Moving Towards Complete Streets:

Multimodal LOS and Its Applications

Caltrans Headquarters

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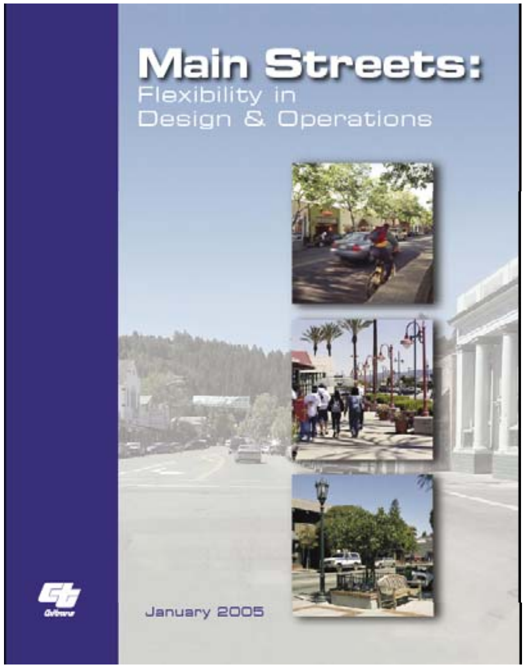
Overview

- **Background**
- **Development of the HCM methodology**
  - Pedestrian LOS model
  - Bicyclist LOS model
  - Transit Passenger LOS model
- **General and Specific Plan Case Studies**
- **Road Diet Case Study**
- **Putting MMLOS to Work**
- **Q&A**

Caltrans Directives

- **Deputy Policy 22, "Context Sensitive Solutions" (2001)**
- **Deputy Directive 64-R1, "Complete Streets - Integrating the Transportation System" (2008)**
  - **DP-05 Multimodal Alternatives**
  - **DP-06 Caltrans Partnerships**
  - **DP-23-R1 Energy Efficiency, Conservation, and Climate Change**



Why Complete Streets Matters to Caltrans

- **Safety and risk management**
- **Environment, economy, and equity (AB-857, 2002)**
- **GHG reduction targets (AB-32, 2006)**
- **Complete streets requirements for general plans (AB-1358, 2008)**
- **Manage capacity and expand travel options on State Highway System**
- **Support State policies for public health**
- **Caltrans Smart Mobility Framework**

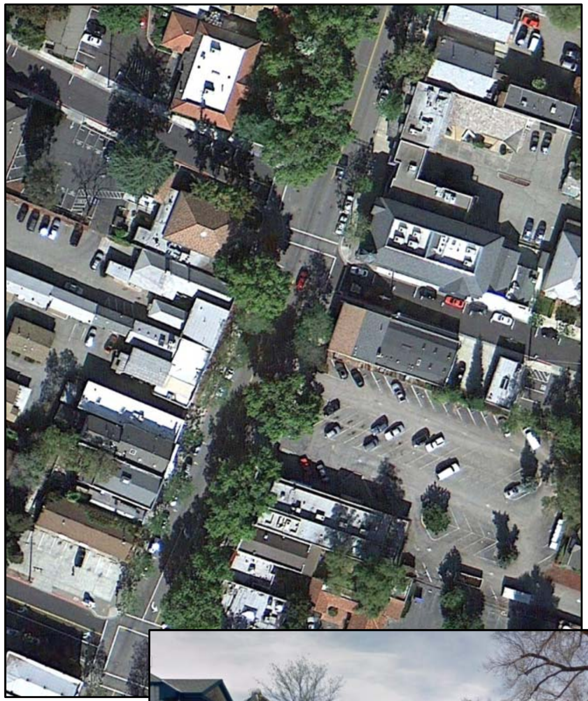
Why Multimodal Level of Service (MMLOS)

- **Vehicle LOS analysis methods**
  - Often used as the only measure of effectiveness for roadway operations
    - Promote only improvements for vehicles
    - Encourage sprawl
  - Don't reflect all operational or safety issues for roadways

Images Source: Google Earth Professional

Uses of MMLOS

- **MMLOS can:**
  - Quantify the operational tradeoffs among modes for a given streetscape design feature or strategy
  - Help prioritize transit, bicyclist, and pedestrian improvements
  - Assist and inform the public involvement process
  - Begin to document compliance with the California Complete Streets Act (AB-1358)



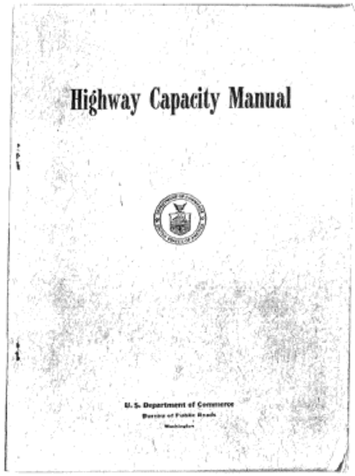
Images Source: Google Earth Professional

Sample Applications of MMLOS

- **Oakland**
  - Community-based transportation plan
- **Pasadena**
  - Traffic impact analysis and road diet
- **City of San Pablo**
  - General Plan and Specific Plan
- **City of Goleta**
  - Roadway redesign (Hollister Avenue)
- **SJCOG Regional CMP Update**
  - Designation of multimodal corridors and baseline analysis

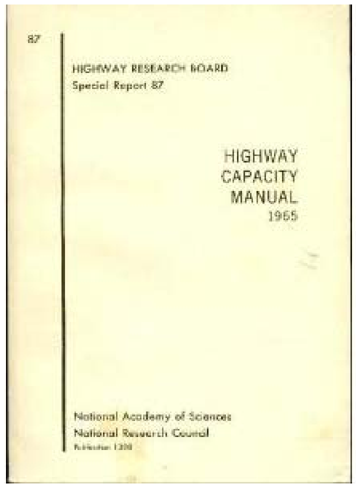
Brief History of Highway Capacity Manual (HCM) Multimodal Analysis

1950



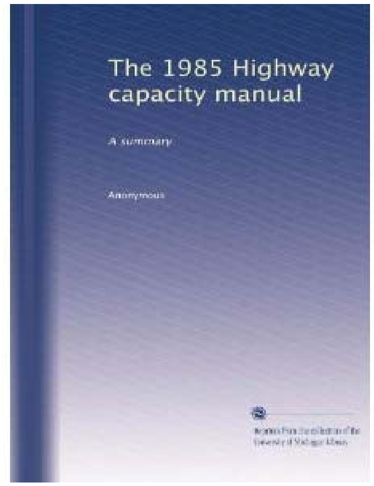
Transit and pedestrian impacts on motor vehicle capacity

1965



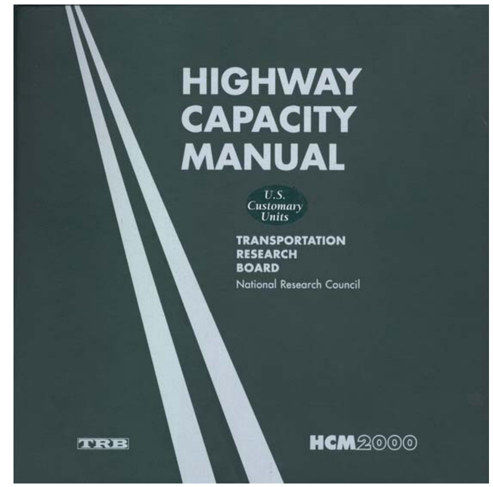
Level of Service concept and bus transit chapter

1985



Expanded bus transit chapter, new pedestrian chapter (density), and new bicycle chapter (vehicle hindrance)

2000

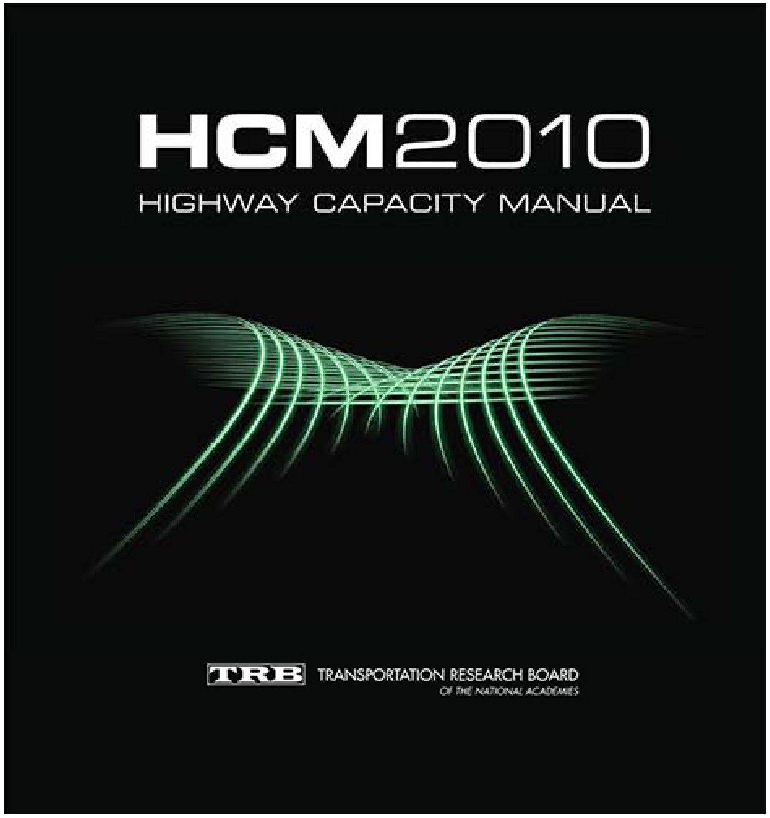


4 Transit LOS measures, expanded pedestrian and bicycle chapters

Brief History of Highway Capacity Manual (HCM) Multimodal Analysis

- **Issues with HCM 2000:**
  - Pedestrian and bicyclist LOS measures reflected a motorist perspective of density
  - Transit measures reflected a traveler's perspective, but the multiple LOS measures created issues with results interpretation

HCM 2010 Multimodal Philosophy



- **Integrate multimodal analysis methods into appropriate chapters**
  - Road user perspective
  - No separate bicyclist, pedestrian, or transit passenger chapters
    - Methodologies for all modes presented together and intertwined
  - Encourage software developers to add multimodal analysis features

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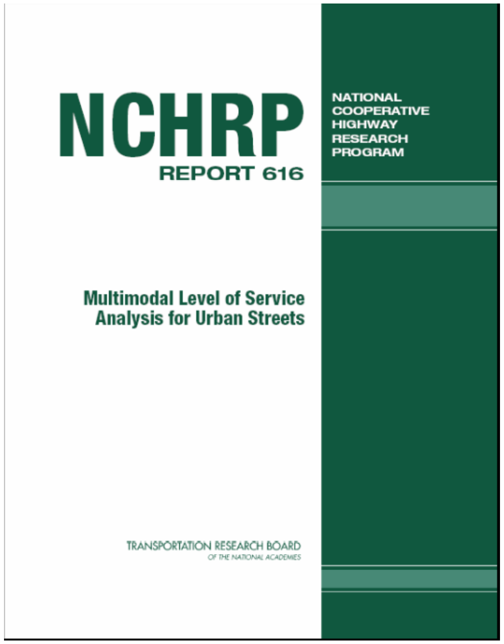
Methodology Selection

- **NCHRP Report 616 method used in HCM 2010**
  - Designed specifically for the HCM
  - LOS measures based on traveler perceptions
  - Modal LOS scores can be directly compared to each other and reflect average traveler satisfaction by mode
  - Model developed and tested based on national conditions



Methodology Development

- **Walking, biking, driving modes:**
  - 90 typical street segments recorded
  - Video labs in four cities around the U.S.
  - 120 Participants rated conditions on a 1–6 scale,

Methodology Development

- **Transit mode:**
  - Video lab not a feasible
  - On-board surveys conducted in 4 cities
    - However, results showed too wide a range to fit a model to
  - Final model was based on national traveler response data to changes in transit service quality
    - For example, when service frequency or travel time is improved, ridership increases

