

Neighborhood Design and Travel Behavior : Evidence from Northern California

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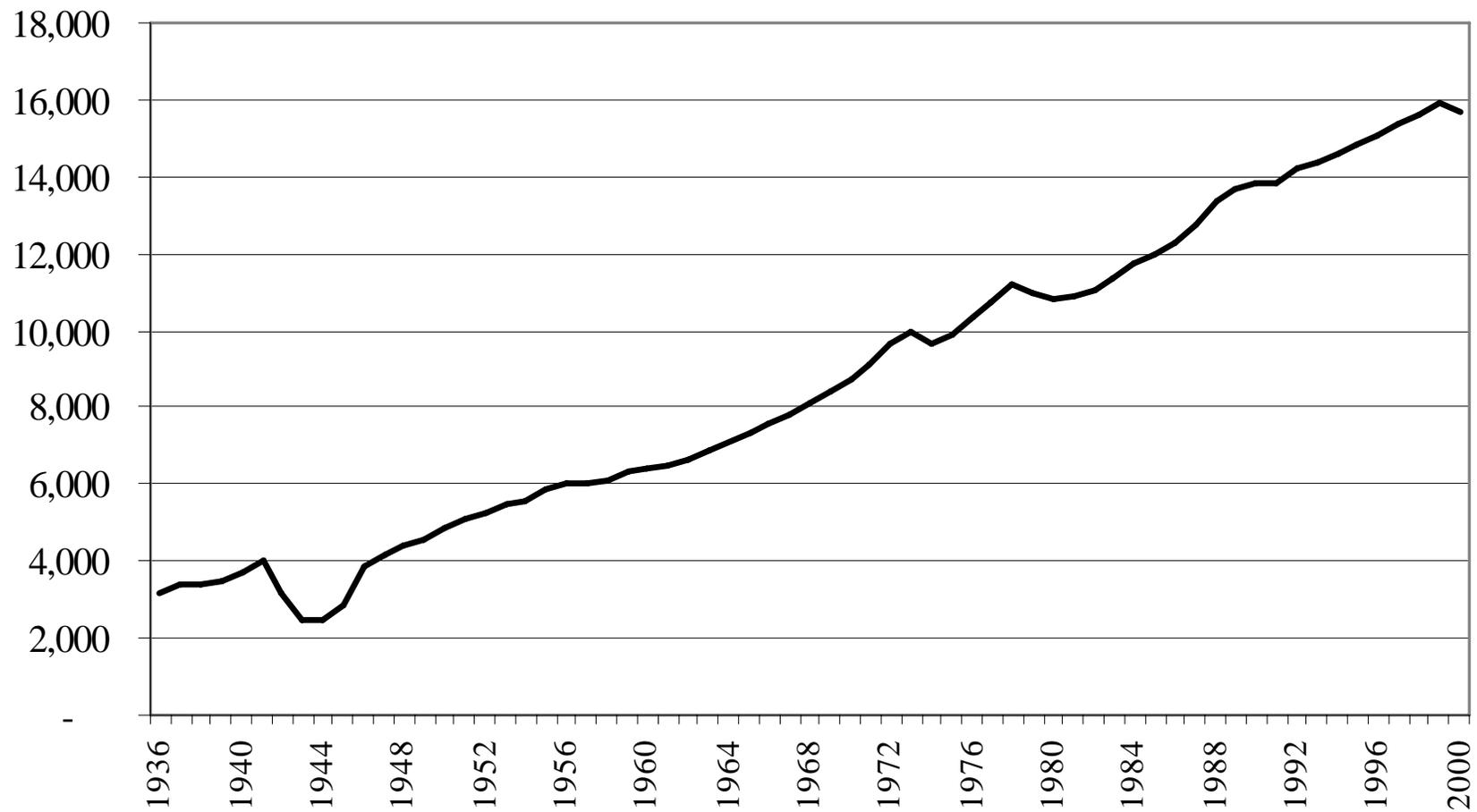
University of California Davis

June 29, 2006



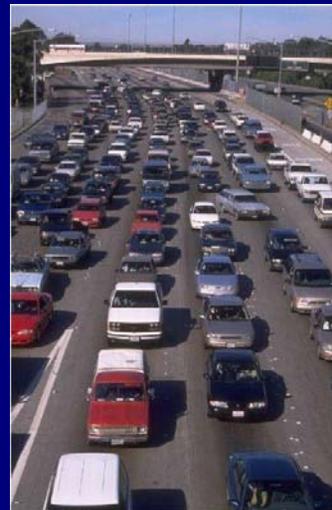
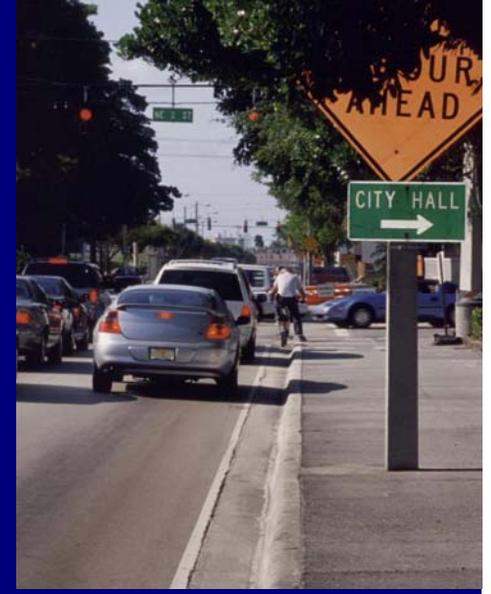


