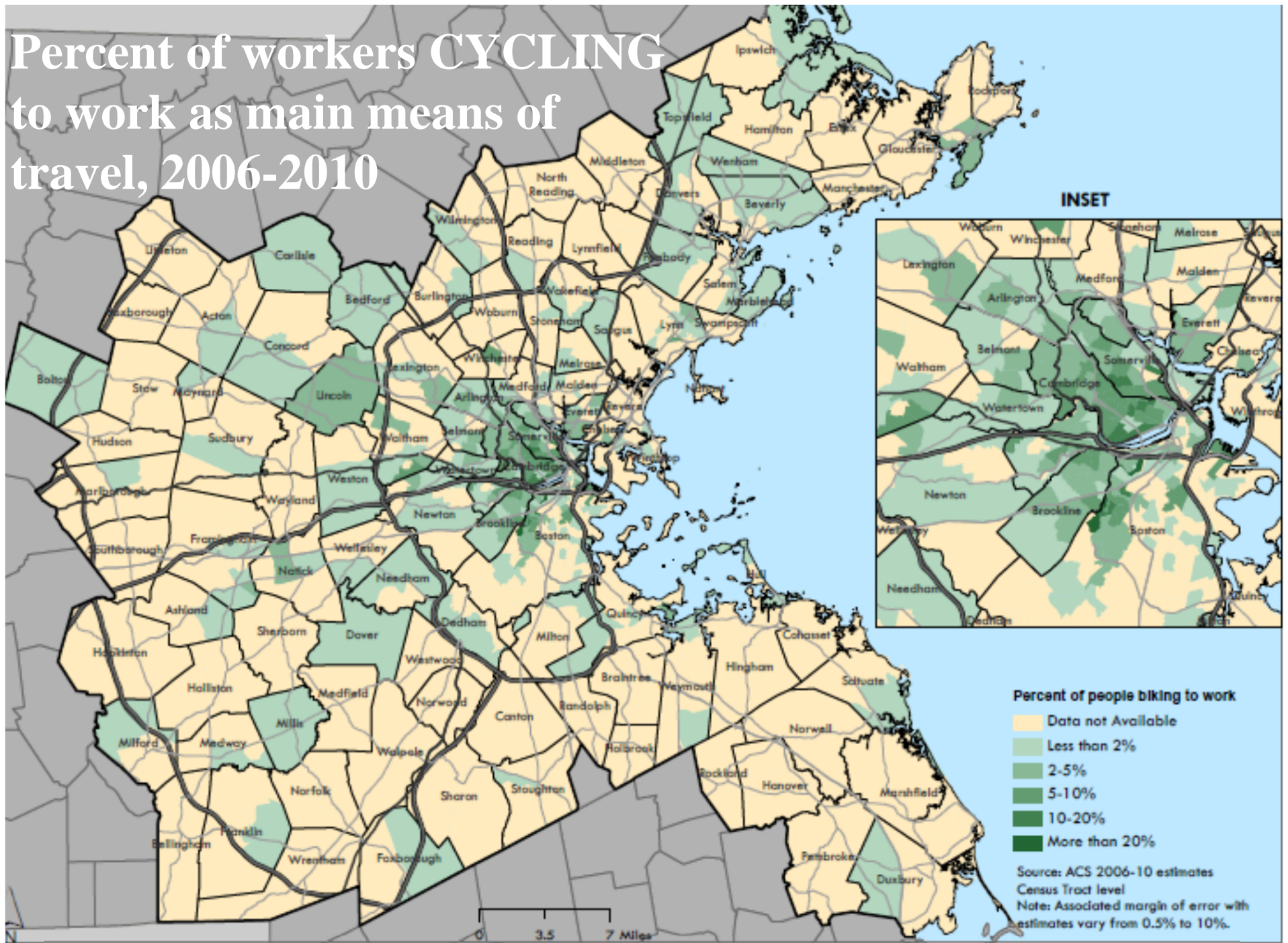
# Percent of workers WALKING to work as main means of travel, 2006-2010



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



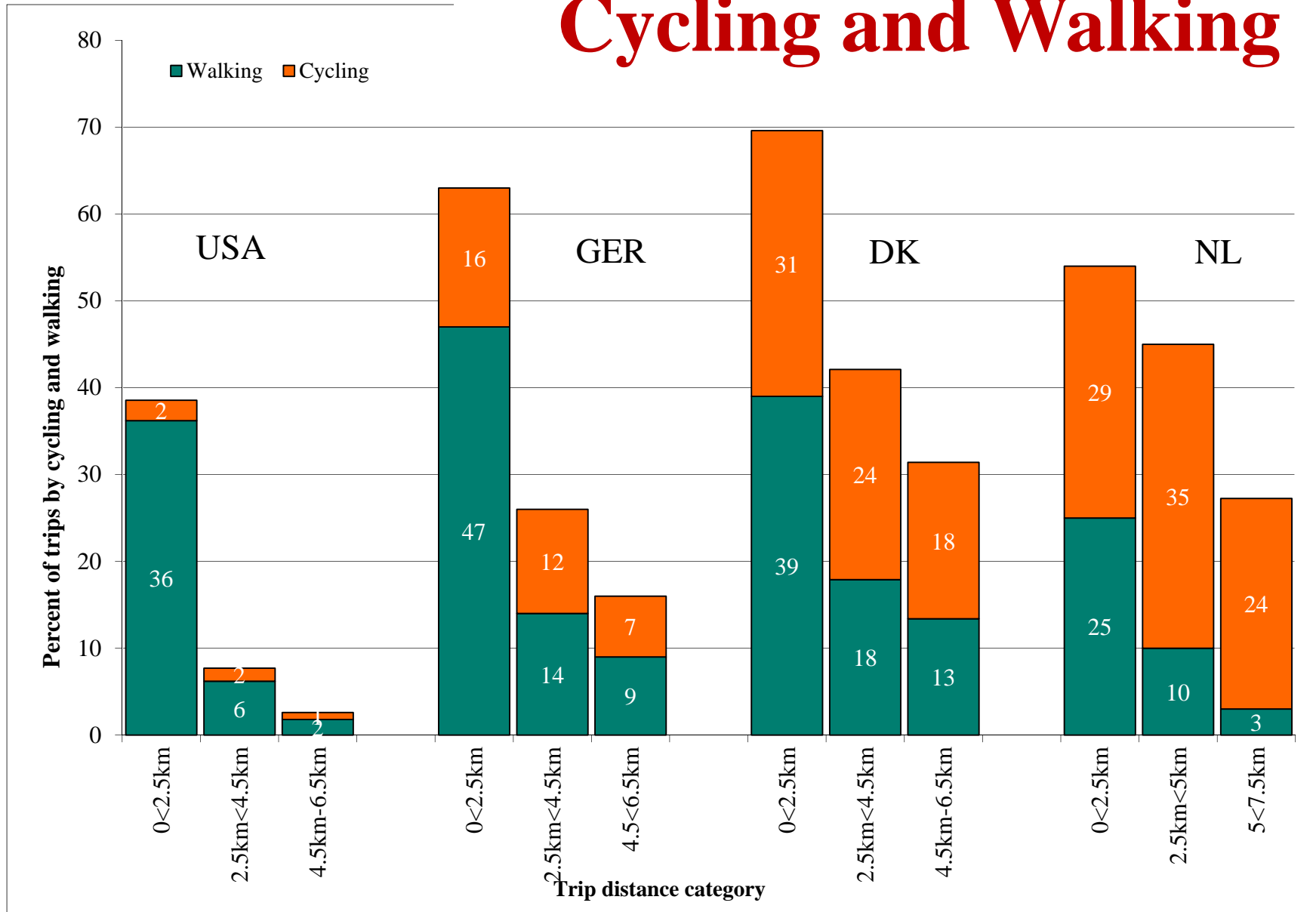
# **Lots of Potential for Increased Walking and Cycling:**

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**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**

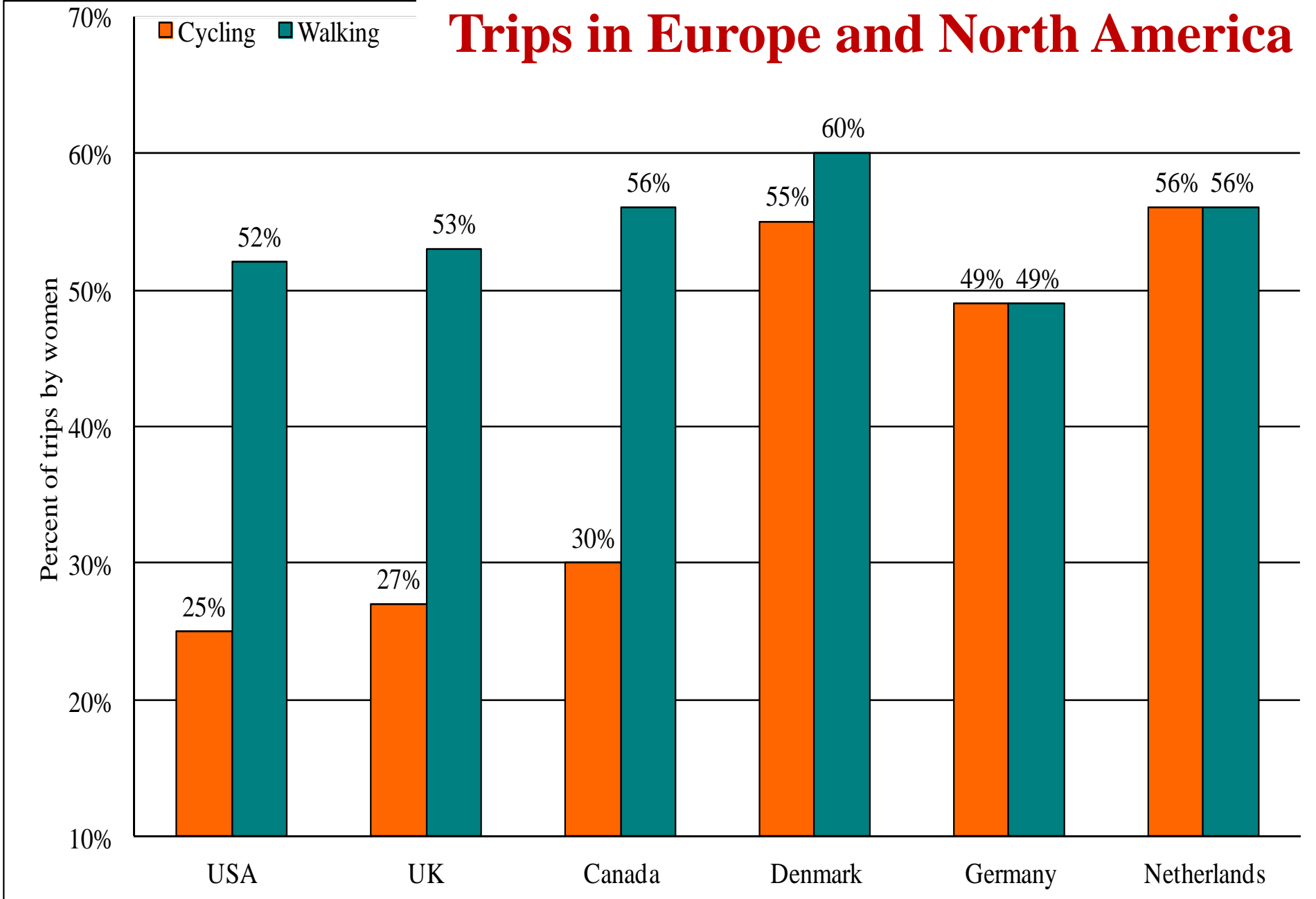
# Share of Short Trips by Cycling and Walking

