

**To:** Menlo Park City Council

This is at: <http://bit.ly/bad2worse>

**From:** Gary Lauder

**Re:** Changing 101/Willow Rd. interchange from cloverleaf to partial cloverleaf

**Date:** Tuesday, February 23, 2016 [\[and updated subsequently as noted below\]](#)

Dear City Council,

After learning about this plan a year ago,<sup>1</sup> I was horrified that the same mistake was going to be made as occurred about 15 years ago when Marsh Rd. was converted from cloverleaf to partial cloverleaf (parclo), which made that intersection dramatically worse. Marsh is the primary 101 intersection that I use, so this won't affect me as much as the residents who depend on Willow, but in the past 6 years I have been trying to do my part in improving regional transportation congestion, so I investigated to learn what I could, since I could not stand idly by knowing what I knew/know. I have had extensive correspondence with Caltrans along with a high-level meeting on this subject, and the important concerns and questions remain unaddressed...[for more than a full year after I raised them \[as of 11/17/16 when I inserted this line\]](#). I have been hoping that Caltrans would defer this project on their own accord, but that has yet to occur, [and construction started in the summer of 2017](#).

**Summary:** Most of the premises upon which this plan are based are flawed, baffling, questionable, and/or achievable through other means at much lower cost. Furthermore, circumstances have changed for this such that — even if it is determined that it's worth doing — the point in time at which it should occur is much further in the future AFTER the downstream bottlenecks have been solved.

**Most compelling point** (if this is all that you read, it should be enough to convince you that it should not be done anytime soon): The environmental impact statement <http://www.dot.ca.gov/dist4/envdocs.htm#sanmateo> looked at the impact on many things: potential Indian burial sites, dinosaur bones, and many animal species...but not on the human residents of Menlo Park. The main problem (among others) is that drivers, who presently exit 101 north to go west on Willow, are able to bypass the one (1) mile queue of cars waiting to exit to Willow Rd. east during the PM rush hours. After the change to a parclo, they would have to queue up to take the same exit. At present throughput, **that would add about 15 minutes to the PM commute for those heading to Willow Rd. west (esp. Menlo Park residents)!** That throughput is presently constricted by the distant congestion at Willow and Bayfront (84). The queue at 101N & Marsh Road is MUCH shorter, but analogous: I wait in the queue until I can get into the left turn lane. [Added 11/29/17: A better example is the NB exit from 101 to Hillsdale Blvd. There is a photo and explanation appended to the end of this document.](#)

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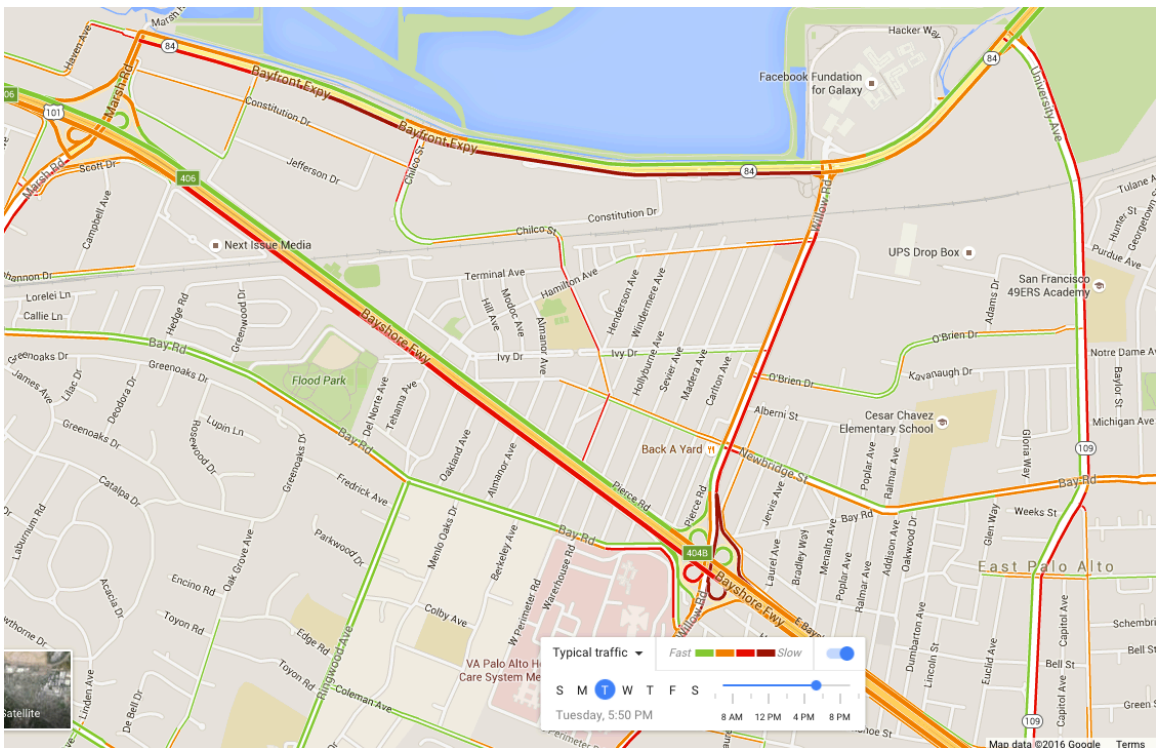
<sup>1</sup> By reading this: [http://www.mercurynews.com/mr-roadshow/ci\\_25173011/roadshow-fixes-mess-at-willow-road-and-101](http://www.mercurynews.com/mr-roadshow/ci_25173011/roadshow-fixes-mess-at-willow-road-and-101)

