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Department of Transportation

Revising Vehicular Level of Service (LOS) Standards in Pasadena

Mike Bagheri, P.E.

Toolbox Tuesdays-Implementing Complete Streets

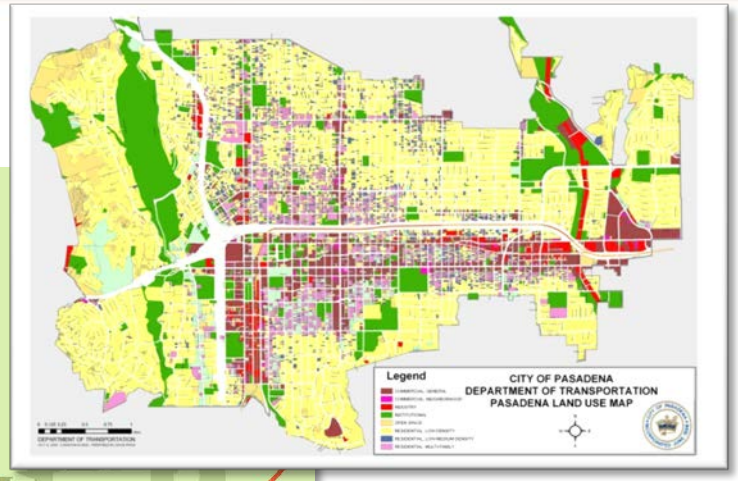
March 27, 2012

Southern California Association of Government (SCAG)

About Pasadena

Department of Transportation

Source: Census Transportation Planning Package, ESRI, Strategic Economics



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Background

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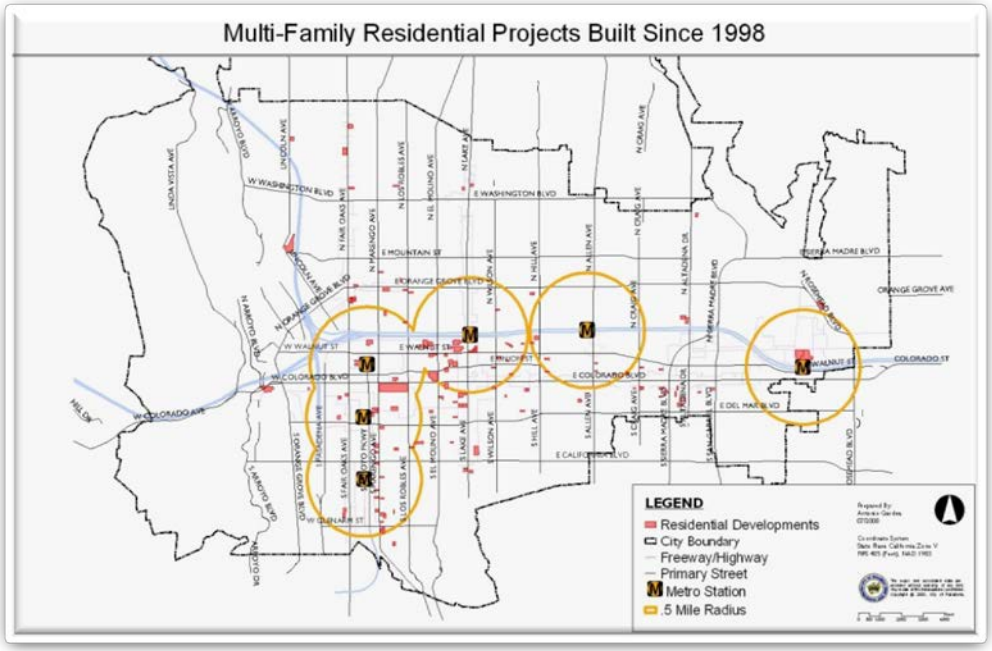
- Land use decisions made in the 1994 and 2004 General Plan updates



> Developed a limited growth strategy that protected the historic neighborhoods that ring the Central District of Pasadena

> Embraced the potential for transit-oriented development (TOD) along the route of the Gold Line LRT service.

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Background

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- Since the opening of the Gold Line in 2003, Pasadena has seen

> A marked increase in mixed-use and multi-family residential in the Central District

> An intensification of commercial office and employment in the TOD areas.

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City's 2004 Mobility Element Objectives

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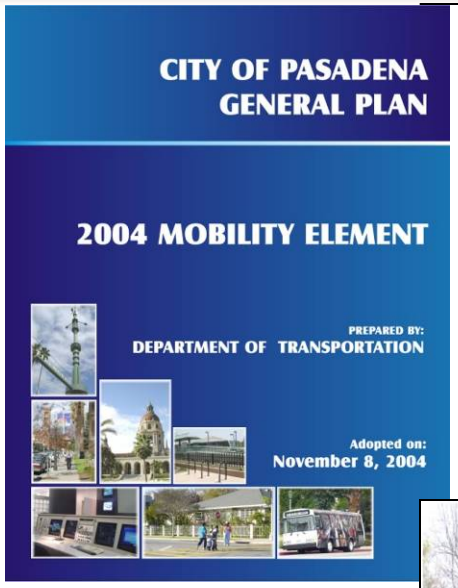
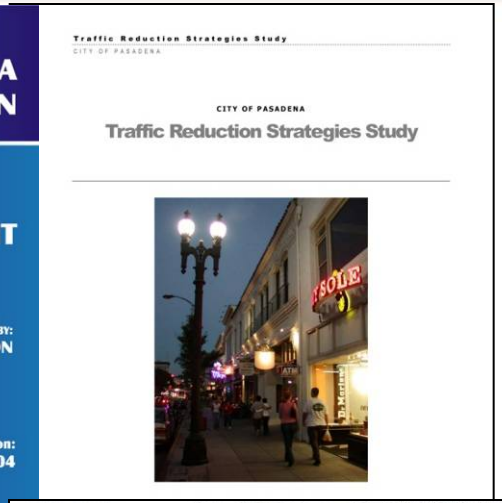
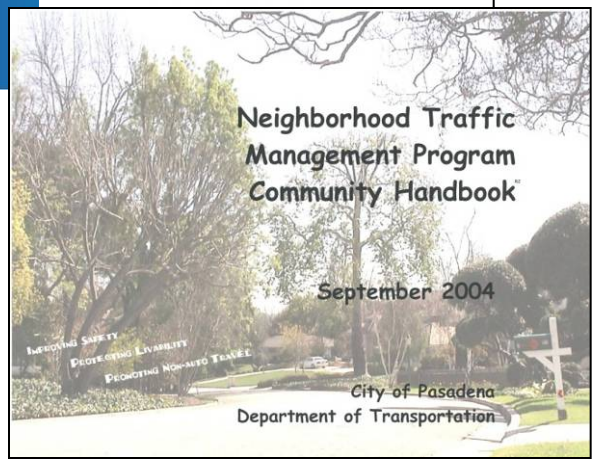
- Promote a livable community
- Encourage non-auto travel
- Protect neighborhoods
- Manage multimodal corridors