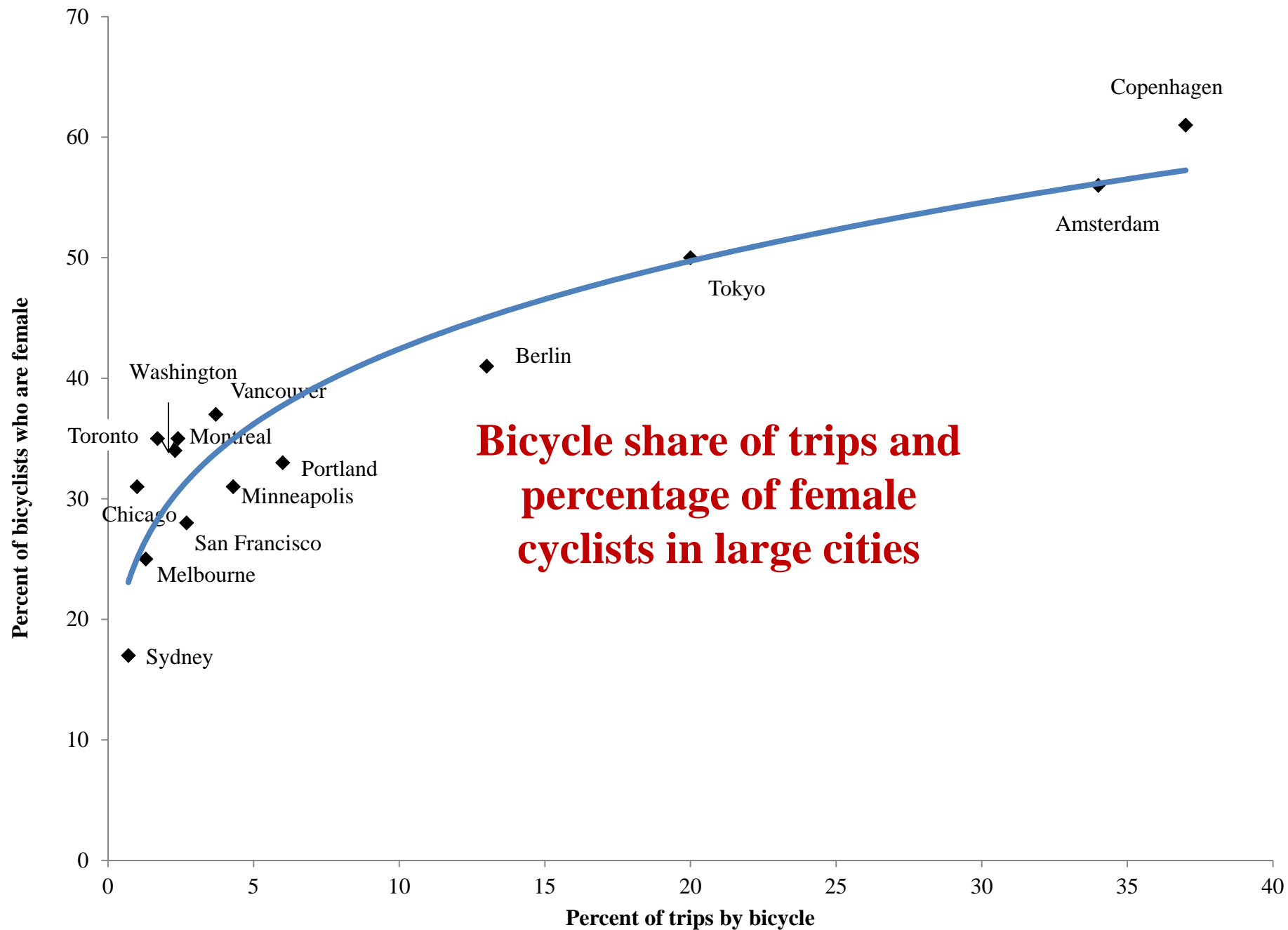


# Europeans cycle for many trip purposes

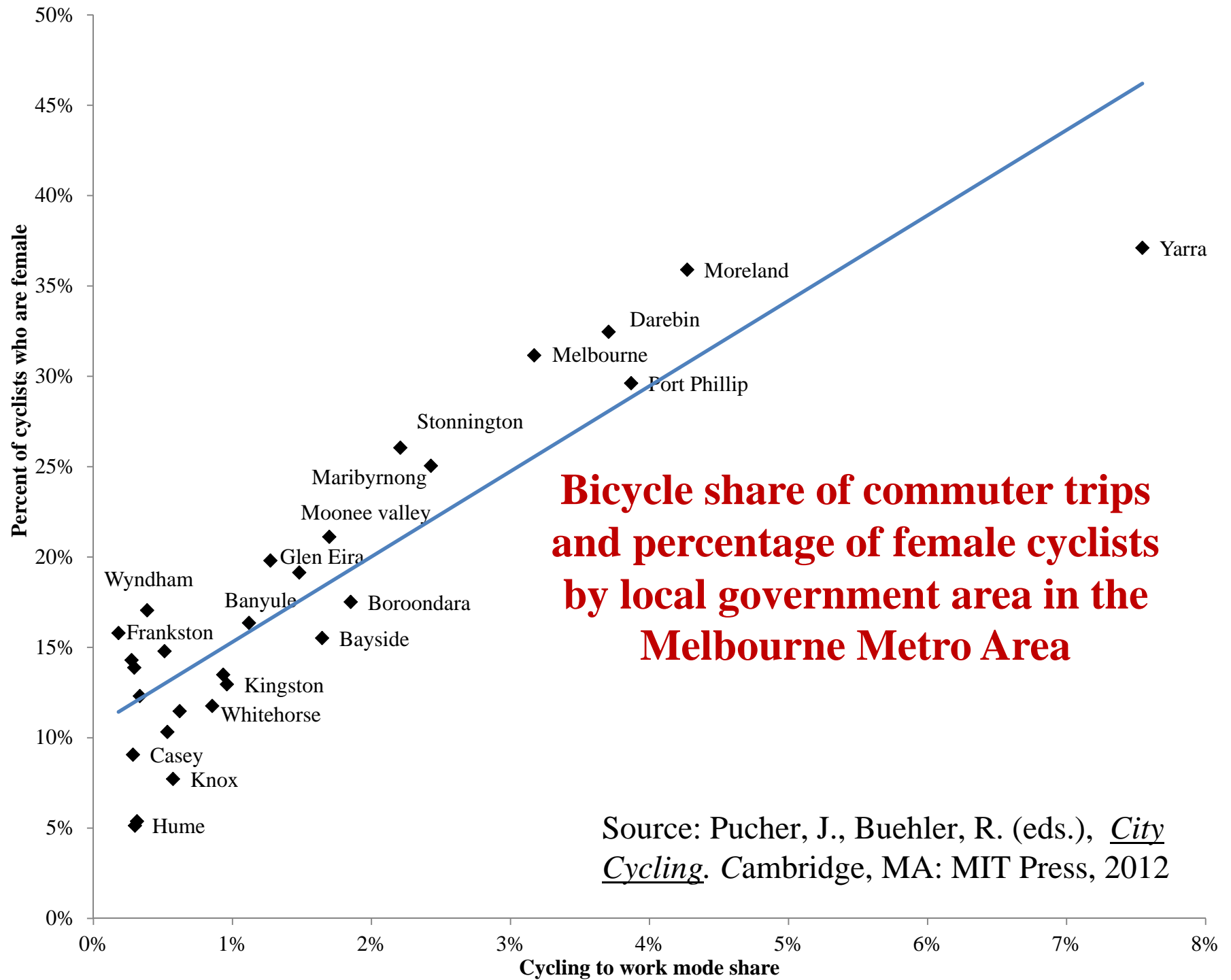


# Women's Share of Bike and Walk Trips in Europe and North America





Source: Pucher, J., Buehler, R. (eds.), *City Cycling*. Cambridge, MA: MIT Press, 2012



