April 8, 2003

DETECTOR SWITCHING AND DETECTOR CALLING

In certain circumstances, detector calling and switching can be used to improve the operational characteristics of a traffic signal. In this article, I describe one situation where detector calling and switching can be of value. But first, what are these items?

Detector Switching is a modern traffic controller setting that can be used to dynamically change the assignment of a vehicle detector to a vehicle phase. For example, a detector (L-7) that is normally used to extend a side street left turn phase (phase 7) can be "switched" to extend the adjacent side street thru phase (phase 4) during a certain point in the cycle.

Figure 1 shows why this might be useful. Let's assume that the demand for phase 7 is heavy such that all of the left turning vehicles do not make it through on the side street protected/permissive green arrow. Let's also assume that the demand for the side street thru phases (4 and 8) is light. Without detector switching, the side street green indication will terminate after the last side street thru vehicle (referred to as vehicle 2 in this figure) leaves the L-4 detector (and the associated phase 4 passage interval times-out).

We would like to somehow keep phase 4 green after the last side street thru vehicle crosses L-4 so that the vehicles queued in the left turn lane can continue to turn permissively on the green ball. This can be done by activating detector switching! The controller is programmed to extend phase 4 with detector L-7 whenever phase 4 is green. Phase 4 will still be extended by detector L-4 as well. In addition, phase 7 will still be extended by L-7 whenever it is green.

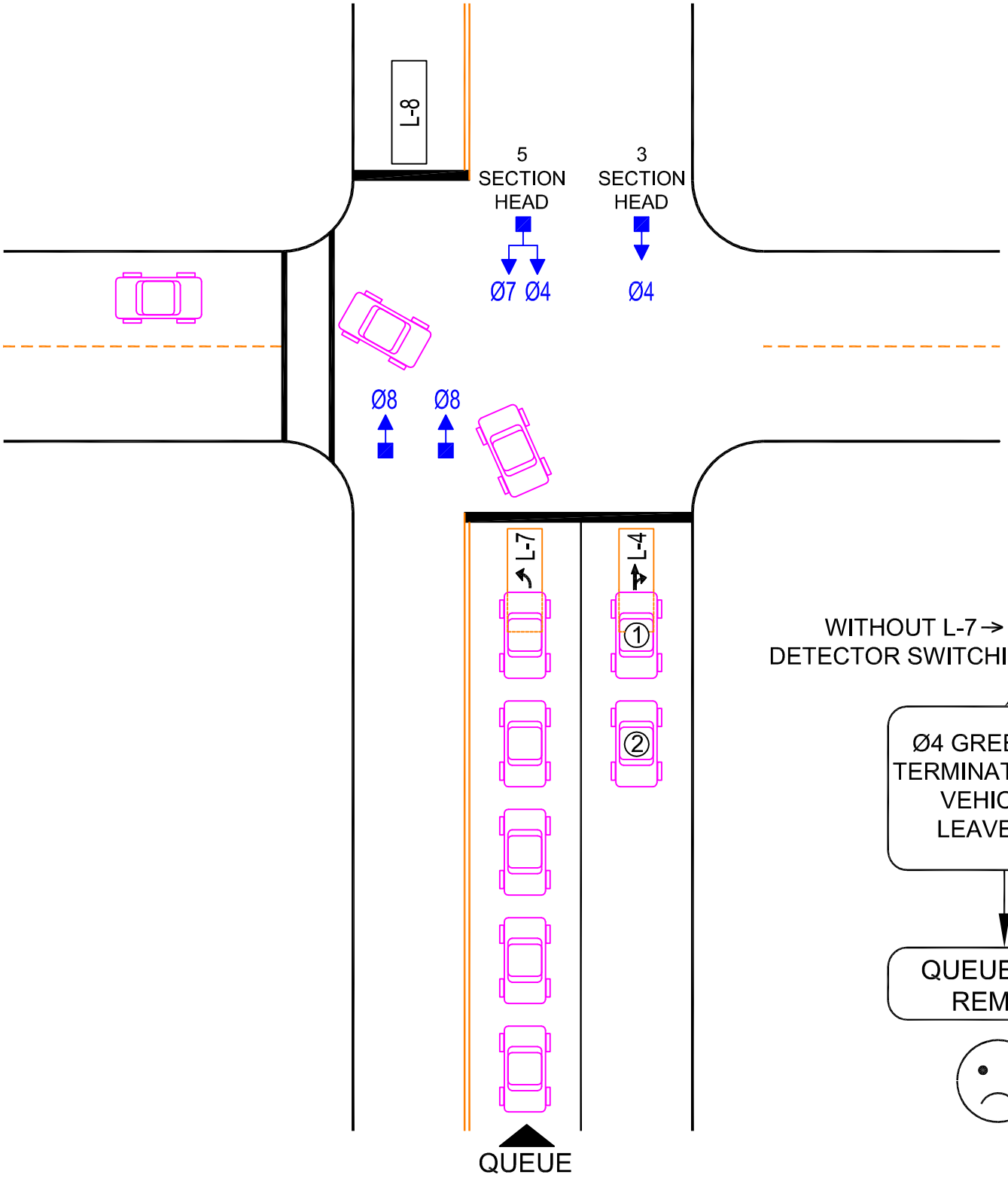
There is one little problem with this arrangement. If, on a particular cycle, there is no traffic in the side street thru lanes then phase 4 will not come up at all and extending phase 4 with detector L-7 will be of no value. Consequently, we must also program the controller for **Detector Calling** such that detector 7 calls phase 4. If Detector Calling is activated then, as is shown in Figure 2, the side street green ball indication (phase 4) will come up even if there is no demand for the side street thru movement.

