Street Design that Supports Walkable, Livable Communities

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Director, Land Use/Transportation Programs
Local Government Commission

Prepared by the Local Government Commission
with assistance from Dan Burden, Walkable Communities

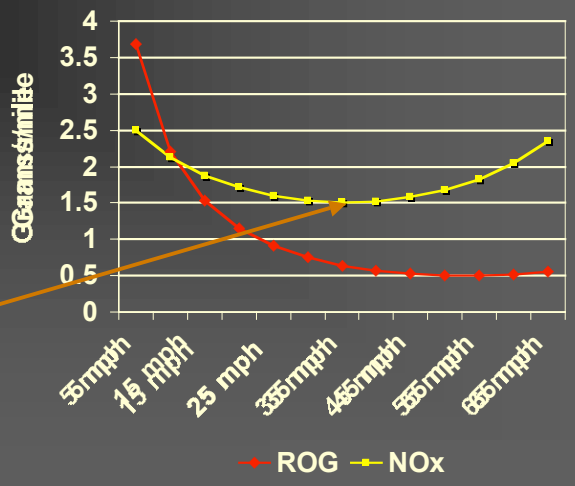
Smart Growth Codes Workshops
San Diego — June 23, 2005
Sacramento — June 24, 2005

Street Design

- Influences trip choices
  - Safe, quiet, slow, shaded streets encourage people to walk, ride bicycle or take transit instead of driving a car

Street Design

- Impacts pollutant emissions
  - Emissions of oxides of nitrogen are lowest at 35 mph
  - NOx plays key role in formation of ozone in most regions of California



Source: EMFAC2000, V. 2.02R

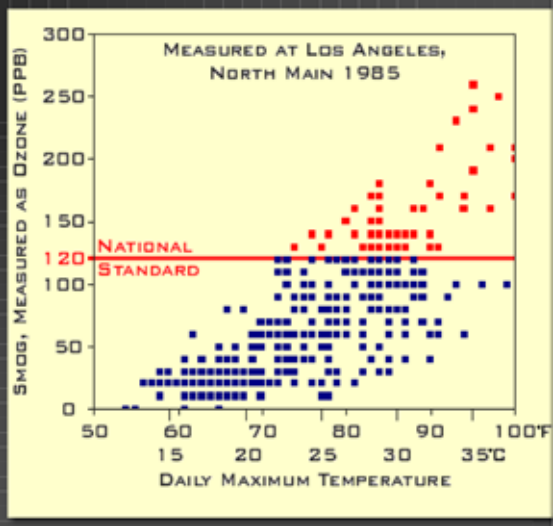
Street Design

- Impacts pollutant emissions
  - Stop and go traffic results in higher pollutant emissions
  - Studies in Germany showed that traffic calming, which reduces average speeds and smooths the flow of traffic:
    - Reduced hydrocarbon emissions by 10-22%
    - Reduced NOx emissions by 32-48%

(Source: Peter Newman and Jeffrey Kenworthy. *Sustainability and Cities: Overcoming Automobile Dependence*. Island Press: Washington DC, 1999.)

Street Design

- Affects formation of ozone
  - Cooler streets reduce heat-island effect which contributes to ozone formation
  - L.A. Study found every degree increase results in approximately 3% increase in ozone



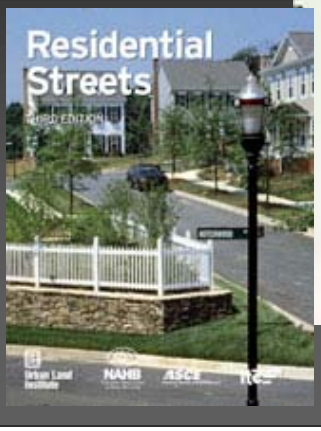
Street Design

- Can help create more livable neighborhoods
  - Improve property values
  - Lower costs
  - Improve quality of life

