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TEN COMMON DEFICIENCIES OF SIGNALIZED INTERSECTIONS

The following text discusses my top 10 "pet-peeves" with respect to traffic signals. This list of common deficiencies is in no particular order:

1.) **Non-Use of Right Turn Overlap Phasing.** For the most part, right turn overlap phasing provides "free" capacity at an intersection. In other words, you can move more cars with it than without it and, if implemented properly, there are no drawbacks to using it. If you have an exclusive right turn lane, whether it be on the main street or a side street, then a right turn overlap phase should always be considered if there is a corresponding left turn phase on the adjacent approach to the right (otherwise there's no parent phase to "overlap" with). As long as you address the "right turns versus u-turns problem" and make sure that your overlap arrow does not cross an active pedestrian movement, then right turn overlap phasing is a win-win-win situation. I simply can't understand why it is not used much more often that it is.

2.) **Overuse of Protected-Only Left Turn Phasing.** In the good ol' days, everybody had to make permissive left turns; there just weren't very many left turn arrows. But now-a-days nobody seems to be able to make a permissive left turn, especially down here in Florida where we tend install left turn arrows by force of habit. Many traffic engineers have become much too conservative in their use of protected-only left turn phasing, using it whenever any aspect of the road is a potential problem (a little too wide, a little too fast, a little too many left turns, a little too much opposing traffic, etc.). Truth be known, protected/permissive phasing (and even permissive phasing) can be used over a very wide range of conditions with considerable success. In other articles I have discussed the conditions during which protected/permissive phasing can become dangerous. However, it is much more often the case that protected/permissive phasing (or straight permissive phasing) is a better choice than protected-only phasing. The vast majority of drivers act like adults and show good judgment. These responsible drivers should not be made to suffer undue delay because we have tailored our designs to meet the needs of the occasional bozo.

3.) **Single Lane Freeway Off-Ramps at Signalized Intersections.** Especially in growing suburban areas, roadway designers need to plan ahead by providing more than the typical one lane at off-ramps. This is particularly true for off-ramps that terminate at signalized intersections. At a minimum, the off-ramp should be sized to provide an exclusive right turn lane and an exclusive left turn lane. If the cross street is 4 or more lanes wide (or might be widened to 4 lanes in the future), then a second left turn lane should be added for a total of three approach lanes on the off-ramp. There is usually plenty of right-of-way surrounding freeway ramps, and few utilities, so this additional width can be provided at a very reasonable cost. I wish I had a c-note for every interchange where such forward thinking with respect to off-ramp design would have prevented future capacity problems at the interchange signals.

4.) **Use of Exclusive Left Turn Lanes Instead of Exclusive Right Turn Lanes on Minor Signalized Side Street Approaches.** When a side street has two approach lanes, some engineers (almost by wrote), automatically designate one lane as a shared thru/right lane and the other lane as an exclusive left turn lane. This is fine if there is a high volume of left turns on the approach or if the number of right turns is low. However, if there is a significant volume of right turns or the left turn volume is relatively low, a shared thru/left and an exclusive right turn lane arrangement is preferable. Having an exclusive right turn lane permits unobstructed right-turn-on-red whereas, with a shared thru/right lane, just one thru vehicle can bottle-up a long queue of vehicles desiring to turn right on red.

Under the appropriate circumstances, the use of a shared thru/left and exclusive right turn lane arrangement on a two lane side street approach can both increase the capacity of the approach and reduce vehicular delay. Having an exclusive right turn lane might also allow the installation of a side street right turn overlap arrow, further increasing the capacity of the approach.

5.) **Confusing Pedestrian Indications.** We really need to make some improvements in the way we handle signalized pedestrian crossings. The common man just doesn't understand how pedestrian signals operate and our attempts at educating the public on pedestrian signal operation have, for the most part, failed. However, there are two items that could fix this situation.

The first item is an LED "countdown pedestrian signal head" which tells the pedestrian the number of seconds that he or she has to cross the intersection. A red number, which counts down from the programmed flashing don't walk time to zero, is displayed next to a flashing red hand. Being able to see this number not only gives the pedestrian a certain level of comfort with respect to the amount of time remaining to cross the street, it also reinforces to the pedestrian the true meaning of the flashing don't walk interval (that it is a clearance interval which allows the pedestrian to complete the crossing). We have a few intersections near our branch office in Ft. Lauderdale that have these pedestrian heads and I am quite impressed with both their operation and the public's response.

The second item is a pedestrian push button which "lights up" when it has been pushed to indicate a call has been placed for the pedestrian interval. When the WALK indication is displayed, the light goes out. This button operates much the same way that an elevator call button does (which lights up when a person pushes it and goes out when the elevator arrives). It has a familiar operation that the average person can understand. Having the lighted call indicator will inform the pedestrian that their request has been recognized (with standard ped buttons, no such acknowledgement is provided), thus reducing both the temptation to cross the street before the WALK indication is provided, and reducing the incentive for pedestrians to continue to "mash" the pedestrian button. I have not yet seen one of these push buttons in use but they seem like a very good idea.

