TRAFFIC ENGINEERING REVIEW

253 SOUTH LOS ROBLES PROJECT AND RELATED TRAFFIC ISSUES

CITY OF PASADENA, CA

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This report addresses several traffic engineering related issues surrounding the proposed project called 253 S. Los Robles, in the City of Pasadena. The following four items are addressed in this review:

I. *Is Level of Service (LOS) Dead as an Analysis Tool?*

II. *Mitigation Requirements as per The Traffic Reduction and Transportation Impact Fee (TR/TIF)*

III. *Use of Traffic Model to Determine VMT and Traffic Impacts*

IV. *253 S. Los Robles Project, Specific Traffic Study Issues*

I. Is Level of Service (LOS) Dead as an Analysis Tool?

This has been a confusing topic throughout California. The answer is, no, it has not been eliminated, and is still a superior analysis tool to determine the Level of Service (LOS) for all modes of traffic including vehicles, pedestrians, and bicycles, at an intersection or along a roadway section. The software to determine this LOS metric is sophisticated, highly developed, and reliable. The vast majority of cities and counties, and even Caltrans, still use LOS as a required metric to determine the quality and efficiency of a transportation system. As a general rule, drivers react to excessive delays to save time, make more risky lane changes, some run red lights to get through. These behaviors compromising safety to all users of a transportation system (including vehicles, bikes, and pedestrians) are a byproduct of an inefficient and delayed transportation system. Cities and counties are requiring development to mitigate their traffic impacts, in addition to what may be required in an EIR process. Nearly ALL cities and counties have a traffic study guidelines document that requires assessment of LOS conditions, and the traffic study report for development must address all needed mitigations for vehicles, bikes, pedestrians, and transit. All four areas are covered in these required reports.

People have come to identify over the decades with a ranking system from A to F to describe the amount of delay, F being the worst condition. Simply spoken, if at an intersection a motorist is delayed less than 10 seconds on the average, then LOS A conditions exist. If there is more than 80 seconds of delay on the average, then LOS F exists. It is really simple. These metrics were developed with much research by the Federal Government and Transportation Research Board, and have been adopted nationwide, and I can say, are even being used worldwide as a common metric. It is not outdated as a metric.

The confusion over LOS in California comes in when there is an EIR required. California legislation has determined that using LOS, or average delay (whether it be for a car, a bike, or a person), is no longer an acceptable metric in the environmental impact report process. The acceptable metrics to evaluate impacts include air quality, vehicle miles traveled (VMT), noise, safety, etc. These metrics used in the EIR process are more compatible with the prospect of getting hi-rise or high-density development approved in fully developed areas where traffic conditions are already at or exceeding capacity. This was really the reason to eliminate LOS as a metric in the EIR, because the LOS F conditions commonly calculated for a large project's traffic impacts could hardly ever be financially mitigated sufficiently to achieve a satisfactory LOS result. Mitigations were impossible using the LOS metric, so it was eliminated in order for more transit, walking, and biking, to be the mitigation instead.

But does this improve the traffic situation? This is a hotly debated topic, and the answer is generally, no, it does not eliminate LOS F conditions where they exist. In fact, ignoring traffic impacts in the EIR actually makes things worse for traffic. When approvals are made for projects even when traffic conditions are unacceptable, the new project will add even more vehicles to the road, and the result is even worse traffic conditions. Typical ramifications of ignoring traffic impacts include longer lines of traffic waiting at intersections, drivers waiting through more signal cycles, and more intense turning movement conflicts at intersections involving vehicles, pedestrians and bikes. Light rail too can exacerbate conflicts of these turning movement conflicts at intersections.

The elimination of LOS and delay from an EIR does not mean that a city, a county, or even a state can eliminate the need to create and maintain an efficient transportation system. Why else would we still be using traffic signals in every city if efficiency was not important? Why not just use a Stop Sign instead? The answer is, it is important and cannot be ignored.

When a project is evaluated in the EIR process, the analysts will take a look at traffic numbers as a part of the overall process. But often in the EIR process, the "mitigations" being required as a result of traffic impacts are not related to the project itself. For instance, adding bike racks is a good mitigation, but it does not address the additional traffic from a new project that has Net New Trips. To ignore the net new trips is a mistake because there is a safety factor or component to all of this. When traffic conditions worsen, drivers take more chances, delays are aggravating the situation, and safety is compromised.

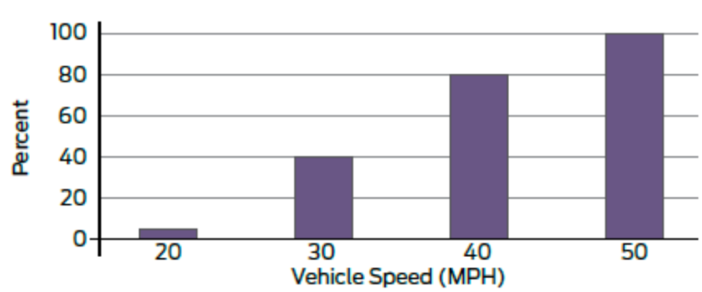
It is important to take a look at safety, because safety IS covered in the EIR process as an impact. However, the connection to traffic is not allowed as a default, in other words, there needs to be data or some history to show an unsafe condition (such as an increase in traffic accidents, or even the severity of the traffic accident. Have fatalities increased as of late? etc.). The City of Pasadena should be looking at safety in the EIR process.

From the California Governor's Office of Planning and Research comes the following chart:

Reducing Speed and Increasing Driver Attention

Vehicle speed plays a fundamental role in transportation safety. The NACTO Urban Street Design Guide, reports: "Vehicle speed plays a critical role in the cause and severity of crashes." The chart below shows increased pedestrian fatality risk associated with higher motor vehicle speeds.

