Meeting of the Ad-Hoc Citizen Traffic Advisory Group
February 23, 2016

Lake Forest City Hall
25550 Commercentre Drive
Council Chambers
Lake Forest, California 92630

AGENDA ON THE INTERNET: The Agenda is available through the Internet at www.lakeforestca.gov**.** You can access the document on the Friday before the meeting on Tuesday.

AGENDA DOCUMENT REVIEW: The full Agenda including all back up information is available at City Hall, 25550 Commercentre Dr., Lake Forest, California, on the Friday prior to the Tuesday meeting.

AGENDA DESCRIPTION: The Agenda descriptions are intended to give notice to members of the public of a general summary of items of business to be transacted or discussed.

CALL TO ORDER: 7:00 p.m.

ROLL CALL:	Chair:	Scott Drapkin
	Vice Chair:	John Irish
	Members:	Grady Glover
		Tim Redwine
		Donald Stoll
		Derek Wieske
	Staff Liaison:	David Rogers, Traffic Engineering Manager

PUBLIC COMMENTS:

At this time, members of the public may address the Ad-Hoc Citizen Traffic Advisory Group regarding any items within the subject matter jurisdiction of the Group. No action may be taken on items not listed on the agenda unless authorized by law. Comments shall be limited to three minutes per person and an overall time limit of thirty minutes for the Public Comments portion of the agenda.

Any person wishing to address the Ad-Hoc Citizen Traffic Advisory Group on any matter, whether or not it appears on this agenda, is requested to complete a "Request to Speak" form available at the door. The completed form is to be submitted to City staff prior to an individual being heard by the Ad-Hoc Citizen Traffic Advisory Group.

CONSENT CALENDAR:

All matters listed under the Consent Calendar are considered routine and will be enacted by one vote. There will be no separate discussion of these items unless Members of the Group, the public, or staff request specific items be removed from the Consent Calendar for separate action.

1. APPROVAL OF MINUTES OF THE REGULAR MEETING OF THE CITIZEN TRAFFIC ADVISORY GROUP HELD ON January 26, 2015, submitted by Public Works staff.

   RECOMMENDED ACTION: Approve as submitted.

2. STATUS REPORT ON CTAG TRAFFIC CONCERNS LIST, submitted by Public Works staff.

   RECOMMENDED ACTION: Receive and File.

DISCUSSION/ACTION ITEMS:

The following matters are for Commission consideration/discussion/action. Members of the public may have the opportunity to address these items if they wish to do so. Please complete the "Request to Speak" form and give to the Public Works Management Aide.

3. DRAFT RECOMMENDATIONS LIST, submitted by Public Works staff.

   RECOMMENDED ACTION: Review the draft recommendations list from the first six meetings and direct staff as appropriate.

4. PRESENTATION AND DISCUSSION REGARDING CARRYOVER CTAG REQUESTS FROM JANUARY 26, 2016, MEETING, submitted by Public Works staff.

   RECOMMENDED ACTION:

   1. Receive a presentation from the Public Works Department regarding the carryover CTAG requests from January; and

   2. Discuss and make findings and recommendations, as appropriate.

ADJOURNMENT:

In compliance with the Americans With Disabilities Act, if you need special assistance to participate in this Meeting, including auxiliary aids or services, you should contact the Public Works Management Aide at (949) 461-3493. Notification 48 hours prior to the Meeting will enable the City to make reasonable arrangements to assure accessibility to this meeting. The Ad-Hoc Citizen Traffic Advisory Group and agenda back-up materials can be obtained from Public Works Management Aide on the Friday prior to the Ad-Hoc Citizen Traffic Advisory Group meeting. Copies of all Agendas, Staff Reports and Supporting Materials can also be found on the City's website – www.lakeforestca.gov/services/agendas. Agenda and agenda packets, if requested, will be made available in an appropriate alternative format to persons with a disability as required by the Americans With Disabilities Act. Copies of the agenda are provided at no cost and agenda back-up materials are available at the per page copy cost. If you wish to be added to the mailing list to receive a copy of the agenda, request must be provided to staff in writing.

The City of Lake Forest mailing address is 25550 Commercentre Drive, Lake Forest, California 92630.
Phone: (949) 461-3400. FAX (949) 461-3511.

CERTIFICATION: I, Amber Haston, Public Works Management Aide, of the City of Lake Forest, California, hereby certify that the foregoing Ad-Hoc Citizens Traffic Advisory Group agenda was posted for public review on February 19, 2015, at 6:00 p.m.

MINUTES OF A SPECIAL MEETING OF THE LAKE FOREST
AD-HOC CITIZEN TRAFFIC ADVISORY GROUP

The meeting of the Lake Forest Ad-Hoc Citizen Traffic Advisory Group which was held January 26, 2016, at the Lake Forest City Council Chambers, 25550 Commercentre Drive, Lake Forest, California was called to order at 7:00 p.m.

ROLL CALL:	Chair:	Scott Drapkin (Arrived 7:15 p.m.)
	Vice-Chair:	John Irish
	Members:	Mark Armando
		Grady Glover
		Tim Redwine
		Donald Stoll
		Derek Wieske

ALSO PRESENT: Tom Wheeler, Director of Public Works/City Engineer
Carlo Tomaino, Assistant to the City Manager
David Rogers, Traffic Engineering Manager
Doug Anderson, Traffic Engineering Consultant

PUBLIC COMMENTS:

There were no Public comments.

CONSENT CALENDAR:

ACTION: The Ad-Hoc Citizens Traffic Advisory Group approved the Consent Calendar Item 3. Item 1 and 2 were pulled for minor modifications.

Consent Calendar (Items 1-3)

1. APPROVAL OF MINUTES OF THE REGULAR MEETING OF THE CITIZEN TRAFFIC ADVISORY GROUP HELD ON December 22, 2015.

   There was consensus among the Group Members to make two revisions: modify the time the meeting was called to order and revise Item 3's reference to the discussion about Trabuco and Lake Forest.

ACTION: The Ad-Hoc Citizens Traffic Advisory Group approved the minutes, inclusive of the two determined revisions to the time the meeting was called to order and Item 3.

2. STATUS REPORT ON CTAG TRAFFIC CONCERNS LIST

Discussion ensued regarding various additional concerns among the Group Members not reflected on the CTAG Traffic Concerns List. The Group Members reached consensus to add a total of 8 items to the CTAG Traffic Concerns List:

1) Review the need for a T-Intersection sign for northbound Commercentre at Larkspur.

2) Review the large box trucks that are parking on Pittsford south of Lake Forest since the street is narrow.

3) Review the possibility of adding on-street parking for the Lake Forest Ice Palace on Arctic Ocean.

4) Inspect the Barker Ranch Dog Park's drain near the drinking fountain due to continual standing water.

5) Review a possible capital project to construct a free right lane for eastbound Ridgeline at El Toro.

6) Review the signal timing and operation for the northbound left turn for Dimension at Commercentre.

7) Provide the status of OCTA's proposed bike path on the railroad tracks.

8) Review the possibility of adding a traffic signal at Jeronimo and Laurelwood/Heroes Park exit.

Dave Rogers, Traffic Engineering Manager, informed the Group Members that Item 4 would be referred to the City's Public Works Maintenance Manager for further review.

ACTION: The Ad-Hoc Citizens Traffic Advisory Group discussed the status of the items on the list of traffic concerns and approved the list, inclusive of 8 items.

3. UPDATED WORK PLAN AND PRELIMINARY RECOMMENDATIONS LIST

Tom Wheeler, Director of Public Works/City Engineer, suggested that the Group Members review the list so the recommendations could be discussed in detail at the upcoming February meeting.

DISCUSSION/ACTION ITEMS:

4. PRESENTATION AND DISCUSSION REGARDING TRAFFIC ENGINEERING AND RELATED TOPICS

Dave Rogers, Traffic Engineering Manager, provided the Group Members with an overview of traffic engineering, including the on-going activities performed in the Traffic Engineering Division, such as studies and reviewing and responding to requests for service. The presentation also included the typical day to day activities, including reviewing the City's Ask Lake Forest (ALF) system that logs and tracks requests for service, field reviews, consultant and contractor activity on behalf of the City, development review and the types of typical requests for service the City receives. The Group Members also received information regarding warrants or justifications and national, state and local standards used to evaluate the need for traffic controls, such as traffic signals and stop signs, as well as the importance in having uniform and consistent traffic controls.

Dave Rogers, Traffic Engineering Manager, also explained to the Group Members the importance of regularly reviewing traffic collision patterns and trends for the City. He went on to explain that the City does not currently have enough resources to complete this comprehensive review on a city-wide basis. The Group Members discussed the importance of this on-going activity. Consensus was reached among the Group Members on three recommendations related to traffic collision review:

1) That the City procures a Traffic Collision Analysis Program, inclusive of GIS compatibility.
2) That City staff collect as many individual collision reports as possible to help with the analysis of collision patterns and trends.
3) That the City maintains individual, digital collision records for a minimum period of 5 years in accordance with the City's records retention schedule.

Dave Rogers, Traffic Engineering Manager, discussed the City's process of reviewing traffic conditions near schools and discussions with representatives of the school district. Discussion ensued regarding the need to prepare school route plans to help parents and students that walk to school so they can select the most appropriate route. The Group Members reached consensus on the below recommendations:

1) That the City works with the SVUSD and OCSD to develop school route plans for each of the public schools in the City.
2) That City staff review traffic conditions at all schools on an annual basis since traffic patterns can change over time. This includes staff reviews during peak periods and discussions with school personnel.

The Group Members reviewed another component of traffic engineering: a Traffic Signal Master Plan. Discussion ensued regarding the need to review traffic conditions at locations on a regular basis to help identify potential issues that may need further review. Questions arose among the Group Members on the type of information that would be gathered as well as how it would be analyzed. The Group Members expressed reservations on the potential installation of new traffic signals. City staff responded to this reservation by informing the Group Members that other less restrictive measures are always considered and evaluated before new traffic signals are considered.

The Group Members suggested that the public be notified when new signals are being installed or considered for installation. City staff advised that this will be included as part of the upcoming meeting on Community Input.

The Group Members reached consensus on the proposed recommendation that the City conduct a Traffic Signal Master Plan review on a regular 2 to 3 year cycle to determine if any new traffic signals should be considered for installation.

Discussion ensued among the Group Members about traffic sign reflectivity reviews. Staff advised the Group Members of the importance of having acceptable levels of reflectivity on the traffic control signs throughout the City and conducting regular reviews of reflectivity to make sure the City meets current standards.

Upon further discussion, the Group Members recommended that the City continue to conduct traffic control sign retro reflectivity reviews as necessary to comply with applicable standard and that the City continue to provide funding to complete the sign replacements.

Dave Rogers, Traffic Engineering Manager, presented the Group Members with an overview of specific traffic engineering related discussion requests that the Group Members requested as part of the first CTAG meeting in August 2015. Due to the considerable number of components to traffic

engineering, the Group Members agreed to postpone the discussion of protected permissive left turn phasing (PPLTP) to the upcoming February meeting.

Another specific CTAG request discussed was the use of roundabouts. Discussion ensued among the Group Members to expand the use of roundabouts to more than new developments. The Group Members amended the proposed recommendation to include the possible use of roundabouts at existing locations that may be considered for other types of traffic controls, such as all way stops.

The Group Members reached consensus on the following recommendation: That the City consider the potential use of roundabouts in new developments and at existing locations that may be considered for other types of traffic controls, such as all way stops.

While the intersection of Shasta Lake and Serrano was initially brought up for discussion, the Group Members decided to also postpone this discussion until the upcoming February meeting so that additional information and background could be gathered and included for the Group's review.

City staff provided information to the Group Members about the sight distance at the intersection of Lake Forest and Sterling. City staff explained that the intersection does meet the minimum sight distance requirements. The Group Members directed staff to continue to work with the homeowner's association to remove some landscaping that may enhance the sight distance.

City staff also provided the Group Members with information on the turn restrictions for the driveways for the shopping center on the northeast corner of Trabuco and El Toro. The Group Members agreed with staff's recommendation that they contact the property owner and ask them to install appropriate "no left turn" signs for the driveway exits.

Discussion ensued on another specific traffic engineering item regarding El Toro High School traffic. The Group Members received some background from Group Member Stoll on the changes that have occurred in the last couple of years. The Group Members recommended that City staff review the expressed concerns as part of the recommended future annual school review process.

The Group Members discussed the possible modification of the existing tunnel under the bridge to accommodate the Serrano Creek Trail users. Discussion ensued on whether this project would be a City or County lead effort since this particular area is a part of the County trail. The Group members recommended City staff ask the County to take the lead on a feasibility study on this project.

Dave Rogers, Traffic Engineering Manager, provided information on the intersection of Trabuco and Lake Forest. The Group Members expressed concern that the number 3 eastbound lane on Lake Forest ends just east of Trabuco and that the lane is shorter than a typical right turn acceleration lane. The Group Members noted that the drivers turning right from northbound Trabuco to Lake Forest have the option to wait for the green light or to turn into any of the lanes when traffic permits.

The Group Members reviewed the preliminary recommendations list and directed City staff to add the above recommendations to the full list of recommendations for City Council that will be reviewed at the upcoming February meeting.

ACTION: The Ad-Hoc Citizen Traffic Advisory Group received a presentation from the Public Works Department regarding general municipal traffic engineering and other related traffic engineering topics; and discussed and made the following findings and recommendations, as appropriate:

1) That the City procures a Traffic Collision Analysis Program, inclusive of GIS compatibility.

2) That City staff collect as many individual collision reports as possible to help with the analysis of collision patterns and trends.

3) That the City maintains individual, digital collision records for a minimum period of 5 years in accordance with the City's records retention schedule.

4) That the City works with the SVUSD and OCSD to develop school route plans for each of the public schools in the City.

5) That City staff review traffic conditions at all schools on an annual basis since traffic patterns can change over time. This includes staff reviews during peak periods and discussions with school personnel.

6) That the City conduct a Traffic Signal Master Plan review on a regular 2 to 3 year cycle to determine if any new traffic signals should be considered for installation.

7) That the City continue to conduct traffic control sign retro reflectivity reviews as necessary to comply with applicable standard and continue to provide funding to complete the sign replacements.

8) That the City consider the potential use of roundabouts in new developments and at existing locations that may be considered for other types of traffic controls, such as all way stops.

ADJOURNMENT:

The Ad-Hoc Citizen Traffic Advisory Group Adjourned the January 26 Ad-Hoc Citizen Traffic Advisory Group Meeting at 9:51 p.m.

Respectfully submitted:	APPROVED:
_____	_____
AMBER HASTON	DAVE ROGERS
PUBLIC WORKS MANAGEMENT AIDE	TRAFFIC ENGINEERING MANAGER

Ad-Hoc Citizen Traffic Advisory Group Agenda Report
Meeting Date: February 23, 2016
Department: Public Works

SUBJECT:

STATUS REPORT ON CTAG TRAFFIC CONCERNS LIST

RECOMMENDED ACTION(S):

Receive and File.

DISCUSSION:

At the August 25, 2015 CTAG meeting, the members provided staff with an initial list of traffic and transportation topics and issues to cover and address as part of future meetings. In subsequent meetings, the Group has added and deleted items from the list. The current list is attached. This will be a standing item for all future CTAG agendas.

The topics and issues range from concerns about traffic signal operations at individual intersections to broad topics such as the status of the gap closure for Portola Parkway between Lake Forest and Irvine. Some of the items have been referred to the City's contractors and consultants for review. Many have been reviewed and addressed in previous meetings. The remaining items will be discussed in one of the future meetings.