The “Route 101/Willow Road Interchange Improvements Traffic Operations Analysis Report” (TOAR)<sup>2</sup> was published in 2012, and it was based on traffic analyses from 2009, during the recession. That document’s conclusion says:

Page 14: "Northbound Route 101 off-ramp to eastbound Willow Road: Queues were observed to extend from the Newbridge intersection onto the off-ramp. The queue, however, was not observed to spill back to the freeway mainline."

At present, it spills back a full mile. The present traffic queue already exceeds the projections made for 2020. If the exiting traffic destined for westbound Willow were to be added to the existing queue, it would extend the queue beyond the University entrance ramp (and perhaps also the exit ramp). This would create a new hazard of crossover traffic, which has not been publicly evaluated.

The congestion on eastbound Willow is due to congestion emanating from the intersection of the Bayfront Expressway (84) and Willow (in front of Facebook’s entrance), and — to a lesser extent — the University Ave./84 intersection. Until/unless that downstream bottleneck is eliminated, eastbound throughput will not be improved by the parclo, so reconfiguring this intersection will create new delays (for MP residents) and hazards (for all) that should be unacceptable to you.

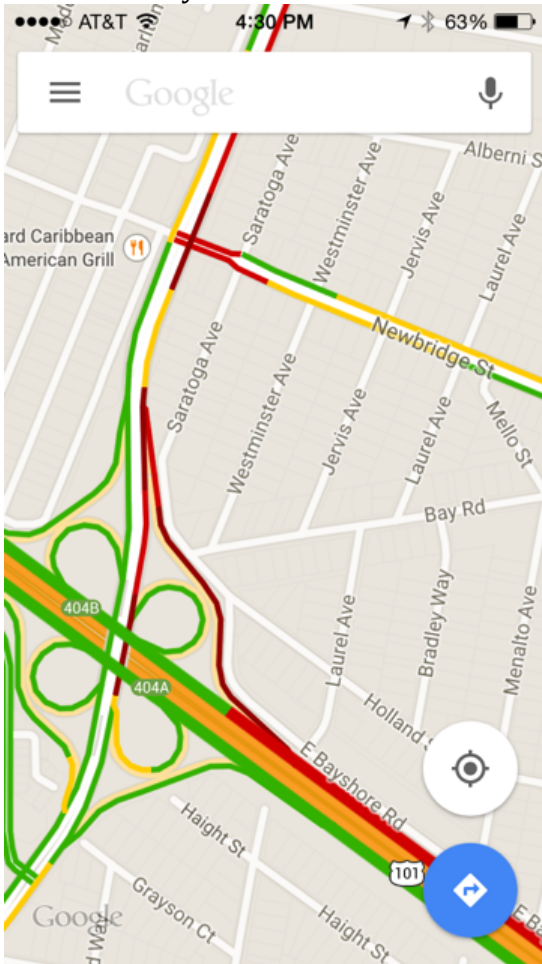


<sup>2</sup> This was sent to me by Caltrans and I can't find a link to it. I presume that MP staff can provide it. Otherwise, I can. [Added 5/24/16: <http://bit.ly/101WillowTOAR>]

**Flawed premises:**

“The purpose of the project is to address the operational deficiencies of this interchange for all modes of travel and to reduce backups and upstream queuing on US 101. The need for this project is to reduce existing and expected traffic congestion in the vicinity of US 101 and Willow Road. **This congestion is being caused because of short weaving segments between loop ramps along US 101/Willow Road Interchange. These short weaving segments create weaving conflicts resulting in reduced traffic speed and increased upstream queuing and backups.**”

Anyone who drives this intersection knows that that is not the cause of congestion in this vicinity.