Risk of Pedestrian Fatality by Auto Speed



Source: Federal Highway Administration

http://opr.ca.gov/docs/OPR_Appendix_B_final.pdf

This chart indicates that lower speeds of vehicles results in less pedestrian fatalities. Pedestrians also play a part in improving safety by refraining from J-walking, or assuming that being in a cross walk even with a green light means you are safe. The same is true for drivers of vehicles who may think that a green light means they are safe to proceed. Looking both ways is safety practice for all modes of travel. As long as cities mix traffic modes (cars, bus, bikes, and pedestrians), there will be safety issues due to human behavior. An EIR needs to consider issues of safety, as a requirement. Separate traffic impact studies also need to look at safety even if an EIR is not required. In these studies, it is required to determine if local accident rates are increasing, if LOS is poor, or if there are some other transportation improvements that are needed. A commonsense engineering judgment approach is needed to prepare a traffic study where several aspects of transportation are considered, including design, safety, LOS, efficiency, signal operations, presence and adequacy of pedestrian and bike facilities, where bus stops should be installed, etc.

Measuring traffic conditions and level of service through software can show where problem locations are, and more often than not, an unacceptable LOS at an intersection is an indication of a potentially unsafe location (because of the driver aggression/competition, cyclist aggression/competition, and even pedestrian impatience trying to navigate through the delays. People take more chances under such conditions). Some drivers will push the limits to get through an intersection as the light turns red, and if high speeds are involved, safety is compromised for non-vehicular traffic.

II. Mitigation Requirements as per "The Traffic Reduction and Transportation Impact Fee" (TR/TIF)

The City's current transportation impact fee program amended by the city on July 24, 2017, requires that new development pay for their net new traffic trips onto the road. So, if a project is a redevelopment project, the net new trips would be the proposed project vehicle trips minus the number of vehicle trips that would have taken place at the existing project site if the business or development were currently functioning. Typically, abandoned properties are redeveloped, and local traffic volumes have already adjusted due to the lack of traffic. So, when a new development comes online, even when their net new trips are low, the full impact of those projects is felt on the street system. The full trip generation of the project is realized by the drivers that already use those roadways. In my view, new/additional traffic from an infill redevelopment project can be as significant as when a brand-new vacant lot is developed, especially when a proposed infill lot has been vacant or abandoned for some time.

Within the document that describes the City's transportation impact fee program, there is an "Attachment A" table from this fee program as follows, which describes various capital improvement projects that are anticipated up until the build out of the City's general plan to the year 2035. What caught my eye in this summary table of facilities needed for future development, is the first line item in blue for a local transit improvement identified as the purchasing of new buses to support the general plan. $99 million, or 50% of the total fees collected, have been allocated to the purchasing of new buses in this table, with 100% funding of these coming from the traffic impact fee program. Most traffic mitigation fee programs do not include purchases of buses, but are used instead for new signals, bike lanes, and other improvements to the physical transportation system, such as a bridge, new road, widened road, or better pedestrian facilities if the nexus can be shown. Part of this is because of California law, AB 1600, which stipulates how these mitigation fee programs are to be administered. The nexus between the purchase of about 200 new buses in the next 15 years, which will also create an impact to traffic (and may not run fully occupied most of the time), and the very real traffic impacts of a new project, seems to be dubious. Other fully built-out cities in California that I have researched, do not place the purchases of buses into their traffic impact mitigation fee program, presumably because the nexus just isn't there (for instance, how does a new bus mitigate in any way, the traffic impacts from new cars impacting the roads? It in fact adds to the traffic impact if drivers don't stop driving their cars in turn[1]).