ATTACHMENTS:

CTAG Traffic Concerns List

Initiated By:	David Rogers, P.E., T.E., Traffic Engineering Manager
Reviewed By:	Carlo Tomaino, Assistant to the City Manager
Approved By:	Thomas E. Wheeler, P.E., Director of Public Works/City Engineer

CTAG TRAFFIC CONCERNS

UNDER REVIEW				
NO.	TRAFFIC CONCERNS	CTAG MEMBER	STATUS	COMMENTS
7	PROTECTED/PERMISSIVE	WIESKE	UNDER REVIEW	WILL BE REVIEWED WITH IN FEBRUARY 2016
9	SB TOLEDO WAY AT SERRANO RD. (POSSIBLE USE OF PROTECTED PERMISSIVE)	WIESKE	UNDER REVIEW	WILL BE REVIEWED WITH IN FEBRUARY 2016
10	SHASTA LAKE RD. AT SERRANO RD. (STATUS)	WIESKE	UNDER REVIEW	WILL BE REVIEWED IN FEBRUARY 2016
42	T INTERSECTION SIGN FOR NB COMMERCENTRE AT LARKSPUR	GLOVER	UNDER REVIEW	STAFF NEEDS TO REVIEW LOCATION
44	ARCTIC OCEAN- REVIEW POSSIBLITY OF ON STREET PARKING BY SAKTING RINK	GLOVER	UNDER REVIEW	STAFF NEEDS TO REVIEW LOCATION
46	CONSTRUCTION OF FREEE RIGHT LANE FOR E/B RIDGELINE @EL TORO	GLOVER	UNDER REVIEW	STAFF NEEDS TO REVIEW WITH DEVELOPMENT SERVICES
48	STATUS OF PROPOSED BIKE PATH ON RAILROAD TRACKS	WIESKE	UNDER REVIEW	WAITING FOR INFO FROM OCTA
49	POTENTIAL SIGNAL AT JERONIMO/LAURELWOOD/HEROS PARK	WIESKE	UNDER REVIEW REVIEWING COLLISION DATA	INTERSECTION TO BE INCLUDED IN SIGNAL MASTER PLAN

CTAG TRAFFIC CONCERNS

COMPLETE				
NO.	TRAFFIC CONCERNS	CTAG MEMBER	STATUS	COMMENTS
1	EB LAKE FOREST DR. INTO MIMI'S – SIGNAL TIMING EXCESSIVE DELAY	STOLL	COMPLETE	ADJUSTMENTS MADE ON SEPT 15
2	EB LAKE FOREST DR. TO 241 TOLL ROAD TRAFFIC SIGNAL ISSUE (LOOP DOES NOT DETECT MOTORCYCLE)	ARMANDO	COMPLETE	FORWARDED TO CALTRANS FOR ADJUSTMENT
3	SB ALISO PARK, LEFT TURN TO GO EB ON EL TORO RD. TRAFFIC SIGNAL ISSUE (LOOP DOES NOT DETECT MOTORCYCLE)	ARMANDO	COMPLETE	ADJUSTMENT MADE ON SEPT 15
4	EL TORO RD. WB AT TOLEDO WAY (NEEDS TO STAY GREEN LONGER)	REDWINE	COMPLETE	SIGNAL TIMING WAS ADJUSTED ON 9/8/15
5	EB EL TORO RD. ON SERRANO (SCHOOL TIME – DEMAND EXCEEDS THE LENGTH)	STOLL	COMPLETE	SIGNAL TIMING WAS ADJUSTED ON 9/8/15
6	EL TORO HIGH SCHOOL TRAFFIC –CONCERN ABOUT GENERAL SCHOOL TRAFFIC	STOLL	COMPLETE	WILL BE INCLUDED WITH NEXT ANNUAL SCHOOL REVIEW
8	EB BAKE PKWY. AT TRABUCO RD.	STOLL	COMPLETE	CTAG RECOMMENDED 3 THRU LANES & DEDICATED RIGHT
11	NB TOLEDO WAY NEEDS DUAL LEFT ONTO WB BAKE PKWY.	STOLL	COMPLETE	NO CHANGE RECOMMENDED
12	STERLING SIGHT DISTANCE	IRISH	COMPLETE	SIGHT DISTANCE IS ADEQUATE WORKING WITH HOA TO MODIFY LANDSCAPING
13	SADDLEBACK RANCH RD. – REVIEW BIKE SAFETY/PORKCHOPS/PARKING NEAR CONCOURSE PARK	GLOVER	COMPLETE	INFORMATION PROVIDED 11/24/15
14	SKYRIDGE DEVELOPMENT	GLOVER	COMPLETE	INFORMATION PROVIDED 11/24/15

CTAG TRAFFIC CONCERNS

COMPLETE				
NO.	TRAFFIC CONCERNS	CTAG MEMBER	STATUS	COMMENTS
15	BIKE SAFETY/TRAIL ALONG RAILROAD/MULTI MODAL STREETS	WIESKE/DRAPKIN	COMPLETE	INCLUDED WITH GENERAL PLAN
16	ROUND ABOUTS	WIESKE	COMPLETE	REVIEWED IN JANUARY 2016
17	PORTOLA GAP CLOSURE	WIESKE	COMPLETE	INFORMATION PROVIDED 11/24/15
19	ACCIDENT/SAFETY DATA INFORMATION	WIESKE/DRAPKIN	COMPLETE	CTAG RECOMMENDED AN ANNUAL COLLISION REVIEW
20	STRATEGIC PLAN BACKLOG PROJECTS	WIESKE	COMPLETE	INCLUDED WITH CAPITAL PROJECT DISCUSSION ON 12/22/15
21	GENERAL PLAN CIRCULATION ELEMENTS	DRAPKIN & WIESKE	COMPLETE	INFORMATION PROVIDED 10/27/15
22	MONITORING DEVELOPMENT IN ADJACENT CITIES	DRAPKIN	COMPLETE	INFORMATION WAS INCLUDED WITH TRAFFIC MODELING DISCUSSION IN NOVEMBER 2015
23	ALL TRAFFIC SIGNALS ESPECIALLY ON ARTERIALS – TOO LONG RED OR GREEN LIGHTS DURING NON-PEAK TRAFFIC PERIODS	GROUP VIA JIM RICHERT	COMPLETE	CYCLE LENGTHS ARE USUALLY REDUCED BUT GREEN LIGHTS WILL EXTEND WITH MINIMAL TRAFFIC
24	NORTHBOUND BAKE AT TRABUCO – RIGHT LANE ON BAKE HAS BOTH RIGHT TURN AND STRAIGHT AHEAD ABILITY – LARGE TRAFFIC BACKUP	GROUP VIA JIM RICHERT	COMPLETE	FUTURE CAPITAL PROJECT TO ADD

CTAG TRAFFIC CONCERNS

COMPLETE				
NO.	TRAFFIC CONCERNS	CTAG MEMBER	STATUS	COMMENTS
				DEDICATED RIGHT TURN LANE
25	SERRANO AND LAKE FOREST – WESTBOUND ON SERRANO CROSSING LAKE FOREST – LEFT TURN LIGHT ONTO LF IS ALWAYS GREEN EVEN WITH NO LEFT TURN TRAFFIC	GROUP VIA JIM RICHERT	CLOSED – PROJECT UNDER CONSTRUCTION	THIS IS CURRENTLY A SPLIT PHASE INTERSECTION FOR SERRANO. CITY IS MODIFYING TO INSTALL PROTECTED LEFTTURNS MAY 2016
26	WESTBOUND TOLEDO AT BAKE – RIGHT LANE BACKUP ON TOLEDO DUE TO NO RIGHT TURN LANE	GROUP VIA JIM RICHERT	COMPLETE	DEDICATED RIGHT NOT JUSTIFIED BASED ON TRAFFIC MODEL
27	SOUTHBOUND LAKE FOREST AT TRABUCO – RIGHT LANE BACKUP ON LAKE FOREST DUE TO NO RIGHT TURN LANE ONTO TRABUCO	GROUP VIA JIM RICHERT	COMPLETE	DEDICATED RIGHT NOT JUSTIFIED BASED ON TRAFFIC MODEL
28	HOME DEPOT ENTRANCE ON RANCHO PARKWAY IN FOOTHILL RANCH – LEFT TURN LIGHT ON RANCHO PARKWAY INTO HOME DEPOT IS NOT NEEDED DUE TO VERY LOW TRAFFIC VOLUME ON RANCHO PARKWAY	GROUP VIA JIM RICHERT	COMPLETE	PROTECTED LEFT IS JUSTIFIED
29	BAKE PARKWAY BETWEEN TRABUCO AND 241 – TRAFFIC CONGESTION ON BAKE – WILL BE EVEN WORSE WITH 4000 NEW HOMES	GROUP VIA JIM RICHERT	COMPLETE	SIGNAL COORDINATION PROJECT UNDERWAY. TRAFFIC MODEL DOES NOT CALL FOR ADDITIONAL MITIGATIONS/WIDENING
30	MUIRLANDS AND RIDGE ROUTE – AT RUSH HOUR, EASTBOUND TRAFFIC ON MUIRLANDS BACKS UP TO DYLAN	GROUP VIA JIM RICHERT	CLOSED – PROJECT UNDER CONSTRUCTION	TRAFFIC SIGNAL SYNCHRONIZATION PROJECT TO BE COMPLETED IN EARLY

CTAG TRAFFIC CONCERNS

COMPLETE				
NO.	TRAFFIC CONCERNS	CTAG MEMBER	STATUS	COMMENTS
				2016
31	MUIRLANDS AND DYLAN – RED LIGHT FOR MUIRLANDS TRAFFIC AT DYLAN EVEN THOUGH NO CROSS TRAFFIC ON DYLAN	GROUP VIA JIM RICHERT	CLOSED – PROJECT UNDER CONSTRUCTION	TRAFFIC SIGNAL SYNCHRONIZATION PROJECT TO BE COMPLETED IN EARLY 2016
32	EL TORO AND ARBOR – GREEN LIGHT FOR ARBOR TRAFFIC IS VERY LONG – EL TORO ROAD TRAFFIC DELAYED NEEDLESSLY	GROUP VIA JIM RICHERT	COMPLETE	PEDESTRIANS ARE COMMON AT THIS LOCATION. PEDESTRIANS REQUIRE EXTENDED TIMES TO CROSS THIS WIDE SECTION OF EL TORO. OVERALL GREEN IS AT MINIMAL NECESSARY
33	EL TORO AT BRIDGER – TRAFFIC BACKS UP ON EL TORO AS THERE IS NO DEDICATED RIGHT TURN LANE ONTO BRIDGER	GROUP VIA JIM RICHERT	COMPLETE	DEDICATED RIGHT NOT JUSTIFIED BASED ON TRAFFIC MODEL
34	CHINOOK AND SERRANO LIGHT COORDINATION – A REAL TRAFFIC MESS – CHINOOK AND SERRANO LIGHTS ALWAYS RED FOR LAKE FOREST TRAFFIC	GROUP VIA JIM RICHERT	CLOSED – PROJECT UNDER CONSTRUCTION	CONTRACTOR ORDERING EQUIPMENT; TO BE COMPLETED 3/2016
35	SUNFLOWER AND ALTON – SUNFLOWER GETS GREEN LIGHT EVEN WHEN THERE IS NO TRAFFIC EXITING SUNFLOWER ONTO ALTON	GROUP VIA JIM RICHERT	COMPLETE	BICYCLE LOOP SENSITIVITY ADJUSTED.
36	TRABUCO BETWEEN BAKE AND EL TORO – GREEN LIGHT DURATION ALONG TRABUCO IS WAY TOO LONG DURING PEAK VOLUME TIMES DUE TO NEW SYNCHRONIZATION	GROUP VIA JIM RICHERT	COMPLETE	LONGER GREEN TIMES FOR THRU MOVEMENT

CTAG TRAFFIC CONCERNS

COMPLETE				
NO.	TRAFFIC CONCERNS	CTAG MEMBER	STATUS	COMMENTS
	PROGRAM			IS TYPICAL FOR COORDINATED SYSTEMS
37	LAKE FOREST AT JERONIMO – LEFT TURN LIGHT FROM SOUTHBOUND LAKE FOREST ONTO EASTBOUND JERONIMO IS TOO SHORT	GROUP VIA JIM RICHERT	COMPLETE	BACKUP OCCURS ONLY DURING SCHOOL AM AND PM PEAKS. MAXIMUM TIME ALREADY ALLOTTED
38	REVIEW SERRANO CREEK UNDERCROSSING ON TRABUCO FOR BIKERS AND HIKERS	WEISKE	COMPLETE	STAFF WILL ASK COUNTY TO CONDUCT A FEASIBILITY STUDY
39	WIDEN BAKE PARKWAY	GLOVER	COMPLETE	INCLUDED WITH CAPITAL PROJECT DISCUSSION ON 12/22/15
40	ADD TRAFFIC DELINEATORS TO NB TRABUCO, NORTH OF EL TORO	ARMANDO	COMPLETE	STAFF TO WORK WITH PROPERTY OWNER TO IMPROVE SIGNAGE
41	TRABUCO/VIA DEL RIO, SIGNAL CYCLING INCORRECTLY	REDWINE	COMPLETE	CYCLE LENGTH CHECKED & ADJUSTED PER SYNCHRONIZATION PLAN
43	LARGE BOX TRUCKS ON PITTSFORD S/O LAKE FOREST – TOO NARROW	ARMANDO	COMPLETE	REFERRED TO OCSD FOR ENFORCEMENT
45	STANDING WATER AT DRAIN NEAR DRINKING AT DOG PARK	ARMANDO	COMPLETE	REFERRED TO MAINTENANCE TO ADDRESS THE CONDITION

CTAG TRAFFIC CONCERNS

COMPLETE				
NO.	**TRAFFIC CONCERNS**	**CTAG MEMBER**	**STATUS**	**COMMENTS**
47	DIMENSION/COMMERCENTRE- REVIEW SIGNAL TIMING/ OPERATION FOR N/B LEFT TURN	STOLL/IRISH	COMPLETE	SIGNAL OPERATIONS TO BE MODIFIED

Ad-Hoc Citizen Traffic Advisory Group Agenda Report
Meeting Date: February 23, 2016
Department: Public Works

SUBJECT:

DRAFT RECOMMENDATIONS LIST

RECOMMENDED ACTION(S):

Review the draft recommendations list from the first six meetings and direct staff as appropriate.

DISCUSSION:

To date, the CTAG has held six meetings from August 2015 – January 2016 and developed a total of 31 recommendations. Additional recommendations will be made as part of the two discussion items on the February (tonight's) agenda and any discussion items on the March agenda. One of the goals of the CTAG was to review and prioritize the recommendations early in 2016 so that the City Council can consider at least the ones that may have funding implications/requests as part of the Fiscal Year 2016-2017 budget process that begins in April.

The attached list has the recommendations in chorological order from August to January. Staff has added a column for the estimated costs (if any and if known) for each recommendation. Staff is suggesting that the CTAG begin the process of discussing the recommendations and prioritizing or organizing the recommendations. The goal would be to complete this process at the March 22 CTAG meeting and then have some or all of the recommendations presented to the City Council in April.

ATTACHMENT:

Draft Recommendations List

Initiated By:	David Rogers, P.E., T.E., Traffic Engineering Manager
Reviewed By:	Carlo Tomaino, Assistant to the City Manager
Approved By:	Thomas E. Wheeler, P.E., Director of Public Works/City Engineer

CITY OF LAKE FOREST
CITIZENS TRAFFIC ADVISORY GROUP

DRAFT RECOMMENDATIONS LIST

RECOMMENDATIONS	
MEETING 2: SEPTEMBER 22, 2015 (TRAFFIC SIGNAL OPERATIONS)	**ESTIMATED COST**
1. Minimize issues with individual traffic signals so that signals are operating at optimum condition at all times.	Staff time and existing O & M costs
2. Have all traffic signal equipment in the cabinets meet or exceed all current standards and be compatible with future technology.	Funded through existing O & M and through OCTA grants
3. Have all traffic signals connected to our master system to insure consistent communication.	Part of 10 Year $1.5 million ($150,000/year) ongoing program
4. Continue to update coordination timing.	OCTA grant funding 80% City funding 20%
5. Evaluate the City's needs and review a possible upgrade to Adaptive Signal Control (ASC) – Long-term Goal	$600,000 onetime cost and $60,000 annually for maintenance and monitoring
6. Pursue supplemental funding opportunities.	Staff and consultant time already budgeted
7. Review the potential use of camera equipment for the sole purpose of monitoring and improving traffic flow.	Staff and consultant time already budgeted
MEETING 3: OCTOBER 27, 2015 (GENERAL PLAN)	
8. The CTAG supported the City's efforts to revise the General Plan and the Circulation Element.	Development Services is the lead department. Cost is likely to be several hundred thousand dollars.