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Changing Expectations

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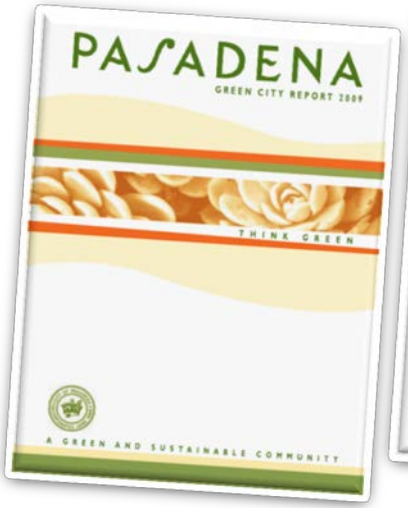
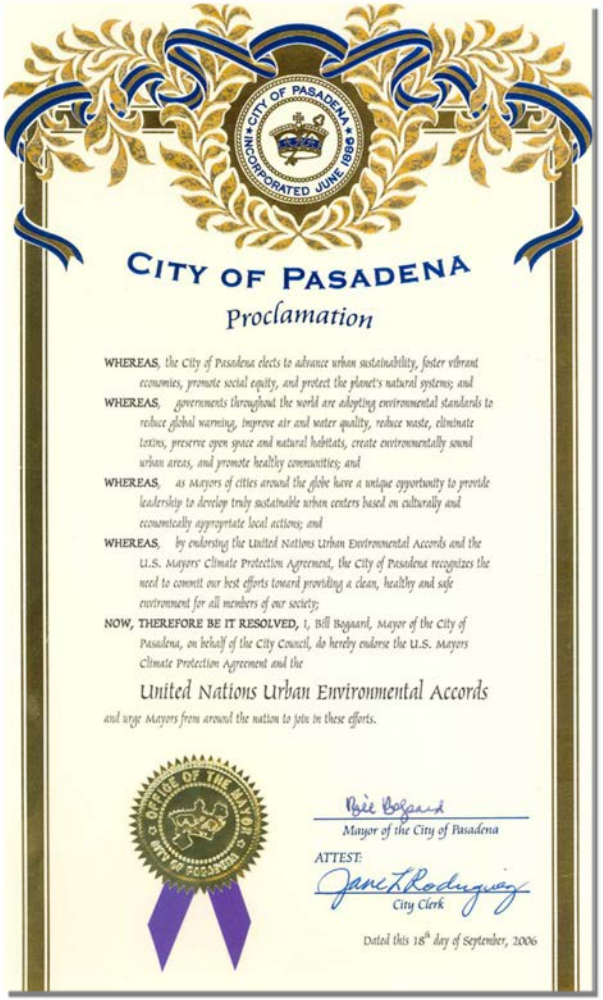
- UN Urban Accords
  - > Sustainability
  - > Green City Action Plan
- State Mandates
  - > Reduce Greenhouse Gas (AB 32)
  - > Community Sustainability (SB 375)
  - > Complete Streets (AB 1358)





CITY OF PASADENA

Proclamation

WHEREAS, the City of Pasadena elects to advance urban sustainability, foster vibrant economies, promote social equity, and protect the planet's natural systems; and

WHEREAS, governments throughout the world are adopting environmental standards to reduce global warming, improve air and water quality, reduce waste, eliminate toxins, preserve open space and natural habitats, create environmentally sound urban areas, and promote healthy communities; and

WHEREAS, as Mayors of cities around the globe have a unique opportunity to provide leadership to develop truly sustainable urban centers based on culturally and economically appropriate local actions; and

WHEREAS, by endorsing the United Nations Urban Environmental Accords and the U.S. Mayors' Climate Protection Agreement, the City of Pasadena recognizes the need to commit our best efforts toward providing a clean, healthy and safe environment for all members of our society;

NOW, THEREFORE BE IT RESOLVED, I, Bill Bogaard, Mayor of the City of Pasadena, on behalf of the City Council, do hereby endorse the U.S. Mayors Climate Protection Agreement and the

United Nations Urban Environmental Accords

and urge Mayors from around the nation to join in these efforts.

Bill Bogaard
Mayor of the City of Pasadena

ATTEST:
Jane L. Rodriguez
City Clerk

Dated this 18th day of September, 2006

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What It Means

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- A change in the perspective from which the performance of the transportation system has been viewed
  - Need to deemphasize auto-centric focus on vehicular delay and speed of travel
- Metrics reflecting **livability** and **sustainability** goals must be balanced across modes
  - Shorter and fewer vehicle trips become an important measure in relation to greenhouse gas production.
- The condition of the network for **pedestrians** and **bicyclists** becomes a factor in the performance of a multi-modal system
- The availability and connectivity of **transit** service increases in importance
- The current Level of Service metric does not address the level of complexity inherent in these urban transportation strategies

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New Direction for Metrics

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Decreasing Emphasis

- Additional capacity/ widening streets
- Reducing individual intersection delay/ reducing volume to capacity ratio

Increasing Emphasis

- Network management
- Travel time reliability
- Improved transit services
- Complete Streets
  - > Multifunctional rights of way: green streets, social spaces
- Managing multimodal system

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Current Mobility Element Street Classification

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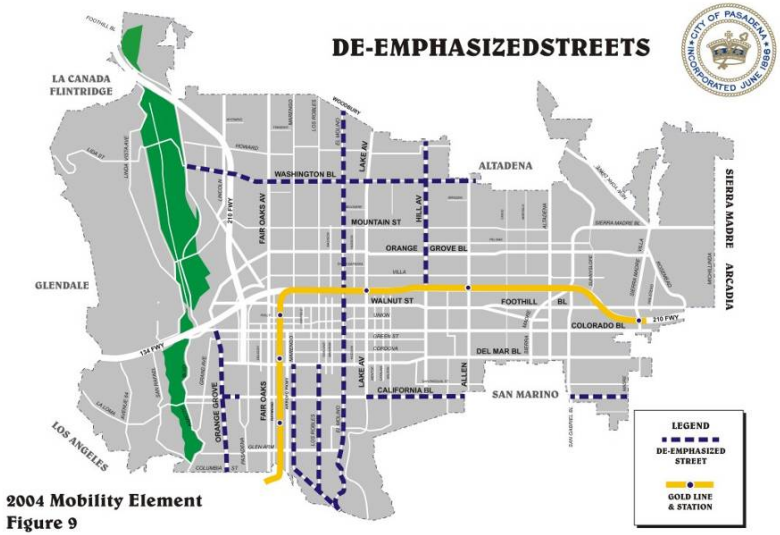
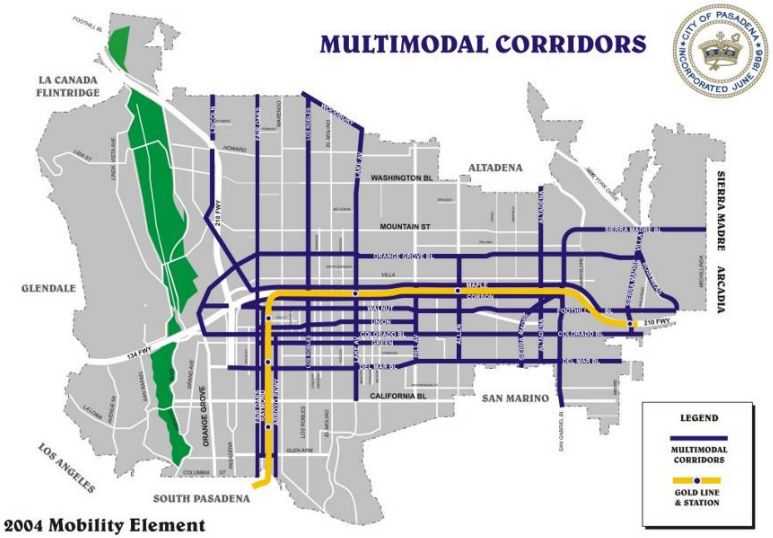
De-Emphasized Streets



2004 Mobility Element
Figure 9

Multi-Modal Corridors



2004 Mobility Element
Figure 10

- **1994 and 2004 Mobility Elements recognized the issues**
- **Introduced an alternate system of street types**
  - **Multimodal Corridors**
  - **De-emphasized Streets**

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California Law- The Complete Street Act (AB 1358)

"The Complete Streets Act of 2007 will ensure that the transportation plans of California communities meet the needs of all users of the roadway including pedestrians, bicyclists, users of public transit, motorists, children, the elderly, and the disabled."

AB 1358- Effective January 1st , 2011

General Plan & Mobility Element Update

- Define context and functions of the streets, Street Classification System, before implementing complete streets
- Use Street Classifications System to balance MMLOS mitigation measures tradeoffs.

