Your Signal Does What……? The Hybrid Pedestrian Interval

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Introduction

Typically, traffic engineers design traffic signals to accommodate peak-period traffic demands and assume that doing so will suffice for other times as well. What if you were designing a traffic signal for an intersection with two very different peaks, one for vehicles and another for pedestrians?

Iconic Santa Monica Boulevard in the City of West Hollywood is a bustling, vibrant corridor with both heavy traffic volumes and brisk pedestrian activity. The intersection of Santa Monica Boulevard and Robertson Boulevard accommodates more than 2,500 vehicles during the vehicular peak-hour and more than 2,700 pedestrians in its crosswalks during the pedestrian peak-hour. Faced with mounting pedestrian safety complaints, the City of West Hollywood retained Albert Grover and Associates (AGA) to recommend walkability and pedestrian safety improvements that would not significantly impact traffic flow during peak travel periods. With so many pedestrians crossing at the intersection, a “pedestrian scramble” seems appropriate; however, doing so could have a devastating impact on vehicular throughput during the peak-period. Recognizing that the vehicular and pedestrian peaks occur at different times of the day, ultimately AGA recommended the implementation of a “hybrid pedestrian interval” that would be active when pedestrian volumes exceeded those of vehicular volumes. The traffic signal essentially prioritizes vehicular throughput during the traditional peak-periods, then morphs its operation to provide an exclusive pedestrian interval during periods of high pedestrian activity, which primarily occur on Friday and Saturday nights. It is this morphing of the traffic signal operation from a traditional peak-period vehicle-centric operation into a pedestrian friendly operation that makes the concept unique.

