

# How to Increase Cycling for Daily Travel: Lessons from Cities across the Globe

Joint Webinar for the Institute of Transportation Engineers and the Active Living Research  
Program of the Robert Wood Johnson Foundation, 14 August 2013

**John Pucher, Jennifer Dill, Susan Handy, and Ralph Buehler**



Photo: Paul Krueger



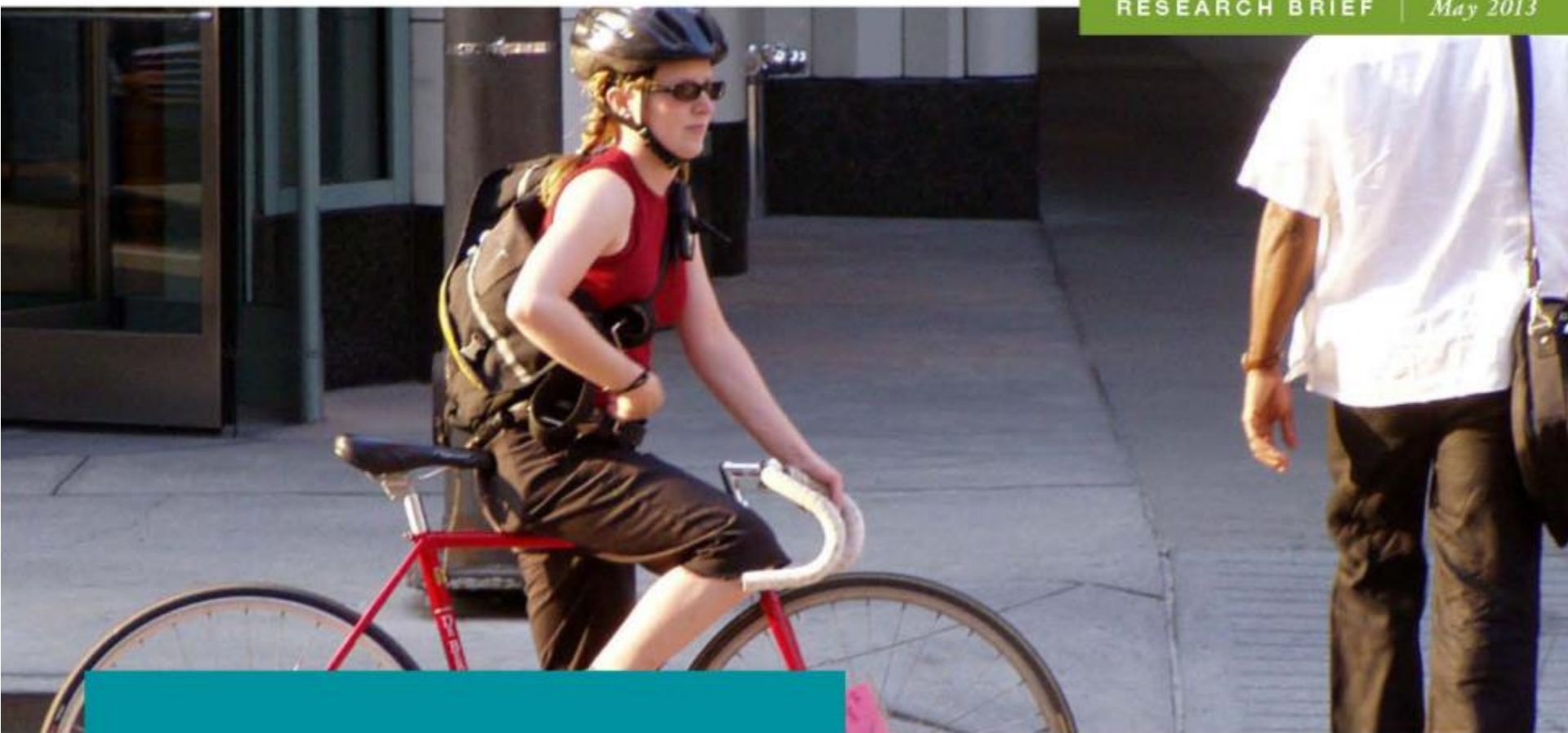
Photo: Greg Raisman

# Active Living Research

Building Evidence to Prevent Childhood Obesity and Support Active Communities  
[www.activelivingresearch.org](http://www.activelivingresearch.org)

RESEARCH BRIEF

May 2013



How to Increase Bicycling  
for Daily Travel



Contents lists available at ScienceDirect

## Preventive Medicine

journal homepage: [www.elsevier.com/locate/ypmed](http://www.elsevier.com/locate/ypmed)



### Review

# Infrastructure, programs, and policies to increase bicycling: An international review

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### ABSTRACT

**Objectives.** To assess existing research on the effects of various interventions on levels of bicycling. Interventions include infrastructure (e.g., bike lanes and parking), integration with public transport, education and marketing programs, bicycle access programs, and legal issues.

**Methods.** A comprehensive search of peer-reviewed and non-reviewed research identified 139 studies. Study methodologies varied considerably in type and quality, with few meeting rigorous standards. Secondary data were gathered for 14 case study cities that adopted multiple interventions.

**Results.** Many studies show positive associations between specific interventions and levels of bicycling. The 14 case studies show that almost all cities adopting comprehensive packages of interventions experienced large increases in the number of bicycle trips and share of people bicycling.

**Conclusions.** Most of the evidence examined in this review supports the crucial role of public policy in encouraging bicycling. Substantial increases in bicycling require an integrated package of many different, complementary interventions, including infrastructure provision and pro-bicycle programs, supportive land use planning, and restrictions on car use.

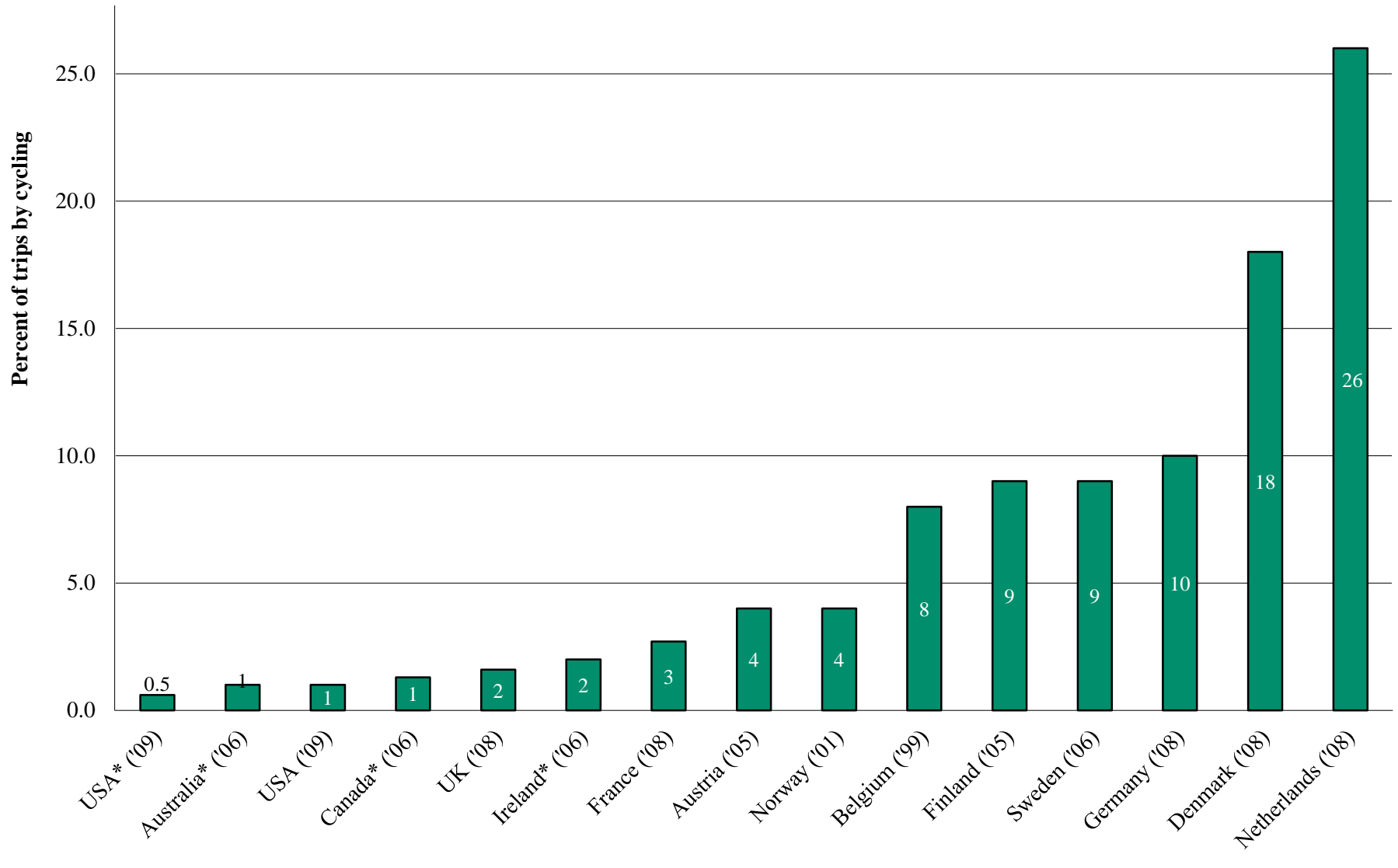


# Advantages of Cycling:

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- **Economical**: Affordable by everyone, requiring minimal costs for individuals and governments
- **Good for business**: Generate retail sales and profits from tourism
- **No pollution**: Clean and quiet
- **Energy-efficient**: Use up calories we need to burn off from eating too much
- **Healthy**: Many studies report on physical, social, mental health benefits
- **Fun**: Getting out into the fresh air with family and friends

