



Traffic Signal Design Manual

ORIGINATOR Director, Bureau of Highway Operations		6-1-4
CHAPTER 6	Signal Infrastructure Design	
SECTION 1	Permanent Signals	
SUBJECT 4	Conduit Size, Type, Layout and Use	

CONDUIT SIZING

Conduit sizes of 2- and 3-inch diameter *should* be used for signalization or interconnection. A 2-inch diameter conduit is recommended for detector leads from an advance detection pull box to larger pull boxes or controller cabinets. The minimum recommended sizes of conduits for various applications *should* be as follows:

Loop-Detector Conduit:	1"
Detector lead-in:	1" or 2" or in accordance with Regional Electrical Unit recommendations (for possible future interconnect cable)
Signal or Light Base to Pull box:	2"
Pull box to Pull box:	2-2" or 2-3" or 1-2" and 1-3" or in accordance with the Regional Electrical Unit recommendations.
Controller cabinet to Pull box:	Varies (see Standard Detail Drawings)

The recommended conduit size is determined by the number and sizes of cables to be contained in the conduit. For large installations (interchange intersections, major intersections, etc.) the conduit-sizing calculations used by WisDOT Regional electrical staff *should* be followed.

CONDUIT LAYOUT

All conduits **shall** be installed in accordance with the *Standard Specifications, Wisconsin Administrative Code*, and Chapter Comm 16 *Wisconsin State Electrical Code*.

The conduit layout *should* be designed to minimize conflicts in construction. All conduit runs *should* be as straight as possible to minimize material costs, construction costs and to facilitate the pulling of electrical cable. An attempt **shall** be made to locate equipment such that conflicts between state-owned equipment and existing utilities are avoided.

A conduit **shall** be provided from each signal or light base to the nearest pull box, from pull box to pull box, from pull box to controller cabinet, and from detector to pull box.

Any conduit under a roadway **shall** have a pull box at each end. Spare conduit **shall** be installed as directed by the signal-maintaining authority. In general, conduit runs crossing existing streets, drives, and alleys *should* be directional bored rather than trenched. Conduit **shall** encircle the entire intersection due to the flexibility it will offer for future changes.

For new road construction, trenched conduit *may* be installed around the entire intersection. The conduit layout at the intersection *should* be designed so that the controller is located in a quadrant and not on an island or median. This will allow for cabling in two separate directions, which minimizes voltage drop.

CONDUIT FOR FUTURE SIGNALS

This topic is covered in TSDM Subject 5-1-5, Underground Plan for Future Signals.

CONDUIT CROSSING STRUCTURES

At times, there may be a need to install conduit across structures. Typically, this will be the case at diamond interchanges when both ramp terminals are signalized.

When there needs to be a crossing of an existing structure, conduit *may* be installed on the structure itself or *may* be routed below the roadway that the structure crosses. To determine which method is appropriate, the Regional Traffic Engineer and Regional Structures Engineer **shall** be consulted.

When installing conduit on the structure, the conduit *should* run either parallel to or at right angles to the structural girders. A variation of ± 15 degrees is acceptable. A conduit expansion fitting **shall** be installed at each structure joint, hinge, or abutment where longitudinal movement greater than 1/2" *may* occur, or in accordance with manufacture recommendations.

At locations where conduit runs through a structure, the conduit **shall** be terminated at a pull box. An adjustment *may* be needed to avoid guardrail posts. At the midpoint of the length of wingwall, run all conduits out of the inside edge of the wingwall (into abutment fill) with 45-degree bend and continue to a pull box (24" x 42") at location. The location of the pull box will be dependent on the presence of paved shoulder, sidewalk, terrace, curb, guardrail, drop inlet or surface drain. The intent is to avoid placing the conduit and pull box behind the guardrail. The preferred location will be in the sidewalk (or future sidewalk) or paved shoulder beyond a surface drain or inlet. The conduit *should* then continue from this first pull box to a second pull box located in the grass beyond the guardrail terminal end. Both pull boxes *should* be 24" x 42".

For exposed locations, such as installations on structural girders, Schedule 80 PVC or RTRC (Reinforced Thermosetting Resin Conduit) **shall** be used. Fiberglass conduit is generally preferable to PVC due to its durability. The regional traffic section *should* be involved in the selection of the exposed conduit materials.

A third alternative to provide conduit to the opposite side of a bridge, is to install an underground conduit system parallel to the structure and underneath the feature (i.e., roadway, railroad, etc.) being crossed.

USE OF SIGNAL CONDUIT FOR OTHER APPLICATIONS

Electrical wiring in state-owned conduit systems for other types of installations that are not associated with signal operation **shall** be avoided for several reasons:

- Reduces capacity of conduit that *may* be required for future signal modifications,
- Wiring used for multiple applications in the conduit *may* violate Electrical Code,
- WisDOT staff does not provide maintenance services for the other electrical facilities (such as outsourced maintenance of state-owned ITS facilities). Changes to wiring that occupy the same space as signal wiring *may* effect signal operations. Additionally, since outsourced staff does not have access to WisDOT service reporting methods, such changes will likely not be documented by means that are readily accessible or apparent.
- WisDOT staff does not provide maintenance and locating services for municipal facilities (such as roadway lighting). Additionally, since municipal staff does not have access to WisDOT service reporting methods, such changes will likely not be documented by means that are readily accessible or apparent.