DRAFT RECOMMENDATIONS LIST

RECOMMENDATIONS	
MEETING 4: NOVEMBER 24, 2015 (TRAFFIC MODELING)	**ESTIMATED COST**
9. That the City continue to update the Lake Forest Traffic Model (LFTM), as appropriate, and continue to use the latest modeling processes and techniques to insure that the LFTM represents the most accurate depiction of the City's traffic condition.	Paid for with LFTM funds
10. That the City continue to review and monitor the LFTM and update the prioritization of the projects, as appropriate, every 2 years.	Staff and consultant time
11. That the City consider conducting biennial peak hour traffic counts at the intersections in the LFTM and other select locations to help track and identify changing traffic conditions. This will assist in the project prioritization process in the years between the full LFTM updates (usually conducted once every 5 years).	$20,000/year may be partially funded by LFTM
12. That the City consider entering into a master funding and project implementation agreement with the City of Irvine to help expedite project delivery.	Staff Time
13. That the City review possible modifications to existing projects or substitute projects and improvements within the framework of the LFTM for projects that have a potential significant impact on residential properties.	Staff and consultant time ($10,000) may be partially funded by LFTM
14. That the City monitor potential traffic issues in the City of Irvine pertaining to the development in and around the Great Park.	Staff Time
MEETING 5: DECEMBER 22, 2015 (CAPITAL PROJECTS)	
15. That the City continue to use the Two Year CIP as the planning tool for near term traffic and transportation projects.	Staff Time
16. That the City continue to use the 5 Year Strategic Plan to identify projects for future consideration.	Staff Time

DRAFT RECOMMENDATIONS LIST

RECOMMENDATIONS	
17. That the LFTM continue to be updated at appropriate intervals to identify the timing of LFTM improvements and to identify other potential projects.	Funded by LFTM
MEETING 5: DECEMBER 22, 2015 (CAPITAL PROJECTS CONTINUED)	**ESTIMATED COST**
18. That the City continue to update both average daily traffic (ADT) counts and intersection counts in alternating years to provide data that can be reviewed to determine if additional traffic and transportation projects may be justified.	20,000/Year may be partially funded by LFTM
19. That the City continue to provide staff with adequate resources to review and evaluate traffic conditions that may result in recommendations for capital projects.	Staff and consultant time. Costs also listed in #11 and #18
20. That the City limit the acquisition of right of way for capital projects until all other alternatives have been implemented and/or evaluated.	Unknown may affect project costs
21. That the City Council direct staff to look into the feasibility of adding a dedicated right turn lane and signal optimization at the intersection of Bake Parkway and Trabuco Road, with minimal impact to property owners.	Total estimate project cost $680,000 project development $50,000
22. That the City continue to monitor and check the model to ensure that there are not any additional potential enhancements to the arterial street system that the City Council may want to consider in the future.	Funded by LFTM
23. That the City acquire a Traffic Collison Analysis Program that is GIS compatible so that the City can perform an annual Citywide collision review and other.	$7/10K- First Year $3/5K- Each additional year
24. That the City continues to collect as much traffic collision data as possible for traffic engineering review and analysis.	Staff Time
25. That the City maintain at least 5 years of individual collision records in digital format for use in collision analysis in accordance with policies.	Staff Time

DRAFT RECOMMENDATIONS LIST

RECOMMENDATIONS	
26. That the traffic conditions and traffic circulation at all public schools be reviewed on an annual basis. This would include staff review and discussions with school personnel (Principal and /or District personnel) on any possible changes to school traffic controls and/or circulation	Staff Time
27. That the City work with the SVUSD and OCSD to develop school route plans for each of the public schools in the City.	Staff Time
28. That the City review select non- signalized intersections in the City once every 2-3 years to determine if any new traffic signals should be considered for installation. If any new traffic signals are proposed for installation as a result of this process, the City shall provide appropriate notification to affected residents in the area.	10k per update
29. That the City continue to conduct traffic control sign retro reflectivity reviews as necessary to comply with applicable standard and that the City continue provide funding to complete the sign replacements.	Study as part of O & M costs Replacements approximately $20,000 per year
30. That the City request that the County of Orange conduct a study to determine the need for and the feasibility of a trail crossing under Trabuco Road for Serrano Creek Trail.	Staff Time
31. That, where appropriate, the City consider the use of roundabouts in lower speed/lower volume environments in new developments and consider their use when other types of similar traffic controls, such as all way stops, are being contemplated for existing lower speed/lower volume intersections.	Staff Time and consultant time

Ad-Hoc Citizen Traffic Advisory Group Agenda Report
Meeting Date: January 26, 2016
Department: Public Works

SUBJECT:

PRESENTATION AND DISCUSSION REGARDING CARRYOVER CTAG REQUESTS FROM JANUARY 26, 2016, MEETING

RECOMMENDED ACTION(S):

1. Receive a presentation from the Public Works Department regarding the carryover CTAG requests from January; and
2. Discuss and make findings and recommendations, as appropriate.

DISCUSSION:

As part of the Traffic Engineering item in January, staff presented information on traffic engineering related CTAG requests. For two items, the Group agreed to defer the discussion to February in order to allow sufficient time to discuss the items. These two items are as follows:

1. <u>Protective Permissive Left Turn Phasing</u>

Protected/permissive left turn phasing (PPLTP) allows left turning drivers to have a fully protected left turn movement typically followed by a permissive movement where drivers may make left turns when there are appropriate gaps in opposing traffic. The CAMUTCD offers minimal guidance on when PPLTP might be appropriate. However, other resources describe some of the advantages and disadvantages.

Advantages include:

- A reduction in average delay per left-turn vehicle.
- A reduction in fuel consumption and pollution.

Disadvantages include:

- The permissive phase increases the potential for vehicle-vehicle and vehicle-pedestrian conflicts.

- There is a limited ability to use lead-lag phase sequences (commonly used in coordination programing).
- Driver confusion and resistance to change.

In the mid 1990's and early 2000's, cities in Orange County were beginning to consider the use of PPLTP. In some cases, PPLTP was installed, with many of them being conversions from fully protected. In order to provide some guidelines and to promote uniformity in the County, the Orange County Traffic Engineering Council (OCTEC) in 1995 prepared the Protected/Permissive Left Turn Phasing Design and Operational Guidelines. This document was last updated in 2001 (see attached). Generally, the document provides information on the types of traffic conditions where PPLTP could be considered and the design of the traffic signal indications.

Some of the conditions where PPLTP is discouraged include streets with speed limits of 45 mph or greater; streets where drivers would turn across 3 or more lanes; streets where there are inadequate gaps during peak hours and/or non-peak hours; and streets with dual left turns. These criteria would generally mean that most signalized intersections in the City of Lake Forest would not be considered good candidates for PPLTP (see attached map).

The attached map shows Lake Forest intersections in red/yellow/green. Those in red do not meet one or more of the criteria noted above. Those in yellow may meet the general criteria, but have other conditions that raise concerns. In particular, many of the intersections have school crossings across all or some of the legs. In these cases, staff would not recommend allowing permissive left turns across crosswalks where school age children may be present. The only traffic signals that appear to be possible candidates are in the Town Center area. However, even in these cases, there are concerns about potential gaps during the holiday period that could make permissive left turns difficult. In addition, the signals in Town Center proper are isolated locations and are not part of any coordinated corridor. This means that other signal timing techniques can be employed to make the signals more responsive to left turn traffic and at least partially mitigate the time advantage of PPLTP.

The current Traffic Engineering Manager and the City's Traffic Engineering Consultant, Doug Anderson, have both been involved in projects in the past to convert traffic signals with protected left turns to PPLTP. In the mid-1990's, the City of Laguna Niguel converted about 6 traffic signals to PPLTP. Traffic collisions increased at the intersections and the City eventually removed all the PPLTP. The City of Tustin has a similar experience, but they did leave a couple locations with PPLTP.

In the case of Laguna Niguel, the City concluded that most residents had no experience with PPLTP and therefore did not understand the operation. Based on the information in the collision reports, many drivers assumed that it was simply another form of fully protected left turns. If PPLTP had been in wide use in South Orange County prior to the City using PPLTP, then perhaps there would have been better understanding and acceptance.

Recommendations:

a. Based on staff's prior experience; the OCTEC guidelines that suggest that most locations in the City may not be good candidates; the general lack of familiarity with PPLTP in South Orange County; and the potential for an increase in vehicle/vehicle and vehicle/pedestrian collisions, staff would not recommend the use of PPLTP in Lake Forest.

b. Staff does recommend that, where appropriate, modifications to traffic signal operations or timing be considered in place of PPLTP to partially address some of the concerns associated with fully protected left turn phasing.

2. <u>Shasta Lake Road at Serrano Road</u>

Group Member Wieske asked that this intersection be brought up for discussion. At the time of the writing of the report, staff had not been able to contact Member Wieske to get information on the specific concerns. As you can see on the attached aerial, this is a t-intersection in a residential area. Shasta Lake (a residential street) intersects Serrano (a 2 lane collector street) at the inside of a curve and therefore this can reduce sight distance. Currently there are t-Intersection warning signs in both directions on Serrano approaching Shasta Lake, as well as a curve warning sign for westbound Serrano. The eastbound t-intersection sign and the westbound curve warning sign are supplemented with a 35 mph advisory speed limit. In addition, there is a dedicated right turn lane for eastbound Serrano, which not only separates the right turning traffic from the through traffic, but also acts to guide vehicles closer to the centerline, thereby increasing sight distance. This is an example of the creative side of traffic engineering where a striping change can have more than one benefit. Overall the sight distance meets the minimum required and there is minimal collision history, which suggests that there are no unusual conditions at this intersection.

Recommendation:

That the CTAG hear the concerns of Member Wieske and direct staff as appropriate.

ATTACHMENTS:

1. OCTEC PPLTP Guidelines
2. Map of Traffic Signals
3. Shasta Lake/Serrano – Aerials/Photos

Initiated By: David Rogers, P.E., T.E., Traffic Engineering Manager
Reviewed By: Thomas E. Wheeler, P.E., Director of Public Works/City Engineer
Approved By: Thomas E. Wheeler, P.E., Director of Public Works/City Engineer

Informational Report:

Protected/Permissive Left-turn Phasing
Design and Operational Guidelines (Updated)

Prepared by:

Orange County Traffic Engineering Council
Protected/Permissive Left-Turn Phasing Update Committee

Draft Report, May 2001

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B. The "Trap" Explanation
C. Pros and Cons of Protected/Permissive Left-turn Phasing
D. Recommended Signal Head Locations
E. Visibility Considerations

REPORT CONTEXT

This Protected/Permissive Left-Turn (P/PLT) Guidelines Report has been prepared for use as a tool for traffic engineers. Recommendations contained herein are based on national and local (Orange County) agency experience regarding design and installation of P/PLT traffic signals.

This report is based on the work of a prior committee that in 1995 published OCTEC's original PPLT guidelines. The focus of the prior committee was to establish guidelines for P/PLT signal design in order to promote uniformity, which is believed to be a key to successful operation; and public outreach/education, in order to promote better understanding among drivers. The focus of this Update Committee was to:

- Update the Guidelines to conform to best current practices.
- Provide sight distance criteria in keeping with new national standards.
- Provide guidance for selecting left-turn phasing type.

This updated report is intended to stand alone; all relevant information from the prior report has been carried over.

The recommendations and guidelines contained in this report represent the majority judgments of the Update Committee as of May 2001. The Committee recognizes that as new research findings and experience are gathered, the opinions expressed in this report may be modified.

The opinions expressed are not intended to establish usage standards, but to provide the best current, collective opinions and experiences that the Committee majority can formulate. The Guidelines are not intended as a substitute for engineering knowledge, experience or judgment; each user must use his/her own judgment and experience in applying the information contained in this report. The guidelines do not necessarily represent the opinions of all OCTEC members, OCTEC officers, Committee members, and/or their employers. The information in these Guidelines shall be considered in addition to, rather than in lieu of other pertinent and generally accepted manuals. Additionally, such information is intended to serve as an aid in the solution of various traffic situations but it is not intended that any standard of conduct or duty toward the public shall be created or imposed by these Guidelines.

NOTE: Complete OCTEC Protected/Permissive Left Turn Phasing Report is available separately.

Informational Report:

Protected/Permissive Left-turn Phasing
Design and Operational Guidelines (Updated)

Prepared by:

Orange County Traffic Engineering Council
Protected/Permissive Left-Turn Phasing Update Committee

Draft Report, May 2001

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I. SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

This is an overview of the Report's "bottom lines." This brief summary only highlights the various issues that the Committee considered and, therefore, the entire document must be considered to fully understand the various detailed conclusions and recommendations.

A. Conclusions

- While the use of protected/permissive left-turn (P/PLT) traffic signal phasing can significantly reduce overall intersection vehicle delays, fuel consumption, and emissions, the technique is not a panacea in traffic signal phasing and may result in the following:
  - A reduction in "green band width" for system operation.
  - Initial misunderstanding by a portion of the area's drivers.
  - Potential increase in left-turn collisions.
- Improved driver education on "turning left on a green ball" is a challenge that is believed to be the most important step toward effective utilization of the more sophisticated P/PLT traffic signal phasing. This phasing has been used in Orange County since the 1960's, but recently has been gaining more widespread use.
- Uniformity of the traffic signal displays by local agencies is expected to help the driver comprehend and understand the P/PLT phasing and better facilitate the education process.
- Conversely, differentiation of traffic signal displays by type is important to helping drivers understand their differences. A major goal of this report is to help new P/PLT installations to look less like protected-only and more like permissive-only, thereby reducing the chance that a driver may mistakenly interpret the green ball as a protected left-turn indication.
- The traffic engineering profession should be actively involved in the public education process, not just the technical aspects, of P/PLT. To this end, OCTEC has previously:
  - Communicated to the California DMV our recommendations for changes in the "California Driver Handbook" concerning traffic signals (and pedestrian signals).
  - Designed color public information "handouts" on traffic and pedestrian signal operations that can be used as a model by local agencies.

- Developed a draft script for a public service video that will feature a celebrity. If produced, this video could be furnished to local agencies as a part of their educational efforts.

- Traffic engineers and their support staff need to be aware of the various aspects of P/PLT, in order to safely and effectively apply this tool.

B. Recommendations

- Signal displays throughout Orange County should be uniform so that there will be no confusion as to the intended operation. Protected-permissive installations should look similar to each other and should look different from protected-only. The latter goal is accomplished by positioning the five-section "cluster" or "doghouse" head to the right of the barrier line.

- Continue to use the "cluster" five-section signal head mounted on the mast arm and the stacked five-section signal head at the far-left corner as the standard signal displays for P/PLT operations. To accentuate the permissive element of the operation, it is recommended that the cluster head be mounted eight feet (±3') to the right of the barrier line separating the left-turn lane from the adjacent through lane. No additional three-section mast-arm indications are required, but one may be provided on very wide approaches.

- If desired, an R73-7 (Left Turn Yield on green ball) sign may be mounted on the mast arm adjacent to the cluster head.

- Additional considerations:

  - Sufficient sight distance should be provided for drivers turning left on the green ball.
  - Avoid the "trap" situation (see Appendix B).
  - In some system situations, lead/lag full-time left-turn phasing may be more efficient than using lead/lead P/PLT.
  - As the number of approach lanes and the volume and speed of opposing through vehicles increase, the task of selecting a safe gap in oncoming traffic while turning left on a green ball is made more difficult. This factor should be evaluated when considering the suitability of P/PLT.
  - The use of queue detection may be appropriate to minimize the display of the green arrow when the left-turn volume (during a particular cycle) can be adequately served with the green ball only.

- The number of left-turn collisions (that cannot be corrected by sight distance or other operational improvements) warranting use of only full-time left-turn phasing should be determined by each local agency. This determination will require engineering evaluation and will consider the agency's desired balance between minimizing overall traffic delay and collisions.

Overall, the Committee has recognized that the successful technical aspects of traffic signal operations are closely related to the driving public's knowledge of our methods to increase the degree of mobility.

II. INTRODUCTION

The use of protected/permissive left-turn (P/PLT) traffic signal operation has, over recent years, proliferated throughout California and the United States. The P/PLT traffic signal operation provides a dual function where an exclusive left-turn movement, under the arrow display, is followed by a permissive left-turn movement on a green ball (under the leading protected left turn scenario). The green ball indication allows drivers to continue making left turns, as a permissive movement, depending on suitable gaps in approaching traffic. The benefit of this P/PLT type of signal operation is a reduction in stops and delays, which reduces driver frustration, fuel consumption, and pollution.

In 1995, OCTEC published its original P/PLT Guidelines. New research and practitioner's experience since 1995 have indicated a need to update the Guidelines. The program for the January 27, 2000, OCTEC meeting, presented by Mr. Hank Mohle, and Mr. Dave Royer was "Protected/Permissive Signals: Lessons Learned." This presentation summarized the current state of the art in P/PLT implementation, especially with regard to sight distance and signal head positioning. Following the meeting, the OCTEC officers and membership chose to initiate a volunteer effort to update the OCTEC P/PLT Guidelines to reflect current best practices. A Committee was formed consisting of representatives from various Orange County municipalities and consulting firms with a wide variety of professional experience.

The membership of the update committee was as follows:

John Kerenyi,	Kimley-Horn and Associates,	Chair
Mark Esposito,	Hartzog & Crabill	
Jose Alire,	City of Fountain Valley	
Mike Evans,	City of Mission Viejo	
Mark Lewis,	City of Fountain Valley	
Hank Mohle,	Rick Engineering	
Carlos Ortiz,	Robert Bein, William Frost & Associates	
Jim Otterson,	Otterson & Associates	
David Royer,	U.C. Berkeley Institute of Transportation Studies	
Bob Stachelski,	City of Huntington Beach	
Monica Suter,	City of Santa Ana	

The members of this committee would like to continue to recognize the efforts of the previous committee that originally authored this document. Much of this document is the result of their efforts and remains an integral part of the these guidelines. The members of the original committee, along with contact information for the Update Committee members, are listed in Appendix "A."