Attachment A: List of Transportation Improvements Funded Through the Fee

FACILITIES NEEDS LIST COSTS FOR FUTURE DEVELOPMENT

Allocation	Category	Project Description	Preliminary Project Costs (Original Needs List)	% Funded by Impact Fee Program*	Final Project Costs (paid for by Fee Program)
NEW DEVELOPMENT ONLY	Local Transit Improvements	New Buses to Support General Plan (net over existing)	$98,872,426	100.0%	$98,872,426
NEW DEVELOPMENT ONLY	Local Transit Improvements	Facility to Support General Plan (net over current proposed)	$20,000,000	100.0%	$20,000,000
NEW DEVELOPMENT ONLY	Complete Streets	Citywide Complete Streets Program FY 2016 - 2020 (75076)	$750,000	100.0%	$750,000
NEW DEVELOPMENT ONLY	Complete Streets	Complete Streets Project - Cordova Street from Hill Ave to Arroyo Parkway (75052)	$400,000	100.0%	$400,000
NEW DEVELOPMENT ONLY	Complete Streets	Citywide Complete Streets Program FY 2016 - 2020 (75076)	$552,000	100.0%	$552,000
NEW DEVELOPMENT ONLY	Complete Streets	Complete Streets Project - Lida Street between Knollwood Dr. and Lancashire Pl. (75074)	$94,000	100.0%	$94,000
NEW DEVELOPMENT ONLY	Complete Streets	Washington Road Diet	$870,000	8.6%	$74,887
NEW DEVELOPMENT ONLY	Complete Streets	Orange Grove Road Diet	$2,300,000	8.6%	$197,978
NEW AND EXISTING	Traffic Ops	Intelligent Transportation System (ITS) Project - Phase I(75701)	$4,198,961	8.6%	$361,436
NEW AND EXISTING	Traffic Ops	Detection of Bicycles at Intersections Controlled by Traffic Signals (75043)	$2,494,505	8.6%	$214,721
NEW AND EXISTING	Traffic Ops	Gold Line Phase I - Project Enhancements (75506)	$6,686,908	8.6%	$575,593
NEW AND EXISTING	Traffic Ops	Mobility Corridor Improvements FY 2016 - 2020 (75079)	$274,000	8.6%	$23,585
NEW AND EXISTING	Traffic Ops	Traffic Signal Indication Safety Improvements - Phase II(75709)	$770,000	8.6%	$66,280
NEW AND EXISTING	Traffic Ops	Left Turn Signal Phasing at Fair Oaks Ave and Colorado Blvd	$160,000	8.6%	$13,772
NEW AND EXISTING	Traffic Ops	Mobility Corridors - Rose Bowl Access Systems (75084)	$1,623,000	8.6%	$139,704
NEW AND EXISTING	Traffic Ops	Intelligent Transportation System (ITS) Equipment Upgrades/Replacement - FY 2016 - 2020 (75078)	$375,000	8.6%	$32,279
NEW AND EXISTING	Traffic Ops	Implementation of Citywide Transportation Performance Monitoring Network (75602)	$3,132,428	8.6%	$269,632
NEW AND EXISTING	Traffic Ops	Intelligent Transportation System (ITS) Master PlanImplementation Phase III (75911)	$5,417,565	8.6%	$466,331
NEW AND EXISTING	Traffic Ops	Upgrade Traffic Signal Heads on One-Way Streets (75050)	$384,500	8.6%	$33,097
NEW AND EXISTING	Traffic Ops	Implement Bus Signal Priority System on Pasadena TransitBuses	$1,447,191	8.6%	$124,571
NEW AND EXISTING	Traffic Ops	Adaptive Traffic Control Network - Phase II	$2,502,572	8.6%	$215,415
NEW AND EXISTING	Traffic Ops	Traffic Signal - Orange Grove Blvd. at Sunnyslope Ave.	$500,000	8.6%	$43,039
NEW AND EXISTING	Traffic Ops	Traffic Signal - Electronic Dr. and Sierra Madre Villa Blvd.	$500,000	8.6%	$43,039
NEW AND EXISTING	Traffic Ops	Replacement of Aging Video Detection Systems	$510,000	8.6%	$43,900
NEW AND EXISTING	Traffic Ops	Traffic Signal Improvements at Garfield Ave and Washington Blvd	$485,000	8.6%	$41,748
NEW AND EXISTING	Traffic Ops	Actuated Traffic Signal Upgrade (CIP)	$5,600,000	8.6%	$482,034
NEW AND EXISTING	Bike Plan	Pasadena Bicycle Program	$12,300,000	8.6%	$1,058,754
NEW AND EXISTING	Pedestrian Improvements	Mid-Block Crossing for Old Pasadena	$3,866,052	8.6%	$332,780
NEW AND EXISTING	Pedestrian Improvements	Mid-Block Crossing for Playhouse District	$1,762,688	8.6%	$151,728
NEW AND EXISTING	Pedestrian Improvements	ADA ramp improvements	$21,000,000	8.6%	$1,807,628
		Total Transportation Improvement Project Cost:	**$199,828,796**		**$127,482,356**

What also is interesting in this table is the 8.6% funding for all other projects (shown in green) from the mitigation fee, without an explanation of where the remaining 91.4% of the project cost will come from, or whether it is even feasible.

Development Impact Fees in California: THE LAW

The Mitigation Fee Act (Government Code Sections 66000-66025) came from Assembly Bill 1600. This law requires that a city must show a reasonable relationship (nexus) between exacted mitigation funds for a project, and the said traffic impacts caused by new project. In other words, if a project impacts an intersection and it operates at a poor level of service as a result, a city should require mitigation of said project in the form of a traffic improvement fee. The following is required of the city:

I. Identify the purpose of the fee;
II. Identify the use to which the fee is to be put;
III. Determine how there is a reasonable relationship between the need for the public facility and the type of development project on which the fee is imposed;
IV. Determine how there is a reasonable relationship between the amount of the fee and the cost of the public facility or portion of the public facility attributable to the development on which the fee is imposed.

[1] **source: https://ops.fhwa.dot.gov/publications/fhwahop08054/sect4.htm

If the government doesn't make adequate findings connecting the fee and the impact, the fee may be subject to challenge as an illegal, non-voter-approved "special tax".

Transit Subsidies in the United States, the most common form of taxation for transit is the SALES TAX. In states as ideologically diverse as California, Texas, and Washington, statewide sales taxes provide the lion's share of transit subsidies. But in California, transit use is way down in recent years. Rather than a shift towards riding buses, the exact opposite is happening. Services such as Uber, riding bikes, even walking, etc., are making an impact on need for buses.

The following report on transit use comes from Transit California:

> **Falling Transit Ridership**
> **New Report from UCLA ITS Scholars Investigates Factors**
>
> Many California communities are banking on more transit use to address problems of congestion and climate change. Yet despite heavy investments in public transportation over the past 15 years, transit ridership is declining — from 2012 to 2016, California lost 62.2 million annual transit rides, and the six-county Southern California Association of Governments (SCAG) region lost 72 million annual rides, 120 percent of the state's total losses.

source: https://caltransit.org/news-publications/publications/transit-california/transit-california-archives/2018-editions/february/falling-transit-ridership/

III. Use of Traffic Model to Determine VMT, Traffic Impacts

The City of Pasadena has a TRANSPORTATION IMPACT ANALYSIS TIA CURRENT PRACTICE & GUIDELINES CP&G document that defines the process of analysis for new projects.

Table 3 (right) shows, that for non-CEQA traffic study situations, there are four (4) areas of analysis that need to be covered in the traffic study. This includes item #2 which address "Auto Level of Service" based on the industry standard Highway Capacity Manual (HCM).