Intersection Layout

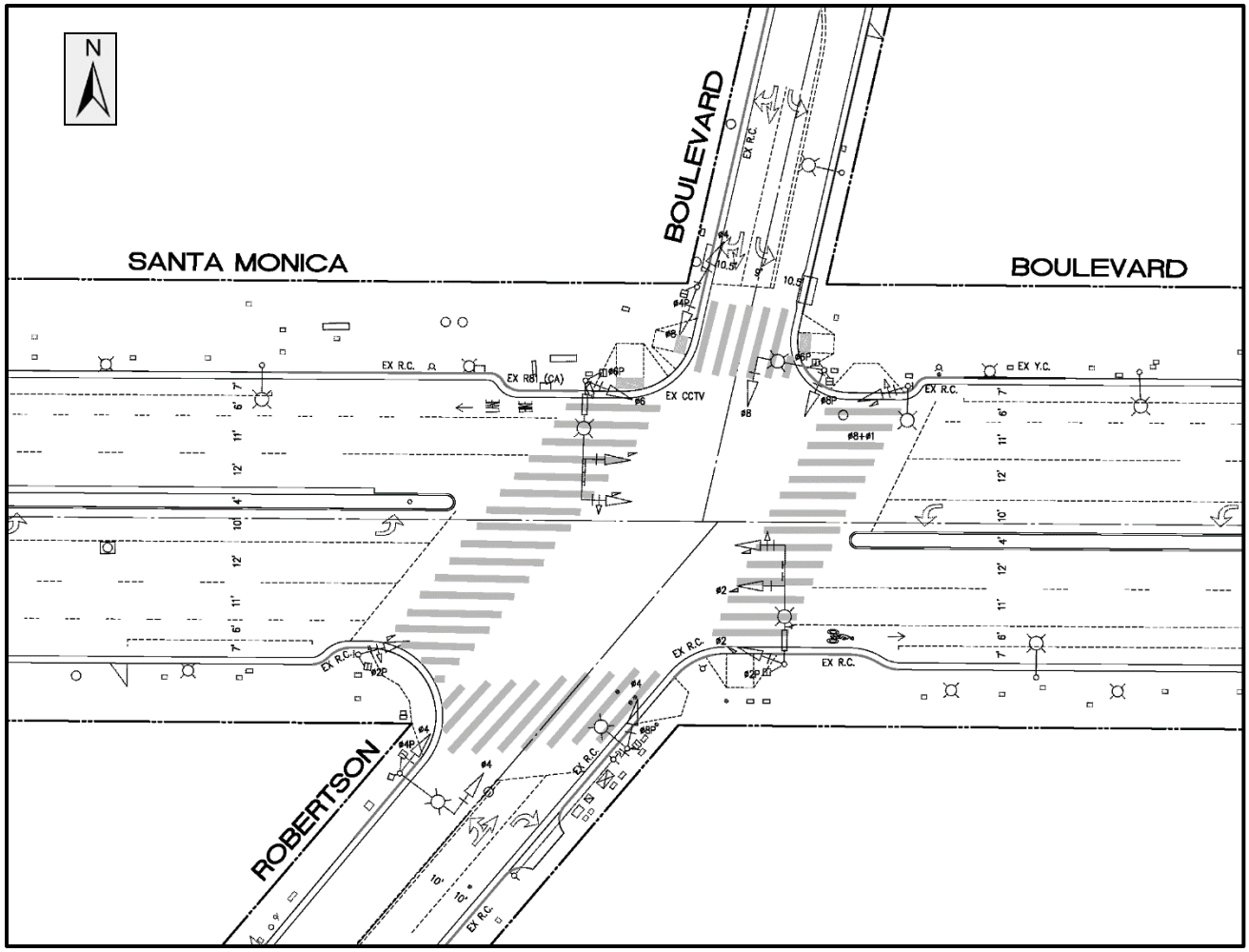

Figure 1: Intersection of Santa Monica Boulevard and Robertson Boulevard

The bustling intersection of Santa Monica Boulevard and Robertson Boulevard is located on the west side of the City of West Hollywood. During the daytime, the intersection has brisk pedestrian activity throughout the day and Santa Monica Boulevard functions as a high-volume commuter corridor through the City. In addition, the intersection serves as the primary pedestrian crossing point for the active weekend night life. Santa Monica Boulevard is a four-lane arterial divided by a raised median and Robertson Boulevard is a two-lane roadway separated by double-solid-yellow striping.

Intersection Traffic Characteristics

The intersection study focused on documenting intersection traffic flow and pedestrian activity; specifically, we conducted video traffic counts and engineering observations when pedestrians were most prominent at the intersection, which are Friday and Saturday from about 8:00 PM until 2:30 AM. Since the intersection is located in an area with vibrant night life, in the later evening hours we found that pedestrian crossings at the intersection outnumbered vehicle demand. **Figure 2** shows a screen capture from the video traffic count with over fifty pedestrians crossing both directions in one crosswalk during just one traffic signal cycle. The traffic and pedestrian data revealed that vehicle traffic declined later into the evening; while pedestrian crossings steadily increased throughout the night to a high of over 2,700 crossings in the hour after midnight.

Figure 2: High Volume Pedestrian Crossing during the Pedestrian Peak Period

Although the pedestrian activity is brisk in the later hours, the vast majority of pedestrians cross in accordance with the traffic signal's pedestrian indications. Despite the excellent pedestrian behavior, from about 9:00 PM onward, traffic on Robertson Boulevard south of Santa Monica Boulevard is severely congested due to insufficient gaps in pedestrian crossings to accommodate the flow of right-turning and left-turning motorists through the intersection. At times the northbound queues approaching the intersection extend more than 750 feet to the south. Despite the congestion and slow-moving traffic on Robertson Boulevard, motorists seem

to be relatively patient and orderly in their movement through the intersection. The traffic signal provides sufficient green-time to accommodate traffic flow on Santa Monica Boulevard for both eastbound and westbound traffic throughout the evening. The traffic signal is equipped with protected-permissive left-turns for both eastbound and westbound traffic. As observed, eastbound and westbound left-turn queues and delays are not significant.

Intersection Evaluation

With such a high volume of pedestrian crossings occurring at the intersection, it was natural for the engineering team to consider an all-way pedestrian phase, or pedestrian scramble operation. However, after reviewing traffic flow conditions during the weekday morning and afternoon peaks it was clear that a pedestrian scramble operation would significantly degrade the intersection's vehicle throughput creating unmanageable queues on Santa Monica Boulevard and potentially diverting traffic to other congested routes. Although, a pedestrian scramble operation would be disastrous during the vehicular peak-periods, it would be ideal during the late-night pedestrian peak-period.

Therefore, to maintain maximum capacity during the vehicular peak-periods, what could and should we do when the pedestrian demand outweighs the vehicle demand? In pondering a solution to this puzzling question, the engineering team came to the realization that designing the intersection's operation to serve just one travel mode's peak, thereby sacrificing the other's, wasn't the only option. What if we could program the traffic signal to serve the vehicular peak and then "morph" its operation to serve the pedestrian peak? Of course, we couldn't "morph" the physical characteristics of the traffic signal; we would have to make whatever change we could operationally with all the same physical traffic signal equipment in place during both operations.

Ultimately, it was determined that by creating an exclusive pedestrian interval that could be activated only when necessary would essentially create the pedestrian scramble operation we desired. When the exclusive pedestrian interval wasn't needed we could turn it off, or repress

it, thus providing operational priority to vehicular traffic flow. We termed this type of “morphing” traffic signal operation aimed at serving pedestrians the Hybrid Pedestrian Interval.

