U.S. Department of Transportation
Federal Highway Administration

Pedestrian and Bicycle Information Center

Road Diets and Pedestrian Safety

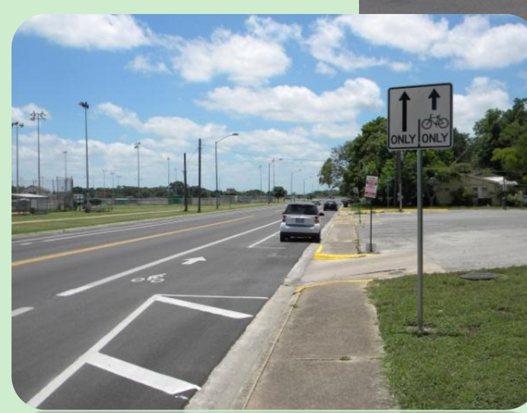
Presented by:

Libby Thomas
UNC Highway Safety Research Center

Mike Sallaberry
San Francisco Municipal Transportation Agency

Gina Coffman
Toole Design Group

Nov. 20, 2012



Today's presentation

- Introduction and housekeeping
- Audio issues? Dial into the phone line instead of using "mic & speakers"
- PBIC Trainings

  http://www.walkinginfo.org/training
- Registration and archives

  http://www.walkinginfo.org/webinars
- Questions at the end
- Follow-up email with certificate of attendance for 1.5 hours of instruction and link to download slides

FHWA Office Of Safety Proven Safety Countermeasures

http://safety.fhwa.dot.gov/provencountermeasures/

1. Roundabouts (Intersection)
2. Corridor Access Management (Intersection)
3. Backplates with Retroreflective Borders (Intersection)

4. "Road Diet" (Pedestrian and Intersection)
5. Pedestrian Hybrid Beacon (Pedestrian and Intersection)
6. Medians and Pedestrian Crossing Islands in Urban and Suburban Areas (Pedestrian)

7. Longitudinal Rumble Strips and Stripes on 2-Lane Roads (Roadway Departure)
8. Enhanced Delineation and Friction for Horizontal Curves (Roadway Departure)
9. Safety Edge$_{SM}$ (Roadway Departure)

“Classic” Road Diet

4 to 3 (5) lanes

- Two regular travel lanes
- Two bike lanes
- Two-way Center Turn Lane

San Antonio TX

Orlando FL

Before

Orlando FL

After

Reclaiming road space can also create room for ped islands or raised medians

Charlotte NC

Studies of Road Diets

- Before and After case study comparisons of raw crash frequencies; some speed studies; other measures of effectiveness
- Operational modeling studies
- How-to guides etc.
- ⇨ Controlled Safety evaluations – FOCUS of this presentation

"Classic" Road Diet

4 to 3 (5) lanes

- Two regular travel lanes
- (with) Two bike lanes
- Two-way Center Turn Lane

San Antonio TX

Safety Studies Reviewed

- Chen, etal. (In Press). *Accident Analysis and Prevention*.
- Harkey, et al. (2008). FHWA report, and in part, Persaud, et al. (2010). *Accident Analysis & Prevention*, Vol. 42, Issue 1: 38-43.
- Huang, Stewart and Zegeer, C.V. (2002) Transportation Research Record 1784: 80-90.
- Pawlovich, et al. (2006). Transportation Research Record 1953, 163-171.

- Gates, et al.(2007). Annual Meeting of the Transportation Research Board compendium.
- Lyles, et al. (2012). Final Report. Submitted to Michigan Department of Transportation.

Safety Studies – Study Methods

Harkey et al., 2008

15 treated

- 296 reference sites

(and Persaud, 2010)

30 treated

- 51 reference sites

Empirical Bayes approach

15 sites - Iowa

30 sites - CA and WA

Pawlovich, etal. (2006)

15 treated

-15 matched comparison sites

- Full Bayes approach

Huang, etal. (2002)

11 of the 30 treated *and*

-24 matched comparison sites

Yoked B-A comparison & trends

8 treated *and 14 comparison sites – Neg. Bin model using ADT*

.

Iowa Data

15 sites	Mean	Min	Max
Years Before data	17.53	11.0	21.0
Years After data	4.47	1.0	11.0
Crashes/ mile-year Before	23.74	4.91	56.15
Crashes / mile-year After	12.19	2.27	30.48
AADT Before	7987	4854	11,846
AADT After	9212	3718	13,908
Segment length (mi.)	1.02	0.24	1.72

California & Washington Data

30 sites	Mean	Min	Max
Years Before data	4.7	1.8	8.5
Years After data	3.5	0.6	8.8
Crashes/ mile-year Before	28.57	0	111.1
Crashes / mile-year After	24.07	0	107.62
AADT Before	11,928	5,500	24,000
AADT After	12,790	6,194,	26,376
Segment length (mi.)	0.84	0.08	2.54

Crash Effects

Harkey et al. & Persaud – Total Crash Effect estimates

- 29.3% (+/- 1.6% s.e.) reduction (per site) – aggregate estimate for Iowa, CA & WA
- 18.9% (+/- 2.5% s.e.) reduction – WA & CA sites – roads in larger urban areas (CA. & WA. - 269,000 avg. pop., avg. ADT 12,000)
- 47.6% (+/- 2% s.e.) reduction – Iowa sites – roads through smaller urban areas (17,000 avg. pop., avg. ADT 8000-9000)

Crash Effects - related studies

Pawlovich et al. total crash rate estimates - Iowa

- 25% (+/- 2.6% s.e.) reduction in total *crashes per mile*

Huang et al. total crash effect estimates – CA & WA

- 6% (0.3%, 10.6 95% CI) avg. fewer crashes per site occurred in after period at road diet sites
- BUT No significant difference in Before/After change than comparison sites when controlling for ADT

Safety Studies – Methods

Chen, etal. (In Press)

460 treated segments

- 3364 comparison segments

324 adjacent intersections

2342 comparison intersections

No vol. data; ANCOVA model

460 treated segments – NYC Only study to measure effects on pedestrian crashes

New York City Data

	Treated - Before	Treated - After	Comp. Before	Comp. After
Years of data	5	2	5	2
No. sites – segments	460		3362	
No. sites - adj. intersections	324		2346	
Crashes/ site year segments	0.12	0.05	0.10	0.12
Crashes/ site year intersections	0.84	0.82	0.98	0.82

Crash Effects

New York City (Chen et al.)

Segments (significant effect estimates with control for RTM)

- 67% (+/- 7%) reduction in total crashes (avg of 0.12 / site/year Before)
- 70% (+/- 9%) reduction in injury and fatal crashes
- 41% (+/- 27%) non-significant reduction in pedestrian crashes

Crash Effects

New York (Chen et al.)

Intersections

- 13% (+/- 5%) reduction in total crashes (avg. of 0.84 / site/year Before)
- 17% (+- 6%) reduction in injury and fatal crashes
- 5% (+/- 16%) non-significant increase in pedestrian crashes

Other Studies - Speed Effects

Knapp and Giese, 2001 (several same Iowa locations)

- Simulation – lower average arterial speeds for 3-lane compared with 4-lane across 63 of 64 scenarios
- Measured speeds – 4 mph reduction in 85th percentile speed at one site
- 3 mph reduction in avg speed and 70% decrease **in speeds > 5 mph over posted limit at another**

Gates et al. (Minnesota)

- Mean and 85th percentile speeds - median decrease of 2 mph

Safety Effects - Conclusions

- The most robust studies indicate total crash reductions between about 19% and 48% (depending on sites)
- Reductions in travel speeds support safety effect
  - HSM shows expected crash reductions for speed reductions for various initial travel speeds

Safety Effects - Conclusions

- Sites with greater speed reductions may observe crash reductions on the higher end (Iowa versus CA and WA)
  - Roads with higher volumes (ignoring turning for the moment) may observe greater differences in speed between 3 and 4-lane configurations
  - Roads with lower density of access points and lower turning volumes may observe greater differences in speed between 3 and 4-lane

Safety Effects - Conclusions

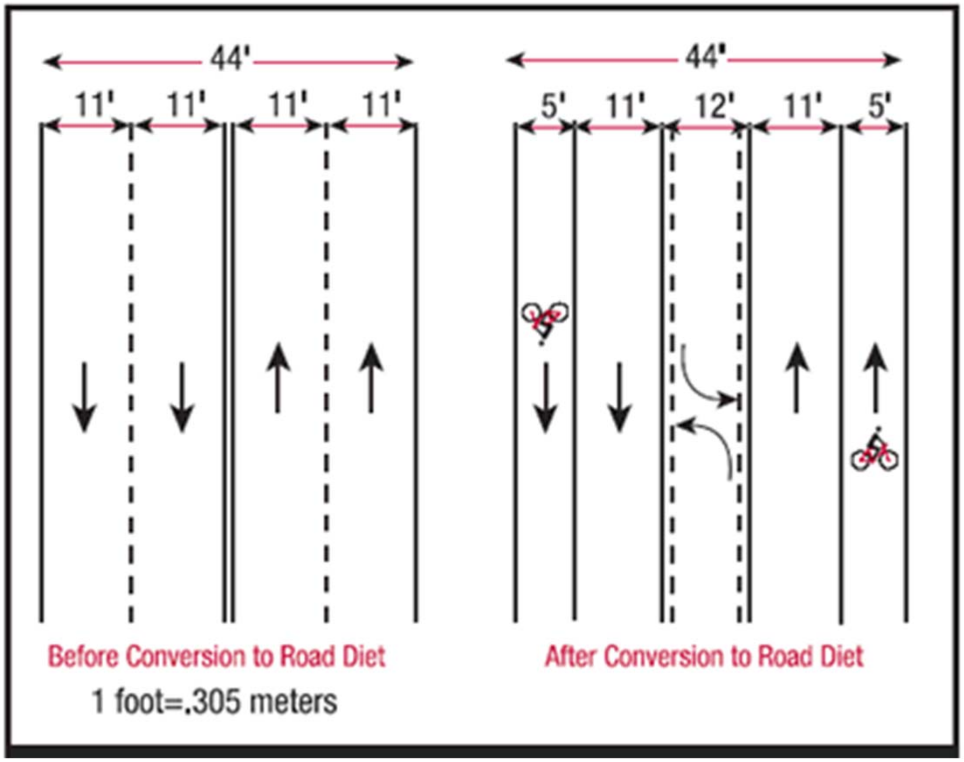
- Higher severity crashes may also be significantly reduced – as found for both segments and intersections (NYC study)
- Effects on pedestrians – also more challenging to measure since fewer crashes and exposure data typically lacking
  - Trends are promising

Road Diets Presentation

November 20, 2012

Road Diets

Excess capacity removed, extra space reallocated for other purposes:
- Bike Lanes
- Wider Sidewalks
- Median/Pedestrian Islands



FHWA diagram

San Francisco has done more (50+) than any other U.S. (and maybe North American) city

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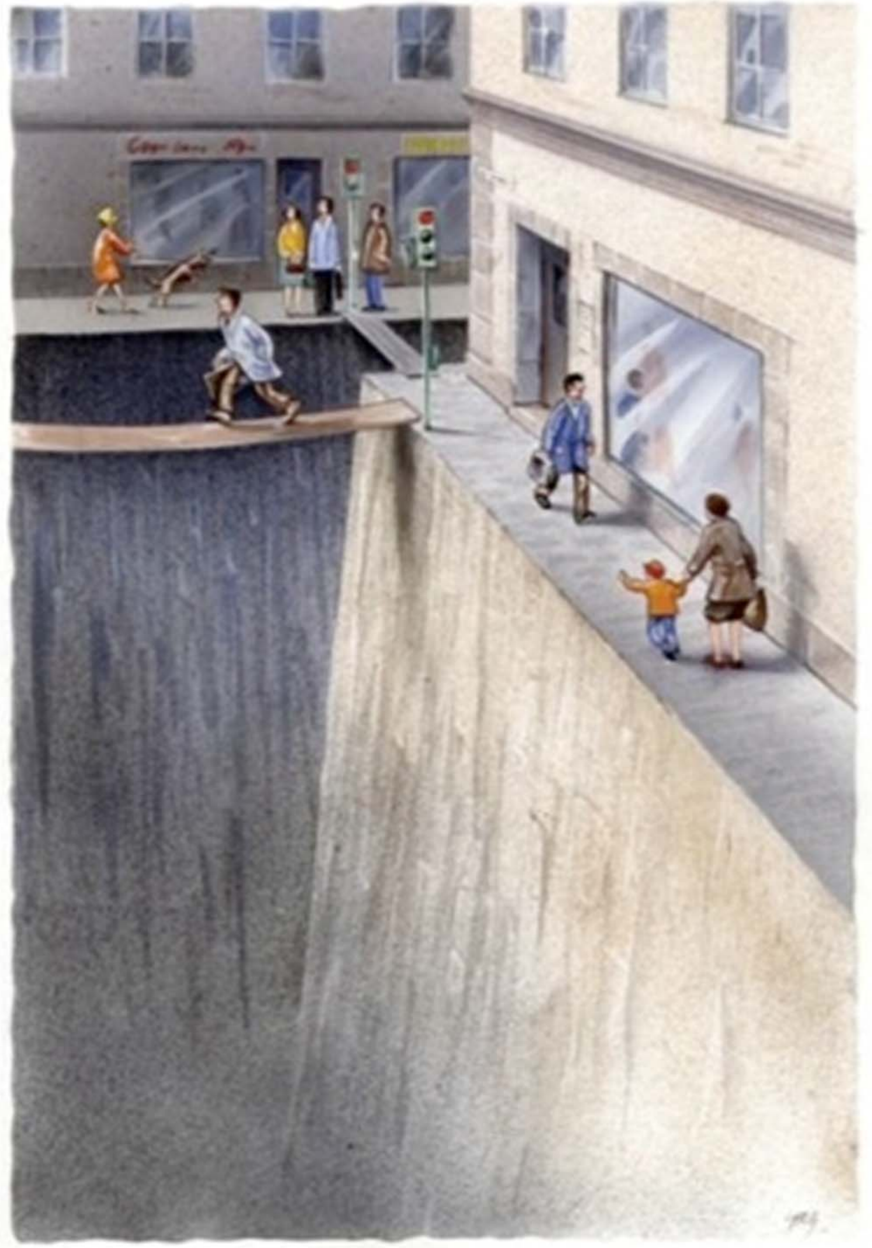
Space is a Limited Resource