PASADENA DEPARTMENT OF TRANSPORTATION

Table 3- Metrics' Cap Outside of CEQA

	METRIC	DESCRIPTION	CAP
1.	Street Segment Analysis	The street segment analysis assesses traffic intrusion on local streets in residential neighborhoods	Increases of 10-15% above existing on streets with more than 1500 ADT would trigger conditions of approval to reduce project vehicular trips
2.	Auto Level of Service	Level of Service (LOS) as defined by the Transportation Research Board's *Highway Capacity Manual (HCM).*	A decrease beyond LOS D Citywide or LOS E within Transit Oriented Districts (TODs) would trigger conditions of approval to reduce project vehicular trips
3.	PEQI	Pedestrian Environmental Quality Index	Below average Conditions
4.	BEQI	Bicycle Environmental Quality Index	Below average conditions

source of Table 3: Pasadena DOT

https://ww5.cityofpasadena.net/transportation/wp-content/uploads/sites/6/2015/12/Current-Practice-and-Guidelines.pdf

VMT vs LOS. Is LOS Dead?

LOS is not dead. Even Pasadena still uses LOS as a metric (for non-CEQA analysis, which happens to be most analyses). Even though Pasadena's methods for calculating LOS at intersections is outdated, based on older Intersection Capacity Utilization (ICU) methodology, DOT still calculates LOS at intersections that might be impacted by a project. It is a requirement of the City's TRANSPORTATION IMPACT ANALYSIS CURRENT PRACTICE & GUIDELINES document. However, LOS is dead in a strict CEQA context. In other words, by new law in California, CEQA transportation assessment is limited to VMT only, and LOS or vehicle delay is no longer considered an "environmental impact." Driving more or less miles is considered to have a direct impact on air quality, global warming, etc.

VMT or vehicle miles traveled, is now a transportation metric that is used to determine how many miles are driven by residents of a city, or a state, or of a project, or of a specific neighborhood, or project site. The calculation of VMT is complicated and intensive, and therefore a traffic model computer program is best suited to quickly give this answer, as this feature is built-in to most citywide traffic demand models. The City of Pasadena has such a traffic model which can accurately determine VMT totals for the entire city, and then that number can be compared with a revised VMT after a certain project is added to the model. Depending on assumptions, the VMT will either go up or down, where going down is the ideal result. Land use changes can also be plugged into the traffic model, and the analyst can determine if the change reflects better or worse on overall VMT.

The problem with VMT is that it is a very "macro level" metric (generally relating to a broad-brush citywide condition), and does not in any way begin to predict better or worse traffic conditions at an intersection or a roadway segment. Traffic conditions at intersections or along street segments still need to be analyzed using traditional Highway Capacity Manual (HCM) methodologies, which require intersection turning movement counts. The City of Pasadena's TRANSPORTATION IMPACT ANALYSIS CURRENT PRACTICE & GUIDELINES specifies in Table 3 the acceptable level of service threshold maximum values (caps) as the following intersection condition:

> *"A decrease beyond LOS D Citywide or LOS E within Transit Oriented Districts (TODs) would trigger conditions of approval to reduce project vehicular trips."*

What this means is that LOS D is the standard in the City for intersection level of service, but LOS E is allowed for areas that are within a transit-oriented development (TOD), where typically higher densities of development would be taking place.

IV. 253 S. Los Robles Project, Specific Traffic Study Issues

City's Traffic Analysis Method Needs Calibration

Several residents who live in the vicinity of the project site, 253 S. Los Robles, have anecdotal information about their experience in traveling through congested intersections during the peak hour time periods. Specifically, they have said that two or three signal cycle waits are experienced. Since a signal cycle is typically around 70 to 80 seconds at intersections in the study area, a wait time for three signal cycles would be around 200+ seconds. Since an 80 second delay is already considered LOS F conditions, the person who waits more than one signal cycle is definitely experiencing aggravated LOS F conditions.

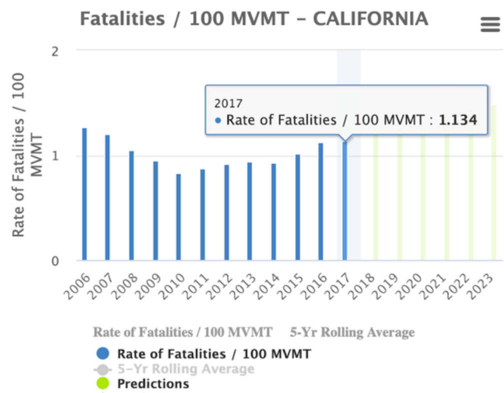
However, in the 253 S. Los Robles traffic study prepared by DOT, all intersections whether it be AM or PM peak hours, are shown to be at LOS B conditions at all S. Los Robles intersections. How does this disparity in real world conditions comport with the analysis result? The only explanation is that the assumptions used in the analysis are either outdated, have incorrect signal timing or configuration information, or the peak hour factors of traffic are incorrect. The older methodology being used by the City (ICU vs HCM 2010) is not sensitive to these details. The Synchro 6 Intersection LOS being used by the City is based upon a "percentile" control delay computation but uses the same numerical delay thresholds as the HCM**. The percentile control delay is different than the HCM control delay for the intersection. The fact remains, the DOT report says LOS B conditions exist, and residents are saying LOS F conditions exist during peak time periods for S. Los Robles traffic, and that there are long lines of cars waiting to get through signalized intersections.

A complete field survey, observing traffic operations and driver behavior in the real world is needed to verify conditions, along with utilizing of detailed traffic data such as saturation flow rate (SFR) and peak hour factors (PHF) which generally cause a realistic and worse LOS calculation compared to when they are not considered (such as in the City's ICU methods). PHF helps identify the congestion that takes place for say, school traffic in the morning but may only last for 30-40 minutes, and not the whole hour.