# Cycling Share of Daily Trips in Europe, North America, and Australia, 1999-2009



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

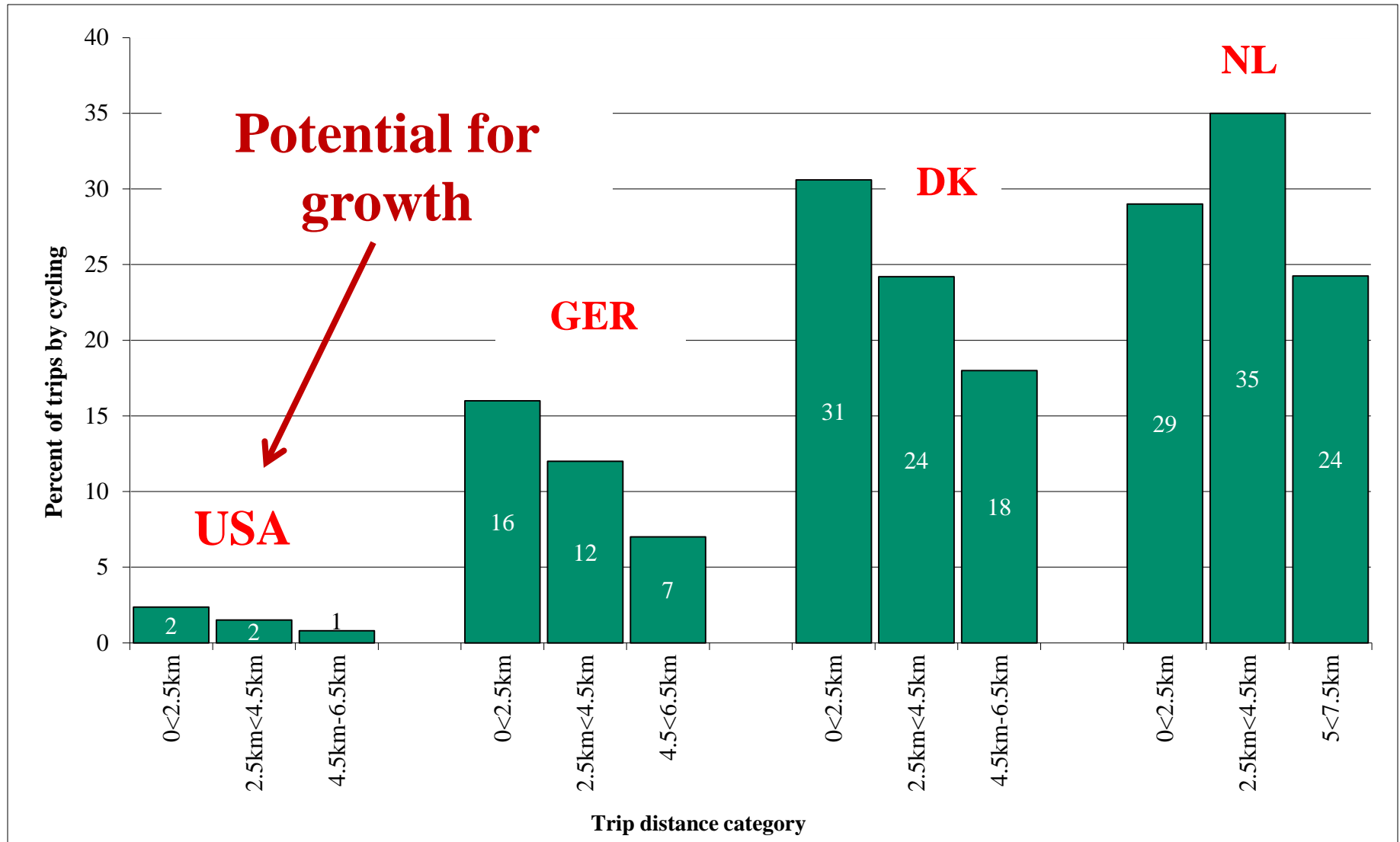
# **Lots of Potential for Increased Cycling:**