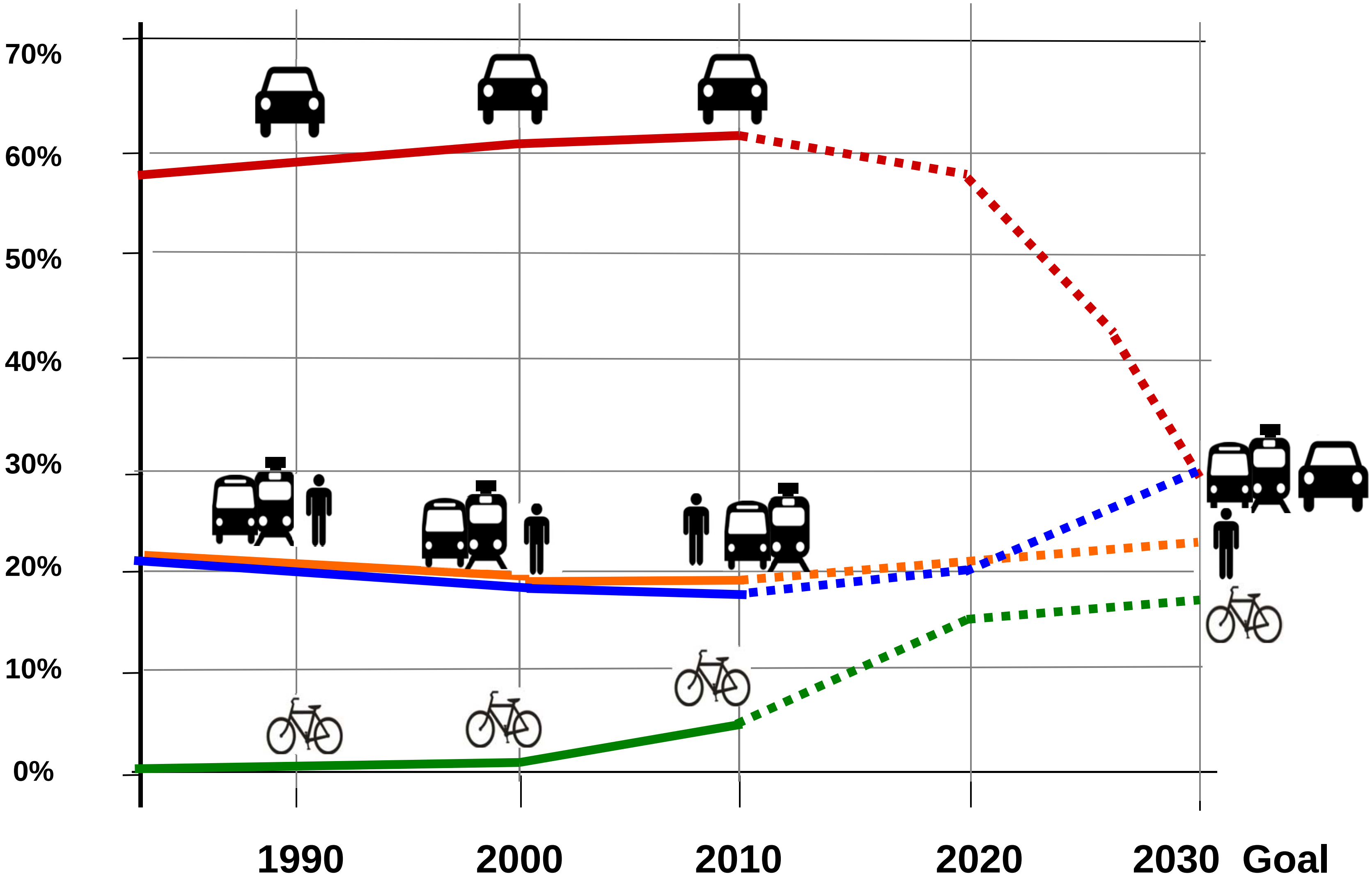
To be used Efficiently

Road Diets create space for Complete Streets, which offer comfort and enjoyment of public space.

Other streets can feel like:



Sustainability Goals



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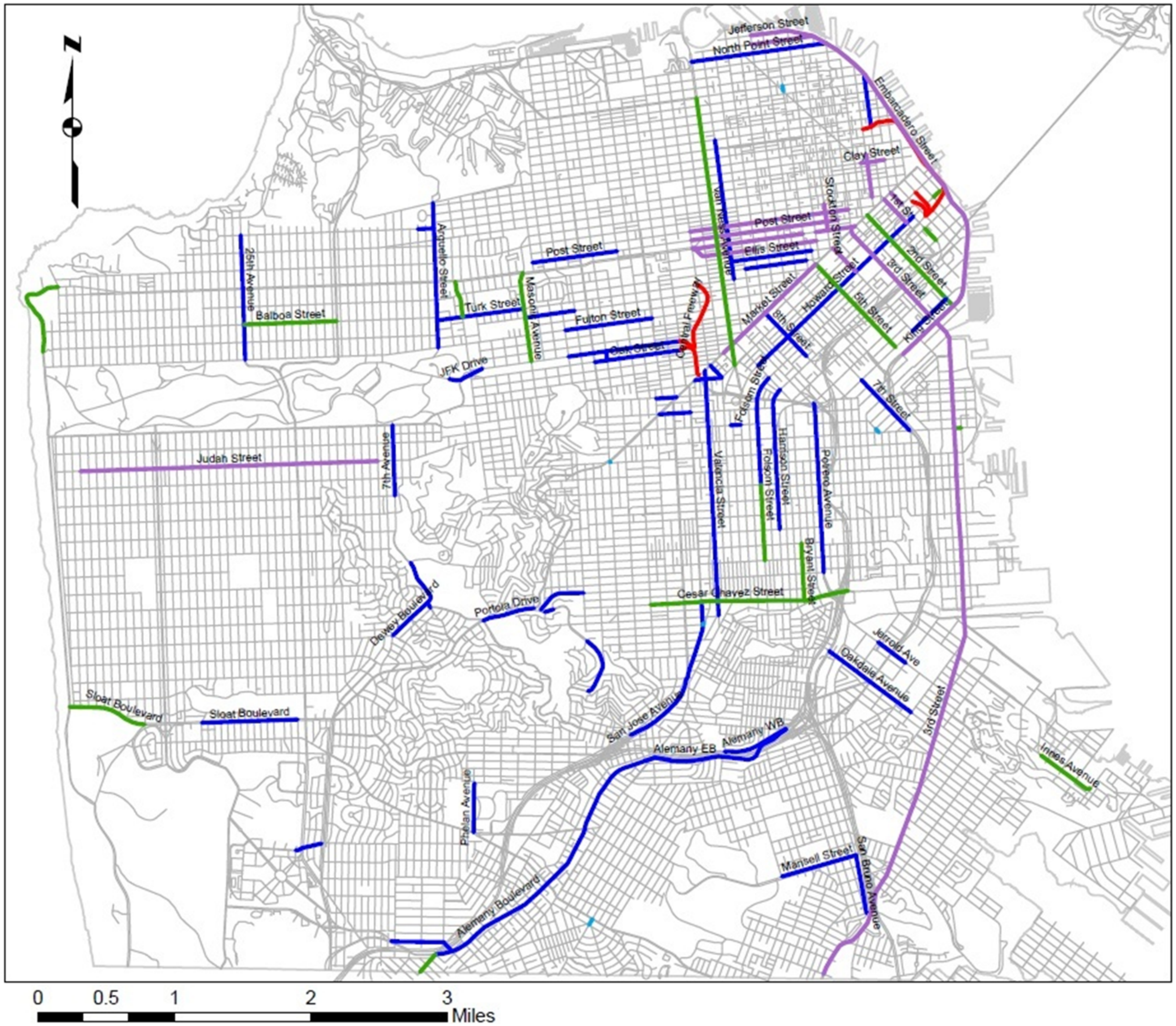
Road Diets in San Francisco



Implemented & Future Road Diets

Streets that have had general traffic lanes reduced in order to promote transit, bikes, pedestrians, and traffic calming since the adoption of the San Francisco Transit First Policy in 1973.

DRAFT

Legend

- Implemented Pavement to Parks
- Removed Elevated Freeway
- Implemented Road Diets
- Implemented Full-Time Transit-Only Lanes
- Future Road Diets

Updated 10/15/12

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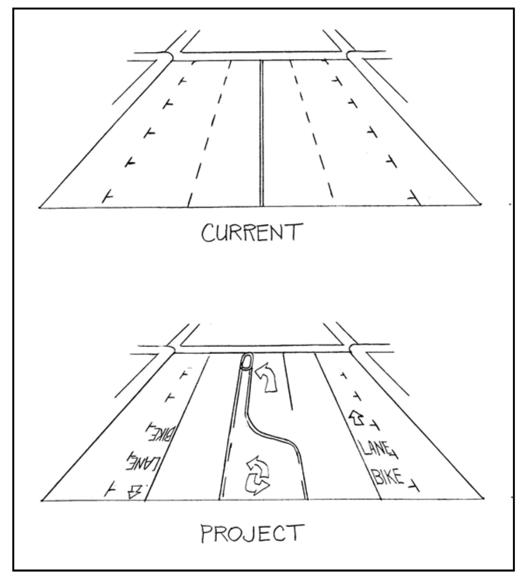
Rules of Thumb

Two cut-offs for classic 4-to-3 road diet:

1) ~20,000 vehicles per day

2) ~1000 vehicles per hour per direction

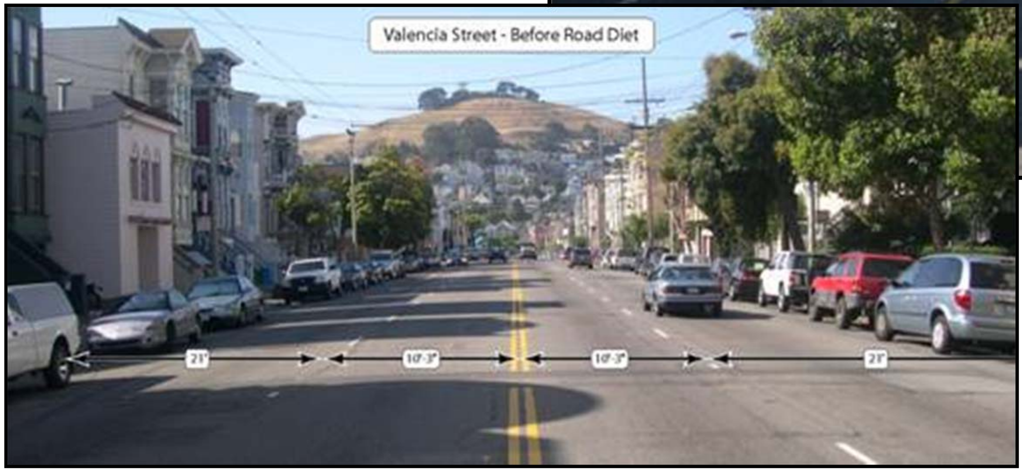


Also, peak hour volume is approx 10% of ADT

ie. if pk hr = 800 vph, ADT ~8000vpd

Valencia Street

Road Diet in 1999



Installed as trial

Valencia Street 2.0

Streetscape Project:

- Widened sidewalks
- Bulb outs
- Widened bike lanes
- Street trees
- Decorative lighting
- Public art
- On-street bike parking
- Truck loading zones
- Bi-directional 12mph “Green Wave” for safer steadier traffic speeds

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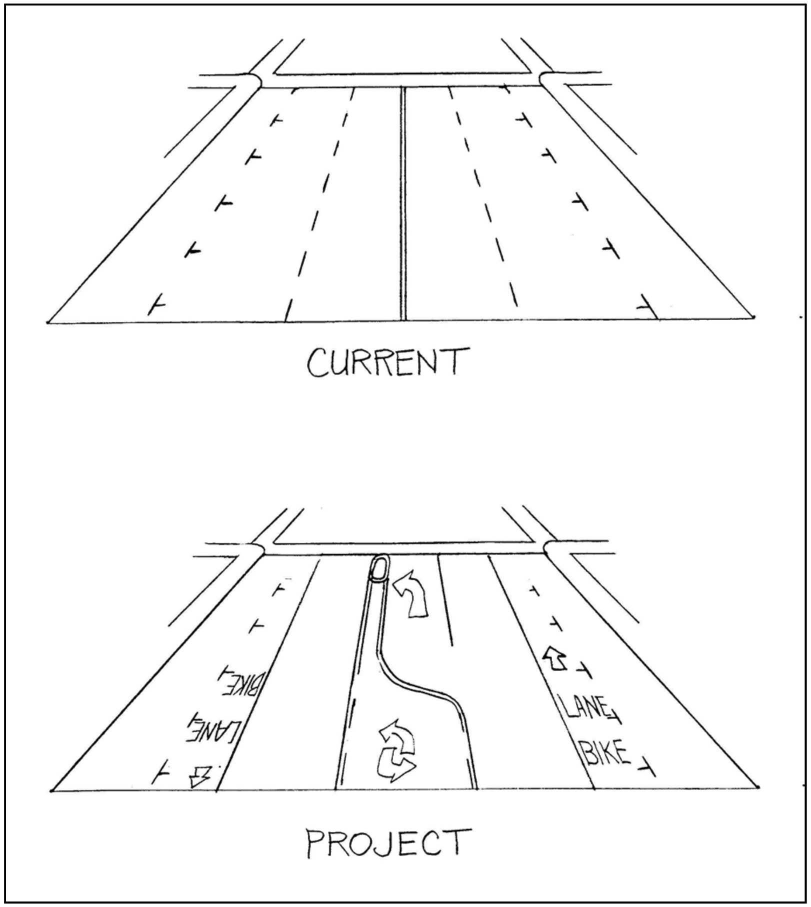
Road Diet Reports by MTA Bike Program