Methodology Characteristics

- **All models generate an perception score that is generally in the range of 1–6**
- **All models have multiple service quality factors as inputs**
  - Traditional HCM service measures are based on a single factor (e.g., delay)
- **LOS thresholds are the same across models**

LOS Score Interpretation

LOS	LOS Score
A	≤2.00
B	>2.00–2.75
C	>2.75–3.50
D	>3.50–4.25
E	>4.25–5.00
F	>5.00

- **Motorist LOS is based on *travel speed as a percentage of base free-flow speed* instead of on the auto perception score**

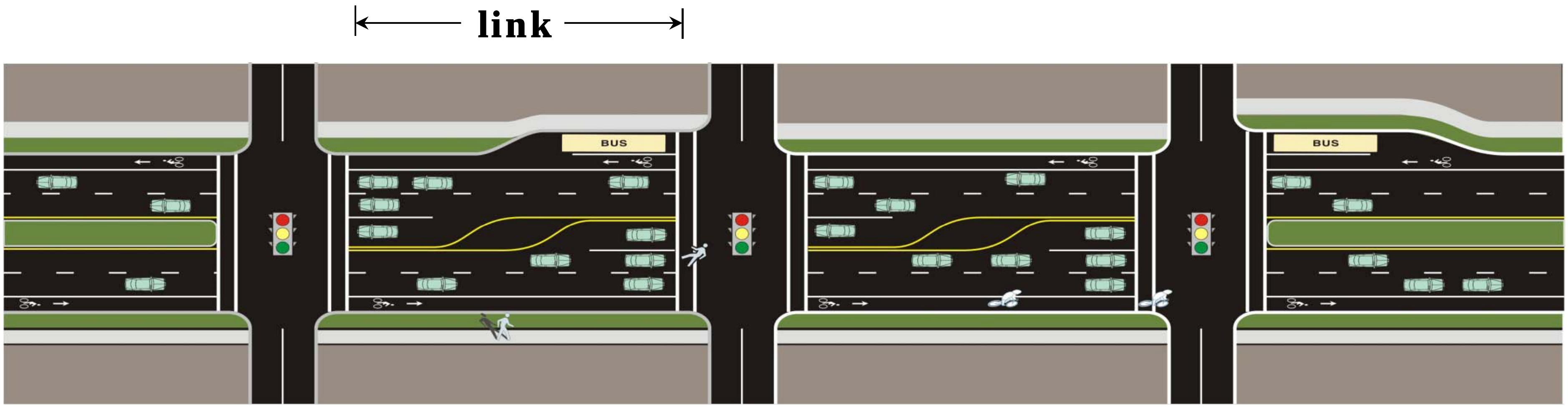
LOS Score Interpretation

- **LOS is reported individually by mode and direction**
- **No combined LOS for the street**
  - Vehicle volumes would typically dominate an LOS weighted by number of travelers
  - Combined LOS would potentially mask important deficiencies for a given mode
- **Measures the degree to which urban streets meet the need of all users**

Treatment of Safety in Multimodal LOS

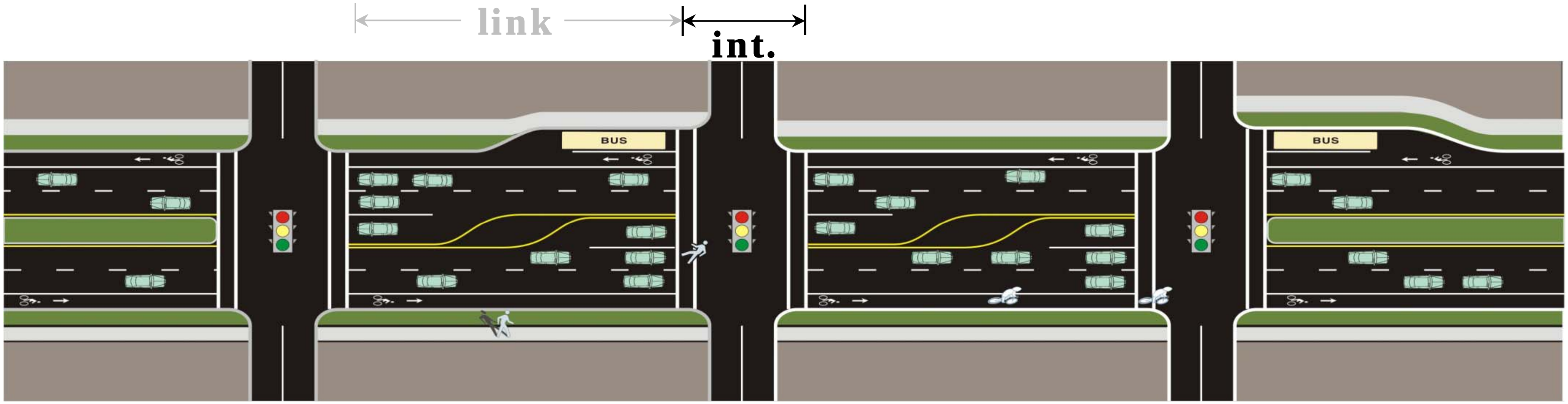
- **HCM 2010 does not explicitly include safety in LOS calculations.**
  - Crash history does not affect LOS
- **However, HCM 2010 does include safety implicitly.**
  - Traveler Perceived Safety
    - Speed of traffic, percent heavy vehicles, barriers between sidewalk and street, lateral separation between vehicle stream and bicyclists and pedestrians.

Urban Street System Elements: Link



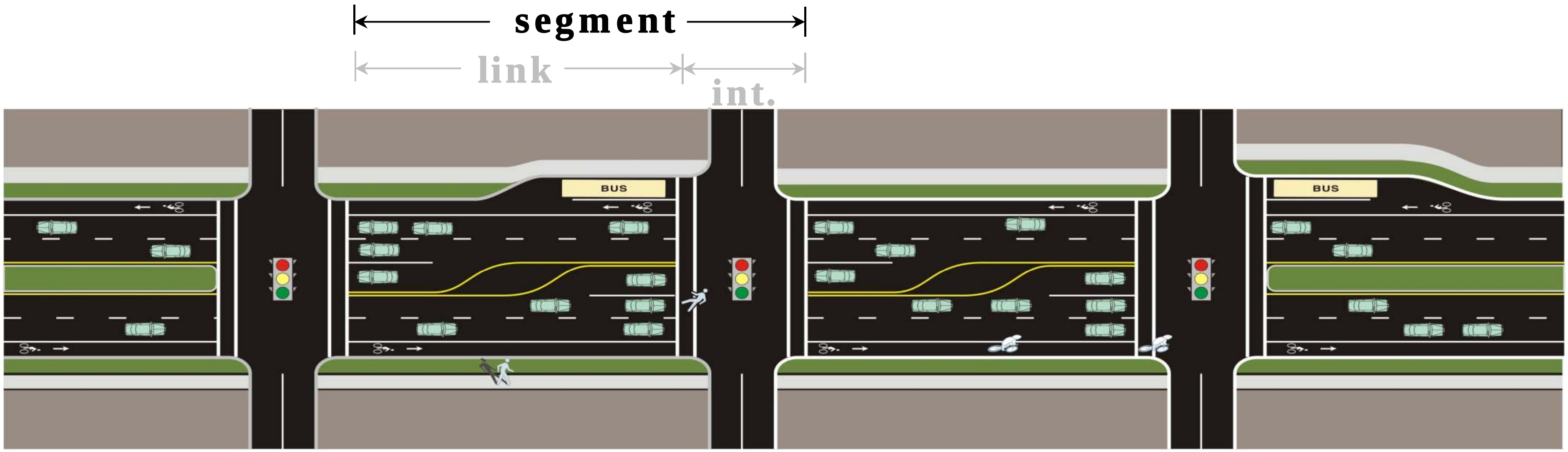
- **Distance between two signalized intersections**
  - Roundabout or all-way STOP could also be an end point
- **Perception score for bike, ped modes**

Urban Street System Elements: Intersection



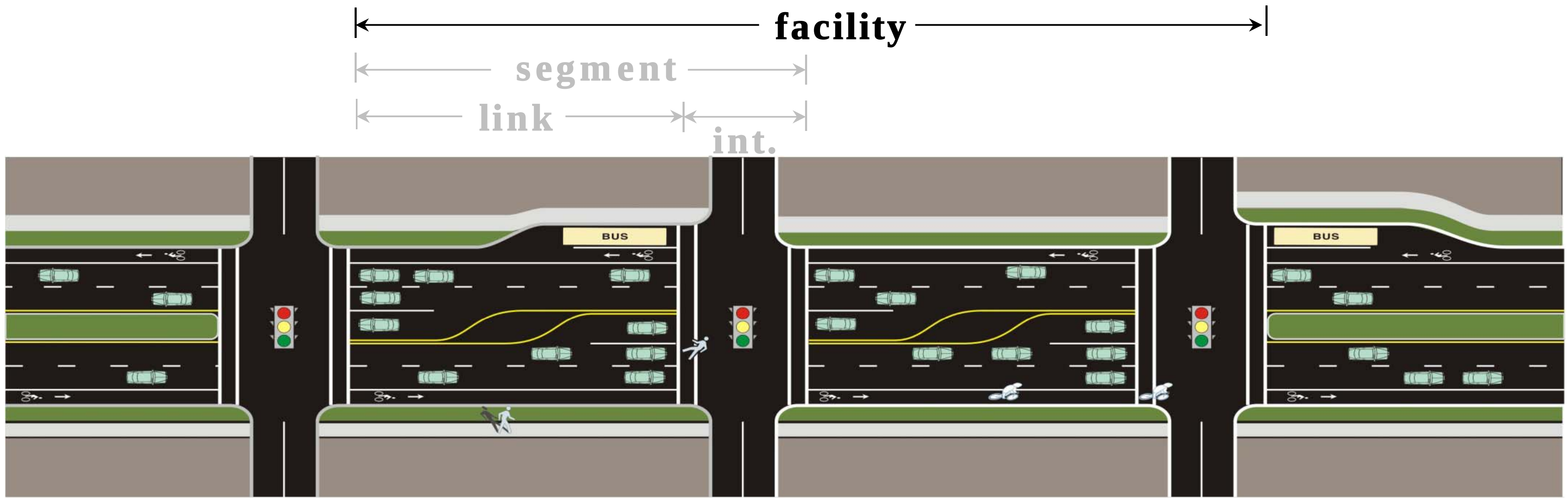
- Signalized intersection, roundabout, or all-way STOP that terminates a link
- Intersection scores only for ped/bike modes

Urban Street System Elements: Segment



- **Segment = link + downstream intersection**
- **Perception scores available for all modes**
  - Pedestrian & bicyclist scores based on combination of link, intersection, and additional factor

Urban Street System Elements: Facility



- **Facility = 2 or more consecutive segments**
- **Perception scores available for all modes**
  - Length-weighted average of the segment scores

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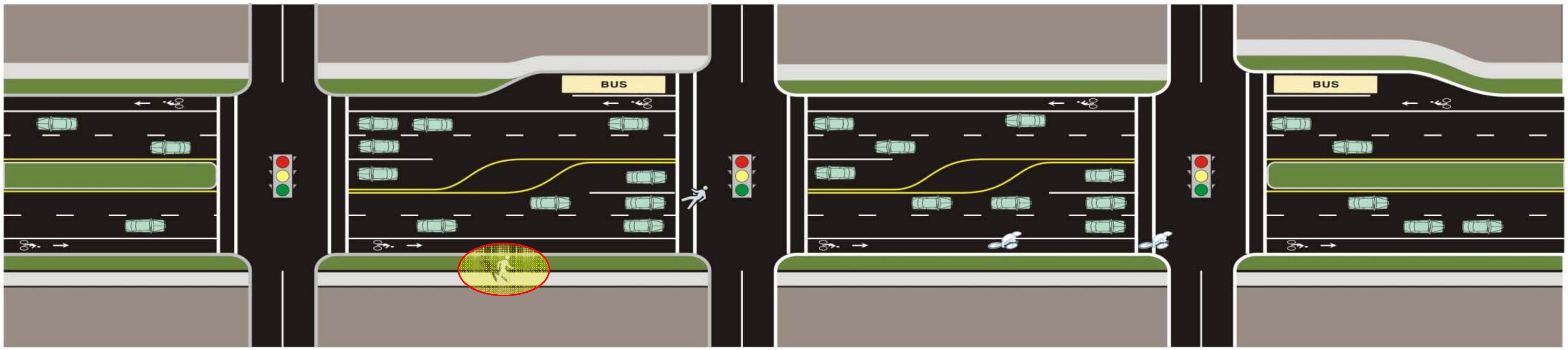
Pedestrian LOS: Links



