



Traffic Signal Construction

An Online Continuing Education Course for Engineers

Course Number: T-4007

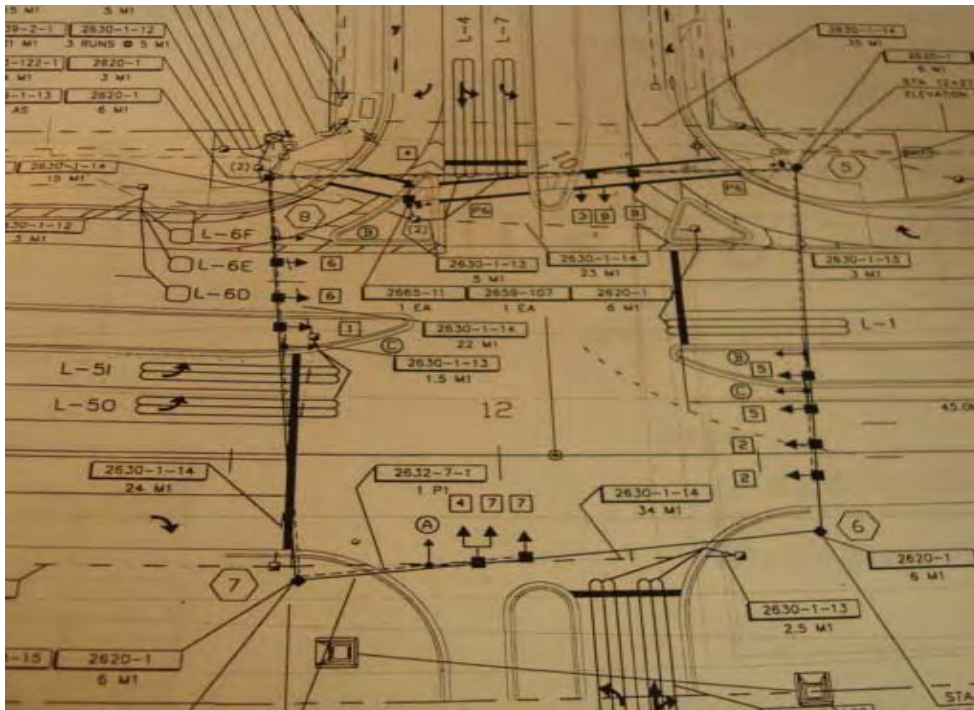
Credit: 4 Hours / 4 PDH / 4 CPD

Traffic Signal Construction

Jeffrey W. Buckholz, P.E., PhD, PTOE

PLANS PREPARATION

Detailed engineering plans and specifications are prepared so that the engineer can accurately communicate design features to construction personnel. Accurate traffic signal plans and specifications are important regardless of whether in-house construction personnel are being used or the construction contract is being "let" to a private firm. When a private construction firm is used to install a signal, the plans and specifications, and any supplementary legal stipulations are referred to as "contract documents" since they represent the work agreement between the owner and the contractor.



Pay items, also called "bid items", are numerical representations used on plans to accurately specify the desired item. For example, pay item 670-5-120 might be used to specify an actuated solid state controller assembly (represented by the 670-5), to be both furnished and installed by the contractor (represented by the 1), of type 170 (represented by the 2), with no preemption capabilities (represented by the 0). The use of numerical identifier helps reduce confusion and ambiguity over exactly what equipment is desired. In addition, each pay item is usually supported by detailed written requirements that describes the characteristics that the item must have and exactly how it is to be installed.

Each pay item has a "unit of measure" which indicates the type of quantity associated with the pay item. Some typical units of measure are:

EA = Each

LF = Lineal Feet

AS = Assembly

SY = Square Yard

PI = Per Intersection

LS = Lump Sum

For example, the installation of conduit is typically measured in lineal feet (LF).

Plans are picture-based documents that are used to communicate to the builder design features that are best described visually. Dimensions are provided on plans so that the exact size of each feature is made clear. Plans are also good for conveying locational information, such as showing the location of a pedestrian signal pedestal with respect to a sidewalk. Signal plans may be prepared "in-house" (that is, by engineers working for the agency that will own the signal) or this work may be farmed out to private engineering consultants. Whichever method is chosen, the end result should be a clear, yet concise, set of engineering plans and specifications that, at a reasonable cost, maximize the operational efficiency of the intersection while meeting all applicable safety and design standards.

Although requirements differ by agency, and even by project, traffic signal plans are typically submitted at the following milestone points:

- 60% complete
- 90% complete
- 100% complete
- Final "signed & sealed" plans

After each submission, the plans are reviewed and comments for improving the plans are provided by review personnel. Revisions are then made to the plans based on these comments.

A set of 60% plans will show the location and intended operation of all of the major components of the signal system, including: the signal supports, the signal and pedestrian heads, the detection system, and the controller cabinet. Also included in the 60% plans will be the proposed phasing and initial non-coordinated signal timings.