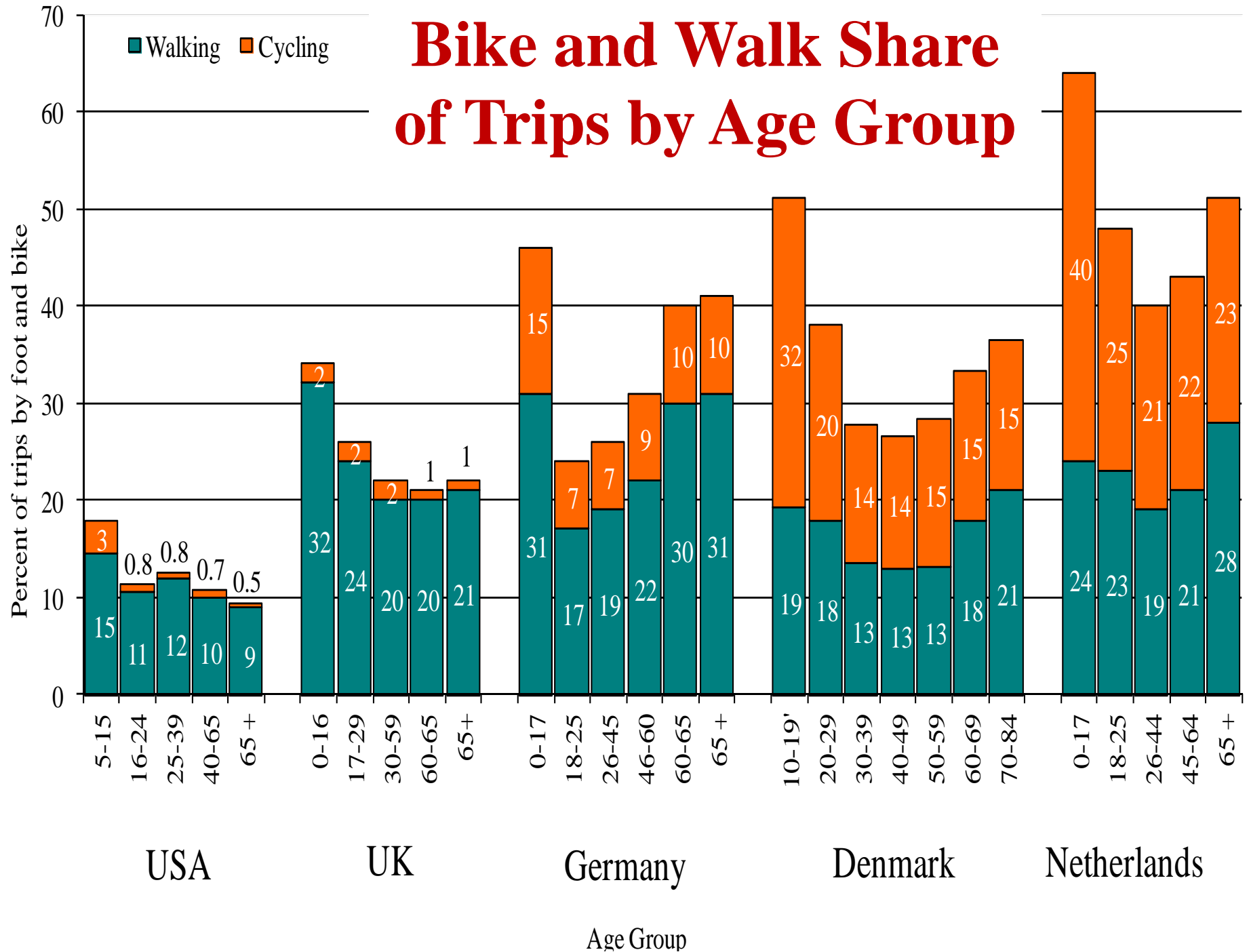




**55% of all bike trips in  
Denmark are by women**

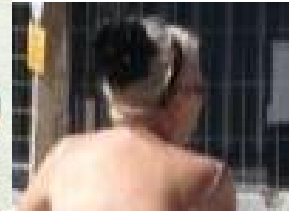
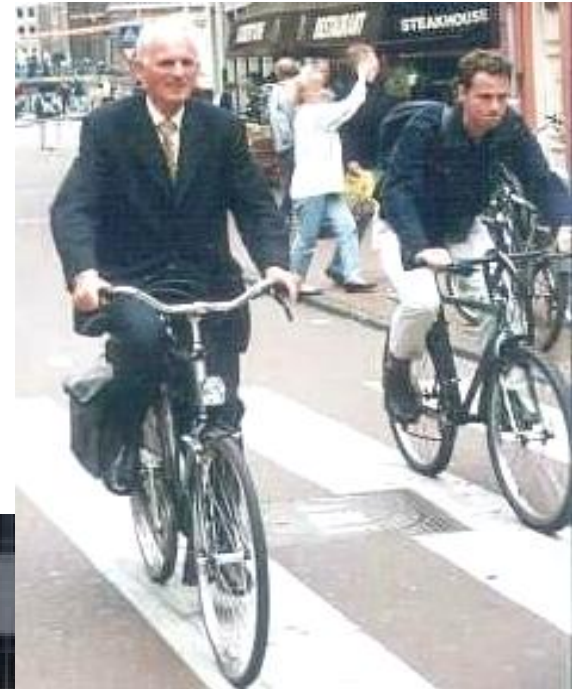
Source: Susan Handy

# Bike and Walk Share of Trips by Age Group





# Cycling for all ages

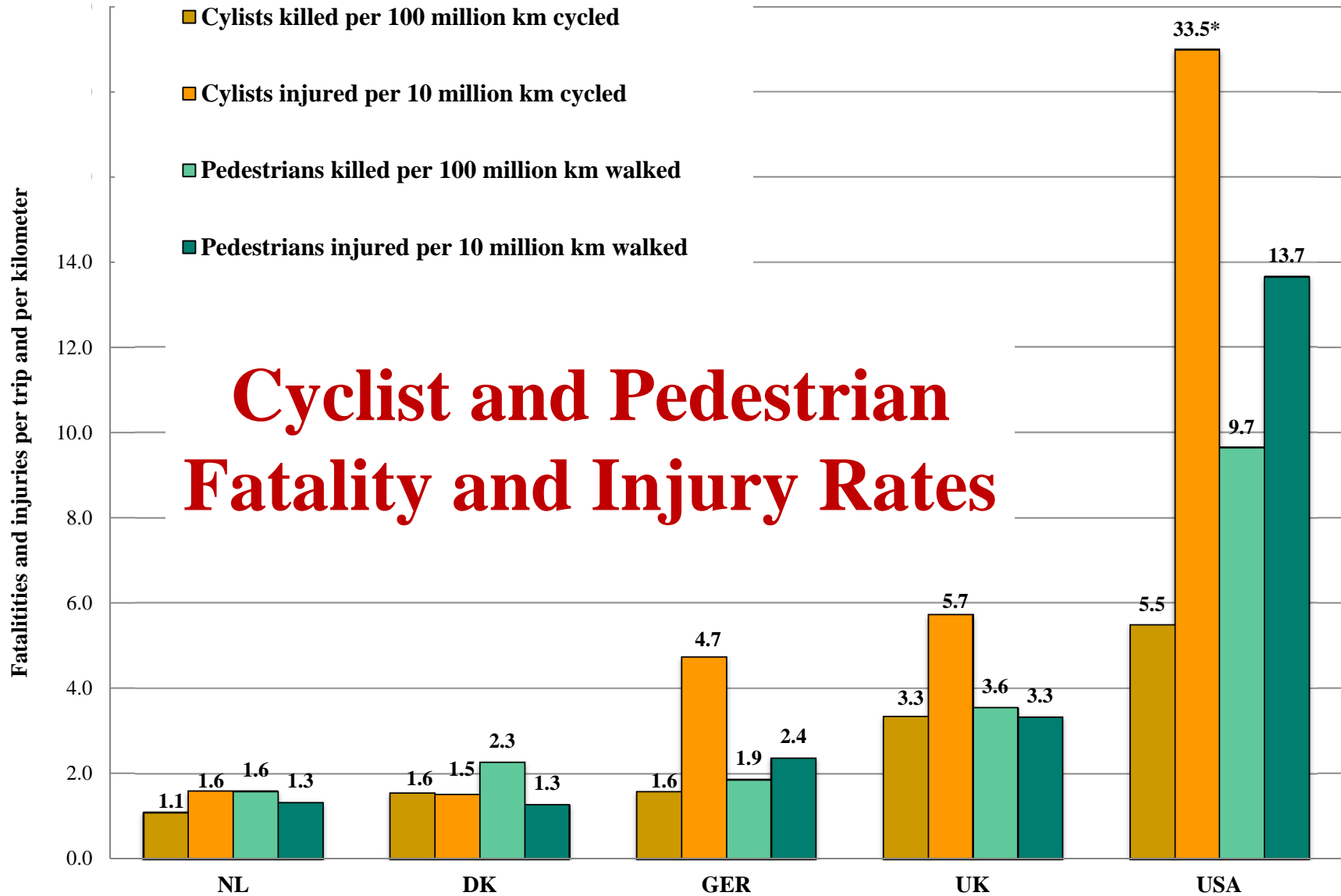


# **Make Walking and Cycling Safe for Everyone !**

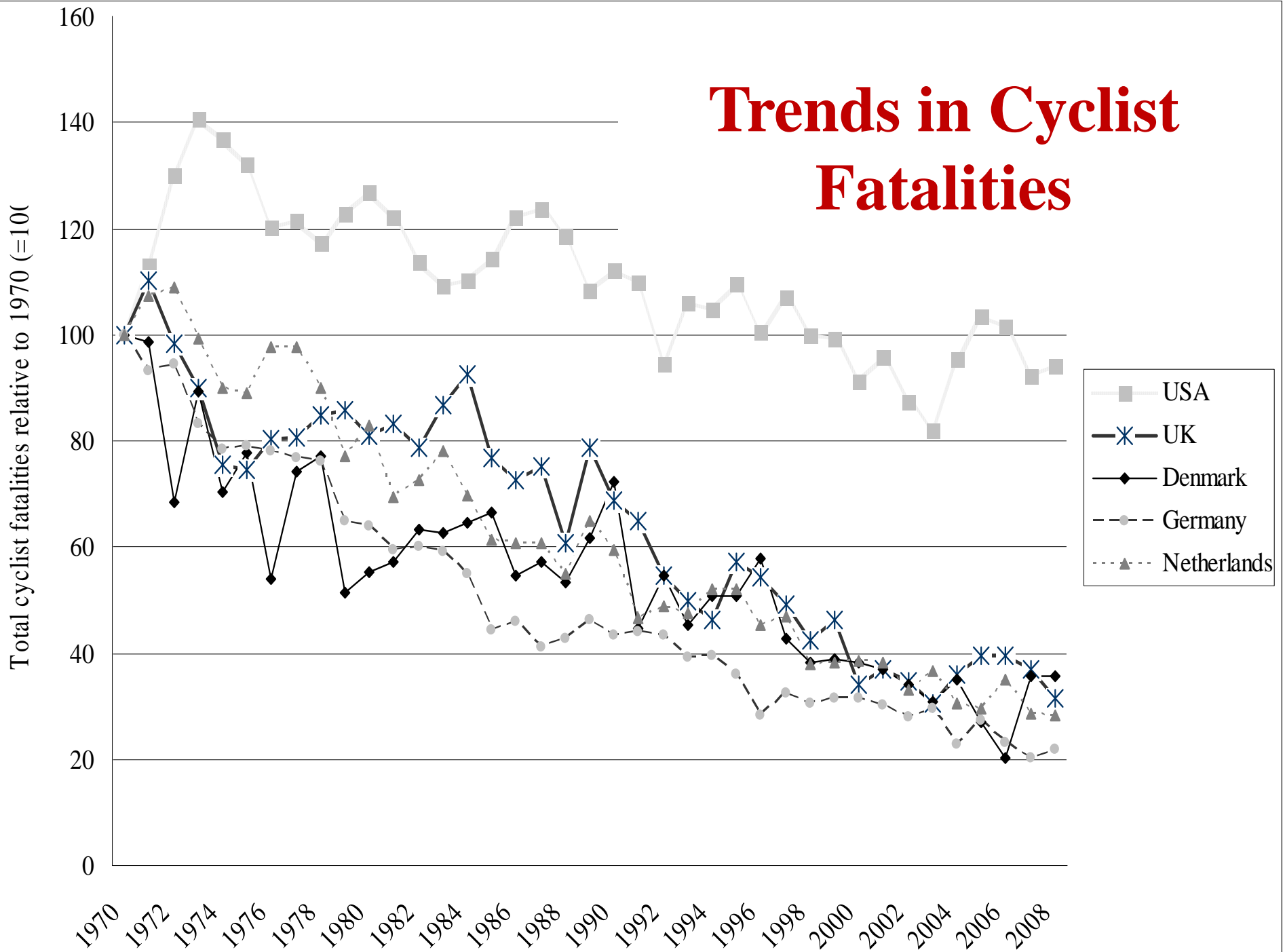
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- Especially important for the young, the old, for anyone with disabilities, for the timid or risk-averse**
- Women more sensitive to safety than men**
- Safety of walking and cycling in the Netherlands, Denmark, and Germany helps explain high levels of walking and cycling there**