**Safer?**

There is a claim that it would be safer. This too flies in the face of some well-known traffic facts, so I have asked Caltrans to provide evidence based on other cloverleaf intersections converted to parclo's. The reason for my doubt is that the primary accident types for cloverleaves are side-swipes or low-speed rear-ends, which have low injury and fatality rates. Traffic lights have more T-bone and head-on collisions,

so one would expect the injury and fatality rates to be higher for parclo's.<sup>3</sup> Based on the limited data in the TOAR, I wrote the following to Caltrans:

"Regarding safety: the prior questions remain. Also, in the existing accident rates on P. 131 of the PDF, I note that in the only parclo in the study area, NB off to Marsh Rd, the injury accident rate is 0.81 (vs. 0.42 statewide), and the total rate is 2.23 (vs. 1.2 statewide)." This implies that Marsh Rd. has double the accident rate of other intersections in the state. Added 11/29/17: According to the same dataset, the Willow Cloverleaf has 60% fewer accidents than the statewide average. Added 12/1/17: CalTrans never complied with my CPRA request for before and after safety data of cloverleaves that were converted to parclo's for all of California. The data that they did supply was not usable. There have not been any published studies of safety data of such conversions. I offered to do it, but it seems that they would rather it not be done.

### **Throughput reduction:**

It is well-known in traffic-engineering that parclo's have lower throughput than cloverleaves.<sup>4</sup> The traffic is already awful. Why make it worse?

### **Worse for self-driving (automated) vehicles**

Another factor that Caltrans has probably not taken into account is the advent of self-driving cars. Last week I confirmed with a knowledgeable (but anonymous) source that self-driving cars would have dramatically greater throughput through cloverleaves than parclo's. I have asked Google for their official answer to this question, but have not yet gotten it. I suggest that MP and Caltrans do so too.

### **Bicycle safety:**

As one who rode my bike to work for the 4 years I worked in NYC, I agree that we need to make safe accommodation for bikers. The interchange replacement is expected to cost about \$70M (not counting the costs imposed on the driving public due to additional delays during construction (and after)). If it were the case that the other reasons to change this intersection do not stand up to scrutiny, then there are cheaper ways to accomplish the bike safety objective. For example, building another bike bridge over 101 (in addition to the one about 3000' up 101). Widening the narrower sidewalk on the bridge could be done without materially adding to the bridge's weight by using light materials (e.g. wood and aluminum) and removing concrete.

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<sup>3</sup> "A smaller percentage of angle accidents [T-bones] occur at full cloverleaves (2%) than at partial cloverleaves (24%) and SPUIs (34%), probably due to the absence of turning movements at the full cloverleaves." Page iv in Guidelines For Preliminary Selection Of The Optimum Interchange Type For A Specific Location (1/99) by the Virginia Transportation Research Council, <http://ntl.bts.gov/lib/9000/9800/9871/99-r15.pdf>

<sup>4</sup> IBID, "Directional interchanges were seen as having the highest capacity, followed by the trumpet, SPUI, **full cloverleaf**, **partial cloverleaf**, and diamond." (i.e. parclo's are slower)

The public hearing process did not raise these concerns. There are many potential arguments and counter-arguments. This memo is not comprehensive. Its purpose is to persuade you that this deserves more scrutiny prior to committing to a course of action.

As part of my investigation into how an advanced civilization such as California's can have the worst traffic in the nation, worsening rapidly with no end in sight, I was informed by Caltrans that their primary consideration is safety, and congestion is primarily the responsibility of C/CAG. When one looks at C/CAG's agenda, it appears to only be able to affect things on the margin (e.g. metering lights, HOV lanes, etc.). So it appears that there is nobody in charge of identifying the bottlenecks and widening them. While funds are not easy to shift around, there are better ways to spend \$70M than on reconfiguring this interchange at this time. Specifically, I recommend fixing the flows to and through 84.

The failure to address the *avoidable* congestion that is wasting the lives of so many is a moral and ethical issue. As the cost of housing on the peninsula skyrockets, we should ameliorate the commute for teachers and others whom we depend on. At a minimum, the Hippocratic Oath should apply: "First do no harm."

If any of you have any questions about this, I would be happy to answer them.