**Figure 1. Vehicle-Kilometers-Traveled per Person
in the U.S.
(1936 - 2000)**

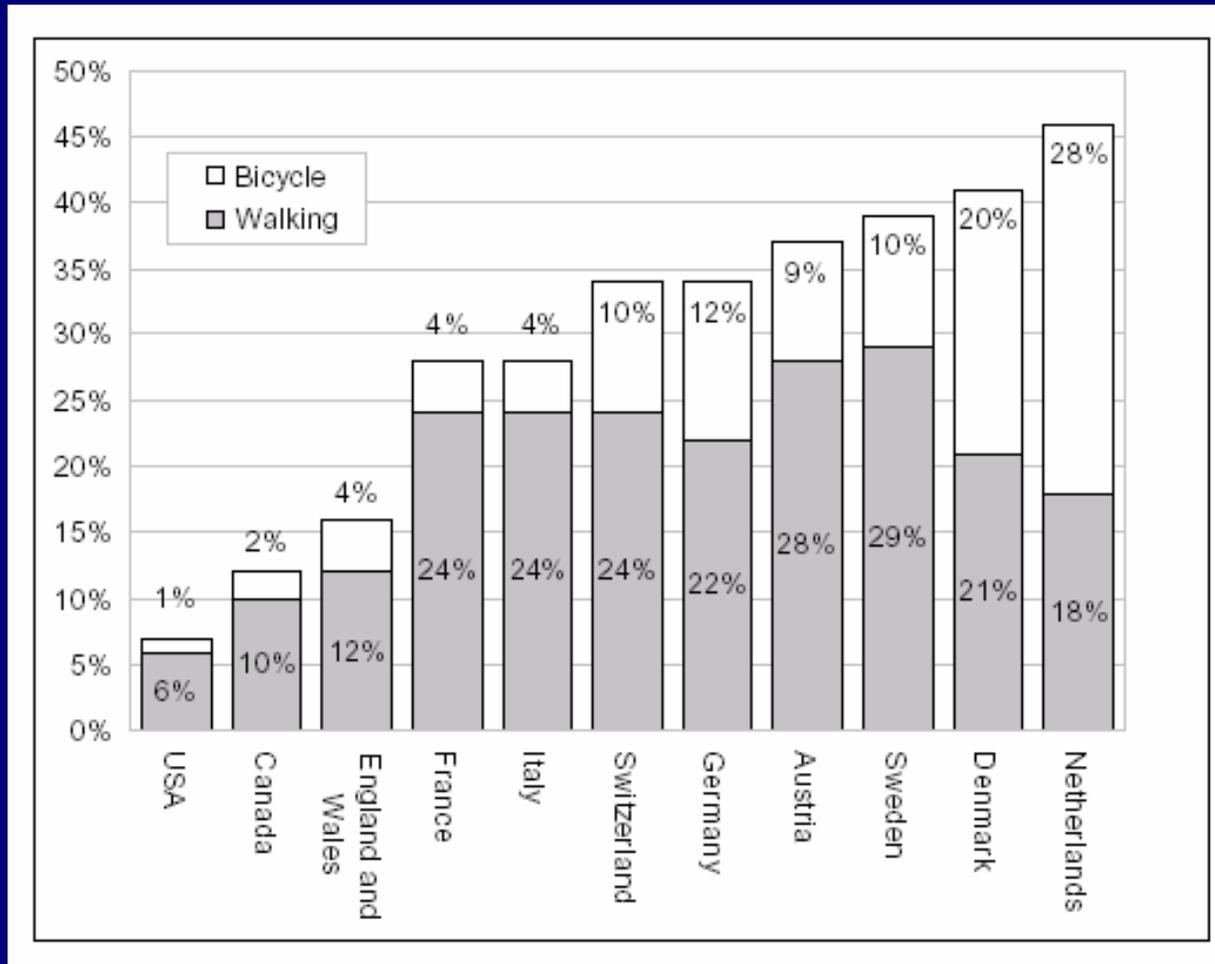


Traditional Transportation Concerns

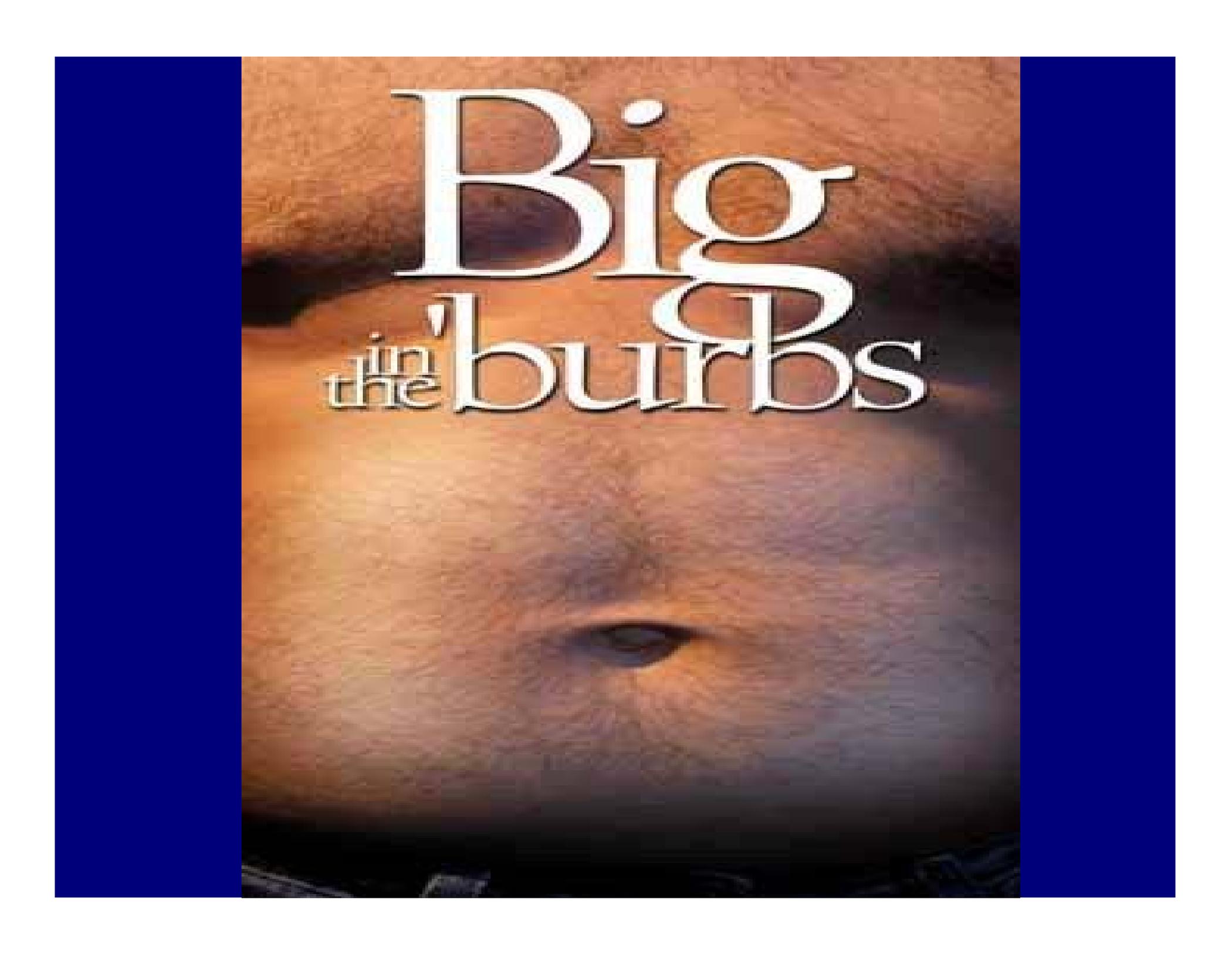
- Economy
- Environment
- Equity
- Safety



Walk/Bike as Share of Urban Trips 1995

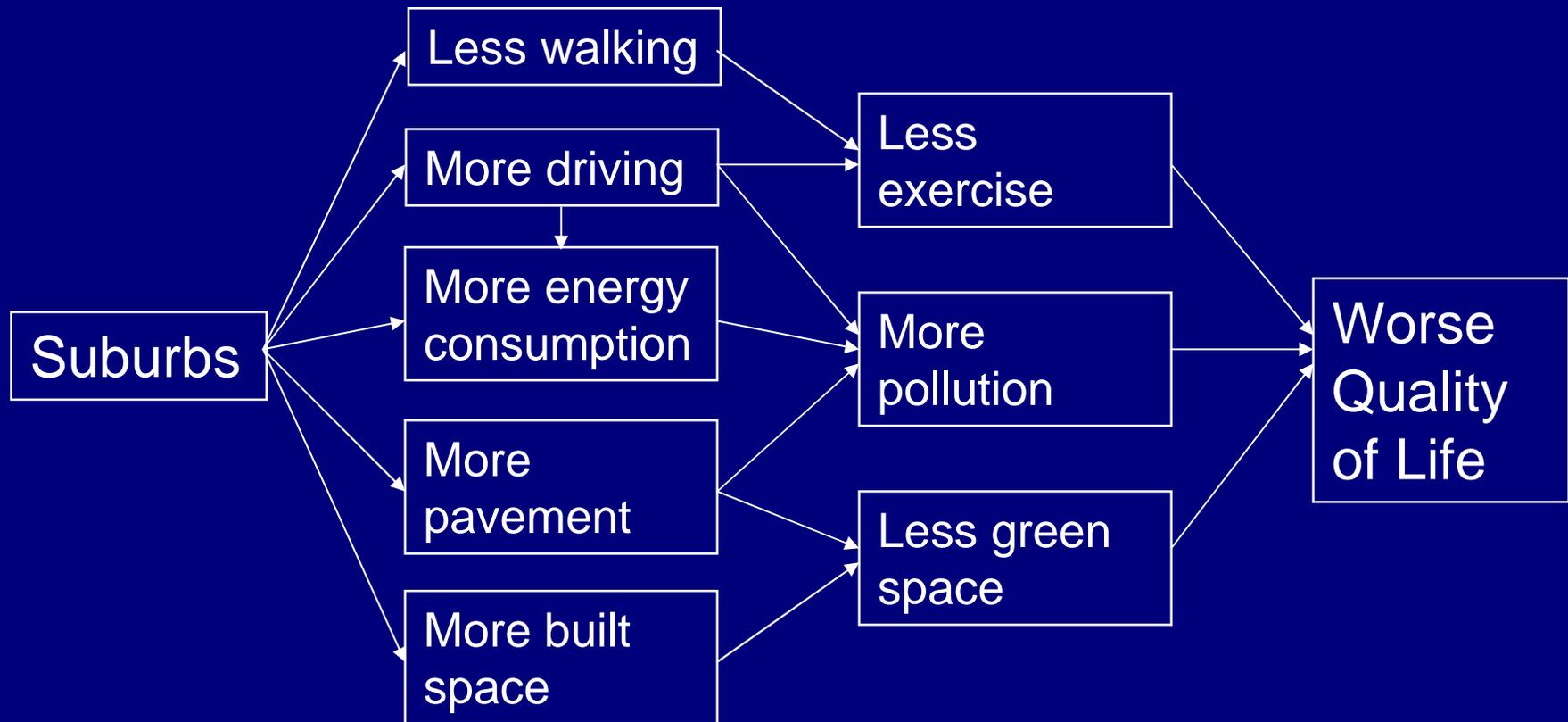


Source: Pucher and Dijkstra 2003



Big in the burbs

Negative Impacts of Suburbia



Questions

- Can we decrease driving by changing the built environment, and if so, in what ways?
- Can we increase walking and biking by changing the built environment, and if so, in what ways?
- Then, how can we influence policy and investment decisions to make these changes happen?

Can we change travel behavior by changing the built environment?