- “Fell St Trial Tow-Away Closure” (2002)
- “Seventh Street Bike Lane Traffic Impact Study” (2001)
- “Polk St Lane Removal/Bike Lane Trial Evaluation” (2001)
- “Valencia St Bike Lanes, A One Year Evaluation” (2000)

Found at www.sfmta.com/bikes,

Click on “Reports and Studies”



Failed trial – learn from mistakes!*

*preferably other's mistakes

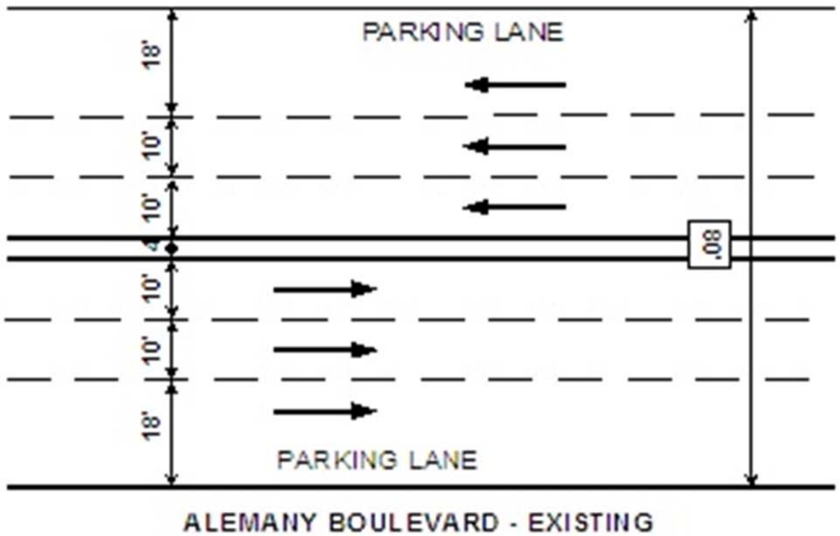
- Misjudged amount of spillover
- Traffic spilled into neighborhood streets
- Understandable project but low demand to justify results
- Street restored to 4 lanes

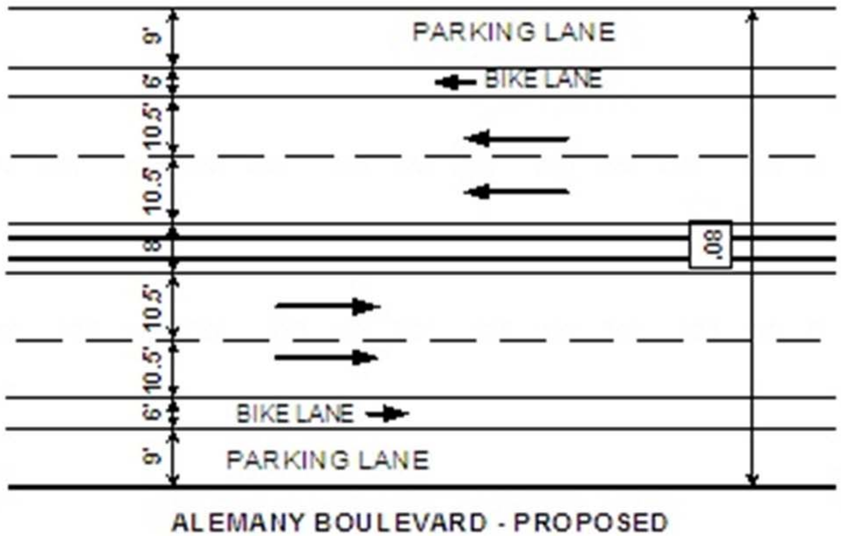
Alemany – Summary Sheet

Proposal for Alemany Boulevard, San Jose Avenue to Rousseau Street

Goal: To re-design Alemany Boulevard in a way that slows speeds and better accommodates pedestrians and bicyclists without creating undue congestion or hardship to motorists or residents.

Proposal: To re-stripe the street so that a lane is removed and a bike lane added in each direction while also widening the median.





Alemany – Summary Sheet

The project will likely have the following effects on various road users/residents:

Pedestrians

- Crossings of Alemany will be easier and safer due to widened median, reduction in number of lanes to cross, and slower speeds
- Fewer cars will be parked partially on sidewalk with wider parking lane

Bicyclists

- Safety and comfort will increase with striped space on road and slower speeds

Motorists

- Speeds (and thus, collisions) will drop as excess capacity/unneeded lanes are removed
- Exits from driveways will be improved with motor vehicle traffic further from the sidewalk
- Parking on the street will be easier with the wide parking lane
- Accessing cars parked on the street will be safer with wide parking lane and bike lane

Residents

- Potential for landscaping median is increased with wider 8' median

Contact List:

Office of Supervisor Sandoval: 554-6975
Mike Sallaberry, DPT/MTA: 554-2351
Andy Thornley, SF Bicycle Coalition: 431-2453 x307

Information on web at: www.bicycle.sfgov.org

Alemany

Crashes (15 months, before vs after)

Midblock: Total down 50% (14 to 7),
Ped: down 2 to 1, Unsafe Speed: down 67% (6 to 2)

Midlbock + Intersection: Total down 35% (68 to 44), Ped: down 60% (8 to 3), Cyclists crashes up (1 to 2) but usage up 300% (5 to 15, pk hour)

Mansell St: Lower Speeds/Improved Safety

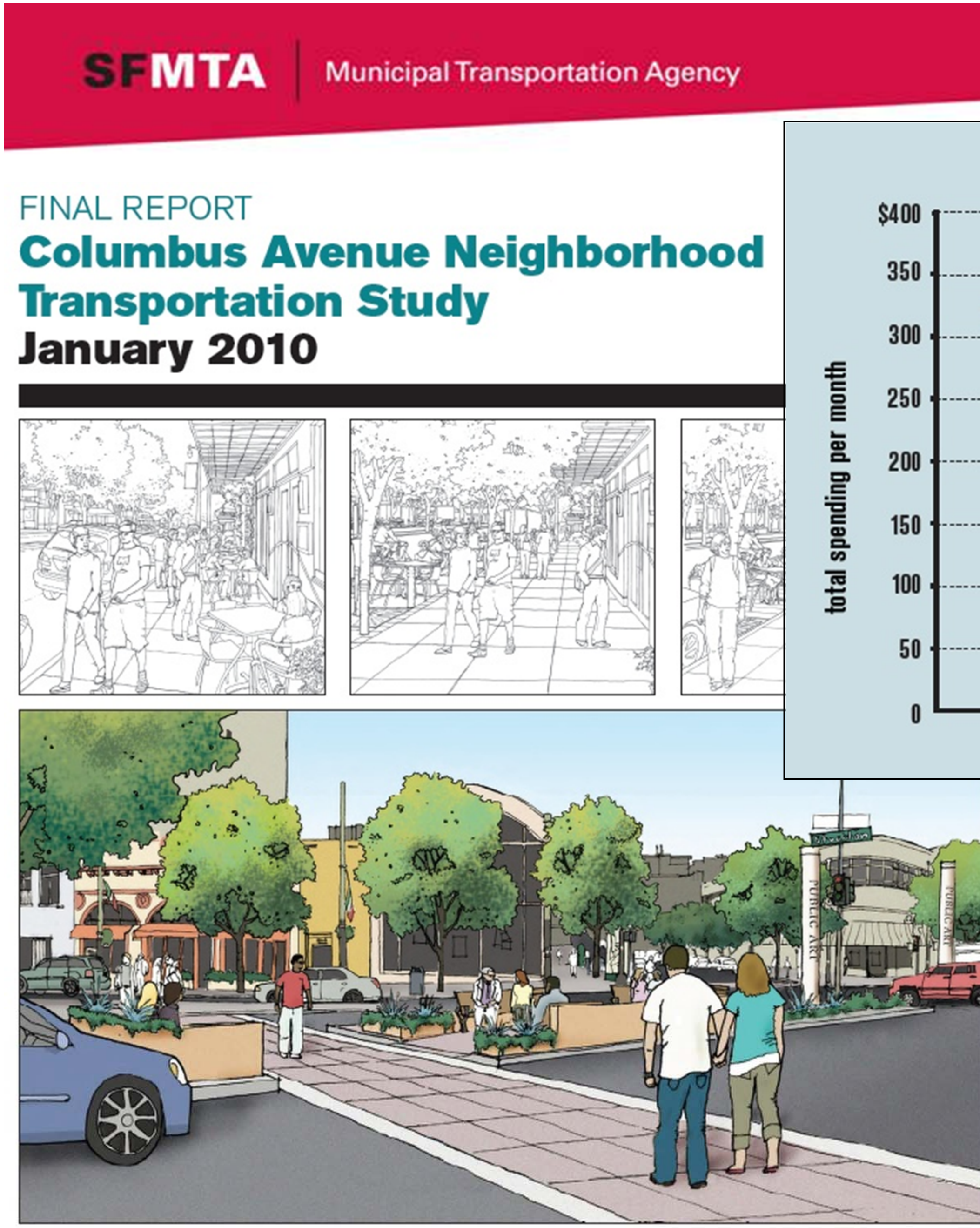
Speeds down 4% - 14%

Mansell btwn:	before (mph)	after (mph)	change (mph)	% change
Holyoke - Somerset				
eastbound	37.6	32.3	5.3	-14
westbound	31.9	30.4	1.5	-5
Colby - Dartmouth				
eastbound	39.8	34.8	5	-13
westbound	37.4	35.8	1.6	-4
Visitacion - John F Shelley				
eastbound	50	47.5	2.5	-5
westbound	47.3	42.6	4.7	-10

Collisions down 84%+

	before	after	change	% change
Total midblock collisions	58	9	49	-84
Midblock Collision Rate	3.89	0.57	3.32	-85

Two to one lane in each direction



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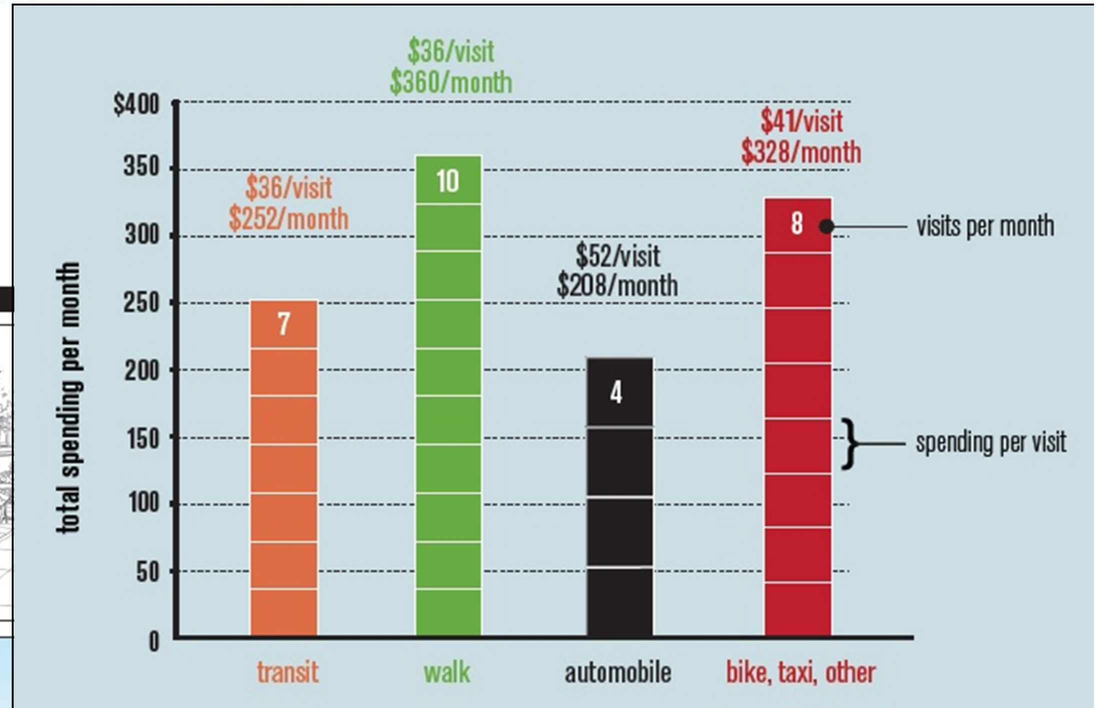
FINAL REPORT

