Basis for Installation of Left-Turn Phasing

There are two types of left-turn phasing currently in use in the State of Michigan; permissive/protected (also known as protected/permissive) and protected only. Permissive/protected left-turn phasing is when the left-turn movement is permissive during the one part of the phase and protected during another part of the phase. The protected portion can be before (leading) or after (lagging) the permissive portion of the phase. Protected only left-turn phasing is when a vehicle movement is made in the absence of conflicting vehicular and pedestrian movements.

The displays used during the permissive operation are the flashing red ball in the three section head, the green ball in the five section head or the flashing yellow arrow (a new display for left-turn phasing which requires FHWA interim approval). The display used for the protected only operation is a steady green arrow.

Left-turn protection should be considered at signalized intersections when:

- the left-turn peak hour volume exceeds 90 vehicles per hour (VPH) or 50 VPH on streets with through traffic over 45 mph, or
- the product of opposing through hourly volume (VHP) and left-turn hourly volumes (VHP) exceeds 50,000, if there is one opposing lane or 100,000, if there are two opposing lanes, or
- a crash pattern is evident at the intersection which could be corrected with left-turn phasing.

Left-turn phasing should only be approved and installed after a comprehensive engineering study indicates such an operation is necessary for the safe and efficient operation of an intersection. The type of left-turn phasing will be determined based on data from the engineering study which includes the amount of delay experienced by left-turning traffic, crash patterns that may be occurring and available capacity of the intersection.

The preferred geometric intersection configuration for left-turn phasing is exclusive left-turn lanes for each approach. In addition, good access management should be present. Left-turn phasing can be used at intersections with shared lanes; however, the intersection approach with the shared left turn lane must have protected only phasing which often causes the intersection to operate less efficiently. Also, any approach that has multiple left-turn only lanes must have protected-only left-turn phasing per the 2005 Michigan Manual on Uniform Traffic Control (MMUTCD).
Left-turn Phasing (Permissive/Protected vs. Protected Only) Guides

Permissive/Protected Left-Turn Phasing should be considered, when left-turn demand is present but cannot be accommodated on two phase signal operation alone, or when a crash pattern* which could be corrected with left-turn phasing is evident at this intersection and the following is met:

1. Adequate sight distance for left-turning vehicles and opposing through traffic is available.
2. There are no more than two lanes of opposing through traffic (including shared through lanes).
3. Intersection geometrics do not promote hazardous conditions.

*Note: protected only left-turn phasing should be considered if crashes exceed four correctable crashes in one consecutive 12 month period or six correctable crashes in two years for one approach or six correctable crashes in one consecutive 12 month period or 10 correctable crashes in two consecutive years.

Protected Only Left-Turn Phasing should be considered when the need for phasing has been identified and the above listed conditions for permissive/protected operation cannot be met for any of the following conditions:

1. Any intersection where the sight distance to opposing traffic is poor due to geometry or opposing left turn vehicles.
2. The left-turn traffic must cross three or more lanes of opposing through traffic.
3. Previous use of permissive/protected phasing has resulted in – one approach – four correctable crashes in one consecutive twelve month period or six correctable crashes in two years. Both approaches – six correctable crashes in one consecutive twelve month period or 10 correctable crashes in two consecutive years.
4. At intersections where the posted speed limit of opposing traffic is greater than 45 mph.
Modifying Left-Turn Signal Phasing

The removal of protected only left-turn phasing requires the completion of an engineering study. The engineering study should consider each of the following criteria:

1. Crash history prior to the installation of the protected left-turn. If the signal was installed due to left turn crashes, protected only phasing should be maintained unless the engineering study indicates a reduction in potential vehicle conflicts.

2. The recent crash history to determine if there is evidence that a reduction in rear-end crashes may be achieved.

3. An estimate of the expected reduction in delay per vehicle entering the intersection if the phasing change were implemented.

4. Additional factors such as high pedestrian volumes, traffic signal progression, geometric design, maneuverability of particular classes of vehicles, adequacy of gaps, or operational requirements unique to pre-emption systems.

If crashes increase significantly after the phasing is modified protected only left-turn phasing should be reinstalled.