# Cyclist and Pedestrian Fatality and Injury Rates

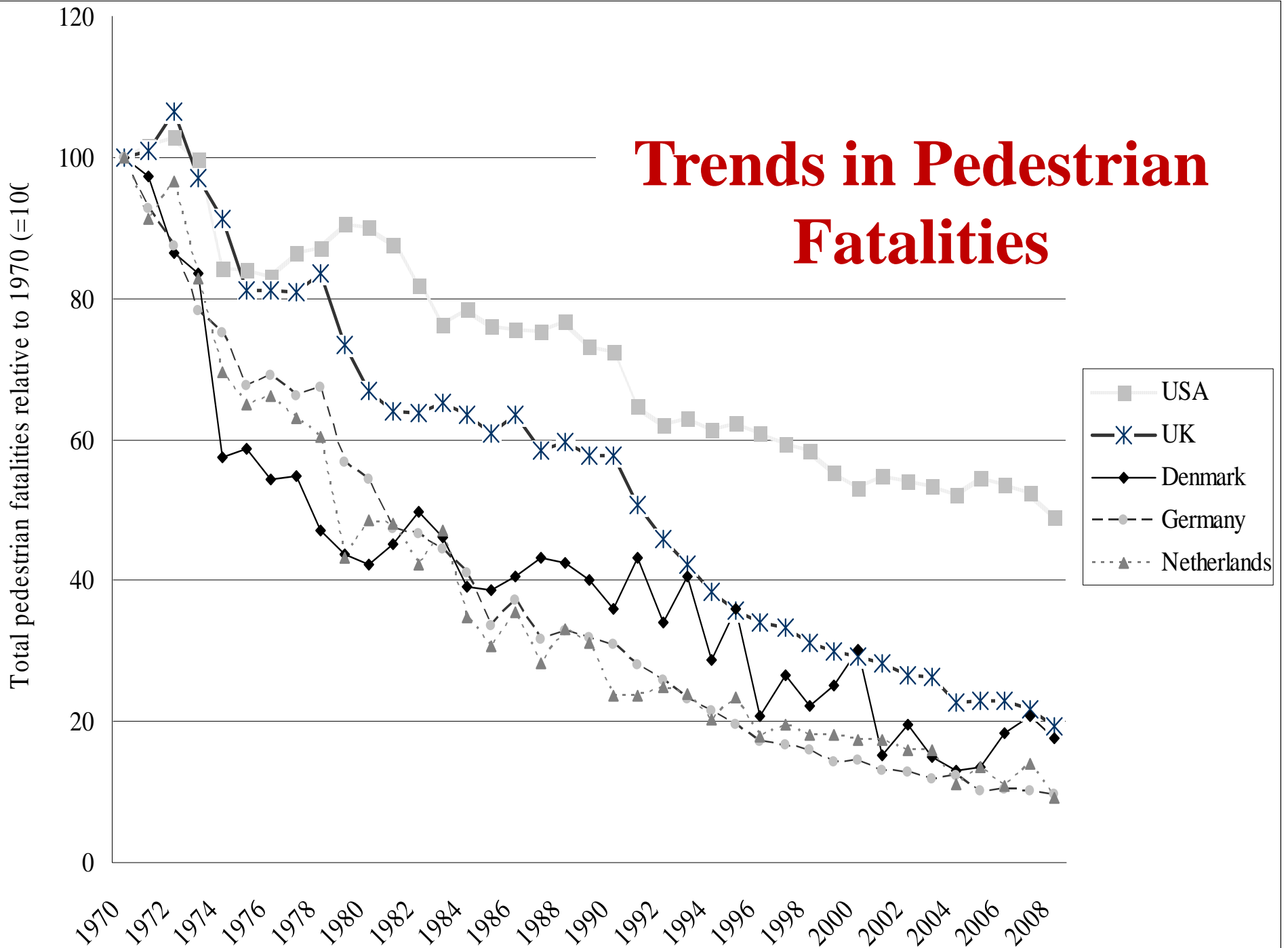


# Trends in Cyclist Fatalities





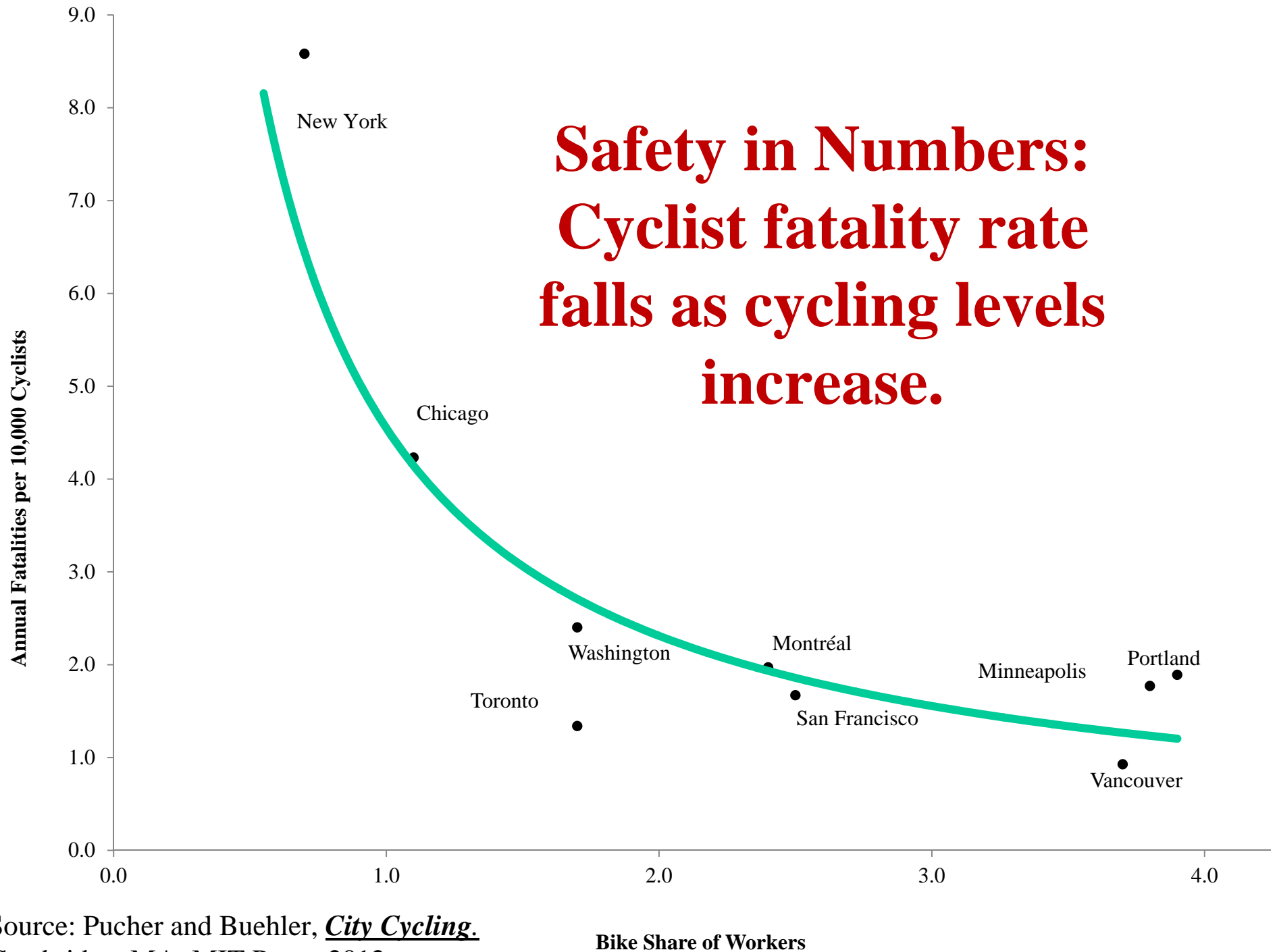
# Trends in Pedestrian Fatalities



## **SAFETY IN NUMBERS**

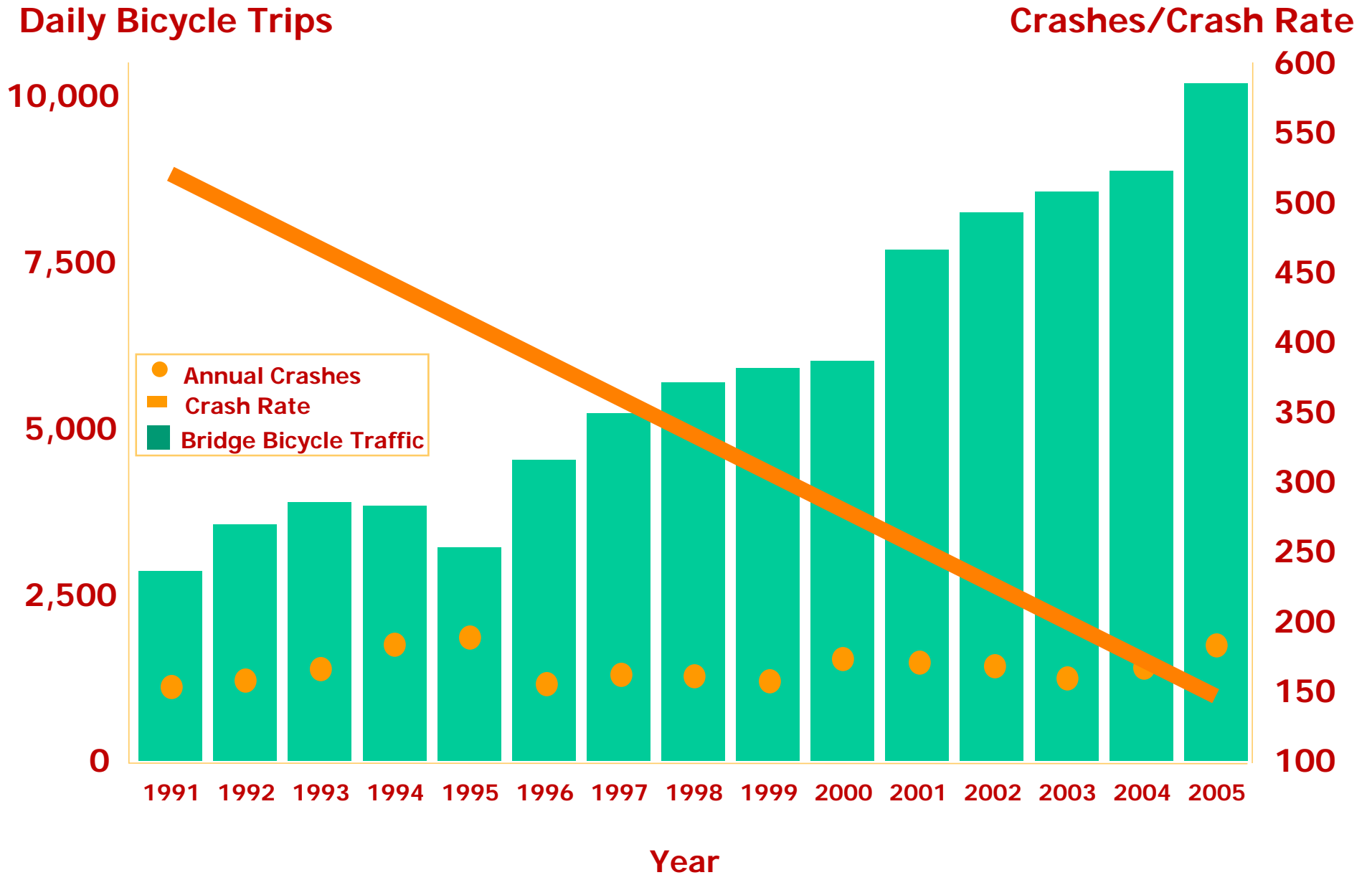
- *As levels of cycling increase, injury and fatality rates per trip and per km traveled fall dramatically*
- *Thus, if we can increase cycling, it will almost inevitably be safer*

# Safety in Numbers: Cyclist fatality rate falls as cycling levels increase.



Source: Pucher and Buehler, *City Cycling*.  
Cambridge, MA: MIT Press, 2012

# Decreasing Crash Rate in Portland





# Public Policies Crucial to Walking and Cycling

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- **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







Livable Streets Alliance

**Longfellow Bridge: Great view but abominable conditions for pedestrians and cyclists.**

What this crossing *should*  
look like!