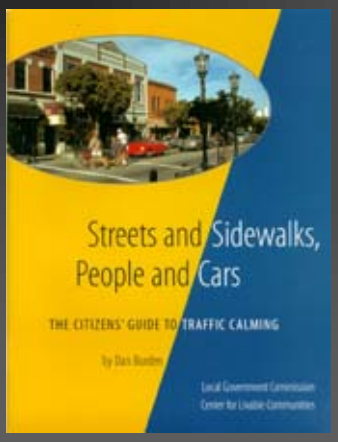
Street Design

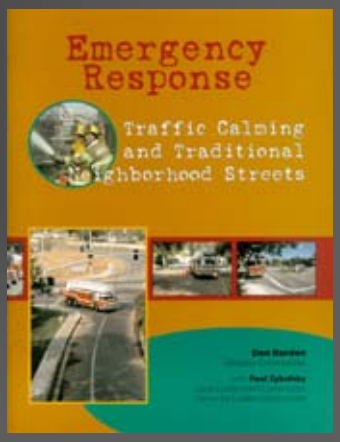
- Can help revitalize retail areas

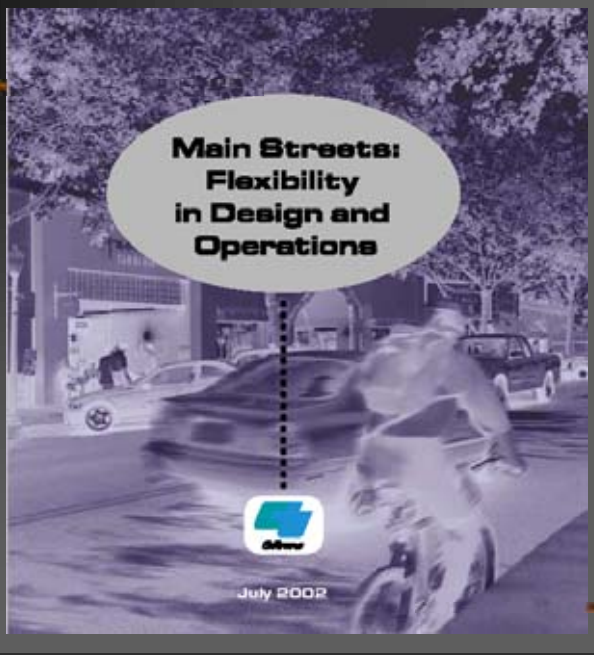
New Approaches to Street Design

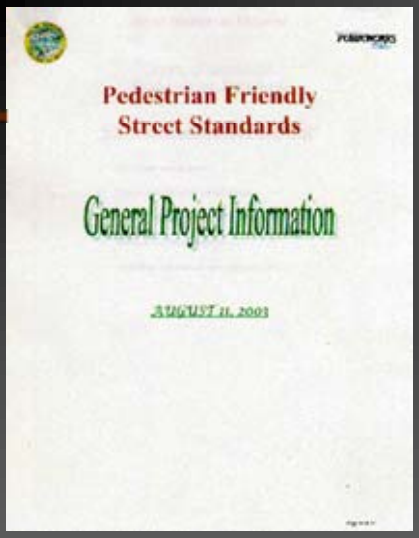


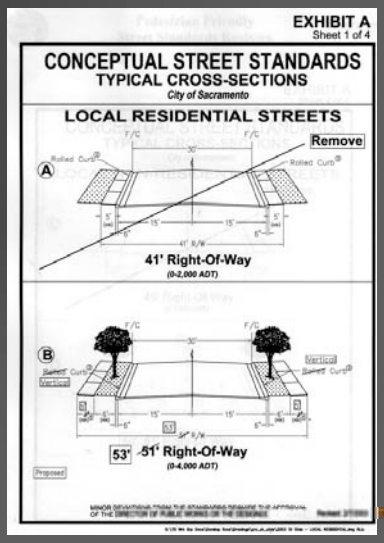
New Approaches to Street Design







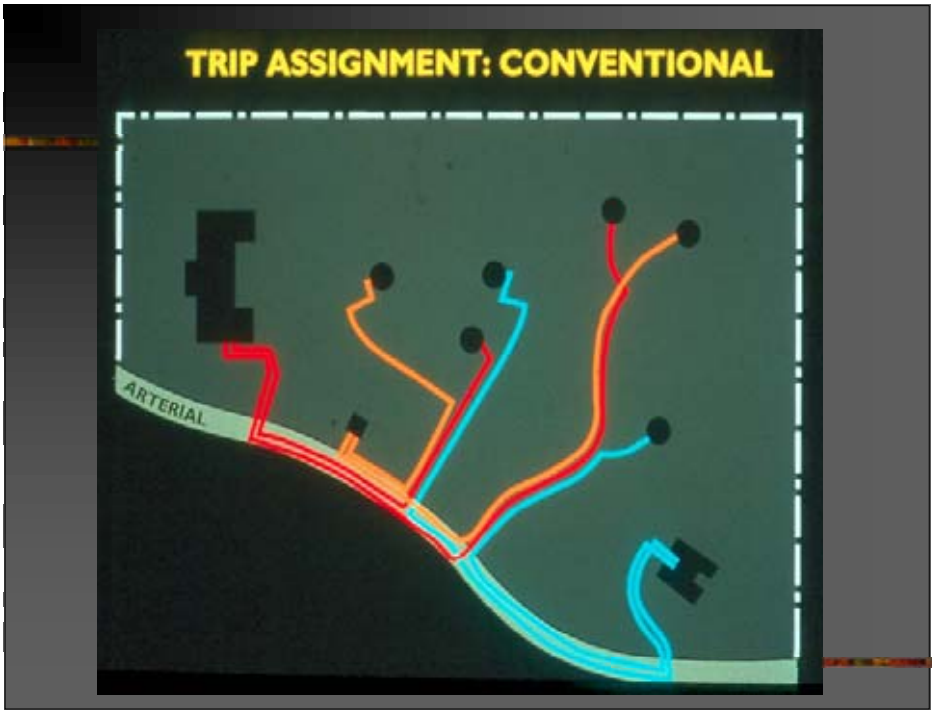


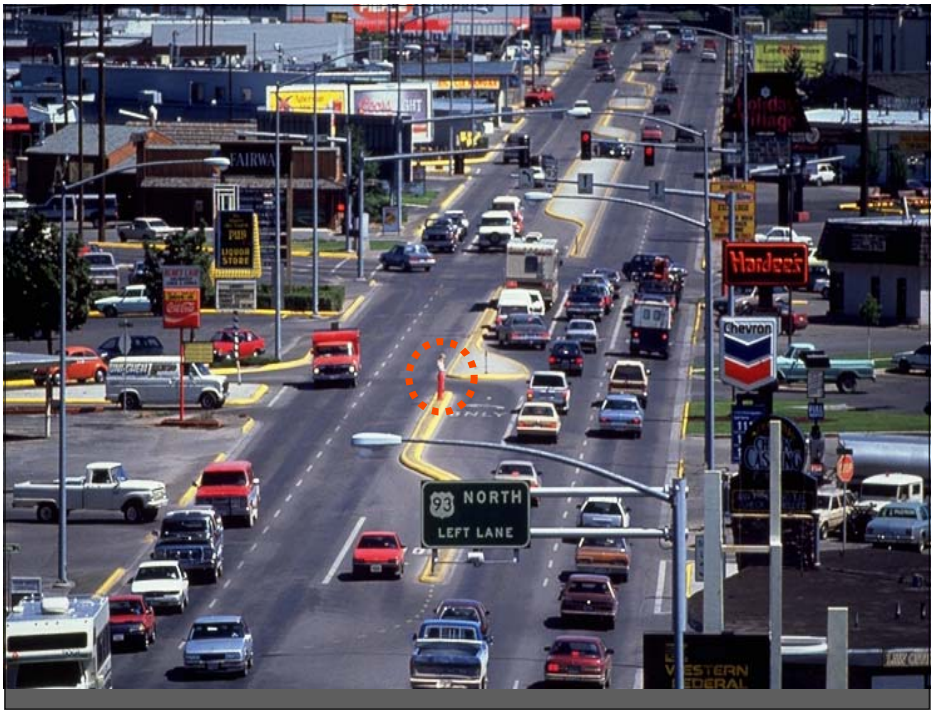


Alternative Patterns of Development

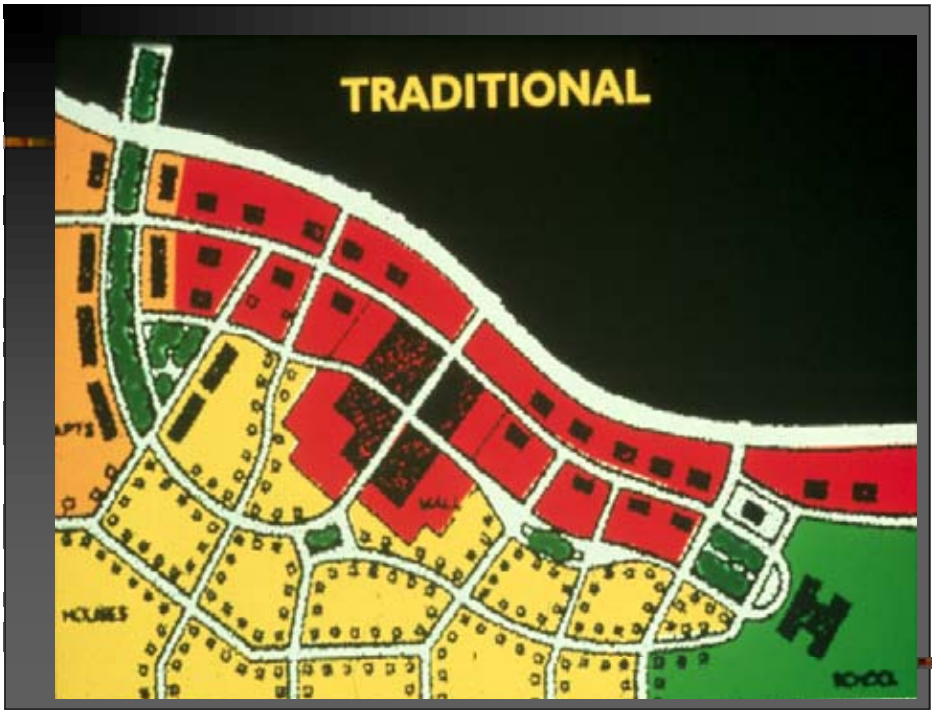
Traditional *Conventional*

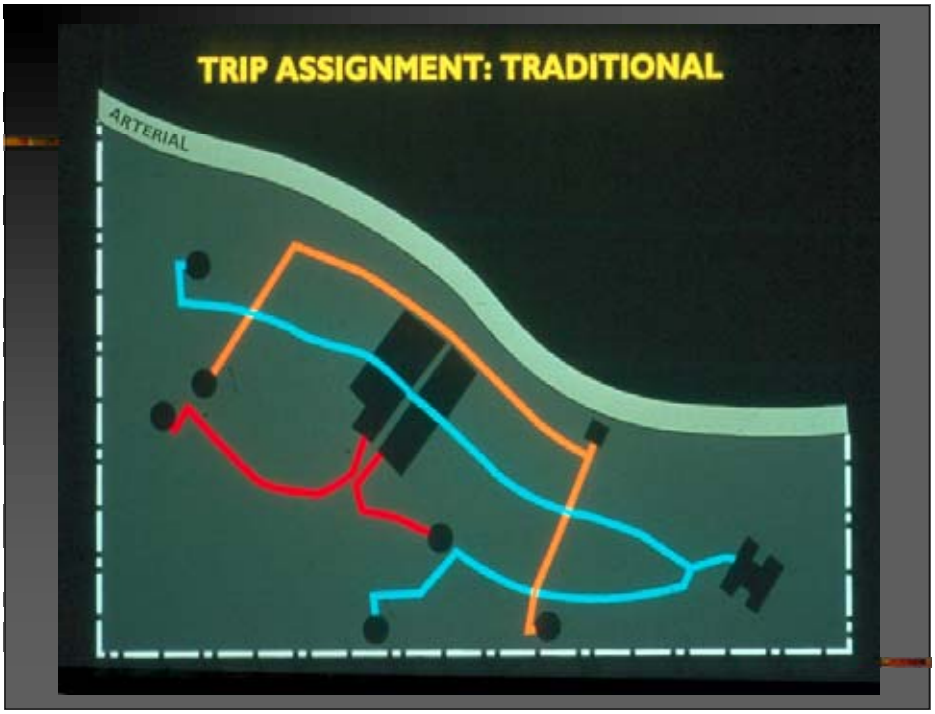

MALL
APARTMENTS
HOUSES
SCHOOL
CONVENTIONAL


TRIP ASSIGNMENT: CONVENTIONAL
ARTERIAL


Hardee's
Chevron
93 NORTH
LEFT LANE

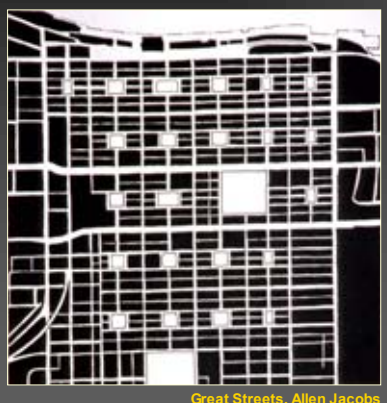

CAFETERIA


TRADITIONAL


TRIP ASSIGNMENT: TRADITIONAL
ARTERIAL

Traditional vs. Conventional

Central Business Districts at the same scale



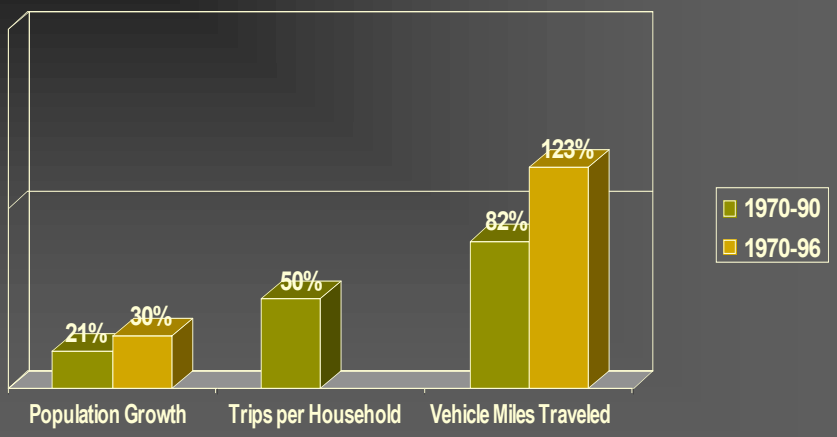
Great Streets, Allen Jacobs

Savannah, Georgia

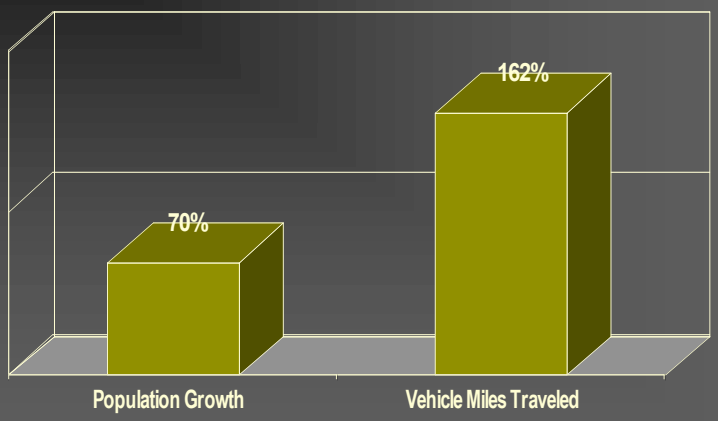
Great Streets, Allen Jacobs

Irvine, California

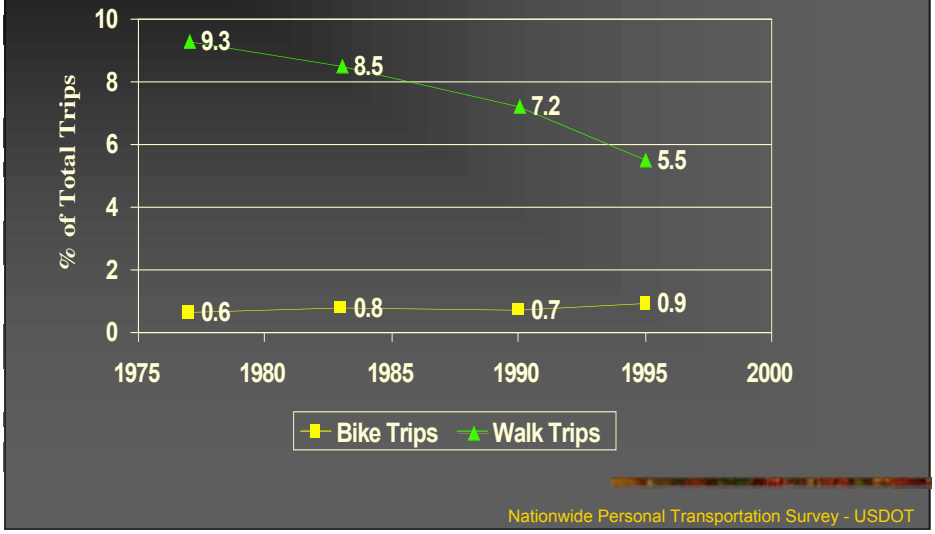