**source: https://ops.fhwa.dot.gov/publications/fhwahop08054/sect4.htm

Technical Summary of Software Deficiencies in Study

The Transportation Impact Analysis Outside of CEQA Analysis prepared for the 253 S Los Robles project, dated Feb. 6, 2018, utilized a methodology other than the methods typically used today for Item #2 in Table 3 above. In that table, the "Auto Level of Service" is said to be calculated using methods contained in the HCM, as defined by the Transportation Research Board (TRB). The latest methods of the TRB are outlined in the HCM 2010 document, and contained in the latest version of the Synchro software, version 11 released last year in 2018. The City uses a much older and outdated version 6 of this software (from year 2008), and which does not have HCM 2010 features. This older version used by Pasadena DOT today utilizes a Synchro method based on older calculation methods used in the 80's and 90's and does not incorporate the latest HCM 2010 methods which allow for more detail and accuracy of peak traffic. This method does not involve Vehicle Miles Traveled (VMT) in any way. Synchro calculations are based on signal timing operations, and a one-hour peak volume of traffic with peak hour factors, NOT an average of different hours or different days, but the worst-case peak condition at an intersection, determined by real-world turning movement counts. The highest one-hour time period during the entire week is to be used so that the worst-case conditions can be considered for maximum optimization. This is the norm throughout the State. However, in Pasadena this method is largely ignored as a meaningful metric for mitigation purposes, despite its common use for mitigation guidance in the vast majority of cities and counties in California, inclusive of even State Caltrans facilities. LOS and intersection operations matter because they have a direct relationship to safety. Accident rates increase as congestion increases, as is shown by an examination of the data pertaining to population growth and accident rates over the past decade. 50% of serious collisions happen at intersections. In California, the statewide accident rate of fatal accidents has been increasing steadily since 2010 (starting at 0.836 per million vehicle miles traveled,



up to 1.134 in 2017)[2]. Why the increase? Congestion is also increasing, especially at signalized intersections where studies have shown 83% of fatal accidents in an urban city take place at a signalized intersection[3]. This is why it is imperative to find solutions to safety at intersections. Because of this trend in California where the accident rate of fatal accidents has been increasing, even as the population of California[4] has also increased from 37.3 million people in 2010 to 39.4 million in 2017, the obvious correlation of higher number of cars/vehicles and the frequency of accidents is undisputed. The accident rate has not remained the same. When the accident rate increases, as it did in California from 2010 to 2017, this is an indicator of a correlation between the number of cars on the road (congestion) and the increasing probability of a serious or fatal accident. California roads are becoming increasingly congested, and the statewide fatality accident ***rate*** is going up, indicating that increased congestion correlates with increased probability of fatality, especially at a signalized intersection.

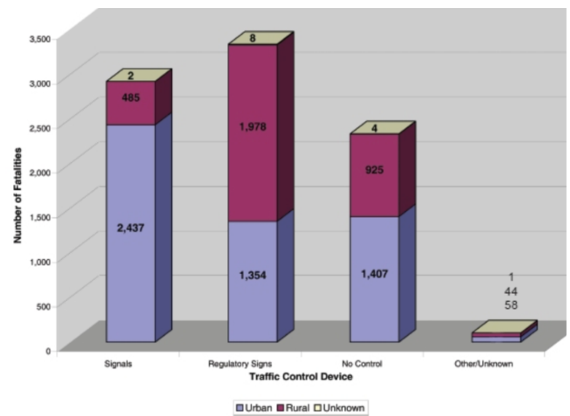


Figure 3: 2007 Fatalities at Intersections by Traffic Control Device

source: — FHWA

For these reasons relating to accident safety, the current methods of traffic analysis being used in Pasadena are insufficient, using outdated software that underestimates congestion (yields LOS results in traffic reports that are more favorable than what field conditions would anecdotally indicate). Newer software should be used, with the latest research in data and analysis. In addition, the calculation results should be calibrated by engineering field review and survey.

Some Cities Have Been Making Evolutionary Shifts to Change the Status Quo of Transportation Basics

Despite how traffic has been analyzed for decades using LOS as the main metric to assess traffic impacts, previous DOT Director Fred Dock, recently retired, worked diligently to change that status quo in Pasadena, and instead focused on other metrics of analysis pertaining to 1) air quality, 2) VMT, and 3) travel mode shift away from cars. He stated in a recent Aug 2019 podcast[5] interview that during his tenure at the City of Pasadena, he worked with staff from the Governor's Office of Planning & Research (OPR). In studies the City conducted for signal timing optimization to improve efficiency in the system of signals, information was shared between OPR and the City. As a result of these improvement efforts to signal timing, they learned that traffic volumes at an intersection were able to increase (more efficient signal operations). He said he viewed it as a negative, because getting transportation funding for the City from

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[2] *Source: https://tims.berkeley.edu/tools/safetypm/*
[3] *Source: https://safety.fhwa.dot.gov/intersection/other_topics/fhwasa10005/brief_2.cfm*
[4] *Source: https://www.statista.com/statistics/206097/resident-population-in-california/*
[5] *source: http://www.pasadenanow.com/main/former-pasadena-transportation-chief-talks-city-planning-on-podcast/#.Xfx70i2ZPok*

outside state and federal sources related to transportation improvements, made eligibility for receiving funds contingent on a city's ability to demonstrate that they have made plans to *reduce* overall traffic volumes, not increase them. What happened in the City's signal timing improvements was not an increase in traffic volumes (they were already on the road!), but was an improvement to efficiency. However, the *hourly* traffic counts showed a higher number. For example, instead of it taking say, 70 minutes for 1000 drivers in Pasadena to get through a hypothetical congested intersection, these same 1000 cars got through in 60 minutes instead, on account of an improvement to a traffic signal's timing and efficiency. Traffic counts are always summarized by *hourly* totals. What happened in the signal timing study with OPR was that more traffic was able to get through affected intersections, in an hour. Mr. Dock said that what happens with these signal timing improvement was "you wind up inducing travel." This is a theory that Mr. Dock may espouse, but is not a proven fact, and would require extensive survey studies to determine if it were true for Pasadena. Since the population of Pasadena, does not change significantly, the same number of drivers are on the road day to day. Any "increase" in traffic volumes for an hour time period through a signal is not an induced traffic increase... it was the same people, just faster and shorter times. Signal timing improvements allow better efficiency for those that are already on the road.