A. Orange County Protected/Permissive Usage

For years, various P/PLT configurations have been used in Orange County. The City of Santa Ana had an installation on 17th Street and Main Street in the early 1960's that displayed a leading left-turn arrow followed by a green ball for eastbound left turns. This operation allowed the heavier eastbound left-turn movement to start early as a protected phase, followed by permissive movements. Caltrans had a similar operation for the southbound on-ramp signal at Red Hill Avenue and the I-5 Freeway. These displays used four-section heads and a blank amber (i.e. "dark yellow") operation. In the 1970's, the City of Tustin installed P/PLT signals at various locations on Irvine Avenue, Newport Avenue, and McFadden Avenue. The installations used four-section, mast-arm-mounted signal heads with the lower section being a dual-color (yellow, green) arrow display that was switched electronically. This allowed for a yellow arrow clearance interval. The dual-color signal indication was phased out of production, which led to using stacked and cluster five-section heads for mast-arm mountings. Five-section heads are generally considered to be a requirement for P/PLT operation. In the 1980's, the County of Orange installed several P/PLT signals in the Mission Viejo and North Tustin areas; however, most of the installations were designed for ease of conversion to full protected by placing the P/PLT mast-arm head where a future full protected head would be located. The conversion to fully protected operation was ultimately made at most locations. Cities such as Anaheim, Fountain Valley, and Tustin presently have progressive programs for the installation of P/PLT signals. All three agencies, along with installing new P/PLT signals, have converted existing signals (including protected left-turn locations) to P/PLT.

Besides the various signal head display configurations used in Orange County, we also have various placement of the signal heads. As with a fully protected operation, mast-arm and far-left display locations are used; however, both are five-section heads. The existing mast-arm-mounted locations vary from a position in the center of the left lane to somewhere in the number one lane. Actual placement of the P/PLT mast-arm head has typically been determined by the local agency.

B. Previous Study Review

The study of P/PLT has been occurring for decades throughout the United States. Various studies have reviewed signal head displays, lane orientation, operation, warrants, and collision information. Public surveys have been taken to evaluate drivers' perception of P/PLT signal displays and operation. The vast amount of information has become somewhat redundant. Therefore, for the purpose of this

Report, information was selected that either involves the Southern California area or applies to the focus of the OCTEC Committee.

The following is a list of recent articles pertaining to P/PLT that were used by the Committee as references and as general background information. A brief overview of each document is provided. The information is for research only and does not imply endorsement by the OCTEC Committee in general.

1. Fisher, John (LADOT), "Toward Uniform Left-Turn Guidelines," ITE Journal, December 1998. This article proposes a warrant system for selecting left-turn phasing type. Criteria include collisions (including time of day criteria), geometry, gaps, capacity, delay, lane blockage, transit reliability, progression, and livable neighborhoods. The article recommends an incremental approach to providing left-turn phasing; that is, generally providing permissive left-turn phasing by default, then protected-permissive if necessary, then protected left turn phasing only if PPLT is not satisfactory.

2. Signals Technical Committee of the NCUTCD, "MUTCD Requirements for Signal Displays to Left-Turning Drivers," ITE Journal, September 1992. This article summarized the requirements of the 1988 version of the MUTCD with respect to various forms of left-turn phasing, including PPLT. The traffic signal indications are clearly specified, but lateral position of the mast arm-mounted five-section head is not specified. (The recommendations of the OCTEC committee were also double-checked against the new Millennium Edition of the MUTCD.)

3. Shebeeb, Ousama (U.T. Austin + City of Hurst, TX), "Safety and Efficiency for Exclusive Left-Turn Lanes at Signalized Intersections," ITE Journal, July 1995. This article quantitatively examined collision history at 54 intersections with different forms of left-turn phasing located in Texas and Louisiana. The analysts found a correlation between safety and efficiency. Permissive left-turn phasing was most efficient (in terms of left-turn stopped delay) but had the highest left-turn collision rate. Conversely, protected left-turn phasing had the highest left-turn stopped delay but the lowest left-turn collision rate. PPLT phasing was generally intermediate in both categories.

4. Poston, Jim (Reno Transportation Commission), "Flashing Yellow Arrow: Novelty or Nascency?" 1999 ITE International Meeting Compendium of Technical Papers. This paper presented a unique four-section display that allows selection of protected-only or PPLT by time of day, and allows for lead-lag PPLT operation without causing the yellow trap. The paper is an example of novel left-turn phasing techniques that Orange County agencies may wish to consider.

5. Agent, Kenneth (University of Kentucky), "Guidelines for the Use of Protected/Permissive Left-Turn Phasing," ITE Journal, July 1987. The study results reviewed previous recommendations and collision history of P/PLT installations in Kentucky. It was recommended that P/PLT be used as a time-

saving operation, rather than protected-only. However, P/PLT is not recommended for installation when any of the following conditions exist:

- Speed limit exceeds 45 MPH.
- Current signal operation is protected-only and speed limit is more than 35 MPH.
- Left-turn movement crosses three or more lanes of opposing traffic.
- Intersection geometrics require that the left-turn lane have a separate signal head.
- Double (or more) left-turn-only lanes on the approach.
- A left-turn collision problem exists (four or more left-turn collisions in one year or six or more in two years on an approach).
- A potential left-turn collision problem exists as documented by a traffic conflicts study.
- Sight distance limitations.

When P/PLT is used, the following recommendations are made for installation purposes:

- The signal head for P/PLT should be located so that the left-turning traffic does not have a separate signal head (this article recommended positioning the indication over the barrier line; that is, the line separating the left-turn lane from the through lane).
- The five-section cluster head should be used.
- No regulatory sign is necessary.

III. GUIDELINES

A. Use Guidelines

Caltrans Traffic Manual and other studies and reports indicate in their guidelines for left-turn phasing that when left-turn phasing is justified, P/PLT operation should be considered when implementing protected left-turn operation. These guidelines should be used to determine the need for left-turn phasing including the use of P/PLT.

Several additional factors should be considered in order to determine whether P/PLT should or should not be implemented if left-turn phasing is justified. Figure 1 presents a flow chart for reviewing basic traffic signal phasing alternatives including P/PLT. The following is a list of factors that should be reviewed when considering P/PLT:

1. Sight distance restrictions for drivers desiring to turn left should be analyzed in all locations where P/PLT is being considered. Sight restrictions for the left-turning driver are potential collision generators for non-protected left-turn operation, and if no modification of the intersection is possible to provide sufficient sight distance, fully protected left-turn operation is recommended. (See Design section.) Information contained in the NCHRP 383 provides standards for minimum sight distance for left-turning vehicles.

2. The designer should consider the number of acceptable gaps in the opposing traffic stream that are available for permissive left-turns during both the peak and off-peak conditions. Without acceptable gaps in traffic, the successful use of the permissive portion of the protected/permissive operation may be limited and may require different implementation strategies. Without sufficient gaps in traffic, significant delays to left turns are likely to occur and motorists may be more inclined to risk turning during gaps of insufficient size. System modifications may help to improve the availability of gaps by improving vehicle platoons. However, it is important that the gaps occur during periods when a permissive left-turn is allowed. Modification of "termination by gap" programming may be needed to allow vehicles the opportunity to use available gaps. The NCHRP Report 383 identifies appropriate gap size for various roadway conditions.

3. A high-speed approach (45 MPH or greater) of opposing through movement traffic makes it more difficult to identify an adequate gap for the driver attempting to turn left during the permissive portion of the green phase. Experience indicates that, as the approach speed of the opposing through traffic increases, the ability to determine an adequate gap for making a permissive left turn is reduced. The speed of opposing approach traffic should be considered along with the availability of gaps in determining the suitability of P/PLT application and the type of operation that should be implemented.

4. The number of opposing through lanes affects the ability of motorists to identify suitable gaps in traffic. The more opposing through lanes that are present, the more difficult it is to identify a suitable gap and the larger the gap must be. The number of opposing through lanes should be considered in combination with the availability of appropriate gaps and vehicle speeds in determining the suitability of P/PLT application and the type of operation that should be implemented. In general, motorists generally start to have more difficulty identifying gaps when more than two opposing through lanes exist. However, P/PLT operations have been successful with more than two opposing through lanes. Vehicle platooning and lower traffic volumes can make P/PLT an acceptable alternative with three opposing through lanes.

5. Left-turn collisions in one direction may indicate conditions that P/PLT cannot address. If it is determined that the collisions are the result of visibility restrictions or other factors that cannot be corrected by changing the configuration of the approaches, then exclusive protected left-turn operation is recommended. (See Design section.)

6. Two or more left-turn lanes in one direction introduces potential confusion and may affect the judgment of drivers attempting to complete a permissive left turn. Permissive dual left-turns may also impact pedestrian safety. Multiple turn lanes across a permitted pedestrian movement can restrict motorist views of pedestrians in crosswalks. Use of P/PLT is not recommended to serve two or more left-turn lanes in one direction unless pedestrians are simultaneously restricted.

7. The location of advance vehicle detection loops may affect the success of the operation of P/PLT at an intersection. One significant assumption of P/PLT is that two to three motorists will complete a left turn during the change interval (amber indication). The placement of advance detection can affect the number of motorists that me be "trapped" in the "dilemma zone." The actions of these motorists may be difficult to predict or discern by motorists making a permissive left turn during the amber indication. Advance loop detection locations and timing adjustments should be carefully evaluated and incorporated into the design of the P/PLT operation.

8. Geometric conditions or traffic signal coordination may restrict left-turn operations to lead/lag phasing. When this is a requirement at an intersection and it appears that protected/permissive left-turn phasing would be beneficial, the use of the "Dallas" style of designing and implementing P/PLT should be considered. This operation allows for the use of lead/lag operations while eliminating the potential for the "left-turn trap" situation.

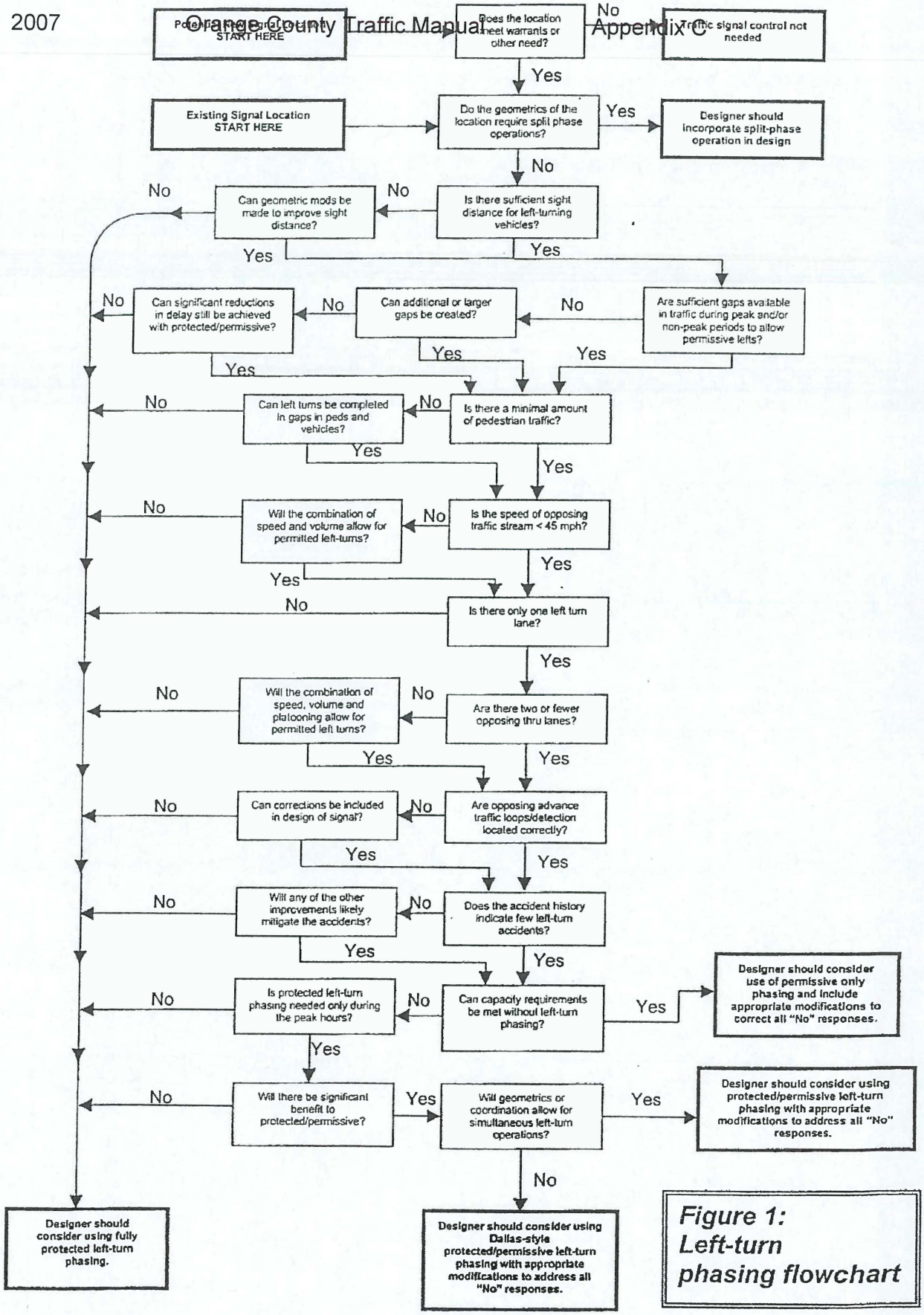


Figure 1: Left-turn phasing flowchart

B. Additional Factors to Consider

1. If there are few or no gaps in the peak hour for the safe movement of a permissive left turn, is there significant gain in reducing overall delay to justify using P/PLT?

2. Is there any way to provide protected left turns in the peak and P/PLT in the off-peaks, and will it be economically feasible? Would this operation introduce a liability factor into the operation?

3. If a signal is operating free and fully actuated and fully flexible in its ability to terminate greens and respond to left-turn demand, is P/PLT effective in reducing delays?

4. Is there a need for P/PLT operation at some level below fully protected left-turn warrant satisfaction?

5. **Implementation of P/PLT must include a guaranteed red interval for through traffic prior to the showing of the protected portion of the left-turn phase, under all conditions, in order to eliminate the possibility of a "trap" situation.** This can either be a secondary phase green or an all-red interval if there is no demand on any secondary phase. A more complete description the "trap" situation is provided in Appendix B.

IV. OPERATIONS

A. Why Use Protected/Permissive Left-Turn Phasing?

From an operational standpoint, the purpose of using P/PLT phasing operation is generally to **reduce delay.** It is an especially effective remedy for reducing left-turn vehicle delay when operating a coordinated fixed-cycle-length timing plan at an intersection. By providing the ability for left-turn vehicles to turn left during permissive gaps in the through phase, required left-turn green phase time can be reduced, therefore reducing minimum required cycle length for the intersection, and hence reducing delay for all vehicles in all non-sync phase movements.

Along with travel time savings, other associated benefits of reduced delay include reduction in fuel consumption and vehicle pollution, thus improving air quality. The Committee also recognizes that motorists sometimes become frustrated at fully protected locations during off-peak hours and illegally turn in spite of the red arrow. This is one safety consideration related to fully protected operations, and motorists can develop an indirect disrespect for traffic control devices in general, as their frustration level increases.

Other factors may cause agencies to consider P/PLT. Intersections operating with protected left-turn phasing under unwarranted conditions may realize improved operations with P/PLT. Another use of P/PLT may be as a solution for left-turn capacity constraints when right of way is not available for a second left-turn lane. However, caution should be taken when operating P/PLT under high capacity levels as discussed later.

B. The "Trap" and Real World Considerations

When operating P/PLT, the protected portion of the left-turn movement may be either simultaneous **leading** or **lagging**. Leading left turns are the most common, as they are generally more operationally efficient. Combination lead/lag operation may be a desirable use at an intersection to promote arterial progression, since through greens are not constrained to start simultaneously. **However, lead/lag operations can incur "trap" situations** (see Appendix B for the "trap" explanation). Lagging left turns may be an effective way to clear left-turn queues at intersections, although for P/PLT they should begin simultaneously.

An important operational factor to consider with P/PLT is the impact on arterial progression. Many agencies take advantage of lead/lag left turns to maximize green bandwidth. But under P/PLT operation, agencies may not want to design around the "trap" scenario. With the standard P/PLT indications **no lead/lag operation is possible without the "trap" scenario unless it is a "T" intersection**. However, the "Dallas style" P/PLT operation enables a lead-lag operation while effectively addressing the "trap" situation, as may other custom solutions.