-Gary

Additional concerns/issues added 11/17/16:

- 1) Drivers waiting at the traffic lights will be facing directly into the rising and setting sun on many days of the year.
- 2) When this was first planned, autonomous vehicles (self-driving cars) were not contemplated. Cloverleaves will be much better than parclo for maintaining speed without making passengers nauseous due to the larger turning radii of cloverleaves.
- 3) Advocates of the change allege that the project should be done to seismically upgrade the interchange. We all like things safer, but at what cost? What is the present level of risk and how much safer would that be? It's a certainty that lives are being wasted due to the absence of investments to reduce congestion. See: <http://bit.ly/GML-TEDx> I allege that life expectancies will be lowered by making this change for the safety reasons enumerated above.
- 4) CalTrans claims that by having 2 right-turn lanes, it provides more "storage" for cars that are queuing that would reduce the backup to the highway. That might have been a valid claim back when the queue did not spill onto 101, but it's now a mile long. The planned incremental lane length looks to be <200', which is <4% of the maximum queue. The fact that officials still claim this shows that some form of delusion is occurring, either self-delusion or intentional. See close-up diagram extracted from larger diagram on next page:

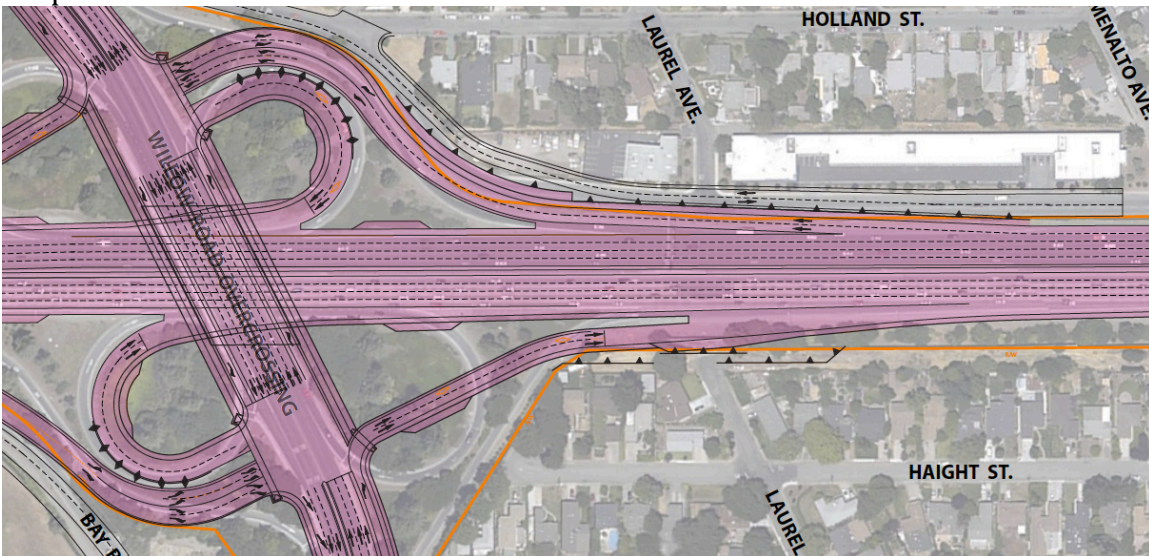


Diagrams added 5/24/16. From page 5 of: <http://www.menlopark.org/DocumentCenter/View/9771>

Current:



Proposed:



Q: Do you really think that everyone headed east will stay in the right lane leaving the left lane clear for people turning left (west)? Q: Do you think that those who don't realize that the queue that starts a mile back at University Ave. and miss getting on the back of the queue will not attempt to exit at Willow and cut in (and therefore clog the west-bound exit lane)? Both questions can be answered by your

trying the Marsh Rd. [better: NB Hillsdale] exit at the PM rush hour. Hint: the answers to both are “no.”

Below: zoomed in view of proposed northbound 101 exit lanes at Willow.



Added 11/29/17: Photo of the 101 northbound exit at Hillsdale Blvd. during the PM rush hour. Hillsdale is a parclo that also suffers a traffic asymmetry traffic with much more heading east in the PM rush hour. This is the same problem that Willow has, which makes it unsuitable for becoming a parclo. The photo illustrates how the right turn lanes are full and spill all the way back onto 101 for a long distance, thereby blocking westbound cars from getting to the intersection until they have waited in the queue. Since it is useful to have a shorthand name for this phenomenon when referring to it (the way “gridlock” explains a dysfunction of intersections), and I have not been able to find any prior description of it, I have named it “hogging.”



One night when I was driving by that exit, I took the following video of the queue:  
<https://youtu.be/PmNqPmY2A4o>

Added 12/1/17: Just because the construction is underway does not mean that it has to be finished as originally planned. It could be restored to a cloverleaf if a decision is made soon enough.