**Many daily trips in American 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**

Source: USDOT, 2009 National Household Travel Survey

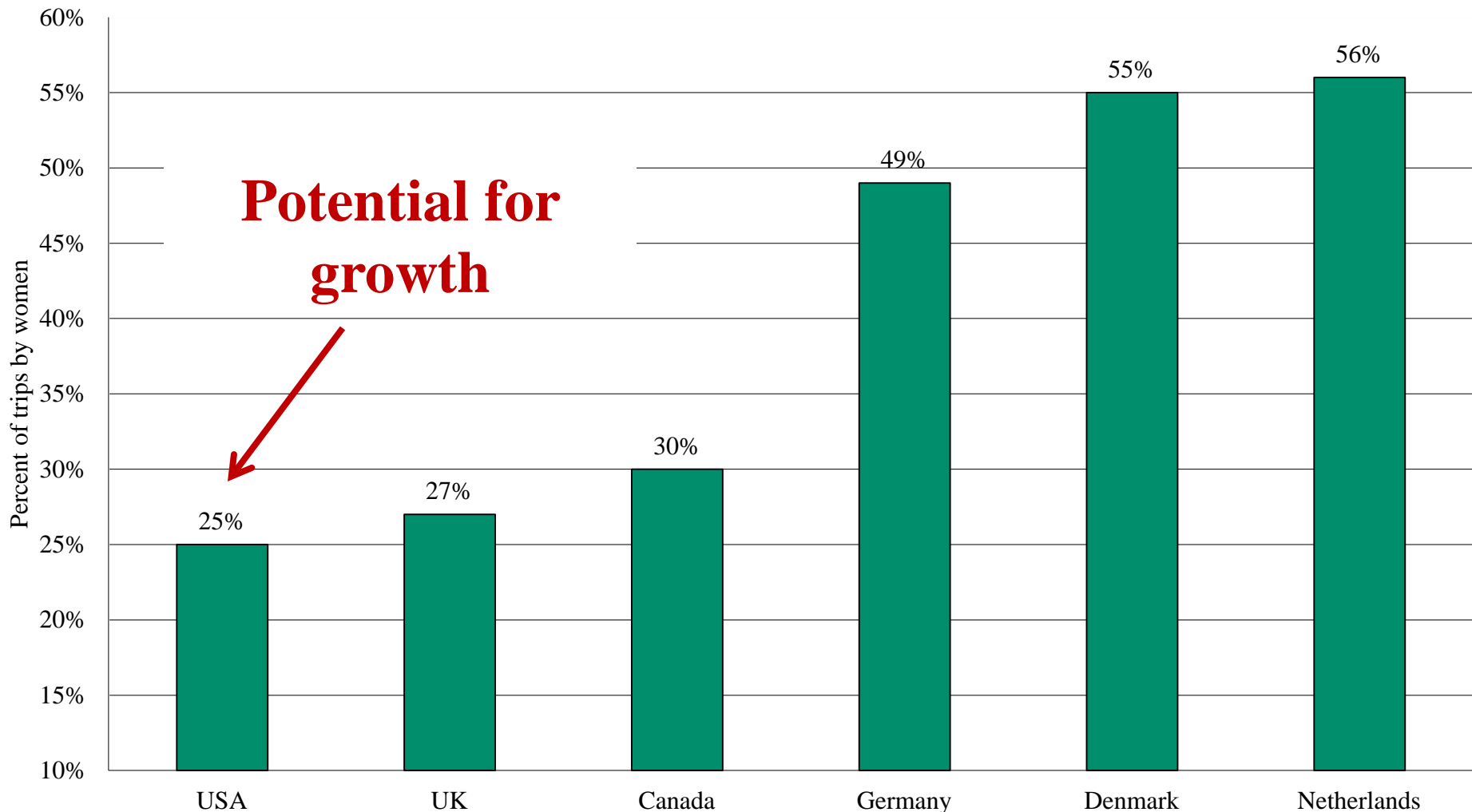
# Share of Cycling for Short Trips



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

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

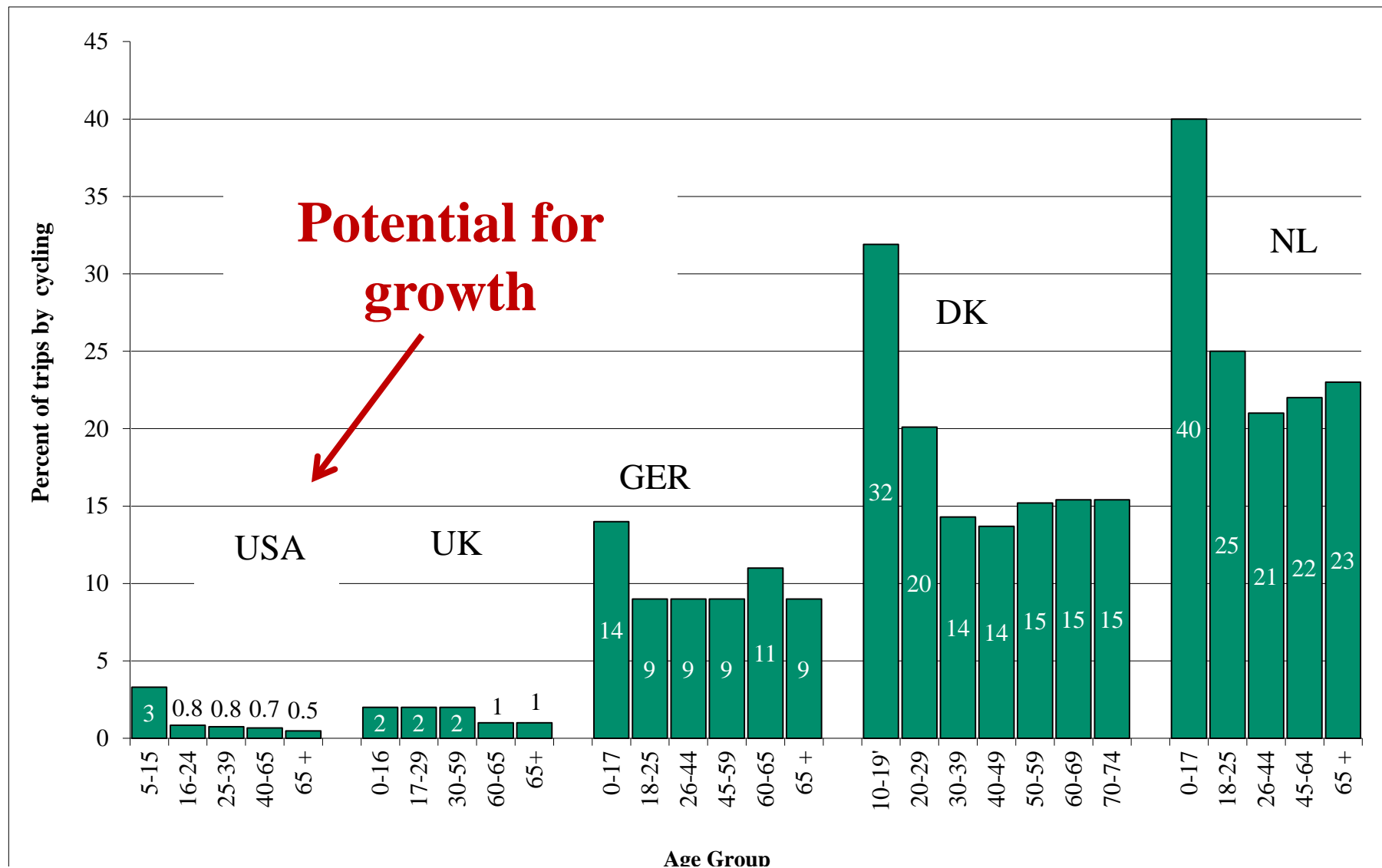
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Source: Pucher and Buehler (eds.) *City Cycling*. Cambridge, MA: MIT Press, 2012



# Bike Share of Trips by Age Group

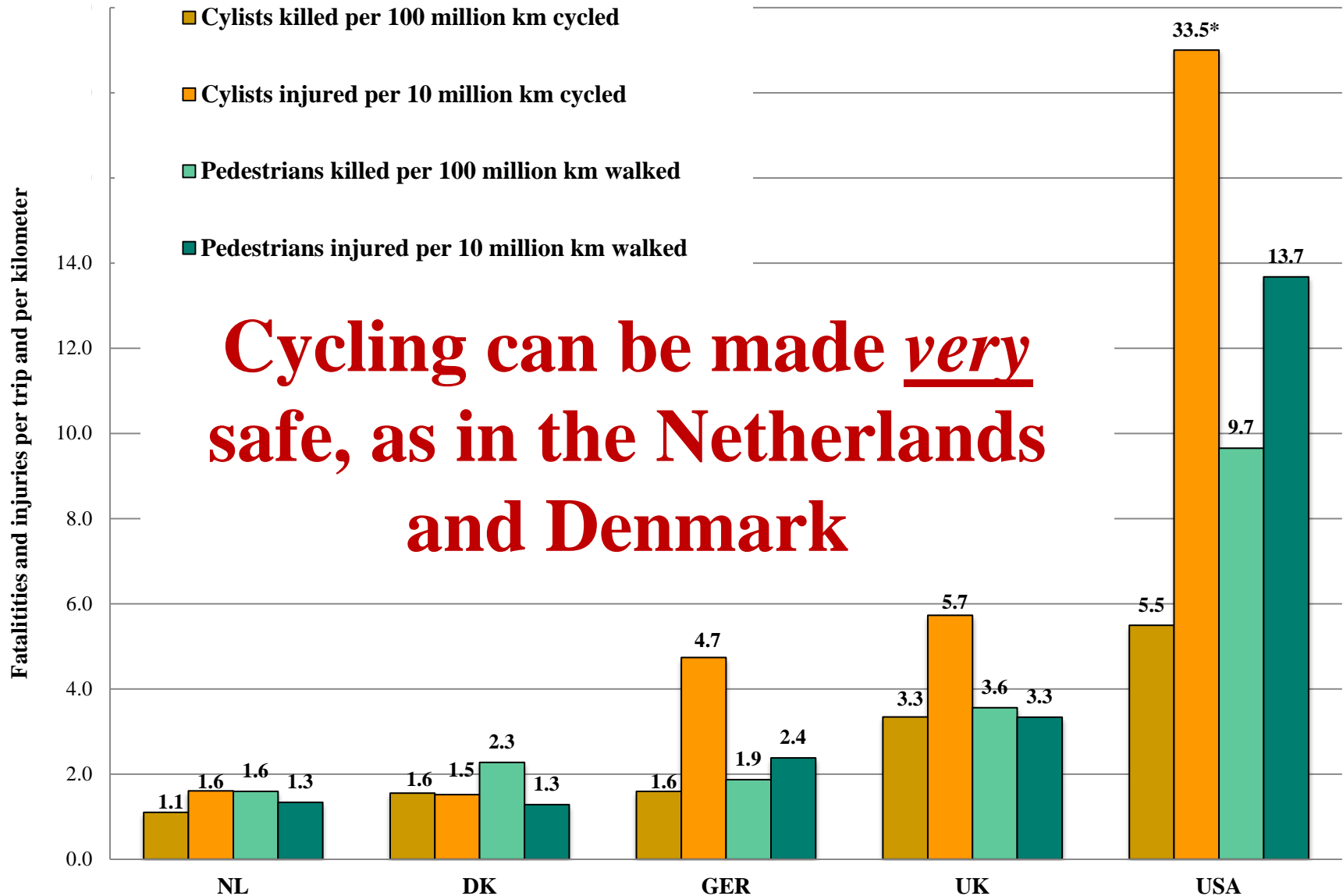


Source: Pucher and Buehler (eds.) *City Cycling*. Cambridge, MA: MIT Press, 2012

# **Cycling Safety Crucial**

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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 cycling in the Netherlands, Denmark, and Germany helps explain high levels of cycling there**