C. Queue Detection

With continual advancements in controllers and signal systems, possibilities exist to operate P/PLT under certain times of day. An operation commonly used that is similar to a "combined" phasing is to fully take advantage of P/PLT operation during off-peak hours by not bringing up the protected left-turn arrow unless there is a predetermined threshold of vehicles in the left-turn lane. This operation requires special left-turn queue detection.

The utilization of a queue detector system, usually located 50 to 80 feet from the limit line in the left-turn lane, provides a logic mechanism to display the green arrow only when there is a queue so long that the left-turning volume cannot be served by the "green ball" only on that particular phase. With only the "green ball" under many situations of opposing Through traffic, the left turners will find an adequate gap in the opposing Through traffic and/or they will be able to make their left turn during the "yellow ball" clearance period. The exact distance back of the limit line to set the queue detector depends on the designer's judgment on the number of vehicles in the queue that warrants "bringing up" the green arrow at the predetermined time in the particular signal cycle. Some agencies, such as Los Angeles, consider bus activity in placing queue detectors.

In many installations, if the queue detector is occupied at the time in the cycle for the left arrow phase to begin, the left-turn lane will be displayed a green arrow. After the start of the left-turn arrow, the timing of the arrow is transferred to the "up close" loops in the left-turn lane for green arrow gap timing with a predetermined maximum time.

It is recognized that there is much to be learned in operating the most efficient queue detection system, including the prediction of the number of adequate gaps that will be available in the opposing through traffic so that the number of vehicles that could turn left in the gaps can be estimated. In most situations, two cars can make a left turn during the clearance interval (amber display). This means that if the intersection is operating on an 80-second cycle length, there would be 45 cycles per hour or 90 cars per hour turning left **without** the need to take time away from the opposing through traffic phase to serve the left turners. In addition to these "yellow clearance" left turners, under many conditions during the day, the left-turn demand can be satisfied by the gaps in the opposing through traffic, thereby increasing the capacity of the left-turn lane without the need for the green arrow.

D. All-Red Considerations

Intersections near major event generators can be good candidates for P/PLT operation. This would occur at an intersection with nominal cross-street traffic volumes most of the time, but with heavy directional flow on the cross street during events. An agency can operate the cross street under P/PLT and change the phase sequencing to run opposed (or "split") phasing on the cross street during event periods.

Agencies operating P/PLT may consider increasing "all red" time following through greens and yellows for permissive left-turn vehicle movements during the clearance interval (i.e., sneakers). However, experience indicates that once motorists become aware of the "all red," they begin to utilize it similar to a yellow clearance interval.

E. Switching between PPLT and Other Modes

It may be desirable to turn off P/PLT during unfavorable gap acceptance periods (i.e., peak). This operation, however, would require a custom application such as:

- A six-section head with a red arrow display for exclusive protected left-turn control.
- The system recommended by Jim Poston (see the "Previous Study Review" section for a reference).

To our knowledge, no Orange County agency has implemented a system that switches between PPLT and another form of left-turn phasing by time of day.

F. Survey of Orange County Agencies

The prior committee's survey of Orange County agencies revealed a desire for regional uniformity. Region-wide consistency on head design (cluster vs. vertical), head placement on the mast arm, and possible use of supplemental signing are most desirable. Agencies that have implemented many P/PLT signals have found that the operation works best when implemented on a corridor- or area-wide basis.

V. DESIGN

A. Introduction

The design element of this report is not intended to be used as a standard of practice for the design of P/PLT phasing. It is, however, intended to add uniformity and consistency in the design of traffic signals utilizing P/PLT phasing. Its use as a reference guideline could be extremely beneficial for traffic design professionals to facilitate design of different scenarios facing today's designer, ranging from a "T" intersection to a fully actuated eight-phase major arterial intersection.

The Update Committee has endeavored to incorporate the most recent hardware and software advances, as well as leading-edge operational practices and philosophies.

These design guidelines attempt to dispel long-standing myths associated with P/PLT phasing and address technical questions concerning operation, design, timing, peak-hour use, and indication placement. Its advantages and disadvantages, geometric constraints, and design characteristics are discussed in detail to allow the designer to be more informed and to make intelligent design decisions.

Being consistent in the design of P/PLT signal phasing is a two-fold proposition: first of all, it will help driver initiation, recognition, and acceptance of this particular form of phasing; and second, it will assist the governing agency to operate, program, and maintain this phasing system.

B. Description of Operation

The particular types of left-turn signal phasing possibilities are as follows: lead/lead, lag/lag, lead/lag, and lag/lead. It seems that for as many different intersection configurations that exist today, there are an equal number of available operating possibilities and phase sequences. The four conditions mentioned previously are the four sequences specifically analyzed for these guidelines.

C. Design Characteristics

This section has been compiled to point out many of the pros and cons the P/PLT designer might encounter (see Appendix C for summary). Review of the pros and cons will assist the designer in determining whether or not it is appropriate to implement this particular type of left-turn phasing at any given location. Also, for determining mounting and signing locations at new, modified, or retrofitted intersections, please review the technical diagrams in Appendix D for desired head placement, sign placement, and indication type considerations.

D. Recommended Design Characteristics and Equipment

This section provides the engineer/designer a brief overview of the recommended equipment and design characteristics for P/PLT phasing.

For further explanation or clarification on any of the recommendations outlined below, please refer to Appendix D at the end of this report.

The recommendations are as follows:

1. Use a five-section cluster head for mast arm mounting only.

2. The five-section cluster head should be placed as follows:

   a. For intersections with one approach lane and a separate left-turn lane, a cluster head should be mounted over the center of the through lane, along with a pole-mounted three-section head for through traffic.

   b. For intersections with two or more approach lanes and a separate left-turn lane, a cluster head should be mounted eight feet (±3') to the right of the barrier line, along with a pole-mounted three-section head.

3. Far-left indications should be a five-section stack head type. All configurations shall have a far-left indication.

4. Use left-turn pocket detector switching or back-up protection to avoid the "trap" situation.

5. Use queue detectors to call protected periods (see Operations section).

6. No sign is required; however, if one is desired by a particular agency, then an R73-7 "Left Turn Yield on 'green ball'" may be used.

7. A four-section stack head type is recommended for use at "T" intersections or one-way streets with lagging left turns. Clearance time is during the yellow ball.

8. A supplemental three-section head on the mast arm is not required but may be provided on very wide approaches.

9. Queue detection should be considered as a part of any P/PLT installation. Many methods exist to implement this design feature, which allows greater signal efficiency. See the Operations section for discussion on the operational parameters.

In order to modify a traditional left-turn phasing intersection into a P/PLT phasing intersection and to reuse existing equipment or hardware, the designer should consider all relevant modifications.

E. Geometric Constraints

The provisions listed in this geometric constraints section is a partial check-list of unfavorable geometric conditions that may exist at certain locations and to help determine if the proposed location is adaptable to P/PLT phasing.

- Horizontal curves creating sight distance problems (see discussion on sight distance problems in the Guidelines section and in Appendix E).
- Vertical curves creating sight distance problems (see discussion on sight distance problems in the Guidelines section and in Appendix E).
- Wide medians could obstruct sight distance (see sight distance considerations in Appendix E).

F. Sight Distance

The terms "gap" and "sight distance" are used to explain and clarify two important aspects in relation to protected/permissive left-turn phasing signal operation. Both of these terms have a direct relationship and importance for the left-turning motorist making a left turn on a "green ball" signal (permissive period).

When a motorist makes a "protected" left turn on a "green arrow," the left turner has the right-of-way and is given an unrestricted pathway for making the left turn. This left-turning motorist will logically assume that all conflicting pedestrian and vehicular movements are not allowed to conflict with the left turner's left-turn movement. Under normal circumstances, the left turner's attention is primarily focused on the "green arrow" signal, and secondarily on possible obstructions in the left-turner's pathway.

When the left turner is making a left turn on a "green ball" (permissive left turn), the situation is significantly different.

The typical "permissive" left-turn operation (left turn on green ball) in full execution involves the following generalized incremental steps by the motorist making the left turn:

1. Left-turning motorist observes oncoming (opposing) vehicles as he/she drives the vehicle into the street intersection area.

2. Left-turning motorist evaluates the available openings, or "gaps," in the opposing traffic stream and conflicting pedestrian movements. The "gaps" are the clear distances between approaching vehicles.

3. Left-turning motorist makes the left turn if the motorist's evaluation of the "gap" in the opposing traffic results in the conclusion that an adequate "gap" is available so that the left turn can be safely completed.

4. If the left-turning motorist's evaluation of the available "gaps" (spaces) in the oncoming (opposing) traffic stream results in the conclusion that there is not an adequate "gap," the left-turning motorist will normally (and should) wait in the intersection until he/she sees the yellow ball signal *and* observes that the

opposing vehicles are slowing and will be stopping for the red signal; after which the left turn is completed on the yellow signal, at the end of the yellow signal, or during the red clearance interval.

In cases when there are not enough adequate "gaps" in the opposing traffic stream, and there is a heavy demand for left turns, the particular signal control for the left-turn movement may incorporate a "queue detector" which changes the operation from "permissive" to "protected." That is, when the number of cars waiting at the signal in the left-turn lane equals or exceeds approximately three or more, the signal has the capability of detecting this queue length and provides that the left-turning vehicles will be given a green arrow.

Protected left-turn operations can also be triggered using "first car detection." With this operation, the protected left turn is triggered whenever any car is present in the left-turn pocket at the point in the cycle when a left-turn arrow can be provided.

For the left-turning motorist making a left turn on a green ball, the availability and determination of an adequate "gap" is important to the safe operation of this type of left turn. It is important to recognize that the "gap" in the opposing approaching traffic stream can be created in the following two ways:

- Density of the opposing traffic stream determines the number of seconds or distance between the opposing vehicles.
- Platooning of approaching vehicles due to an upstream traffic signal operation.

Sometimes roadway alignment conditions may limit the left-turning motorists' ability to observe the "gaps" in the approaching traffic stream in adequate time to make the permitted left turn. Standards for sight distance of approaching vehicles are discussed below.

"Gap" Standards

Prior to the publication of NCHRP Report 383 titled "Intersection Sight Distance," by the Transportation Research Board of the National Research Council in 1996, the standard for sight-distance evaluation was based on stopping sight distance. This means that the opposing through-movement vehicle was expected to have adequate distance to stop for the left-turning vehicle assuming that the left-turning vehicle stopped or was in the direct line of the opposing through-movement vehicle. The new standard now relates to having adequate "gaps" in the flow of traffic along the major road opposing the left-turn movement so that it is now the left turner who has adequate "gaps" in the opposing stream. While the new standard is given in "seconds," the "gap" distance can be determined as the product of "gap" in seconds and the vehicle speed in feet per second. Table 1 titled "Recommended Travel Times for Determining Sight Distance for Left Turns from the Major Road Across Opposing Traffic Lanes," as shown on page 81 of NCHRP Report 383, provides the current acceptance standard for "gap" spacing or sight distance wherever left turns are made from the major road across opposing traffic lanes.

Table 1 (Table 37 from page 81 of NCHRP Report 383) and its accompanying note are shown below.

TABLE 1:
Recommended Travel Times for Determining Sight Distance for Left Turns from the Major Road Across Opposing Traffic Lanes (Gap Acceptance)

Vehicle type	Travel time (sec) at design speed of major road
Passenger car	5.5
Single-unit truck	6.5
Combination truck	7.5

Note: For left turns that must cross more than one opposing lane, add 0.5 sec per additional lane for passenger cars, and 0.7 sec per additional lane for trucks.

As noted in the above table, the travel times or "gaps" shown in the table (for instance, 5.5 seconds for passenger cars) are for left turners crossing just one opposing lane of traffic. If there are two opposing lanes of traffic to be crossed by the left-turning motorist, the table indicates that an additional one-half second should be added to the 5.5 seconds, thereby providing a total required "gap" of 6 seconds for left turners crossing two opposing through lanes of traffic.

While Table 1 shows the "gaps" in terms of seconds, the distance requirement between vehicles, or from the intersection to the nearest sight obstruction, can be converted to distance in feet by multiplying the travel time in seconds required for the particular speed in feet per second. The required minimum "gap" establishes the sight-distance requirement. The previously used standard using "stopping sight distance" (in feet) did not relate to the left turner but referred to the vehicle opposing the left turner.

Determining the "Design Speed"

It is recommended that in those instances where the particular agency does not have a "design speed" designated for the particular street segment, one of the following two alternative procedures be used to determine the "design speed" for the approaches to the particular intersection.

The alternatives are as follows:

AASHTO Procedure

Using Figure II-22, *Relation of Average Running Speed and Volume Conditions* (p. 70 of "A Policy on Geometric Design of Highways and Streets," 1994), and the average speed recorded for the particular street approach to the intersection, the "design speed" can be estimated using the appropriate traffic volume curve. A copy of Figure II-22 is included in Appendix F for reference.

Procedure Based on 85th Percentile Speed

To determine the design speed from the 85th percentile speed, the following procedure is recommended:

- If the 85th percentile speed is at a 5 MPH increment, the design speed would be assumed to be 5 MPH higher (e.g. 45 MPH 85th percentile, 50 MPH design speed).
- If the 85th percentile speed is not at a 5 MPH increment, the design speed would be assumed to be 5 MPH higher than the next highest 5 MPH increment (e.g. 46 MPH 85th percentile, 55 MPH design speed).

Other examples include:

85th Percentile	5 MPH Increment	Design Speed
40 MPH	40 MPH	45 MPH
43 MPH	45 MPH	50 MPH
52 MPH	55 MPH	60 MPH
39 MPH	40 MPH	45 MPH

Based on this procedure, the design speed will range from 5 to 9 MPH above the 85th percentile speed.

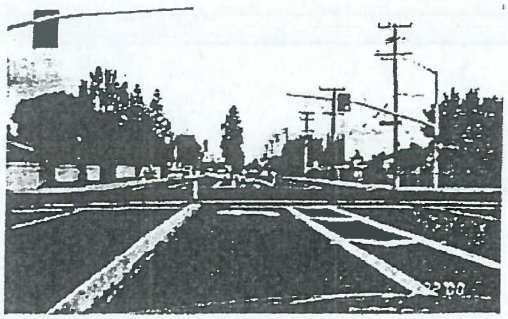
Positive Offset Left-Turn Lanes

In some cases, the policy in implementing protected/permissive left-turn phasing involves the offsetting of the left-turn lanes so that left-turning vehicles have a clear sight line of opposing through traffic which is not restricted by vehicles in the opposing left-turn lane.

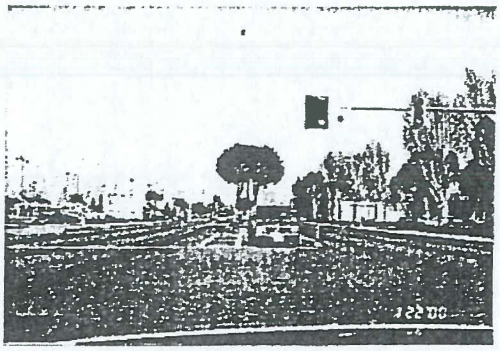
Figure 2, titled *Examples of "Positive Offset" Left-Turn Lanes at Signalized Intersections*, shows some examples of left-turn lane geometrics designed so that the driver in the left-turn lane can see approaching through traffic (i.e., past the vehicles in the opposing left-turn lane).

Appendix E illustrates examples of positive and negative offset.

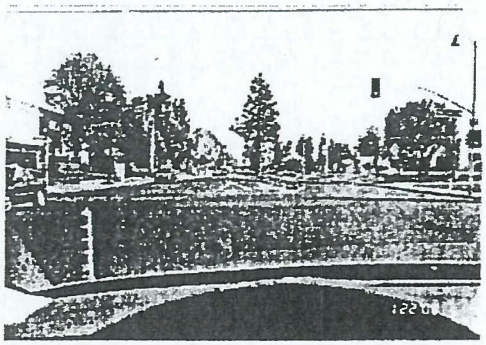
Left turn "positive offset"



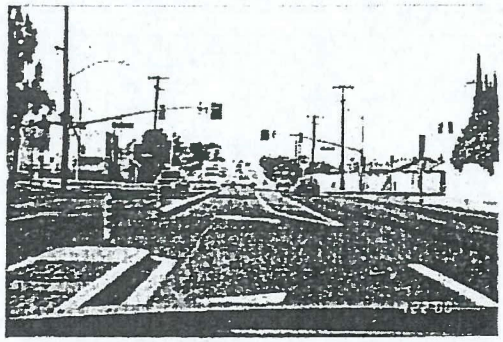
Example of left turn lane
to create "positive offset" for
visibility of opposing thru vehicles



Shows how "positive offset"
allows good view of on-coming
thru vehicles for permitted
left turn driver



Example of a "positive offset"
at a two phase signal



Shows narrowing of median
nose to create "positive offset"

Photos taken in Fountain Valley

HMA	Examples of "positive offset" left turn lanes at signalized intersections	FIGURE 2

G. Signal Indications

As the variety of signal displays for similar movements by agencies increases, so does driver confusion. There is a need for the driver to be able to associate (identify) specific indications for specific movements. These design guidelines will help resolve some of the problems with conflicting displays.