U.S. Population Growth and Transportation – 1970-1996



California Population Growth and Transportation – 1970-2000

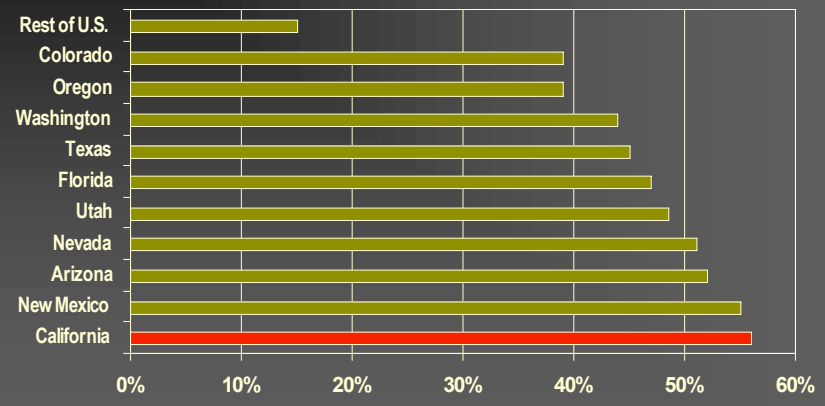


Walk and Bicycle Trips 1977-1995



Nationwide Personal Transportation Survey - USDOT

Projected Population Growth Rate in the U.S. (1995-2025)



Source: U.S. Dept. of Commerce, Census Bureau

Land Use Pattern Affects Travel

- Traditional pattern makes it possible to make some trips without a car
  - Less than 20% of trips are home to work
  - Other 80% are often short trips, running errands, picking up the kids, etc.
- Create communities in which some of those trips can be done without driving a car

Good Neighborhood Streets

- Safe
- Low volume
- Slow speeds
- Quiet
- Shaded
- Good sidewalks
- Easy to ride bicycle on

Principles of Healthy Streets

- Street as an outdoor room
  - People feel more comfortable when trees and houses provide a sense of enclosure
  - Eyes on the street make the street safer

Principles of Healthy Streets

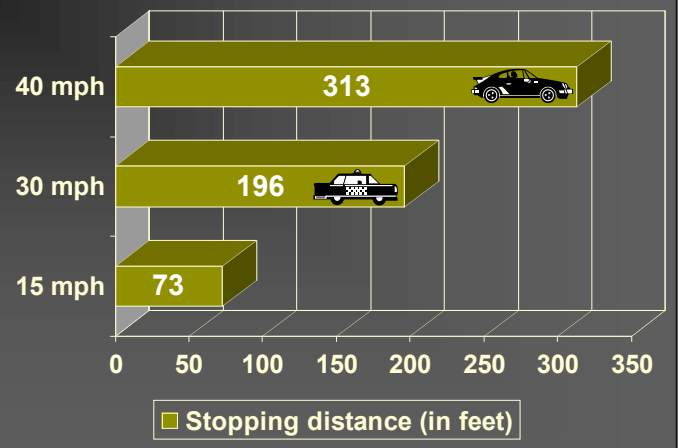
- Streets designed for people, not just cars
- Friendly to cars, pedestrians and cyclists