I think the traffic industry will make a lot of points with the public once these improvements become common place.

6.) **Difficult to Read Street Name Signs.** Florida has been a leading state with respect to improved street name signing, and a number of good ideas continue to be aggressively pursued:

A.) The use of large letters (at least 6-inches in height) for street name signs,

B.) The use of advanced street name signs at signalized intersections (located a few hundred feet upstream of the signal on all approaches), and

C.) The use of photocell-controlled internally illuminated street name signs at signalized intersections, signs which hang from the signal mast arms or from brackets attached to the concrete signal support poles.

All of these are excellent ideas for improving the driving experience of the motorist and, where funds allow, should be seriously considered. Traffic volumes are increasing throughout the nation and, because of both demographics and improved health care, our driving population continues to get older and older. These two trends increase the need for clear roadway signing. Motorists who slow to read dimly lit or small street name signs, or who shoot over to make a turn at the last minute because they recognized a street name too late, are dangerous. Signing improvements reduce this potential while making life easier for all motorists.

7.) **Non-Use of Low Volume Flashing Operation.** At most signalized intersections, traffic volumes at night (and sometimes on weekends) become low enough to permit the use of flashing operation. If the geometric characteristics of the intersection are typical (not too wide, not too complicated, no sight distance restrictions, etc.) then flashing the signal at night (yellow on the main street and red on the side street) results in a general decrease in delay and is usually well-received by area citizens.

If the intersection is controlled by a fixed-time signal then delay is greatly reduced for both main street and side street motorists by instituting low-volume flashing operation. Intersections controlled by fixed-time signals receive the greatest benefit from flashing operation. However, contrary to what some people say, the operational benefits of low-volume flashing operation are also significant for fully-actuated traffic signals. Even with full actuation, vehicles still experience a certain level of unnecessary delay caused by the timing of initial intervals and change intervals (yellow and all-red) for conflicting movements. And if a loop or pedestrian button goes bad causing a phase to "stick-on", then this delay can go from significant to substantial.

8.) **Poor Signal Coordination.** Having spent many years developing and implementing coordinated signal timings on a wide variety of equipment, and over a wide variety of corridors, I fully appreciate the difficulty involved in the task. Consequently, I hate to criticize our profession in this technically difficult area, but it must be done. We have not done a very good job at implementing and maintaining good coordinated timing plans. Traffic signal controller quirks and real-world road network anomalies (frontage roads, compressed diamond interchanges, 5-leg intersections, staggered intersections, closely-

spaced intersections, cross-coordination issues, exclusive pedestrian crossings, etc., etc., etc.) make the development and implementation of workable coordination plans as much of an art as it is a science. The simple truth is that some traffic engineers and some traffic technicians are good at it, but most are not. It requires a type of inductive logic and willingness to "tinker" that not all people possess. I have tried to train some very intelligent engineers in this area and have watched them throw up their hands in frustration. So, even if you are quite good at running one of the many increasingly-sophisticated coordinated signal timing computer programs that are available, if you cannot convert the results into settings that the different controllers understand, or if you cannot adjust your results to accommodate real-world anomalies, or if you cannot decide when to turn-on and turn-off the various plans so that the right cycle length is used at the right time, or if you cannot develop settings that keep left turn queues from spilling-over into thru lanes, then your timing plans will start to smell under the heat of implementation. The bottom line is that there needs to be in-the-field, hands-on training in the proper implementation of coordinated signal timing plans. And we also need to spend time training traffic engineers and signal technicians on how to both check the plans and maintain the plans once they are implemented.

9.) **Ugly Signal Supports.** When intersections are large, or when swale drainage systems require that signal support poles be set-back a long distance from the edge of pavement to meet clear zone requirements, the cost-effectiveness of a strain pole/span wire design becomes obvious. However, with smaller intersections, or in areas where curb-and-gutter drainage allows the poles to be placed near the edge of the road, decorative paint-over-galvanized mast arms are much more attractive than ugly wooden (or concrete) poles and span wires. This is especially important in aesthetically sensitive areas such as downtowns or entertainment areas. When possible, we should make things look nice.

10.) **Premature Use of Dual left Turn Lanes.** If one left turn lane is good, then shouldn't two left turn lanes be better? Not necessarily. Two left turn lanes require the use of protected-only left turn phasing whereas a single left turn lane can be controlled by less restrictive protected/permissive phasing (or permissive phasing). Unless peak hour traffic volumes at the intersection are such that a dual left turn lane is really needed (and this is best determined through a formal intersection capacity analysis), or unless protected-only phasing is needed for some other reason (such as a sight restriction or a bad accident history), a single left turn lane is preferable. If is expected that traffic volumes will increase to the point that a dual left turn lane will be needed in the future, then room can be set aside in the median for a future second left turn lane or the second lane can be installed now but "striped-out" for future use.

These are my top 10 traffic signal annoyances; it is by no means an exhaustive list.