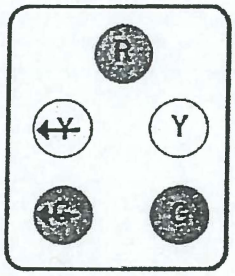
To aid drivers in movement identification, the following recommendations for protected/permissive signalized intersections are made:

1. The cluster head be used exclusively for left-turn displays on mast arm mount.
2. Three-section vertical heads only (on the mast arms) for Through movements (for two or more approach lanes and a separate left-turn lane).
3. Five-section stack heads should be used for far-left indication.

A graphic display of the signal heads, their uses, and their functions are discussed as follows:

Common Name:

Cluster Head (aka "Doghouse")



Uses: Mast-arm mounting. PPLT phasing.

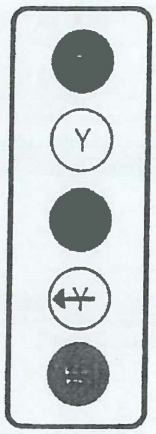
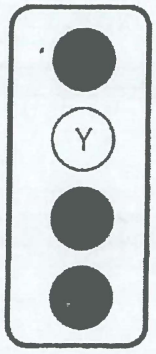
Sign: (if used) R73-7 "Left-Turn Yield on 'green ball' (others possible)

Advantages: Distinctive indication arrangement, which alerts drivers to the P/PLT operation. Consistent with heads already in use.

Disadvantages: May be confusing to first-time users.

Note: Due to the distinctive shape of the cluster head and the Committee's desire to distinguish P/PLT operations, it was determined that this head should be used only for P/PLT operation (for the mast arm indications).

DRAFT

Common Name:	Five-Section Stack	Common Name:	Four-Section Stack
			
Uses:	Far-left mounting. P/PLT phasing.	**Uses:**	Far-left and mast-arm mounting. P/PLT phasing at "T" intersections and where lagging left turns are used.
Sign: (if used)	R73-7 "Left-Turn Yield on 'green ball'."	**Signs:** (if used)	R73-7 "Left-Turn Yield on 'green ball'."
Advantages:	More consistent with traditional displays. Consistent with existing installations. (TV-1-T mounting recommended.)	**Advantages:**	Compact size and ease to recognize. (TV-1-T mounting recommended.)
Disadvantages:	Not as compact as the cluster head. May not be identified by drivers as a P/PLT operation.	**Disadvantages:**	No yellow arrow display.

Note: Numerous other signal head configurations are in use today that cannot be listed separately here. Only commonly used configurations are illustrated in this section.

H. Summary

Use of the P/PLT phasing sequence is a viable operational parameter during non-saturated traffic flow condition. Through the use of accepted updated traffic signal equipment, the installation, operation, and maintenance of these systems is an acceptable alternative to conventional left-turn design. Most people would prefer not to remain at a signalized intersection any longer than possible. At the same time, P/PLT saves the commuter time and increases the efficiency of the signal systems, which translates into fuel efficiency and less driver frustration.

It is always a good idea to remember that many locations are not well suited for this form of operation, such as arterials with high approach speed, multiple left-turn lanes, vertical and horizontal alignment problems, and high left-turn collision history. Therefore, extra care should be taken when designing a new P/PLT phasing intersection or in the modification of an existing conventional left-turn phasing intersection.

The benefit of using the protected/permissive operation is clearly in time savings and pollution reduction. This is a trend that has far-reaching impacts. Most public agencies using this system have reduced stop delay, fuel consumption, and citizen complaints.

The Committee acknowledges this operation is not ideal for every situation, but recommends considering this type of left-turn phasing at locations that could benefit from P/PLT phasing.

VI. PUBLIC AWARENESS AND EDUCATION

A. Summary of Prior Efforts

The previous PPLT Committee organized a major public education campaign with the following features:L

- Revisions to the State of California Department of Motor Vehicles (DMV) Driver Handbook to educate drivers about PPLT.
- Preparation of public information bulletins and hand-outs, also to educate drivers about PPLT.
- Preparation of a script for a Public Service Announcement video.

The current committee's efforts were focused on updating the guidelines to conform to best current practices, in part to reduce the need for public education. Therefore, no additional public education campaign was undertaken.

Appendix A:

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and the

Original PPLT Committee

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Appendix B:

The "Trap" situation explained

Appendix B: The "Trap" Explanation

This appendix contains diagrams to explain the "trap" situation which shall not be permitted when protected/permissive left-turn phasing is used.

The "trap" occurs when a person turning left on a "yellow ball" crosses in front of opposing thru traffic that continues to be controlled by a "green ball."

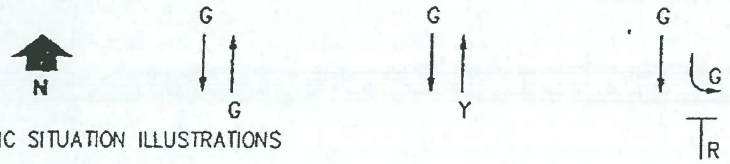
A basic driving assumption is that when a driver is turning left on a "yellow ball," the opposing thru traffic is also observing a "yellow ball" and, therefore, the opposing thru traffic will be stopping on the "red ball" following the "yellow ball." The driver turning left on the "yellow ball" must be assured that this basic assumption is true.

The diagrams were furnished by Brian Gallagher, P.E., Transportation Engineer, Signal Systems and Research Section, Department of Transportation, City of Los Angeles. Brian's valuable contribution to the original PPLT Committee's work is hereby acknowledged with sincere appreciation.

THE "TRAP" ILLUSTRATED

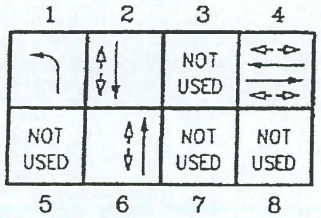
1) QUESTION – What is a "left turn trap" ?

2) ANSWER – This is a "trap" for Northbound & Westbound left turns. The left turns are permissive.



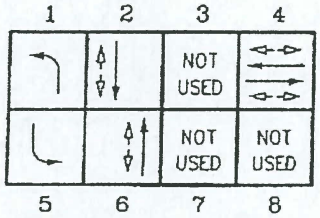
3) SPECIFIC SITUATION ILLUSTRATIONS

A)



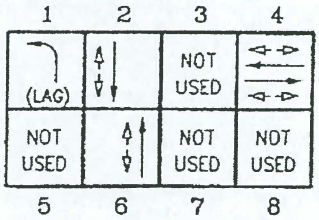
Trap for S/B Left–Turn if ø4 not on recall or ø1 does not place a call to ø4.
ø1 can be either Protected–Only or Protected/Permissive.

B)



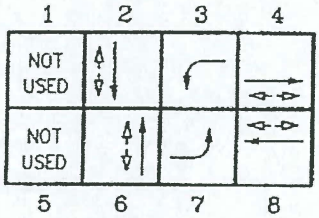
Trap for either N/B Left–Turn or S/B Left–Turn if there is no ø4 call and both Left–Turn Phases do not come up simultaneously.
Only applies if ø1 and ø5 are Protected/Permissive Left–Turn.

C)



You can Not have a Lagging Permissive/Protected Left–Turn when the cross street is 2–way.
This would be acceptable (and preferred) if the East–West street shown was One Way Westbound.

D)



As long as ø2 and ø6 are on recall, this is O.K. for Protected only or Protected/Permissive Left–Turn in either ø3, ø7 or both.
See note "C" regarding Lagging Permissive/Protected.

RULES:
1. If Left–turn phase for only 1 of 2 directions, use call to phase or min. recall for side street.
2. Don't use Lagging Permissive/Protected left–turn phases when a one–way street or T–intersections is Not Involved.
3. Even a 2–phase intersections a left–turn trap can occur during preemptions – BE CAREFUL.

Page 1 of 1
JULY 22, 1994

Appendix C:

Pros and Cons of PPLT

Appendix C:

Pros and Cons of Protected/Permissive Left-Turn Phasing

Pros:

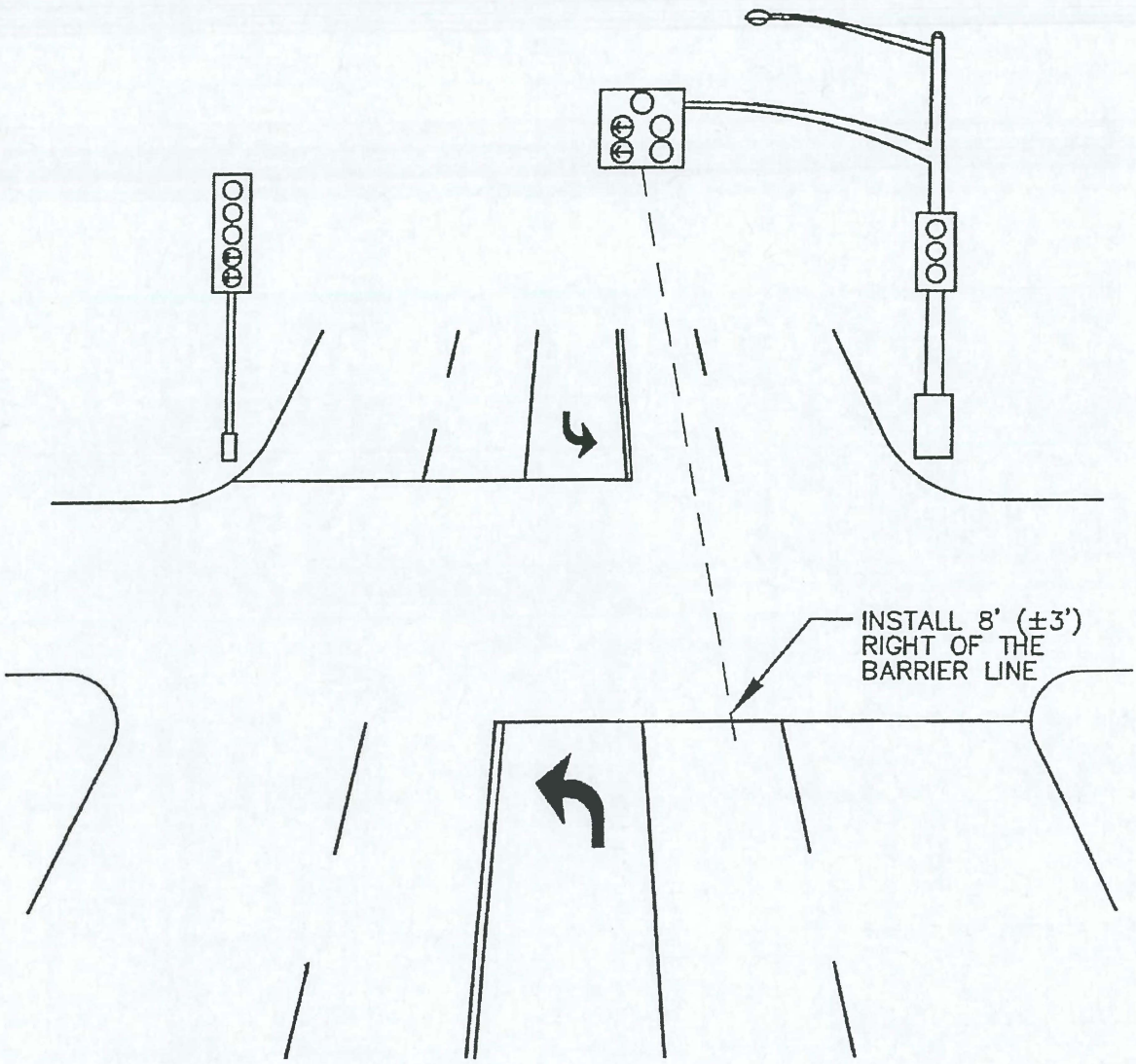
- Reduces delays and stopped time on coordinated systems.
- Allows for selective use of shorter cycle lengths at each intersection.
- Reduces fuel consumption.
- Reduces pollution.
- Provides high signal system efficiency (slightly less than only permissive in the worst case and as good in the best case) because it allows for all left-turn phasing combinations (with special equipment), thus producing the best fit into the green band, while still providing protected left turns. This benefit is high both during peak travel periods, when protected lef-turn phasing has the greatest effect; and off-peak, when the larger number of acceptable gaps in through traffic allow left turners to proceed without waiting for the green arrow.
- Fewer right-angle accidents may occur than under permissive-only operation, due to the presence of the protected lef-turn phase.

Cons:

- Lost time due to various measures required to prevent left-turn trap phasing situations.
- Driver confusion and resistance to acceptance.
- More right-angle accidents may occur when compared to protected-only.
- Signal head configuration and placement not uniform throughout the area.
- Arterial system timing is difficult to use with protected/permissive operation.

Appendix D:

