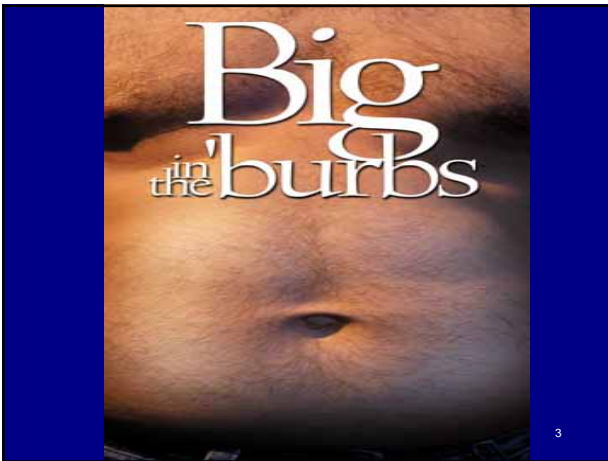


The Built Environment and Physical Activity: Evidence from the Transport Field

Susan Handy
University of California Davis

Walk21 Satellite Symposium "Transport-Related Physical Activity and Health"
Maglingen, Switzerland
September 19, 2005

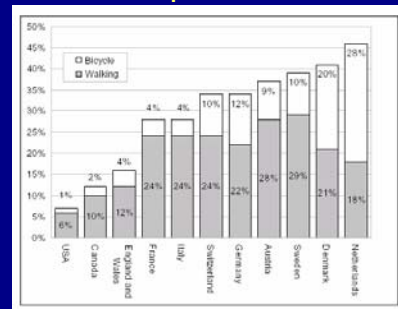


Traditional Transportation Concerns

- Economy
- Environment
- Equity
- Safety

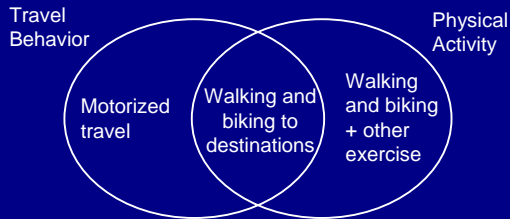


Walk/Bike as Share of Urban Trips 1995



Source: Pucher and Dijkstra 2003

Overlapping Concerns



7

Shared Questions

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

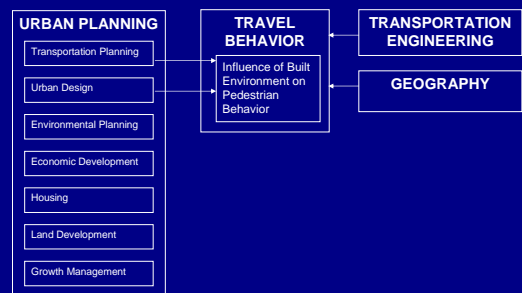
8

Can we increase physical activity by changing the built environment?

Research approach



Travel Behavior Field



10

Differences by Field

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

11

Built Environment Elements

- Land use – what activities where
- Transportation system – how linked
- Design – aesthetic features



Data Sources

	Objective	Perceived
Land Use	Existing data In-field data collection	Surveys
Transportation	Existing data In-field data collection	Surveys
Design	In-field data collection	Surveys

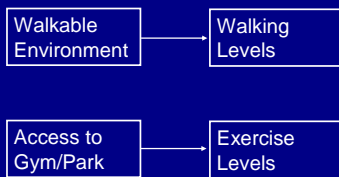
13

Study Design

- Cross-sectional designs: different geographic locations at one point in time
 - Comparative: comparisons of walking in neighborhoods of different types, with analysis of variance
 - Correlative: household-level measures of urban form as predictors of walk behavior, with multivariate analysis

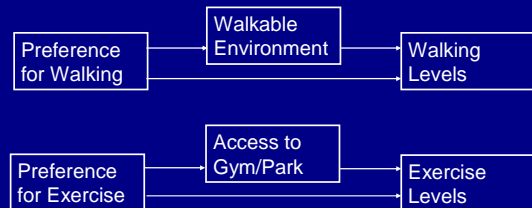
14

Assumed Causality



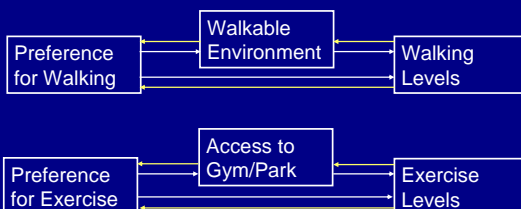
15

Possible Causality



16

Possible Causality



17

Critical Questions

- To what degree does “self-selection” explain the observed correlations between the built environment and physical activity?
- Can the built environment do more than facilitate physical activity for motivated individuals? ... change motivation? ... change preferences?