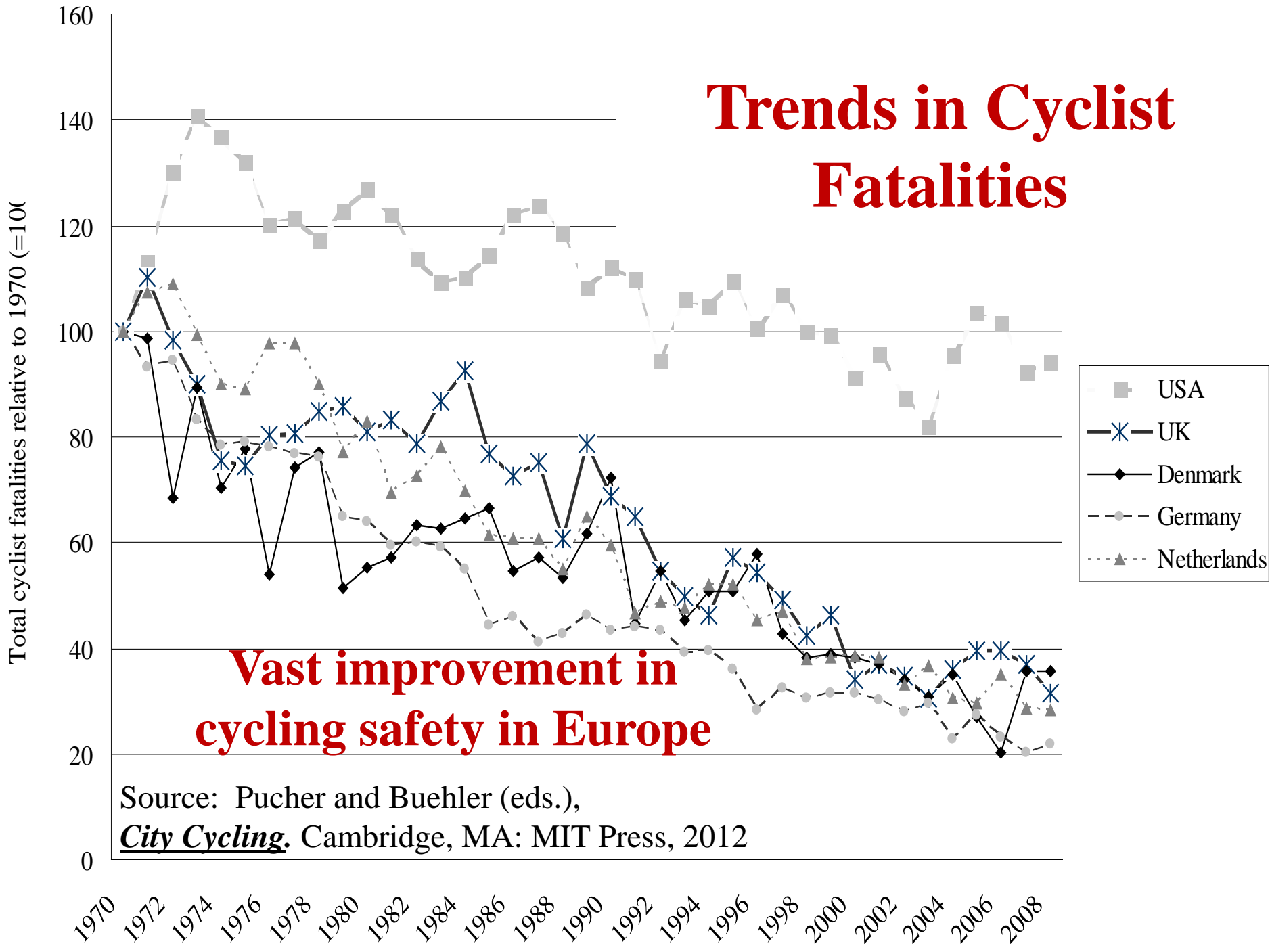


Source: Pucher and Buehler (eds.), *City Cycling*. Cambridge, MA: MIT Press, 2012

# Trends in Cyclist Fatalities

**Vast improvement in  
cycling safety in Europe**

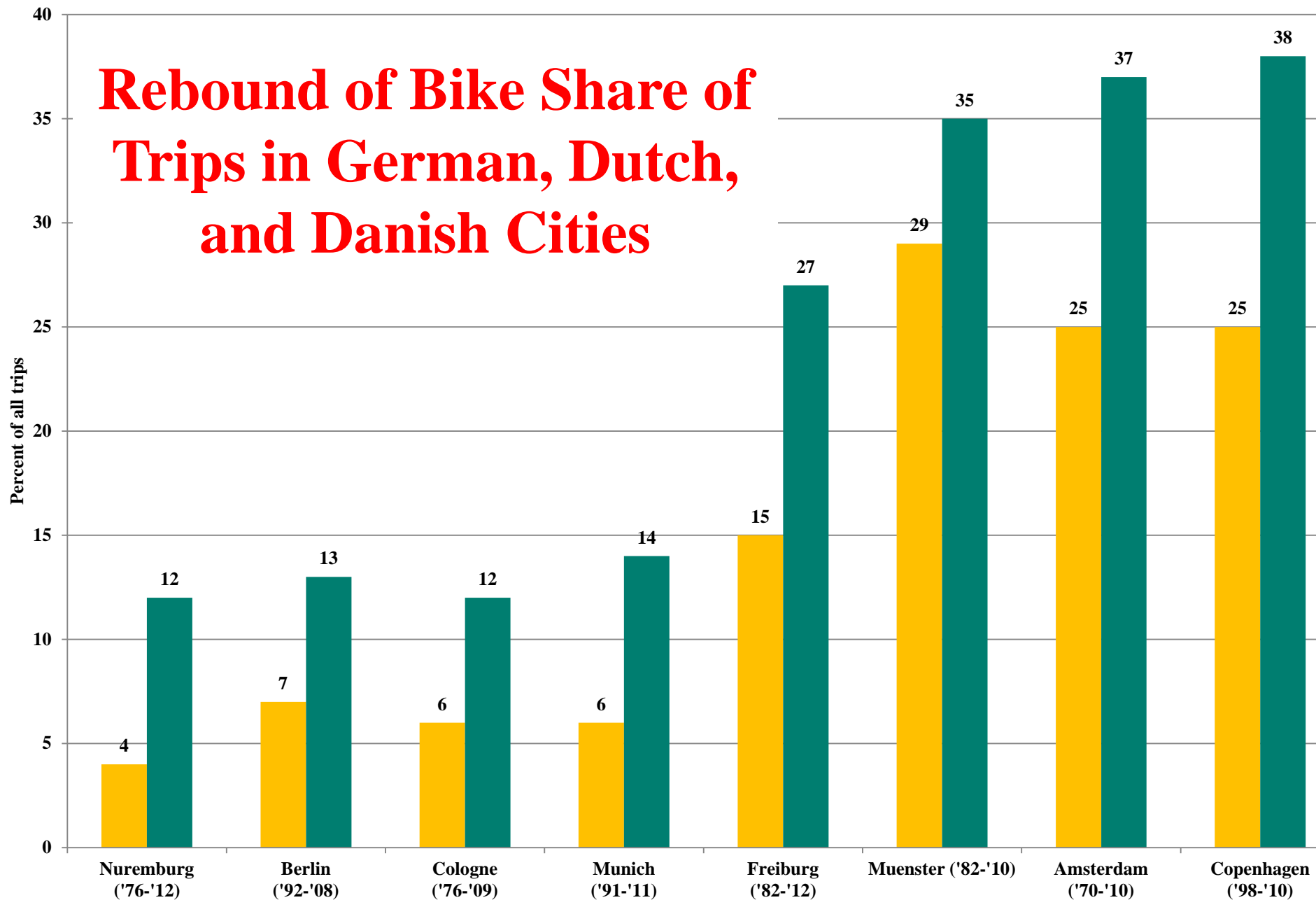
Source: Pucher and Buehler (eds.),  
**City Cycling**. Cambridge, MA: MIT Press, 2012



# **Reversal in Public Policies in Germany, Denmark, and the Netherlands in 1970s**

- **Pro-car policies in European cities in 1950s and 1960s caused huge decline in cycling and walking**
- **Dramatic policy turn-around since 1970s to limit car use and promote cycling, walking, and public transport in Dutch, Danish, and German cities**