Columbus Avenue Neighborhood Transportation Study

January 2010



<u>Improve Business</u>

People who walk and use bikes spend more $$$

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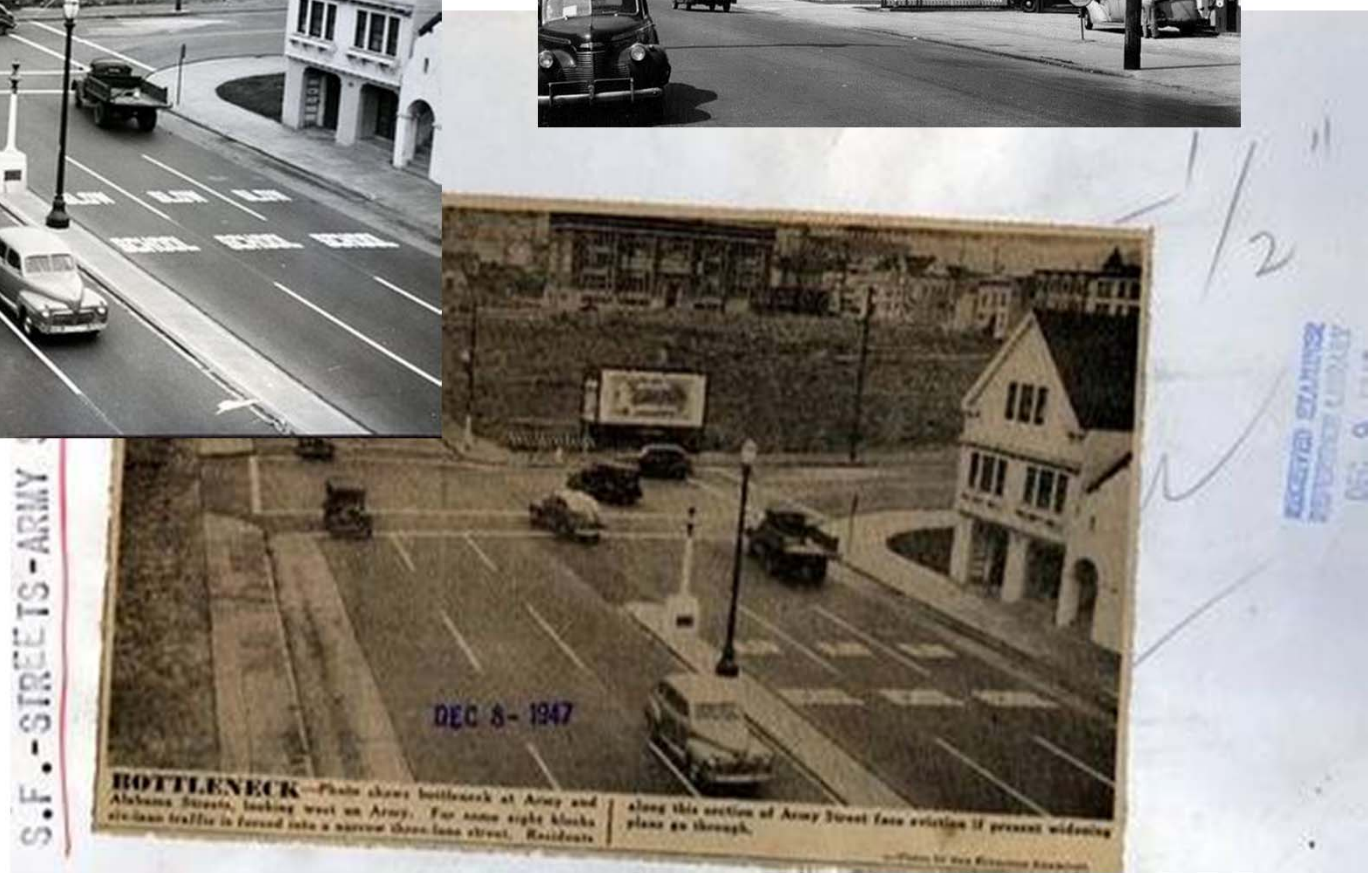
Cesar Chavez Street

Six lanes, 53,000 veh/day

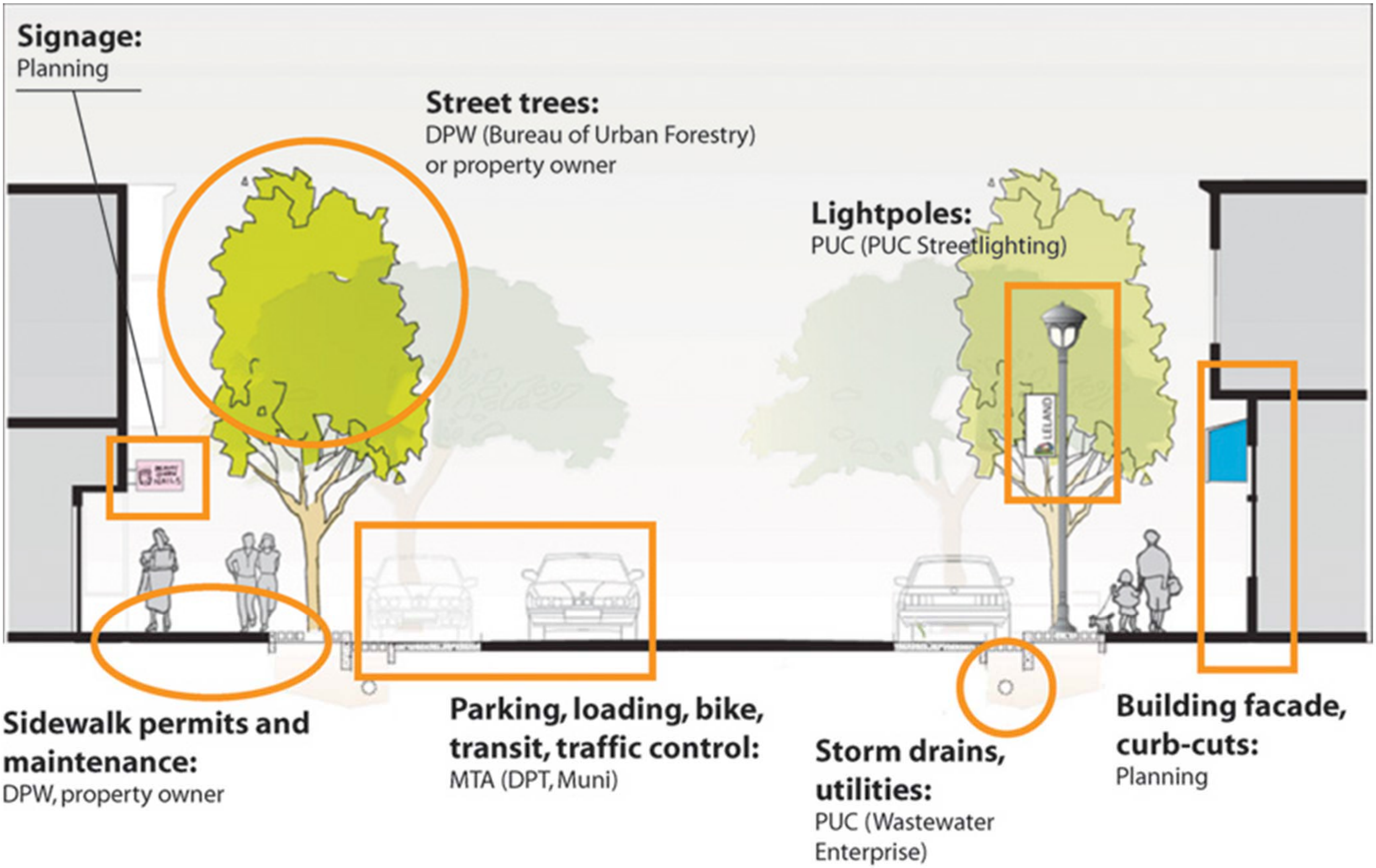
Cesar Chavez – early days



Cesar Chavez St

Existing Conditions for Pedestrians

Multi-Agency Effort



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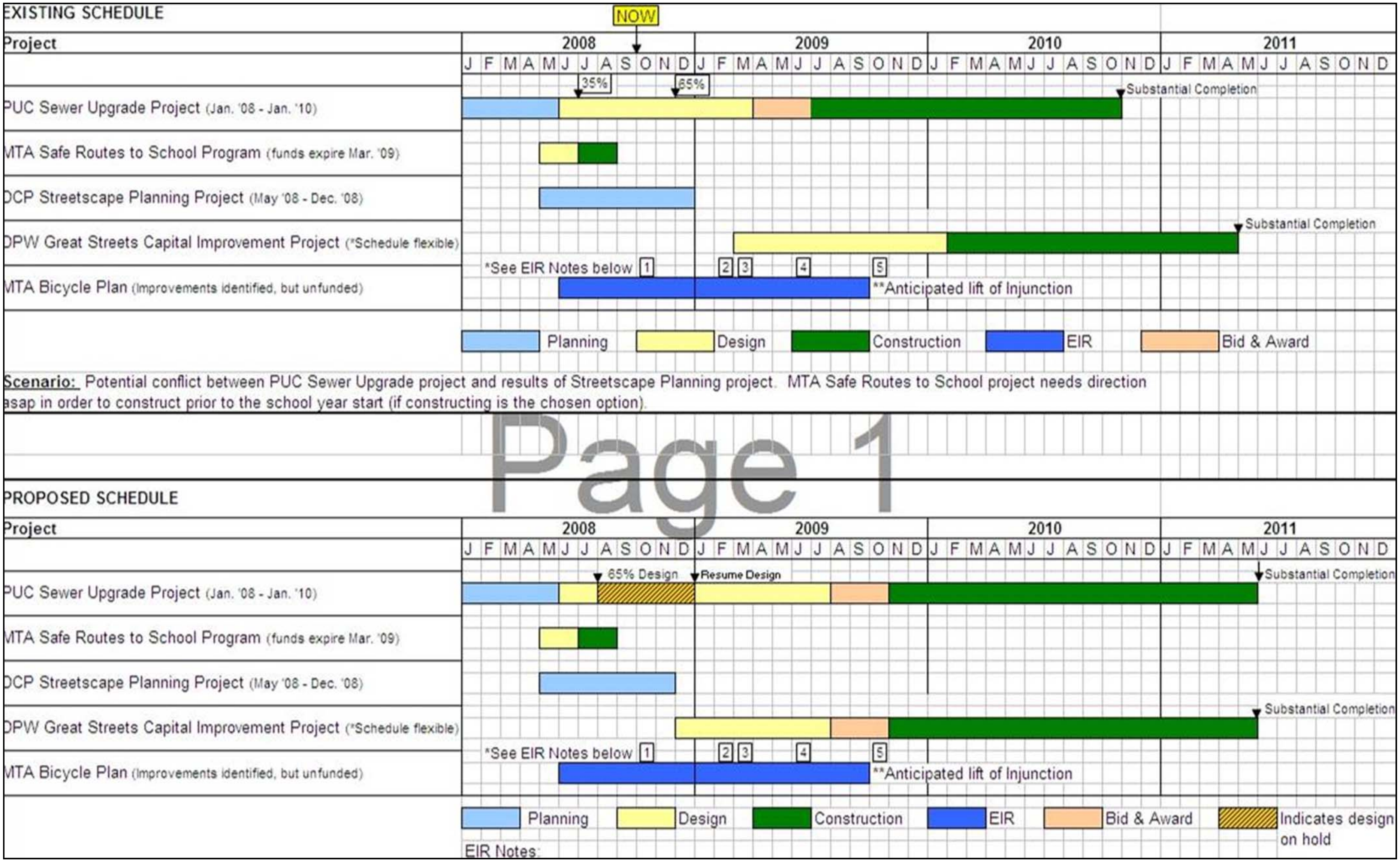
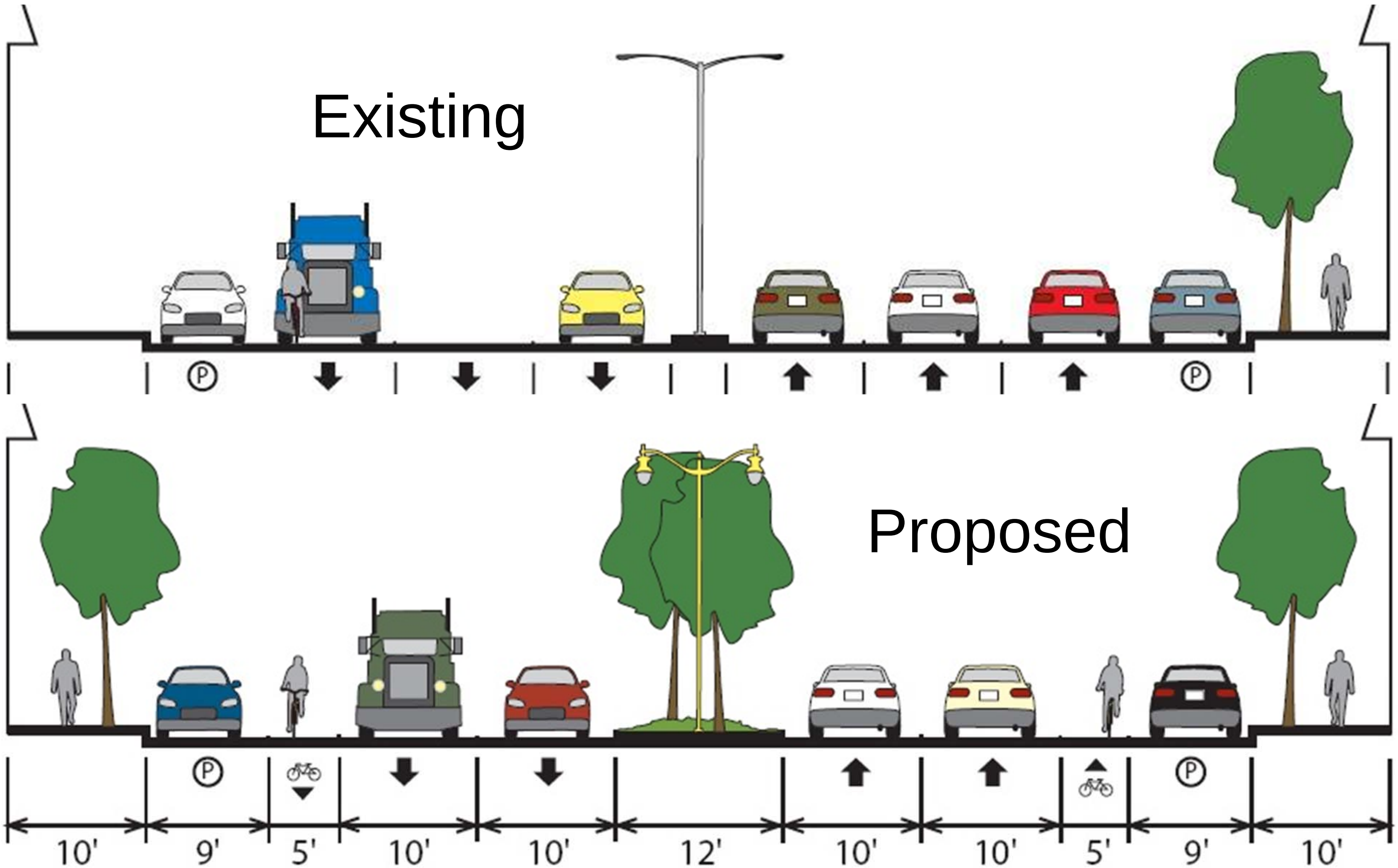
Coordination