Pedestrian LOS: Links Model Factors

- **Factors included:**
  - Outside travel lane width (+)
  - Bicycle lane/shoulder width (+)
  - Buffer presence (e.g., on-street parking, street trees) (+)
  - Sidewalk presence and width (+)
  - Volume and speed of motor vehicle traffic in outside travel lane (–)
- **Pedestrian density considered separately**
  - Worse of (density LOS, link LOS score) used in determining overall link LOS

Pedestrian LOS: Links
Model Form

$$I_{p,link} = 6.0468 + F_v + F_S + F_w$$

Ped Link LOS Score — **Constant** — **Vehicle Volume** — **Vehicle Speed** — **Cross-Section Factor**

Mid-segment demand flow rate (veh/h)

$$F_v = 0.0091 \frac{v_m}{4\ N_{th}}$$

Number of through lanes in direction of travel

$$F_s = 4\left(\frac{S_R}{100}\right)^2$$

Motorized vehicle running speed (mi/h) [from auto model]

Pedestrian LOS: Links Model Form

$$F_w = -1.2276 \ln(W_v + 0.5\,W_1 + 50\,p_{pk} + W_{buf}\,f_b + W_{aA}\,f_{sw})$$

Constant

W_v = effective total width of outside through lane, bike lane, and shoulder

W_1 = effective total width of bike lane and shoulder

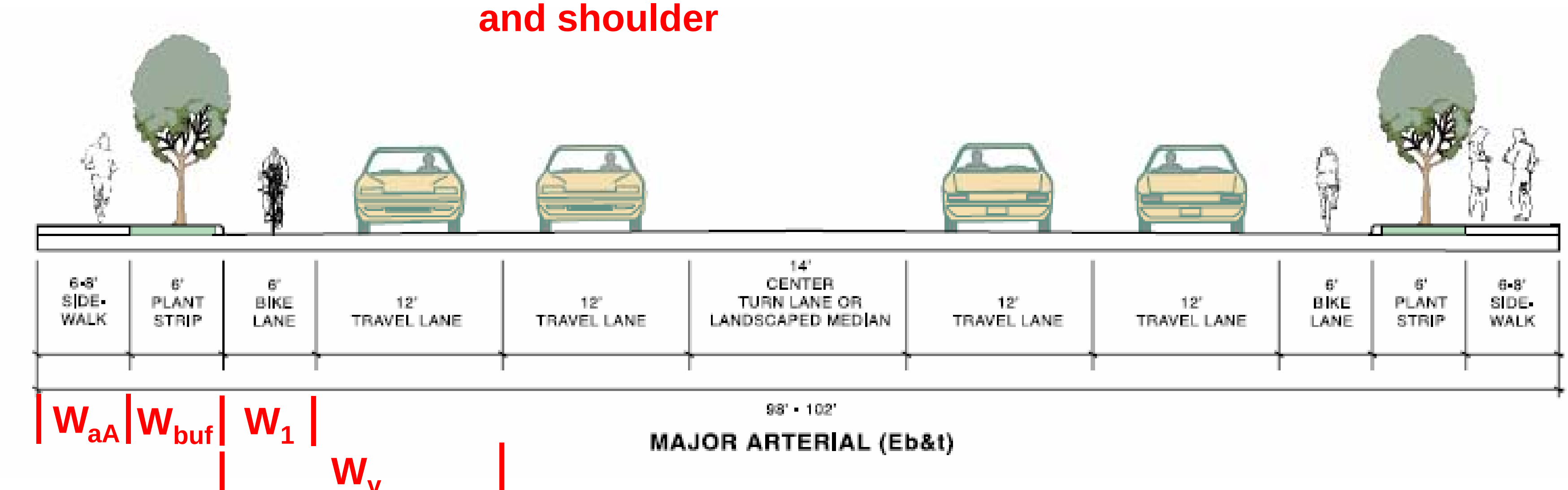
% occupied on-street parking

F_b = 1.00 (no barrier)

F_b = 5.37 (barrier)

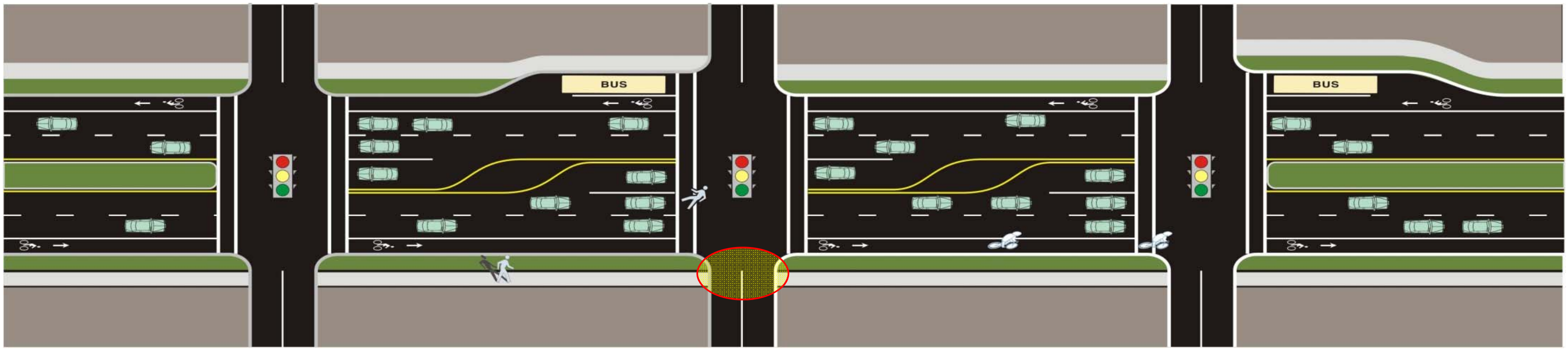
f_{sw} = 6.0 – 3W_{aA}

W_{aA} = min(W_A,10 ft)



HCM 2010 Overview & Multimodal Level of Service

Pedestrian LOS: Signalized Intersections



Pedestrian LOS: Signalized Intersections Model Factors

- **Factors included:**
  - Permitted left turn and right-turn-on-red volumes (–)
  - Cross-street motor vehicle volumes and speeds (–)
  - Crossing length (–)
  - Average pedestrian delay (–)
  - Right-turn channelizing island presence (+)

Pedestrian LOS: Signalized Intersections Model Form

$$I_{p,int} = 0.5997 + F_w + F_S + F_{delay} + F_v$$

Ped Intersection LOS Score — **Constant** — **Cross-Section Factor** — **Speed Factor** — **Pedestrian Delay Factor [from auto model]** — **Volume Factor**

$$F_w = 0.681\,(N_d)^{0.514}$$

Number of traffic lanes crossed

$$F_S = 0.00013\; n_{15,mi}\; S_{85,mi}$$

Minor street traffic volume (veh/ln/15 min) — **Minor street midblock auto speed (mi/h)**

Pedestrian LOS: Signalized Intersections Model Form

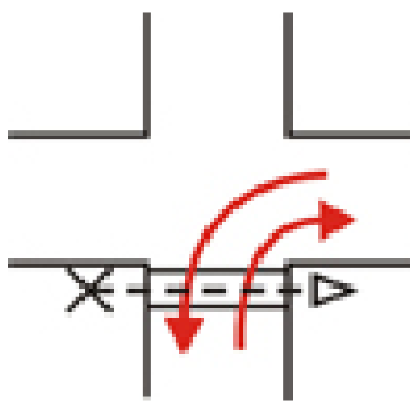
$$F_v = 0.00569\left(\frac{v_{rtor} + v_{lt,perm}}{4}\right) - N_{rtci,d}\left(0.0027\ n_{15,mj} - 0.1946\right)$$

Constant

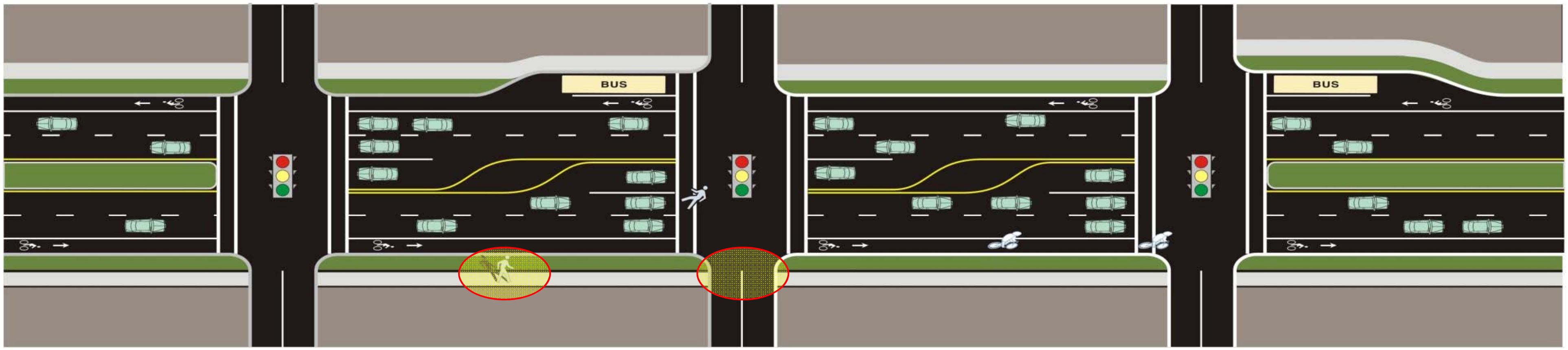
Conflicting traffic flow over crosswalk (veh/h)

Number of right-turn channelizing islands along crossing

Traffic volume of street being crossed (veh/ln/15 min)



Pedestrian LOS: Segments



Pedestrian LOS: Segments Model Factors

- **Factors included:**
  - Pedestrian link LOS (+)
  - Pedestrian intersection LOS (+)
  - Street-crossing difficulty (–/+)
    - Delay diverting to signalized crossing
    - Delay crossing street at legal unsignalized location

Pedestrian LOS: Segments Model Form

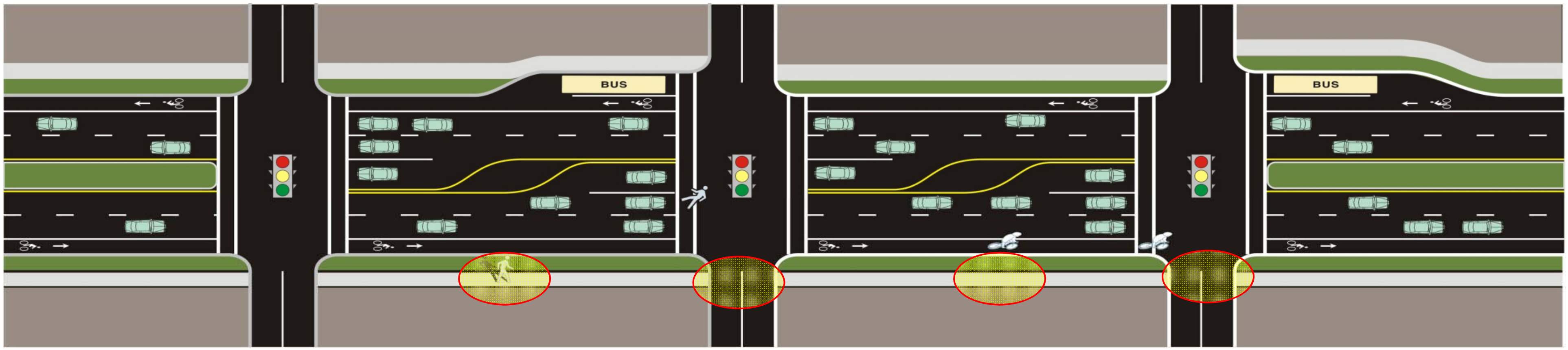
$$I_{p,seg} = F_{cd}\left(0.318\ I_{p,link} + 0.220\ I_{p,int} + 1.606\right)$$