Proposed Context-based Street Classification

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- Context Types
  - Freeway Frontage
  - Downtown
  - Main Street
  - City Mix
  - Commercial/Industrial
  - Park
  - Civic
  - Residential
- Function Types
  - Freeway
  - Throughway
  - Connectors
  - Access
- Overlays
  - One Way
  - Truck Routes
  - Transit
  - Bicycle
  - Emergency Routes
  - Pedestrian Emphasis
  - Landscape
  - Historic Designation
  - Special Events

Context-based Street Types

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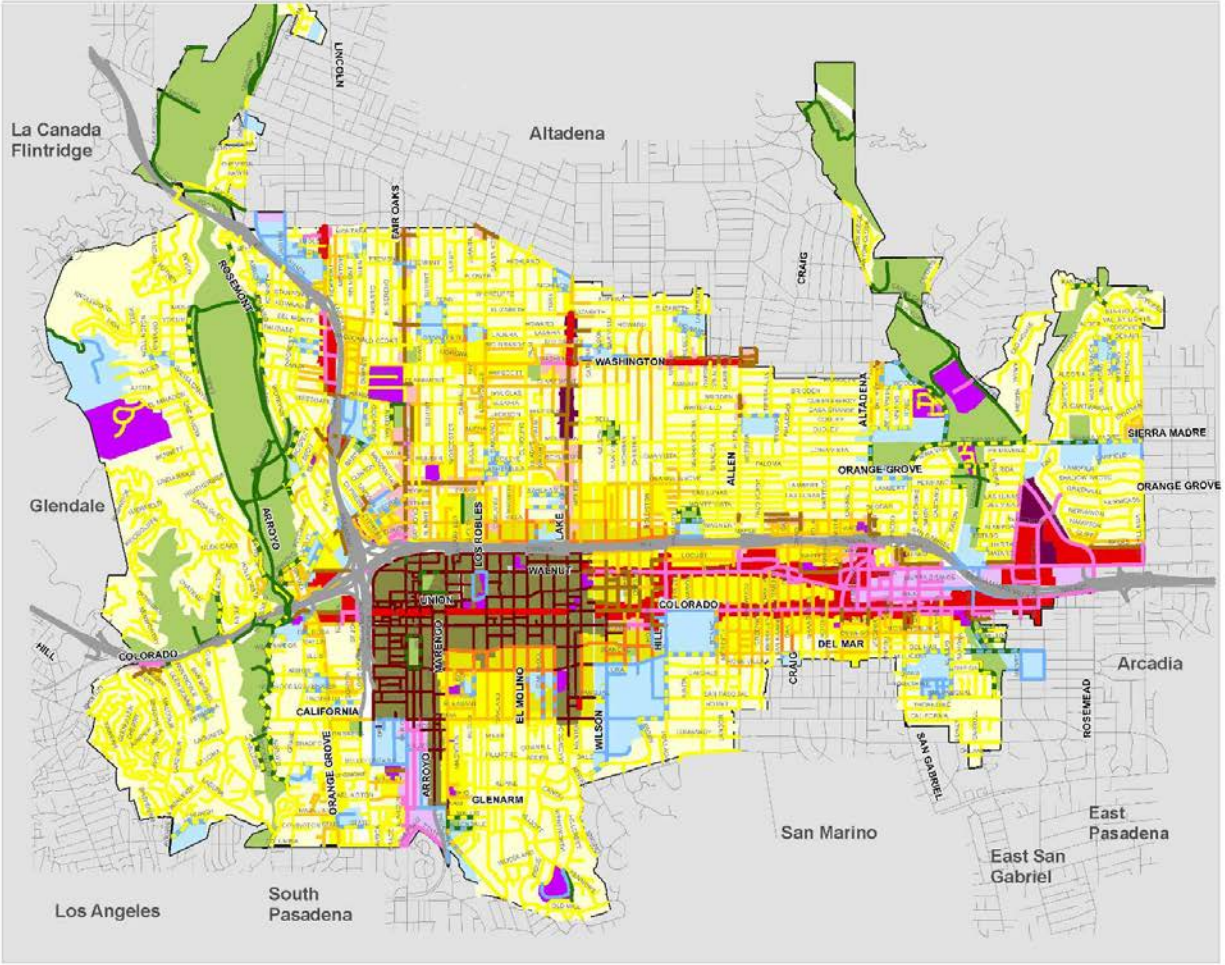

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Context Types Images

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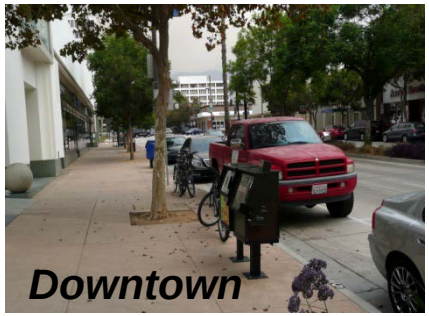

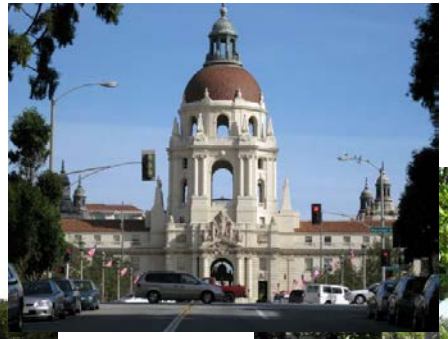

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Street Types- Function

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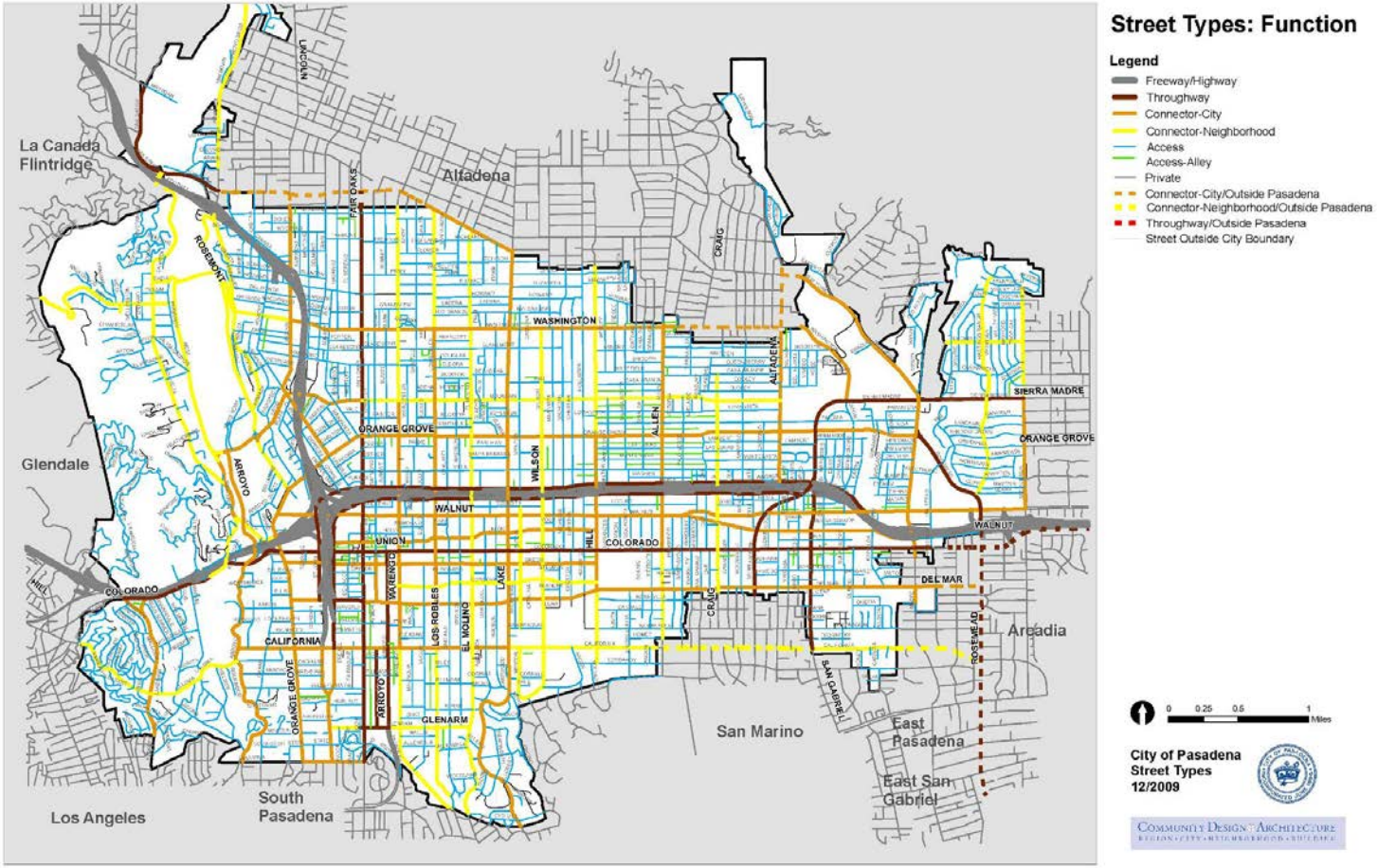