Design Considerations

- Pedestrians
- Bicyclists
- Trucks
- Signal Design
- Schools, Parks Access
- Transit
- Local and Regional Traffic
- Accessibility (APS)
- Traffic Routing during Construction

Detailed Design 2010 – Construction 2012



53,000+veh/day – LOS F acceptable trade-off for benefits

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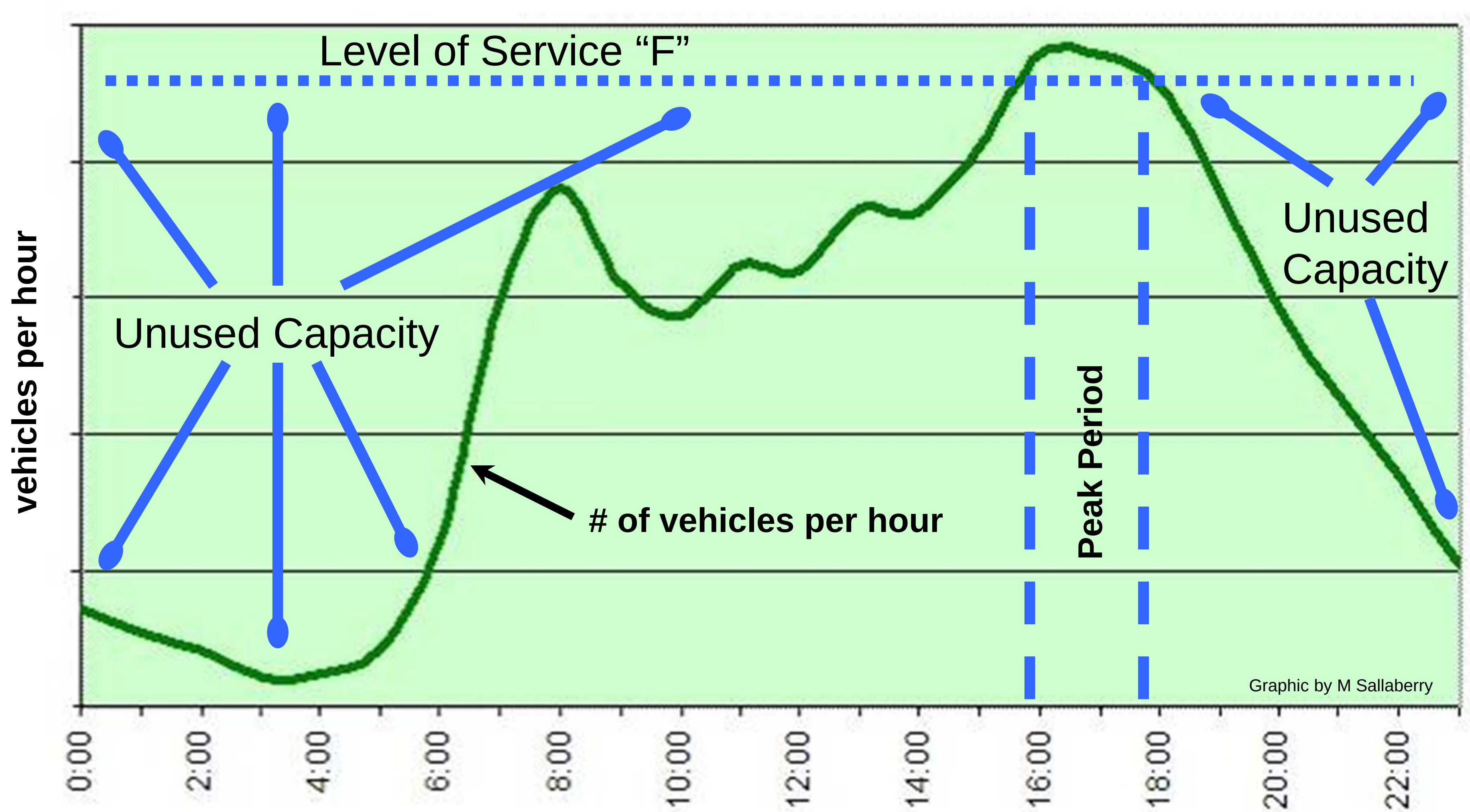
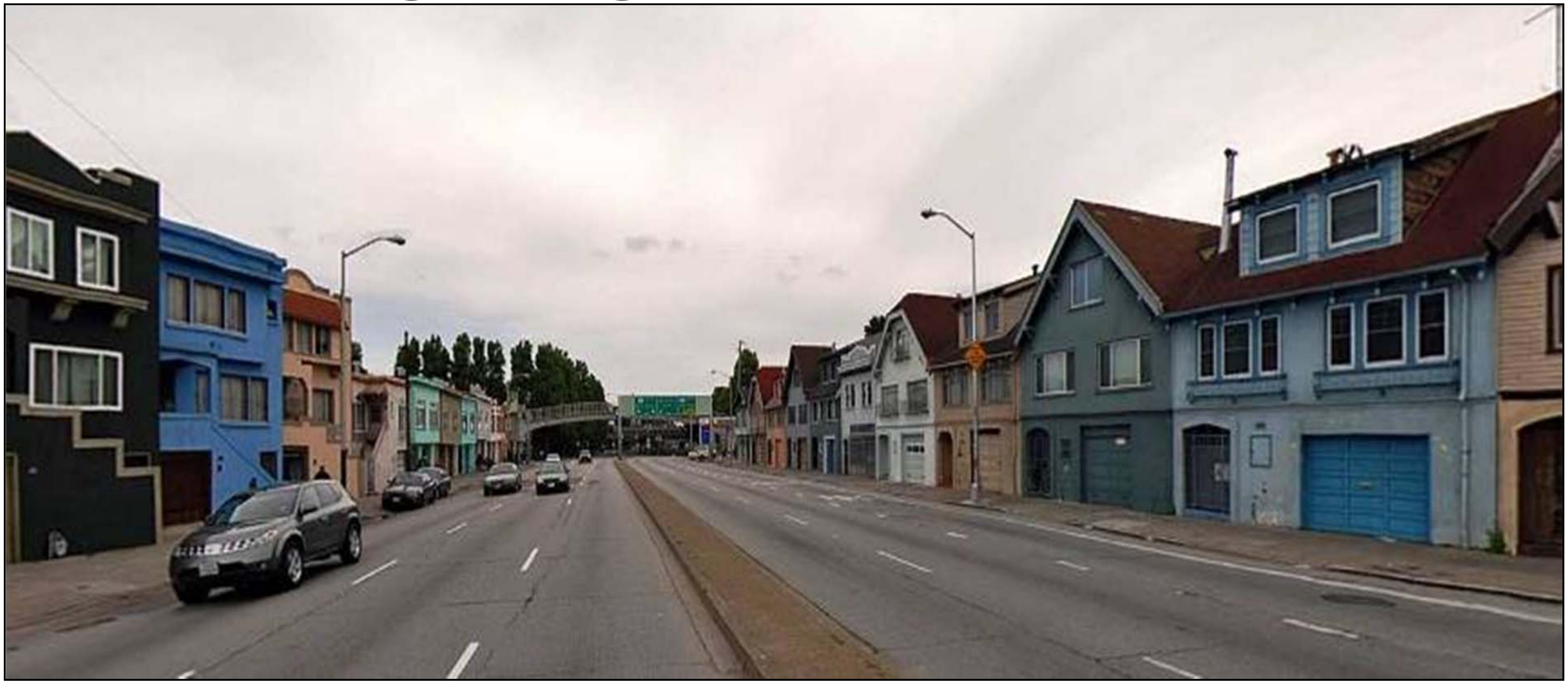
Designing for Peak Motor Vehicle Flow



Designing for Peak Hour



Inefficient Use of Valuable Space
Empty Lanes Encourage Speeding
Unnecessarily Wide for Pedestrians

*Peak hour occurs ~2hrs/day, 5 days/week, or 6% of the time

"This project will create congestion!"

There may be congestion during the peak hour* but the safety benefits will be there 24 hours/day, 7 days/week.

*Peak hour occurs ~2hrs/day, 5 days/week, or 6% of the time

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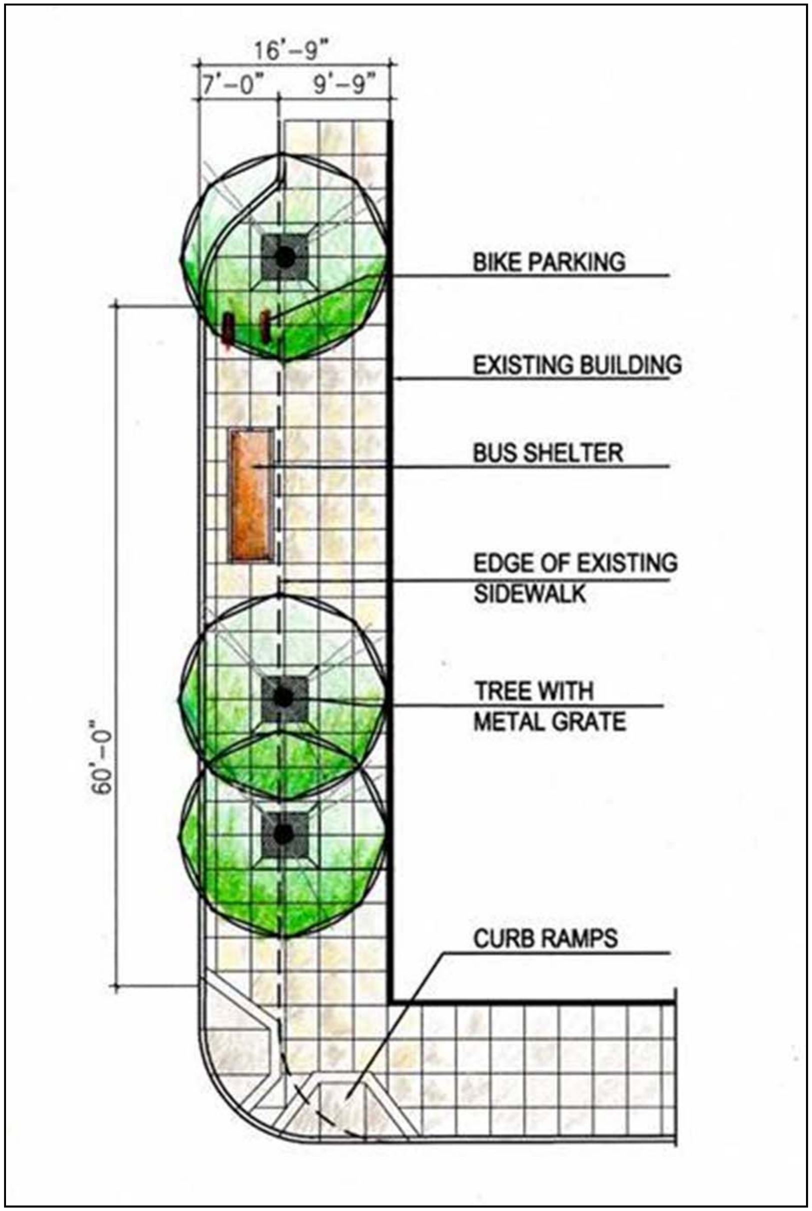
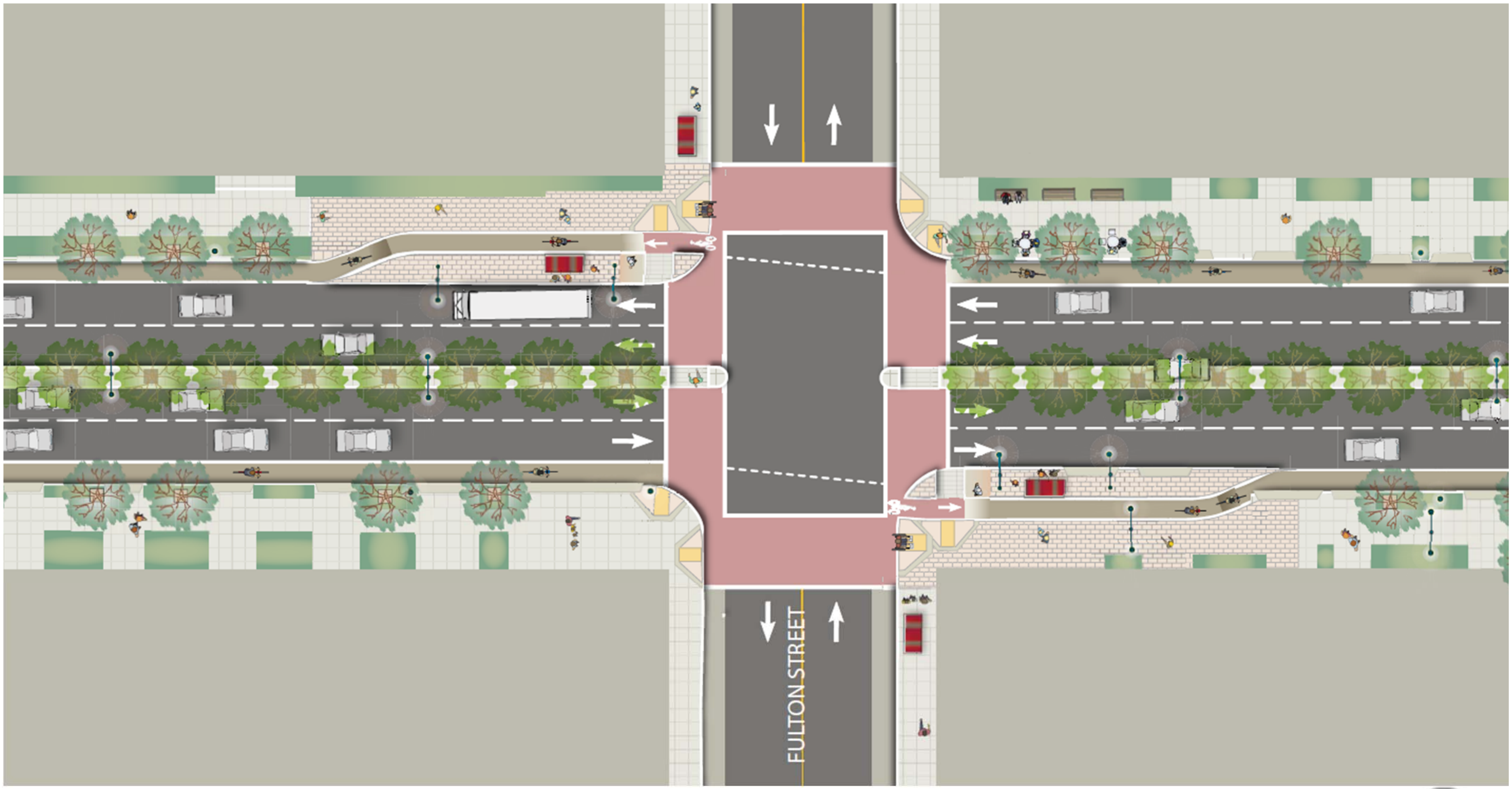
Bus Bulbouts