Livable Streets Alliance

**Improved crossing for pedestrians and cyclists on Longfellow Bridge**



# How to Encourage More Cycling and Walking while Improving Safety

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- **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

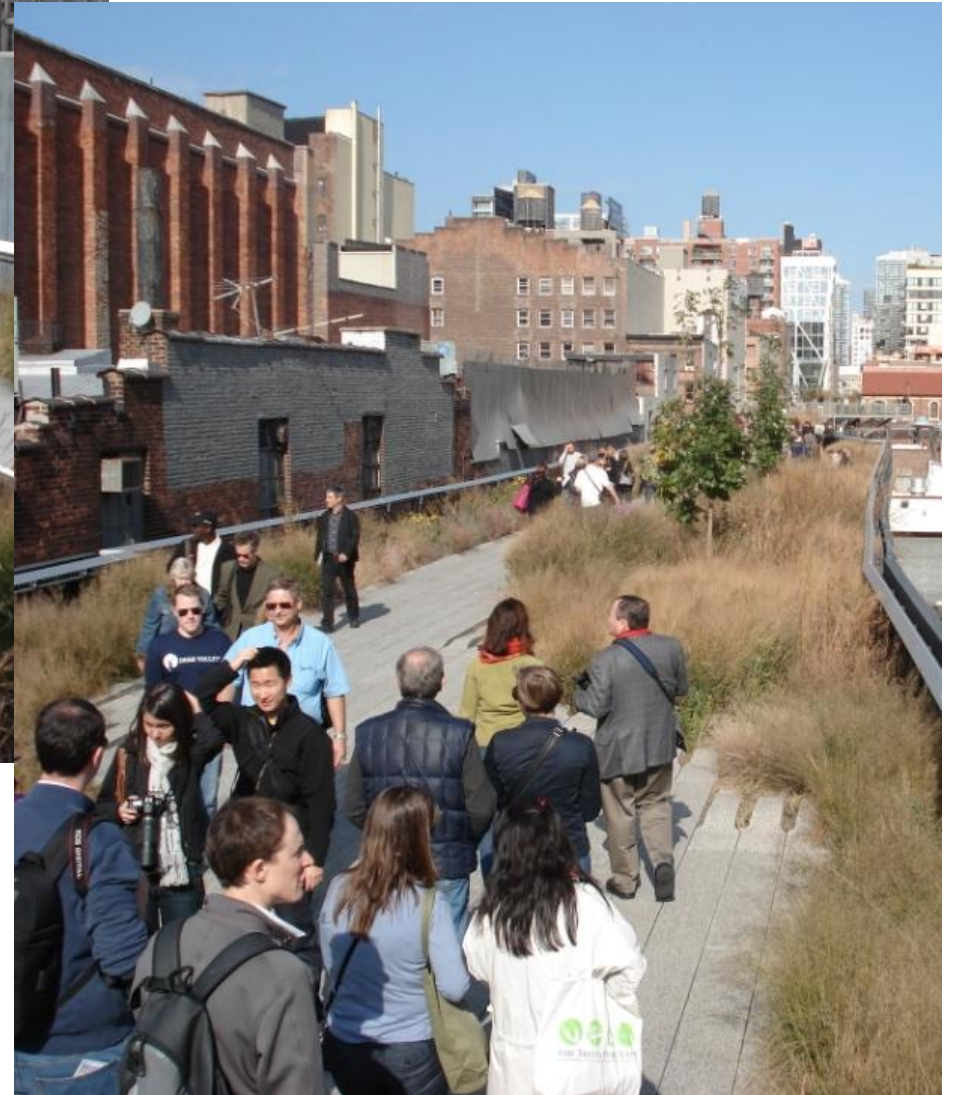


**Times Square**  
**Herald Square**



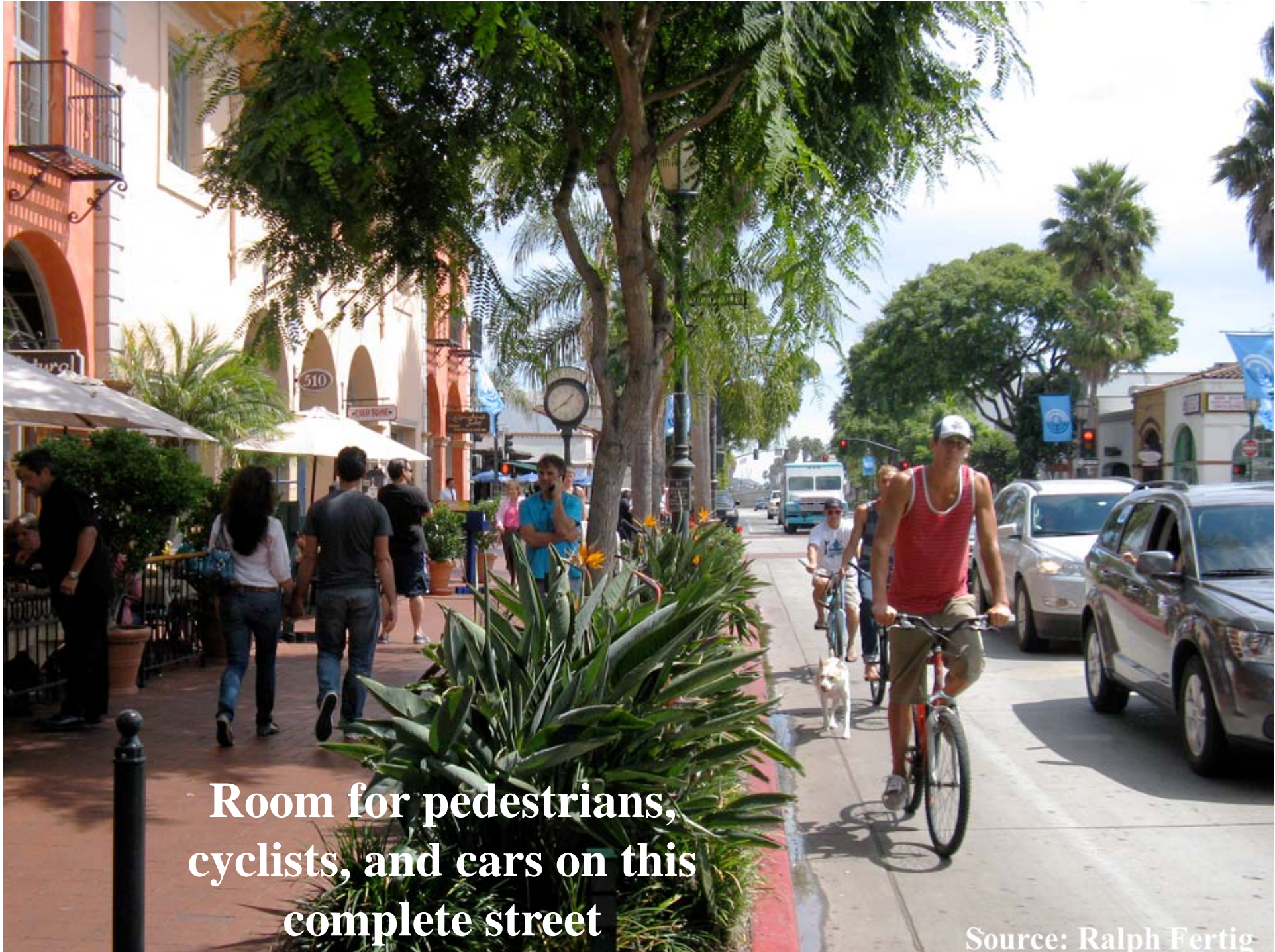


# High Line in New York City



...from an abandoned freight  
line to a popular promenade...





**Room for pedestrians,  
cyclists, and cars on this  
complete street**

Source: Ralph Fertig



A photograph of a coastal path in Santa Barbara, California. The path is paved and runs parallel to a road on the left and a grassy area on the right. Two cyclists are riding away from the camera on the path. The path is lined with tall palm trees and other vegetation. In the background, there are mountains under a clear blue sky. The overall scene is bright and sunny.