Based on this approach, we recommended that the Hybrid Pedestrian Interval be activated only during the late-night pedestrian peak periods Fridays and Saturdays. The Hybrid Pedestrian Interval would be turned off during the day, thus allowing the traffic signal to provide priority to vehicular throughput.

Figure 3 compares the intersection’s vehicle volumes and pedestrian volumes on a Friday night. It is clear from the graphic that the pedestrian crossing volume at the intersection significantly increases after 11:00 PM and by midnight pedestrians out-number vehicles. Based on the intersection’s traffic and pedestrian characteristics we were able to determine an ideal time to operate the Hybrid Pedestrian Interval on Friday and Saturday nights.

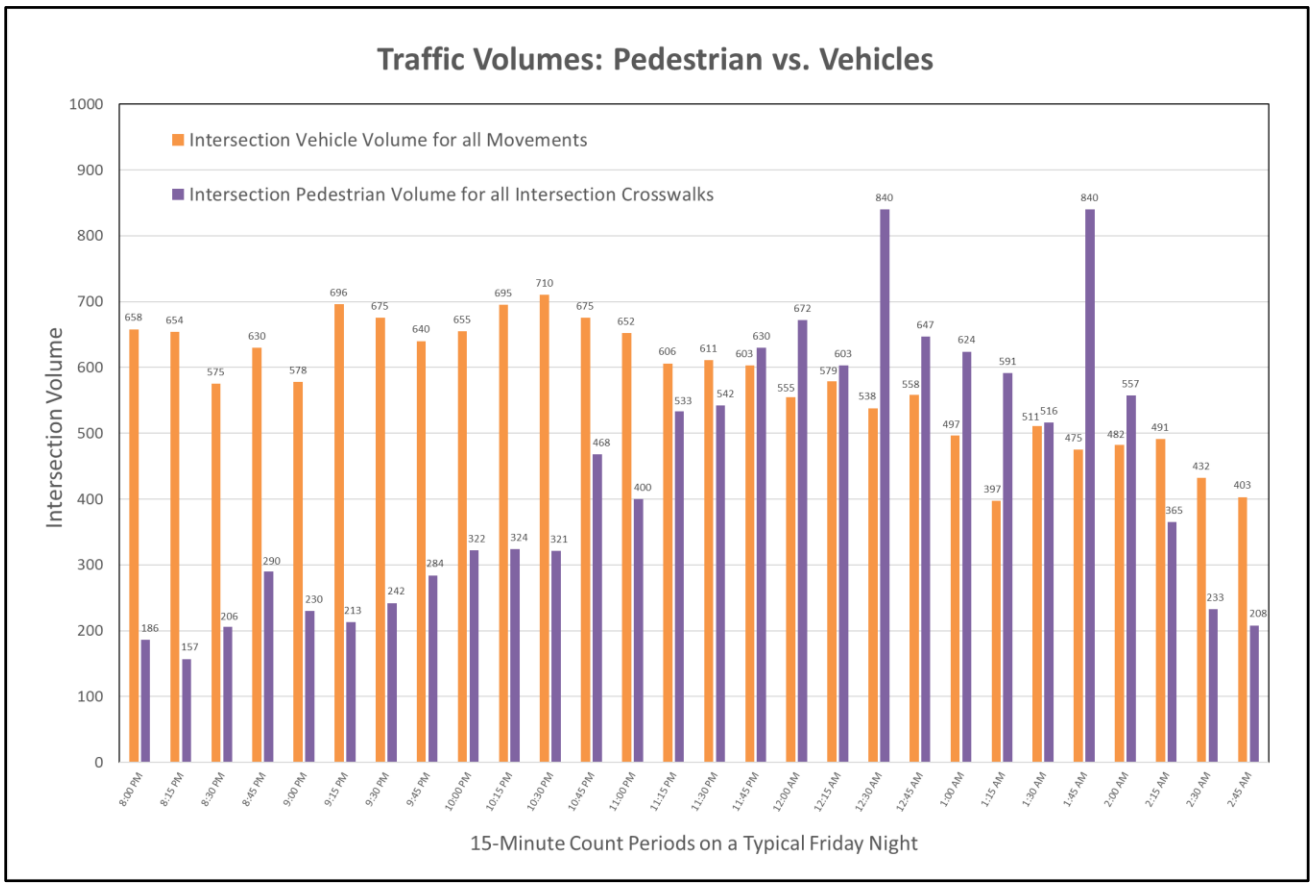

Figure 3: Intersection Traffic Volumes: Vehicle vs. Pedestrian

Hybrid Pedestrian Interval Operation

Although, we as engineers knew how we wanted the Hybrid Pedestrian Interval to work, could we generate timing that would work on the City's 2070 controller? After much discussion, brainstorming, and testing by engineers and technicians in our controller laboratory, we were successful in getting the operation to work with the City's controller and software.