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Function Types Images

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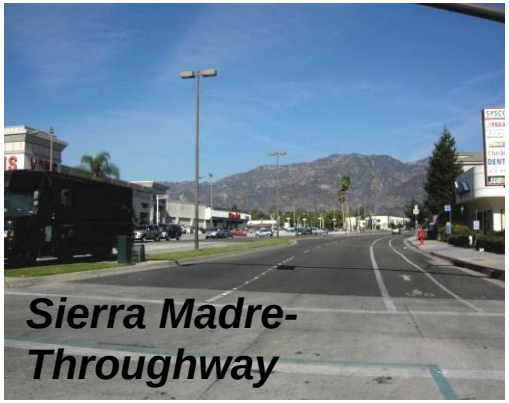
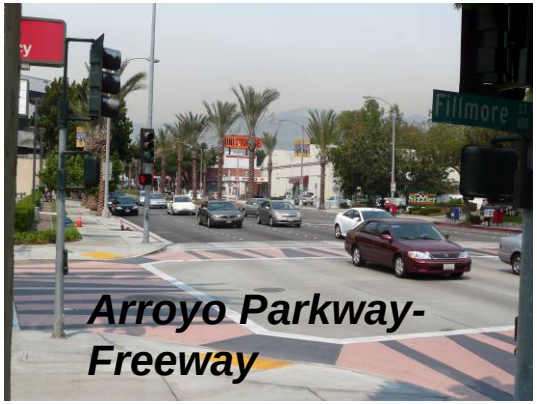


Sierra Madre- Throughway

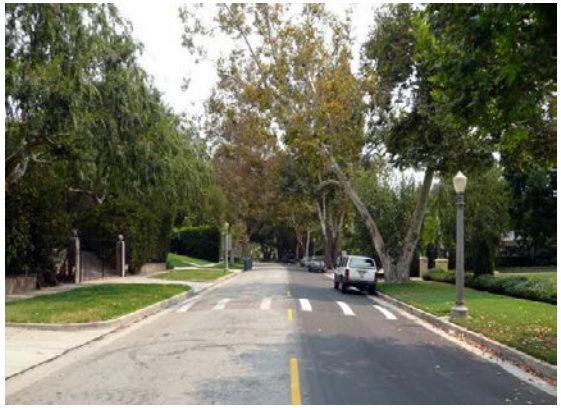


Arroyo Parkway- Freeway

Fair Oaks- Throughway

Washington – City Connector

Glenarm – Neighborhood Connector



Access - Street

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Public Right-of-Way Shared by Four Major Users

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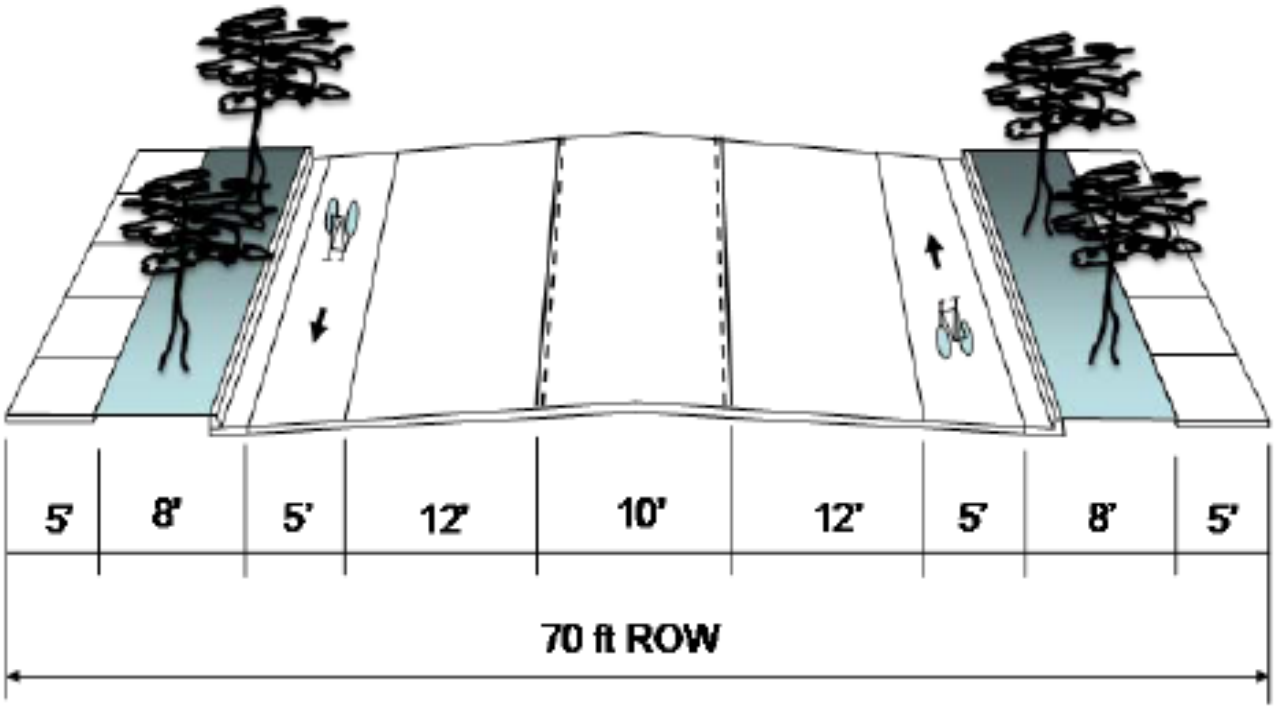

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Complete Street Images

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COMPLETE STREETS

HAWAII

Walk, Bike, Drive, Ride

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Current Traffic Impact Study Guidelines

- Vehicular-based Intersection Impacts
- Vehicular-based Street Segment Impacts

Vehicular-based Intersection Significant Impact Thresholds

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Intersection Level of Service- Pre-project Conditions	Change in V/C (Future w/Project less Future w/o Project)
A	0.060
B	0.050
C	0.040
D	0.030
E	0.020
F	0.010

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Street Segment Thresholds

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Traffic Growth on Street Segment	Required Traffic Mitigation Measures
0.0 - 2.4% Daily Traffic Growth	Staff review and conditions
2.5% - 4.9% Daily Traffic Growth	• Initial study required if existing count is greater than 2,000 VPD; • Soft mitigation required
5.0% - 7.4 % Daily Traffic Growth	• Initial study required; • Soft mitigation required; • Physical mitigation may be required
7.5% + Daily Traffic Growth	• Initial study required; • Soft mitigation required; • Extensive physical mitigation may be required; • Project alternatives may be considered

Evaluation of Approaches

Pasadena researched several approaches and evaluated them for their effectiveness with implementing city's Complete Street vision:

