

Chapter 4

STARTING THE DESIGN

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4 STARTING THE DESIGN

Before starting the design, follow the simple check-list below. Design work should not begin until every item on the check list is complete. Starting a design with incomplete check-list items usually results in wasted time through unnecessary rework.

- Operational Approval is complete (See Chapter 3),
- Standards applied to the project are known (See Section 4.1), and
- Applicable background information has been compiled (See Sections 4.2 through 4.3)

The signal designer should also take a few moments to plan out what design work will be required:

- Will there be any unique details that are not covered in the Standard Drawings? The most current standard drawings (updated every 6 months in January and July) should be reviewed for any changes that may affect the design. If unique details are anticipated, these details will need to be included in plan set. See Chapter 9 and Chapter 18 for more information.
- Will any existing signal equipment need to be removed? If equipment will be permanently removed, where will ODOT want that equipment stockpiled? Check with the Region Electricians.
- Will a temporary signal be needed for any stage of construction? Existing signals need to remain in service until the re-built signal is turned on and certain lane use configurations should not be open to traffic unless they have proper signalized control (e.g. dual turn lanes). Check with the Roadway Designer and Workzone Traffic Control Designer. See Chapter 11 for more information.

4.1 What Standards Will Be Used?

This question MUST be answered before starting the design and specifications. Failure to determine which standards will be used could result in complete failure of the project. In extreme cases, plans and specification will not be approved for construction and the entire project might be terminated. Every traffic signal within the state of Oregon, regardless of jurisdiction, is required to meet the minimum standards as stated in current, adopted editions of the Manual on Uniform Traffic Control Devices (MUTCD), the Oregon Supplement to the MUTCD, and the National Electric Code. There are levels of standards that apply to signal design:

- **Full ODOT design standards and specifications**
This is typically required for any project on the State Highway System. If ODOT will maintain and operate the traffic signal this is always the case. Full ODOT standard consists of the ODOT Traffic Signal Design Manual, the ODOT Traffic Signal Drafting Manual, and the ODOT Traffic Signal Policy and Guidelines.
- **Partial ODOT design standards and specifications**
This is typically allowed if a Local Agency will maintain and operate the traffic signal on the State Highway for ODOT. This is also the case where ODOT will maintain and operate a traffic signal owned by a Local Agency. The portions of the design and specifications that are not full ODOT standard are negotiated in the Inter Governmental Agreement (IGA) or directly with the Traffic-Roadway Section during the Design Approval Process. Generally the variance to ODOT Standards is minor, such as the use of interior illuminated lane use signs.
- **Full Local Agency design standards and specifications**
This standard only applies to local agency owned and maintained traffic signals. As stated above, if the local agency will maintain and operate an ODOT owned traffic signal then some of the local agency standards might be allowed through negotiation.

4.2 Intergovernmental Agreements (IGA) and Jurisdictional Transfers

An Intergovernmental Agreement (IGA) is a legally binding document that defines the obligations of each party involved in a project. An IGA is typically needed for a state highway intersection with a local county road or city street. Depending on the scope and nature of the project there could be a lot of responsibilities to define, some of which have a direct impact on the design of traffic signal, for example; Maintenance responsibility (what design standards should be used), signal timing responsibility (what type of controller and type of detection should be used), and aesthetics (what decorative treatments are to be used).

Jurisdictional transfers allow agencies to legally redefine who has ownership of the roadway (typically changing from ODOT owned to local agency owned). They are rare, but if one is being considered on the project, it is imperative that Jurisdictional Transfer Agreement is complete and final prior to any design work. The fundamental question of what design standard should be used cannot be answered until then.

Unfortunately, the IGA or the jurisdictional transfer is sometimes processed simultaneously with the design the traffic signal. If this is the case, it is highly recommended that the signal is designed according the applicable standards that CURRENTLY apply, not to the standards that are ANTICIPATED. It is VERY risky to design according the anticipated standards, as past history has shown IGAs and especially jurisdictional transfers often do not go forward as expected given the many negotiated factors and political nature. Also, the Traffic-Roadway Section review and design approval process becomes more onerous and may cause delays to the project due to the uncertainty of the proper standard that should be applied.

Designing a signal according to anticipated standards is risky. This will result in wasted time and effort should the IGA or Jurisdictional Transfer fall through.

4.3 Background Information to Gather

4.3.1 As-Built Drawing Archive (Filenet)

As-built plan sheets should be downloaded from the internet at the Traffic Signal Standards Website under “Drawing Archive”. There is also a “Getting Started Guide” for help in using the database.

<http://www.oregon.gov/ODOT/Engineering/Pages/Signals.aspx>

When searching for drawings, it is often best to search with the Highway Number. Also, leave the search as generic as possible (while still specific enough to return less than 200 entries). This is because many of the more specific fields are not consistently populated for all intersections entered in the database. Searching these specific fields may result in missing certain drawings.

