



Principles of Signal Design

An Online Continuing Education Course for Engineers

Course Number: T-2014

Credit: 2 Hours / 2 PDH / 2 CPD

PRINCIPALS OF SIGNAL DESIGN

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This Traffic Signal design course describes principals used in the design of traffic signals. Included in this course is a discussion of support selection, signal head placement, detection design, and the selection of signal control and timings.

After collecting the needed data and completing the necessary planning tasks, the final design plans for the traffic signal installation are prepared. Prior to initiating the design work, it is very important that the designer visit the site so that he or she can have an accurate visual image of the design environment. More than one site visit will typically be required to fully understand the traffic operations environment of the intersection in question. At the very least, a visit should be made during both the weekday AM peak hour and the weekday PM peak hour. If the intersection is in close proximity to a special traffic generator, such as a school or factory, a site visit during the entrance and exit times of the generator will also prove valuable. A night visit is also a good idea.

The type of intersection to be controlled has a pronounced affect on the design that is developed. Although standard 4-leg intersections are the norm, there are many other types of intersections that, in one respect or another, require special treatment:

- 5-leg Intersections
- "T" Intersections
- Skewed Intersections
- Staggered Intersections
- Freeway Ramps
- Intersections with Frontage Roads
- Single Point Urban Interchanges

The initial step in developing a traffic signal design is the preparation of an accurate base plan. Ideally, a base plan is prepared using field survey information supplemented by information contained on the condition diagram. If a complete field survey cannot be conducted, either for cost or time reasons, then a base plan can be prepared using the condition diagram along with existing construction plans or aerial photographs. Although this approach may be less accurate than a comprehensive field survey, it will also be less costly. The base plan should include all relevant

geometric and topographic features of the intersection, including curb lines, median locations, driveways, sidewalks, and utilities.

Since signal equipment cannot be located on private property without special permission from the property owner, right-of-way lines also need to be shown on the base plan. Unless old plans with right-of-way information can be obtained, establishing accurate right-of-way lines will probably require the assistance of a registered land surveyor.

Regardless of which method is chosen for preparing the base plan, the final plan will need to be "to-scale". A two-scale plan is one where a dimension on the plan directly corresponds to a dimension on the ground. For example, on a base plan prepared at a scale of 1-to-20 (1 inch equals 20 feet), a road that is 40 feet wide will be 2 inches in width on the base plan.

Common base plan scales for traffic signal design are 1-to-20, 1-to-40, and 1-to-50. Plans prepared to these scales are also referred to as 20 scale, 40 scale, and 50 scale plans.

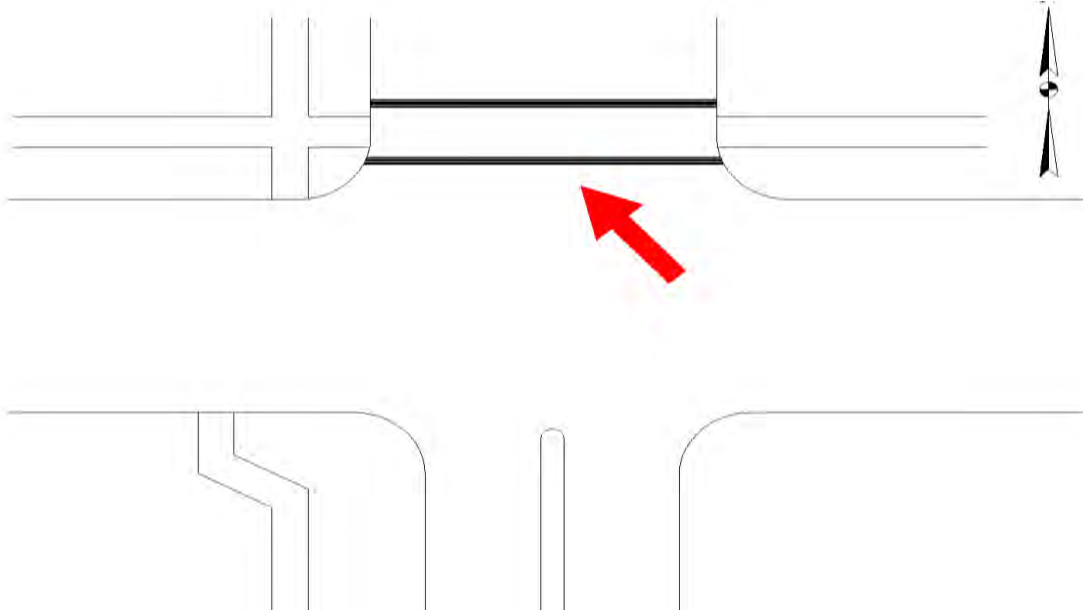
The smaller the scale number, the larger a given item will appear on a plan sheet. For example, an item on a 20 scale plan appears 2.5 times larger than the same item on a 50 scale plan. For this reason, 20 scale plans are frequently referred to as "large scale" plans while 50 scale plans are called "small scale" plans. The advantage of large scale plans is that they show features more clearly but the disadvantage is that they require a bigger sheet to display a given drawing.