One might ask, if the side street left turn traffic is so heavy and the side street thru traffic is so light, why not just reallocate green time from the thru movement to the left turn movement? This could be a viable solution if the signal is isolated or if there are no side street pedestrian movements. However, as is shown in Figure 3, when cycle time is constrained by coordinated operation and when pedestrians crossing the main street must be served, green time reallocation may not be feasible. In this example, we are forced to give 25 of the 40 seconds of available side street time to the thru movements (to accommodate the phase 8 ped) which leaves only 15 seconds of phase time for the heavy left turn movement. And we are forced to do this even if pedestrian volumes are sporadic. Detector calling and switching is a nice way to solve this dilemma.

It should be noted that different controller manufacturers refer to these features using different terminology (such as "Cross Switch") and some accommodate one or more of these features via a detector assignment matrix, but the idea is basically the same.

Advanced controller features, such as Detector Calling and Detector Switching, can be very useful in helping us to make the controller "do what we want it to do".

FIGURE 1
DETECTOR SWITCHING



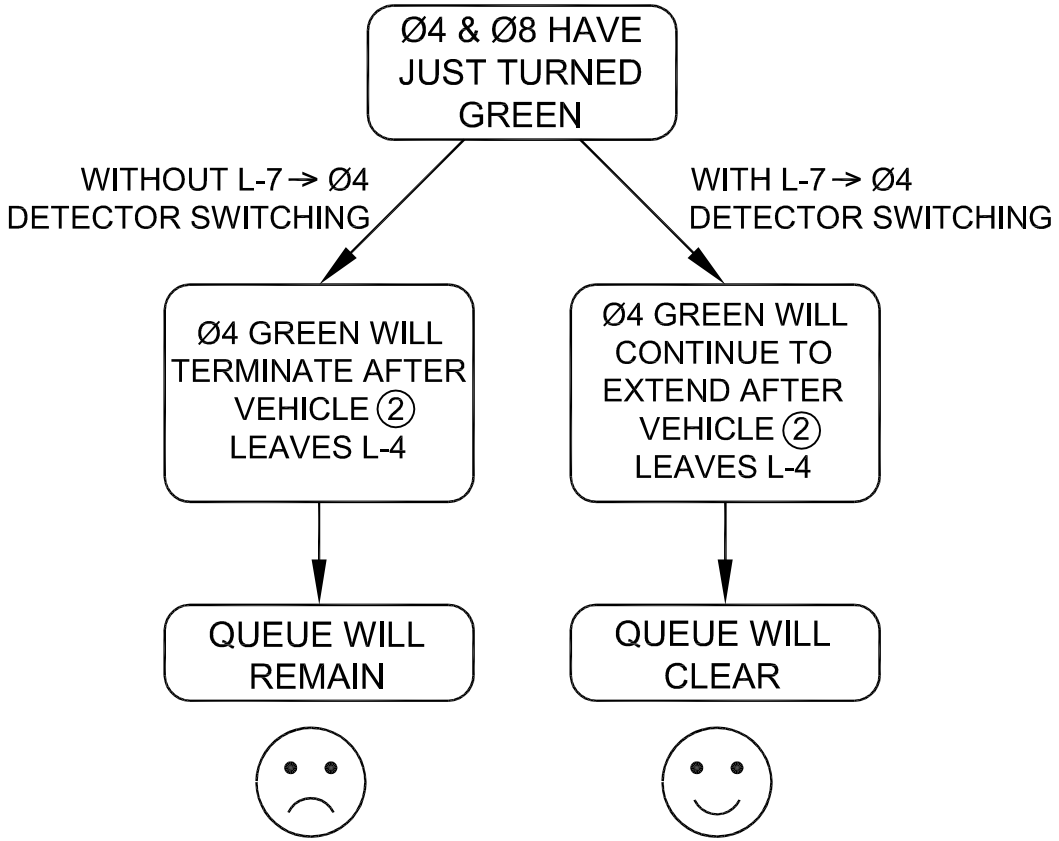
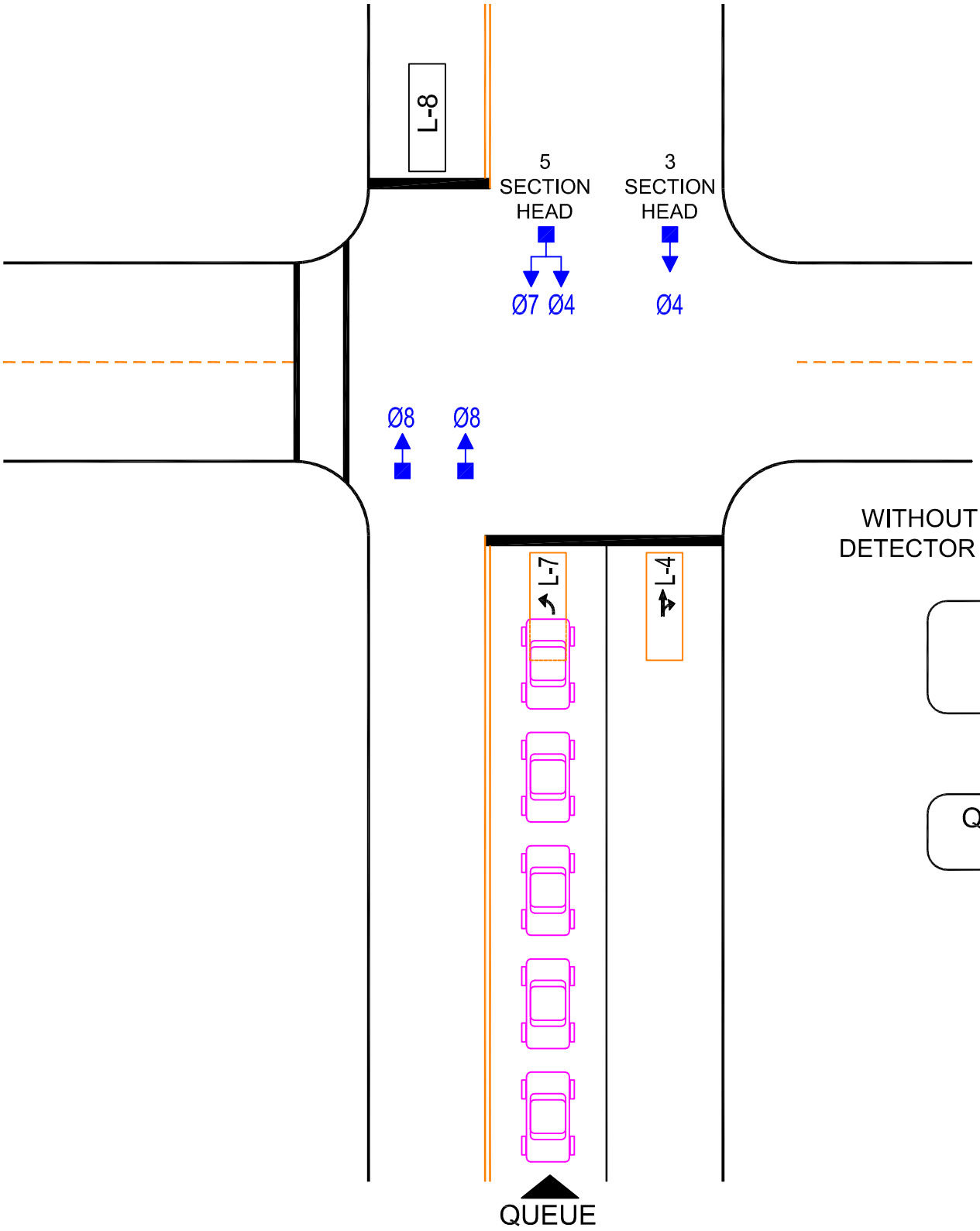