4.3.2 Electronic Information

Prior to the field verification discussed in Section 4.3.3 below, it is good to get familiar with the project area using the available electronic sources of information: ODOT digital video log and Google/Bing maps. This can help the signal designer zero in on issues/questions to address during the field verification, resulting in an efficient use of time when on-site. Note that ODOT uses a unique numbering system for all the highways; use the Cross-Reference Guide link below to find the ODOT highway number.

ODOT Highway Number Cross-Reference Guide:

<http://www.oregon.gov/ODOT/Data/Documents/Routes-to-Highway-Cross-Reference-Table.pdf>

ODOT Digital Video Log: <http://www.oregon.gov/ODOT/Data/Pages/index.aspx>

4.3.3 Field Verification

Field verification is the one of the most important steps in the process of designing a traffic signal or signal modification and should not be skipped. Thousands or tens of thousands of dollars can be saved during the construction phase of the project by simply making a field visit during the design phase and verifying the existing conditions. Seeing the actual site with your own eyes is more valuable than just looking at photos or a base map because photos and drawings only



provide limited perspective and can be incomplete or misleading.

A field visit is ALWAYS cost effective and well worth the effort. At least one field visit should be done during the design phase.

When conducting the field visit, bring a camera and take a lot of photos. These photos will be very helpful throughout the design and construction support phase the project. If in doubt, take a photo; something that seems insignificant now may prove to be extremely useful in the future (it may save an additional trip in the field to re-verify or might be useful data in resolving a construction claim). Some tips for taking good photos (depending on the scope and nature the project, some may not apply):

- Take photos of the same area from different perspectives
- Get specific, micro detail photos – inside of junction boxes (conduits and wire), inside the controller cabinet (front and back), existing signal equipment and attachments.
- Get “bigger picture” photos – each approach (approximately 500’ feet back from the intersection), each quadrant of the intersection, slopes, utility locations (the ones that are visible)



Measurements can also be very helpful, especially if the project has limited or no survey information (depending on the scope and nature of the project, some may not apply):

- Existing conduit sizes and number of wires (these measurement are critical if attempting to re-use them or add additional wire)
- Push button and pedestrian head mounting heights (if the project will be adjusting or adding ADA ramps)
- Sight distance measurements

Other useful information to gather in the field includes:

- Posted speed in the vicinity
- Location and nature of any accesses/streets that are close by
- Potential locations for all of the signal hardware (poles, pedestals, & cabinets)
- Power source location (typically nearest transformer)
- The driver’s perspective – drive each approach, note any sight distance issues (depending on the time of year, vegetation may block sight distance when leaves return).
- Information on the signal pole