- **Same traffic calming and ped safety benefits of corner bulb outs, plus:**
- **Shorter dwell time for transit**
- **More space for shelter and other street furniture outside walking space**
- **More landscaping opportunities**
- **Reduces impact of congestion on transit**

Upcoming Road Diet - Masonic



Cycletracks, transit and pedestrians bulbs, landscaping

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Road Diets can include conversion of parking spaces to ped/bike uses

Parklets

On-Street Bike Parking/Corrals

Clears sidewalk for peds

1 car space = 10 to 12 bike spaces

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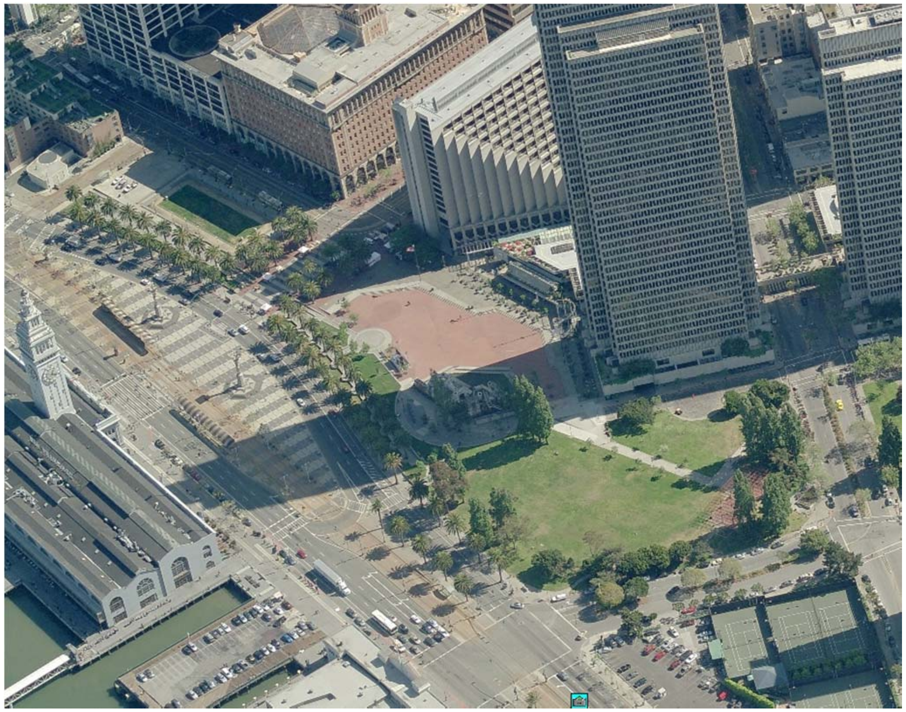
The Embarcadero




FERRY PLAZA
FARMERS MARKET


1818

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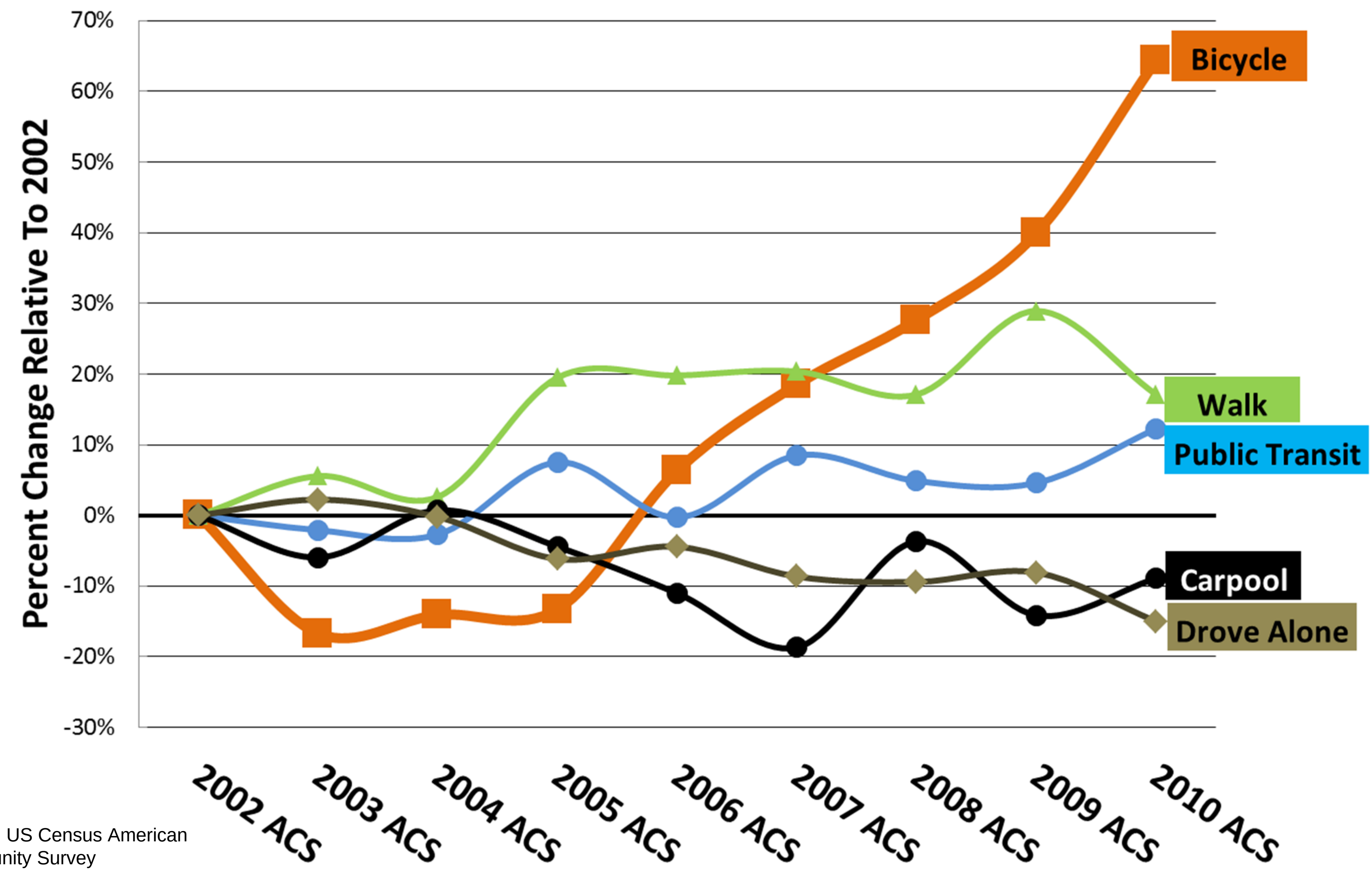
Changes in Mode Share in SF



Source: US Census American Community Survey

Thanks!

Mike Sallaberry
SFMTA, Livable Street
“SFMTA Livable Streets” on facebook
mike.sallaberry@sfmta.com


Road Diets: The Seattle Experience

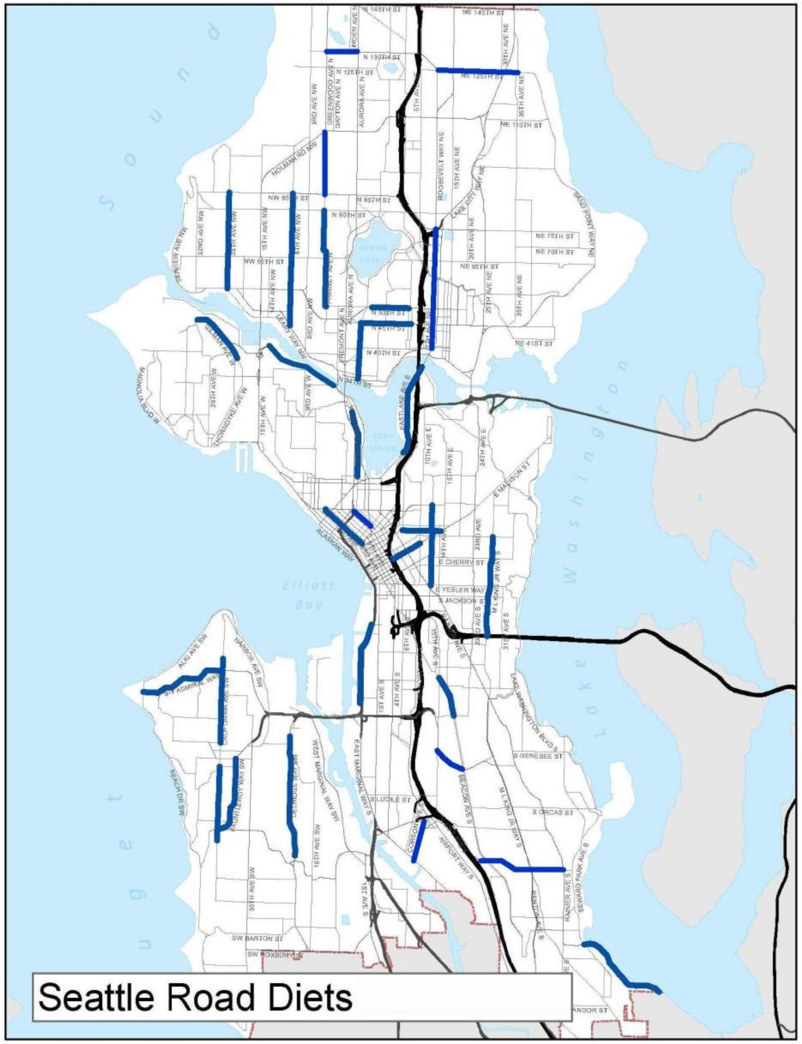
November 20th, 2012
Gina Coffman, Planner
Toole Design Group
vcoffman@tooledesign.com

TooleDesignGroup

Seattle Road Diet History

- 34 road diets have been installed in Seattle since 1972

- Five projects in 2010
- Five projects in 2011
- Two studies in 2012
- One study in 2013



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Seattle's Complete Streets Approach

- **Vision:** Streets that are safe, convenient and accessible for everyone
- **Plans**: Bicycle, Pedestrian, Transit, Freight
- **Funding**: Bridging the Gap, state, federal grants
- **Implementation:** Complete Streets checklist
- **Outreach:** Community collaboration
- **Opportunities**: Redesigning streets

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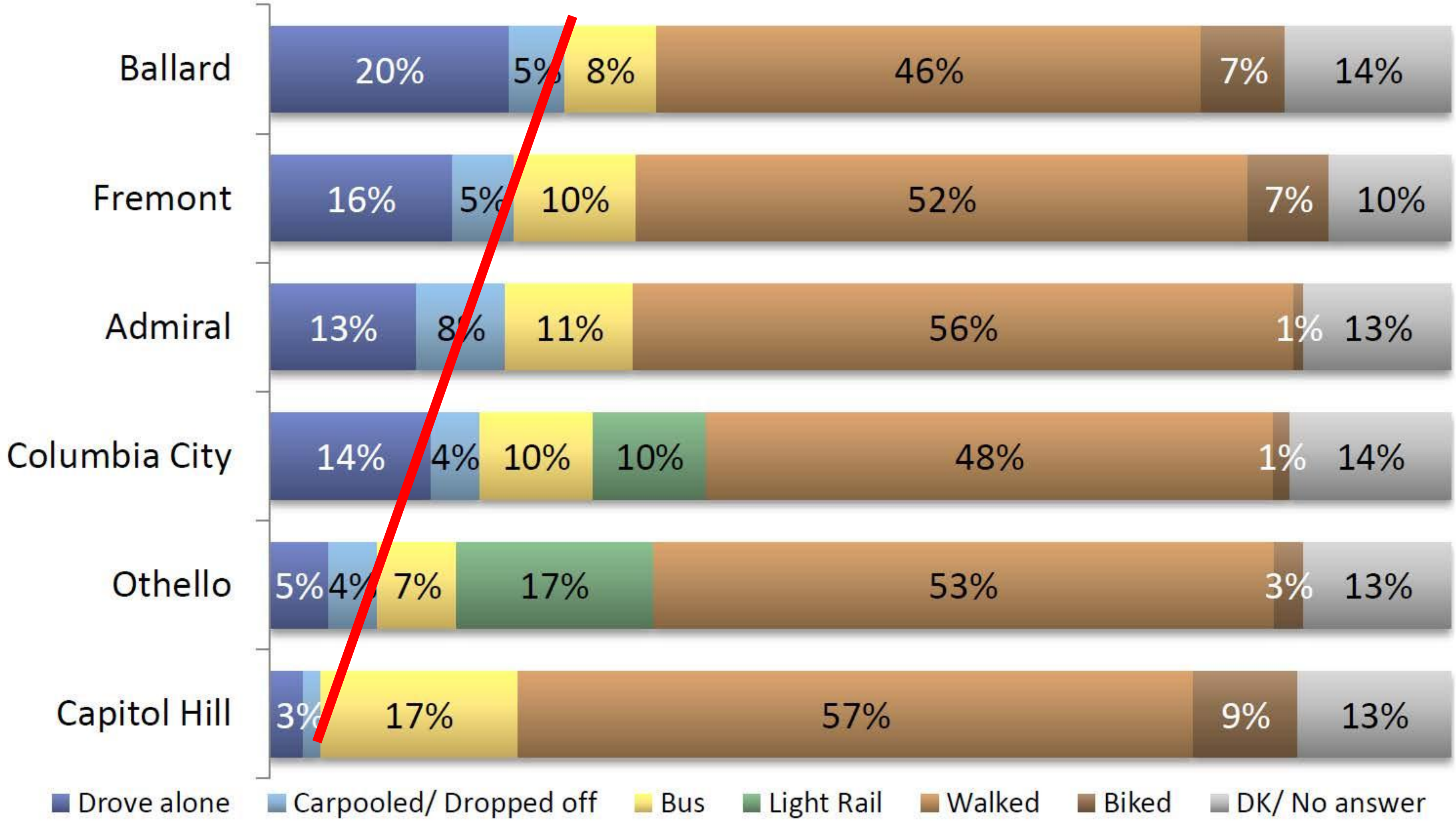
45th St: Rechannelized in 1972