- Research approaches
- Research findings
- Outstanding issues



Two Fields with Overlapping Concerns

Travel
Behavior

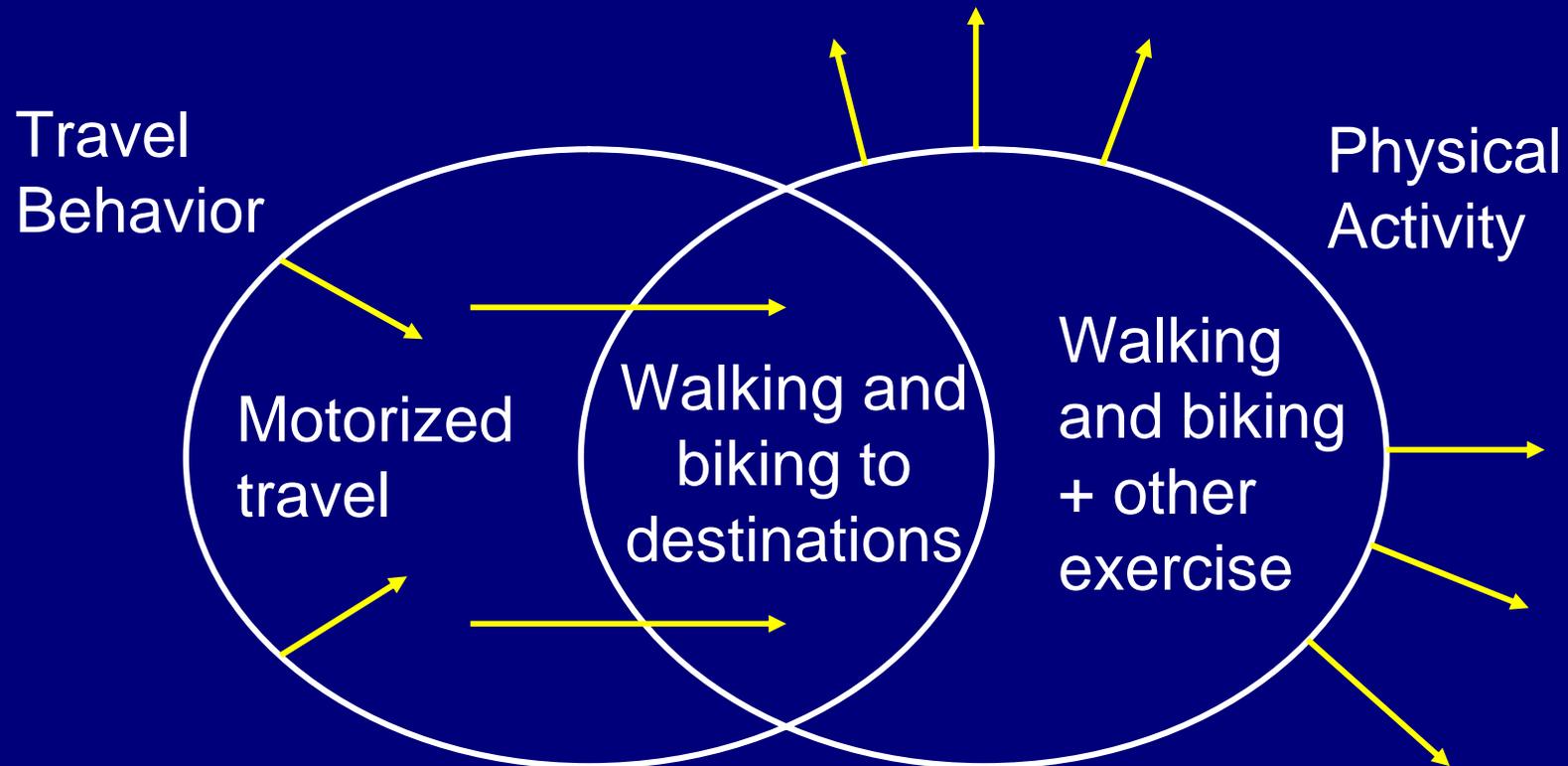
Physical
Activity

Motorized
travel

Walking and
biking to
destinations

Walking
and biking
+ other
exercise

Overlapping Concerns but Differing Motivations



Research Approaches

	Travel Behavior Research (TBR)	Physical Activity Research (PAR)
Theory	Utility-maximizing framework	Ecological framework
Measures	Objective BE Active Travel	Perceived BE Other Physical Activity
PA Data	Diary surveys	Self-reports, accelerometers
Design	Cross-sectional	Cross-sectional, interventions

Research Findings

- Driving
- Walking



Elasticities for Vehicle Travel

	Vehicle Trips	Vehicle Miles Traveled
Density	-0.05	-0.05
Diversity	-0.03	-0.05
Design	-0.05	-0.03
Regional	n/a	-0.20

Source: Ewing, R. and R.Cervero 2001, Transportation Research Record

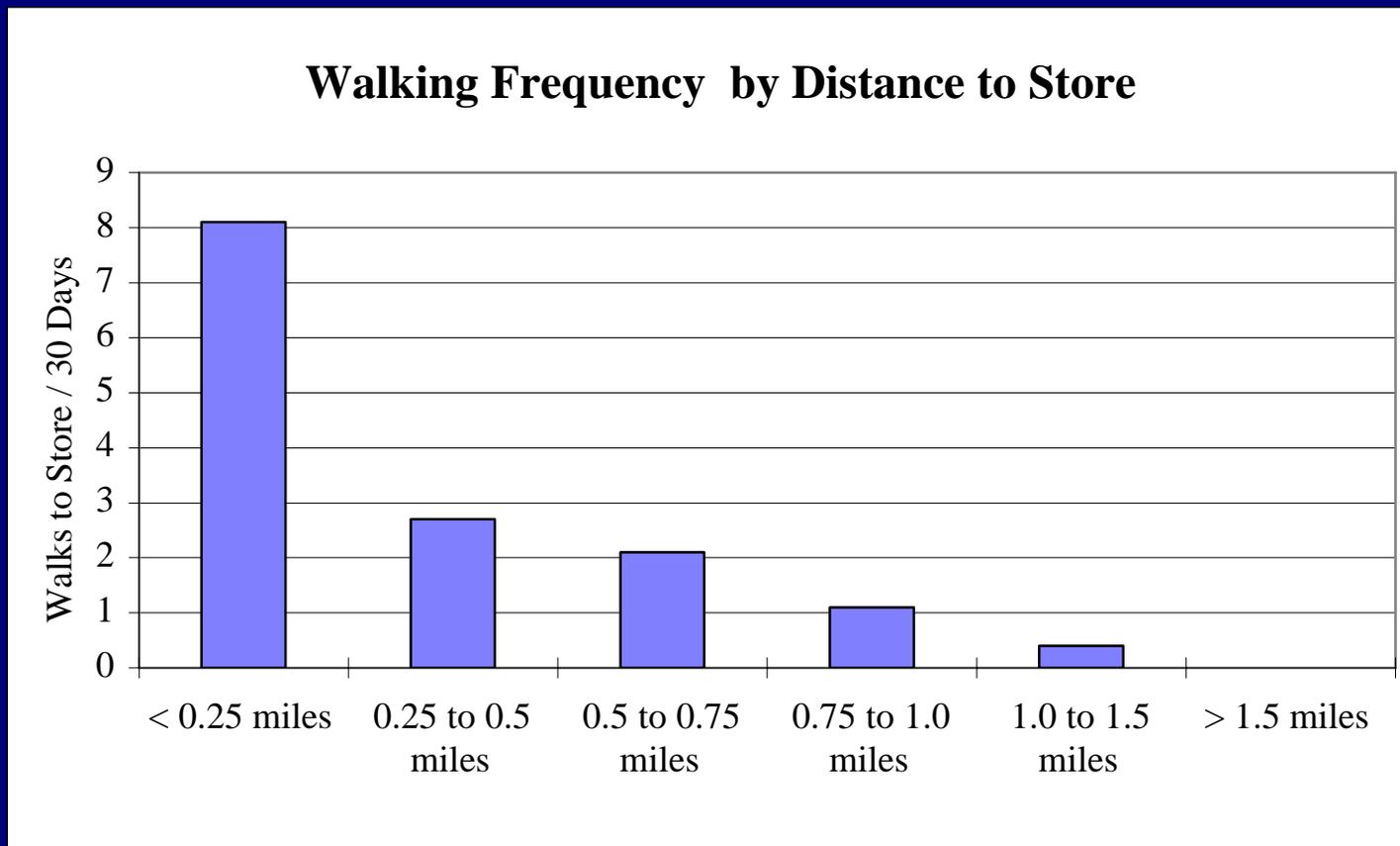
TRB-IOM Review on Walking

- 22 Travel behavior studies
 - 31 measures of active travel
 - 50 measures of the built environment
- 28 Physical activity studies
 - 23 measures of physical activity
 - 42+ measures of the built environment

Active Travel

Population and employment density	+	Walking/biking
Accessibility to destinations	+	Walking/biking
Distance to nearest destination	-	Walking/biking
Design	?	Walking/biking
Walkable/transit-oriented/traditional	+	Walking/biking

Walking to Store vs. Distance

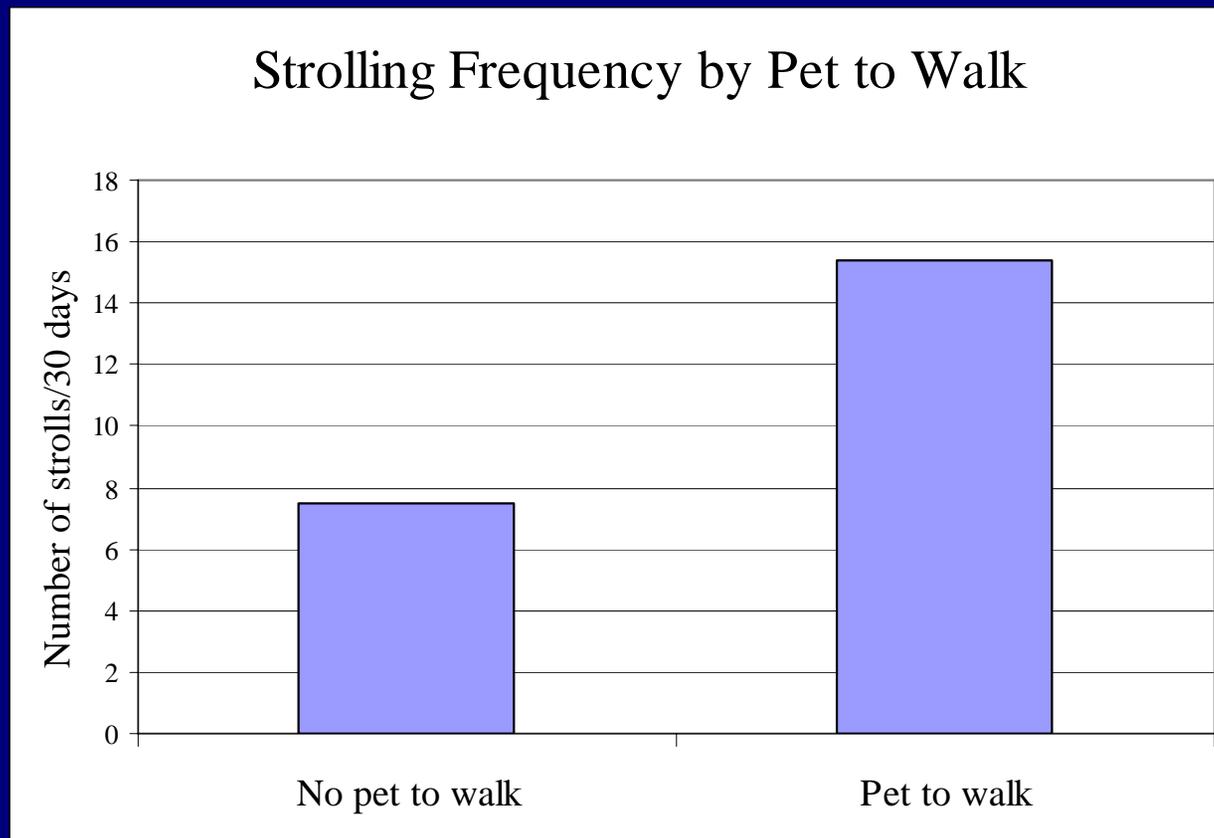


Source: Handy S. and K. Clifton 2001 *Transportation Research D*

Other Physical Activity

Accessibility to facilities	+	Physical activity
Distance to trail or bikeway	-	Use of trail or bikeway
Reported presence of sidewalks	+	Walking
Perceived neighborhood aesthetics	+	Walking/biking

Strolling vs. Pet Ownership



Source: Handy S. and K. Clifton 2001 *Transportation Research D*

* CANINE CONSTITUTIONAL



By David Cooper

A brisk walk in the park keeps Mares B in shape between dog shows. His owner, Columbus resident Cathy Stumbo, got up early

to give her 3-year-old Doberman his regular workout. They typically log 15 miles in Berlinet Park.