Principles of Healthy Streets

- Streets designed so drivers feel comfortable at slow speeds
  - 15-25 mph on neighborhood streets
  - 25-35 mph on avenues and boulevards

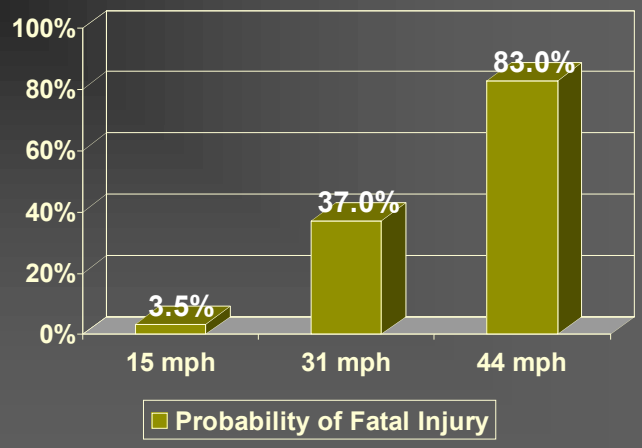
Principles of Healthy Streets

- Slow streets are safer streets
  - What happens when a driver slams on the brakes?



Principles of Healthy Streets

- Slow streets are safer streets
  - What happens when a vehicle hits a pedestrian



Principles of Healthy Streets

- Narrower streets are slower and safer
  - Longmont, CO study of 20,000 accidents
    - Found street width had the greatest relationship to injury accidents
  - Accidents/mile/year were higher on wider streets
    - 40-foot wide street 2.23 a/m/y
    - 36-foot wide street 1.21 a/m/y
    - 24-foot wide street 0.32 a/m/y

Source: "Residential Street Typology and Injury Accident Frequency," Swift and Associates, Longmont, CO, 1997

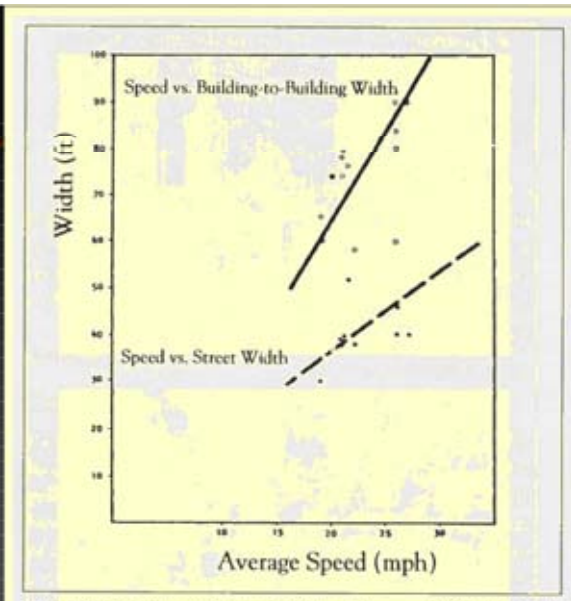
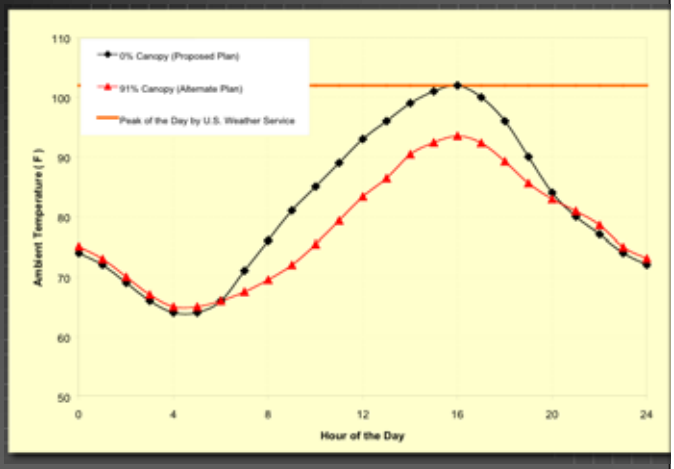


Figure 5.51. Speed versus Pavement Width and Pavement Width Plus Setbacks.

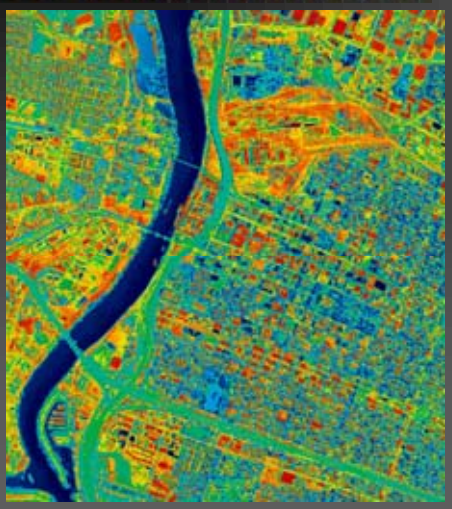
Source: D.T. Smith and D. Appleyard, *Improving the Residential Street Environment—Final Report*, Federal Highway Administration, Washington, D.C., 1981, p. 127.

Healthy Streets Need Tree Canopies

- Trees help reduce ambient temperature
- Lower energy costs
- Reduce ozone formation
- Tests in the Central Valley during summer showed 9 degree temperature difference
  - No canopy: 103°F
  - Canopy: 94°F



Trees Reduce Heat Island Effect



Sacramento -- June 29, 1998

Designing Healthy Streets

- To create tree canopy need planting strip next to street

Designing Healthy Streets

- Short blocks and T-intersections reduce vehicle speeds
- Medians, gateways and other techniques that visually narrow the road reduce vehicle speeds
- On-street parking helps narrow the street and provides buffer for sidewalks

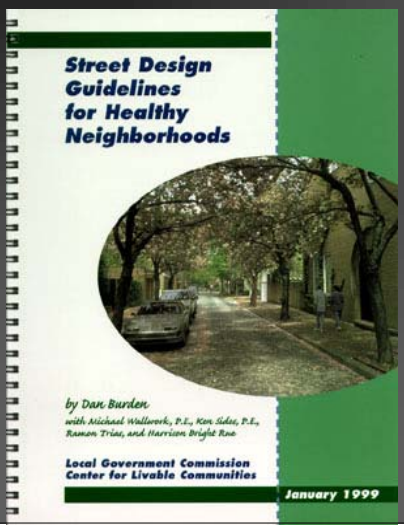
Designing Healthy Streets

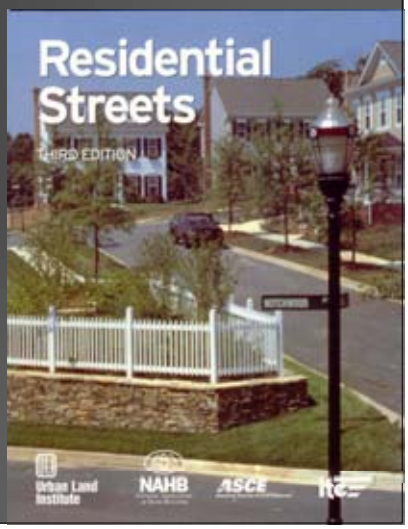
- Network of interconnected streets with nearby destinations and mix of uses is critical

Plan for Celebration, Florida, a traditional neighborhood being built by Disney Development Corp.