**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





Source: City of Cambridge

# **Minuteman Trail north of Boston**

**Second most popular recreational trail in the country**





**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



Source: Peter Furth

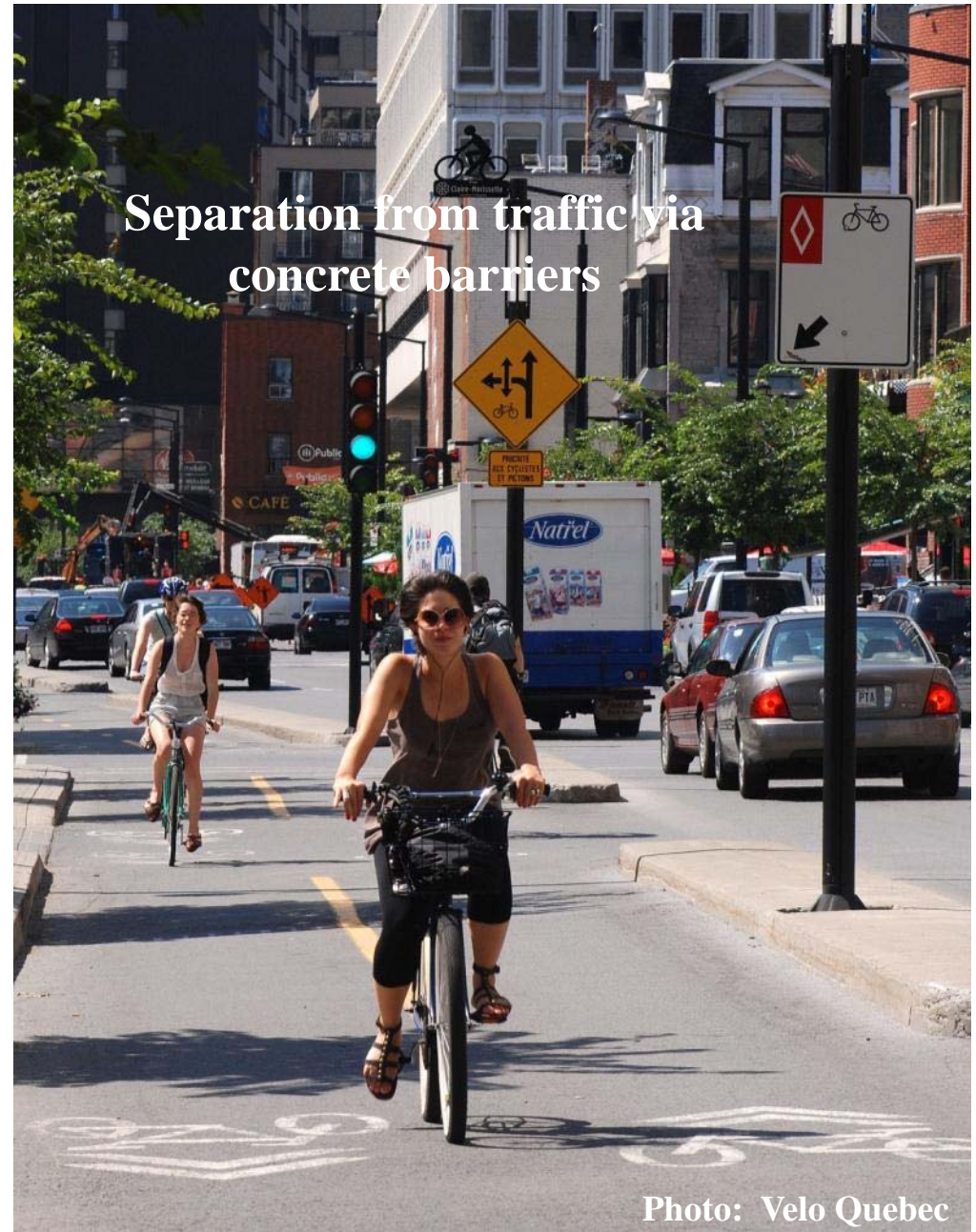
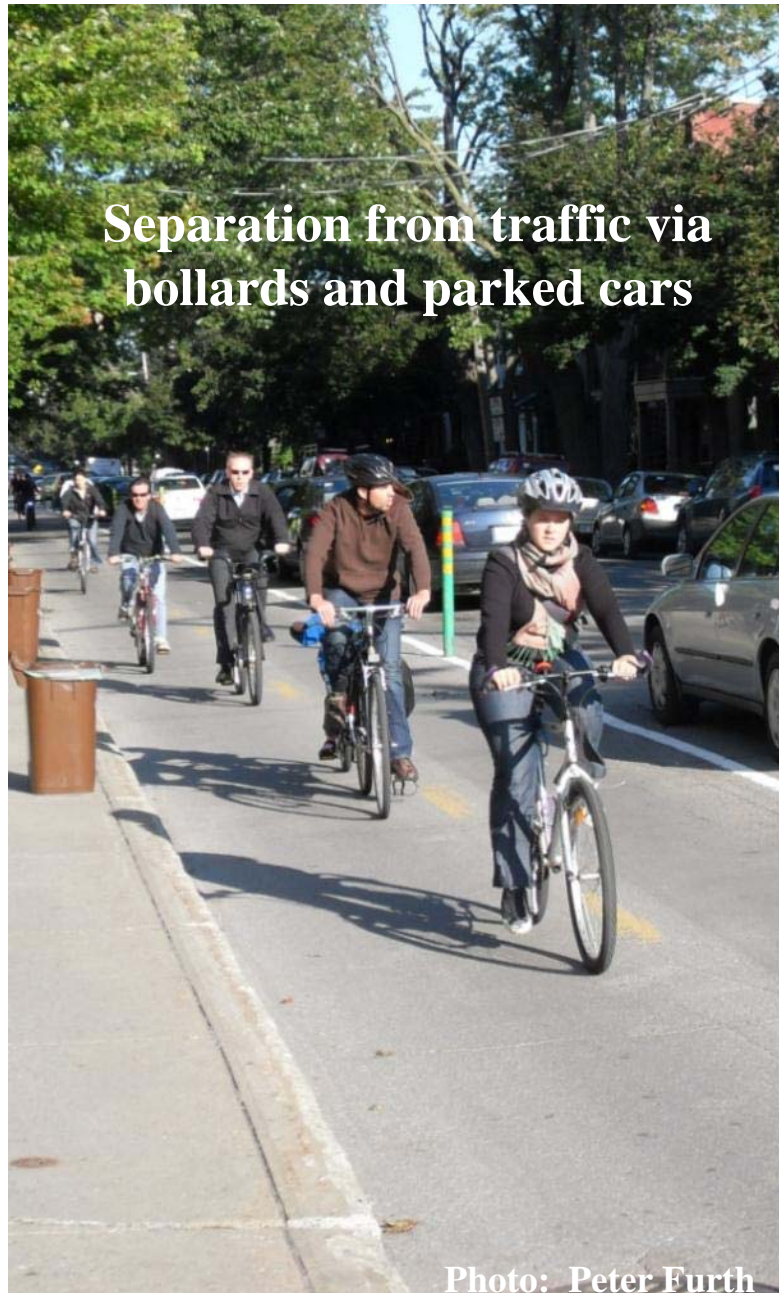
# Dutch bicycle facility selection matrix

Lane Configuration	Average daily traffic (vehicles / day)	Street type and speed limit			
		Urban local street 30 km/h (19 mph)	Urban through street 50 km/h (31 mph)	Rural local road 60 km/h (37 mph)	Fast traffic road 70+ km/h (44+ mph)
2-way traffic with no centerline	≤ 2500	mixed traffic <sup>1</sup>	bike lane <sup>2</sup> or cycletrack <sup>3</sup>	advisory bike lane <sup>4</sup>	cycle track or low-speed service road
	2000 to 3000			bike lane <sup>2</sup> or cycle track <sup>5</sup>	
	3000 to 5000				
	> 4000	bike lane or cycle track			
2 lanes (1+1)	any	bike lane or cycle track	bike lane or cycle track <sup>3</sup>		
4 lanes (2 + 2) or more	any	(does not exist)	cycle track or low speed service road		

Source: Peter Furth, "Cycling Infrastructure," in Pucher and Buehler, eds. *City Cycling*, MIT Press, 2012.



# Almost 100km of 2-way cycle tracks in Montreal






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



Photo: Velo Quebec





Source: Vélo Québec

**... and here on their way back up**



# Bi-directional cycle track and bike sharing near metro station in Montréal



Metro station

BIXI bike docking station

Cycle track

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

Photo: NYC DOT

**Traffic-protected cycle track on 9<sup>th</sup> 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**



Source: City of Cambridge



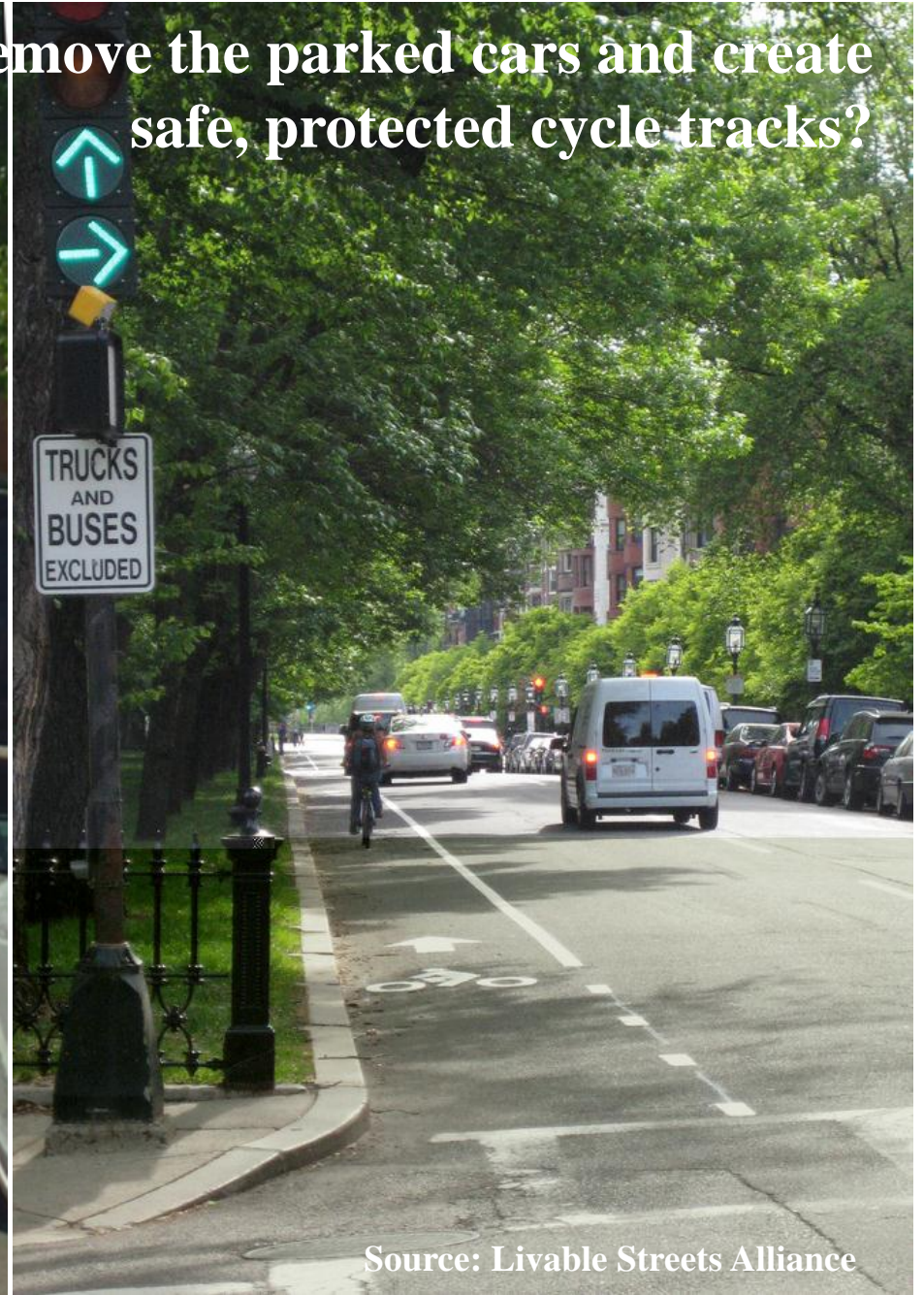
**Planned cycle track and pedestrian improvements on Western Ave, Cambridge**