Ped Segment LOS Score — **Ped Link LOS Score** — **Ped Intersection LOS Score** — **Constant**

Minimum of diversion time & unsignalized crossing delay time

$$F_{cd} = 1.0 + \frac{0.10\ d_{px} - (0.318\ I_{p,link} + 0.220\ I_{p,int} + 1.606)}{7.5}$$

Pedestrian LOS: Facility



- **Length-weighted average of segment LOS scores**
  - **Can mask deficiencies in individual segments**
  - **Consider also reporting segment LOS score for the worst segment in the facility**

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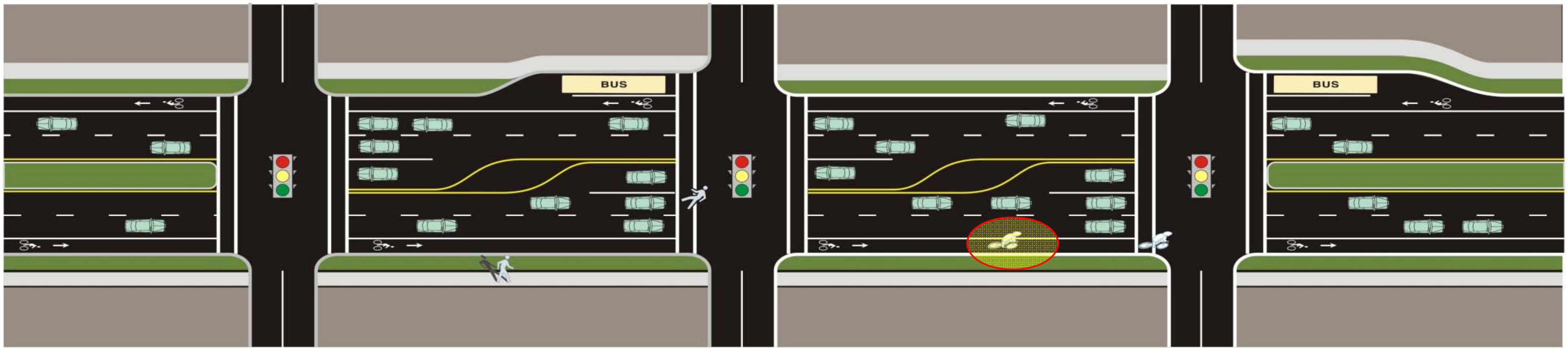
Bicyclist LOS: Links



Bicycle LOS: Links Model Factors

- **Factors included:**
  - Volume and speed of traffic in outside travel lane (–)
  - Heavy vehicle percentage (–)
  - Pavement condition (+)
  - Bicycle lane presence (+)
  - Bicycle lane, shoulder, and outside lane widths (+)
  - On-street parking utilization (–)

Bicyclist LOS: Links
Model Form

$$I_{b,link} = 0.760 + F_v + F_S + F_p + F_w$$

Bike Link LOS Score | **Constant** | **Volume Factor** | **Speed Factor** | **Pavement Condition Factor** | **Cross-Section Factor**

$$F_p = \frac{7.066}{P_c^{\,2}}$$

Pavement condition rating (1–5)

Adjusted midblock vehicle flow rate (veh/h)

$$F_v = 0.507 \ln\left(\frac{v_{ma}}{4\,N_{th}}\right)$$

Number of through lanes in travel direction

$$F_S = 0.199\,\left[1.1199 \ln(S_{Ra} - 20) + 0.8103\right]\left(1 + 0.1038\ P_{HVa}\right)^2$$

Vehicle running speed (>= 21 mi/h)

Adjusted percent heavy vehicles

Bicyclist LOS: Links Model Form

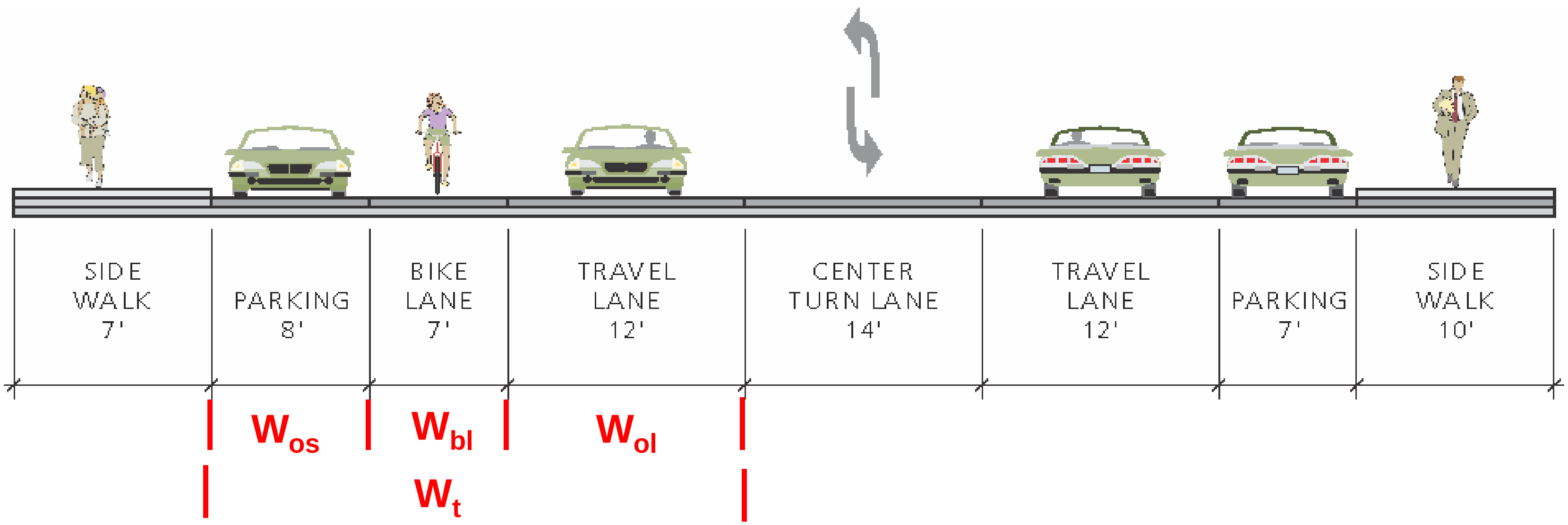
$$F_w = -0.005\, W_e^2$$

Effective width of outside through lane

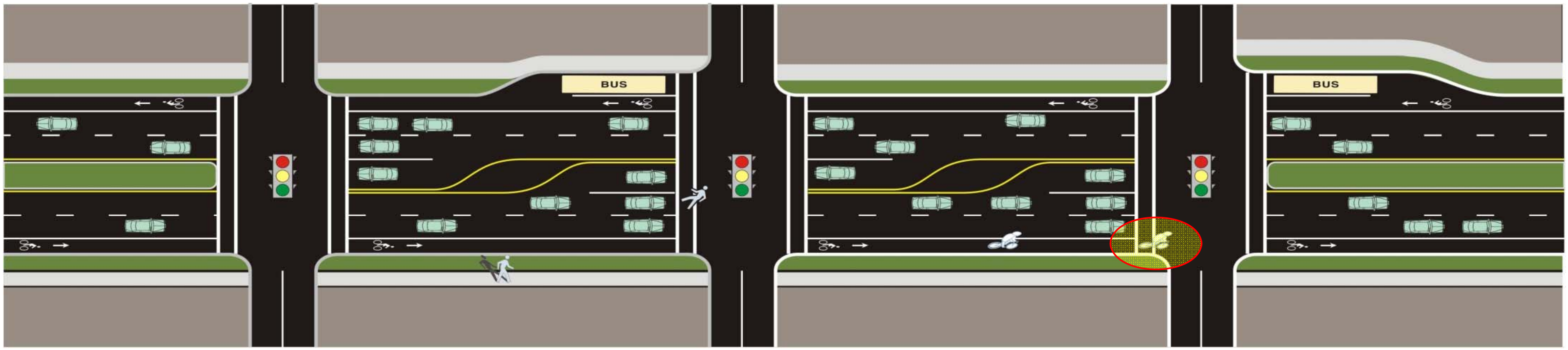
Condition	Variable When Condition Is Satisfied	Variable When Condition Is Not Satisfied
$p_{pk} = 0.0$	$W_t = W_{ol} + W_{bl} + W_{os}^*$	$W_t = W_{ol} + W_{bl}$
$v_m >$ 160 veh/h or street is divided	$W_v = W_t$	$W_v = W_t(2 - 0.005\, v_m)$
$W_{bl} + W_{os}^* < 4.0$ ft	$W_e = W_v - 10\, p_{pk} \geq 0.0$	$W_e = W_v + W_{bl} + W_{os}^* - 20\, p_{pk} \geq 0.0$

W_{os} = width of paved outside shoulder

W_{os}^* = adjusted width of paved outside shoulder (same as ped link LOS)



Bicyclist LOS: Signalized Intersections



Bicyclist LOS: Signalized Intersections Model Factors

- **Factors included:**
  - Width of outside through lane and bicycle lane (+)
  - Cross-street width (–)
  - Vehicle traffic volume in the outside lane (–)

Bicyclist LOS: Signalized Intersections Model Form

$$I_{b,int} = 4.1324 + F_w + F_v$$

Bike Intersection LOS Score — **Constant** — **Cross-Section Factor** — **Vehicle Volume Factor**

$$F_w = 0.0153\ W_{cd} - 0.2144\ W_t$$

Curb-to-curb cross-street width

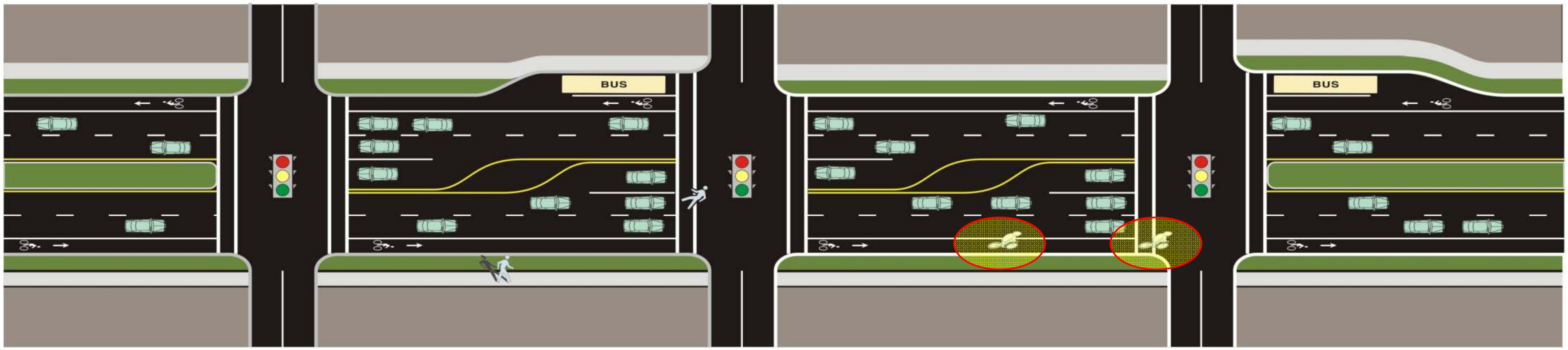
Total width of outside lane, bike lane, paved shoulder

Motorized traffic volume in travel direction

$$F_v = 0.0066 \frac{v_{lt} + v_{th} + v_{rt}}{4\ N_{th}}$$

Number of through lanes in travel direction

Bicyclist LOS: Segments



Bicyclist LOS: Segments Model Factors

- **Factors included:**
  - Bicyclist link LOS (+)
  - Bicyclist intersection LOS, if signalized (+)
  - Number of access points on right side (–)
    - Includes driveways and unsignalized street intersections
    - Judgment required on how low-volume residential driveways are treated