# Rebound of Bike Share of Trips in German, Dutch, and Danish Cities



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

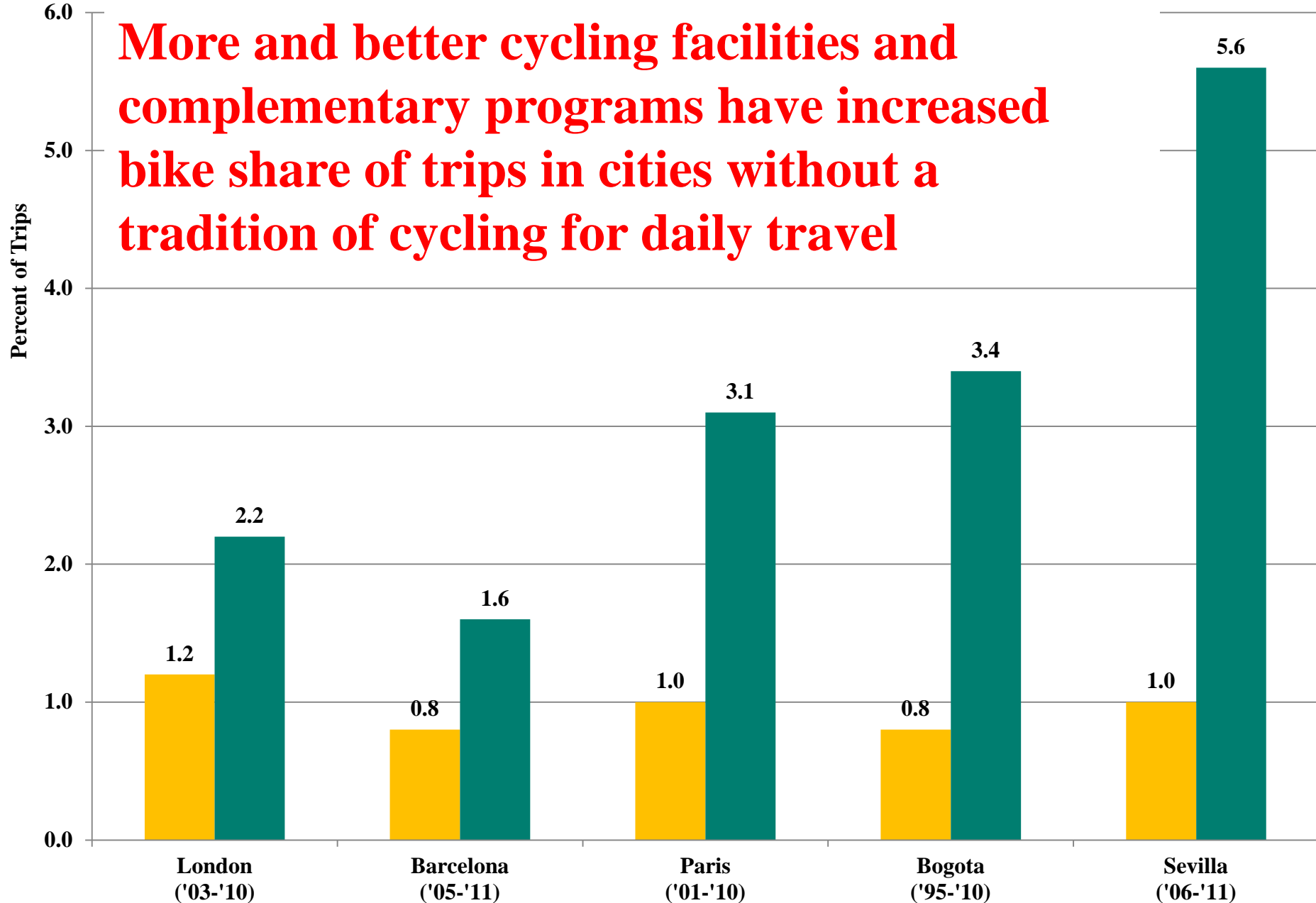


# **Recent Boom in Pro-Bike Policies in Many Cities**

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- **Especially since 2000, European and North American cities without a tradition of cycling for daily travel have dramatically raised cycling levels**
- **Improved cycling infrastructure and many other measures to encourage cycling**

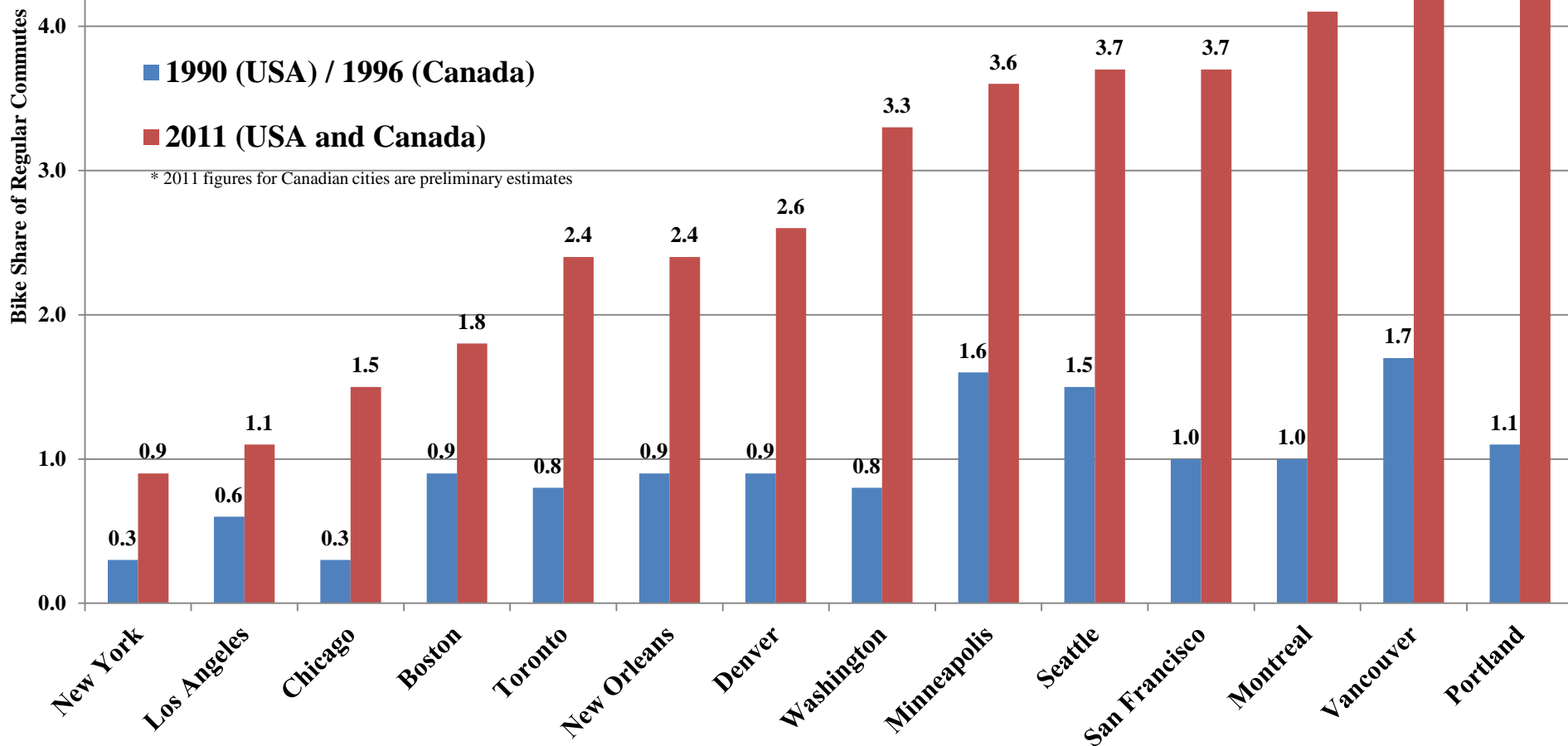
**More and better cycling facilities and complementary programs have increased bike share of trips in cities without a tradition of cycling for daily travel**



**Source: Pucher, Dill, and Handy, “Infrastructure, Programs, and Policies to Increase Bicycling,” *Preventive Medicine*, Jan 2010, Vol. 50, S.1, pp. S106-S125.**

# Boom in Cycling to Work in 14 Large US and Canadian Cities

Source: Pucher, J. and Buehler, R. *City Cycling*, MIT Press, Cambridge, Mass, 2012.



# How to Encourage More Cycling while Improving Safety

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- **Better cycling facilities**
- **Integration of cycling 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**



**Most  
European  
cities have  
extensive car-  
free districts  
ideal for  
walking and  
cycling**



Cycling is perfect for getting around  
car-free college campuses such as here  
at UC Santa Barbara



Photo: Ralph Fertig



A photograph of a scenic coastal path in Santa Barbara. The path is paved and runs along a grassy area with many palm trees. In the foreground, a person in a light blue shirt is riding a bicycle away from the camera. Further ahead, another person in a white shirt is also riding a bicycle. To the right of the path, there is a wider, unpaved area with more trees and a few people walking. In the background, the ocean and mountains are visible under a clear blue sky.