Typically, an intersection will operate with the same phase sequencing twenty-four hours a day every day of the year, but in this case the traffic signal would operate with one phase sequence most of the time then it would change to operate with the Hybrid Pedestrian Interval on Friday and Saturday nights. **Figure 4** outlines the typical vehicle-centric phasing sequence that operates the majority of the time. **Figure 5** outlines the pedestrian-centric phasing sequence that operates Friday and Saturday nights.

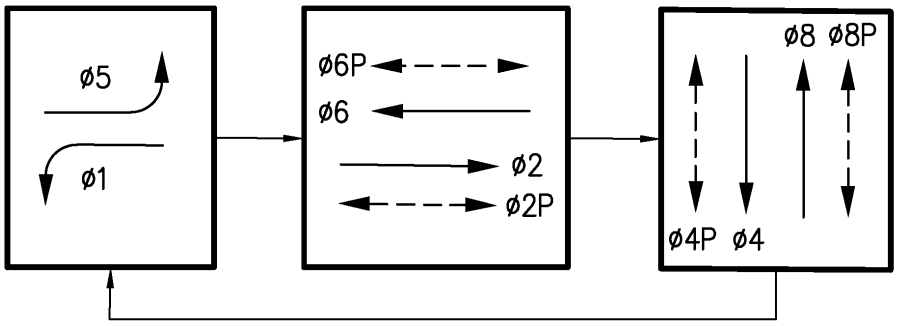

Figure 4: Traditional Intersection Phasing that Operates Majority of the Week

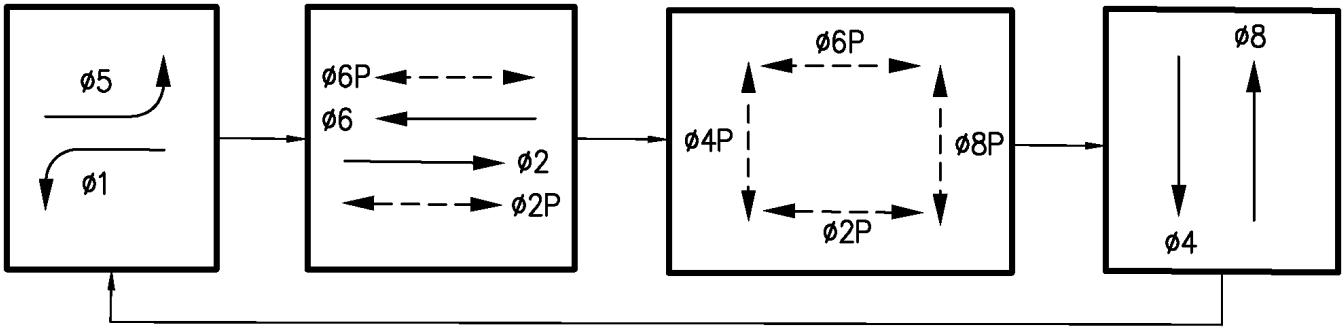

Figure 5: Exclusive Pedestrian Phase that Operates on Friday and Saturday Nights

The Hybrid Pedestrian Interval operation essentially improves pedestrian safety and the pedestrian experience by introducing an exclusive pedestrian phase during times of peak pedestrian activity, while still allowing the flexibility to switch back to normal operation providing vehicle priority during the traditional peak periods. Notably, this solution using phase sequencing can be implemented at relatively low cost at an intersection with minimal modifications to the cabinet and traffic signal.

Applications for Hybrid Pedestrian Interval

Why shouldn't all of our traffic signals change, or morph, their operation to dynamically accommodate the varying demands of all roadway users? The concept of a Hybrid Pedestrian Interval, or dynamic signal phasing, isn't just for the unique environment of Santa Monica Boulevard. It has everyday applications across the country at universities, sports venues, parks, entertainment districts, and downtowns. Essentially, the concept can be deployed anywhere it's important to prioritize the safe and orderly movement of people - be they in cars, on bicycles, or on foot. It only makes sense that we design our traffic signals to morph their operation to accommodate the demands of all roadway users in the most efficient and safe manner possible.