Bicyclist LOS: Segments Model Form

Number of access points on right side

$$I_{b,seg} = 0.160\ I_{b,link} + 0.011\ F_{bi}\ e^{I_{b,int}} + 0.035 \frac{N_{ap,s}}{(L/5280)} + 2.85$$

Bike Segment LOS Score

Bike Link LOS Score

Indicator Variable

Bike Intersection LOS Score

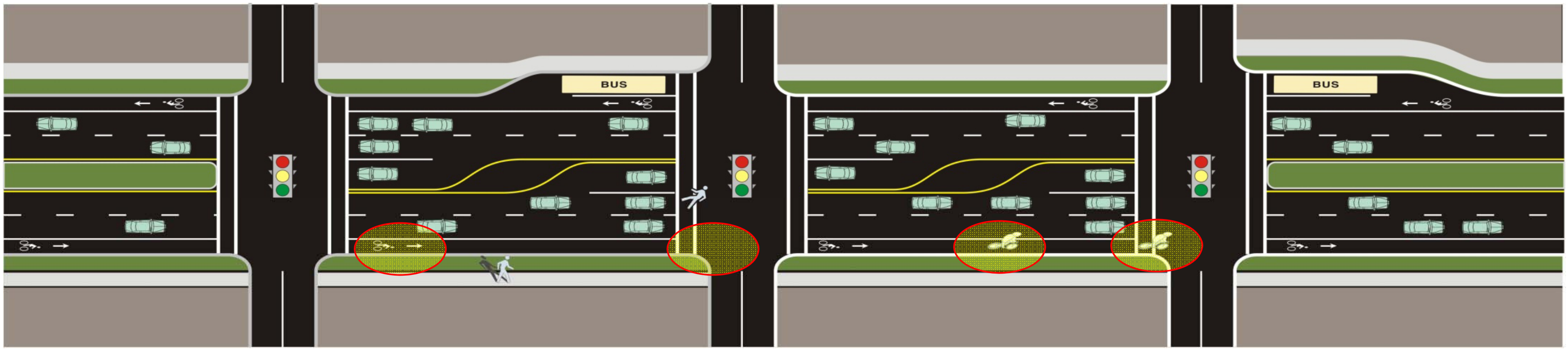
Segment length (mi)

Constant

F_{bi} = 1 if signalized

F_{bi} = 0 if unsignalized

Bicyclist LOS: Facility



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Transit Passenger LOS: Overview

- **Only segment and facility LOS models**
- **Transit facility LOS is a length-weighted average of segment LOS**
- **“Transit” includes buses, streetcars, and street-running light rail**
- **Three main model components:**
  - Access to transit (pedestrian link LOS)
  - Wait for transit (frequency)
  - Riding transit (perceived travel time rate)

Transit Passenger LOS: Segment Model Form

Perceived Travel Time

$$I_{t,seg} = 6.0 - 1.50\ F_h F_{tt} + 0.15\ I_{p,link}$$

Transit Segment LOS Score

Headway Factor

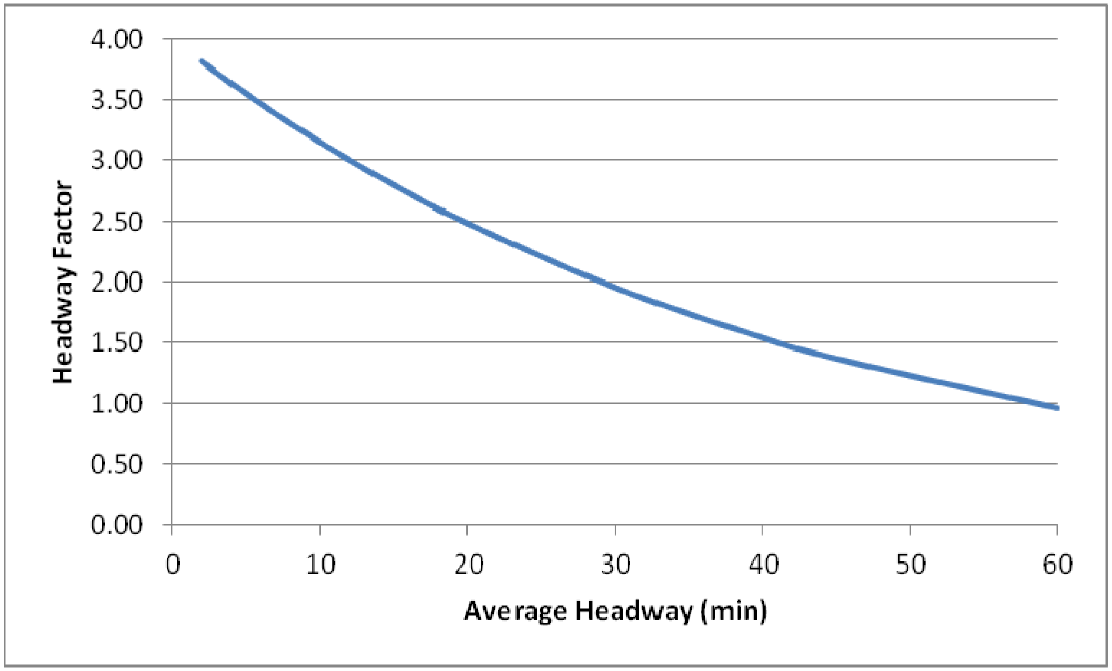
Ped Link LOS Score

Transit Passenger LOS: Headway Factor

$$F_h = 4.00\ e^{-1.434\ /(v_s + 0.001)}$$

Headway factor

Number of transit vehicles serving segment per hour



Transit Passenger LOS: Perceived Travel Time Components

- **Factors included:**
  - Actual bus travel speed (+)
  - Bus stop amenities (+)
  - Excess wait time due to late bus/train arrival (–)
  - On-board crowding (–)
- **Default value of time data and average passenger trip lengths used to convert actual times into perceived times**
  - For example, the trip seems to take longer when one has to stand

Transit Passenger LOS: Perceived Travel Time Factor

$$F_{tt} = \frac{(e-1)\,T_{btt} - (e+1)\,T_{ptt}}{(e-1)\,T_{ptt} - (e+1)\,T_{btt}}$$

e = ridership elasticity with respect to travel time changes, default value = -0.4

T_{btt} = base travel time rate (4.0 or 6.0 min/mi)

T_{ptt} = perceived travel time rate

Transit Passenger LOS: Perceived Travel Time Rate

$$T_{ptt} = \left(a_1 \frac{60}{S_{Tt,seg}} \right) + \left(2\, T_{ex} \right) - T_{at}$$

Perceived travel time rate (min/mi)

Crowding perception factor

Actual travel time rate

Perceived travel time rate due to late arrivals

Perceived travel time rate due to stop amenities

$$a_1 = \begin{cases} 1.00 & \text{Load factor (p/seat) <= 0.80} \\ 1 + \dfrac{(4)(F_l - 0.80)}{4.2} & \text{0.80< Load factor <= 1.00} \\ 1 + \dfrac{(4)(F_l - 0.80) + (F_l - 1.00)(6.5 + [(5)(F_l - 1.00)])}{4.2 \times F_l} & \text{Load factor > 1.00} \end{cases}$$

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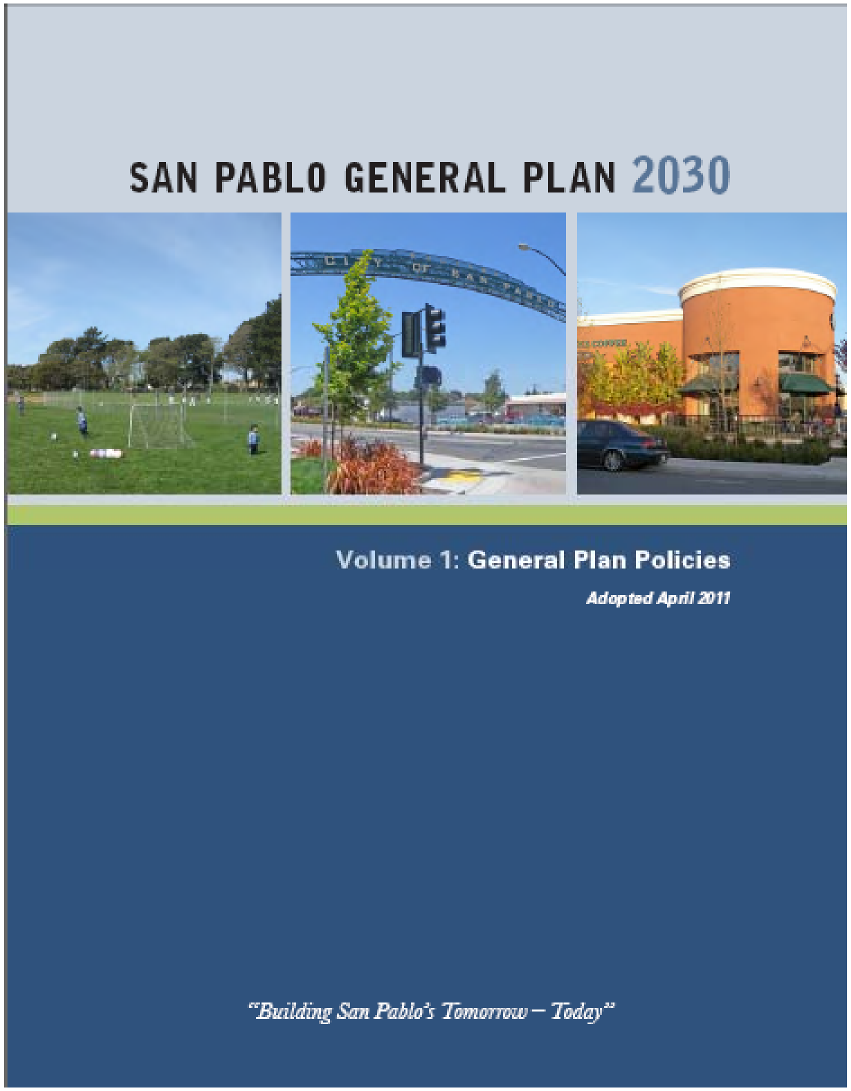
Case Study
General Plan

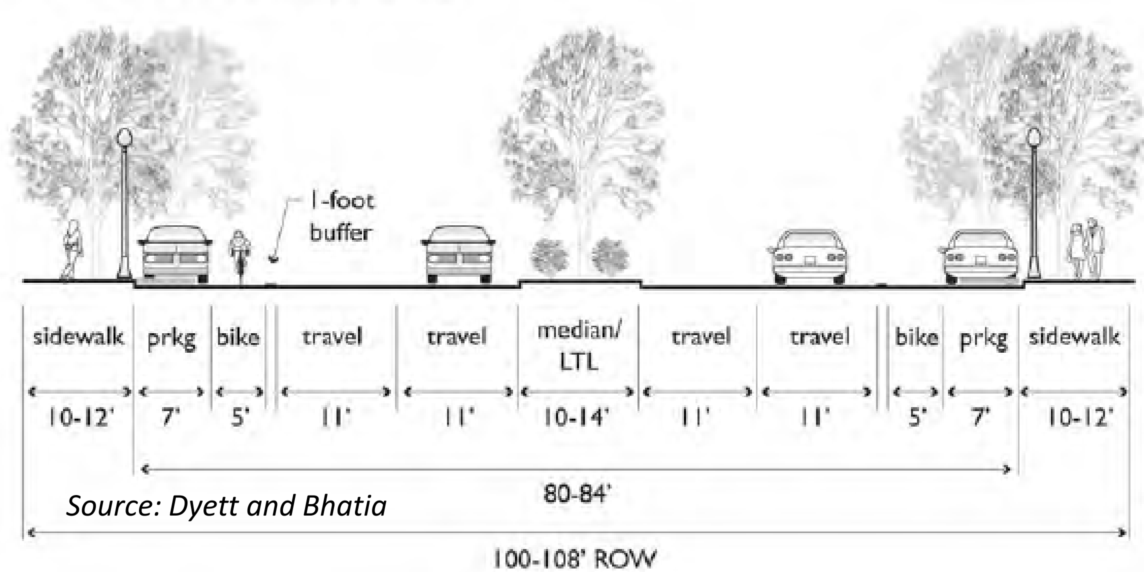
- **Adopted 2011**
- **Dyett and Bhatia – Prime consultant**
- **How to incorporate MMLOS**