FIGURE 2
DETECTOR CALLING



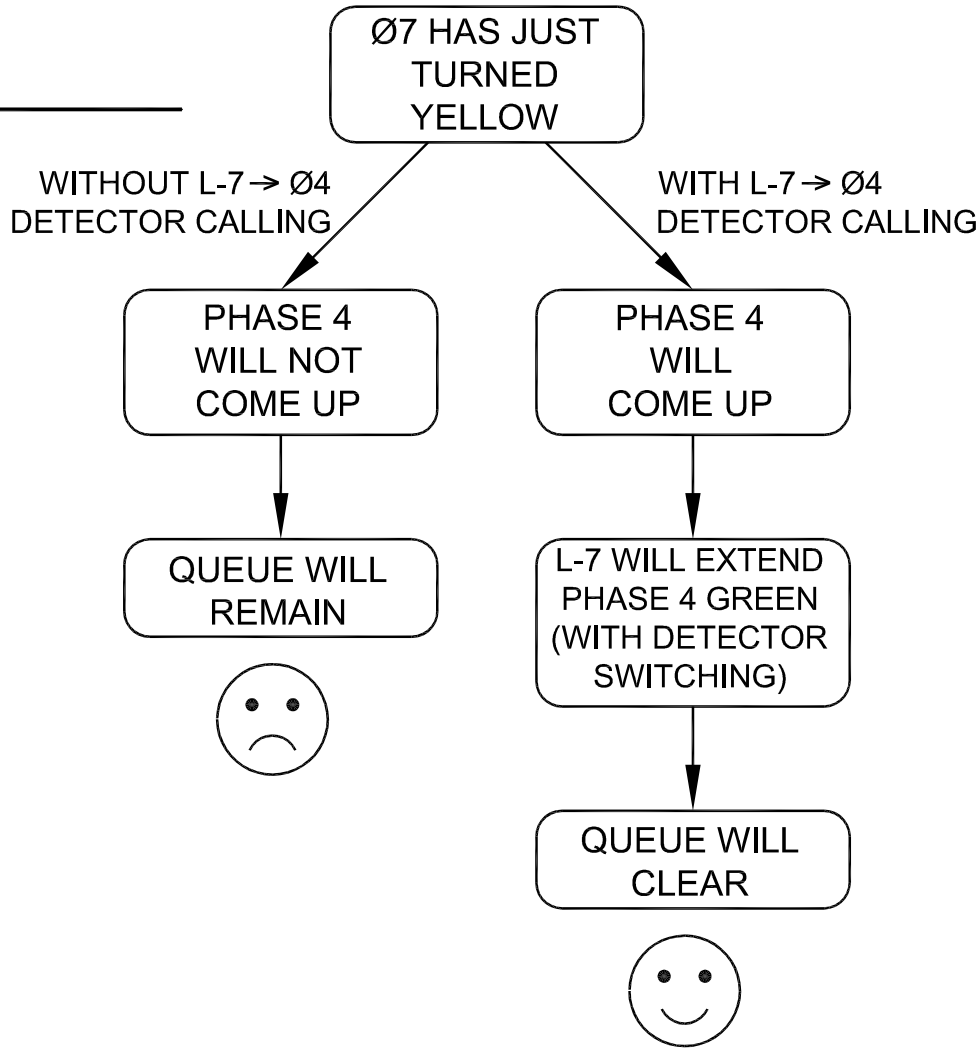
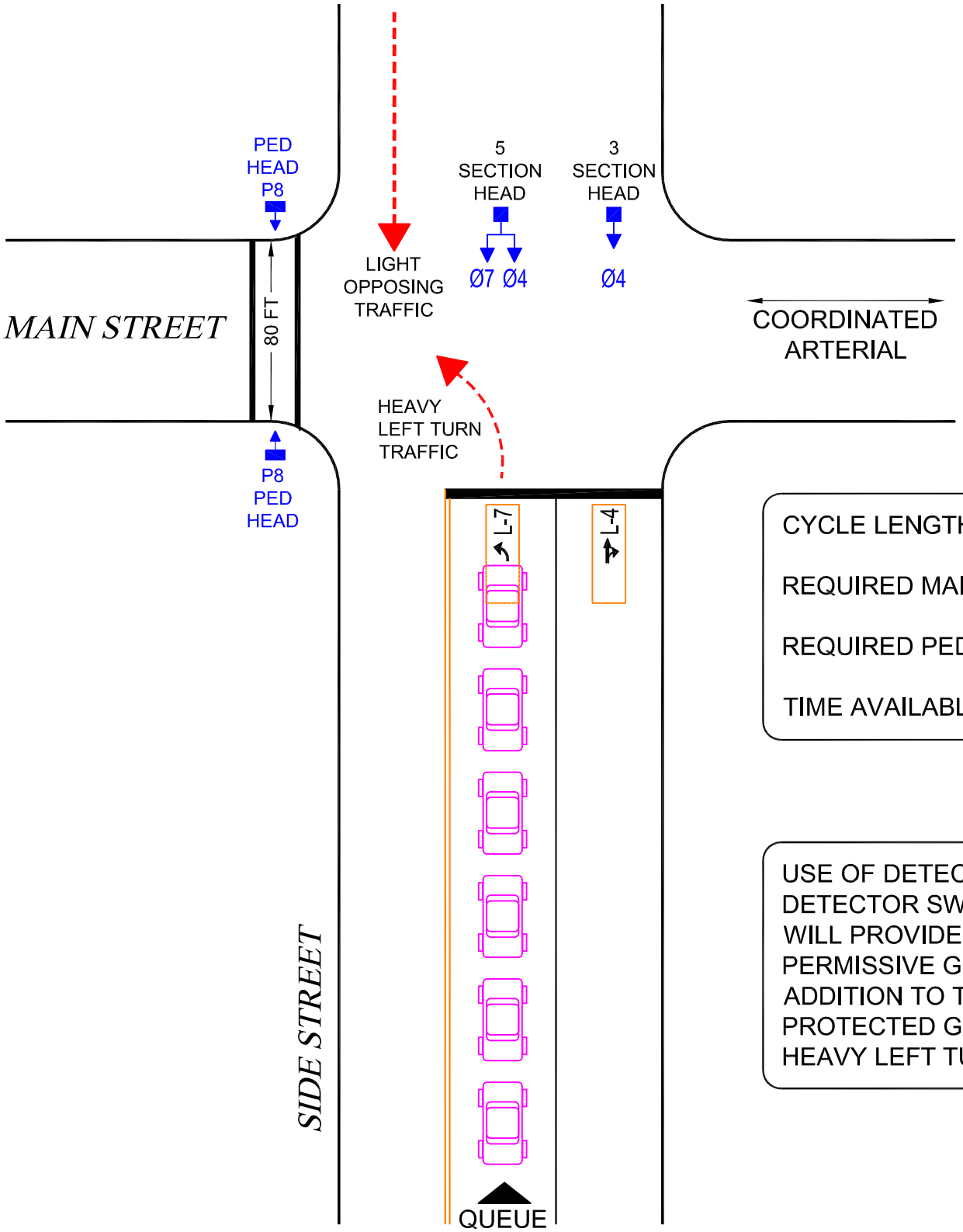


FIGURE 3
EXAMPLE APPLICATION



CYCLE LENGTH = 90 SEC.

REQUIRED MAIN STREET TIME = 50 SEC.

REQUIRED PEDESTRIAN TIME = $\frac{80}{4}$ + 5 = 25 SEC.

TIME AVAILABLE FOR LEFT TURN = 90-50-25 = 15 SEC.

USE OF DETECTOR CALLING AND DETECTOR SWITCHING FOR L-7 → Ø4 WILL PROVIDE UP TO 25 SECONDS OF PERMISSIVE GREEN TIME IN ADDITION TO THE 15 SECONDS OF PROTECTED GREEN TIME FOR THE HEAVY LEFT TURN.