Fairview Village, OR

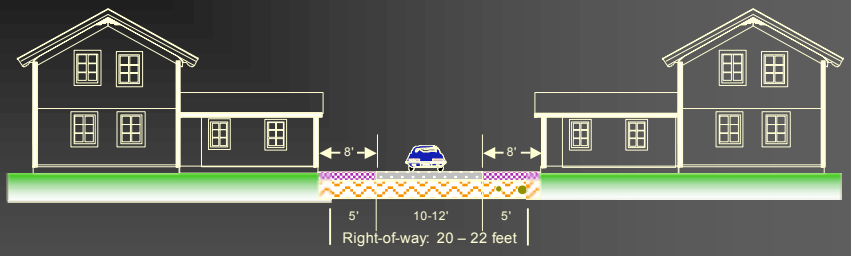
Recommended Designs for Different Types of Roadways





Alley

Provides access to the rear of the property



Street

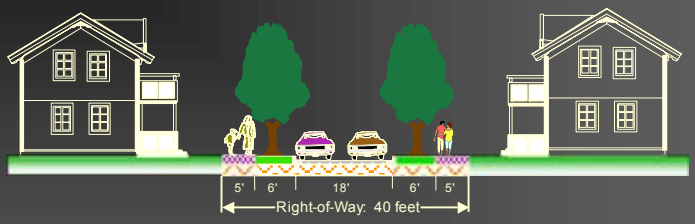
- Speed 5-10 mph
- Requires a 20 foot minimum ROW
- Utility location underground on one side
- Paved width minimum of 10 feet

Buildings & Land Use

- Residential — primarily single family
- Consistent building line recommended
- Provides rear access to garages
- Consider accessory unit above garage
- 8-foot minimum setback of building
- Garage door on track, to reduce outward swing.

Lane

Provides access to single-family homes.



Street

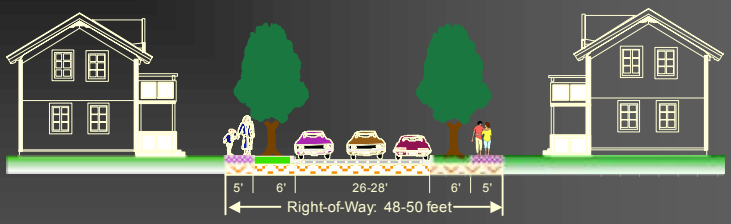
- Street width 16-18 feet with curb, gutter and informal parking
- Planting strips 6 feet
- Sidewalks 5 feet on each side
- Average speed 15 mph
- Requires a 40-foot ROW
- Utility location — Underground or alley
- Drainage — Curb and gutter
- Two to six blocks long

Buildings & Land Use

- Residential — primarily single family
- Buildings brought close to sidewalk
- Consistent building line recommended

Street

Provides access to single-family homes.



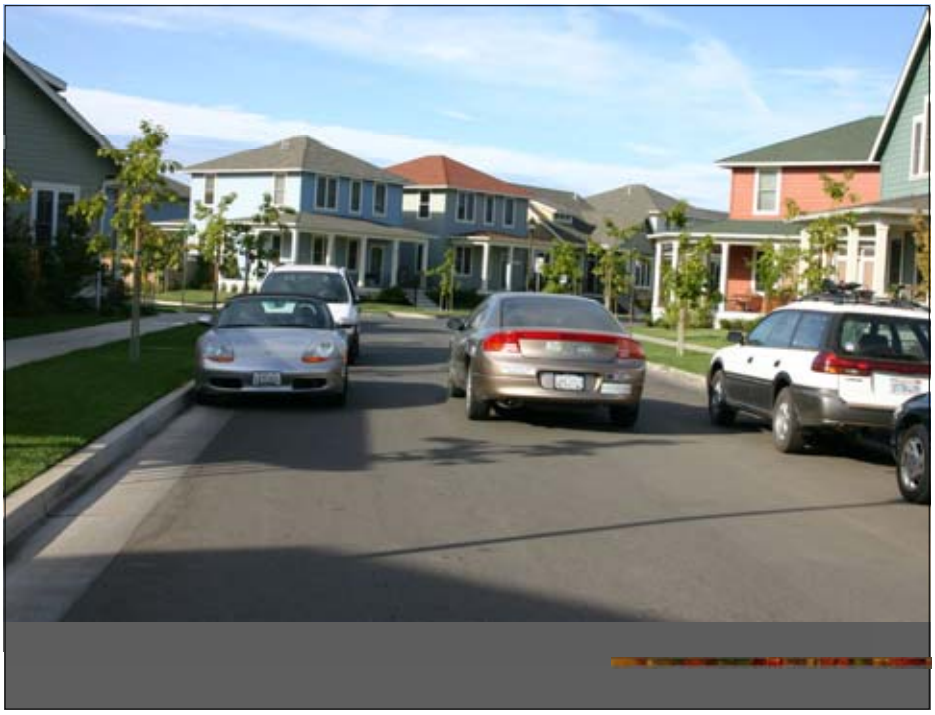
Street

- Street width 26-28 feet with curb, gutter and informal parking
- Planting strips 6 feet
- Sidewalks 5 feet on each side
- Average speed 20 mph
- Requires a 48-foot ROW
- Utility location — Underground or alley
- Drainage — Curb and gutter
- Two to six blocks long

Buildings & Land Use

- Residential — many residential types
- Residences brought close to sidewalk
- Consistent building line recommended
- Front porches encouraged

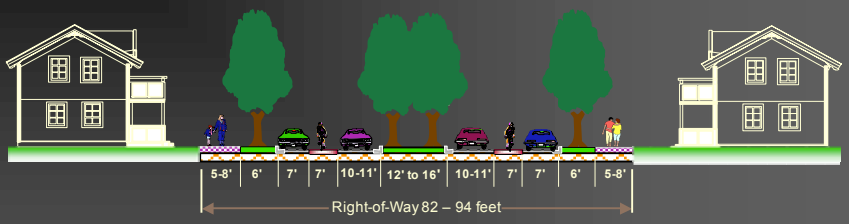
Doe Mills, Chico, CA



Stapleton, CO

Avenue with Parking

Connects town and neighborhood centers.



Street

- Street width 24 foot on both sides of median with curb and gutter.
- Median width 12-16 foot.
- Travel lanes 12 foot.
- Planting strips 6 foot.
- Sidewalks 5-8 feet on each side.
- Average speed 35 mph.
- Requires an 82-94 foot ROW.
- Utility location — underground.
- Drainage — Curb and gutter, median can have swale for natural drainage

Buildings & Land Use

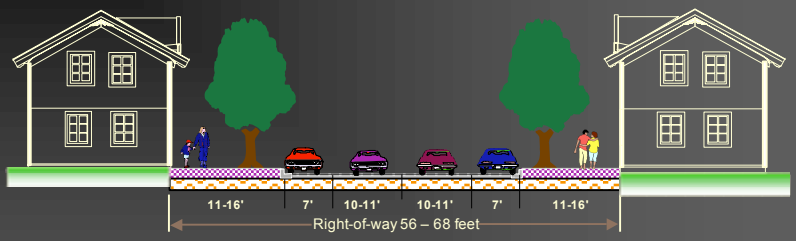
- Mixed residential and commercial use
- Buildings brought close to sidewalk
- Consistent building line recommended
- Avenues are designed to connect town centers to neighborhoods
- Sidewalks and bike lanes on both sides.
- Place prominent public buildings and plazas at end of vistas

Mountain View, California

Issaquah Highlands, WA

Main Street

Provides access to and a space for neighborhood commercial and mixed use buildings



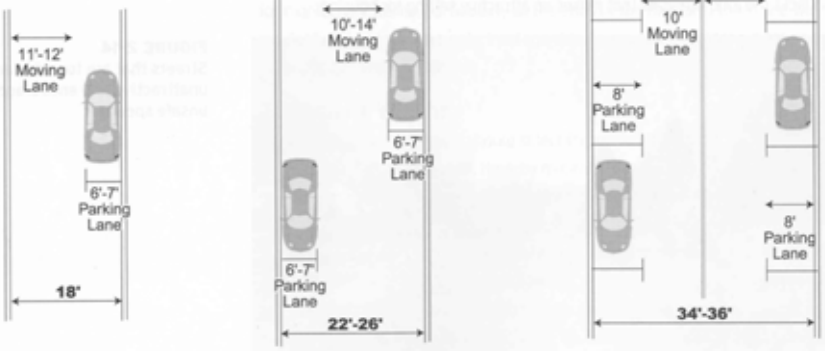
Street

- Street width 38 foot with curb and gutter
- Street dimensions curb-to-curb
- Lanes 11 feet with striped parking
- Planting wells
- Sidewalks 11 feet on each side.
- Average speed 20-25 mph.
- Requires a 60 foot minimum ROW
- Utility location — underground
- Drainage — Curb and gutter
- Include bulbouts at intersections and mid-block crossings

Buildings & Land Use

- Commercial and mixed use
- Buildings next to sidewalk
- Consistent building line recommended
- Pedestrian awnings, arcades, sidewalk dining and sidewalk retail are recommended

FIGURE 2-15
Street and lane widths.



Local
(Parking not expected or restricted to one side)

Local
(Parking on both sides)

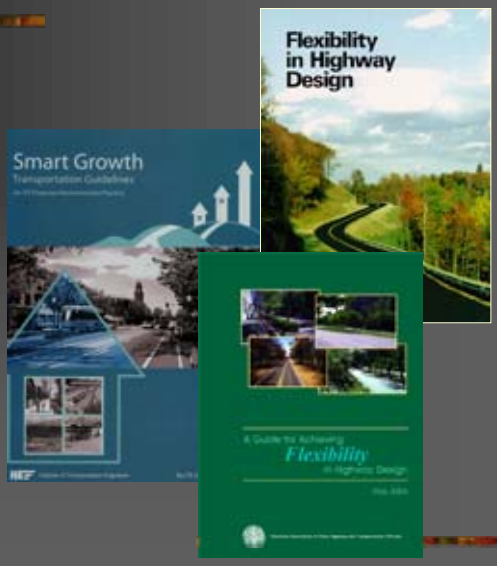
Residential Collector
(Parking on both sides)

From: *Residential Streets*, Third Edition, ULI, ITE, NAHB, ASCE, 2001

Joint ITE-CNU Project

Developing Guidance For Context Sensitive Design of Major Urban Thoroughfares

- FHWA, states, cities working on context-sensitive design
- AASHTO's Bridging Document
- EPA smart growth program
- ITE smart growth & traditional design work
- CNU design work
- Developed joint project

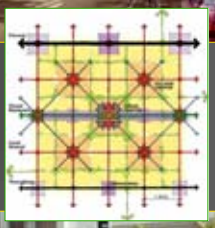


Goals

- Leverage flexibility in existing guidelines
- Make context-sensitive design the standard
- Provide guidance in "adaptable pieces"
  - ITE Recommended Practice
  - Break down into independent parts
  - Suitable to insert in DOT, DPW manuals
- Support local implementation

Components of Guidelines

- Design Framework & Process
- Network Design
- Thoroughfare Design Criteria

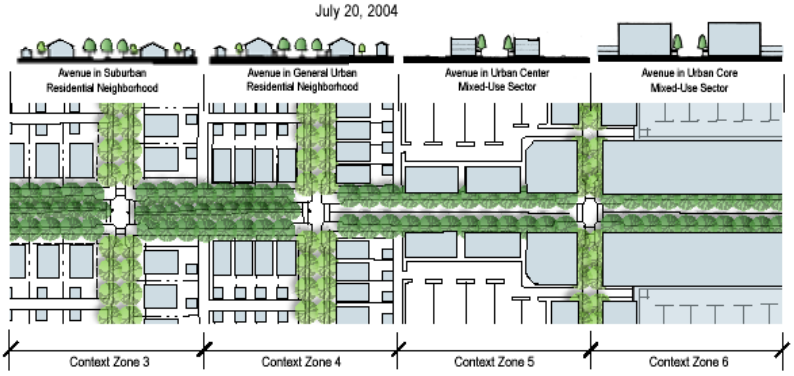


ITE/CNU Guidance for Context Sensitive Design of Major Urban Thoroughfares

THOROUGHFARE – CONTEXT RELATIONSHIP DIAGRAM

DRAFT

July 20, 2004



Travelway Realm	4-lanes with median and on street parking	4-lanes with median and on street parking	4-lanes without median and on street parking	4-lanes without median and on street parking
Intersection Spacing	less frequent (~ 1/4 mile)	moderately frequent (between 1/4 and 1/8 mile)	frequent (~ 1/8 mile)	frequent (~ 1/8 mile)
Pedestrian Realm	separated sidewalk with ground cover and street trees	separated sidewalk with ground cover and street trees	wider sidewalk with landscaped tree wells or tree grates	wide sidewalk with trees in tree grates
Building Frontage	deep landscaped often with picket fence or hedge	landscaped with porch narrowing setback	little or no setback with store fronts and entries	no setback with storefronts and entries

Design of the Avenue changes as it passes through different Context Zones & uses

Thoroughfare Design Framework

Functional Classification	Thoroughfare Type					
	Boulevard		Avenue		Street	
	Residential	Non-Res.	Residential	Non-Res.	Residential	Non-Res.
Principal Arterial						
Minor Arterial						
Collector						
Connector						

- Cross-sections
- Transitions
- Building orientation
- Sidewalk width
- Pedestrian buffers
- Lighting
- Materials

- Level of service
- Street, lane widths
- Left turn treatments
- Transit stops
- Intersections
- Curb extensions
- …many more

Thoroughfare Design Framework

FUNCTIONAL CLASSIFICATION	THOROUGHFARE TYPE	CONTEXT ZONE				
		Natural/Rural (CZ-1/2)	Suburban (CZ-3)	General Urban (CZ-4)	Urban Center (CZ-5)	Urban Core (CZ-6)
Arterial	FREEWAY/EXPRESSWAY/PARKWAY	●	P	P	P	P
	RURAL HIGHWAY	●	·	·	·	·
	BOULEVARD	·	●	●	●	●
	AVENUE	·	●	●	●	●
Collector	AVENUE	·	●	●	●	●
	STREET	·	●	●	●	●
Connector	AVENUE	·	●	●	●	●
	STREET	·	●	●	●	●
Local	STREET	·	●	●	●	●
	ROAD	●	·	·	·	·
	ALLEY/REAR LANE	·	●	●	●	●

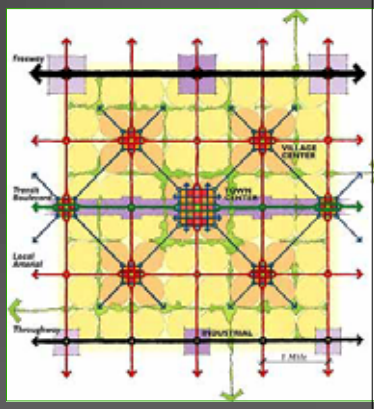
Functional Classification	Thoroughfare Types						
	FREEWAY/EXPRESSWAY/ PARKWAY	RURAL HIGHWAY	BOULEVARD	AVENUE	STREET	RURAL ROAD	ALLEY/REAR LANE
PRINCIPAL ARTERIAL							
MINOR ARTERIAL							
COLLECTOR							
CONNECTOR							
LOCAL							

Context Zones	Thoroughfare Types						
	FREEWAY/EXPRESSWAY/ PARKWAY	RURAL HIGHWAY	BOULEVARD	AVENUE	STREET	RURAL ROAD	ALLEY/REAR LANE
NATURAL (CZ-1) RURAL (CZ-2)	●	●	·	·	·	●	·
SUBURBAN (CZ-3)	P	·	●	●	●	·	●
GENERAL URBAN (CZ-4)	P	·	●	●	●	·	●
URBAN CENTER (CZ-5)	P	·	●	●	●	·	●
URBAN CORE (CZ-6)	P	·	●	●	●	·	●

Functional Classification	Urban Thoroughfare Type					
	ARTERIAL		COLLECTOR		CONNECTOR	
Context Zone	BOULEVARD	AVENUE	AVENUE	STREET	AVENUE	STREET
SUBURBAN (CZ-3)	●	●	●	●	●	●
GENERAL URBAN (CZ-4)	●	●	●	●	●	●
URBAN CENTER (CZ-5) URBAN CORE (CZ-6)	●	●	●	●	●	●

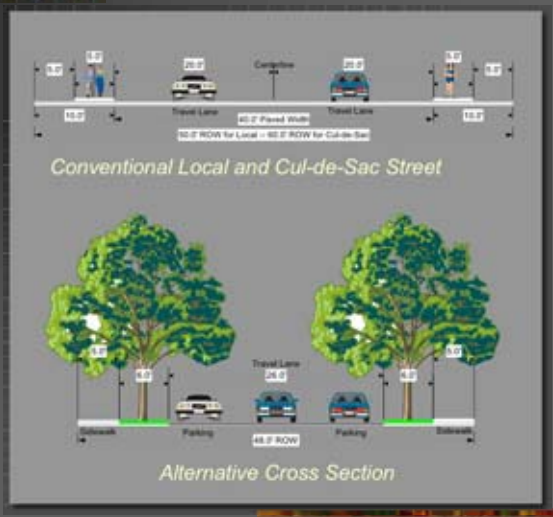
Network Design

- Use to validate thoroughfare design
- Create connectivity with layers of smaller thoroughfares
- Access management on larger thoroughfares
- Emphasize network capacity



Impacts of Reducing Street Widths

- Savings
  - $61,000 less per mile in pavement costs (with additional trees)
  - Asphalt on shaded streets can last up to 10 years longer, thus deferring re-paving costs
  - 15% reduction in home cooling energy requirements



Impacts of Reducing Street Widths

- Northern California cost differential is substantial, especially if land costs are high
  - Per mile:
    - $212,160 for construction
    - $648,960 including land

	Cost per 100 feet of street	
	24′ Wide	36′ Wide
5-Inch Asphalt Paving/6-Inch Base	$6,800	$10,880
6-Inch Curb and Gutter	1,265	1,265
4-foot Sidewalk	1,400	1,400
Total Construction Costs	**9,465**	**13,545**
Additional Cost		***$4,080***
Land (at $300,000/acre)	16,800	25,200
Total Cost	**$26,265**	**$38,745**
Additional Cost		***$12,480***

From: *Residential Streets*, Third Edition, ULI, ITE, NAHB, ASCE, 2001

Street width and property values

Width: 20 feet 30 feet
Speeds: 20-22 mph 28-32 mph

Same home sells for $5-10,000 more on the narrower street.

Victorian Harbor, Suisun City, California

Healthy Streets Need Good Sidewalks

- We impact the freedom of all residents — especially children and seniors — when we fail to provide good sidewalks

Healthy Streets Need Good Sidewalks

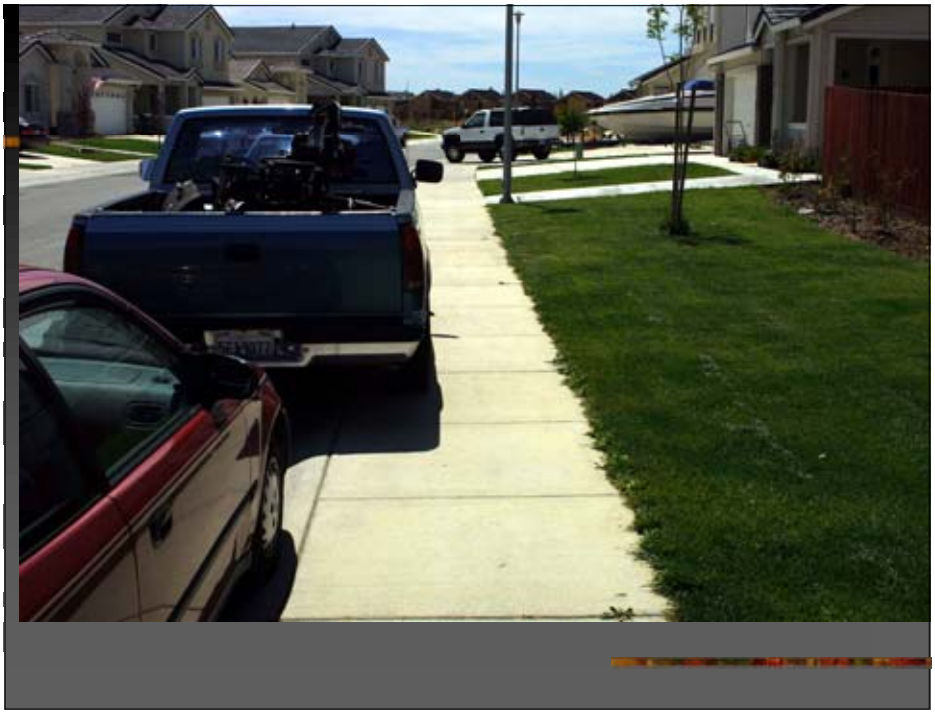
- Detached from curb
- At least 5 feet wide
- Planting strip helps shade street and sidewalk

Healthy Streets Need Good Sidewalks

- Sidewalks narrower than 5 feet may work well for lovers walking arm-in-arm…

Healthy Streets Need Good Sidewalks

- … but average size people need sidewalks that are at least 5 feet wide (6 feet if sidewalk is attached to the curb) to walk side-by-side



Healthy Neighborhoods Need Good Street Crossings

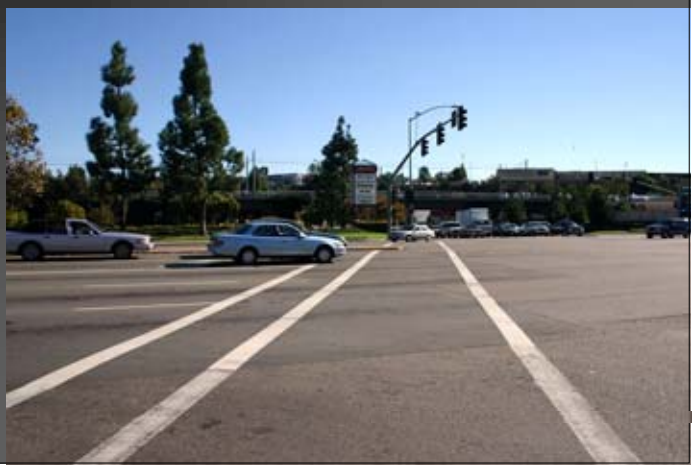
Large versus Compact Intersections

- How long does it take to cross this street?

Assume 8 lanes x 12 feet = 96 feet

@ 4.0 feet/second will take 24 seconds

@ 3.0 ft/sec will take 32 seconds



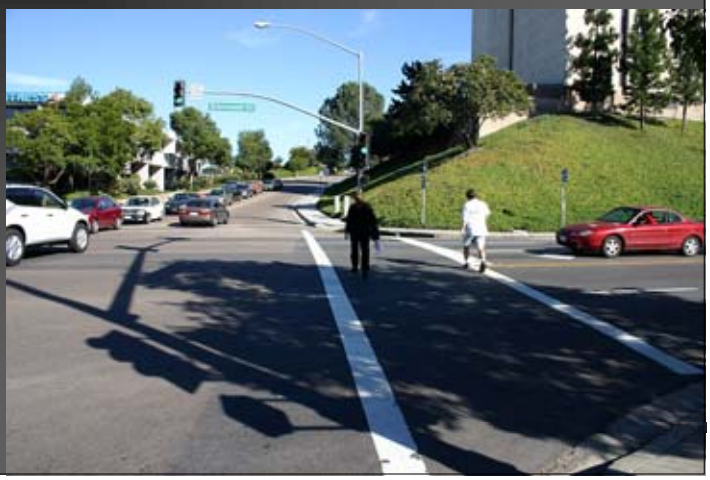
Large versus Compact Intersections

- How long does it take to cross this street?