Case Study
General Plan

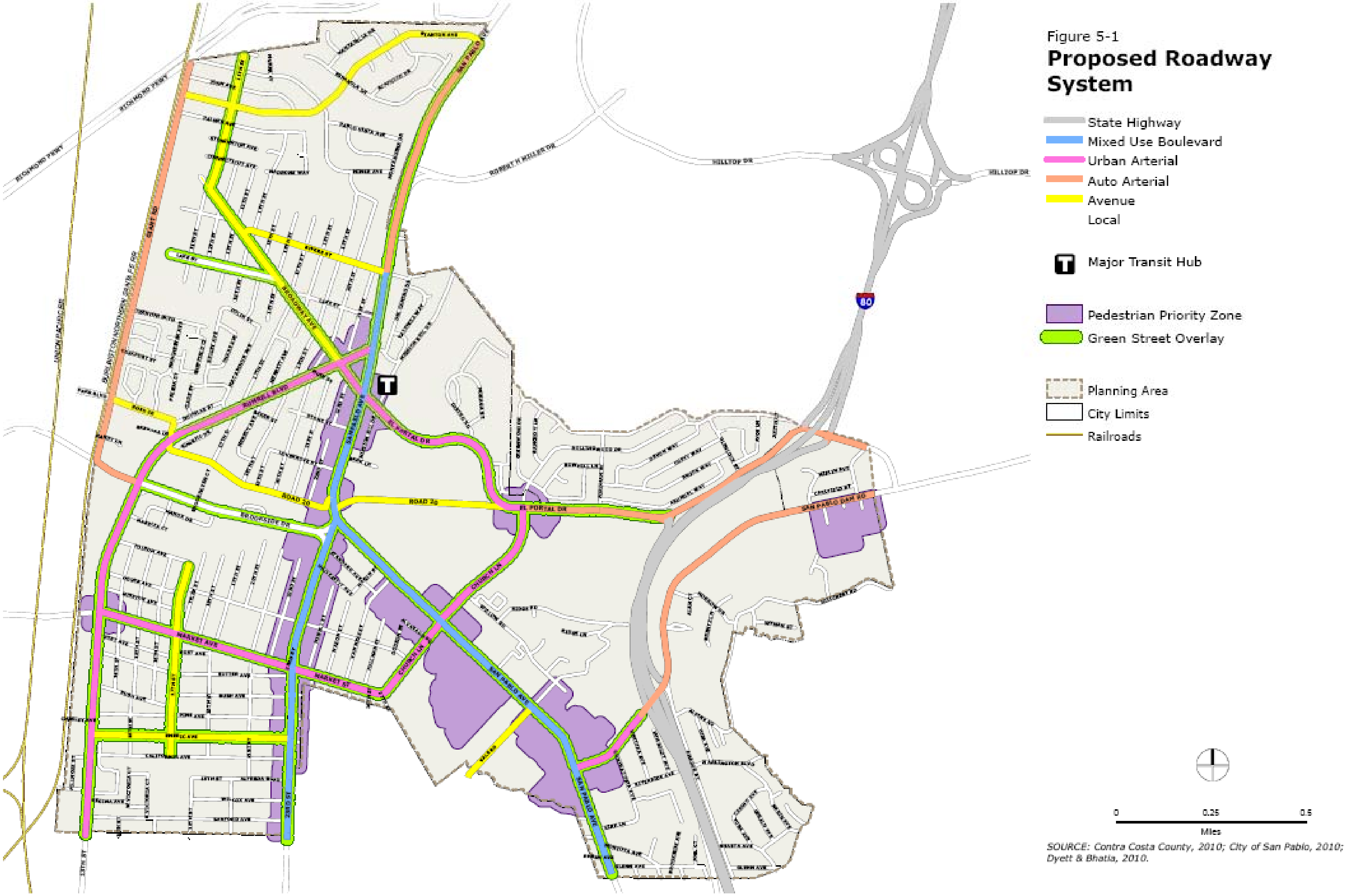
- **Complete Street general policies**
- **Designation of circulation system**
  - Move away from motorist-only perceptions
  - Incorporate more multimodal designations

Mixed-Use Boulevard (4 lanes)



Case Study
General Plan

CITY OF SAN PABLO
City of New Directions



Case Study
General Plan

CITY OF SAN PABLO
City of New Directions

- **Prioritization of different street types by mode**

Table 5.2-1 Transportation Facilities Matrix

Facility	*Transit*	*Bicycles*	*Pedestrians*	*Trucks*	*Automobiles*
State Highway	□	×	X	□	□
Auto Arterial	□	□	○	■	■
Urban Arterial[1]	■	■	□	○	■
Mixed Used Boulevard	■	□	■	□	□
Avenue	○	□	□	○	□
Local	○	□	□	X	□

■ = Dominant

□ = Accommodated

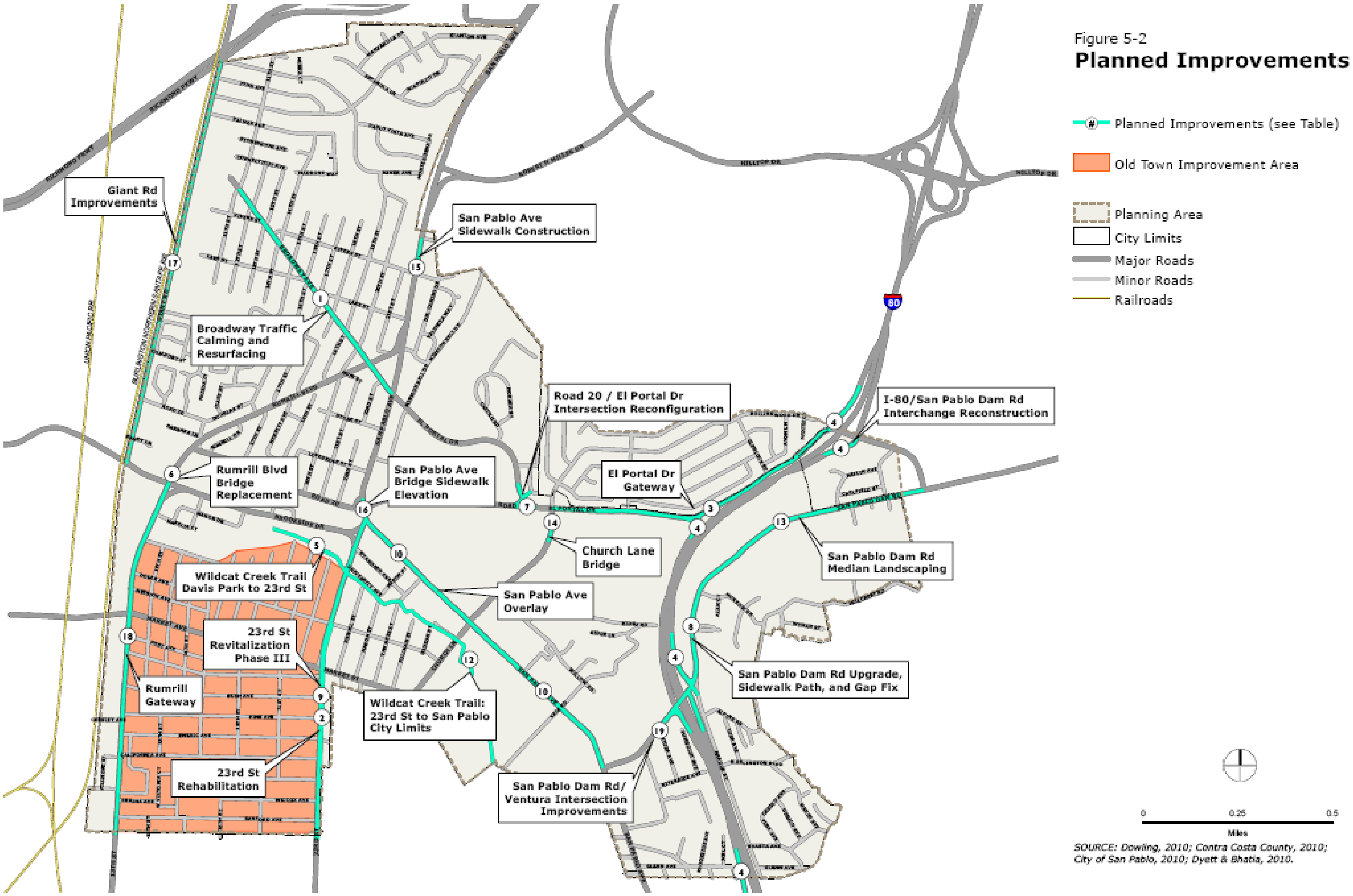
○ = Incidental

X = Prohibited

[1] Transit has priority over bicycles on Urban Arterials, where conflicts exist.

Case Study
General Plan

- **More robust determination of improvements**



CITY OF SAN PABLO
City of New Directions

- **MMLOS summary of factors for each mode**

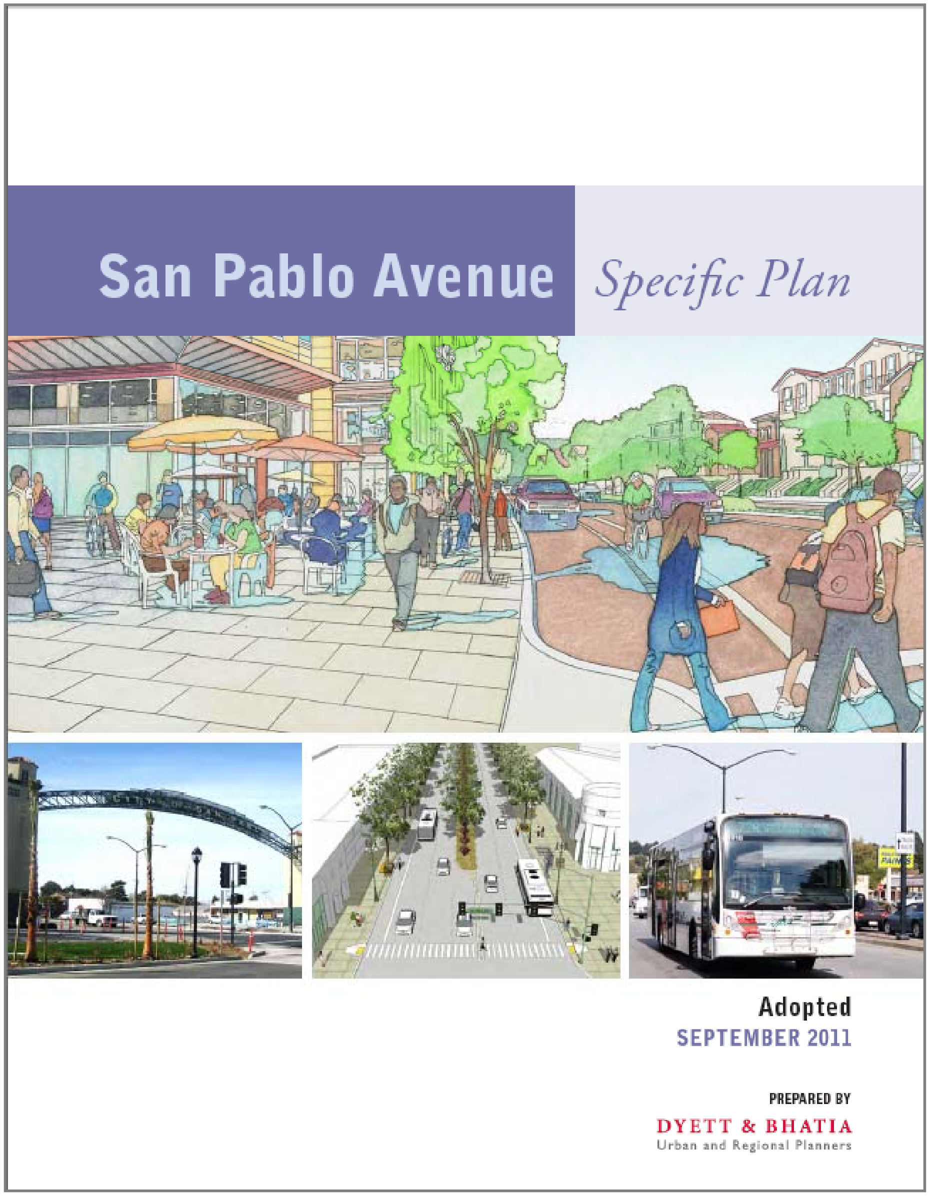
Table 5.2-4 Definition of Multi-modal Level of Service Indicators

LOS	*Transit*	*Bicycle*	*Pedestrian*
A	(Good walk access to bus stops, frequent service, good bus stop amenities.)	(Few driveway and cross street conflicts, good pavement condition, ample width of outside lane, including parking and bike lanes.)	(Low traffic volumes, wide buffer separating sidewalk from traffic, numerous street trees, and high parking occupancy.)
B			
C			
D			
E			
F	(Poor walk access to bus stops, infrequent service, poor schedule adherence, no bus stop amenities.)	(Poor pavement condition, narrow width of outside lane, frequent driveways and cross streets.)	(High traffic volumes, limited buffer separating sidewalk from traffic, few street trees, low parking occupancy.)