- Network-based Metrics
  - Vehicle Miles of Travel (VMT)
  - Travel Time
- Traveler Experience Metrics
  - S.F. Pedestrian Environment Quality Index (PEQI)
  - S.F. Bicycle Environment Quality Index (BEQI)
  - Multi-Modal Level of Service (MMLOS)

PEQI & BEQI- Traveler Experience Metrics

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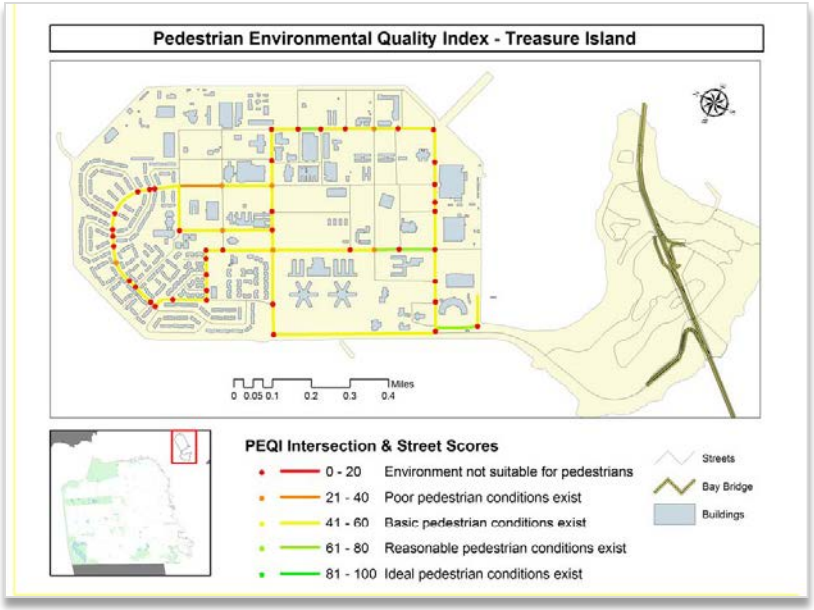

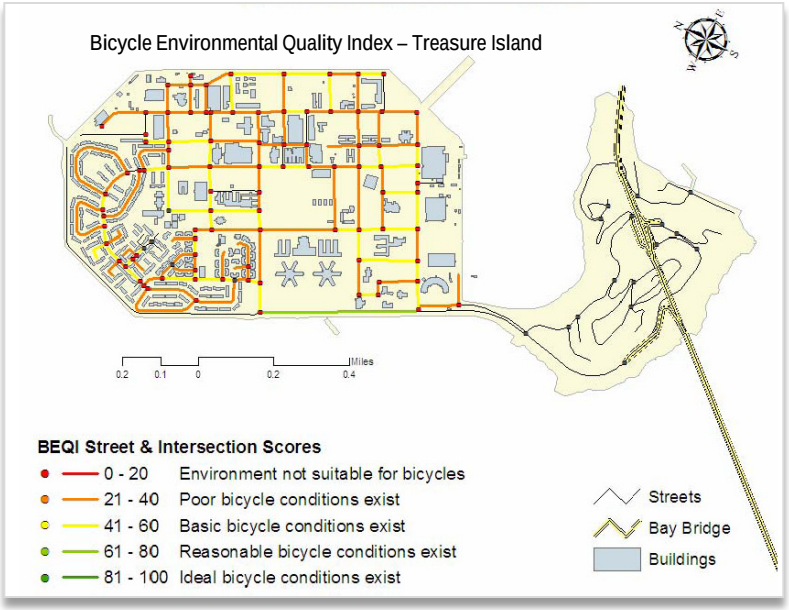

San Francisco's Healthy Development Measurement Tool (HDMT) includes transportation-related metrics

- Pedestrian Environmental Quality Index (PEQI)
- Bicycle Environmental Quality Index (BEQI)
- Evaluates design characteristics, volumes, and safety

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Multi Modal Level of Service (MMLOS) for Urban Streets

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- Multi Modal Level of Service for Urban Streets- National Cooperative Highway Research Program- Report No. 616

- MMLOS Model- The LOS rating for an urban street is the weighted average of the sum of the probabilities of people reporting each LOS rating multiplied by a system of weights that gives greater weight to the proportion of people who perceive poorer level of service.

- Model output is based on users experience

*trb.org/publications/**nchrp/nchrp**_rpt_**616**.pdf*

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MMLOS Modes Influential Factors

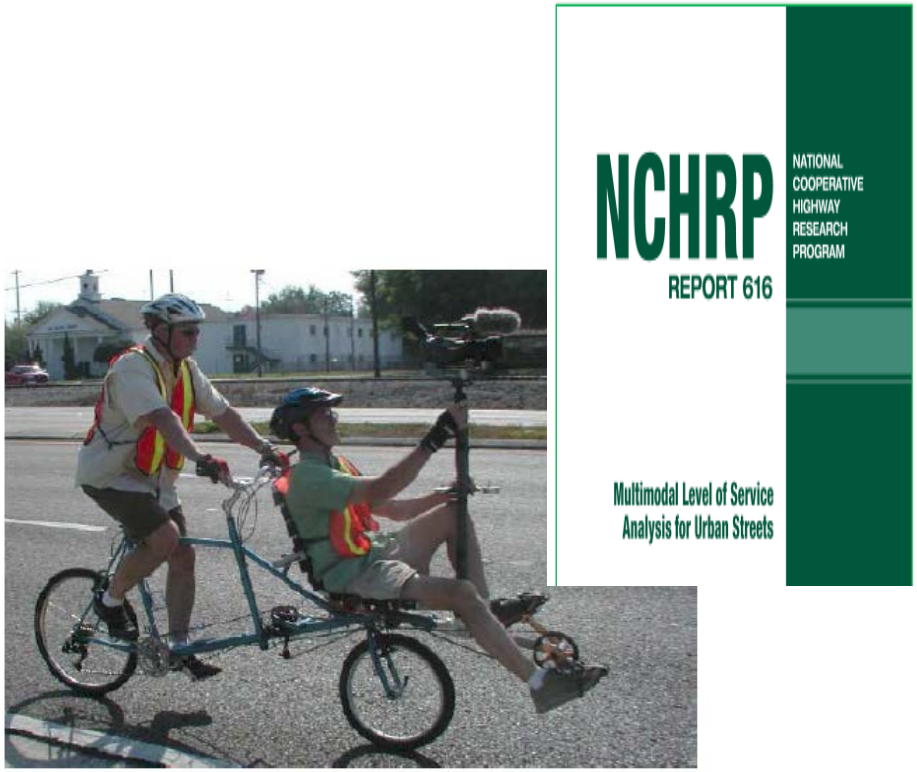
The MMLOS calculation for each mode is based on each mode's users perception of level of service and factors that influence their perception. Typical street sections were shown to people in four metro areas. The influential factors for each mode are as follows:

Motorists:

- Presence of Median
- Landscaping
- Signal Progression (number of stops)
- Posted Speed Limit

Pedestrian:

- Sidewalk Width
- Separation of Walkway from Traffic
- Traffic Speed
- Pedestrian Volumes
- Number of Traffic Lanes
- Traffic Signal Delay



MMLOS Modes Influential Factors- Cont.