In order to avoid confusion when discussing the layout of an intersection, proper directional terminology should be used. For example, vehicles arriving at an intersection from its north leg are said to arrive on the "north approach" or, alternatively, the "southbound approach". Vehicles arriving at the intersection from the east leg are said to arrive on the "east approach" or, alternatively, the "westbound approach".

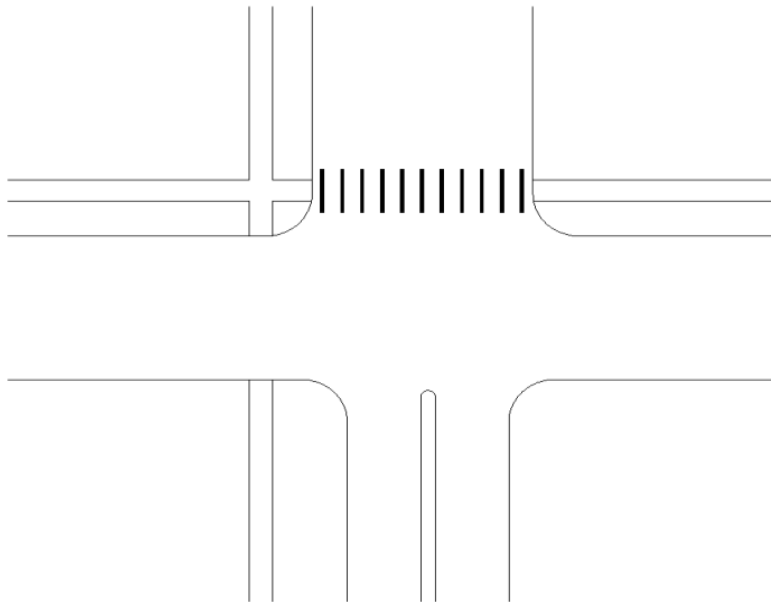
The first design question that needs to be answered is whether or not pedestrian features (crosswalks, pedestrian heads, and pedestrian buttons) will be needed at the intersection under study. All other things being equal, it is usually much easier to design traffic signals for intersections that do not require pedestrian features.

If the intersection has sidewalks, or a significant amount of pedestrian activity, pedestrian features will probably be required. In this case, the signal design should begin with the design of the pedestrian crossing system.