FWIW: As of 2/17, this project was opposed by the MP Fire District.

Added 12/5/17: **Parclo's are 6,600X more likely than cloverleaves to result in deadly wrong-way entry onto freeway:**

On 3/1/17 I sent an e-mail to the MPCC, the city manager (Alex McIntyre), and CalTrans following the prior night's MPCC meeting at which the interchange project was discussed. Among other things, it pointed out an issue that I had raised with CalTrans on 2/12/16: that parclo's result in many more wrong-way entries onto on-ramps of highways than do cloverleaf interchanges:

"Ray [Mueller] asked about the tendency for people to enter the highway in the wrong direction. He referred to this incident which happened shortly after the cloverleaf to partial cloverleaf conversion. San Jose: One killed, one hurt in wrong-way driver crash on Highway 101

<http://www.mercurynews.com/2015/12/04/san-jose-one-killed-one-hurt-in-wrong-way-driver-crash-on-highway-101/>

Sean [Nozzari of CalTrans] said he did not have info on parclo's being riskier than cloverleaves for that, but it was in the voluminous e-mail below, and that citation was sent to Caltrans multiple times going back to early 2015 and to all of you. It shows that partial cloverleaves are 6,600 times as likely to result in a wrong-way entry onto a highway ramp than a cloverleaf (that's 11.0/month x 12 months per year= 132/year vs. cloverleaves' 2 incidents per 100 ramp-years (see below)). That was based on a 1979 study, so parclo designs may have improved since then, but probably not by factors of thousands.

There are additional safety arguments against parclo's that I have not cited in my prior e-mails since I was mainly asking questions:

From: Countermeasures for Wrong-Way Movements on Freeways P.13

<http://d2dtl5nnlpfr0r.cloudfront.net/tti.tamu.edu/documents/4128-1.pdf>

"Several studies have concluded that the most frequent origin of wrong-way incidents is the freeway exit ramp. Research has shown that some ramp and interchange types are more problematic and susceptible to wrong-way movements: Tamburri and Theobald (1966) analyzed 400 wrong-way incidents where entry was made to the freeway via an exit ramp and found that the trumpet interchange category had the highest wrong-way entry rate, with approximately 14 incidents per 100 ramp-years, and **the full cloverleaf interchanges had the lowest wrong-way entry rate, with 2 incidents per 100 ramp-years** (6).

Parsonson and Marks (1979) also determined that the half-



diamond (3.9 per month), **partial cloverleaf ("parclo") loop ramp (11.0 per month)**, and parclo AB loop ramp (6.7 per month) had the highest wrong-way entry rates. They concluded that the parclo loop ramp and parclo AB loop ramp shared the same problem, which is an entrance and exit ramp in close proximity."

I have seen reference to the fact that this type of accident is on the rise. It is also not that uncommon:

San Jose: Wrong-way DUI crash seriously injures two on I-280

<http://www.mercurynews.com/2016/12/28/san-jose-wrong-way-dui-crash-seriously-injures-two-on-i-280/>

Given how they are SO much more likely due to parclo's, I assume that the rise is due to there being more and more of them. The wrong-way accidents happen away from the interchange, so it does not get attributed to it. If it's like everything else CalTrans does, they don't study their past actions to determine if they were the right ones unless there is a glaringly obvious problem."

I sent that to the MPCC 8 months ago, and to CalTrans 32 months ago. No response or even acknowledgement has ever occurred. A cursory search of the SJMN for the terms "Wrong way crash" resulted in these stories about wrong-way accidents since then:

<http://www.mercurynews.com/2017/11/13/fiery-crash-victim-on-interstate-880-identified/>

<http://www.mercurynews.com/2017/10/22/search-on-for-wrong-way-highway-4-driver-that-crashed-into-suv/>

<http://www.mercurynews.com/2017/08/20/suspect-who-drew-deputys-gunfire-drove-wrong-way-on-freeway-on-ramp-arrested/>

<http://www.mercurynews.com/2017/08/07/californian-charged-in-i-94-crash-that-killed-3-minneapolis-men/>

<http://www.mercurynews.com/2017/07/31/san-jose-wrong-way-driver-dies-in-fiery-crash-on-highway-101/>

<http://www.mercurynews.com/2017/07/15/wrong-way-driver-causes-mass-injuries-on-brentwood-highway/>

How much evidence would be sufficient evidence that this is a flawed design and should be reverted to a cloverleaf at Willow Rd.?