Outstanding Issues

- Special populations
- Causal relationships



Community
design for
women?



Community
design for
elderly?



Community
design for
low-income?



Walking for Low-Income Households

- Low-income household walk for travel and use transit more than moderate- and high-income households.
- Low-income persons perceive less favorable walking conditions, and pedestrian accidents are relatively high in low-income areas.

Source: Walkable Communities, Inc.



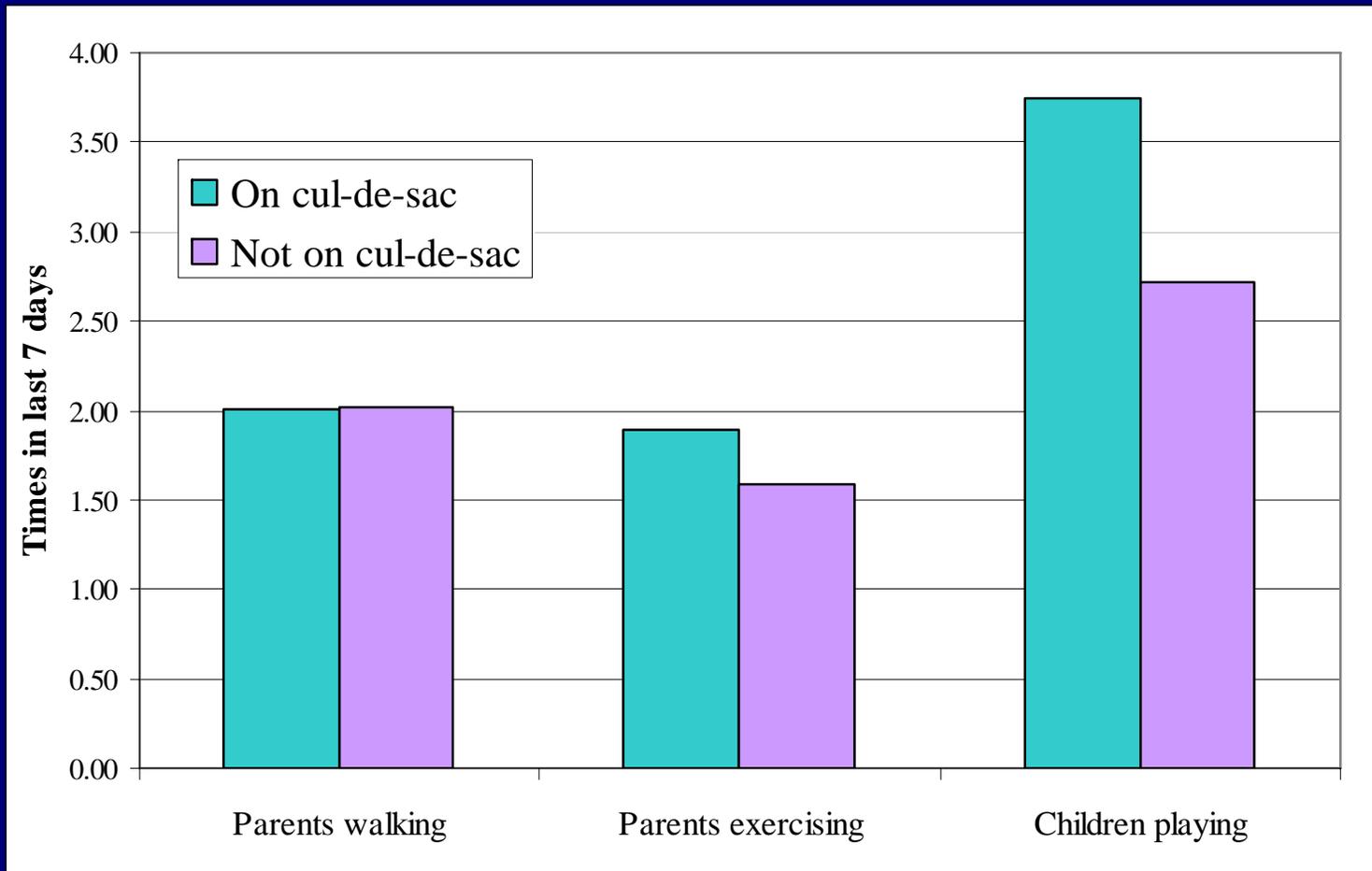
Community
design for
parents

?
=

Community
design for
children

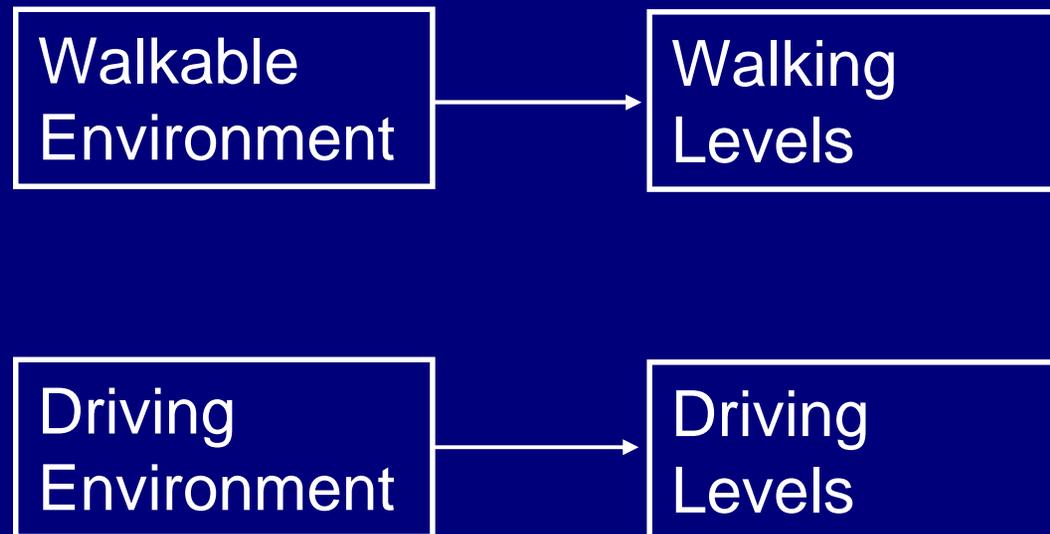


Cul-de-sacs and Exercise

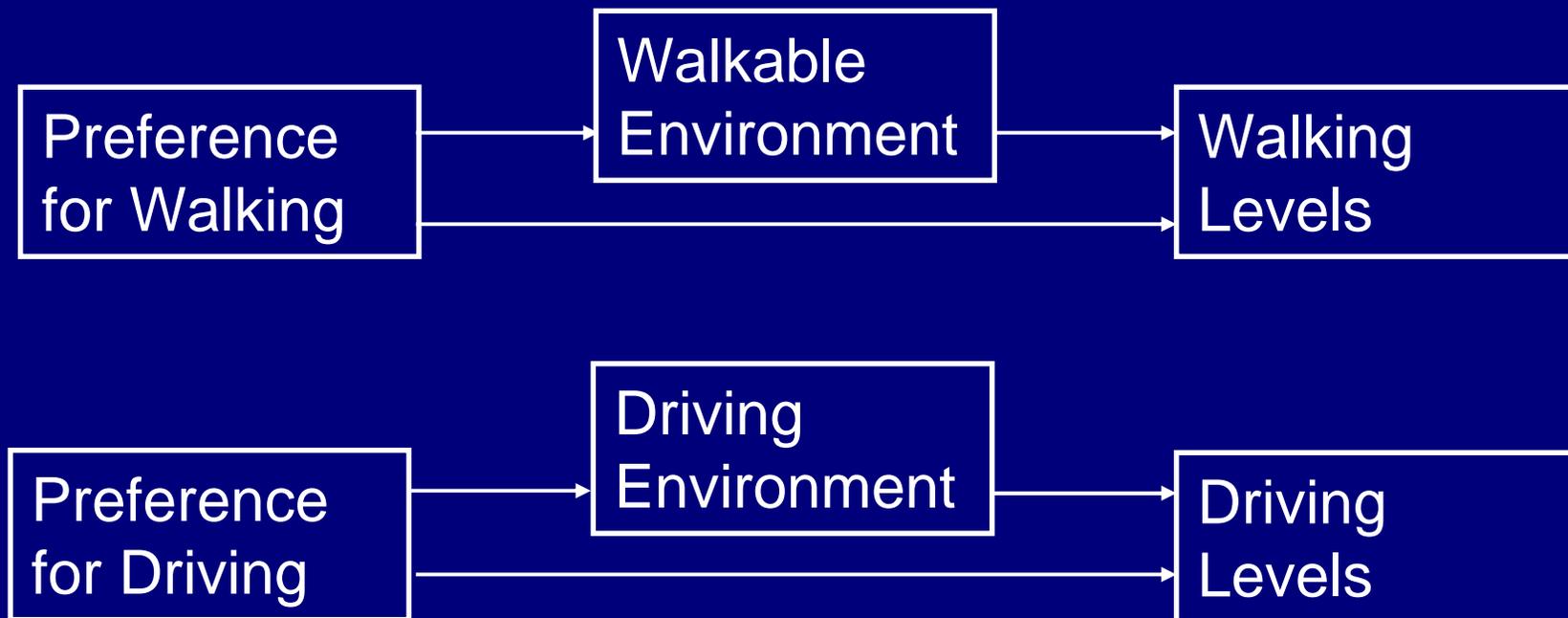


Source: Handy, et al. in preparation

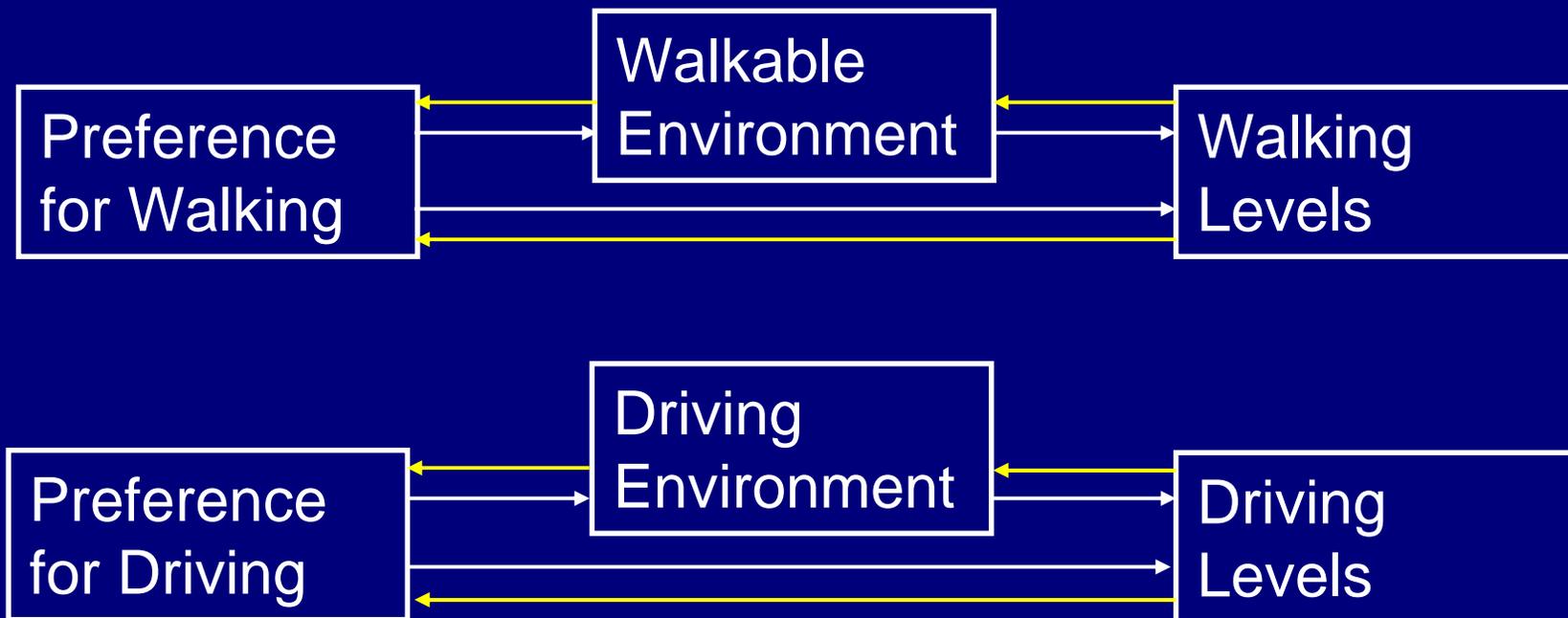
Causal Relationships?



Causal Relationships?



Causal Relationships?



Critical Research Questions

- To what degree does “self-selection” explain the observed correlations between the built environment and travel behavior?
- Can the built environment do more than facilitate less driving/more walking for motivated individuals? ... change motivation? ... change preferences?

Beyond cross-sectional designs

- Measure changes in travel associated with changes in BE
 - ex. California SR2S study
- Measure changes in travel associated with changes in residential location
 - ex. RESIDE study
 - ex. Caltrans study

California SR2S Study - UCI

Work Type	Schools
Sidewalk improvements	Sheldon Elementary, West Randall Elementary (primarily sidewalks) Murrieta Elementary, Valley Elementary, La Gloria Elementary (includes other work types) Juan Cabrillo Elementary, Ocean Knoll Elementary
Traffic calming & speed reduction	La Gloria Elementary, Hawthorne Elementary
Pedestrian/bicycle crossing	Mt. Vernon Elementary, Jasper Elementary, Valley Elementary, Glenoaks Elementary
Bicycle facilities (on-street or off-street)	La Gloria Elementary, Murrieta Elementary
Traffic control devices	Cesar Chavez Elementary, Newman Elementary
Traffic diversion improvements	La Gloria Elementary, Sulphur Springs Elementary

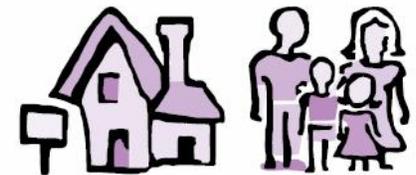
Note: Most projects with multiple work types are shown in multiple categories.