# **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**



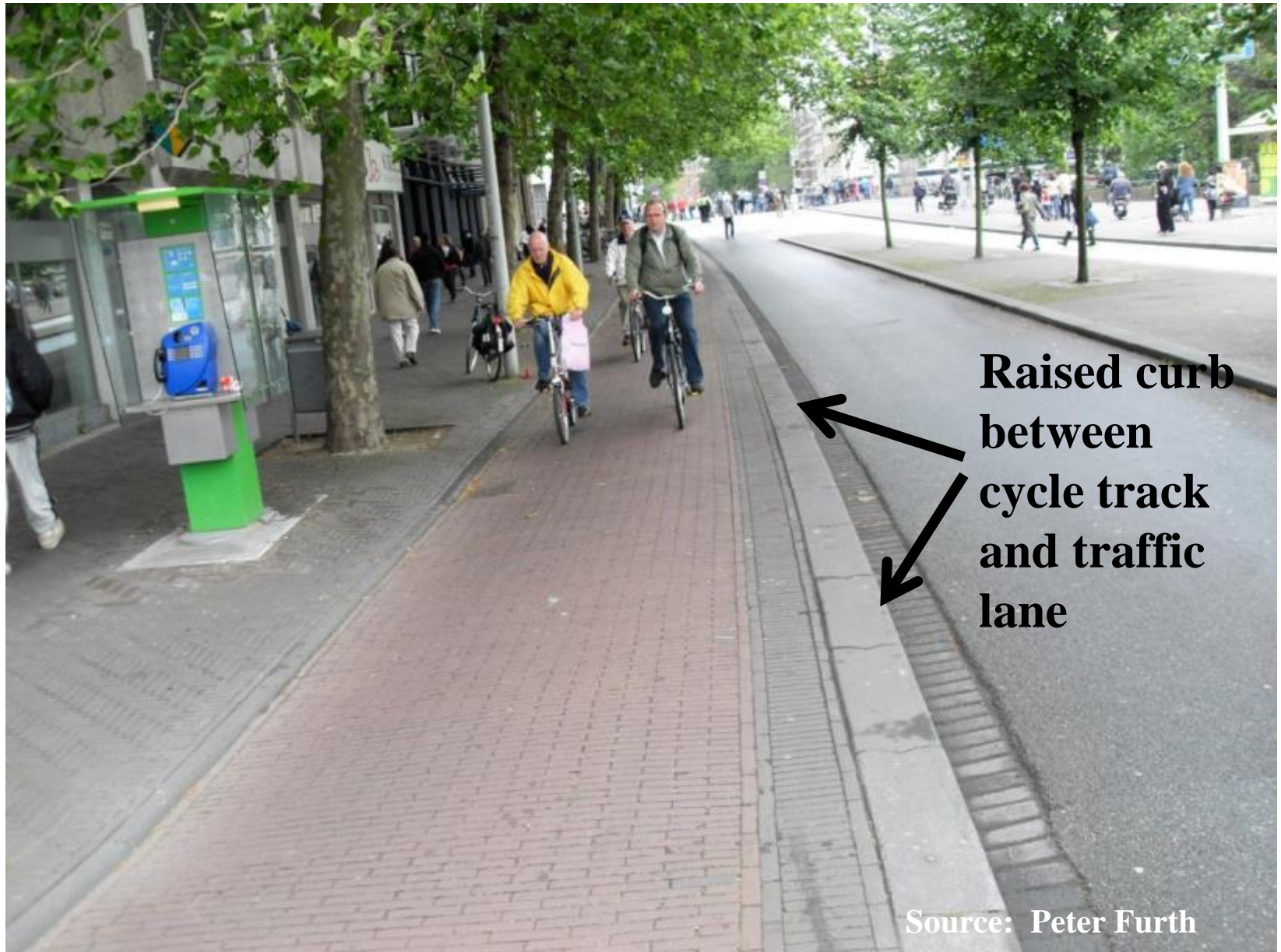


**Bike paths in Dutch cities  
make it safe and  
comfortable for all to bike:  
including women, children,  
and seniors**

**Source: Warren Salomon**



# One-way cycle track in The Hague



**Raised curb  
between  
cycle track  
and traffic  
lane**

Source: Peter Furth



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





# Provision of cycle track at this key underpass in Montreal

Separation from traffic via concrete barriers *AND* bollards



**For 6 Montreal cycle tracks studied, injury rate averaged 28% lower and usage rate 2.5 times higher than on comparable “reference streets” without facilities (Lusk et al, 2011, Injury Prev)**





- 380 mi of new bike lanes and paths since 2000
- Quadrupling in bike trips since 2000
- 74% decrease in serious cyclist injuries and fatalities per million bike trips
- Biggest increases in cycling on protected bike lanes (cycle tracks)

Photo: NYC DOT

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



**Economic benefits of this cycle track exceed costs by over three-to-one!**



**Cycling has doubled in Sydney, Australia since installation of its cycle track network**

Photo: Fiona Campbell

# Increased Bicycling on Protected Bike Lanes

(% growth in bike trips relative to pre-installation levels)

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- Buffered bike lanes on Spruce and Pine Streets in Philadelphia: **+266%**
- Buffered median bike lanes, DC, Pennsylvania Ave: **+200%**
- Cycle track, Kinzie St., Chicago: **+55%**
- Cycle track, NYC, Prospect Park West: **+190%**
- Cycle track, NYC, Columbus Avenue: **+56%**
- Cycle track, SF, Market St: **+115%**
- Cycle track, Vancouver, Canada, Dunsmuir St: **+54%**
- 6 cycle tracks in Montreal: **2.5 times** more cyclists on cycle tracks than on comparable “reference streets” without facilities
- New system of 164km of cycle tracks in Sevilla, Spain led to over a **6-fold increase** in number of daily bike trips from 2006 to 2011

# Are Protected Bike Lanes Safer?

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- **3 cycle tracks in NYC, decrease in total cyclist injuries**
  - **9<sup>th</sup> Ave: -57%; 8<sup>th</sup> Ave: -30%; Prospect Pk West: -62%**
- **Sevilla, Spain: Construction of 164km of cycle tracks led to halving in cyclist serious injury rate per 100,000 trips from 2006 to 2010**
- **Study of 19 cycle tracks in USA: Avg. injury rate per million bike km much lower on cycle tracks (2.3) than on roads without cycling facilities (range of 4-54 in other published studies). (Lusk et al., 2013, *Am J of Public Health*)**
- **Montreal, 6 cycle tracks: Avg. cyclist injury rate 28% lower than on nearby “reference streets.” (Lusk et al, *Injury Prevention*, 2011)**
- **Vancouver and Toronto: Cycle tracks had only 11% the injury rate of cycling on busy roads without bike facilities (Teschke et al., *Am J of Public Health*, 2012)**



200%  
increase in  
bike trips  
after  
installation

# Buffered median bike lanes on Pennsylvania Avenue in Washington



Photo:  
Ralph Buehler



**Construction  
and  
maintenance  
financed by  
private  
foundation**

**Cultural  
Heritage  
cycle track in  
Indianapolis**

**Photos: Ralph Buehler**



**Tripling in cycling in  
Indianapolis since 2000**





**Transformation of Hornby Street in Vancouver  
with installation of first-class cycle track**



Photo: Warren Salomon



Raised crossing for  
both cyclist and cars,  
with special pavement  
and markings

**Improving safety of cycle tracks at road crossings**





Photo: Velo Quebec

**Safe cycle track crossing at busy intersection in Montreal**



# Bike lanes are much more typical in US cities

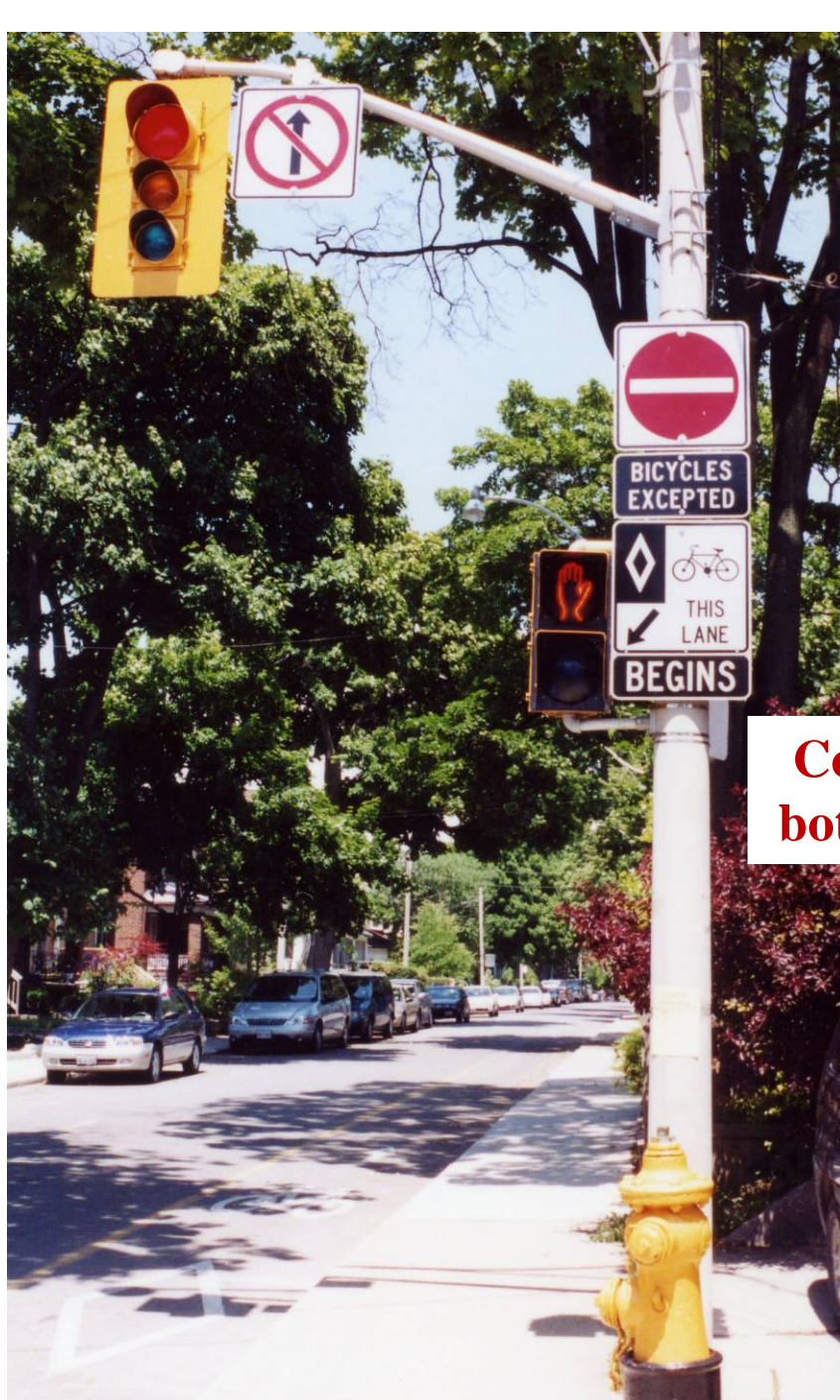


Photo: Ralph Fertig



Photo: Lewis Thorwaldson





**Contra-flow lanes facilitate bike travel in both directions on one-way streets for cars**





**But bike lanes are definitely better than no separate bike facilities, but they do not provide nearly as much protection of cyclists from motor vehicles as cycle tracks**