Pasadena's traffic mitigation fee program is showing that about 200 future buses ($99 million cost) is to be paid for by the fee program, even though in nearly all other cities in California buses are purchased through various tax assessments instead. The reason for this is the lawful need for a direct nexus to be in place showing how traffic mitigation fees go to improve things that are impacted by a project. A bus system is a city benefit, but these do not reduce traffic or improve traffic flows. They are primarily an option for those that do not own a car, and a less convenient option for those who do. Therefore, the nexus between new development and the need for buses is not a direct link.

The reason that the nexus is lacking between the need for buses as a mitigation, and the direct additional traffic impacts that a project will have on the adjacent roadway, is because the software being used calculating VMT is not related to traffic congestion, but only how far vehicles drive (this is loosely associated with air quality improvements). Pasadena has been striving to evolve the City's examination of traffic away from LOS, safety, and congestion, to a focused look on how far drivers drive their cars as a whole (VMT). It is important to note that all VMT estimations come not from reality or a survey, but from a theoretical traffic model based on gravity equations (see next section). The VMT can never be proven and will always remain in the theoretical realm. VMT itself has never been calibrated to real world except sometimes at the most macro levels such as an average length of vehicle trip for "Journey to Work" census surveys, and this is only by County. Los Angeles County has a Journey to Work trip length of 29.3 minutes[6] on the average. In the City of Pasadena traffic model, a part of Los Angeles County, I observed that the longest "work trip" time (looking at the "friction factor curve") was tapering off at 20 minutes and shutting off any trip over 23 minutes, indicating that the City's model was ***not*** calibrated for work trip length even though there is statewide data as well as Countywide data from surveys. This is a very significant deficiency in the model when trying to estimate VMT.

Use of the Traffic Model to Determine Traffic Impacts at Intersections is Incorrect

It is generally not appropriate to utilize a travel demand model tool to determine intersection turning movements, or to determine trip distribution assignments for a project, if the model is only accurate to macro level detail of roadway segments, not intersection turns. The City's traffic model has NOT been

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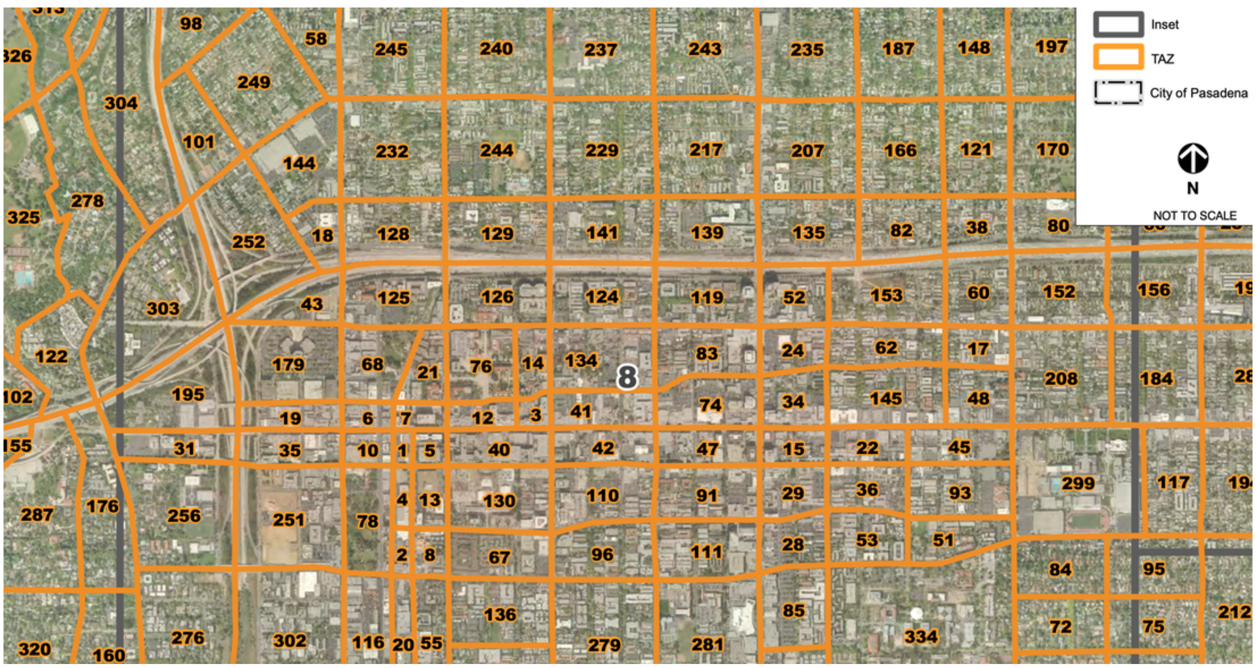
[6] *Source: https://www.indexmundi.com/facts/united-states/quick-facts/california/average-commute-time#map*

calibrated to the turning movement level of traffic counts in the City's intersections. It has been generally calibrated to large link segments, like freeways and main roads, and can still have a 50% error max on some of these (considered acceptable by Caltrans, generally for Caltrans freeway and highway facilities) . The map that follows represents a snapshot of part of the City's travel demand model, in the study area near to where 253 S. Los Robles is proposed. All trips in the model are assigned ONLY from one of these orange boxes (called a TAZ or traffic analysis zone) to another orange box. Generally, one TAZ is residential based, and the destination TAZ's are non-home-based (such as office, industrial, commercial, retail, school, etc.). Trips are generally assigned from TAZs that contain homes, to TAZs that contain non-home land uses.