Why Road Diets? Walk/Bike Trips



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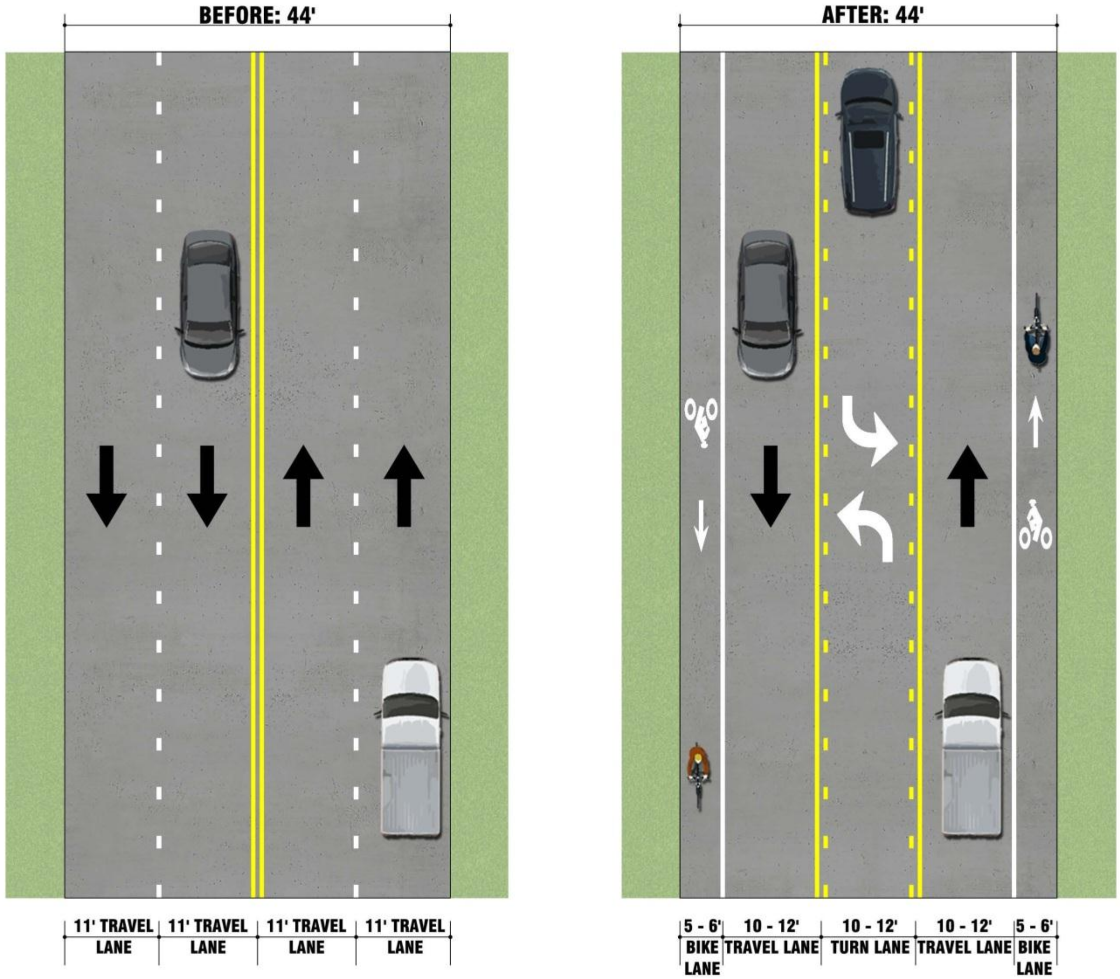
Why Road Diets? Fewer Lanes



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Why Road Diets? Fewer Collisions

US Federal Highway Administration Proven Safety Measure to reduce all collisions by 29%

Marginal Way

Nickerson St

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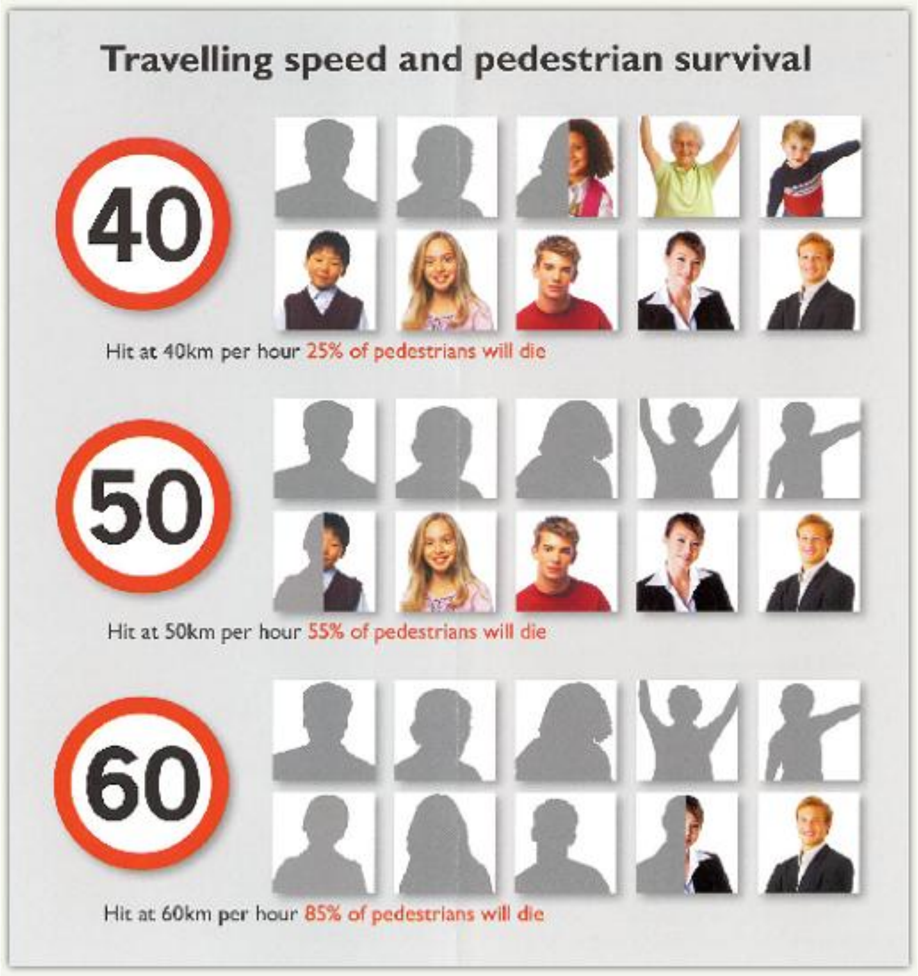
Why Road Diets? Pedestrian Safety

~ 25 MPH

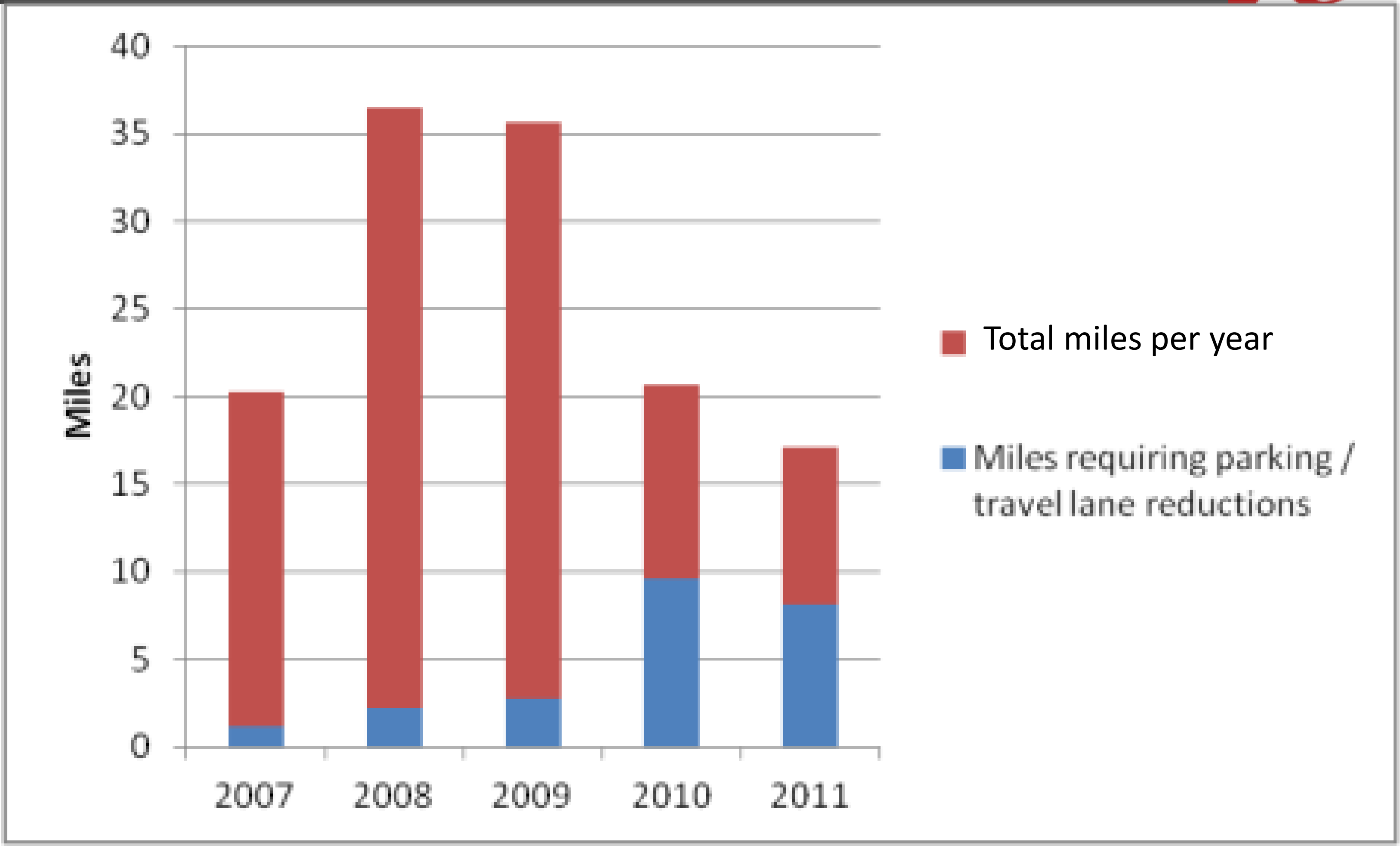
~ 31 MPH

~ 37 MPH



City of Canterbury, UK

Why Road Diets? Bicycle Accomodation



Why Road Diets? Bike Lanes

20th Ave

Why Road Diets? Bike Lanes

Why Road Diets? Transit

Why Road Diets? Transit

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Pitfalls

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How are Corridors Identified?

- Bike/Ped Master Plan Prioritization Process
- Community requests

S Columbian Way: ADT 8,000

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How are Corridors Implemented?

- CIP Projects
- Repaving Projects
- Bike/Ped Plan Funding
- Transit Projects


Phinney Ave

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What Factors are Considered?

Tier 1: Traffic Operations

What Factors are Considered?

Tier 2: Safety/Collisions

Ne 130th St Before

Ne 130th St After

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What Factors are Considered?

Tier 3: Livability

Before & After Studies

Data needs	Before Study	After Study (>1 year)
ADT	√	√
Bike and Ped Counts	√	√
Crash Data	√	√
Speed	√	√
Transit Operations	√	√
Turning vehicle counts	√	√
Gap Studies	√	√
Parking use	√	√
Side street diversion	√	√
Vehicle Classification	√	√
Signal LOS	√	√
Stakeholder Satisfaction	√	√

Out Reach: Common Concerns

- ***There will be gridlock!***
  - Maintain capacity at signalized intersections
  - Gain efficiency by removing left turns from travel lanes

- ***People will cut though the neighborhood***!
  - Monitor pre and post project implementation
  - Implement traffic calming measures if problems occur

- ***I'll be trapped in my driveway by all the traffic!***
  - Sight distance is improved for left turns
  - Access from side streets and driveways improved by crossing only one travel lane to the two-way left turn lane.