**Bike lanes used for car parking**



**Bike lanes used for truck deliveries**



**Dooring of cyclists**



**265% increase in bike trips (2009-2012)**

**Spruce St, Philadelphia**



Photo: Kyle Grading

**111% increase in bike trips (2008-2012)**

**South St Bridge, Philadelphia**



Photo: Kyle Grading

**Installation of these buffered bike lanes in Philadelphia improved safety and greatly increased cycling levels**



# Bridge connections crucial for an integrated cycling network

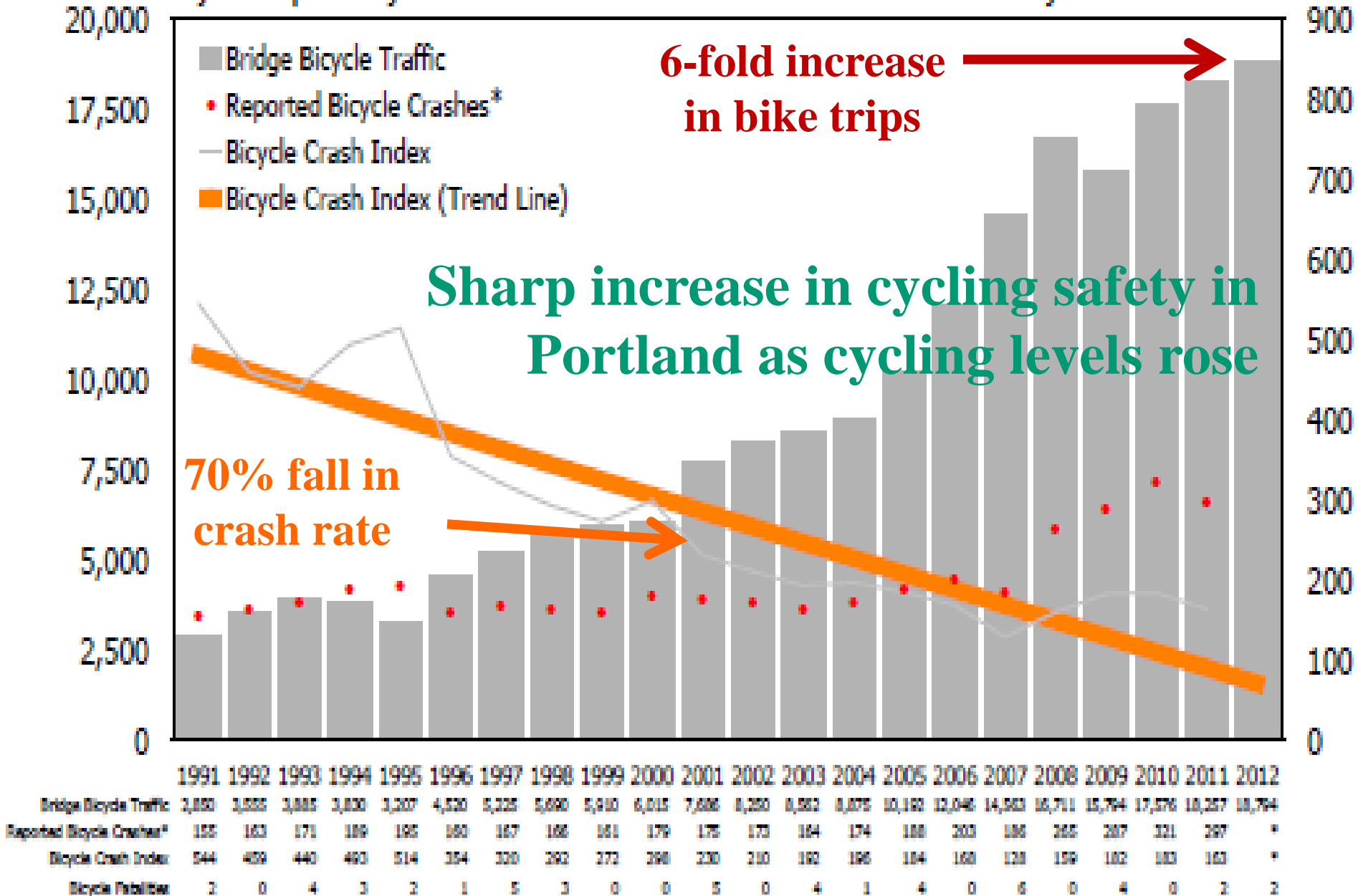


Almost 20,000 daily bike trips  
over Portland bridges

Photo: Greg Raisman

## Cyclists per Day

## Crashes and Bicycle Crash Index



Source: City of Portland (2013)

Year



**Bike paths on the four East River  
bridges provide crucial connections from  
Brooklyn and Queens to Manhattan**



**Source: Transportation Alternatives NYC**



**Bike  
boxes  
in  
Seattle  
also**



Photo: Seattle DOT





Photo: Gord Price



Photo: Gord Price

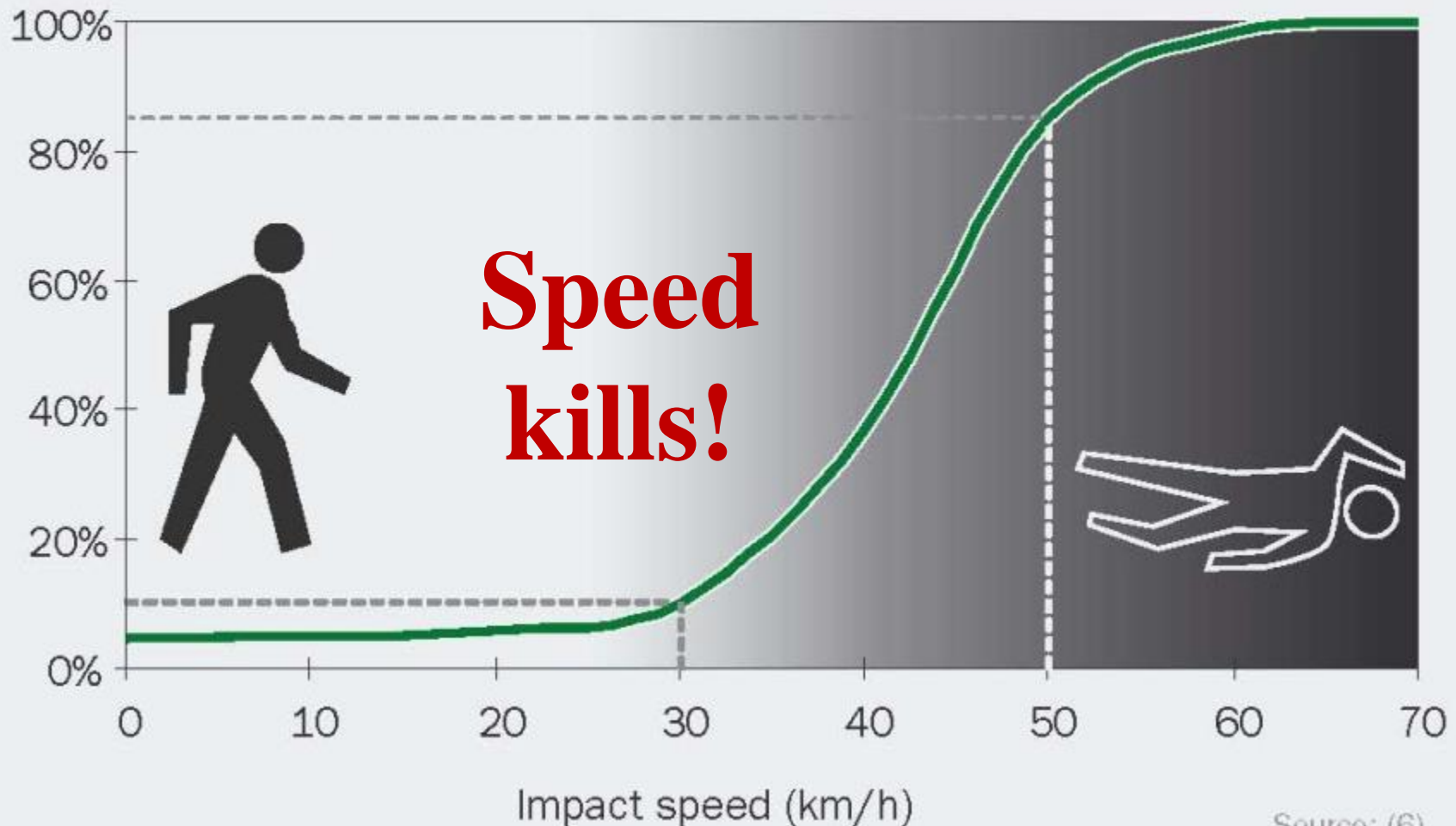
## Bike boxes in Vancouver



Photo: Rich Drdul

# Why Traffic Calming Saves Lives


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



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



These streets are, in effect, bike  
boulevards, neighborhood greenways,  
and local street bikeways