A copy of the 60% plans is sometimes submitted to the local utility companies so that they can mark the location and size of their facilities, and then return the plans to the designer. For example, the local gas company might indicate that they have a 6-inch diameter gas main running along the east

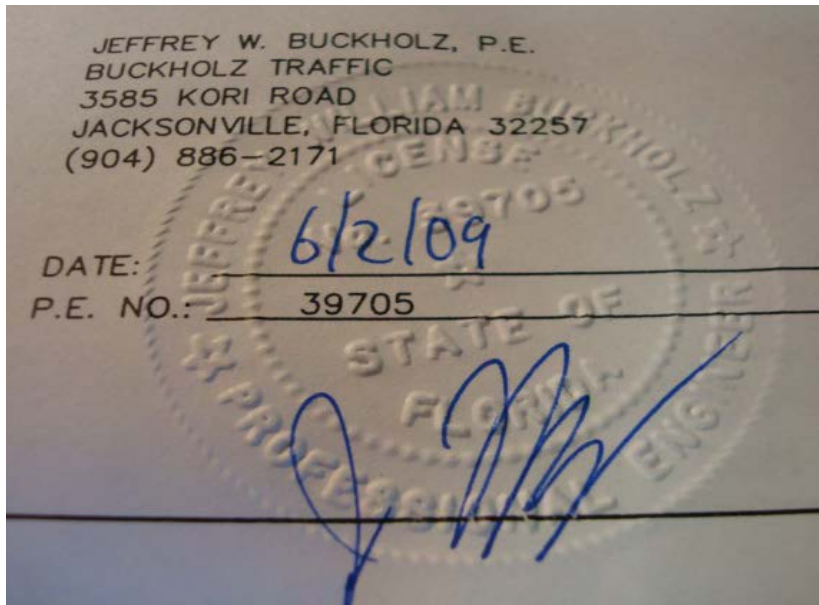
side of the road, 1 foot behind the back of sidewalk. This is important information in determining the final location of certain signal features, such as the support poles. The primary problem with utility mark-ups is that many utility companies do not have a good handle on the exact location of their underground facilities. It is not uncommon for unknown lines to be located during construction or for the location of known lines to be off by a significant distance. Unfortunately, many utility companies are just not very good at keeping accurate as-built records.

Since utility conflicts can cause major problems during construction, some agencies employ vacuum excavation technology (commonly referred to as "soft-dig" technology) during design to determine the exact location of underground utilities. Test holes are vacuum excavated at key locations, including every signal support location. Since there is usually some flexibility in the location of traffic signal equipment, it is typical for the signal designer to alter his or her original design to avoid existing utilities. Forcing the utility company to relocate their line is a rather drastic measure that is usually reserved for cases where there is no other reasonable option.

Another successful approach to identifying conflicting utilities is to hand-dig (usually down to about 4 feet) the future location of all traffic signal support poles. It is much better to find out that a utility conflict exists during the design process, when the pole can be easily moved on the plans and the design modified accordingly, rather than discovering this during construction where an easy remedy may not be available.

For the 90% submittal the location of pull boxes and conduit are added to the plans and a complete set of details are provided. Bid items and preliminary quantities are also typically included with this submittal, as is the preliminary cost estimate. For the 100% submittal the location of all items is finalized and the final set of quantities is determined. The final cost estimate is also prepared.

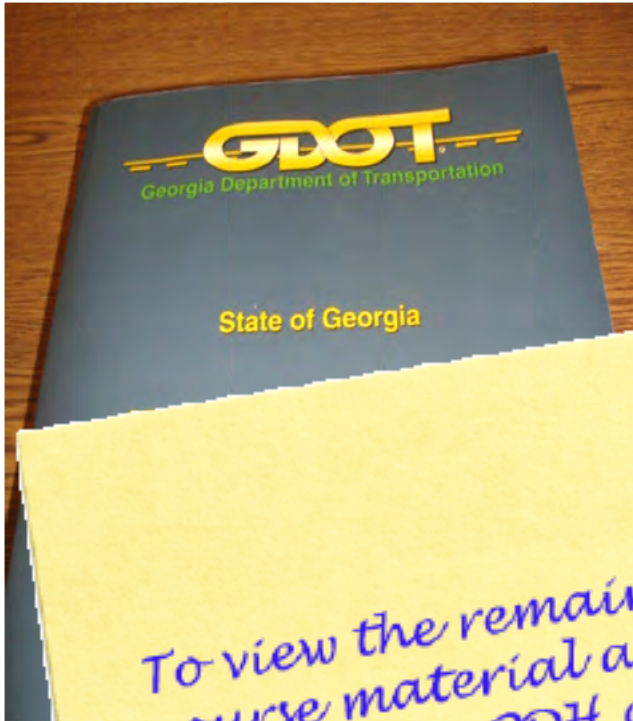
The final set of plans must be "signed and sealed" by a registered professional engineer (P.E.) with expertise in traffic signal design. In signing and sealing the plans, the engineer becomes responsible for both the accuracy of the plans and the safety of the design.



In order to ensure that the plans are accurate, a quality assurance (QA) program is sometimes established. The primary element of a typical QA program is usually an independent peer review wherein an engineer not associated with the design effort examines the plans for accuracy and completeness.

Specifications are word-based documents that are used to communicate to the builder design features that are cumbersome or impossible to describe using drawings. The operational characteristics of a traffic signal controller, the temperature requirements of a load switch, or the frequency range of a detector unit, are examples of items that are best described using detailed written documentation rather than pictures. There are two basic types of specifications, standard specifications and technical specifications

Standard Specifications describe items that are repeatedly found in traffic signal designs. The operational requirements of common signal items, such as the signal heads, inductance loops, and conflict monitor are spelled-out in the standard specifications. State DOT's usually have their own set of standard specifications, as do some local agencies.



To view the remainder of the course material and to take the quiz for PDH credit, you must purchase the course.

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After the pre... specifications is submitted they are reviewed and comments provided. App... revisions are then made and incorporated into the revised specifications. As with the final plan set, the final set of Technical Specifications must be "signed and sealed" by a registered professional engineer with expertise in traffic signal design. In signing and sealing the technical specifications, the engineer becomes responsible for the accuracy of the information contained in this document.