18

Beyond Cross-Sectional Designs

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

19

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



20

California SR2S Study - UCI

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

Source: Boarnet, M. et al. 2005. *Journal of the American Planning Association* (Summer).

21

Can we increase physical activity by changing the built environment?

Research findings



Weekly Walking Trips for Transport by Neighborhood Type

	High-Walkable Neighborhoods	Low-Walkable Neighborhoods
Austin, TX	4.3	0.8
San Francisco Bay Area, CA	6.8	1.1
Orange County, CA	2.2	2.1
Portland, OR	2.1	0.5

Source: Saelens, B.E., J.F. Sallis, et al. 2003. Environmental Correlates of Walking and Cycling: Findings From the Transportation, Urban Design, and Planning Literatures. *Annals of Behavioral Medicine* 25(2): 80-91.

23

High Walkable



24

Low Walkable



25

TRB-IOM Review

- 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

S. Handy, 2005. "Critical Assessment of the Literature on the Relationships Among Transportation, Land Use, and Physical Activity," prepared for the Transportation Research Board and Institute of Medicine Committee on Physical Activity, Health, Transportation, and Land Use, January.

26

Summary of TBR Studies

Built Env't Measure	Walking to Destination
Population density	+++++0
Employment density	++0
Land use mix	++0
Distance to destination	-----000
Pedestrian Env't Factor	++
Tradl/transit/walkable nbhd	+++++++0000

- Negative relationship; + positive relationship; 0 not significant

27

But what about self-selection?

CalTrans Study

- Eight neighborhoods, by design and location
- Mail-out, mail-back survey – 1672 respondents, 24.8% response rate:
 - "Movers" – moved within previous year
 - "Non-movers" – had not moved

29

Source: Handy, et al. 2006. Journal of the American Planning Association (Summer).

Variables

Current	Change
Walks to the store	Change in Walking
Strolling	Change in exercise in Neighborhood
Exercise in Neighborhood	Change in kids playing outside
Kids playing outside	Change in perceived neighborhood characteristics
Perceived neighborhood characteristics	(assumed unchanged)
Preferences for neighborhood characteristics	(assumed unchanged)
Transportation attitudes	(assumed unchanged)
Socio-demographic characteristics	Changes in socio-demographic characteristics

30

Research Design

- Cross-sectional
 - Compare walking/exercise of residents of neighborhoods of different types, taking into account attitudes and preferences
- Quasi-longitudinal
 - Look at changes in walking/exercise for residents who have moved recently, taking into account attitudes and preferences

31

Hypotheses

- Cross-sectional
 - Environments that offer more opportunities for walking/exercise are associated with more walking/exercise
- Quasi-longitudinal
 - Moves to environments that offer more opportunities for walking/exercise are associated with an increase in walking/exercise

32

Selection of Neighborhoods

	Traditional Neighborhood (pre-WWII)	Suburban Neighborhood (1960+)
Large Metro Area	Mountain View Sac Midtown	Sunnyvale Sac Natomas
Stand-Alone City	Santa Rosa JC Modesto Central	Santa Rosa RV Modesto Fringe

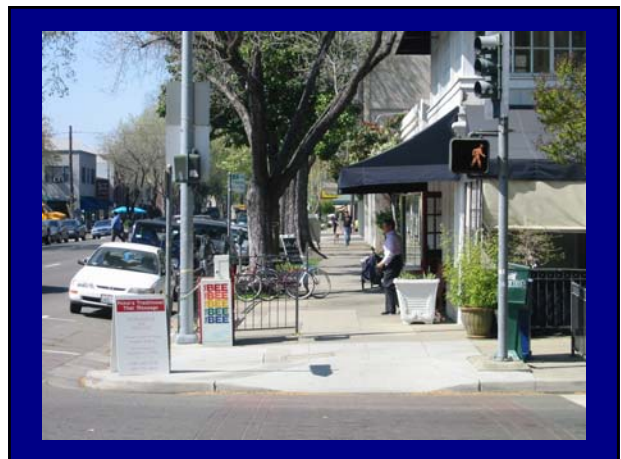
33

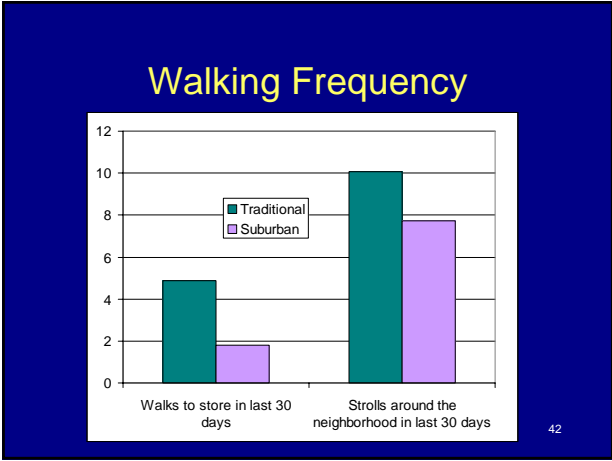
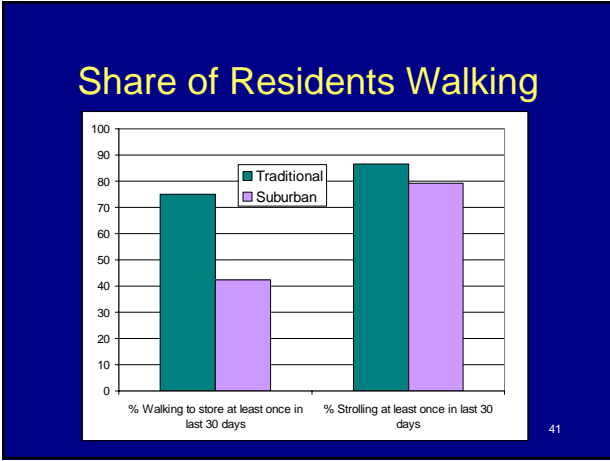


Sacramento - Traditional

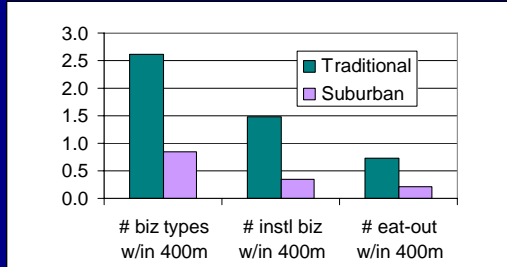


35



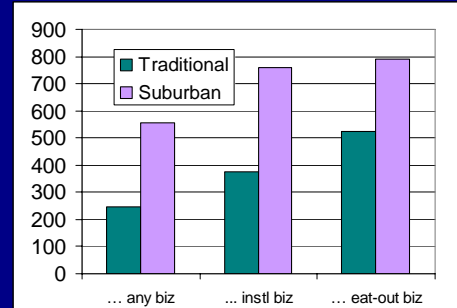


Access to Businesses – Number within 400m



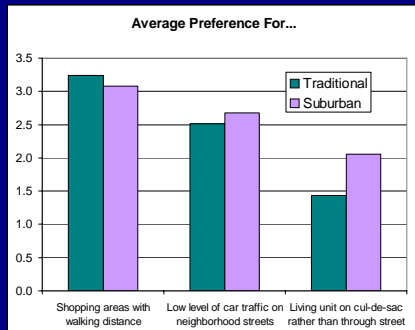
43

Access to Businesses – Meters to Closest...



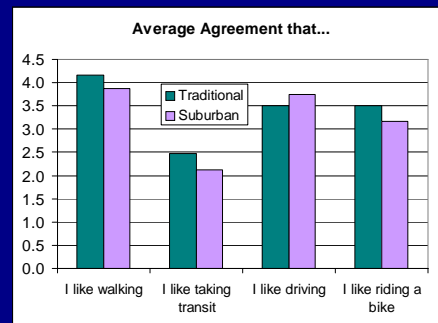
44

Preferences for Neighborhood Characteristics



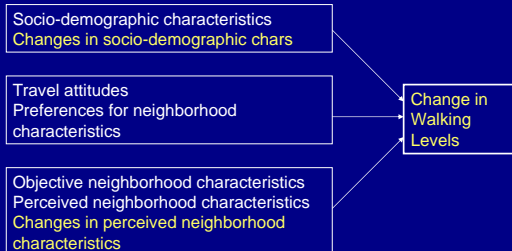
45

Travel Attitudes



46

Quasi-Longitudinal



47

Change in Walking

Socio-Demographic	Attitudes & Preferences	Neighborhood Characteristics
<ul style="list-style-type: none"> + Current income - Current age - Limits on walking + Change in kids < 5 yrs - Change in income 	<ul style="list-style-type: none"> + Pro-bike/walk attitude 	<ul style="list-style-type: none"> + 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