Why not remove the parked cars and create safe, protected cycle tracks?



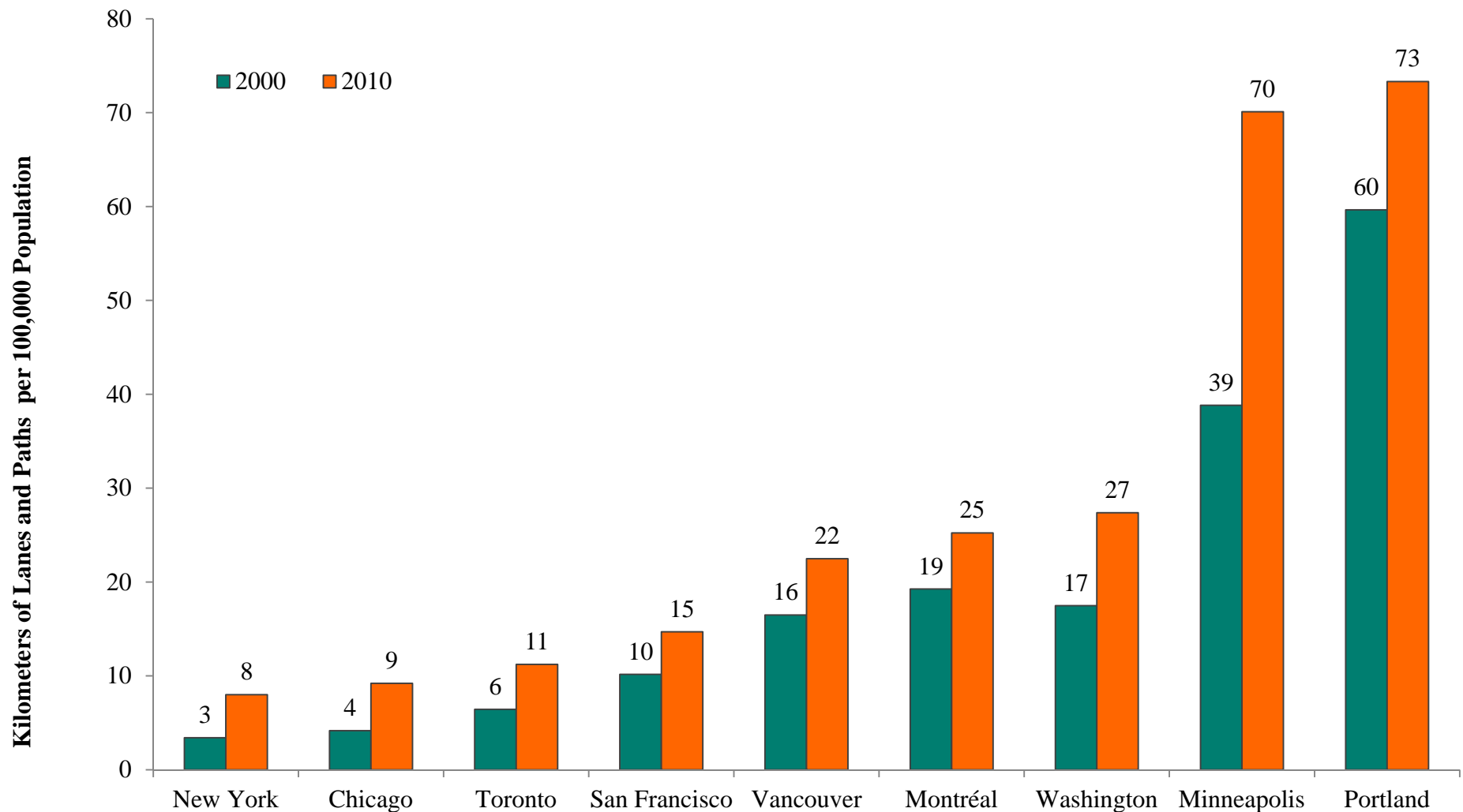
Source: Livable Streets Alliance



Source: Livable Streets Alliance

## **Bike lanes on Beacon Street and Commonwealth Avenue, Boston**

# Trend in Bike Paths and Lanes per 100,000 Population in Nine Large North American Cities, 2000-2010





**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

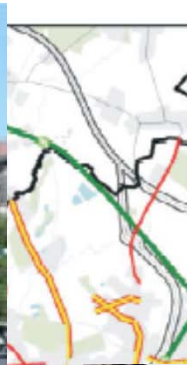




**Crucial provisions for cyclists and pedestrians on bridges even during construction as here in Montreal**

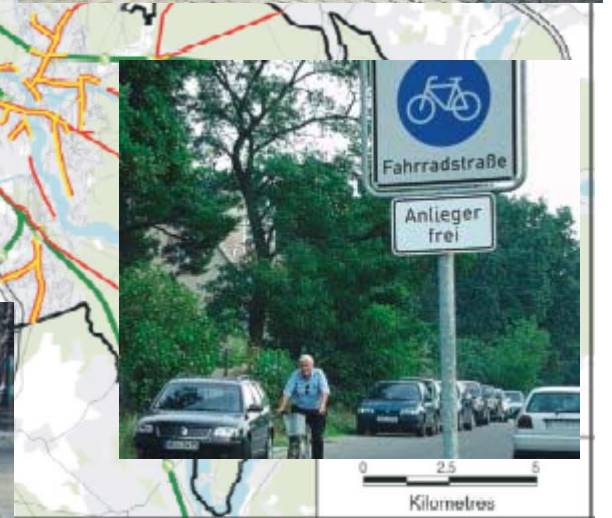
Source: Velo Quebec





most paths, and in parks where signposted accordingly

**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







Source: Velo Quebec

**Superb bike crossing at busy intersection in Montreal**



# **Red bike lanes for intersection crossings, connected with red brick sidepaths on both sides of every road**



**Muenster, Germany**





# Bike boxes and advance stop lines







**Raised curb  
protects  
bike path  
from cars**

**Green wave  
for *cyclists* in  
Odense,  
Denmark**

Troels Andersen, "Cycling in Odense, Denmark"



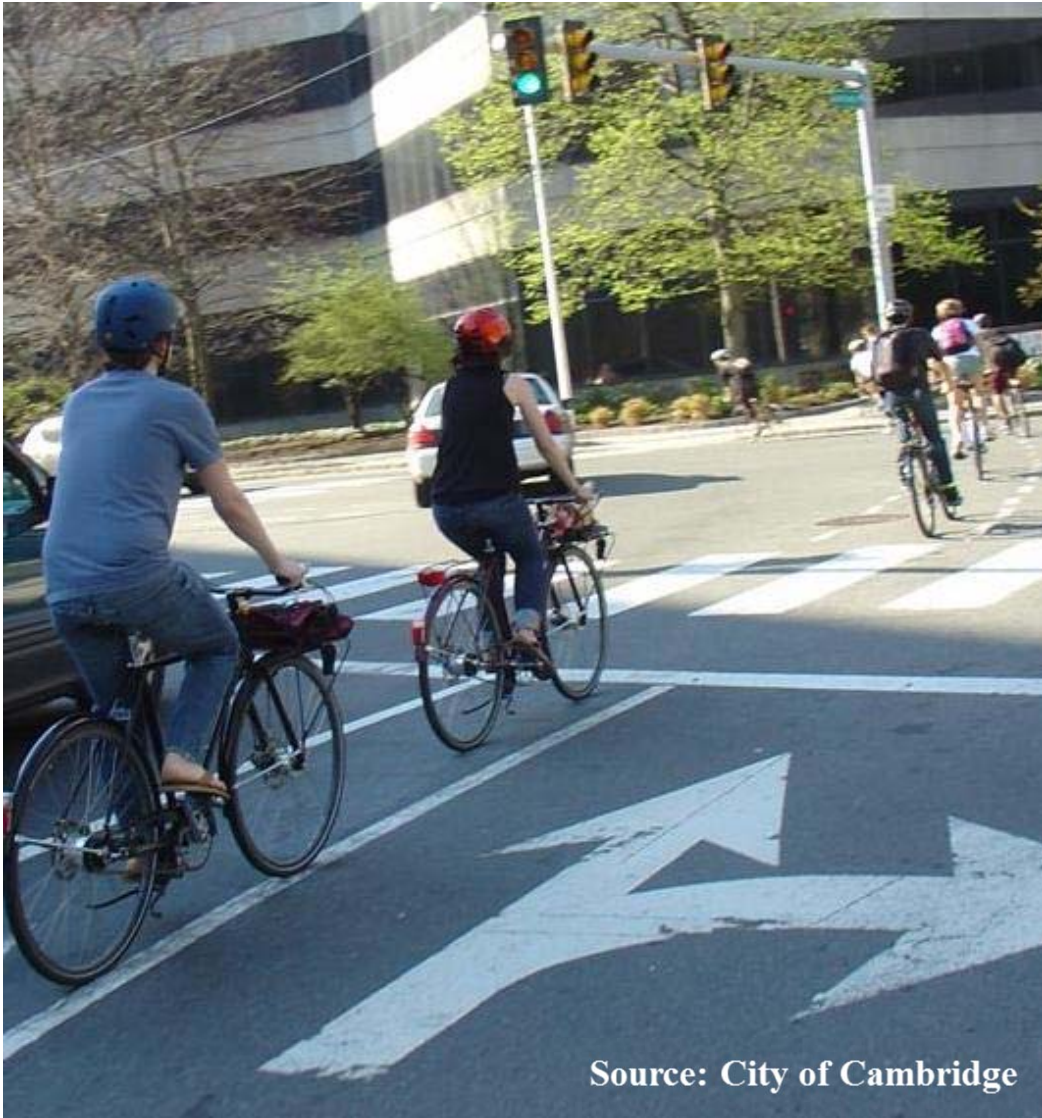
**Express  
bikeways  
for  
commuters**



**Bike speed  
indicators**







Source: City of Cambridge

## **Accommodation of cyclists at intersections in Cambridge**



Source: City of Cambridge



Source: City of Cambridge



Protected left-turn lane for cyclists crossing Mass Ave to reach Church St. and Brattle St.