Bicyclists:

- Width of Outside lane
- Presence and width of Bike Lane
- Speed Limit
- Intersection Crossing Width
- Intersection Type of Control

Transit Users:

- Frequency
- Speed
- Reliability, On Time Percentage (OTP)
- Bus Stop Amenities (Bench, Shelter)
- Pedestrians Access to Stops
- Load Factor (Passenger/seat)

MMLOS Level of Service Thresholds

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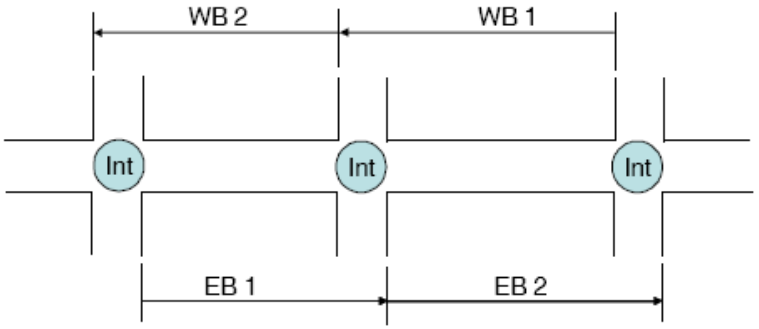
LOS model output presented below is used to translate complex numerical performance results into a simple letter grade system representative of the travelers' perception of the resulting quality of service provided by the facility. It is a quantitative stratification of quality of service into six levels of service.

LOS Letter Grade Numerical Equivalents

LOS Model Output	LOS Grade
<= 2.00	A
2.00 < Model <= 2.75	B
2.75 < Model <= 3.50	C
3.50 < Model <= 4.25	D
4.25 < Model <= 5.00	E
Model > 5.00	F



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MMLOS Model Interaction

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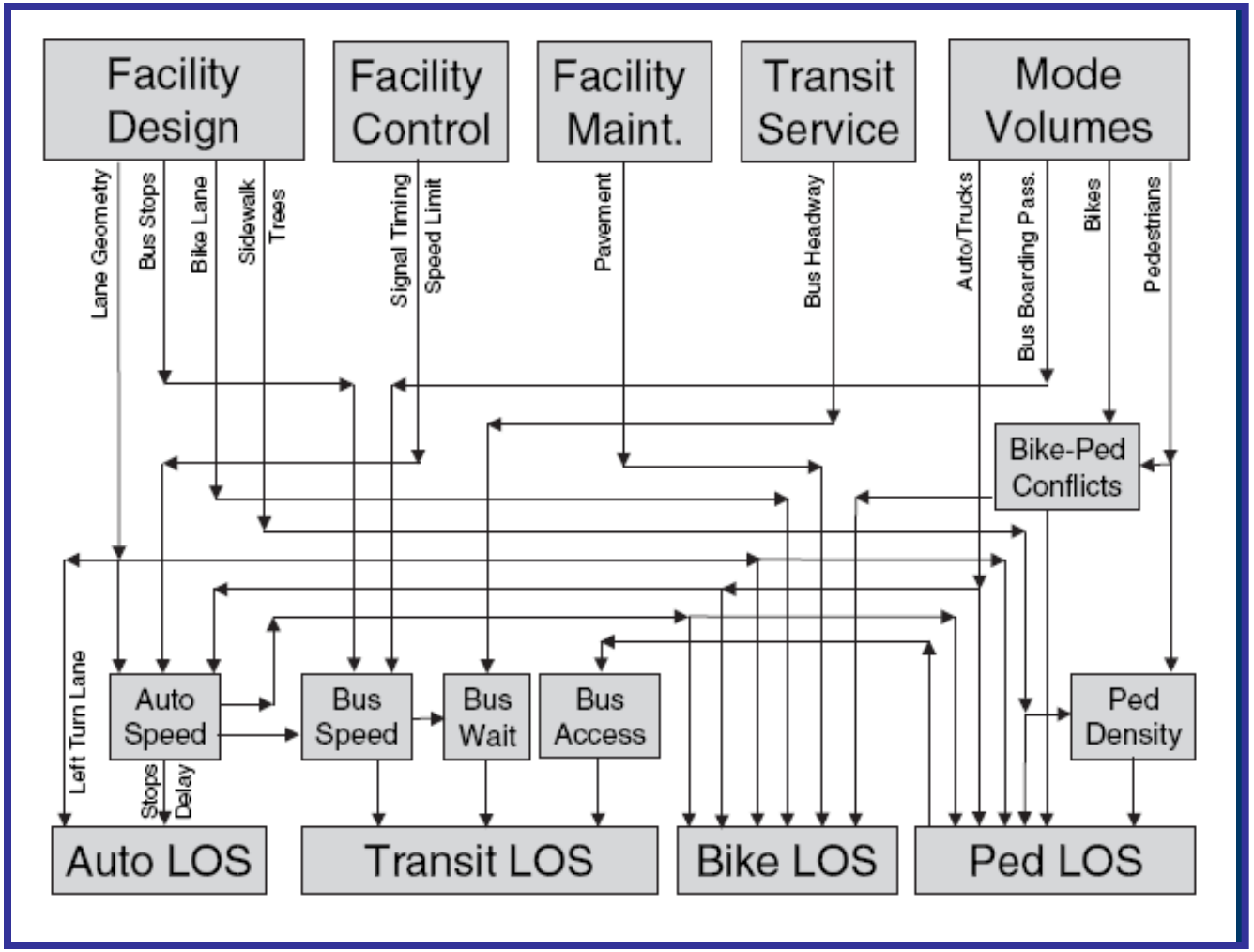

Interdependency of all modes is evident in the MMLOS model.

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Case Studies

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- PEQI
- MMLOS

PEQI Case Study

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- EIR for an Office Building Project was challenged based on inadequate Analysis of Project's Impact on Pedestrians
- Integrated PEQI score with the Evaluation Matrix for Alternative Pedestrian Schemes to comply with Court's Ruling

ALTERNATIVE PEDESTRIAN SCHEME NO.	ALTERNATIVE DESCRIPTION	EVALUATION CATEGORY/CRITERIA												
		ADA ACCESSIBILITY ISSUES [1]	POTENTIAL SIG. IMPACTS TO HISTORICAL LANDMARK [2]	PEQI SCORE FOR EAST/ WEST SIDES OF EL MOLINO [3]	POTENTIAL SIG. IMPACTS AT OFF-SITE INT. OPERATIONS [4]	OPINIONS OF PROBABLE COSTS [5]	REQUIRES RELOCATION OF EX. EL MOLINO VALET	REQUIRES REMOVAL OF ON-STREET PARKING	SIGNAL W/IN 300' OF EXISTING SIG. INTS [6]	PEDESTRIAN VOLUMES WARRANT HIGH COSTS	CONSISTENT W/ ADOPTED CITY PLANS/POLICIES/ GOALS [8]	EL MOLINO ADT WARRANTS FURTHER CONSIDERATION	POTENTIAL FOR PEDESTRIAN VIOLATIONS [9]	REJECTED (R) OR SELECTED FOR FURTHER CONSIDERATION (FC)
1	Uncontrolled Mid-block Crosswalk	Yes	No	79/95	No	L	Likely	No	No	-	Yes	-	No	R
1 - S	Signalized Mid-block Crosswalk	Yes	Yes	79/95	No	L - M	Likely	No	Yes	-	Yes	-	Yes	R
2	Uncontrolled Mid-block Crosswalk with Narrowing East and West Sides of El Molino Avenue	No	No	79/95	No	M - H	Yes	Yes	No	-	Yes	-	No	R
2 - S	Signalized Mid-block Crosswalk with Narrowing East and West Sides of El Molino Avenue	No	Yes	79/95	No	M - H	Yes	Yes	Yes	-	Yes	-	Yes	R
3	Uncontrolled Mid-block Crosswalk with Narrowing West Side Only of El Molino Avenue	No	No	79/95	No	M	Yes	Yes	No	-	Yes	-	No	FC
3 - S	Signalized Mid-block Crosswalk with Narrowing West Side Only of El Molino Avenue	No	Yes	79/95	No	M	Yes	Yes	Yes	-	Yes	-	Yes	R
4	Pedestrian Tunnel	Yes	Yes	79/95	No	H	Likely [7]	Likely [7]	No	No	Yes	No	No	R
5	Pedestrian Overpass/Bridge	Yes	Yes	79/95	No	H	Likely [7]	Likely [7]	No	No	Yes	No	No	R
6	Partial Northbound Lane Closure with Uncontrolled Mid-block Crossing	Yes	No	82/97	Yes - M	M	No	No	No	-	Yes	-	No	R
7	Partial Southbound Lane Closure with Uncontrolled Mid-block Crossing	No	No	82/97	Yes - L	M	Yes	Yes	No	-	Yes	-	No	FC
8 - F	Full Mid-block Closure of El Molino Avenue (Full-Time)	No	No	85/100	Yes - H	M - H	Yes	Yes	No	-	Yes	-	No	FC
8 - P	Full Mid-block Closure of El Molino Avenue (Part-Time)	Yes	No	85/100	Yes - M	M	Yes	Yes	No	-	Yes	-	No	R
9	Installation of Physical Barriers along the East Side of El Molino Avenue	No	No	74/89	No	L	No	No	No	-	Yes	-	Yes	FC

[1] ADA accessibility issues relate to the difficulties of the construction of ADA compliant wheelchair ramps due to existing curb heights/grades, the potential requirement for a sidewalk easement and reconstruction of the concrete Playhouse Plaza stairs, and the requirement for construction of vertical circulation components (e.g., stairs, elevators, etc.). See Appendix E for reference documents.