Out Reach: Common Concerns

Street	Before Comments	After Comments	Requests to remove
NE 125th St	394	7	3
Nickerson St	66	8	0

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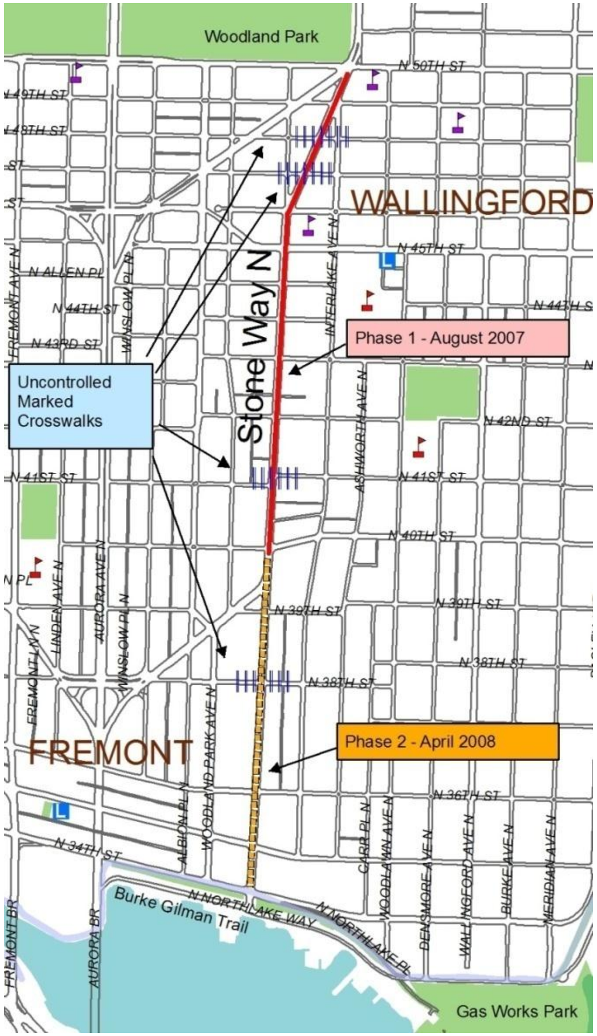
Case Study: Stone Way N

- 1.2 miles
- ADT – 13,000
- Burke-Gilman Trail Access
- Woodland Park Access
- Within 5 blocks – 8 schools, 2 libraries and 5 parks



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Stone Way N: Marked Crosswalks

- Uncontrolled, marked crosswalks at 4 intersections.
- Crosswalk guidelines changed in 2004.
- Marked crosswalks would be non-compliant with four-lane cross section.

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Stone Way N: Bicycle Master Plan

- Adopted in 2007
- 1st Project: Stone Way
- Recommended climbing lane and shared lane markings.

Stone Way N: 85^{th} Percentile Speed

- Speed limit 30
- Before: 85^{th} % was 37 mph
- After: 36 mph northbound
- After: 34 mph soundbound

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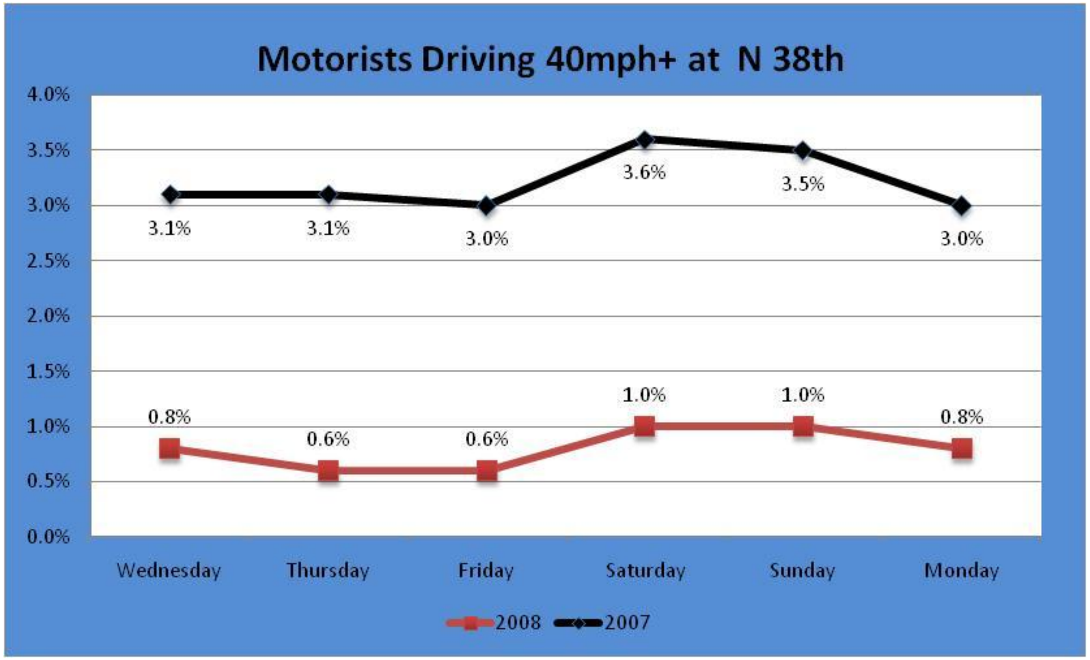
Stone Way N: Aggressive Speeders

- Before : 3% of vehicles 40 mph+
- After: <1%, 40 mph+ after rechannelization
- Reduction in seriousness of collisions/injuries.



Stone Way N: Bicycle Volume

- Increased 35%
- 15% of the peak hour traffic volume!

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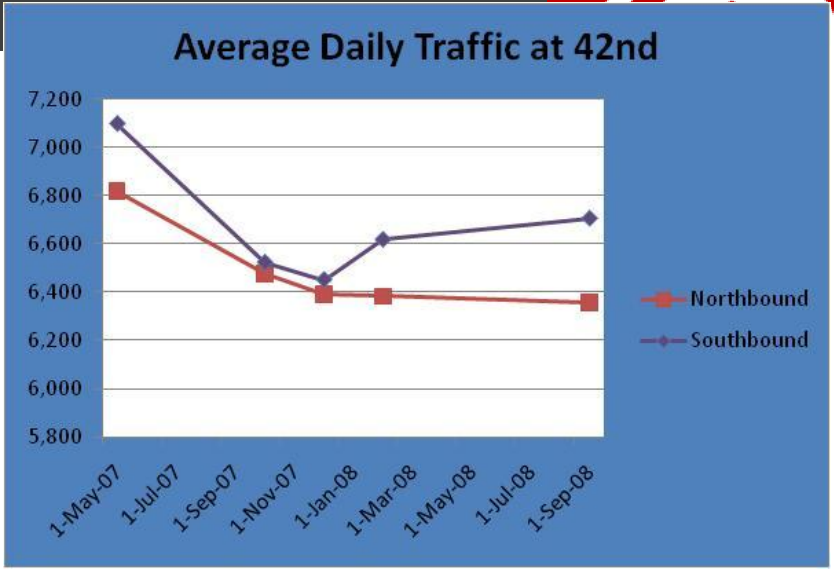
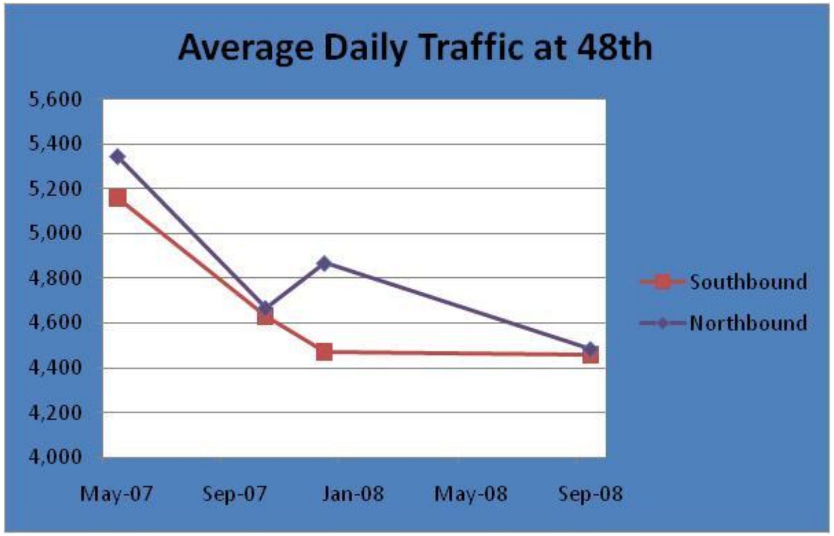
Stone Way N: Motor Vehicle Volume

- ADT Dropped 6% (consistent with citywide trend between 2006-08)
- Peak Hour volume dropped approximately 5%
- Off-peak volume actually increased south of 45th Street





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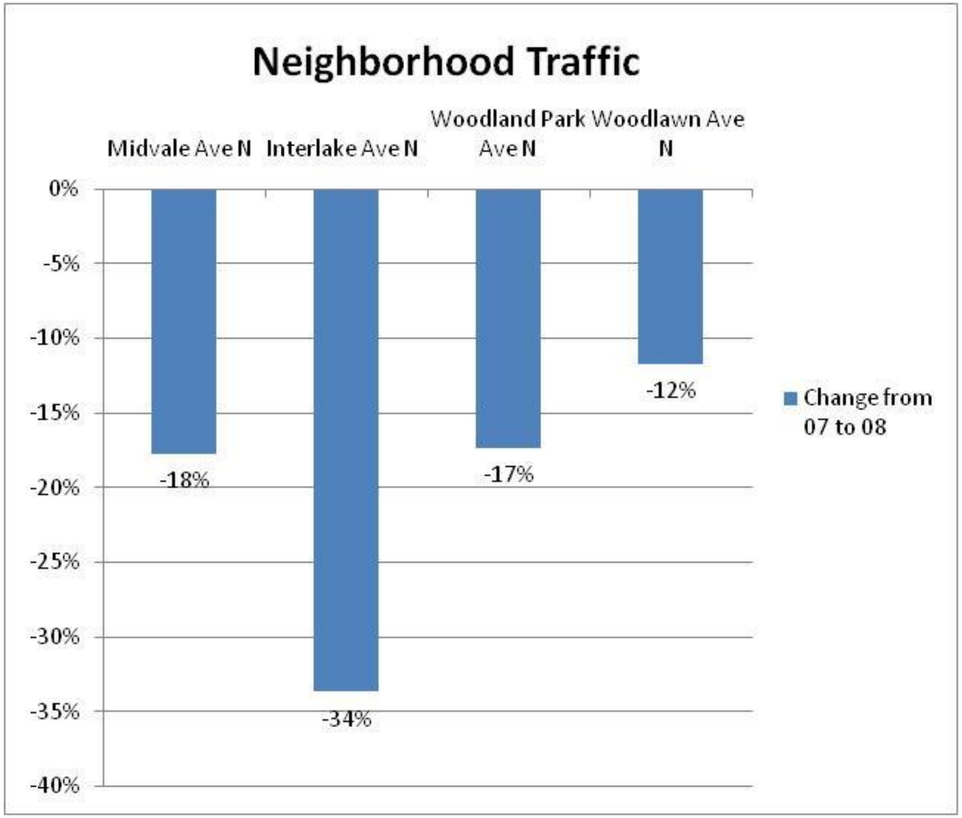
Stone Way N: Neighborhood Traffic

- Four non-arterial streets commonly mentioned as alternatives to Stone
- Volume decreased on all four of those streets
- Traffic did not divert after rechannelization.



Stone Way N: Collisions

- Total collisions declined 14%
- Injury collisions declined 33%
- Angle collisions declined 56%
- Bicycle collisions no change, but rate declined
- Pedestrian collisions declined 80%

COLLISIONS BY TYPE			
	2005-07	2007-09	Change
Right Turn	1	0	-100%
Pedestrian	5	1	-80%
Sideswipe	14	6	-57%
Angle	34	15	-56%
Left Turn	12	9	-25%
Parked Car	34	29	-15%
Head On	1	1	0%
Pedalcyclist	7	7	0%
Rear End	17	28	65%
Total	**159**	**137**	**-14%**
Injury	52	35	-33%
Percent Injury	33%	25%	

Stone Way N: Conclusions

- Speed has declined
- Collisions have declined
- Pedestrian crossings are safer
- Bicycle volume has increased
- Traffic has not diverted to neighborhood streets
- Peak hour capacity has been maintained
- Strong case for implementing road diets

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Possible Elements of Future Studies

Study Data:

- Pre and Post survey of nearby businesses and residents
- Volume of parallel arterials

To Address/Answer:

- Livability
- Impact to business
- Travel time
- Diversions to other arterial streets

Follow-up studies and monitoring

- Volume of principal street /peak hour capacity
- Speed and collisions
- Traffic signal level of service
- Volume of parallel arterials
- Travel time
- Bicycle volumes

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NE 125th St

Factors:

- ADT 16,200
- 4 lanes to 2 lanes with TWLTL and bike lanes
- Business district
- High bus usage
- High number of pedestrian collisions

Before

NE 125th St

ADT
4%

AM
6%

PM
12%

85th%
-8%

OVER 30
-12%

TOP END
-69%

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NE 125th Public Meeting

Results of Studies

Street	ADT begin	ADT change	Collisions	85th %	Top end speeders	Travel time
Stone Way	13,000	-6%	- 14%	- 6%	- 80%	N/A
NE 125th St	16,200	+ 4%	N/A	- 8%	- 69%	+ 1.5 min
Nickerson St	18,600	- 1%	- 23%	- 21%	- 94%	N/A
Fauntleroy	16,500	+ 0.2%.	- 31%	- 1%	- 13%	+ 32 sec
Columbian Way	11,200	+ 20%	No change	- 6%	-50%	N/A

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Results of Studies

For 30 road diets, the average change in ADT was 1.97%.

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Thank you!

- Archive at
  - walkinginfo.org/training/pbic/pedfocus_webinars.cfm
  - Downloadable and streaming recording and presentation slides

- Questions?
  - Libby Thomas: libby_thomas@unc.edu
  - Mike Sallaberry: mike.sallaberry@sfmta.com
  - Gina Coffman: vcoffman@tooledesign.com
  - Other: webinars@hsrc.unc.edu