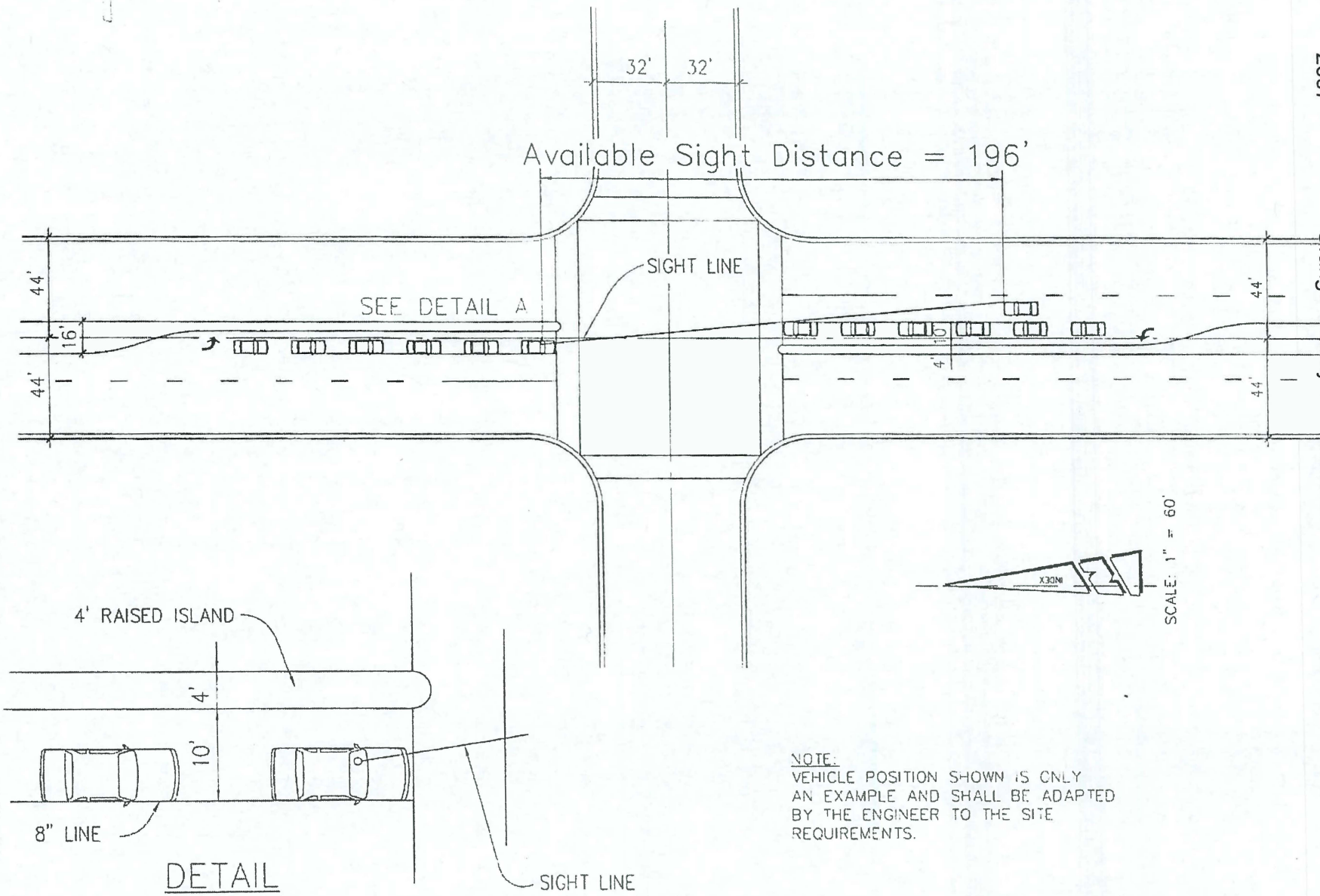
Recommended Signal Head Locations



Appendix D:
Recommended Signal Head Locations

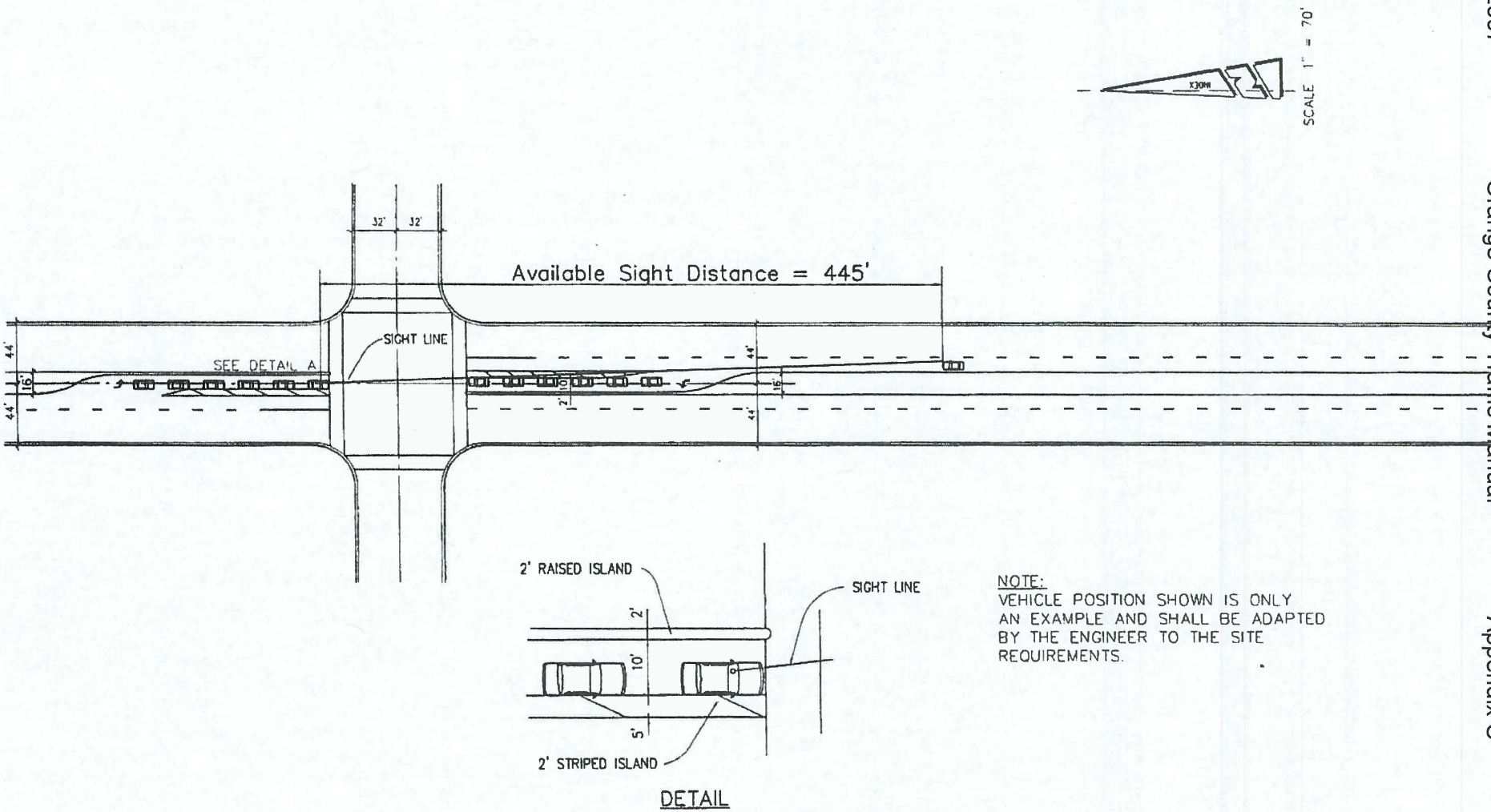
Appendix E:

Visibility Considerations



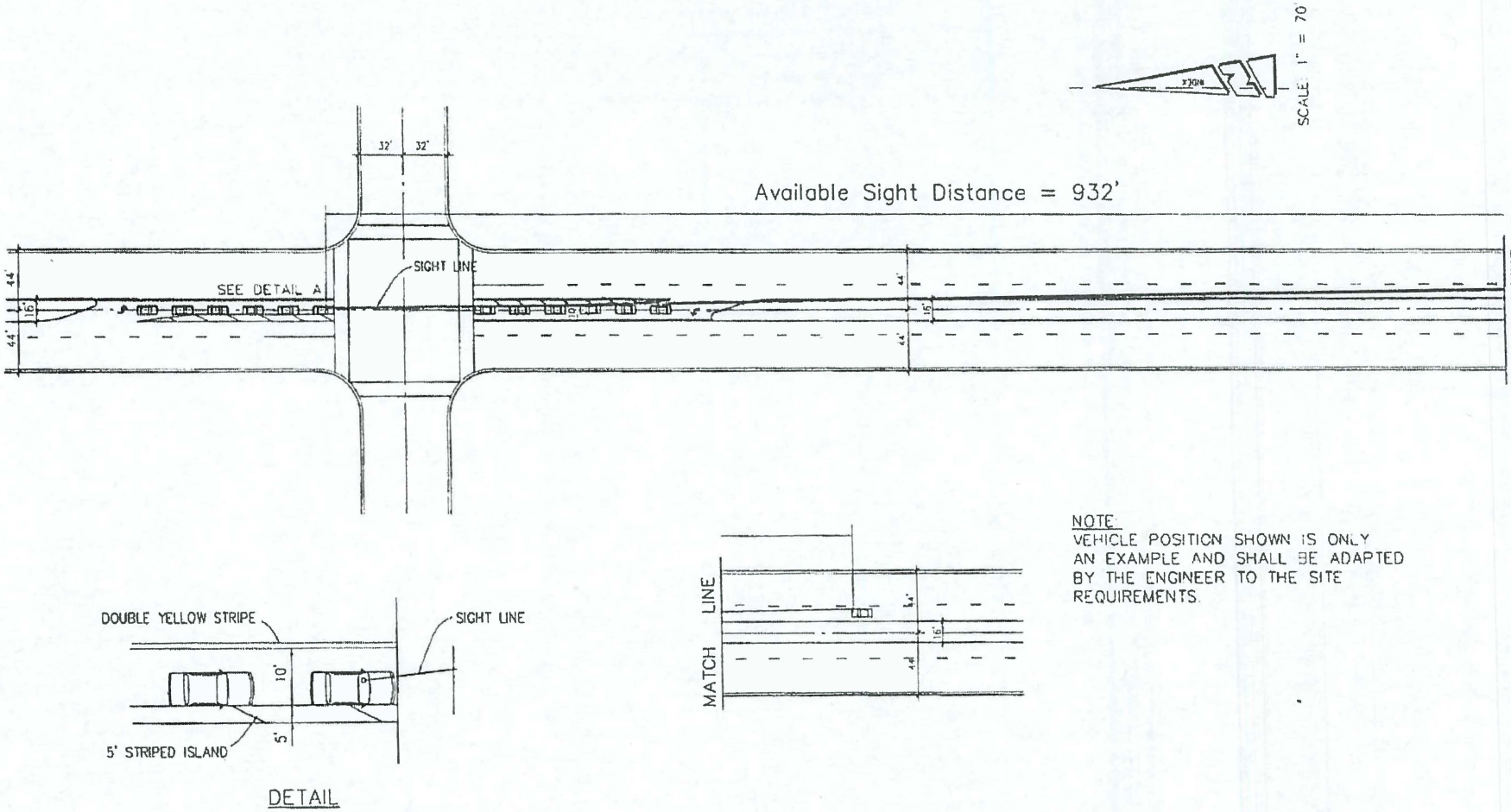
NOTE:
VEHICLE POSITION SHOWN IS ONLY AN EXAMPLE AND SHALL BE ADAPTED BY THE ENGINEER TO THE SITE REQUIREMENTS.

OCTEC	Visibility Consideration for Left Turning Vehicles– Straight Roadway with Standard Islands	FIGURE E–1

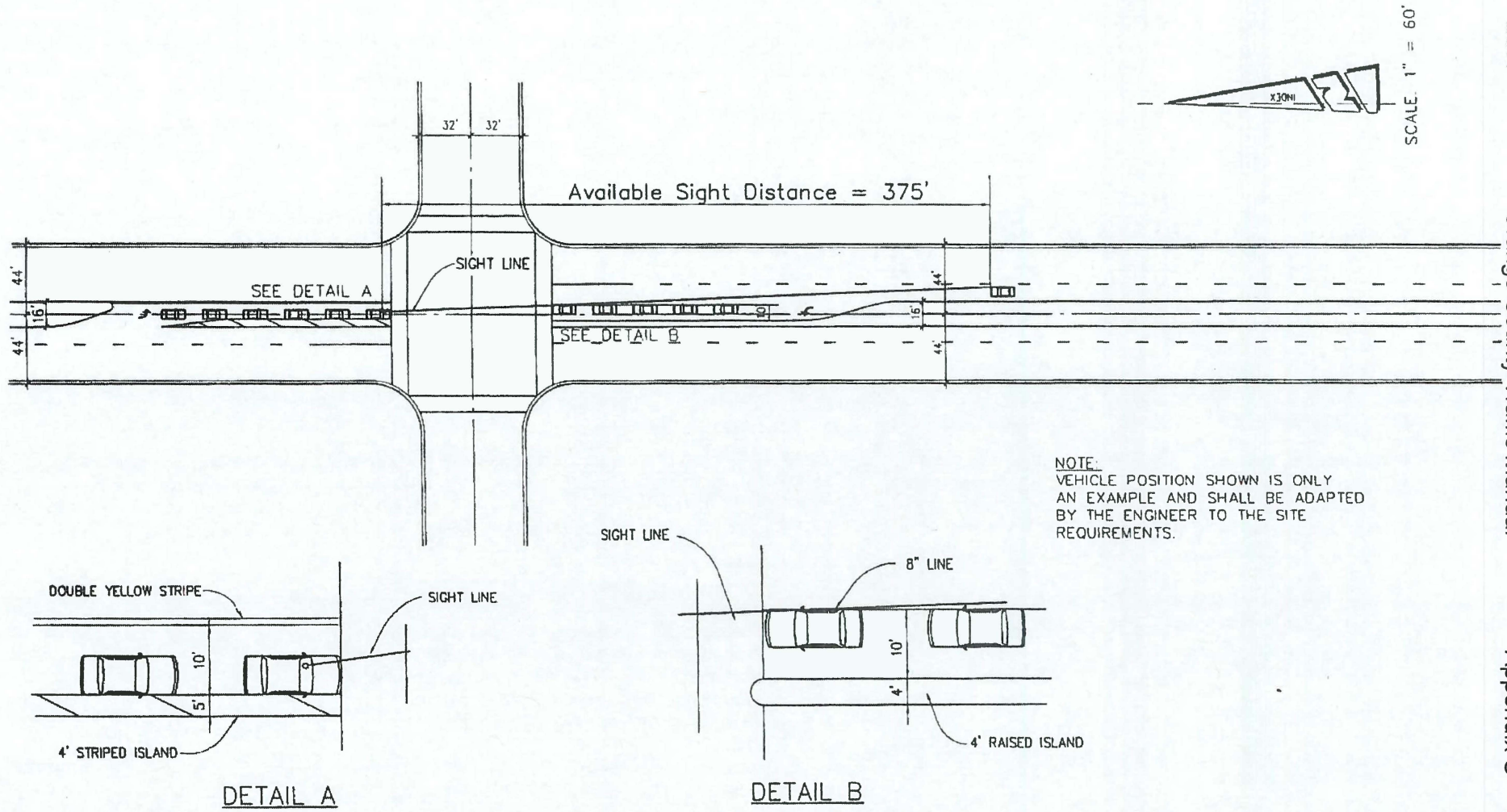


NOTE:
VEHICLE POSITION SHOWN IS ONLY AN EXAMPLE AND SHALL BE ADAPTED BY THE ENGINEER TO THE SITE REQUIREMENTS.

OCTEC	Visibility Consideration for Left Turning Vehicles– Straight Roadway with 2–Foot Noses	FIGURE E–2



OCTEC	Visibility Consideration for Left Turning Vehicles– Straight Roadway with Double–Yellow Lines	FIGURE E–3



OCTEC	Visibility Consideration for Left Turning Vehicles– Straight Roadway with Double–Yellow Line and Opposing Standard Island	FIGURE E–4

4.2.3 Protected-Permissive Left-Turn phasing

A combination of protected and permissive left-turn phasing is referred to as protected-permissive left-turn (PPLT) operation. This phasing pattern is illustrated in figure 28. A typical signal head and associated signing arrangement that implements protected-permissive phasing is shown in figure 29; refer to the MUTCD for other configurations.

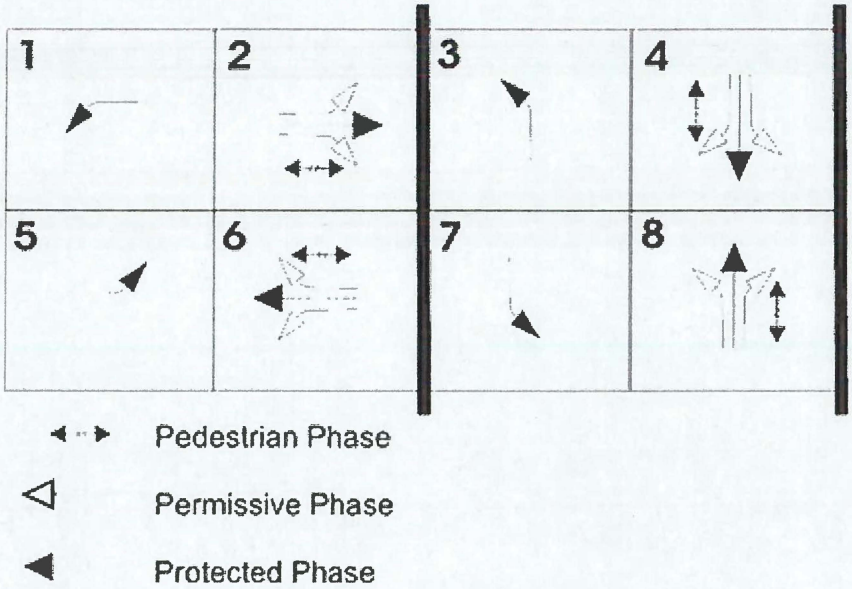
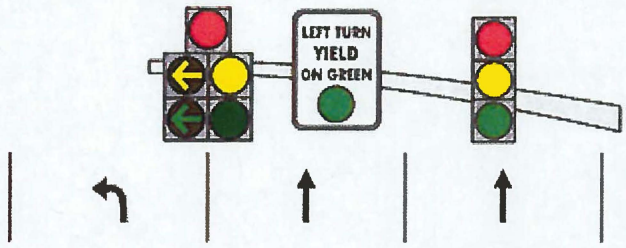
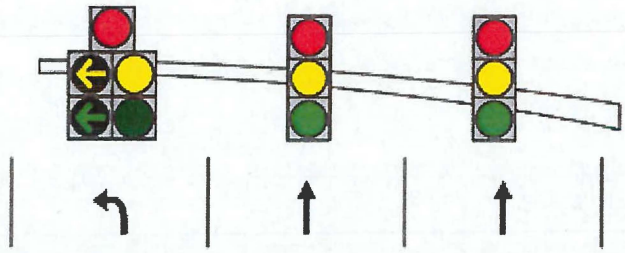


Figure 28. Typical phasing diagram for protected-permissive left-turn phasing.



(a) Protected-permissive left-turn phasing using a five-section head located directly above the lane line that separates the exclusive through and exclusive left-turn lane, along with an accompanying sign.



(b) Protected-permissive left-turn phasing using a five-section signal head located directly above the exclusive left-turn lane.

Figure 29. Possible signal head and signing arrangement for protected-permissive left-turn phasing.

Observed improvements in signal progression and efficiency combined with driver acceptance have led to expanded usage of PPLT over the years. PPLT signals offer numerous advantages when compared to "protected-only" operation. These advantages are associated with both protected-permissive and lead-lag operation. They include the following (adapted with additions by the authors):[48]

- Average delay per left-turn vehicle is reduced.
- Protected green arrow time is reduced.
- There is potential to omit a protected left-turn phase.
- Arterial progression can be improved, particularly when special signal head treatments are used to allow lead-lag phasing.