**3,800 km of traffic-calmed streets in Berlin:  
ideal for cycling: 78% of ALL streets in Berlin!**





**7 km/hr speed  
limit**

Shared streets: Typical  
traffic calming in new  
German suburbs





# Shared street in Indianapolis



Photo: Ralph Buehler





Photo by Peter Berkeley

**Blockage of through car and truck traffic but convenient cut-through for cyclists and pedestrians**





# Traffic calming in Quebec City and Montreal

Photo: Transports Viables

Cheap, easy, and very  
effective traffic diverters



Photo: Velo Québec



**Bollard  
blocks  
passage of  
cars**



Traffic diverter in  
Berkeley which  
provides a through  
connection for two bike  
boulevards





Photo: Paul Krueger



**152km of bike  
boulevards in  
Vancouver**

Photo: Paul Krueger





Photo: Paul Krueger



Photo: Paul Krueger

## Cut-thrus along bike boulevards in Vancouver



Photo: Paul Krueger



Photo: Paul Krueger



Photo: Richard Drdul



Photo: Paul Krueger



Photo: Paul Krueger

**Traffic calming in  
Vancouver that creates  
bike boulevards**



# Dutch bicycle facility selection matrix

Average daily traffic (vehicles / day)		Street type and speed limit			
Lane Configuration		Urban local street	Urban through street	Rural local road	Fast traffic road
		30 km/h (19 mph)	50 km/h (31 mph)	60 km/h (37 mph)	70+ km/h (44+ mph)
2-way traffic with no centerline	$\leq 2500$	mixed traffic <sup>1</sup>	bike lane <sup>2</sup> or cycle track <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	bike lane or cycle track <sup>3</sup>		
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.



Photo: Peter Berkeley



Photo: Translink

## BIKE TRANSIT INTEGRATION



Photo: Translink





# Over 50,000 buses in the USA now come equipped with bike racks, as here in Santa Barbara

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Source: Ralph Fertig



# Bike on LRT in NJ and Minneapolis



Photo: John Boyle



Photo: Metro Transit





Capacity: 3,500 bikes

**Bike Station next to main train  
station in Muenster, Germany**

*Photo: Peter Berkeley*



Capacity: 150 bikes

# Bike Station next to Union Station in Washington, D.C.



*Photo: Ralph Buehler*





300-bike parking spaces in two bike cages at northern terminus of subway line in Boston



Bike-transit integration at Alewife Station on Red Line in Boston

Photo: David Loutzenheiser



# Bikes on Caltrain in San Francisco



*Photo: San Francisco Bicycling Coalition*



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



Metro station

BIXI bike docking station

Cycle track

Source: Vélo Québec





**72% average increase in overall cycling by bikesharing users (Shaheen et al., 2013)**



Hubway Bikeshare in Cambridge, Boston, Somerville, and Brookline



Nice Ride in Minneapolis

**Over 50 bike sharing systems in North America by end of 2013**



Capital Bikeshare in Washington, DC





## Citi Bike in New York

- Launched May 27, 2013
- 6,000 bikes
- 330 bike stations
- Over 30,000 daily users



Which is the cheaper and more sensible way to get exercise?

Photo: Alta Planning



Photo by Susan Handy

## Innovative directional signs and bike trip counters in Denmark



Photo by Susan Handy



Photo: Paul Krueger



**Convenient, free air pumps for bikes on local  
neighborhood bikeways in Vancouver**





**27** bike corrals in San Francisco



**Good bike parking benefits merchants**



**97** bike corrals in Portland





# Safe Routes to Schools

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Photos: Bike Texas







Photo: Fiona Campbell

**After installation of this  
cycle track in Sydney,  
Australia, over a third of  
children now bike to school!**



Photos: Ralph Buehler

# 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!**





Source: NJ Bike Walk Coalition



## **Bike Training for Children in New Jersey**







Photo: Bonnie Fenton

# Cycling training course for adults



Photo: Amy Walker



# Guided Bicycle Tours for Seniors



# Bike to Work Day in San Francisco



Source: San Francisco  
Bicycle Coalition

# **GIVE EMPLOYEES FREE BIKES!**

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**The perfect zero  
emissions vehicles!**

Photo: Troels Andersen



A large group of cyclists is riding on a city street during the CicLAvia event. The cyclists are of various ages and are wearing casual clothing. The street is wide and has a crosswalk. In the background, there are buildings, traffic lights, and a red car. The sky is clear and blue.

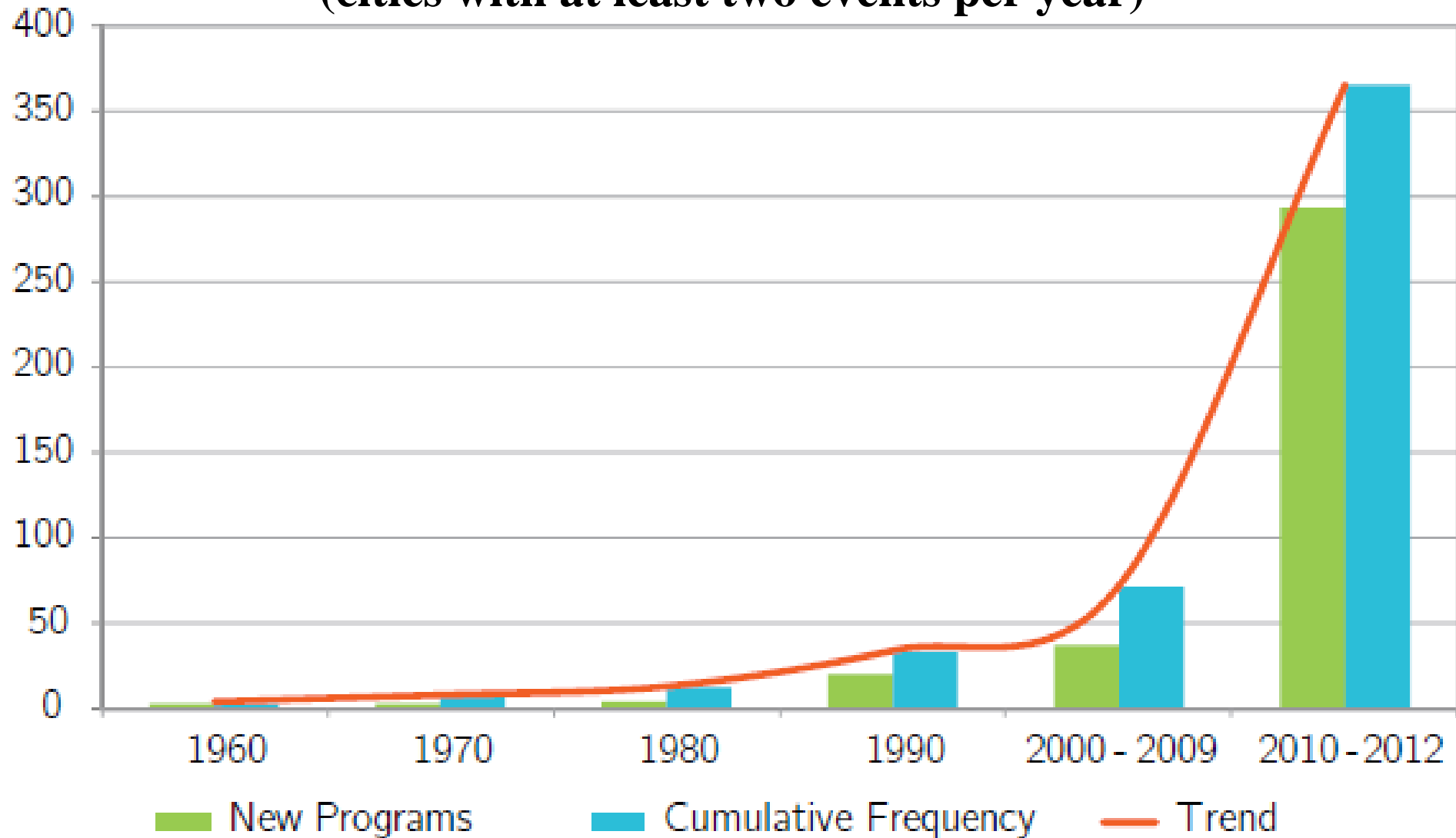
Over 100,000 participants at LA's fourth annual CicLAvia in October 2012

Source: Ryan Snyder

CicLAvia: 9 miles of car-free streets in Los Angeles

# Expansion of Open Streets (Ciclovias) in the Americas

(cities with at least two events per year)



Source: Sarmiento et al. (2013). *Open Streets: A Healthy Epidemic*. Bogota, Colombia: Universidad de los Andes. Financed by Centers for Disease Control and Prevention



# New book with MIT Press

<http://citycyclingbook.wordpress.com>

About the authors:

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

<http://ralphbu.wordpress.com>

## City Cycling

edited by John Pucher  
and Ralph Buehler



# CONCLUSIONS

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- *Many economic, environmental, social, and health benefits of cycling*
- *Even in North America, many local trips are short enough to cover by cycling*
- *Many cities throughout the USA and Canada are vastly improving their cycling facilities*
- *But much more could be done, and there are many ways to do it.*

# QUESTIONS?

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