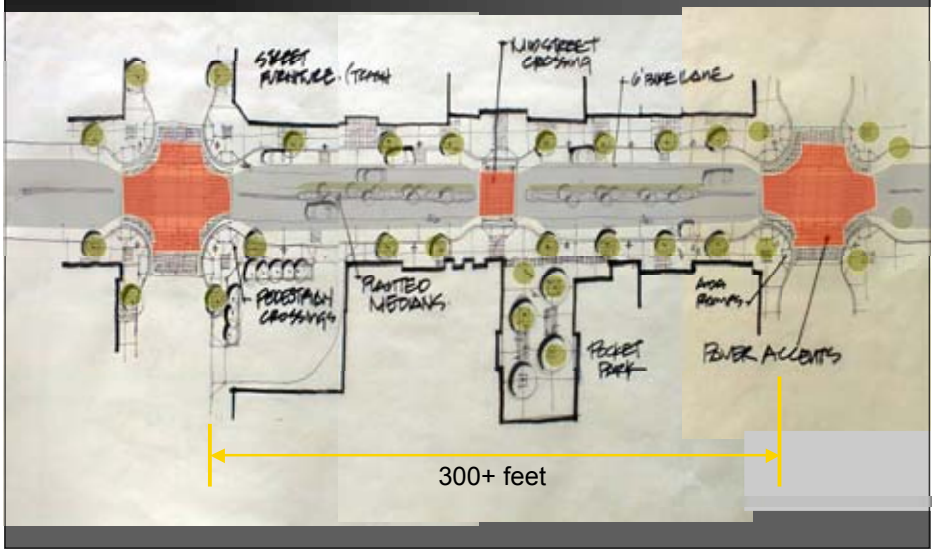
Assume 5 lanes x 12 feet = 60 feet

@ 4.0 feet/second will take 15 seconds

@ 3.0 ft/sec will take 20 seconds



Pedestrians will walk up to 150 feet out of their way to cross




Can be seen from 1000 feet
Day and Night

Retrofitting Existing Streets

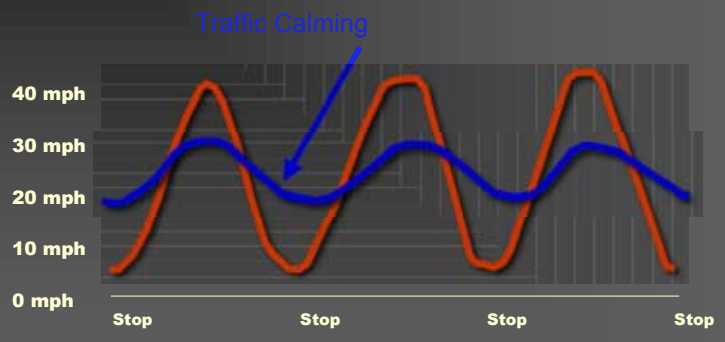
- Traffic Calming has emerged in the last few years to address problems with existing streets
  - Streets that are unsafe, especially for pedestrians and bicyclists
  - Streets that are too wide
  - Streets with too much cut-through traffic
  - Streets that are difficult to cross

What is 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.

Lockwood, Ian. *ITE Traffic Calming Definition*. ITE Journal, July 1997

Stop signs versus traffic calming



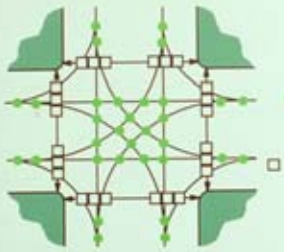
Why Calm Traffic?

- Reduce crash potential
- Improve pedestrian/bicyclist safety
- Reduce auto use, reduce congestion
- Increase walking, bicycling, fitness, health
- Increase property values
- Increase access, pride, ownership
- Increase neighborhood involvement

Roundabouts

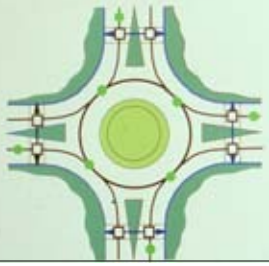
Roundabouts are safer

Conflicts At a Four-Way Interection



- 32 vehicle-to-vehicle conflicts
- 24 vehicle-to-pedestrian conflicts

Conflicts At Roundabouts

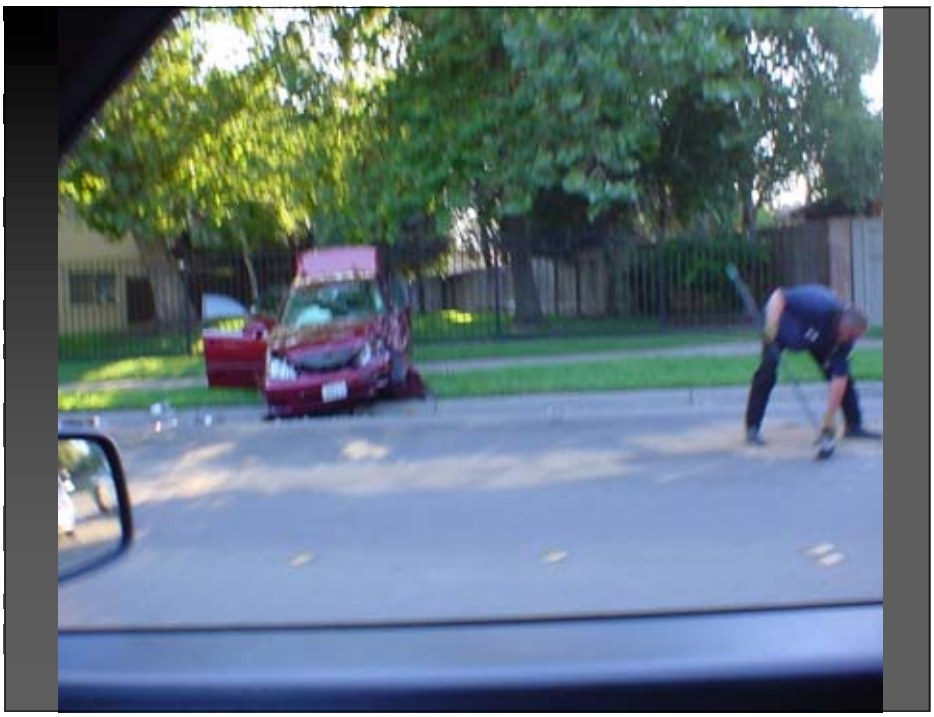


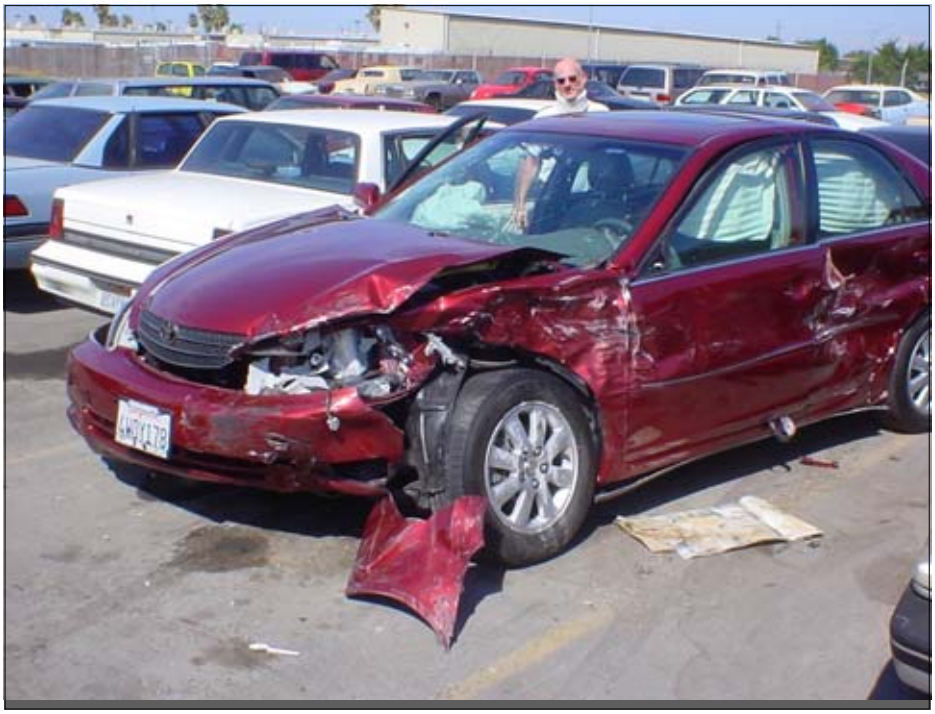
- 8 vehicle-to-vehicle conflicts
- 8 vehicle-to-pedestrian conflicts

"Results of this study indicate that converting conventional intersections from stop sign or traffic signal control can produce substantial reductions in motor vehicle crashes."

March 2000 Study by the Insurance Institute for Highway Safety


Before
Bradenton Beach, FL, Intersection of State Routes 684 and 789
Site of one pedestrian fatality every year
After
No pedestrian fatalities in eight years





“Anything worth doing is worth doing slowly.”

...Mae West

For more information

- Local Government Commission Center for Livable Communities
  - Web: www.lgc.org
  - Phone: 800-290-8202
  - e-mail: center@lgc.org
- Walkable Communities
  - Web: www.walkable.org