48

Conclusions 1

- The built environment is significant even after accounting for attitudes and preferences
- Changes in the built environment are associated with changes in physical activity
- Results show stronger evidence of a causal relationship between the built environment and physical activity!



Conclusions 2

- To increase walking, increase accessibility, alternatives, safety, socializing, attractiveness:
 - Neighborhood stores
 - Sidewalks
 - Traffic calming
 - Block parties
 - etc.



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



U.S. Planning Movements Supportive of Physical Activity

Movement	Effect
Street connectivity	Shorter distances, more choice of routes
Main Street programs	Stores within walking distances
Trails programs	Separate facilities for peds and bikes
Traffic calming programs	Increased safety and comfort for peds

52

Street Connectivity



"The purpose of a street network is to connect spatially separated places and to enable movement from one place to another."

Source: Handy, et al. 2003

53

Reducing Severance



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

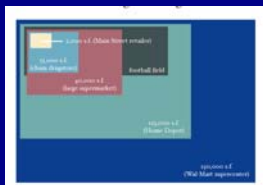
Ex. Portland Metro's Main Street Handbook: "...main streets help define a community so that a neighborhood or city can develop a unique identity within a larger regional context... main streets are tremendously efficient in reducing the amount of automobile traffic in the area."



Anti "Big-Box" Efforts

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

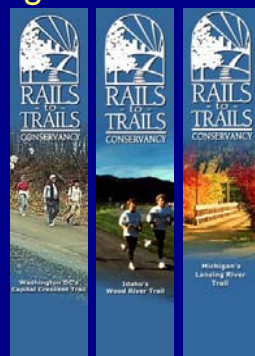
Sprawl-Busters



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



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:

- ✓ 11% Fuel
- ✓ 11% Healthy
- ✓ 11% Non-polluting
- ✓ 11% Friendly
- ✓ 11% Educational
- ✓ 11% Economical

Walking + Biking = Healthy, Alert Children



"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

Putting it all together...



61

Congress for the New Urbanism



"Across North America 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

The Crossings



"The Crossings Transit-Oriented neighborhood project transforms a 1960s auto-oriented strip mall into a vibrant pedestrian-oriented community. Located adjacent to a new CalTrain commuter station, The Crossings provides a range of housing and retail opportunities, with single-family homes, townhouses, rowhouses, and apartments all located within a short walk of shopping and transit. An interconnected network of tree-lined streets and pedestrian paths knit this new mixed-use neighborhood together. The street network provides important connections to an existing Safeway grocery store, allowing residents to walk directly to the store without crossing arterial streets. Community parks and open spaces are distributed throughout the 18-acre site. Bandstands and tot lots provide areas for neighborhood gatherings within parks."



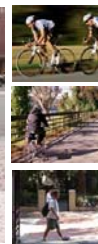
63

Source: <http://www.calthorpe.com/Project%20Sheets/crossings.htm>



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.

64

Active Living by Design Community Partnerships



Seattle, Washington

Feet First "Active Living Seattle"

Project

- Pedestrian improvements in 5 Seattle neighborhoods
- Walking map "periodicals" developed with citizen input
- Neighborhood design workshops and community assessments driving a revision of SDOT street design manual
- Promotion of maps and active living via health clinics, events and local media



Bronx, NYC Sustainable South Bronx "South Bronx Greenway"

Project:

- Create Safe Routes to School Programs
- Youth-led transit ridership initiative
- Safe routes programs to a variety of destinations
- Promotion of city trail network
- Competitive organizational challenges around events in worksites, schools and transit



Winnebago Reservation, NE Ho-Chunk Community Development Corporation "Active Living Winnebago"

Project

- Mixed use village with active living features
- Trail master plan with bike/ped roadway improvements
- Walk/bike clubs
- Safety campaign and neighborhood watch
- Gardening programs



68