[2] Potential significant impacts to Pasadena Playhouse, a designated Historical Landmark, either with construction of vertical circulation features on both public and/or private right-of-way, aesthetic views of the Pasadena Playhouse, etc.

[3] The existing conditions Pedestrian Environmental Quality Index (PEQI) scores for the east and west sides of El Molino Avenue were calculated at 74 and 89, respectively. This matrix identifies the changes in score along El Molino Avenue with the various alternatives. Source: PEQI, City of San Francisco Department of Public Health. See Appendix F.

[4] Potential significant secondary impacts pursuant to formal intersection analyses contained in Appendix G of this study. A total of six intersections in the immediate vicinity were formally analyzed. H=3 or more locations, M= at least 2 more locations, and L = at least one more location.

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MMLOS Case Studies

With assistance from Kittelson & Associates (Formerly Dowling Associates, Inc.), two projects were selected for detailed analysis with the MMLOS approach and for a comparison of the results to the findings of the current approach.

Road Diet Project Vicinity Map

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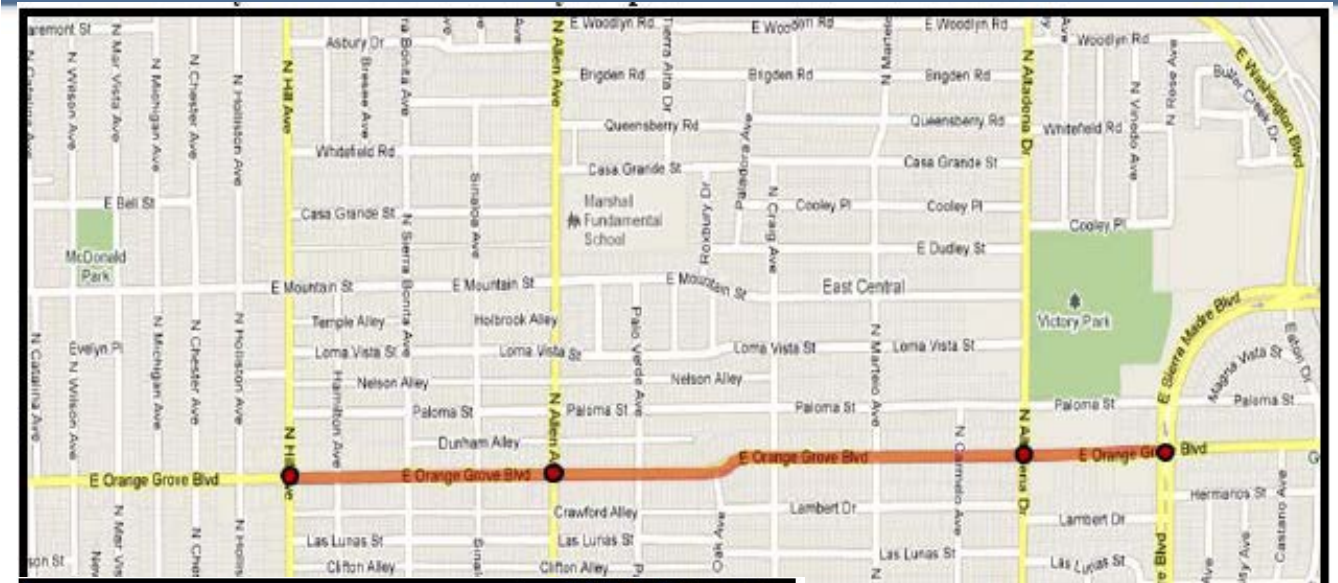

Source: Dowling Associates, Inc.

A proposed road diet project- removing two lanes of traffic and installing bike lanes in both directions

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Case Study-Road Diet Project

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MMLOS Results of the Road Diet Project during AM Peak Hours

Orange Grove Boulevard - Combined AM						
	Segment	Mode	Existing Score (LOS)	Road Diet Score (LOS)	Difference	% Change
EB	Hill Ave to Allen Ave	Auto	2.34 (B)	2.39 (B)	0.05	2.1%
		Transit	4.46 (E)	4.47 (E)	0.01	0.2%
		Bicycle	3.44 (C)	2.73 (B)	-0.71	-20.6%
		Pedestrian	2.45 (B)	2.55 (B)	0.10	4.1%
	Allen Ave to Altadena Dr	Auto	2.25 (B)	2.26 (B)	0.01	0.4%
		Transit	2.60 (B)	2.57 (B)	-0.03	-1.2%
		Bicycle	3.40 (C)	2.70 (B)	-0.70	-20.6%
		Pedestrian	2.43 (B)	2.26 (B)	-0.17	-7.0%
	Altadena Dr to Sierra Madre Blvd	Auto	2.52 (B)	2.60 (B)	0.08	3.2%
		Transit	2.61 (B)	2.59 (B)	-0.02	-0.8%
		Bicycle	3.23 (C)	2.65 (B)	-0.58	-18.0%
		Pedestrian	2.52 (B)	2.39 (B)	-0.13	-5.2%
WB	Sierra Madre Blvd to Altadena Dr	Auto	2.50 (B)	2.56 (B)	0.06	2.4%
		Transit	1.87 (A)	1.85 (A)	-0.02	-1.1%
		Bicycle	2.92 (C)	2.47 (B)	-0.45	-15.4%
		Pedestrian	2.50 (B)	2.37 (B)	-0.13	-5.2%
	Altadena Dr to Allen Ave	Auto	2.25 (B)	2.27 (B)	0.02	0.9%
		Transit	2.60 (B)	2.57 (B)	-0.03	-1.2%
		Bicycle	3.38 (C)	2.67 (B)	-0.71	-21.0%
		Pedestrian	2.44 (B)	2.28 (B)	-0.16	-6.6%
	Allen Ave to Hill Ave	Auto	2.34 (B)	2.51 (B)	0.17	7.3%
		Transit	4.45 (E)	4.47 (E)	0.02	0.4%
		Bicycle	3.39 (C)	2.72 (B)	-0.67	-19.8%
		Pedestrian	2.41 (B)	2.52 (B)	0.11	4.6%

Source: Dowling Associates, Inc.