Source: Dowling Associates, 2010.

Case Study
Specific Plan

CITY OF SAN PABLO
City of New Directions



- **Adopted 2011**
- **Guide to revitalize in a sustainable manner**
- **MMLOS analysis**
  - Existing
  - 2030 No Project
  - 2030 Specific Plan

Case Study
Specific Plan

CITY OF SAN PABLO
City of New Directions

- **MMLOS Analysis**

AM Peak-Hour													
		Northbound						*Southbound*					
		Transit Passenger		*Bicyclist*		*Pedestrian*		*Transit Passenger*		*Bicyclist*		*Pedestrian*	
Corridor Section	*Scenario*	*Score*	*LOS*	*Score*	*LOS*	*Score*	*LOS*	*Score*	*LOS*	*Score*	*LOS*	*Score*	*LOS*
North	Existing	1.67	A	3.45	C	2.98	C	1.65	A	3.55	D	3.07	C
	2030 No Project	2.11	B	3.49	C	3.08	C	1.78	A	3.61	D	3.19	C
	2030 Specific Plan	2.07	B	3.18	C	2.84	C	1.76	A	3.29	C	3.04	C
Central	Existing	1.08	A	3.50	C	3.06	C	1.10	A	3.49	C	2.96	C
	2030 No Project	1.22	A	3.54	D	3.15	C	1.27	A	3.55	D	3.07	C
	2030 Specific Plan	1.20	A	3.48	C	3.03	C	1.23	A	2.95	C	2.83	C
South	Existing	0.91	A	4.13	D	2.87	C	0.80	A	3.60	D	2.83	C
	2030 No Project	1.07	A	4.22	D	2.99	C	1.06	A	3.65	D	2.96	C
	2030 Specific Plan	1.04	A	3.69	D	2.81	C	1.05	A	3.57	D	2.85	C

Dowling Associates, Inc., Multi-Modal Level of Service analysis using CompleteStreetsLOS version 2.1.8, November 2010

Legend

(dark red)	Worse than existing
(light red)	Worse than existing but better than 2030 No Project
(green)	Better than existing

CITY OF SAN PABLO
City of New Directions

▪ MMLOS Analysis

PM Peak-Hour													
		Northbound						*Southbound*					
		Transit Passenger		*Bicyclist*		*Pedestrian*		*Transit Passenger*		*Bicyclist*		*Pedestrian*	
Corridor Section	*Scenario*	*Score*	*LOS*	*Score*	*LOS*	*Score*	*LOS*	*Score*	*LOS*	*Score*	*LOS*	*Score*	*LOS*
North	Existing	1.71	A	3.61	D	3.26	C	1.64	A	3.53	D	3.03	C
	2030 No Project	1.79	A	3.70	D	3.43	C	2.08	B	3.63	D	3.23	C
	2030 Specific Plan	1.76	A	3.35	C	3.20	C	2.05	B	3.30	C	3.08	C
Central	Existing	1.10	A	3.57	D	3.20	C	1.08	A	3.44	C	2.84	C
	2030 No Project	1.14	A	3.70	D	3.47	C	2.50	B	3.50	C	3.06	C
	2030 Specific Plan	1.12	A	3.62	D	3.35	C	2.46	B	2.90	C	2.82	C
South	Existing	0.95	A	4.36	E	3.10	C	0.79	A	3.58	D	2.76	C
	2030 No Project	0.99	A	4.78	E	3.37	C	1.30	A	3.69	D	2.99	C
	2030 Specific Plan	0.96	A	3.90	D	3.21	C	1.29	A	3.60	D	2.89	C

Dowling Associates, Inc., Multi-Modal Level of Service analysis using CompleteStreetsLOS version 2.1.8, November 2010

Legend

Colour	Meaning
(dark pink)	Worse than existing
(light pink)	Worse than existing but better than 2030 No Project
(green)	Better than existing

Case Study
General and Specific Plan

- **Benefits of MMLOS**
  - Provided baseline LOS for all travel modes
    - Reasonableness of LOS standards
  - Tested MMLOS for Specific Plan scenario
  - Multimodal roadway designations
    - Provides guidelines for improvements
    - Informs mitigation requirements
    - Provides an analysis tool

Overview

- **Background**
- **Development of the HCM methodology**
  - Pedestrian LOS model
  - Bicyclist LOS model
  - Transit Passenger LOS model
- **General and Specific Plan Case Studies**
- **Road Diet Case Study**
- **Putting MMLOS to Work**
- **Q&A**

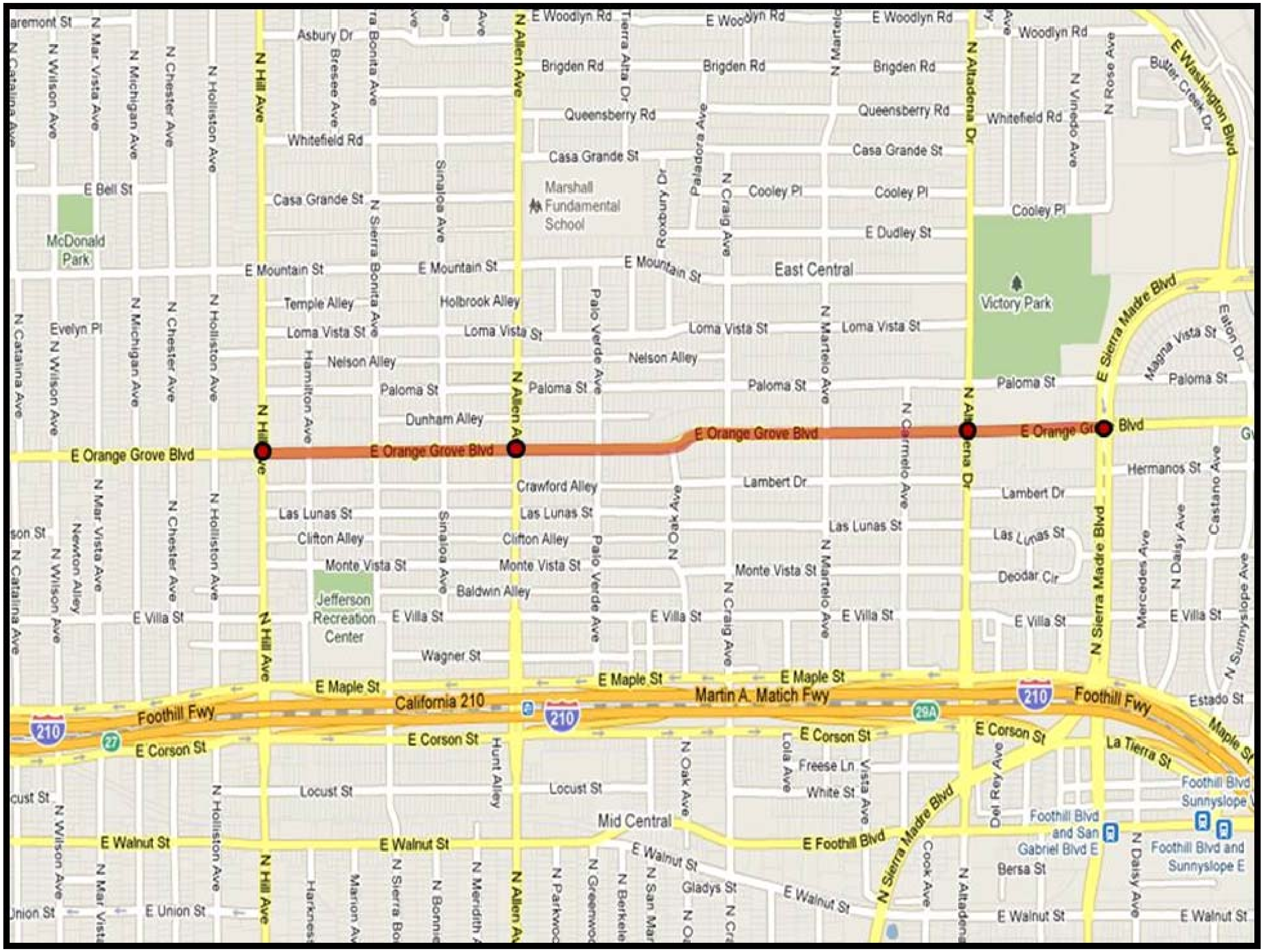
Road Diet Case Study

- **Worked with the City of Pasadena to analyze multimodal impacts of a Road Diet**

Road Diet Case Study

- **When implementing a road diet, many concerns arise including:**
  - How will the lane reduction affect the auto mode?
  - Will transit operations be affected?
  - How much will the bicycle mode improve as a result of adding bike lanes?
  - Will there be any benefit to pedestrians?
- **Orange Grove Blvd. was analyzed using multimodal LOS to address these concerns**