- Parents of 3rd and 5th graders surveyed before and after improvements
- Traffic counts and driver behavior before and after improvements

RESIDE Study – UWA, Perth

- 2003-2008
- 5000 new home builders invited to participate
- Surveys before move, one year after, two years after, plus pedometers
 - Physical activity measures: self-report and objective
 - Perceived BE characteristics
 - Attitudes and preferences
- Environmental audits for BE characteristics



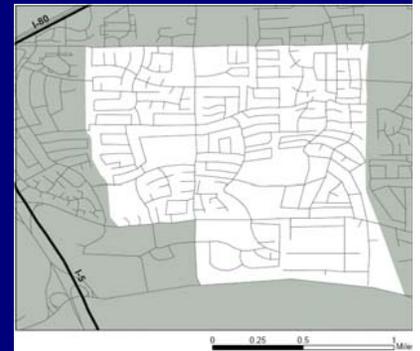
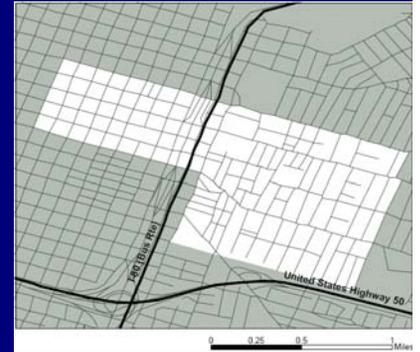
The RESIDE Project

RESidential Environments Project

How the design of local communities affects people's leisure-time activities, transport patterns, health and sense of community.

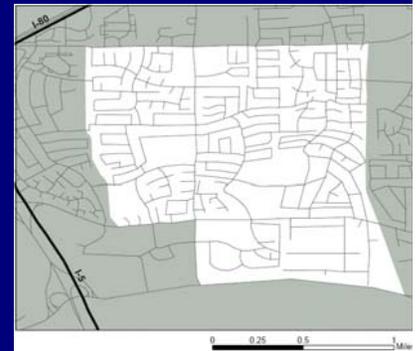
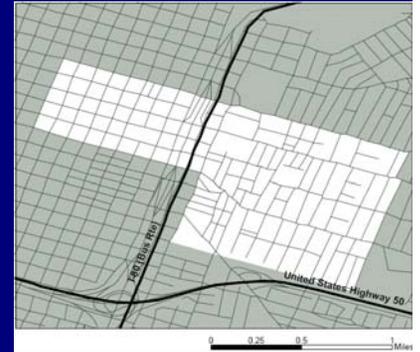
Caltrans Study

- Funded by...
 - The UC Davis – Caltrans Air Quality Project
 - The Robert Wood Johnson Foundation
 - The University of California Transportation Center
- Results published in...
 - Handy, et al. 2006 JAPA
 - Handy, et al. 2005 TRD
 - Cao, et al. 2006 TRD



Method

- Eight neighborhoods, by design and location
- Mail-out, mail-back survey
 - 1672 respondents:
 - “Movers” – moved within previous year
 - “Non-movers” – had not moved



Variables

Current	Change
Vehicle miles driven per week Vehicle type Walks to the store Strolling	Change in driving Change in walking
Perceived neighborhood characteristics	Change in perceived neighborhood characteristics
Preferences for neighborhood characteristics	(assumed unchanged)
Transportation attitudes	(assumed unchanged)
Socio-demographic characteristics	Changes in socio-demographic characteristics

Hypotheses

- Cross-sectional
 - Environments designed for walking and transit are associated with less driving and more walking
- Quasi-longitudinal
 - Moves to environments designed for walking and transit are associated with a decrease in driving and an increase in walking

Selection of Neighborhoods

	Traditional Neighborhood	Suburban Neighborhood
Large Metro Area	Mountain View Sac Midtown	Sunnyvale Sac Natomas
Stand-Alone City	Santa Rosa JC Modesto Central	Santa Rosa RV Modesto Fringe



Sacramento - Traditional





Pensi's Traditional Thai Massage

WONDERFUL
and
HEALING!

Graduate of Wat Po Temple
Bangkok, Thailand

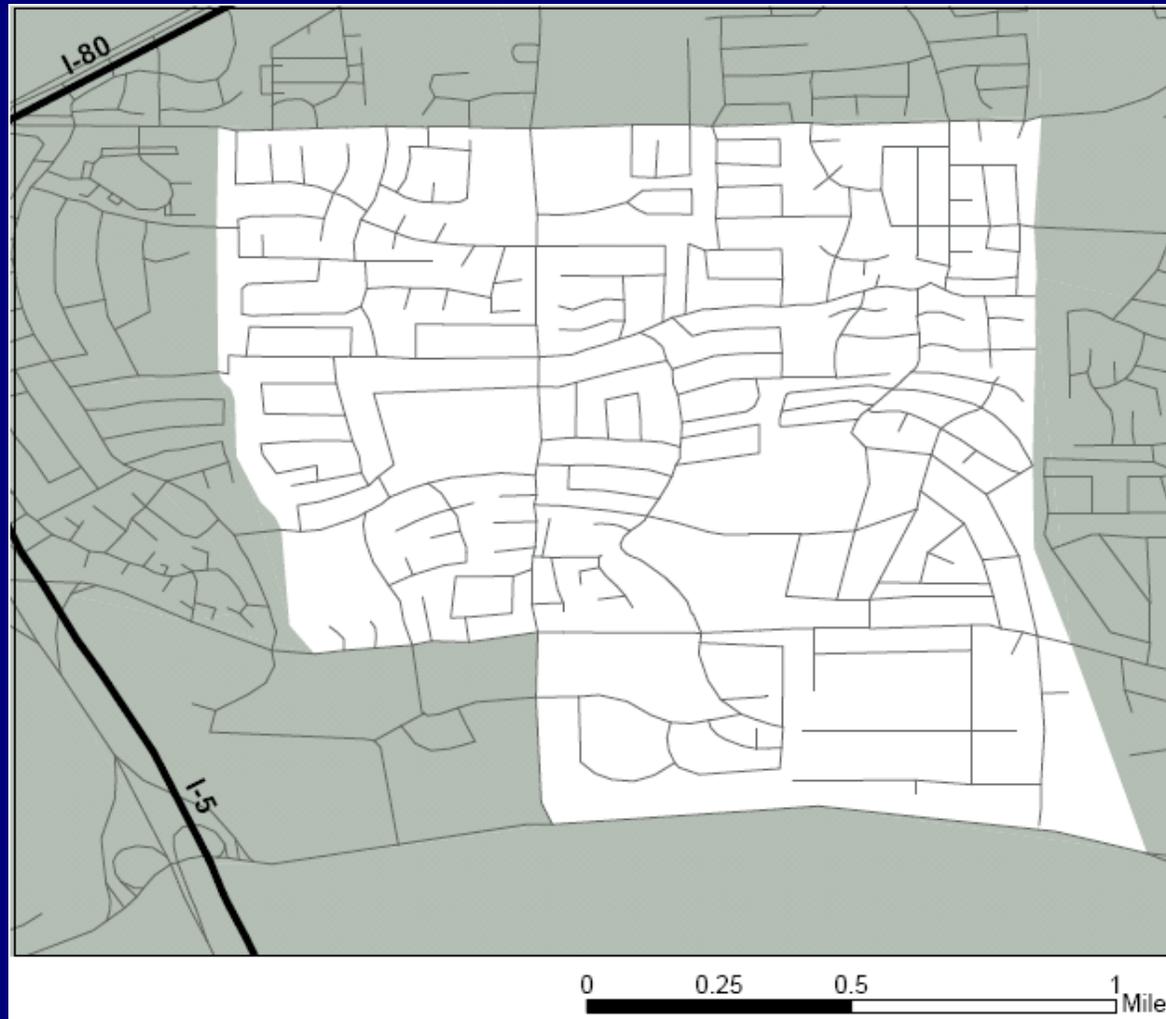
778 25th Street #11
Sacramento, CA 95818

(916) 498-0739
(916) 743-6649

THE BEE
THE BEE
THE BEE
THE BEE
THE BEE



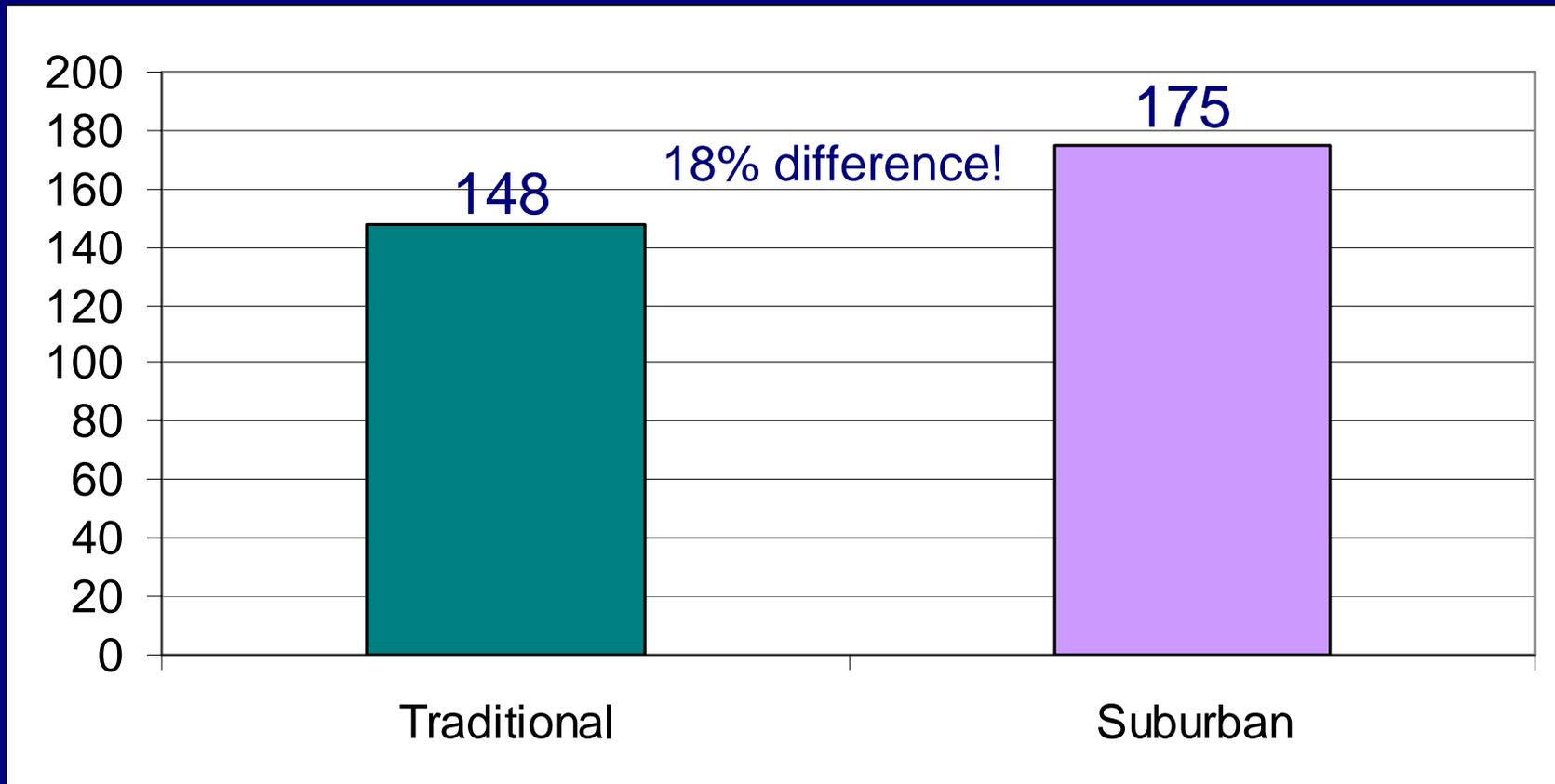
Sacramento - Suburban



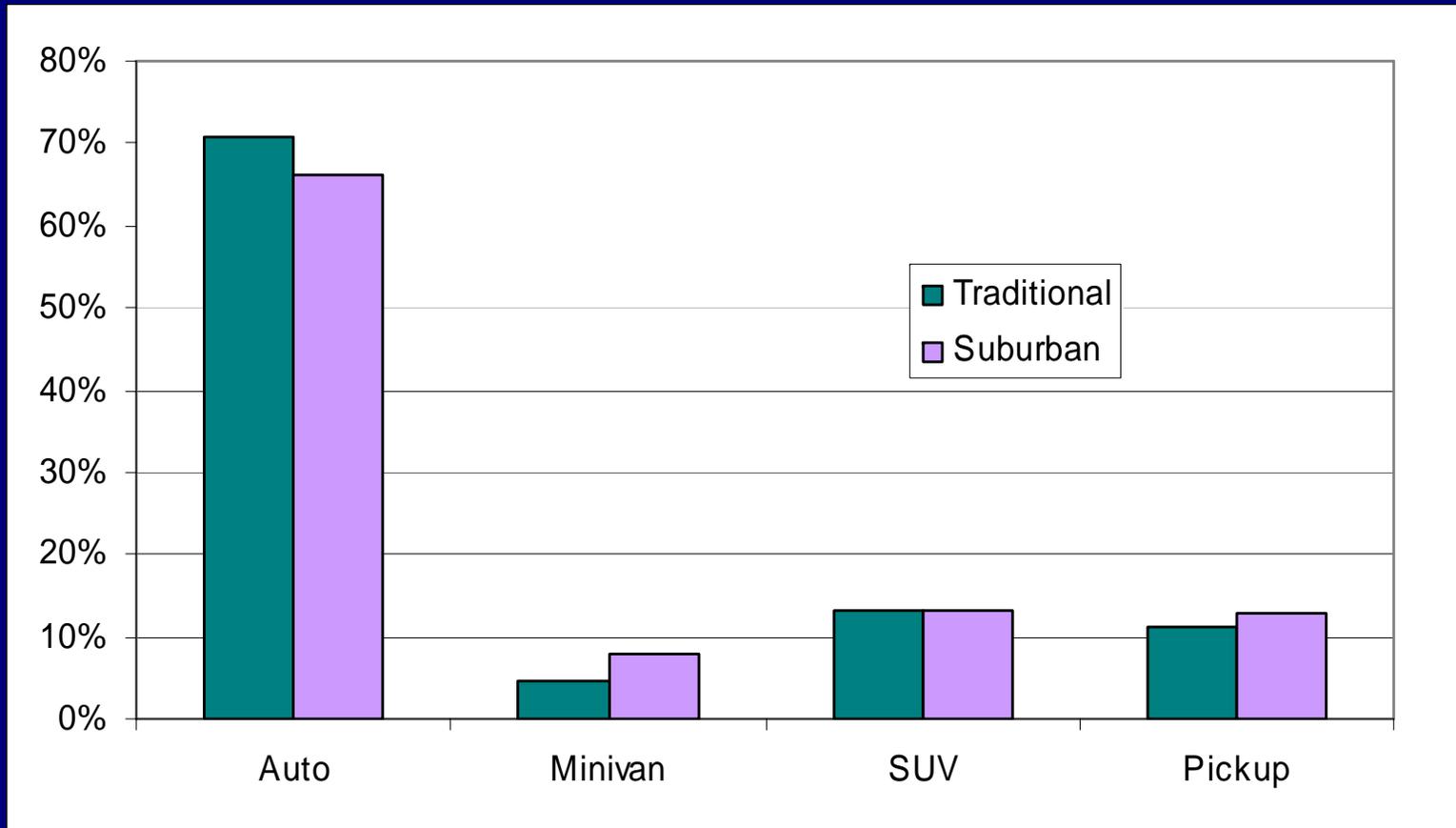




Vehicle Miles Traveled per Week



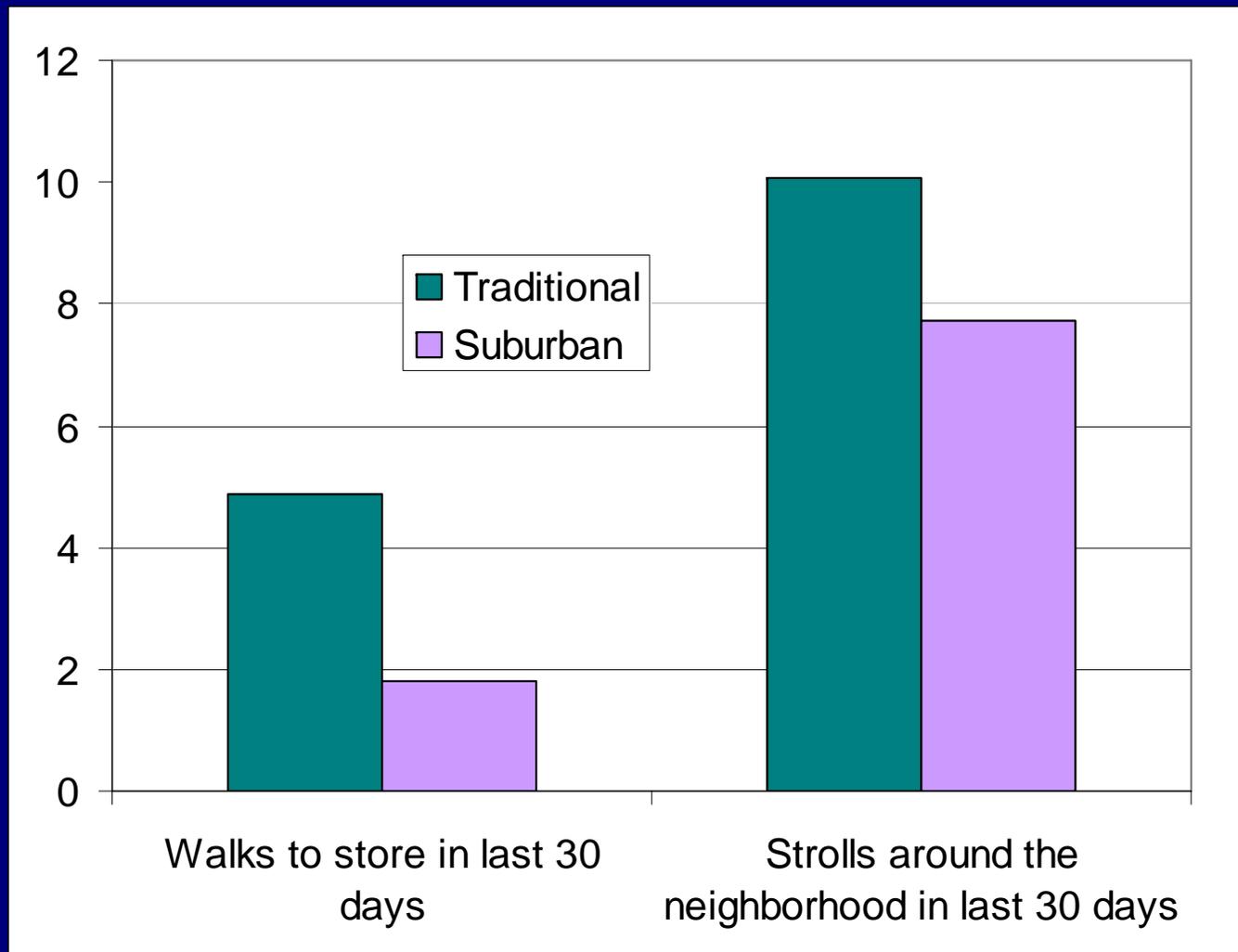
Vehicle Types



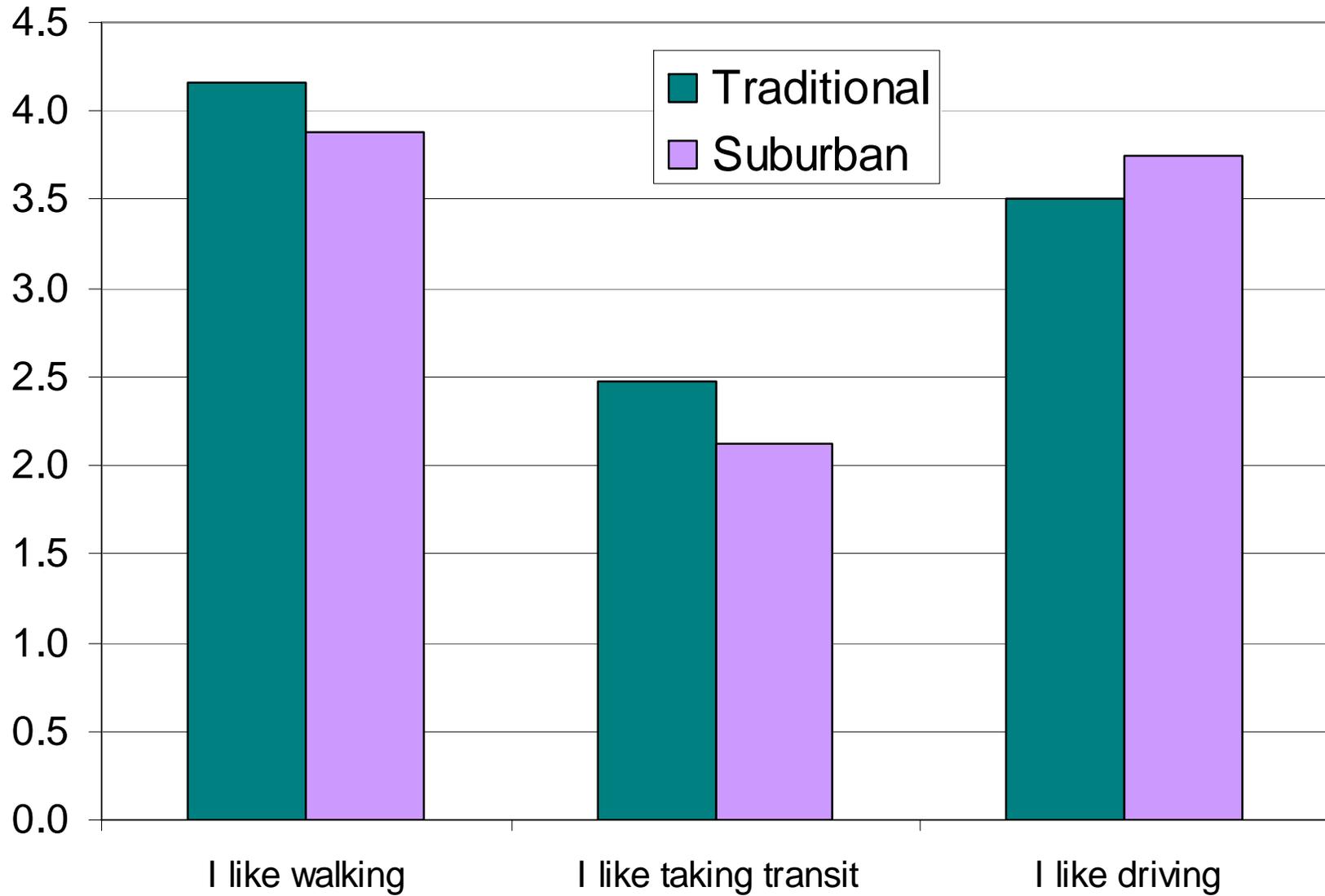
Share of Residents Walking



Walking Frequency



Average agreement on 5-Point scale that...



Quasi-Longitudinal Models

Socio-demographic characteristics
Changes in socio-demographic chars

Travel attitudes
Preferences for neighborhood characteristics

Objective neighborhood characteristics
Perceived neighborhood characteristics
Changes in perceived neighborhood characteristics

Change in
Driving or
Walking
Levels

```
graph LR; A["Socio-demographic characteristics  
Changes in socio-demographic chars"] --> D["Change in Driving or Walking Levels"]; B["Travel attitudes  
Preferences for neighborhood characteristics"] --> D; C["Objective neighborhood characteristics  
Perceived neighborhood characteristics  
Changes in perceived neighborhood characteristics"] --> D;
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Change in Driving

Socio-Demographics	Attitudes and Preferences	Neighborhood Characteristics
<ul style="list-style-type: none">- Current age+ Currently working+ Current kids under 18- Limits on driving+ Change in income	<ul style="list-style-type: none">+ Car dependent attitude- Pro-bike/walk attitude	<ul style="list-style-type: none">- #Groceries within 1600m- #Pharmacies within 1600m- #Theaters within 400m- Change in accessibility factor- Change in safety factor- Change in alternatives factor

Change in Walking

Socio-Demographic

- + Current income
- Current age
- Limits on walking
- + Change in kids < 5 yrs
- Change in income

Attitudes & Preferences

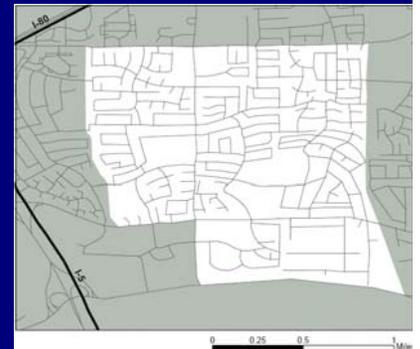
- + Pro-bike/walk attitude

Neighborhood Characteristics

- + Minimum distance to bank
- + #Banks within 800m
- + #Types of businesses within 1600m
- Current space perception
- + Change in accessibility factor
- + Change in alternatives factor
- + Change in safety factor
- + Change in socializing factor
- + Change in attractiveness factor

Caltrans Conclusions

- The built environment has significant effect on travel behavior even after accounting for attitudes and preferences
- Changes in the built environment are associated with changes in driving and walking
- Results show stronger evidence of a causal relationship between the built environment and travel behavior!



Implications of the Evidence

- We can't yet say that changes in the built environment will necessarily lead to decreases in driving and increases in walking.
- We can say that changes in the built environment will increase the opportunities for less driving and more walking.



How can we influence policy and investment decisions to make these changes happen?



Planning Movements Supportive of Less Driving and More Walking

Neighborhood Characteristic	Planning Movement
Shorter distances to destinations	<ul style="list-style-type: none">▪ Street connectivity▪ Local stores
Increased safety and comfort for pedestrians	<ul style="list-style-type: none">▪ Trails programs▪ Traffic calming programs

Increasing Connectivity



e.g. Berkeley Bike Bridge



e.g. Davis Bike Tunnel

e.g. “sinking” freeways – The Big Dig in Boston

e.g. removing freeways – The Embarcadero Freeway in SF

Bridging Barriers



Stone Arch Bridge, Minneapolis



Sun Dial Bridge, Redding, CA

Main Street Programs

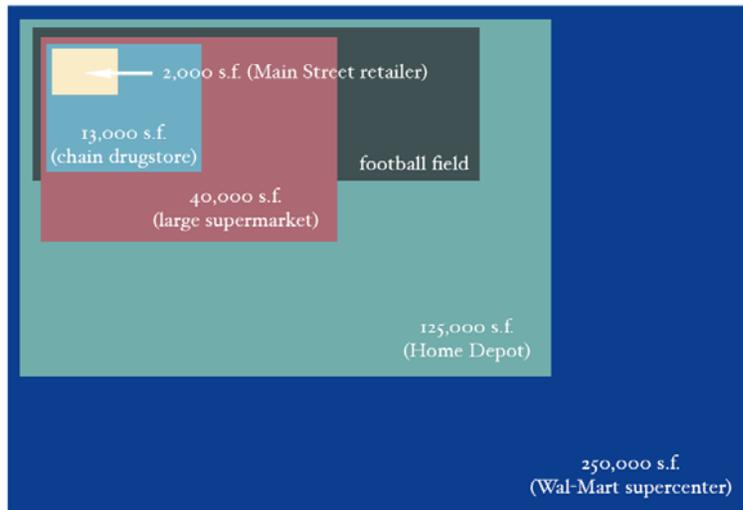
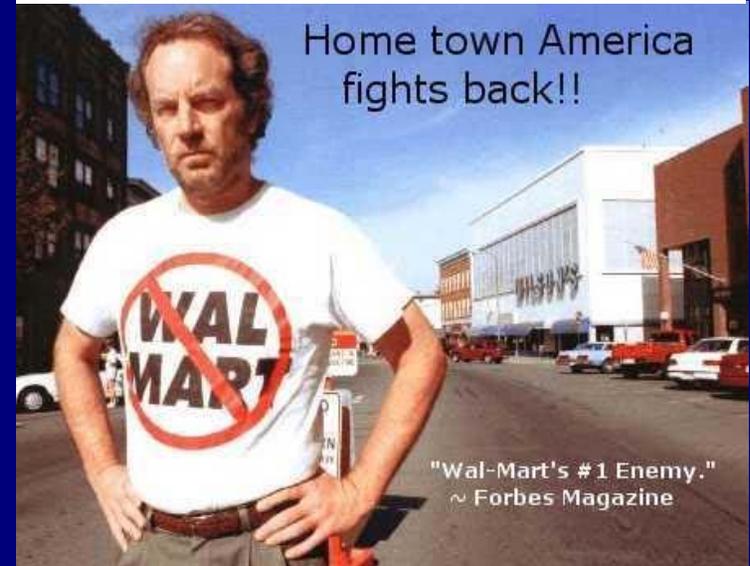
Ex. Portland Metro's **Main Street Handbook**: "...main streets help define a community so that a neighborhood or city can develop a unique identity within a larger regional context... main streets are tremendously efficient in reducing the amount of automobile traffic in the area."



Anti "Big-Box" Efforts

Ex. San Francisco ordinance: No new stores over 120,000 square feet

Sprawl-Busters



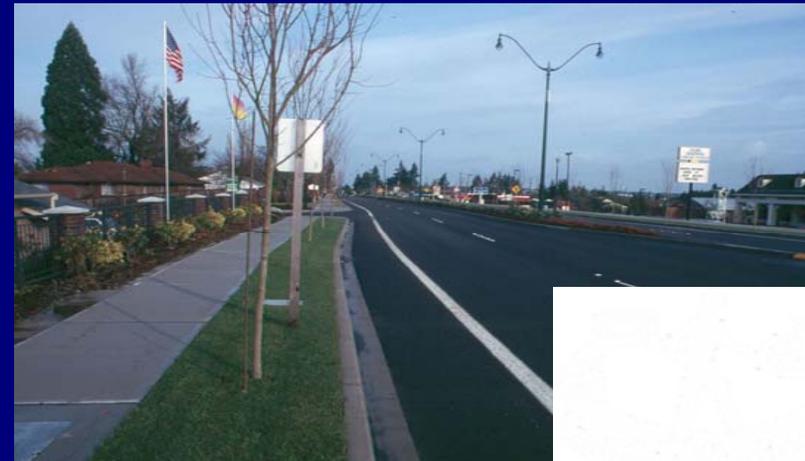
Trails Programs

“Rail-trails... enhance existing recreational resources by linking neighborhoods and schools to parks, waterfronts, recreational centers and other facilities.”

– Rails to Trails Conservancy

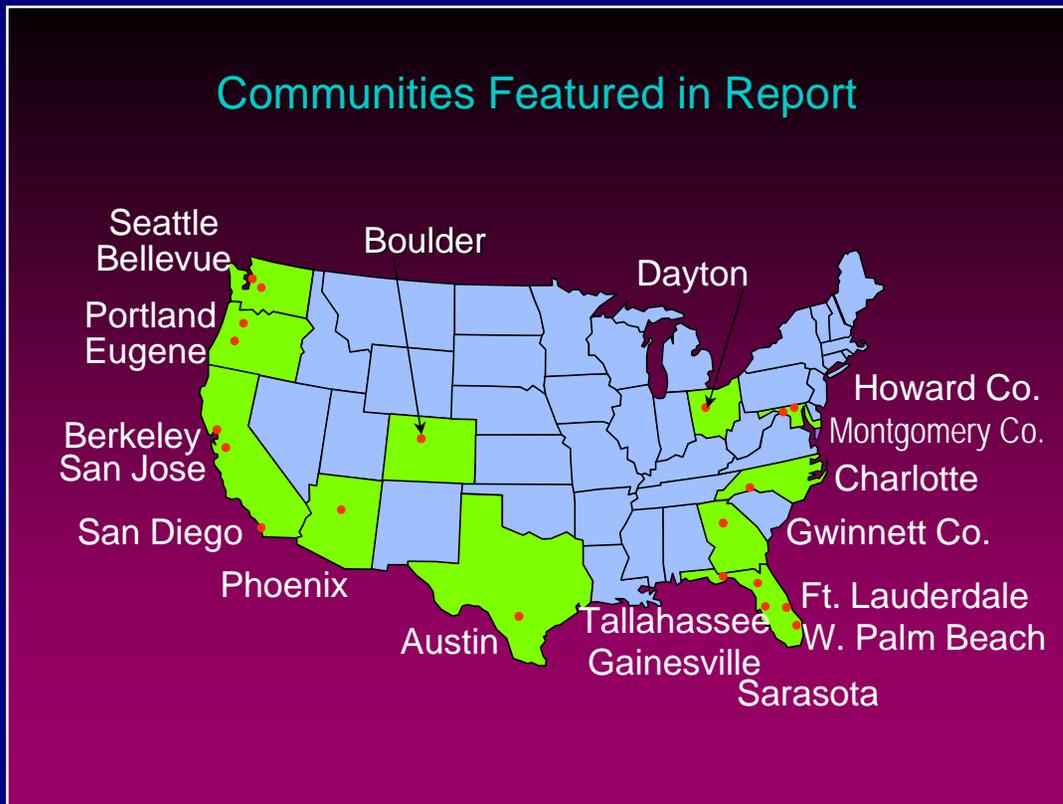


Complete the Streets



The many types of Complete Streets

Traffic Calming



"Traffic calming is the combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behavior and improve conditions for non-motorized street users."

- ITE Subcommittee on Traffic Calming

Safe Routes to School



Providing safer routes to school offers a full range of benefits:

- ✓ It's Fun!
- ✓ It's Healthy
- ✓ It's Non-polluting
- ✓ It's Friendly
- ✓ It's Educational
- ✓ It's Economical

Walking + Biking = Healthy, Alert Children



Permanent speed feedback sign *



In-street crosswalk sign *



Walking school bus



Advance pedestrian signal timing

“Parent and neighborhood groups, school and local officials, law enforcement officers and traffic engineers are working together to make streets safer for pedestrians and bicyclists along heavily traveled routes to school, while encouraging both parents and their kids to take advantage of the many benefits of getting around on foot or by bike.”

- California Dept. of Health Services

Congress for the New Urbanism



“Across North American and around the world, a movement called New Urbanism is changing the way our cities and towns are built...”

“New Urbanist developments create walkable neighborhoods, rather than large, single-use developments connected by streets hostile to pedestrians.”

-CNU website



ACTIVE LIVING BY DESIGN

Increasing physical activity through
community design



**Our vision is active Americans
in healthy communities.**

Providing leadership in promoting environments that offer choices for Active Living, a lifestyle that easily integrates physical activity into daily routines.





Davis

California