In the graphic below, taken from the *PASADENA TRAVEL DEMAND FORECASTING MODEL DEVELOPMENT REPORT* appendix (see link below), it can be seen that the 253 S. Los Robles proposed project would be in TAZ #67, and would represent only 5% of the total content of that zone. This TAZ 67 is large and includes two blocks of existing development bounded by S. Los Robles on the east, Cordova on the north, E. Del Mar on the south, and Marengo on the west. With this arrangement, the 253 S. Los Robles project could just as easily be directly assigned in the model randomly to any one of the four "block" faces of the TAZ.



City's Traffic Model TAZ Structure.
Source: City of Pasadena

This is not anywhere near precise or accurate enough to utilize model-generated turning movements at an intersections, or project trip distribution assignments for the very small 253 S. Los Robles project that is contained within a very small part of TAZ 67. The project is literally only 5% of the TAZ 67 total land uses, trip assignment is 95% influenced by the other land uses in the TAZ, and S. Euclid Ave even splits TAZ 67, so that the project could even potentially be assigned in the model directly to Marengo, let alone Cordova or Del Mar, which would not be correct.

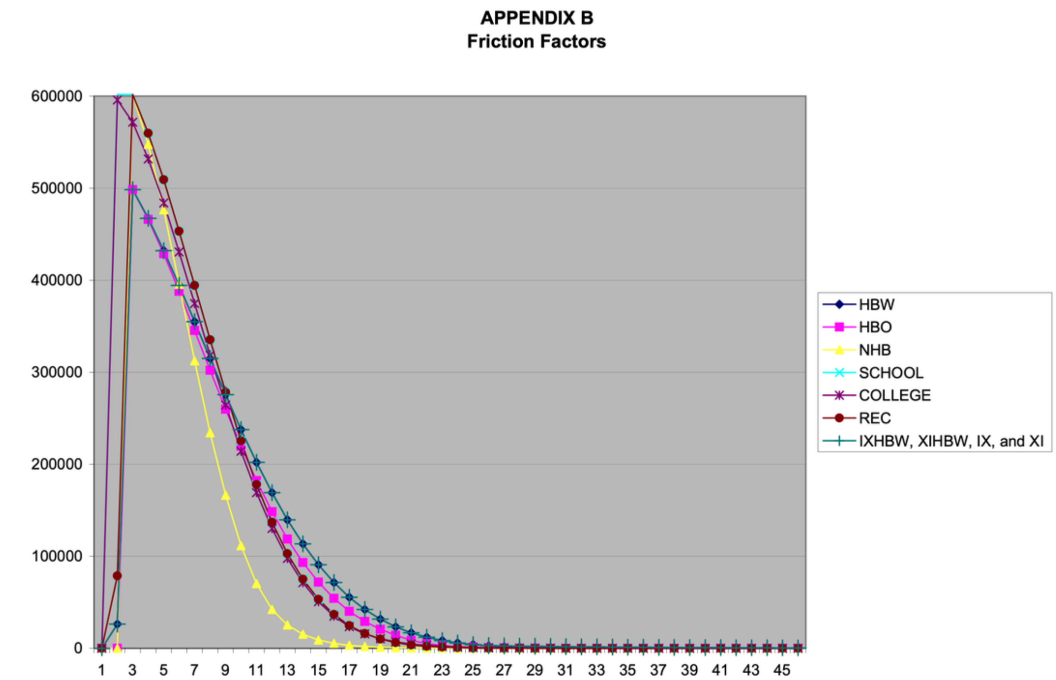
TAZ 67 is very large, two blocks, part of a macro-level model. A micro-level model at the parcel level is necessary in order to have appropriate use in assigning traffic from potential projects. Since this level of parcel-based TAZ precision does not exist in the City's model, the model should not be used for assigning project traffic at the intersection level. The level of precision to do that is not built into the model. Project traffic should be assigned manually, by a traffic engineer, in performing the traffic study.[7]

In the context of an EIR process, the traffic model being used as a tool to determine traffic impacts (in terms of strict VMT only) is entirely appropriate and is now State law for CEQA to do so. The traffic model is used to calculate VMT for the City before and after a project is added to the model. This enables analysis to see the positive or negative effect that a project might have on air quality, greenhouse gas reductions, etc., since CEQA no longer requires traffic impacts (delay and LOS) to be studied. However, traffic related safety, or safety in general, *is* a CEQA impact that can be required in an EIR.

The City's travel demand model is an extremely limited tool to determine anything beyond the macro level predictions of volumes for roadways only (usually only can predict daily volumes, and are inaccurate for peak hour volumes). California State standards for travel demand models, set by Caltrans pertaining to the calibration of travel demand model, allows for very large errors... up to 50% error when compared to a real traffic count. Generally, these macro travel demand models best predict existing and future volumes for larger roads such as freeways, where no more than a 10% error is required to calibrate. In my experience creating and using numerous traffic models, the literal output from a software model predicting existing or future volumes may be significantly in error, and according to the guidelines this is OK. What is not good practice, however, is when outputs are used literally, without engineering judgment. The best practice is to take the percentage difference in a model between existing and future volumes (say it is 80% increase on a specific roadway), and to use that percentage to multiply against an existing/real traffic count. The resulting value would be used in the traffic study for analysis. It is the most common accepted practice in my dealings with government agencies all over California.