Some disadvantages include the following:

- The permissive phase increases the potential for vehicle-vehicle and vehicle-pedestrian conflicts.
- There is a limited ability to use lead-lag phase sequences unless special signal head treatments are used (see below).

The controller phasing for protected-permissive mode is the most complicated phasing because of the safety implications created by the potential of what is known as the "yellow trap." In a permissive-mode operation, the left-turning driver must obey the green display for the adjacent through movement, which also gives permission for the permissive left turn. When the yellow display for the adjacent through movement appears, the left-turning driver ordinarily expects the opposing through display to be yellow as well. The driver may now mistakenly believe that the left turn can be completed on the yellow display or immediately thereafter when the opposing through display will be red.

For ordinary lead-lead operation where both protected left-turn phases precede the permissive phases, this is not a concern, as both permissive phases end concurrently. However, this problem can occur when a permissive left turn is opposed by a lagging protected left turn. In this type of operation (known as lag-permissive), the yellow display seen by a left-turning driver is not indicative of the display seen by the opposing through driver. The opposing through display may be yellow or may remain green. A driver who turns left believing that the opposing driver has a yellow or red display when the opposing driver has a green display may be making an unsafe movement. This yellow trap is illustrated in figure 30.

Drivers who encounter this trap are those that attempt to make a permissive left-turn after a protected leading left-turn phase. Typically they have entered the intersection on a permissive green waiting to make a left turn when sufficient gaps occur in opposing through traffic. If the absence of gaps in opposing through traffic requires them to make their turn during the left-turn clearance interval, they may be "stranded" in the intersection because of the absence of gaps and because the opposing through movement remains green. More importantly, they may incorrectly presume that the opposing through traffic is being cleared at the same time that the adjacent through movement is being terminated. Therefore, they may complete their turn believing that opposing vehicles are slowing to a stop when in fact the opposing vehicles are proceeding into the intersection with a green ball signal indication.

There are two ways to eliminate the yellow trap. First, the phase sequence at the intersection can be restricted to simultaneous leading (lead-lead) or lagging (lag-lag) left-turn phasing. Second, the signal display can be altered to allow the left-turn signal head to display a permissive left turn independently of the adjacent through movements, which allows the through movements to terminate but allow a permissive left turn to continue during the opposite approach's lagging protected left-turn phase. Some agencies have experimented with signal displays (e.g., "Dallas Display," flashing circular red, flashing red arrow, flashing circular yellow, and flashing yellow arrow) that allow this type of operation. Of these, the "Dallas Display" optically restricts the visibility of the permissive movement using louvers; it is fully compliant with the MUTCD and is shown in figure 31.

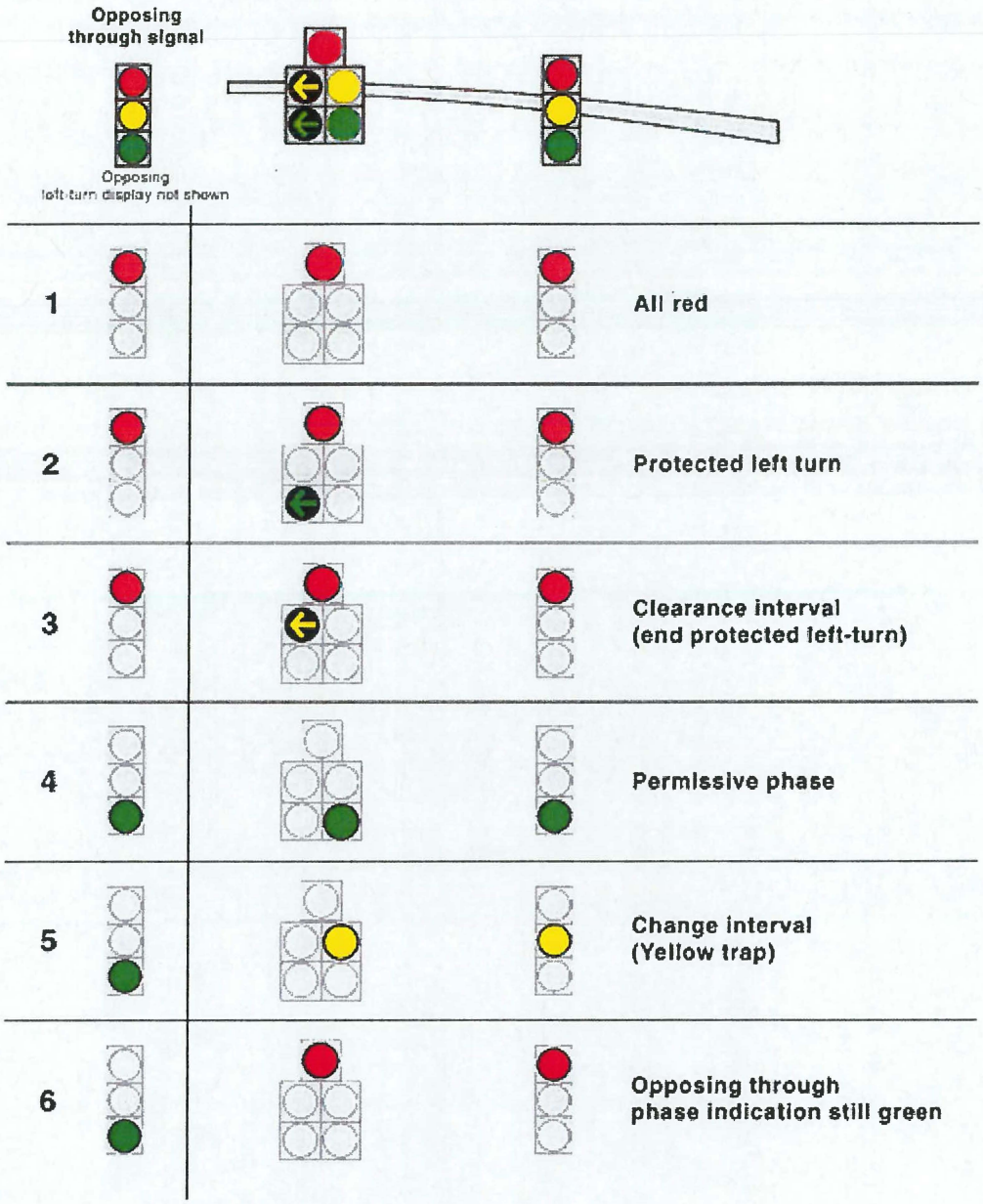


Figure 30. Illustration of the yellow trap.[3]

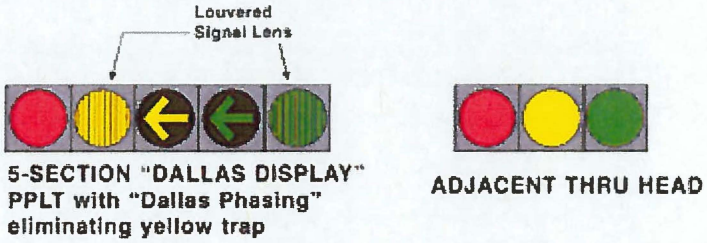
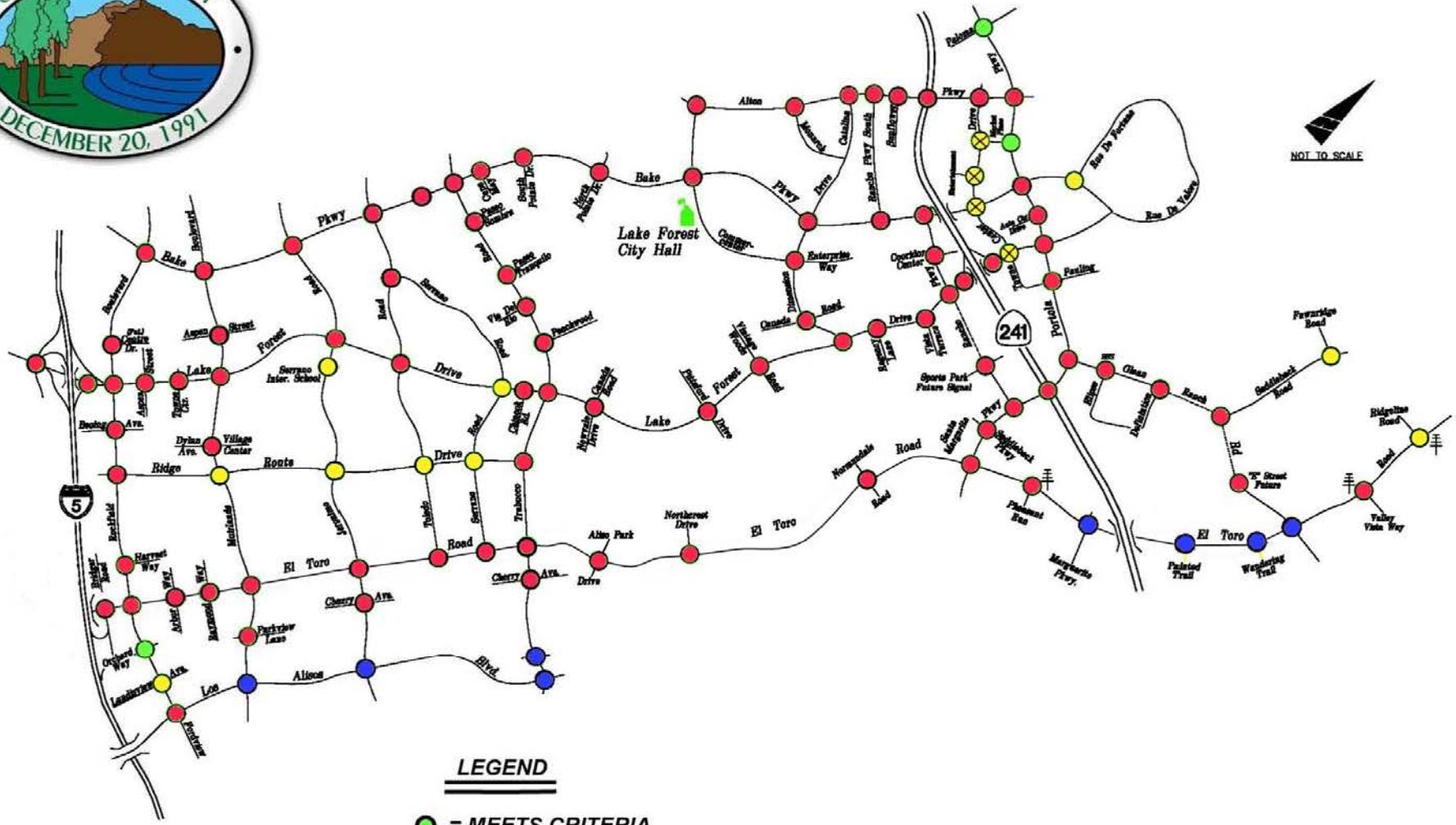
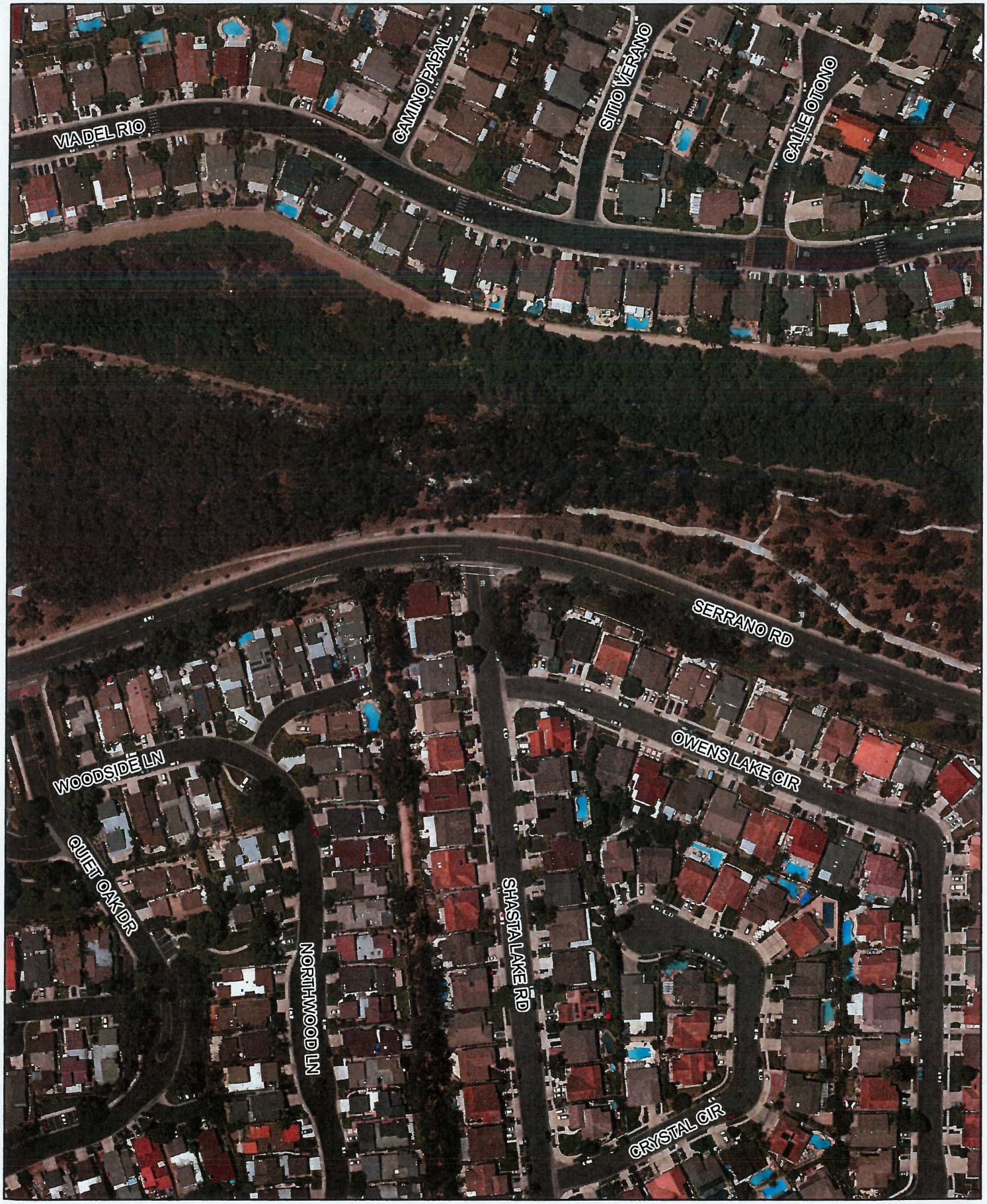


Figure 31. The protected-permissive left-turn display known as "Dallas display" uses louvers to restrict

visibility of the left-turn display to adjacent lanes.[49]

A national NCHRP study, has examined the operational advantages and safety aspects of various PPLT control devices and signal arrangements. The study determined that a flashing yellow arrow PPLT display was consistently found to be equal or superior to existing PPLT displays both in a laboratory environment and in cities where the display was experimentally implemented in the field.[49] The flashing yellow arrow display for PPLT is still considered experimental by the MUTCD and is undergoing further field testing.


CITY OF LAKE FOREST
DECEMBER 20, 1991
NOT TO SCALE
Lake Forest City Hall
Bake
Pkwy
Alton
Lake
Forest
Drive
Serrano
Portola
Glass
Ridge
Routs
El Toro
Road
Alton Park
Northcrest Drive
Normandale
Sports Park Future Signal
Pleasant Run
Marguerite Pkwy.
Painted Trail
Wandering Trail
Valley Vista Way
Ridgeline Road
Saddleback Road
Fawnridge Road
"S" Street Future
Harvest Way
Cherry Ave.
Parkview Lane
Alicia
Blvd
Los
Paseo Tranquilo
Paseo Sonoro
Paseo Trabuco
Paseo Valencia
Paseo Del Rio
Paseo Verde
Paseo Alicante
Paseo Del Sol
Paseo Del Mar
Paseo Del Lago
Paseo Del Prado
Paseo Del Rey
Paseo Del Sur
Paseo Del Norte
Paseo Del Oro
Paseo Del Cielo



Clty of Lake Forest

Shasta Lake Road & Serrano Road

Car in left turn lane looking right

Shasta Lake turning onto Serrano Road

Car in left turn lane looking left

Shasta Lake turninig onto Serrano Road

Approaching Shasta Lake traveling W/B

On Serrano Road

Approaching Shasta Lake traveling E/B

On Serrano Road