4.4 Background Information from Others

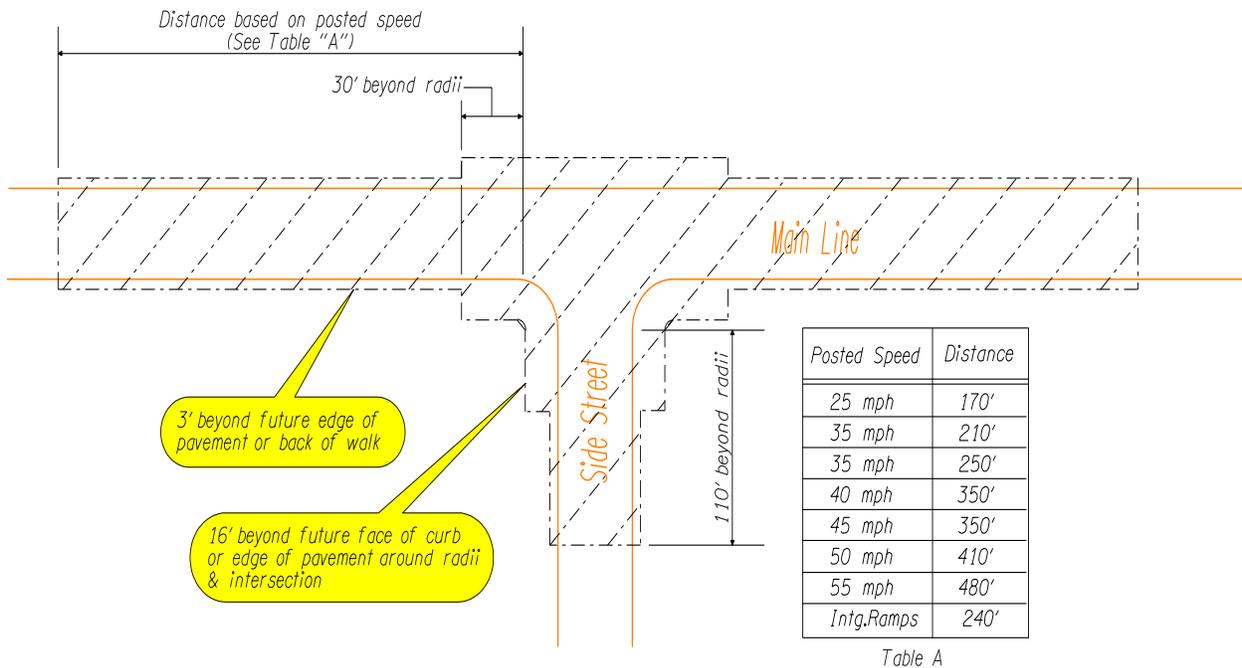
4.4.1 Base Map and Survey Information

Survey data is needed on most projects. To determine the amount and type of survey needed, the scope of the design must be defined. Below are a few examples:

- Replacement of existing loops – Typically as-built plans and field visit are all that is needed.
- Rebuild of detection system – Typically as-built plans and field visit are all that is needed. If utilities appear to be an issue a simple survey is needed.
- Installation of pedestrian signal poles, vehicle pedestals, controller cabinets, service cabinets – A simple survey is needed
- Installation of SM or STP poles – Full survey is needed with geotechnical report

Figure 4-1 below shows the recommended minimums for a survey within the intersection area. If the intersection has not yet been surveyed or additional information is required, this figure will help guide you in getting the necessary data.

Figure 4-1 | Survey Needs For Typical Traffic Signal



Data to collect within the survey area shown in Figure 4-1:

- Underground utilities less than 18' deep in the 16' wide survey areas around the radii (pole foundation conflicts)
- Underground utilities less than 3' down in the 3' wide survey areas beyond edge of pavement or back of walk (conduit and junction box conflicts)
- Above ground utilities and wire attachment heights in 16' wide survey areas around the radii (mast arm and span wire conflicts)
- Power poles with transformers (potential power source). Note: this may be located outside of survey area
- All Striping within survey area: lane lines, centerline, fog lines, crosswalks, stop bars, legends
- Any existing signal features within survey area: controller cabinet, poles, junction boxes, loops, etc.

4.4.2 Roadway Design

If the project is rebuilding the roadway, then there will be a roadway design base map. It is critical that the signal design is based on what will be built in the field. The Signal Designer must communicate with the Roadway Designer from the start of design through final plans and specifications. Since the Roadway Designer's final product is the base for the Signal Designer to start their design, it is easy to see using outdated roadway base maps will result in total failure of the traffic signal design.

4.4.3 Geotechnical Report

If new SM or STP poles are proposed, then a geotechnical report is required to determine the foundation depths. Standard loading, not actual loading, is shown in the Standard Drawings for the poles and is what is used to determine foundation depth.

As soon as the pole locations are defined, contact the Region Geo/Hydro Manager for a foundation investigation of the proposed site. This information will need to be incorporated into the pole entrance chart for the pole foundations.

4.4.4 Utility Hook-ups

New signals require a connection to commercial power and may require other connections (e.g. telephone). Or the project may involve moving existing utilities. The signal designer must coordinate with the Region Utility Specialist when locating the power supply and any other utility connections as early as possible in the design process.

4.4.5 Rail Crossing Order

If a rail crossing order is required for an intersection, it will be processed simultaneously with the design the traffic signal. The final Rail Crossing Order will be issued prior to letting the project. The signal designer will provide a sealed Railroad Preemption Plan

Sheet during the early stages of the design (DAP or Preliminary Plans) for inclusion into the Rail Crossing Order. See Chapter 16 for more detailed information.

4.5 Signal Design Project File

A project file for the signal designer's personal use should be created and maintained for the project. It should contain all of the supporting documentation, calculations and major decisions related to the traffic signal design and construction. The items listed below, if applicable, are typically included in the personal project file (either electronically, hard copy, or both):

- Project narratives
- Operational Approval letters
- Photometric Data for Illumination
- Calculations for:
 - Wire size
 - Wire fill
 - J-Box Size
 - Wire count
 - "AH" for strain poles
- Special provision boilerplates
- Cost estimates (itemized breakdown for each bid item, total bid item cost, and anticipated item cost)
- E-mails and memos concerning design decisions
- Review comments and their resolution
- Photos
- Field verification information
- Geotechnical report
- Rail crossing order
- Pole submittals and shop drawings
- Manufacturer's cut sheet or submittals
- Correspondence between project managers, consultants or contractors
- A clean copy of the title sheet and index
- A clean copy of the signed, final signal plans portion of the project used in construction
- Existing as-builts

Good record keeping can save time and effort when issues/questions arise during the design, construction, or even maintenance phase.