This assumption in the model, the "Friction Factor" curves (see figure below), represents how "attractive" (according to the "gravity model") a trip will be based on how many minutes it takes to get from one TAZ (traffic analysis zone, see orange boxes in figure above) to another. Notice that ALL trip categories and their curves are essentially the same values, which is not logical. All curves closely follow each other, the HBW curve (home to work), the School curve, etc. making different kinds of trips in the model no more attractive than the others... but in the real world, work trips are generally very long as most people don't live next to their place of employment, but school trips are much shorter, even neighborhood based where the child lives, as most neighborhoods have access to a nearby elementary school (that facilitates the possibility of walking).

[7] **Traffic from the project should be assigned manually, because the City's travel demand model does not have the sufficient precision to determine intersection turning movements, or to assign project traffic since the project traffic in the model could be assigned to one or more of four potential block faces of TAZ 67.*



"Friction Factor Curves" in the City's Traffic Model

In the figure above for friction factor curves[8], the way to interpret this chart is to first look at the bottom axis which represents minutes of travel. It can be seen that a 20-minute trip is near to the point at which all curves flatten out at zero (no longer attractive). Slightly over 20 minutes of travel time in the model there is zero "attractiveness" and so a 25-minute trip would never be assigned. Long trips are not possible. A 10-minute trip would have a friction factor value of about 220000. A 5-minute trip has a corresponding value of about 450000 for most curves. This means, a 5-minute trip in the model will be at least twice as attractive as a 10-minute trip. More traffic will be assigned from one TAZ 5 minutes away from another nearby TAZ (five minutes of travel time away).

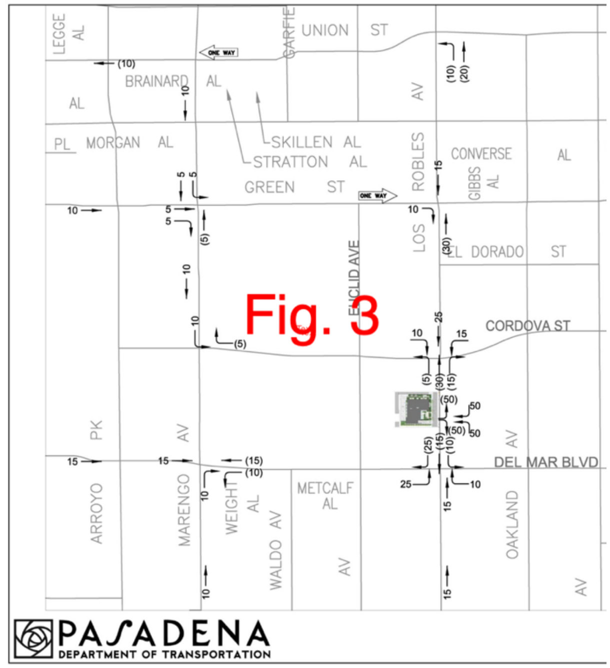
Project Traffic Assignment, Incomplete Analysis...

Traffic from the project should be assigned manually, because the City's travel demand model does not have the sufficient precision to determine intersection turning movements, or to assign project traffic since the project traffic in the model could be assigned to one or more of four potential block faces of TAZ 67.

The traffic study showed a project traffic assignment as follows in the clip from Figure 3 of the report (below). Anecdotal information from residents who drive S. Los Robles on a regular basis indicates that there are currently long lines of traffic that back up on S. Los Robles in front of the proposed project site, and that the assumptions shown in Figure 3 could not happen, as there will not be a gap in traffic for project traffic to get out in the morning.

[8] *https://www.cityofpasadena.net/wp-content/uploads/sites/20/2362_Model_Development_Report_FINAL.pdf*

50% of the project traffic was assumed in the DOT study to make a left turn out of the project, presumably because the travel demand model showed this.



A closer look at the figure shows project traffic patterns that raises questions... such as 50% of the project turning left out to go north on S. Los Robles in the morning when there are long lines of northbound traffic already on the road that would prevent this from being reasonable/possible (no sufficient gaps in traffic).

For these kinds of reasons, manual assignments of traffic, by a traffic engineer, should have been performed so that trip distributions are reasonable, and project impacts can therefore be properly analyzed, based on real world engineering judgment of what is possible/reasonable.

The levels of service calculated for the project in the DOT study cannot be relied upon as they currently exist, because the travel demand model was the source for project traffic assignment which did not consider real world constraints of existing congestion, signal timing, pedestrian totals, and related delays. A travel demand model is not capable of this level of precision, the kind of precision required when using software like the Synchro intersection analysis tool. The City did use Synchro, but the method of calculation used was not the HCM 2000 or HCM 2010 methodologies, as the City's traffic study guidelines requires.

Traffic was assigned for the project using the City's travel demand model, which does not have the level of precision built into it to accomplish this appropriately. It was last calibrated in the year 2011 and is based on 2009 counts for base conditions. Because of this lack of precision in traffic assignment between Traffic Analysis Zones (TAZs), the 253 S. Los Robles project traffic should have been assigned manually by a traffic engineer, based on engineering judgment of what is probable/reasonable. Given that there are long lines of congested traffic going northbound on S. Los Robles past the project site in the morning, it is not reasonable that the project traffic would turn left since there will not be a gap in the stop and go traffic. The project traffic is much more likely to turn right to go south out S. Los Robles and find another way to various destinations.

A 91-unit apartment building, proposed for 253 S. Los Robles Ave. in Pasadena, was rejected by the Pasadena City Council on July 23, 2019. Pasadena, California. (Rendering courtesy of the city of Pasadena)