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Case Studies Findings

- Proposed Orange Grove Road Diet Project between Hill Avenue and Sierra Madre Boulevard
  - Findings showed that road diet project would improve bicycle LOS with minimal impact on other modes LOS

Mixed-use Project Vicinity Map

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A mixed-use project consisting of 125,000 sq ft of Retail/Office with a 156-room Hotel

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Case Study- Mixed Use Project

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Summary of Facility Scores by Mode and Overall Score for Lake Avenue

Direction	Mode	AM Peak			PM Peak		
		Existing	2015	2015 + Project	Existing	2015	2015 + Project
Northbound	Auto	2.75 (B)	2.76 (C)	2.76 (C)	2.78 (C)	2.80 (C)	2.80 (C)
	Transit	1.48 (A)	1.51 (A)	1.52 (A)	1.54 (A)	1.60 (A)	1.62 (A)
	Pedestrian	2.84 (C)	2.89 (C)	2.90 (C)	2.92 (C)	2.98 (C)	3.00 (C)
	Bicycle	4.06 (D)	4.10 (D)	4.11 (D)	4.10 (D)	4.15 (D)	4.16 (D)
	Overall	2.78 (C)	2.82 (C)	2.82 (C)	2.84 (C)	2.88 (C)	2.90 (C)
Southbound	Auto	2.78 (C)	2.81 (C)	2.81 (C)	2.81 (C)	2.85 (C)	2.86 (C)
	Transit	1.27 (A)	1.33 (A)	1.33 (A)	1.62 (A)	1.70 (A)	1.70 (A)
	Pedestrian	2.92 (C)	2.99 (C)	2.99 (C)	2.96 (C)	3.03 (C)	3.04 (C)
	Bicycle	3.97 (D)	4.03 (D)	4.03 (D)	4.01 (D)	4.09 (D)	4.10 (D)
	Overall	2.74 (B)	2.79 (C)	2.79 (C)	2.85 (C)	2.92 (C)	2.93 (C)

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Case Studies Findings

- Mixed-use Project at Colorado Boulevard and Lake Avenue
  - Compared MMLOS analysis with recent EIR traffic analysis
  - MMOLS approach reasonably predicted the Modes' perception of the conditions.
  - Findings accurately revealed the need to improve LOS for bicycles on Lake Avenue

Significant Impact Thresholds & Mitigation Measures

MMLOS Significant Impact Thresholds

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Applying Traditional Vehicular-based Significant Impact Percentages to Establish MMLOS Significant Impact Thresholds (Overall Facility Score)

MMLOS LOS Modal Output	MMLOS Mode LOS	MMLOS Future Pre-Project Model LOS	MMLOS Proposed significant Impact Δ Existing vs. W/Project LOS	Vehicular-based Future pre-Project LOS	Significant Impact Thresholds Δ Vehicular-based Existing vs. W/Project
Model ≤2.0	A	A	0.30	A (>=0.60)	0.06
2.0<Model ≤2.75	B	B	0.25	B (>0.60-0.70)	0.05
2.75< Model ≤3.50	C	C	0.20	C (>0.70-0.80)	0.04
3.50< Model≤4.25	D	D	0.15	D (>0.80-0.90)	0.03
4.25< Model ≤5	E	E	0.10	E (>0.90-1.0)	0.02
Model >5	F	F	0.05	F (>1.0)	0.01

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MMLOS Thresholds

- Applying traditional vehicular-based thresholds of significant impacts to MMLOS Model output reveals that MMLOS model is not sensitive to minor changes
- Alternate significant impact thresholds must be considered. A few alternatives are:
  1. Worsening of Mode's LOS by one letter
  2. Only LOS C or better is acceptable
  3. 2% & 1% incremental change for LOS A, B,C, and LOS D,E,F, Respectively

Case Study- Mixed Use Project- continued

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LOS for the Worst Approach to Each Intersection on Lake Avenue during the PM Peak

Lake Avenue -			Worst Direction PM Intersection LOS					
Segment	Mode	Approach	Existing	2015	2015 + Proj	Difference	% Change	Sig. Impact
Lake Ave. & Cordova St.	Auto	Intx.	0.658 (B)	0.737 (C)	0.752 (C)	0.015	2.0%	
	Transit	SB	1.78 (A)	1.83 (A)	1.83 (A)	0.00	0.0%	No
	Pedestrian	SB	2.64 (B)	2.69 (B)	2.69 (B)	0.00	0.0%	No
	Bicycle	SB	2.36 (B)	2.52 (B)	2.51 (B)	-0.01	-0.4%	No
Lake Ave. & Green St.	Auto	Intx.	0.574 (A)	0.652 (B)	0.663 (B)	0.011	1.7%	
	Transit	SB	2.13 (B)	2.24 (B)	2.25 (B)	0.01	0.4%	No
	Pedestrian	SB	2.59 (B)	2.63 (B)	2.63 (B)	0.00	0.0%	No
	Bicycle	NB	1.83 (A)	1.97 (A)	1.99 (A)	0.02	1.0%	No
Lake Ave & Colorado Blvd.	Auto	Intx.	0.817 (D)	0.848 (D)	0.877 (D)	0.029	3.4%	
	Transit	NB	1.71 (A)	1.74 (A)	1.75 (A)	0.01	0.6%	No
	Pedestrian	SB	2.75 (B)	2.82 (C)	2.83 (C)	0.01	0.4%	No
	Bicycle	SB	4.13 (D)	4.36 (E)	4.41 (E)	0.05	1.1%	Yes
Lake Ave. & Union St.	Auto	Intx.	0.545 (A)	0.603 (B)	0.615 (B)	0.012	2.0%	
	Transit	NB	1.47 (A)	1.54 (A)	1.56 (A)	0.02	1.3%	No
	Pedestrian	NB	2.46 (B)	2.48 (B)	2.48 (B)	0.00	0.0%	No
	Bicycle	NB	3.27 (C)	3.40 (C)	3.44 (C)	0.04	1.2%	No
Lake Ave. & Walnut St.	Auto	Intx.	0.885 (D)	0.988 (E)	1.010 (F)	0.022	2.2%	
	Transit	NB	1.48 (A)	1.51 (A)	1.52 (A)	0.01	0.7%	No
	Pedestrian	NB	2.77 (C)	2.83 (C)	2.84 (C)	0.01	0.4%	No
	Bicycle	NB	3.73 (D)	3.85 (D)	3.90 (D)	0.05	1.3%	Yes

Alternative 1- Worsening of LOS by one letter:

- **No Impact- Future vs. Future w/Projects**

Alternative 2- LOS C or better

- **Impact, but….**

Alternative 3- incremental change in LOS

- **Impact**

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MMLOS Mitigation Measures

- Street Classifications System can be used as a tool to balance MMLOS mitigation measures tradeoffs.
- Ability to use CEQA substitute mitigation measure provision to improve the mode identified as the priority mode in the Street Classification System, if not the same as impacted mode.
- Use of MMLOS Modes Consolidated Score or individual Segment Modes' Score to mitigate impacts to the level of insignificance

Current vs. Proposed Guidelines

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Integrate Traveler Experience Metrics (i.e. MMLOS) into current Guidelines

	Intersection		Street Segment			
	Auto	Pedestrian	Auto	Pedestrian	Bicycle	Transit
Current Guidelines	X	None	X	None	None	None
Proposed Complete Streets Guidelines	X	X	X	X	X	X

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Planned Methodology

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	Current Methodology	Proposed Methodology	Significant Impact Thresholds
Auto Intersection LOS	Intersection Capacity Utilization (ICU)	ICU	No Change
Pedestrian Intersection LOS	None	Multi-Modal Level of Service (MMLOS)	TBD
Auto Segment LOS	Ratio of Project + Existing Auto Volumes over Existing Auto Volumes	MMLOS	TBD
Pedestrian Segment LOS	None	MMLOS, PEQI	TBD
Bicycle Segment LOS	None	MMLOS, BEQI	TBD
Transit Segment LOS	None	MMLOS	TBD

Parting Thoughts

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- People do not fully understand the value of multimodal transportation systems that expand transportation choices and how those choices support other community goals
  - Metrics need to contribute to this understanding, not impede it
  - "*What gets measured gets managed*" - Peter Drucker
- A few memorable quotes from UCLA Complete Streets Seminar
  - Everyone is a Pedestrian
  - Change is not made by consensus.
  - Implement 15 mph signal progression speed to accommodate bicyclists

Next steps

- Take Street Classification System to the City Council for adoption
- Take CEQA Thresholds to the City Council for adoption
- Incorporate the adopted measures into General Plan EIR and Transportation Review Guidelines.

Questions

Department of Transportation

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