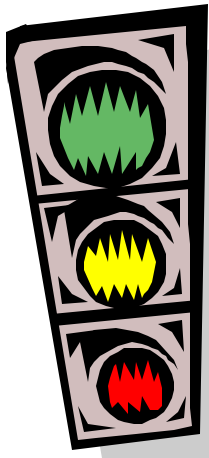




Optimization of Left-Turn Traffic Signals



There are two ways a traffic signal system copes with left turns (cross flow) at an intersection. Permitted Phase allows drivers to choose a safe gap in the oncoming traffic. If either oncoming traffic or turning traffic is substantial, a Protected Phase gives turning drivers an exclusive turn phase. A Permitted/Protected Phase (P/P) is a combination of the two that accommodates different left-turn and through patterns throughout the day. Figure 1 is an example of a P/P Phase.

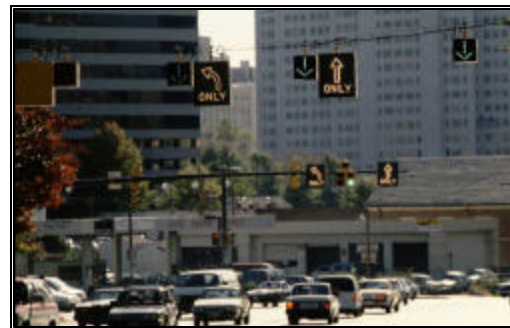
Figure 1 is an example of a P/P Phase.



Figure 1: Example of a Permitted/Protected Phase

The Utah Traffic Lab (UTL) conducted a study for the Utah Department of Transportation (UDOT) comparing the performance of different left-turn phasing arrangements. Typically, engineers and

technicians make judgments about different left-turn phasing arrangements that are not supported by research data. UTL research helps them to make judgments based on guidelines and reference data. The research was divided into two parts, Volume, Delay and Different Phasing Arrangements, and Geometry and Queue Detectors.



UTL analyzed Permitted, Protected, and P/P phasing during the first part of the research. It measured left turn volumes and opposing through traffic. UTL researchers also measured left, through, and overall intersection delay and compared the information from different phasing arrangements. It paid special attention to finding a location best suited for the queue detector for P/P phasing. It also considered left-turn volume, opposing through volume, and lane geometry in its analysis. The analysis indicates that P/P phasing provides the best method of left-turn phasing signal control under most conditions. The P/P phasing is controlled more easily and is better able to accommodate the changing volumes throughout the day.

UTL and UDOT have set up guidelines to determine the type of phasing that best suits different conditions. Figure 2 is a flowchart that helps determine the best phase for the corresponding location.

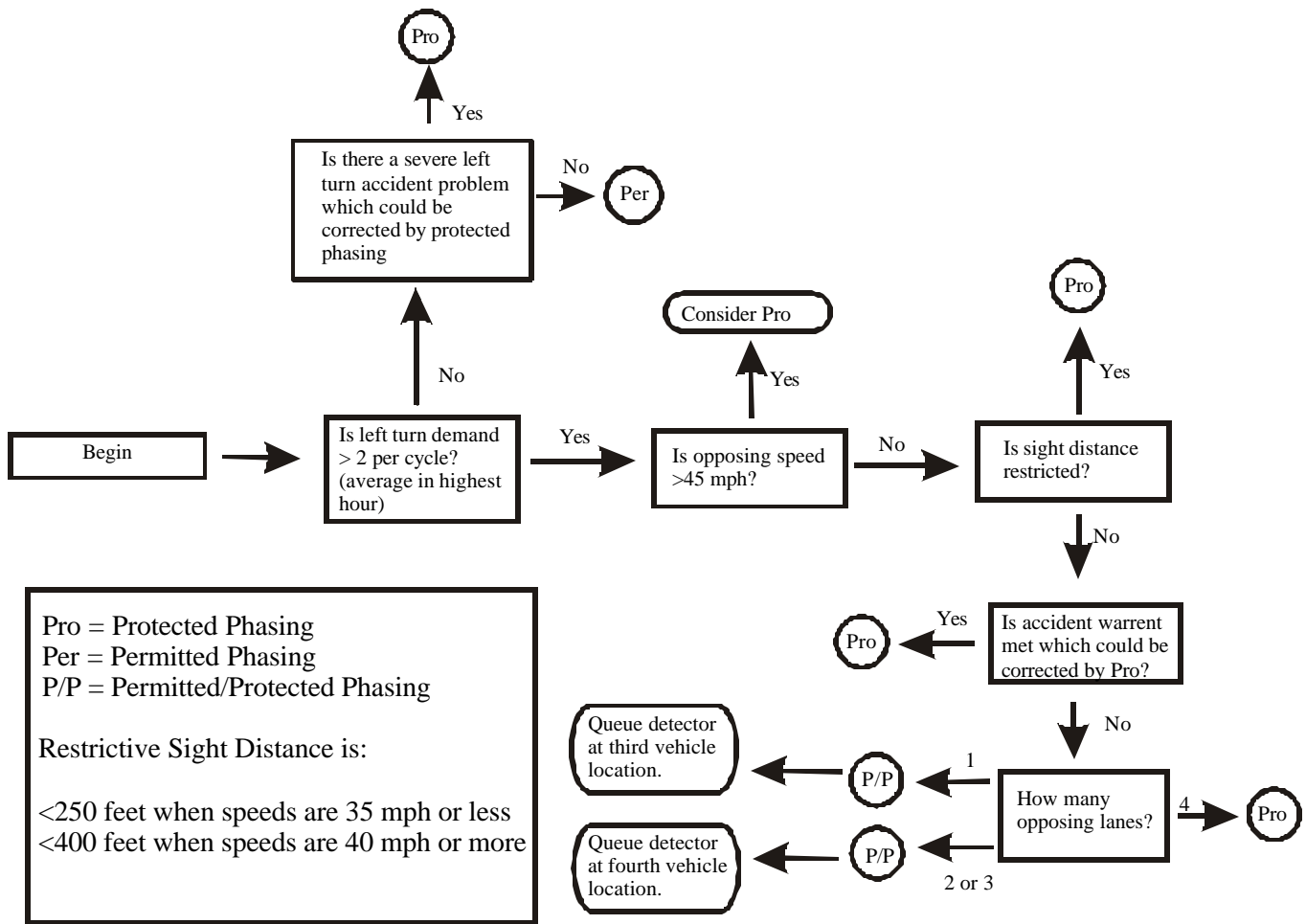


Figure 2: Phasing Arrangement Guidelines

Researchers found that the best place to install queue detectors depends on the volume and geometry. UDOT typically places the detector at the third vehicle location so that, during the Permitted Phase, two “sneakers” (vehicles that turn at amber lights) may turn per cycle. The third vehicle location triggers the protected phasing to accommodate all left turning vehicles. However, placing the detector in that position assumes that there are no gaps in the oncoming traffic or that the oncoming traffic is near capacity.

UTL concludes that geometry and queue locations are related. One lane geometry should have a third vehicle detector. Nevertheless, two or three lane geometry should have a fourth vehicle detector because oncoming traffic increases with the number of lanes. Such a detector reduces overall intersection delay.

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For more details, see our website.
www.trafficlab.utah.edu

There you will also find project reports, facilities and graduate student opportunities.

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