Source: Cara Seiderman



Then the cyclist can safely cross Mass Ave to continue onto Church Street or turn right onto Mass Ave going outbound.

# **Traffic Calming of Residential Neighborhoods**

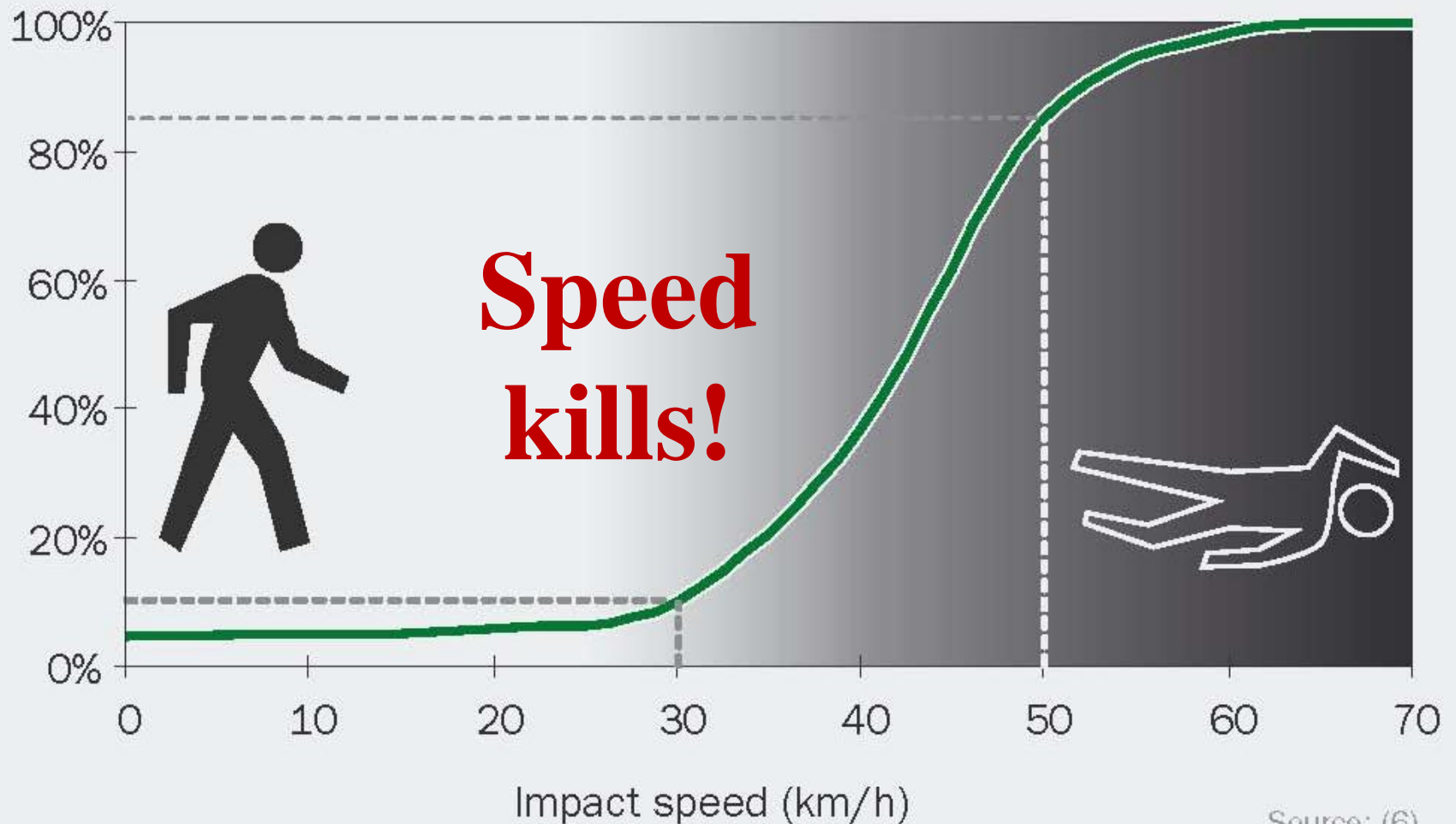
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- **Speed limited *by law* to 30km per hour (19mph) or less**
- ***Physical measures that force cars to slow down:***
  - Road narrowing, zigzag routing, chicanes
  - Raised intersections and crosswalks
  - Traffic circles
  - Speed humps and bumps
  - Mid-block closures and artificial dead-ends
  - Bulb-outs at intersections and crosswalks, with sidewalk widening



# Why Traffic Calming Saves Lives

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



Source: (6)

Source: World Health Organization (2008) and OECD Transport Research Centre (2006)



Source: Cara Seiderman

**Curb extensions, protective bollards, raised crosswalks, refuge islands**

**Traffic calming increases pedestrian visibility and slows down cars**



Source: Jeff Rosenblum

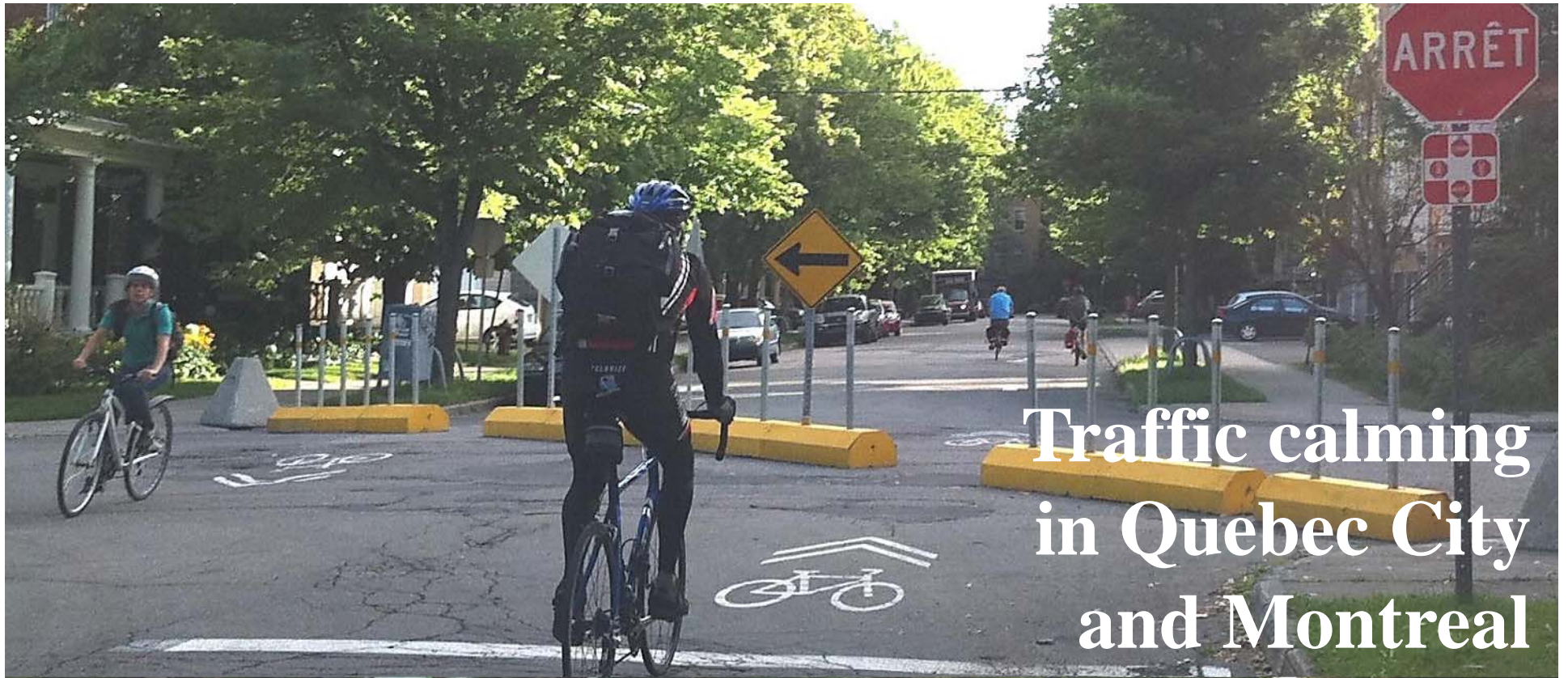




Foto by Peter Berkeley

**Convenient bike cut-thru for cyclists**





# Traffic calming in Quebec 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





Fotos: Jonathan Maus



Traffic  
calming  
turns  
these  
streets  
into  
bikeways



**Bike Boulevards  
in Portland**





# BIKE TRANSIT INTEGRATION





# Over 50,000 buses in the USA now come equipped with bike racks



*Photo: Metro Transit*



# Bike on LRT in NJ and Minneapolis



*Photo: John Boyle*



*Photo: Metro Transit*



# 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*



 Commuter Bike Parking  
WEST CAGE

300 bike parking spaces in two cages



Bike-transit integration at  
Alewife Station on Red Line

David Loutzenheiser



# Main form of bike-transit integration in Europe for decades



*Photo: Eva Heinen*





# Conversion of Car Parking to Bike Parking







*Photo: Peter Berkeley*



*Photo: Peter Berkeley*



## **Bikesharing in Paris and Berlin**



## **Easy bike rentals at Dutch transit stations**





Hubway Bikeshare in Cambridge, Boston, Somerville, and Brookline



Nice Ride in Minneapolis

**Over 20 bike sharing systems in North America**



Capital Bikeshare in Washington, DC

# Traffic Education

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- **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**





## **Cycling training and testing course in Berlin**

**Most German and Dutch children take cycling lessons by the 3<sup>rd</sup> or 4<sup>th</sup> 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



Source: Cara Seiderman



**Fun bike rides for  
kids and parents**





Troels Andersen, "Cycling in Odense, Denmark"

## **Guided Bicycle Tours for Seniors**

# CONCLUSIONS

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- *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