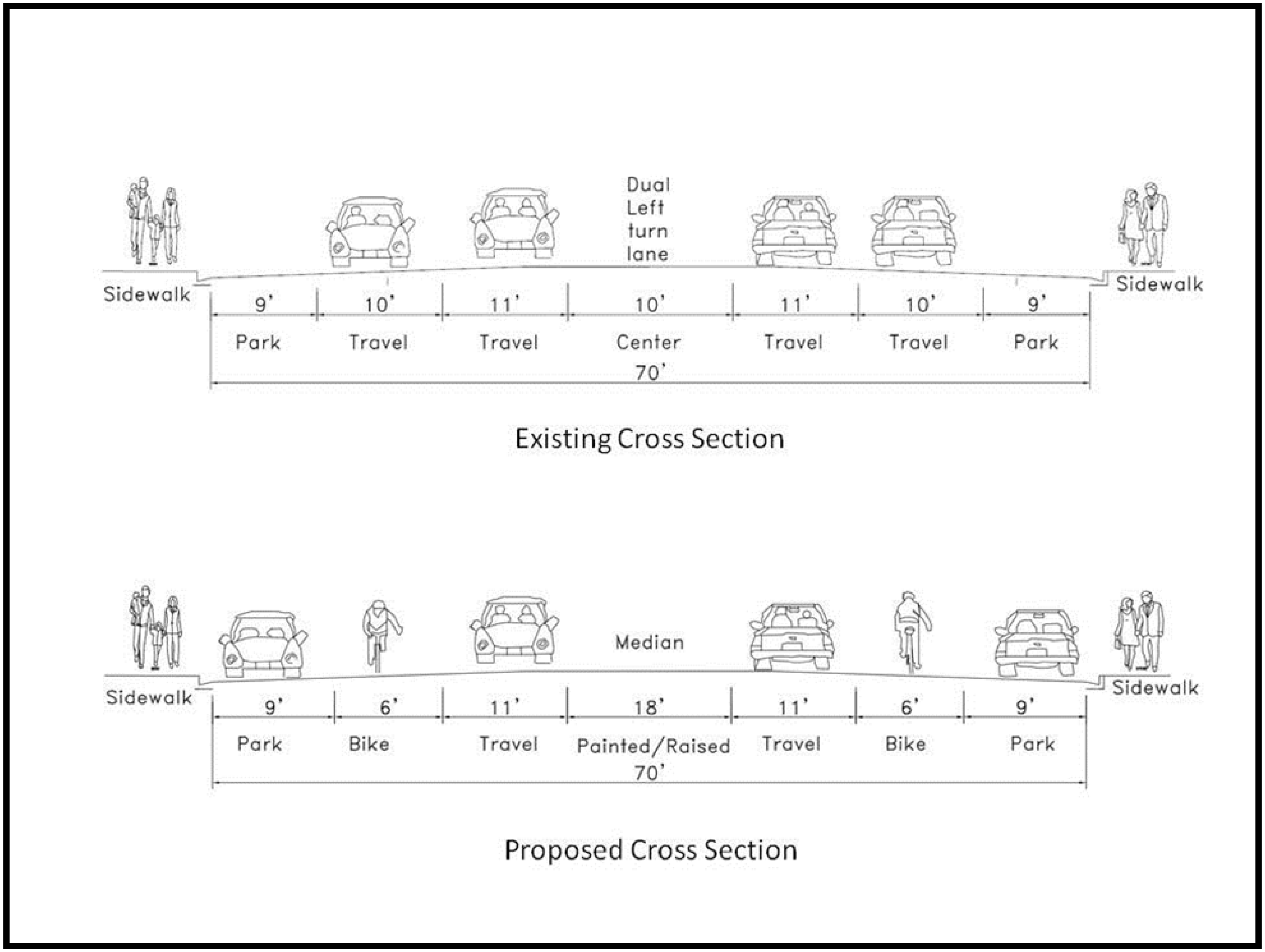
Road Diet Case Study



11,200 ADT

1.6 Miles

Road Diet Case Study



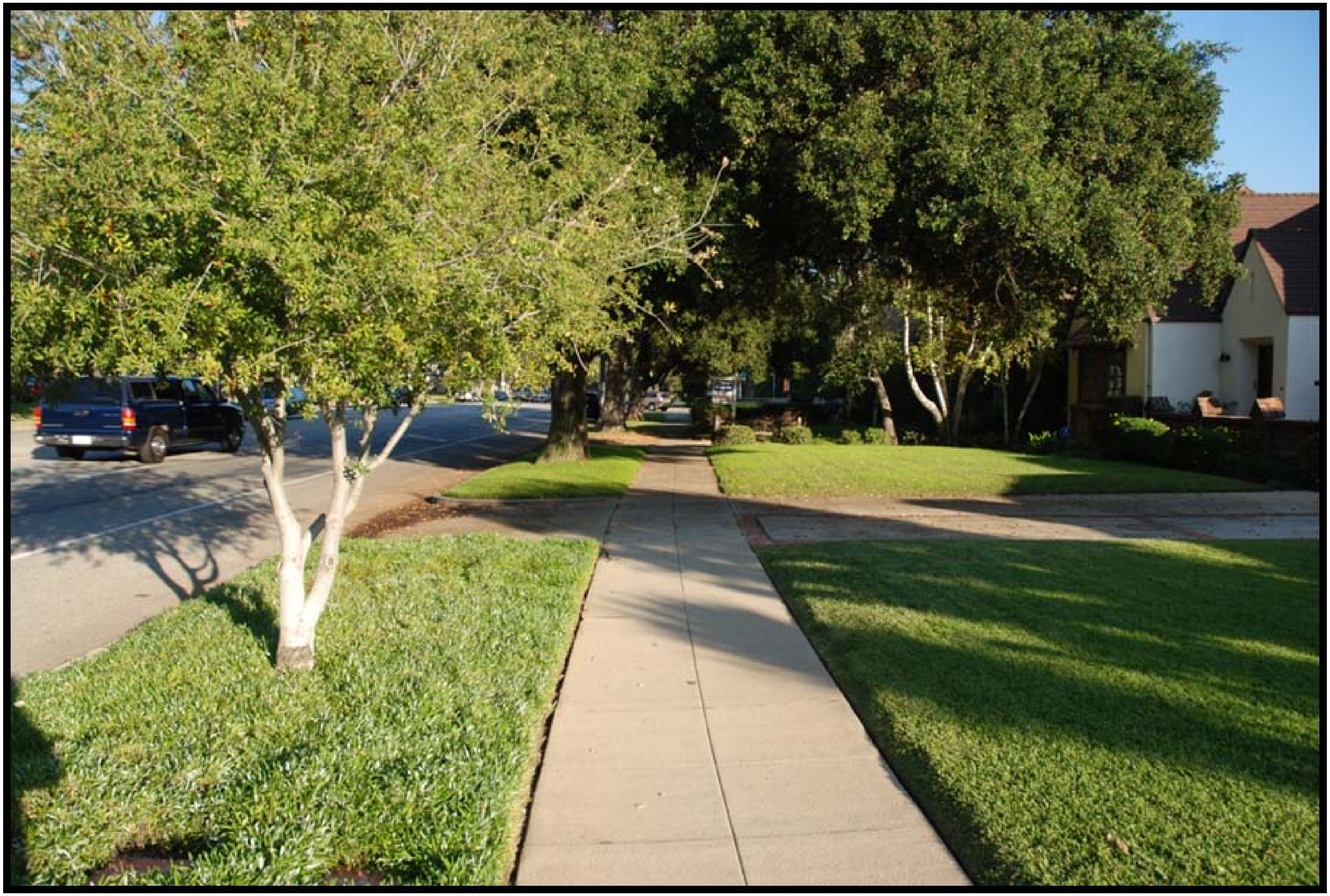
Road Diet Case Study

- **Issues with Current Cross Section**
  - No facilities for bicyclists
  - Light traffic volumes for a large right-of-way (ROW) roadway
  - Higher speeds and wider crossing width which detract from a neighborhood feel

Road Diet Case Study

Road Diet Case Study

Road Diet Case Study



Road Diet Case Study

The Result:

- *Analysis showed that the road diet will result in minor changes to the transit and auto mode*
- *The pedestrian and bicycle modes will improve between 9% and 20% if the road diet is implemented on this corridor*

Orange Grove Boulevard - Facility PM					
	Mode	**Existing Score (LOS)**	**Road Diet Score (LOS)**	**Difference**	**% Change**
EB	Auto	2.33 (B)	2.57 (B)	0.24	10.3%
	Transit	3.23 (C)	3.19 (C)	-0.04	-1.2%
	Bicycle	3.44 (C)	2.73 (B)	-0.71	-20.6%
	Pedestrian	2.89 (C)	2.63 (B)	-0.26	-9.0%
WB	Auto	2.32 (B)	2.45 (B)	0.13	5.6%
	Transit	3.09 (C)	3.05 (C)	-0.04	-1.3%
	Bicycle	3.33 (C)	2.66 (B)	-0.67	-20.1%
	Pedestrian	2.84 (C)	2.58 (B)	-0.26	-9.2%

Road Diet Case Study

- **Transit Passenger**
  - Motorist speed decreased (-)
  - Pedestrian LOS improved (+)
- **Bicyclist**
  - Slower auto speeds (+)
  - Fewer through lanes for same volume (-)
  - Exclusive bike lane (+)
- **Pedestrian**
  - More vehicles in lane nearest pedestrians (-)
  - Increased space between auto and ped (+)
  - Slower auto speeds (+)

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- **Q&A**

Putting MMLOS to Work

- **Caltrans Smart Mobility Framework Pilot Study**
  - Purpose: To integrate the Smart Mobility Framework (principles, place types, and performance measures) into Department planning practice.
  - Pilot Areas
    - North Cal. – Second Generation CSMP for I-680
    - South Cal. – South Bay Cities COG Subregional Long Range Transportation Plan

Putting MMLOS to Work

Smart Mobility FRAMEWORK

- **Smart Mobility Framework**
  - 6 sustainable principles including location efficiency, reliable mobility, safety, equity, and economy
  - 7 place types based on community design and regional accessibility
  - 17 performance measures
    - Includes Multimodal Service Quality (LOS)

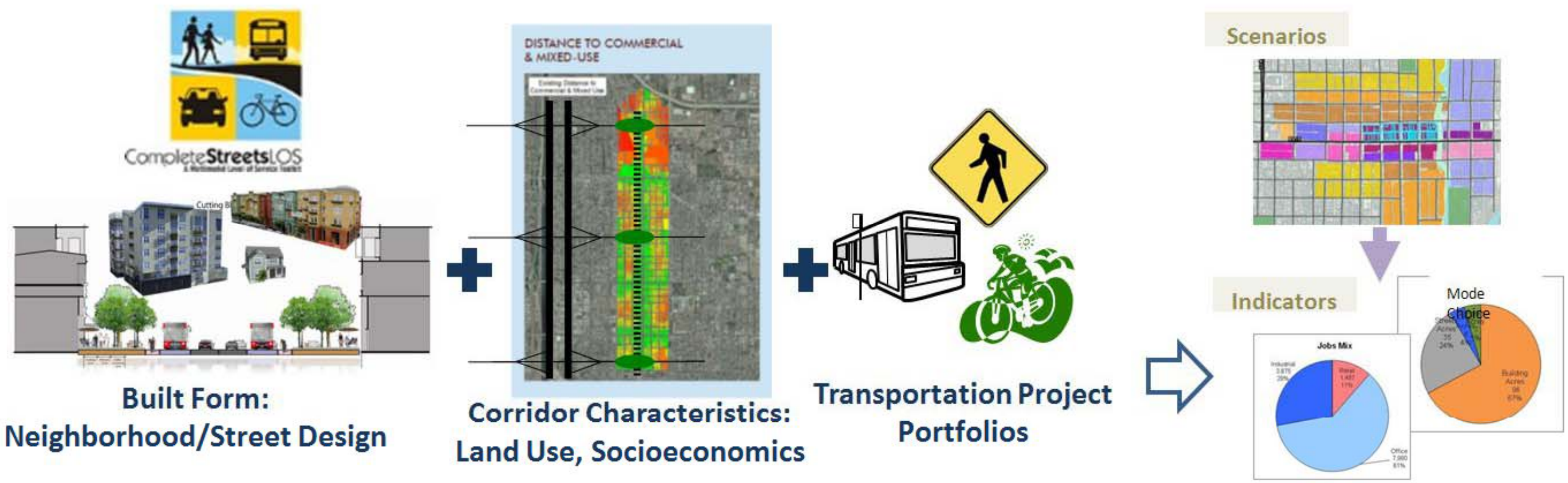
Putting MMLOS to Work

- **Multimodal Service Quality**
  - One of 17 SMF performance measures
  - Recommended metrics are mode-specific (bicycle and pedestrian) LOS measures, transit availability and reliability, and auto travel efficiency
  - HCM 2010 is one of the tools cited in SMF for measuring MMLOS

SMF History

Smart Mobility FRAMEWORK

- Came out before HCM 2010 MMLOS
- Land Use/Urban Form oriented
- Laundry list of performance measures



Current SMF Efforts

Smart Mobility FRAMEWORK

- **Pilot Area 1 – I-680 CSMP**
  - Network includes freeway corridor, parallel arterials, transit services, on-street bicycle lanes, trails, and pedestrian
  - Performance measures identified based on quality and availability of tools and data.
    - MMLOS was not recommended, too data intensive for the entire corridor
- **Pilot Area 2 – South Bay Cities Subregional Transportation Plan**
  - Kick-off scheduled for January 2013
- **More Info:**
  - Chris Ratekin, Caltrans HQ – Community Planning

    (916) 653-4615

    chris_ratekin@dot.ca.gov

Overview

- **Background**
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- **Q&A**

Questions/Comments

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