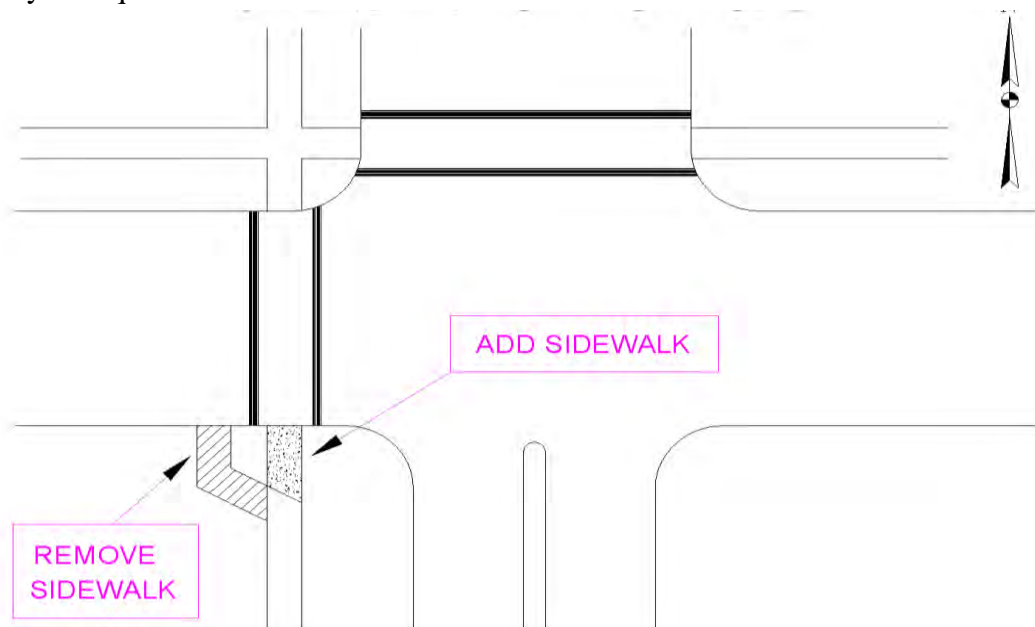
Where possible, crosswalks should be located to match up with existing sidewalks:



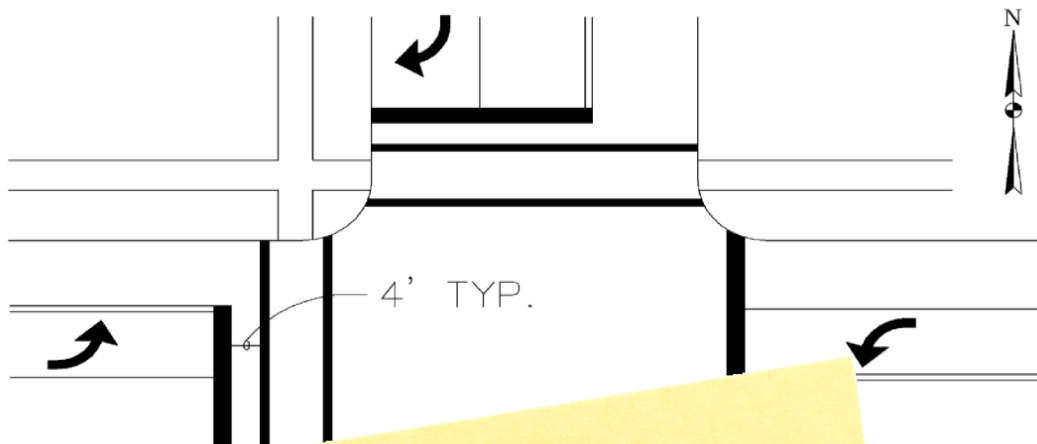
Crosswalk lines are typically 1 foot in width. Special emphasis crosswalks may be used at locations requiring increased conspicuity:



In order to form a continuous pedestrian system the addition or relocation of sidewalk segments may be required:



With the sidewalk and pedestrian crosswalk locations set, the next task is to locate the stop lines and associated lane lines and pavement arrows. Stop lines are white in color, typically 2 feet in width, and are usually located 4 feet behind any pedestrian crosswalk lines that exist:



The "TYP." indication is used for stop lines located behind crosswalks. The distance between the crosswalk; otherwise, the distance between vehicles is not a concern. Place them as close as possible to the crosswalk.

GOOD LOCATION



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it means that all stop lines should be placed behind the crosswalk. When vehicles and crossing lines it is also desirable to place them as close as possible to the crosswalk.

A stop line location close to the end of a median nose is a more natural stopping position than one some distance from the median nose. Not locating stop lines in their natural position will result in some drivers pulling past the stop line.

Having located the crosswalks and stop lines, the next step in the design process is to select the signal indications for each approach. As part of the signal planning process the phasing of the intersection was determined, so the designer must now simply select the indications which best communicate the desired phasing. Continuing our example, protected-only left turn phasing has been added to the west approach: