CITY OF AUSTIN
TRAFFIC SIGNAL DESIGN MANUAL

ATD Review Version 2.0
(October 21 2022)

Contents

City of Austin

Traffic Signal Design Manual

1. Introduction

The purpose of this manual is to aid engineers, contractors, new employees and those unfamiliar with City of Austin engineering practices, applicable standards, and policies related to traffic signal operation and design.

It is expected that anyone utilizing this manual has in depth knowledge of traffic signal engineering principles and a thorough understanding of the Texas Manual of Uniform Traffic Control Devices (TMUTCD).

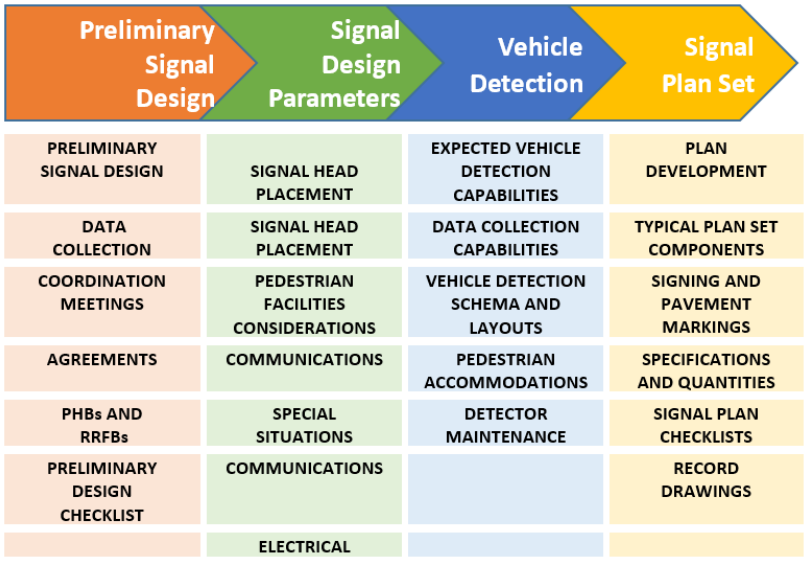
The Texas Engineering Practice Act says that the practice of engineering includes the development or optimization of plans and specifications for engineering works or systems. It also states that engineers shall practice only in their areas of competence. Given this, it is required that all traffic signal designs submitted to the City are prepared, signed, and sealed by an engineer competent in this area of engineering.

This manual presents the fundamental concepts and standard practices related to the design of traffic control signal systems operated by the City of Austin. This manual is structured to parallel the progression of decisions, activities and functions related to the design of traffic control signal systems. This is accomplished through the following chapters:

- ***Chapter 2*** addresses the activities required in the initial design stages. This includes the collection of data necessary for the design process; the requirement for utility meetings, the Preliminary Signal Design Meeting and a discussion on cooperative agreements.
- ***Chapter 3*** describes the signal design parameters to be considered in the design.
- ***Chapter 4*** covers vehicle detection requirements.
- ***Chapter 5*** describes the required content of the signal plan design set.

General organization of this manual is provided in graphical form on the next page.

As noted, traffic signals must comply with the TMUTCD. This includes the preparation, submittal, and City of Austin approval of a Traffic Signal Warrant Study prior to even considering the construction of a signal.



2. Preliminary Signal Design

All traffic signal designs must be compatible with City of Austin specifications and detail sheets, the National Electric Code (NEC), the National Electric Safety Code (NESC), the Texas Architectural Barriers Standards (TAS) maintained by the Texas Department of Licensing and Regulation (TDLR), and the Public Right of Way Accessibility Group (PROWAG) guidelines. All design sheets shall be signed, sealed and dated by an engineer registered in the State of Texas.

Operation and maintenance of traffic signals on City of Austin roadways, and State-owned roadways within the City limits are the responsibility of the Arterial Management Division (AMD) of the Austin Transportation Department (ATD).

2.1 Data Collection

The designer is required to meet with City of Austin Arterial Management staff at the beginning of any signal design project. It is the responsibility of the designer to perform any research necessary for informed decisions to be made and bring this documentation to the meeting. This includes the results of a pre-design site inspection and field utility meeting. In addition, a project intake form must be provided prior to the preliminary signal design meeting This form can be found in the appendix.

2.1.1 Field Data Requirements

For all projects involving digging or underground work, the project must go through the Austin Utility Location and Coordination Committee (AULCC). As such, a SUE Level C survey is required. This involves surveying visible utility facilities (e.g., manholes, valve boxes, etc.) and correlating this information with existing utility records. Collect data along each leg of the proposed signalized intersection as follows:

- Arterial Roadways – 400 feet
- Collector and Local Roadways – 200 feet
- Driveways – to the property line.

The existence of utilities, either underground or overhead, shall be taken from the best records available and confirmed in the field.

The basic field data to be collected and shown on the plans shall include the ROW lines, all gas valves, water valves, hydrants, manholes, catch basins, utility poles, various other objects and structures, overhead electric cables, reinforced concrete pipes, sanitary sewers, communications, electric lines, fiber, water lines, gas lines, and storm sewers.

Information regarding submittals to the AULCC, can be found on their website, located at:

https://www.austintexas.gov/page/austin-utility-location-and-coordination-committee

https://abc.austintexas.gov

AULCC meetings are held every Thursday from 2 p.m. to 4 p.m. After review fees are paid and the application is processed, you will receive additional information regarding your AULCC meeting date.

2.1.2 Traffic Data

As part of the data collection effort, the designer must provide copies of the Traffic Impact Analysis (TIA), Signal Warrant Study, and any other pertinent information affecting traffic through the intersection. The designer may also be required to provide count data and studies for bicycles and pedestrians. Acceptable days and times for conducting traffic data collection shall be based on the latest City of Austin requirements for under s.

2.1.3 Pre-design Site Inspection

The designer should conduct a site inspection to visually check the intersection for conditions that will affect the design. It is recommended that the designer create a photographic record of the site which includes all areas of the proposed construction and all affected utility poles. This takes very little time and may be very beneficial later during construction. The location of existing utility facilities, overhead and underground, is the most important thing to check during the site inspection and is discussed in the utility section. Other areas to check include, but are not limited to, the following:

- Check the terrain for possible complications where traffic signal appurtenances are proposed, e.g., a rock ledge near the intersection suggests bedrock near the surface which may prevent or encumber the installation of conduit or foundations; an adjacent wetland area may prevent the installation of a pole anchor.
- Determine if there are any trees that need to be trimmed or removed, e.g., saplings or shrubs that have grown adjacent to the utility cables will have to be removed prior to the installation of interconnect cable.
- Check the roadway condition and width. Check property and right of way lines. Sufficient right-of-way is needed for pole anchors. Span wire or messenger with cable should not be placed over private property. This is called an aerial trespass.
- Check existing lane markings on all approaches
- Check for evidence of underground utilities (i.e. water valves, fire hydrants, manholes, catch basins)
- Note any objects which may not be on the survey and will affect the signal installation, e.g., trees, bushes, signs, walls, fences, beam rail, etc.
- Check the drainage system. If catch basins are present at the intersection there is a drainage system that must be avoided. The catch basins will be connected by reinforced concrete pipe (RCP). If not shown on a survey plan, the location of the RCP may be learned by looking into the catch basin. The RCP is deep enough so that the placement of conduit will not be affected, but foundations should not be placed over it. Foundations should not be placed adjacent to the catch basin structure either.

- Check the sanitary sewer system. The sewer system is usually owned by the city but may be owned by a utility company or private entity. Some sewer pipes are pressurized to force the waste uphill. The pipes are generally deep. Manhole structures are placed at regular intervals in the system for maintenance access. If two or more manholes, owned by the same company, are found it can generally be assumed the sewer runs between them. Foundations should never be placed over a sewer line. The sewer system owner should be contacted to either access their plans or to have an employee field locate the main sewer lines and laterals.
- If station numbers are not being used to locate the various traffic signal appurtenances, ensure they are tied off nearby existing physical objects such as a utility pole, catch basin, hydrant, edge of road or extended curb line.
- Check overhead utility facilities. Identify all existing utility cables that are attached to poles at or near the intersection. Measure and record the heights where attached to the poles and at mid span points where conflicts may be created with a traffic signal span wire or mast arm. Potential conflicts must be discussed and resolved later during the utility meeting.

2.2. Field Utility Coordination Meetings

The designer must meet with and coordinate with Arterial Management Division Construction Inspectors and utility companies of the proposed work and identify and resolve conflicts between the traffic signal and utility facilities. The designer should prepare and be ready to provide each utility engineer the following information.

- A preliminary layout showing the proposed location of signal poles or mast arm assemblies with dimensional references to permanent physical elements or, if available, station number and offset.
- Underground and overhead utilities.
- The estimated height of any span attachments to utility poles.
- The estimated height of the span wire or mast arm where it will cross existing utility cables. A cross-section sketch is recommended. Note: Span Wire signals are generally not accepted for new or permanent installations in the City of Austin.
- The estimated electrical load of the traffic signal.
- The party responsible for the electrical energy to operate the traffic signal.
- The reimbursable percentage of all utility work and the party responsible for payment.
- The construction schedule.

This manual cannot discuss all possible utility situations the designer may encounter. The following subjects should be used as a guideline when conducting a utility meeting.

- Electric service, type (metered or unmetered) and source.
- Proposed steel pole/mast arm assembly types and locations. Note: The City of Austin only uses galvanized steel poles.
- Span wire attachment to poles and the necessary anchors and guys.
- Potential mid-span crossing conflicts with utility cables.
- Conduit attachment to poles and the need for stand-off brackets.
- Messenger and detector cable attachment to poles for arterial detection.
- Interconnect cable attachment to poles.

The designer must leave a copy of the preliminary plan with the utility company engineer showing all utility pole attachments, span wire crossing points (with estimated heights), risers, anchors, etc.. The designer should also request from the power and telecom company a cost estimate (by letter or e-mail) for the work they will perform.

It is recommended to complete a report-of-meeting document. The report should list all subjects discussed (even if there is no action required), including all agreements, responsibilities and resolutions to anticipated conflicts. The designer should send a copy to all interested parties (whether in attendance or not) along with a copy of the preliminary signal design. If personnel changes are made before construction begins (by the utility company or the signal designer) the report-of-meeting will be very beneficial to the replacement engineer.

2.3. Initial Signal Design Meeting

The designer must conduct the pre-design site inspection and utility coordination prior to the initial design meeting and bring documentation of findings to the meeting. This includes communications with the electric service provider regarding the locations available to draw power for the traffic signal equipment. At a minimum, representatives from the Signal Design and Construction Section, Signal Timing and Operations Section, and Signal Communication Section should be present. The following topics will be discussed that would impact the signal design:

- Electrical service location and name of provider
- Location of proposed equipment, including, but not limited to, the cabinet, poles, and pedestrian buttons
- Connection to the City's communication network.
- Battery Backup Unit (BBU) requirements. (Required for all new signal construction)
- Minimum clearances per the National Electric Safety Code (NESC)
- Minimum clearance to railroad tracks
- Minimum clearance to existing utilities
- Conformance with the American with Disabilities Act (ADA)
- Conformance with Public Right of Way Accessibility Guidelines (PROWAG)
- Required plan sheets and their content
- Signal Operations
- Specifications and submittals for all signal equipment to be installed
- Project schedule
- Temporary traffic control and staging
- Identification of key personnel and channels of communication.

The Preliminary Signal Design Checklist in Section 2.7 will be discussed at the initial signal design meeting. Documentation of the content and attendees of the initial design meeting will be provided by the City. A copy of this documentation must be provided with each plan submittal. Failure to do so will result in delays to the project.

2.4. Agreements

The City of Austin operates and maintains numerous signals that are owned by other entities, such as TxDOT and the surrounding counties. These signals typically have funding agreements showing which entity is responsible for the cost of designing, constructing, and operating the signal. In addition, some signals are installed to accommodate new developments and funding agreements are in place with the property owner.

For signals constructed on right-of-way owned by others, these agreements must also include a requirement that these entities are included in the design and approval process. For example, there might be both an Advance Funding Agreement (AFA) and the Municipal Maintenance Agreement (MMA). All funding agreements and approvals must be completed prior to construction of a traffic signal. Signals constructed in other jurisdiction's right-of-way will need to be approved by the appropriate entity in addition to the City of Austin.

2.5. Pedestrian Hybrid Beacons (PHB)

Data collection and pre-design activities for Pedestrian Hybrid Beacons (PHBs) are the same as for traffic signals.

2.6. Rectangular Rapid Flashing Beacons (RRFB)

Data collection and pre-design activities for a Rectangular Rapid Flashing Beacon (RRFB) are the same as for traffic signals. (Electricity provider data is not needed for solar powered RRFBs.) In addition, the designer must consider the connectivity of the pedestrian network and what pathways the RRFB will serve.

2.7. Preliminary Signal Design Checklist – FIELD INVESTIGATION CHECKLIST

The designer must be prepared to discuss the items listed on the following checklist at the Signal Initial Design meeting:

MAIN STREET:_____ **DATE/TIME:**_____

CROSS STREET:_____ **DESIGNER NAME:**_____

PROJECT NO (TxDOT CSJ OR CITY SITE PLAN NUMBER):_____ **DESIGN FIRM:**_____

☐ CABINET LOCATION	☐ ROADWAY MARKINGS
☐ SOP (SOURCE OF POWER) AND APPLICATION	☐ GROUND MOUNT AND OVERHEAD SIGNING
☐ UTILITY COORDINATION	☐ EXISTING EQUIPMENT CONDITION
☐ ROADWAY CONDITION	☐ CABINET, CONTROLLER, AND MONITOR
☐ PRESENCE AND CONDITION OF CURB AND GUTTER	☐ PEDESTRIAN RAMPS/PEDESTRIAN AMENITIES
☐ BASIC GEOMETRY - LANE USAGE, LANE WIDTHS, DISTANCE CENTERLINE TO CURB, CORNER RADIUS	☐ ADA REQUIREMENTS
☐ TOPOGRAPHY (SLOPES, GRADES, ETC.)	☐ DETECTION TYPE AND DETECTOR ZONE PLACEMENT
☐ VISIBILITY OF INTERSECTION, ENTERING VEHICLES, SIGNS, SIGNAL INDICATIONS	☐ ELECTRICAL DETAILS
☐ DRAINAGE FEATURES	☐ COMMUNICATIONS (FIBER OR CELL MODEM)
☐ LOCATION AND CONDITION OF PULLBOXES	☐ SIGNAL HEADS (NUMBER AND TYPE)
☐ RAILROAD OR EMERGENCY PROVIDERS IN AREA	☐ SIGNAL PHASING
☐ EMERGENCY VEHICLE PREEMPTION (EVP)	☐ BATTERY BACKUP UNIT
☐ OVERHEAD WIRES OR STRUCTURES	☐ TEMPORARY TRAFFIC CONTROL AND STAGING
☐ OVERHEAD CLEARANCES	☐ PROJECT SCHEDULE
☐ UNDERGROUND CLEARANCES	☐ KEY PERSONNEL AND CHANNELS OF COMMUNICATION ☐ GROUNDING

Notes:

A signed copy of this form will be returned to the designer and must be included with submittal of the Preliminary Signal Plans.

3. Signal Design Parameters

There are a number of parameters that must be considered when designing new traffic signal infrastructure or modifications to existing signal infrastructure. These include how the signal will operate, the layout of the traffic signal heads, vehicle detection, etc.

3.1 Traffic Signal Phasing, Operations and Head Placement

Traffic Signal Phasing and Operations must be given careful consideration in any signal design. Signal phasing, sequences, and timings vary by time of day and week at most locations. Furthermore, the users of the intersection are often multi-modal, not only including cars and trucks, but also pedestrians, bicycles, and transit. The location and types of signal heads must be designed to give the City Signal Timing Engineers the most flexible and safest options.

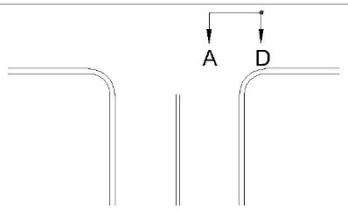
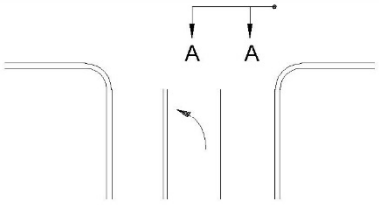
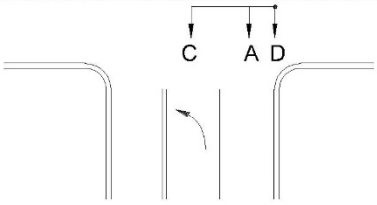
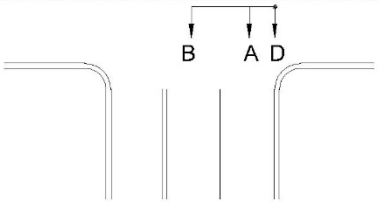
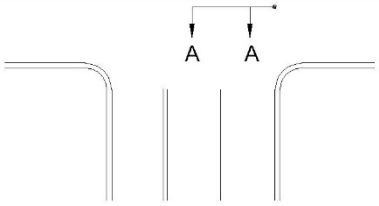
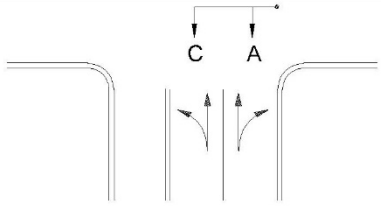
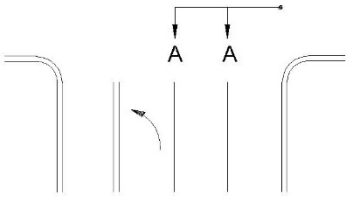
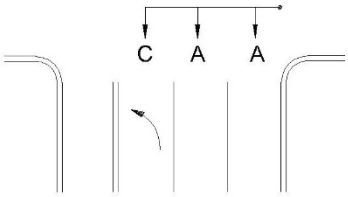
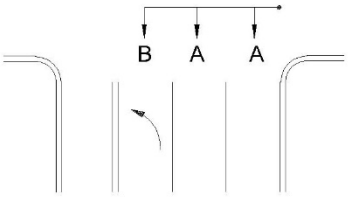
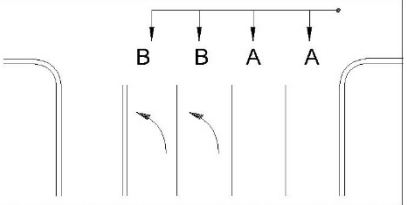
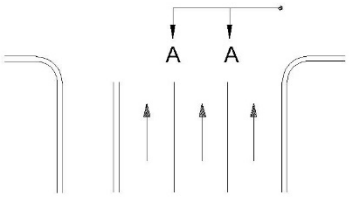
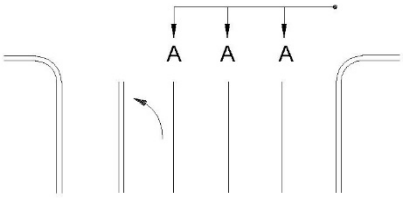
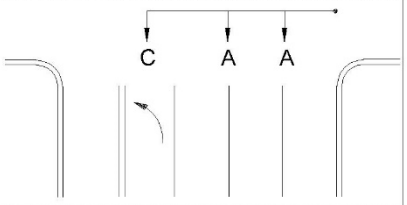
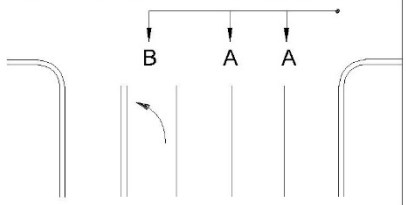
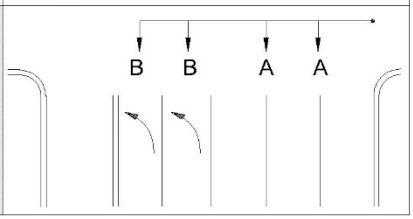
3.1.1 Traffic Signal Head Design

The City of Austin uses several types of signal head configurations. In general, the following heads are used for almost every application. Heads should be centered directly in front of the lane controlled by that head, unless otherwise determined as acceptable by the City. For the purposes of this document, the term FYA stands for "flashing yellow arrow".

1. Thru lanes
   a. Three-section circular colors
   b. Three-section "up/slanted" arrows
2. Exclusive left-turn lanes
   a. Three-section left-turn head
   b. Three-section left-turn FYA head
   c. Four-section left-turn FYA head
3. Shared left-turn/thru lanes
   a. Four-section "split-phase" head
   b. Five-section left-turn arrow and circular colors
   c. Three-section circular colors
4. Exclusive U-turn lanes
   a. Four-section U-turn FYA head
5. Exclusive right-turn lanes
   a. Three-section right-turn head
   b. Four-section right-turn FYA head
   c. Three-section circular colors
   d. No right turn indication
6. Shared right-turn/shared lanes
   a. Three-section circular colors and/or no right-turn indication
   b. Five-section right-turn arrow and ball colors

These heads and their applications are all illustrated and explained in detail below.

SIGNAL HEAD PLACEMENT

LANE CONFIG. THRU/LEFT	UNPROTECTED	PROTECTED/PERMISSIVE	FULLY PROTECTED
1/0		NOTES: A = 3 SECTION HORIZONTAL - RED, AMBER, GREEN B = 3 SECTION HORIZONTAL - RED, AMBER ← , GREEN ← C = 4 SECTION HORIZONTAL - RED, AMBER ← , AMBER ← , GREEN ← D = 3 SECTION VERTICAL - RED, AMBER, GREEN	
1/1			
2/0			
2/1			
2/2			
3/0			
3/1			
3/2			

3.1.1 Special Signal Heads:

Bicycle signals

These signals are provided where a bicycle movement is not adjacent and on the right-side of vehicular traffic. Bicycle indications are preferred but cannot be used in all applications. Engineer may determine that operations require a three-section circular colors head with all sections louvered which would be accompanied by a sign that reads "BIKE SIGNAL".

Transit signals

These signals are provided where transit vehicles (buses, light rail vehicles, etc) have a dedicated approach at a signalized intersection and is given a specific transit phase during the cycle. Transit indications are always mounted vertically and have three sections as shown in the TMUTCD (Figure 8C-3 Single LRT Route Three-Lens Signal).

Pedestrian crosswalks

Countdown pedestrian heads should be provided at all signalized intersections that have curb ramps and striped crosswalks on both ends of the crosswalk and in a median refuge when directed by a signal engineer.

T-intersection layout

At a T-intersection, the minor movement shall consist of three signal heads in one of the following:

Two left-turn signal heads and one right-turn signal head or

One left-turn signal head and two right-turn signal head.

All movements that cross a crosswalk shall be 4-section FYA heads. If a movement does not cross a crosswalk then it shall be a 3-secton head with turn arrows.

Two signal heads must always be provided for the turning movement with the heavier traffic volume.

3.1.1 Traffic Signal Visibility

The primary consideration in signal face placement, aiming, and adjustment shall be to optimize the visibility of signal indications to approaching traffic. Road users approaching a signalized intersection or other signalized area, such as a midblock crosswalk, shall be given a clear and unmistakable indication of their right-of-way assignment.

The geometry of each intersection to be signalized, including vertical grades, horizontal curves, and obstructions as well as the lateral and vertical angles of sight toward a signal face, as determined by typical driver-eye position, shall be considered in determining the vertical, longitudinal, and lateral position of the signal face. Minimum sight distance for signal visibility is shown in the figure.

85th-Percentile Speed	Minimum Sight Distance
20 mph	175 feet
25 mph	215 feet
30 mph	270 feet
35 mph	325 feet
40 mph	390 feet
45 mph	460 feet
50 mph	540 feet
55 mph	625 feet
60 mph	715 feet

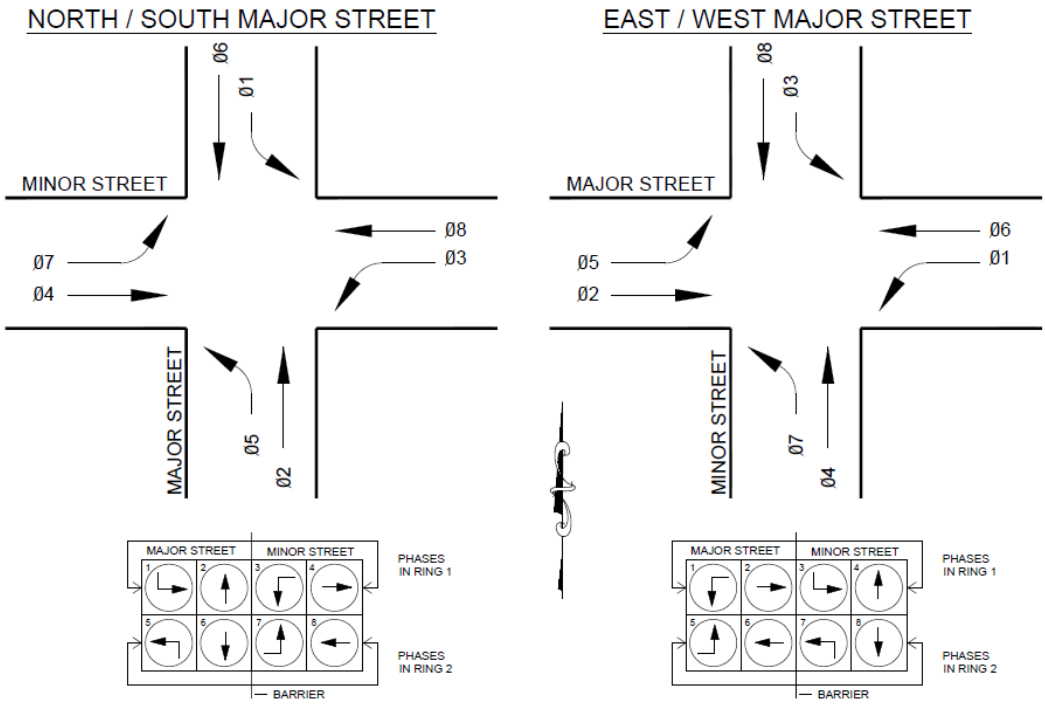
Note: Distances in this table are derived from stopping sight distance plus an assumed queue length for shorter cycle lengths (60 to 75 seconds).

3.1.2 Traffic Signal Phasing

The City of Austin Signal Timing Engineers have developed standard phasing for typical intersections and the signal plans shall reflect the standards shown in the following figures.

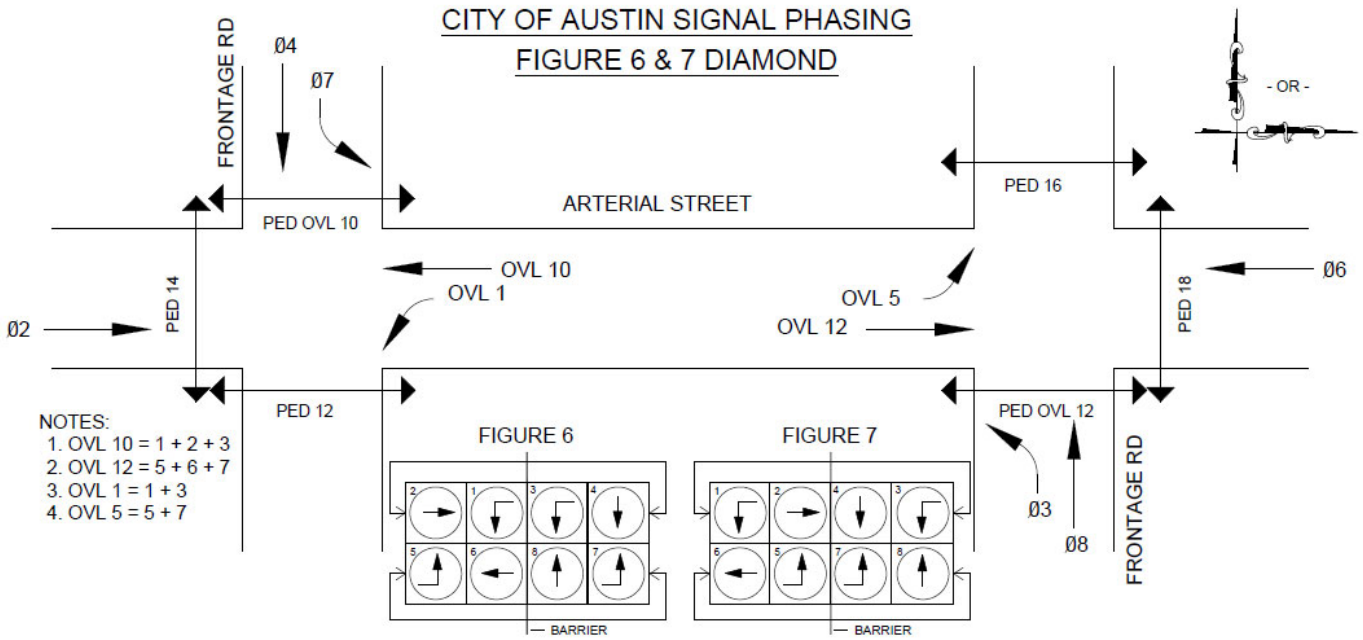
Standard Intersection Phasing

For intersections in the City of Austin the main street through movements are assigned to phases 2 and 6. The figures below show typical phase assignments used by the city for an eight phase intersection.



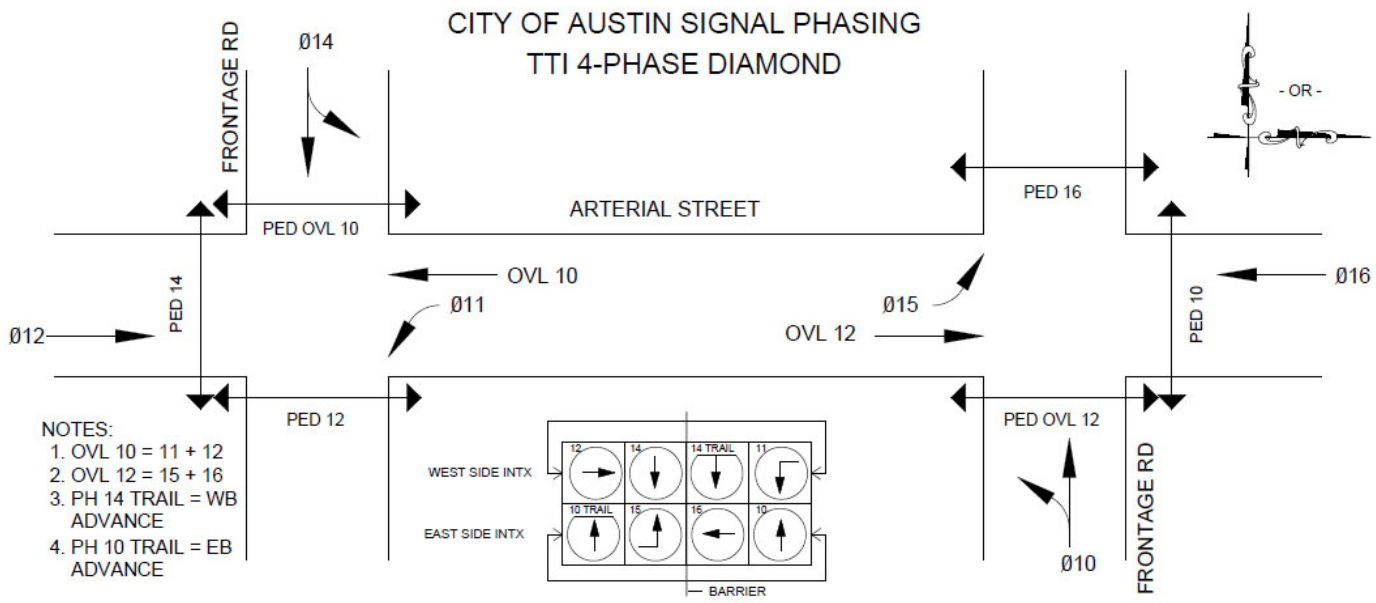
Diamond Interchange Phasing

The City of Austin typically configures diamond interchanges based on the lane assignment configuration of each approach as well as the traffic volumes at the intersection. Depending on these factors, phasing at an interchange may be TTI-4Phase, Figure 3, Figure 6 or Figure 7 phasing or a combination of each. Examples are provided in the following figures :



TTI 4-Phase Diamond Interchange

At some locations, the City may use the TTI 4-Phase Diamond phasing as shown in the figure below.



A leading pedestrian interval (LPI) gives pedestrians the opportunity to enter the crosswalk at an intersection 3-7 seconds before vehicles are given a green indication. Pedestrians can better establish their presence in the crosswalk before vehicles have priority to turn right or left. FHWA's Handbook for *Designing Roadways for the Aging Population* recommends the use of the LPI at intersections with high turning vehicle volumes.

The need for any leading pedestrian intervals should be established with the City of Austin Signal Timing Engineer during the pre-design meeting.

3.1.3 Pedestrian Facilities Considerations

Pedestrian infrastructure include: pedestrian indications, pedestrian push buttons, pedestrian pavement markings (crosswalks), pedestrian ramps, sidewalk, and APS push buttons. A signalized crosswalk should be installed on each leg of the intersection. All pedestrian facilities must comply with the TMUTCD and PROWAG.

3.1.4 Roadway Geometric Considerations

For all pedestrian crossings with a median width greater than 16’ (measured from lip of gutter or edge of marked travel way), significant consideration should be given to designing a two-stage crossing with two pedestrian poles in the median.

Pedestrian poles and push buttons should be installed at the top of the ramp adjacent to a level landing area where feasible to minimize pedestrian crossing distances.

A turning movement analysis should be conducted to ensure that the pedestrian pole and push buttons are not in the turn path of 18-Wheeled trucks. The WB-50 design vehicle should be used for traffic signals.

All corners of a signal plan set may require a separate sheet with sidewalks and ramp elevations as well as pedestrian pushbutton location details. This is to help clarify that each corner meets Accessibility Guidelines.

3.4 Special Situations

Design Step	Design Consideration
Design Step 1 Modifications to Existing Traffic Signal Infrastructure	Ensure new wire labeling is clear Ensure phasing and pole and pullbox numbering conforms to current standards, LED, international peds Clearly define what is to be done and contractor required work is clear (such as re-labeling system components for phasing changes and phasing standards) Ensure that existing items are clearly defined as existing items. Identify portions of existing to be retained How to remove/salvage/re-install existing and add new should be clear Careful delineation on plans of revisions to existing signal(s) Review wiring Change controller and cabinet? Electrical Service? Temporary operations required? Consider new head bracketing when replacing a head Ensure that revised graphics and notes clearly reflect the conditions after the revision Flashing Yellow Arrow operations? Include a Narrative on the Layout Sheet to clearly indicate what is being done.
Design Step 2 Other Traffic Signals	Lane use control Pedestrian Hybrid Beacons (PHB) Rectangular Rapid Flashing Beacon (RRFB) Freeway ramp metering Traffic Control - Use of one-lane two-way roadways Traffic Control - Use of portable signals

3.5 Communications

AMD operates and manages 1100+ traffic signals and PHBs. Every signal is linked to the City's Mobility Management Center (MMC). This allows the MMC to utilize CCTV camera to monitor traffic conditions, make timing adjustments and remotely troubleshoot issues prior to dispatching signal technicians. This section outlines the communication requirements at traffic signals.

AMD has an extensive traffic signal communication network (TSCN) consisting of 250+ mile files of fiber optic cable (FOC). Each traffic signal has a Layer 2 switch and Layer 3 switches are deployed strategically in Hub cabinets throughout the City. Fiber is the primary means of data transmission with 80%+ connected via fiber. The remaining signals are connected either via wireless radio or cellular modems.

As each traffic signal consists of numerous IP capable devices, most with one CCTV cameras and a number with two CCTVs, bandwidth is a critical design element that needs to be considered when connecting to the TSCN. Below is a list of typical devices installed at an intersection. Although each device may not be extremely bandwidth demanding, latency is critical for many of these devices which are polled on a second by second basis.

- Signal Controller,
- Battery Backup Units,
- Malfunction Monitoring Unit,
- Detection Devices,
- CCTV Cameras,

- Network Switches,
- TSP/EVP functionality*

* Traffic Signal Priority (TSP) /Emergency Vehicle Preemption (EVP) functionality is not hardware dependent but requires low latency communication.

The aim of AMD is to connect each device to the fiber optic backbone to provide the highest bandwidth and reliability. This is not always feasible, so AMD created the following table as a guide to when wireless radio and cellular modems may be used for communications at a traffic signal.

Scenario	Communication		Notes
	Primary	Secondary	
Existing fiber on pole line	Fiber	Fiber	Install riser to appropriate wood pole and into existing fiber
Existing fiber in conduit	Fiber	Fiber	Install 1-3” conduit to nearest fiber pull box and splice into existing fiber
Nearest fiber <1,000'	Fiber	Fiber	Install 1-3” conduit to nearest fiber pull box and splice into existing fiber
Nearest fiber <2,610'	Fiber	Wireless/cellular	Install fiber on existing pole line. If there is not an existing pole line, then one should be installed. If constructability is infeasible then wireless antenna or cellular modem to be used.
Nearest fiber <5,200'	Fiber	Wireless/cellular	Install fiber on existing pole line. If there is not an existing pole line, then wireless antenna or cellular modem to be used.

To maintain compatibility throughout the TSCN, the following equipment are acceptable. Any other equipment will need to be approved by AMD.

3.6 Electrical

3.6.1 General

The electrical service needed to operate a traffic signal is 120 VAC. With low power LED traffic and pedestrian indications now being standard, the load will rarely exceed 2000 watts even at a large intersection. Normally #6 AWG, Type SE (Service Entrance), copper conductors is adequate and is the Department’s standard. Copper clad aluminum or aluminum conductors are not allowed.

3.6.2 Traffic Signal Equipment Clearance Requirements

All designs must be in accordance with the “National Electrical Safety Code” (NESC), “National Electrical Code” (NEC), and local utility company regulations. These design and construction standards have been developed to ensure a safe work site for the installation crew and a safe installation for maintenance personnel, traffic engineers, and the public.

The NESC establishes clearances between utility lines to all signal appurtenances such as span wire, steel poles and mast arm support structures. Refer to the following sections of the NESC:

- Section 233 - Clearances Between Wires, Conductors, and Cables on Different Structures
- Section 234 - Clearances of Wires, Conductors and Equipment from Buildings, Bridges, Rail Cars, Swimming Pools, and Other Installations
- Section 238 - Vertical Clearance Between Certain Communications and Supply Facilities Located on the Same Structure.

In addition to the NESC clearances in Section 234, all traffic signal appurtenances shall be at least 10 feet from utility primary cables.

3.6.3 Traffic Signal Conduits

There are many types of electrical conduits available. Underground cable that is used in a traffic signal installation is installed in PVC conduit. Direct buried cable is not allowed. The designer should review and be familiar with the NESC section 32, “Underground Conduit Systems”, several Articles of the NEC, Chapter 3, “Wiring Methods”, and City of Austin Detail Sheets and Specifications regarding conduit.

3.6.4 Conduit Under Railroad Tracks

When it is necessary to install conduit under railroad tracks, use a minimum size of 2 ½ inch and terminate it in a large pullbox, one on each side of the railroad right-of-way. Include a spare conduit under the tracks. The NESC rule 320A5 requires a minimum 50 inches depth. Individual RR owners may have different requirements. The depth may either be increased when required by the RR owner or decreased where that depth is impractical. If reduced, the agreement of both parties is necessary.

3.6.5 Wiring, Poles, and Conduit Near Overhead Utilities

NESC rule 235 requires a 40 inch clearance between the highest communication cable and the lowest power (supply) cables. This is considered a “communication worker safety zone”. If these clearances are not present and cannot be met by adjusting the existing cables, consider replacing the pole with a taller one. The designer should be familiar with certain exceptions to the regulations. In the interest of safety, the designer is also obligated to correct any existing clearance violations that are found on poles that will be used in the design. Below are some options if the proper clearances cannot be provided.

- Request relocation of the affected utility cables or replacement with taller poles.
- Request reconstruction of the pole top with an out-rigged cross arm away from span attachment or a pole top extension.

Utility pole construction depends on a variety of factors which cannot be discussed here. All reconstruction must be agreed upon by both the power company and the telecom company

3.6.6 Overhead Wiring Clearance

The proposed span wire must have the proper clearance to other cables within the intersection. Section 233 of the NESC addresses mid-span vertical and horizontal clearances. A span wire supporting signal cable is classified by the NESC as a 230C3 cable. Normally the span is high enough not to conflict with communication cables and low enough not to conflict with power cables. Unusual conditions such as low primary conductors or a high span wire will require corrective action. The designer should calculate the height of the proposed span where it will cross other cables. Anticipated conflicts should be discussed during the utility meeting. For safety reasons a 10 foot clearance to primary cables is desired. The suspended traffic signals must also have sufficient horizontal clearance to communication cables to prevent contact during high winds. A minimum 4 feet is recommended.

A mast arm signal design usually does not introduce the utility clearance concerns that a span wire design does. There are no wireline attachments to traffic signal poles and, if the mast arm structure is not the combination type (with a luminaire), it is not near the primary cables. The major concern of a mast arm signal design is the heights of communication cables where the arm will cross under. A mast arm with fixed-mounted signals is usually at the same elevation as communication cables, between 18 feet and 19 feet above the road. The designer should always measure the height of the cables and compare this to the estimated height of the proposed arm. A cross section diagram showing the arm and all communication cables is helpful. If a potential conflict is found, the designer should request that the cables be raised or lowered. If one or more utility poles must be replaced to provide the clearance, the designer may consider a free-swinging signal design. A free-swinging signal design allows the arm to pass above the communication cables. The arm is usually between 20 feet and 23 feet above the road. As in a span wire design,

the suspended signals and signs should not be near communication cables. A minimum 3 feet of horizontal clearance is needed to prevent contact during high wind conditions.

3.6.7 Installing Traffic Signals Beneath Electrical Transmission Lines

Electrical transmission lines operate at higher voltages and currents than electrical distribution lines. Alternating current flowing through a conductor will create an electrical field in the space around the conductor, which is typically unsheathed. The field from a distribution voltage circuit has little effect on an adjacent traffic signal. Transmission lines however, have extremely high voltage and current. The effect of an electrical field from transmission lines may damage electronic equipment.

There are certain conditions the designer must consider when a traffic signal is located beneath or adjacent to electric transmission lines. The electric field created by the high voltage in the lines (up to 345 kv) will induce a voltage in any conductive material nearby. The induced voltage level depends on the transmission line voltage, the proximity of the object to the lines, and the orientation of the object to the lines, e.g., a span wire or mast arm parallel to the lines will receive a higher charge than one perpendicular. Normally the induced voltage is dissipated by draining the current to ground, however material that is not grounded properly will develop a discernable electrical charge.

Traffic signal appurtenances, including conduit, should not be placed within 50 feet of a transmission support structure. Consult with the transmission line owner regarding the signal design. Include in the design all recommended material and actions to reduce, and eliminate, if possible, the induced voltage. This may include additional ground rods, bonding wire, or a ground grid. In addition, include all recommended installation procedures such as keeping a mast arm assembly grounded during erection.

3.6.8 Underground Conduit Clearance

The location of underground utilities is critical in the vicinity of a proposed foundation of a controller, steel pole, or mast arm. The most common utilities encountered are natural gas, water, and sewer lines. In urban or downtown areas, power and communication conduit systems are common. The cost to relocate existing utilities preclude that option unless absolutely necessary. A roadway reconstruction project, however, may allow the relocation of utilities to accommodate a pole foundation. Otherwise, all underground utilities should be avoided.

There are many clues that indicate the presence of underground utilities that the designer should be aware of during the field survey. Manhole covers (power and communication) or gas vent pipes indicate a vault which may be quite large. Primary risers, communication risers, gas gates, water gates, communication provider identification posts, a recently patched trench, are a few other visual indications. The field survey should not be restricted to just the intersection under design. An inspection of the road and sidewalk area a short distance each side, may also provide evidence to the location of underground utilities.

The Texas 811 Call-Before-You-Dig (CBYD) system does not locate underground utilities for an engineer during the design stage. Occasionally however, old mark-outs will still be visible at an intersection from a recent excavation. Old mark outs should not be relied on to accurately locate underground utilities. They may be used as a guide only. The CBYD system uses different color paint for each type of utility. See the CBYD color code table below. If the location of underground utilities is suspected in the area of a proposed pole or mast arm foundation, the utility company should be contacted to determine the exact location. Test pits may also be done to establish the exact location of an underground utility.

CALL-BEFORE-YOU-DIG COLOR CODE	
COLOR	UTILITY
Red	Electric Power Lines and Conduits
Yellow	Gas, Petroleum Products, Steam, Other Hazardous Liquids
Blue	Water
Green	Sewer
Orange	Communication Cables and Conduits, Fiber, Cable TV
Purple	Radioactive Material
Pink	Temporary Survey
White	Proposed Excavation

Minimum clearance of underground signal conduit to other utilities, foundations, or drainage structures is three feet. Where the conduit approaches the three feet limit, it is recommended that the contractor be required to hand dig the trench.

3.6.9 Intersection Illumination

All new City of Austin signals are required to include illumination at the intersection. City of Austin poles are designed to accommodate illumination. Wiring and fixtures must meet Austin Energy standards.

3.6.10 Electrical Distribution

The electrical service to a traffic signal is fed by service provider's distribution network via a step down transformer, as shown on the next page (this detail is provided for illustration of the electrical service and does not reflect acceptable signal span wire installation).

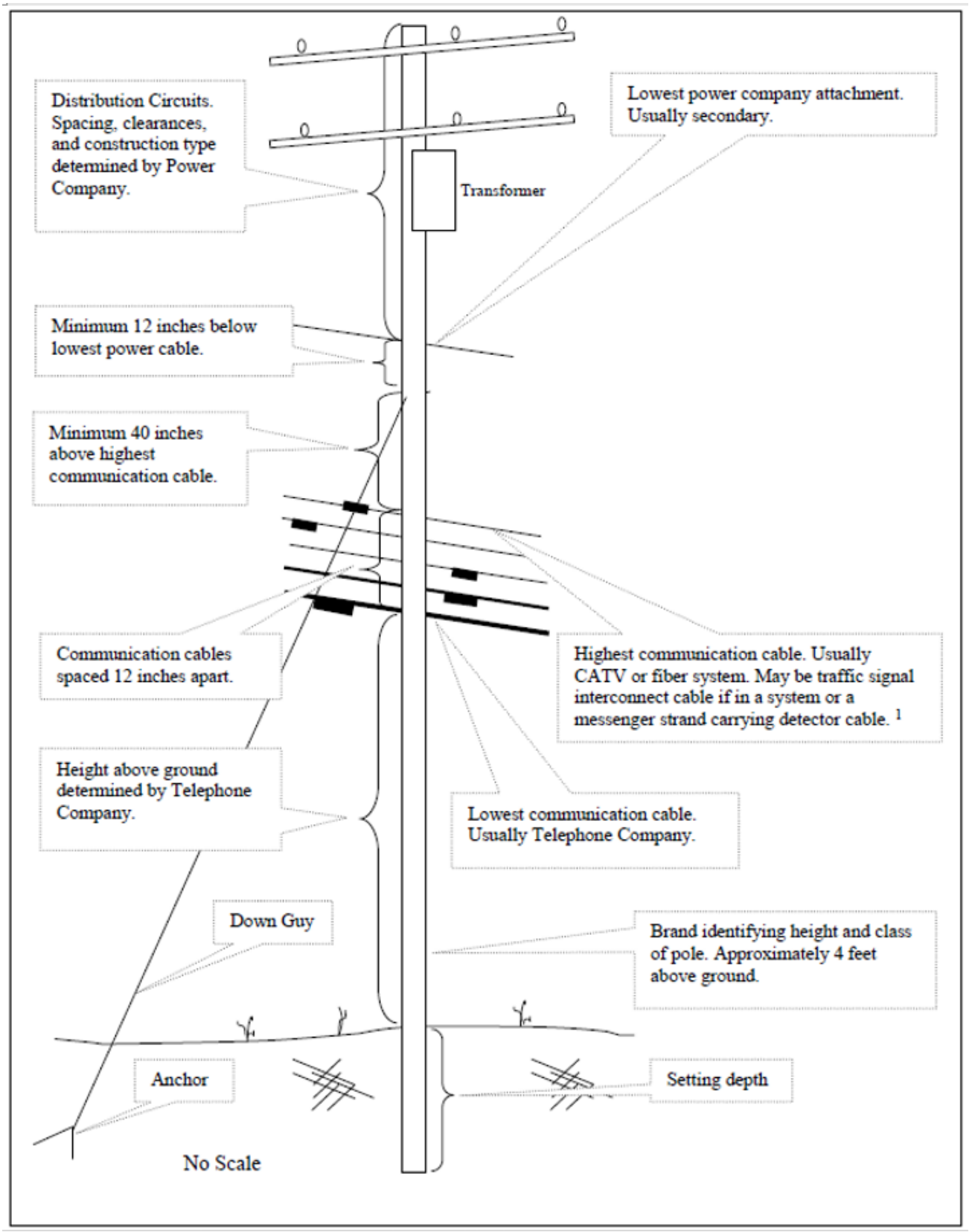
Existing detail sheets for overhead and underground electric service must be obtained online from City of Austin Standard Details.

Coordination with electric service providers is required prior to the initial design meeting and must be approved by the provider prior to the final plan set being submitted.

3.6.11 Source of Power

Electrical service for a large majority of the traffic signals operated by the City of Austin is provided by Austin Energy. A step by step summary of the process required to obtain AE power is provided in the table below:

Austin Energy Electrical Service Process				
1	Validate Intersection Address	https://www.austintexas.gov/department/address-management-services	7	AE Provides Cost Calculations
2	Submit Plan Set to AE		8	Applicant Payment to AE
3	Create ESPA (Electrical Service Planning Application)	https://austinenergy.com/wcm/connect/241f7826-5071-42de-b62f-6d7c352cf6d0/ESPAFormv1.14.pdf?MOD=AJPERES&CVID=nQFMKUH	9	AE Constructs Infrastructure
4	Submit ESPA To City Portal	https://austinenergy.com/ae/contractors/electric-service-design-and-planning/espa	10	Signal Contractor Builds Tie In
5	Designer Assigned by AE		11	AE Civil Inspection
6	Site Visit with AE Designer		12	Schedule Service for Activation


Distribution Circuits. Spacing, clearances, and construction type determined by Power Company.
Lowest power company attachment. Usually secondary.
Transformer
Minimum 12 inches below lowest power cable.
Minimum 40 inches above highest communication cable.
Communication cables spaced 12 inches apart.
Highest communication cable. Usually CATV or fiber system. May be traffic signal interconnect cable if in a system or a messenger strand carrying detector cable. [1]
Height above ground determined by Telephone Company.
Lowest communication cable. Usually Telephone Company.
Down Guy
Brand identifying height and class of pole. Approximately 4 feet above ground.
Anchor
Setting depth
No Scale

3.6.12 Voltage Drops

The NEC recommends that the maximum combined voltage drop for both the feeder and branch circuit should not exceed five percent, and the maximum on the feeder or branch circuit should not exceed three percent. The designer should verify that none of the signal cable runs exceed the NEC maximum voltage drop recommendations based on the typical cable utilized by the City of Austin:

- Electrical Service #6 AWG
- Signal Heads #14 AWG
- Pedestrian Heads #14 AWG
- Pedestrian Push Buttons – Single Twisted Pair – IMSA-50-2 - #12 AWG

Cable runs that exceed the maximum voltage drop need to be identified with recommended mitigations

Resistance of typical AWG wiring sizes are listed in the table below:

AWG gauge	Conductor Diameter Inches	Conductor Diameter mm	Ohms per 1000 ft.
4	0.2043	5.18922	0.2485
5	0.1819	4.62026	0.3133
6	0.162	4.1148	0.3951
7	0.1443	3.66522	0.4982
8	0.1285	3.2639	0.6282
9	0.1144	2.90576	0.7921
10	0.1019	2.58826	0.9989
11	0.0907	2.30378	1.26
12	0.0808	2.05232	1.588
13	0.072	1.8288	2.003
14	0.0641	1.62814	2.525
15	0.0571	1.45034	3.184
16	0.0508	1.29032	4.016

3.6.13 Battery Backup Units (BBU) for Traffic Signals

The City of Austin requires that all new and modified signals have a Battery Backup Unit (BBU) installed. Current Specifications for the units being used are provided in the Appendix. The signal designer must make provisions to have the contractor furnish and install a BBU that complies with the provided specification. The BBU should be delivered to the Traffic Signal Shop for a two week testing period prior to installation. Electrical service to the intersection must be in place before the BBU is installed. During the time that the contractor has possession of the BBU unit, batteries must be charged to a 90 percent or higher maintenance level at all times.

4. Detection

4.1 General

The control of traffic relates to the movement of vehicles and pedestrians. Since the volume of these movements generally vary at different times of the day, it is desirable to be able to detect approaching movements by placing one or more devices in the path of approaching vehicles or at a convenient location for the use of pedestrians.

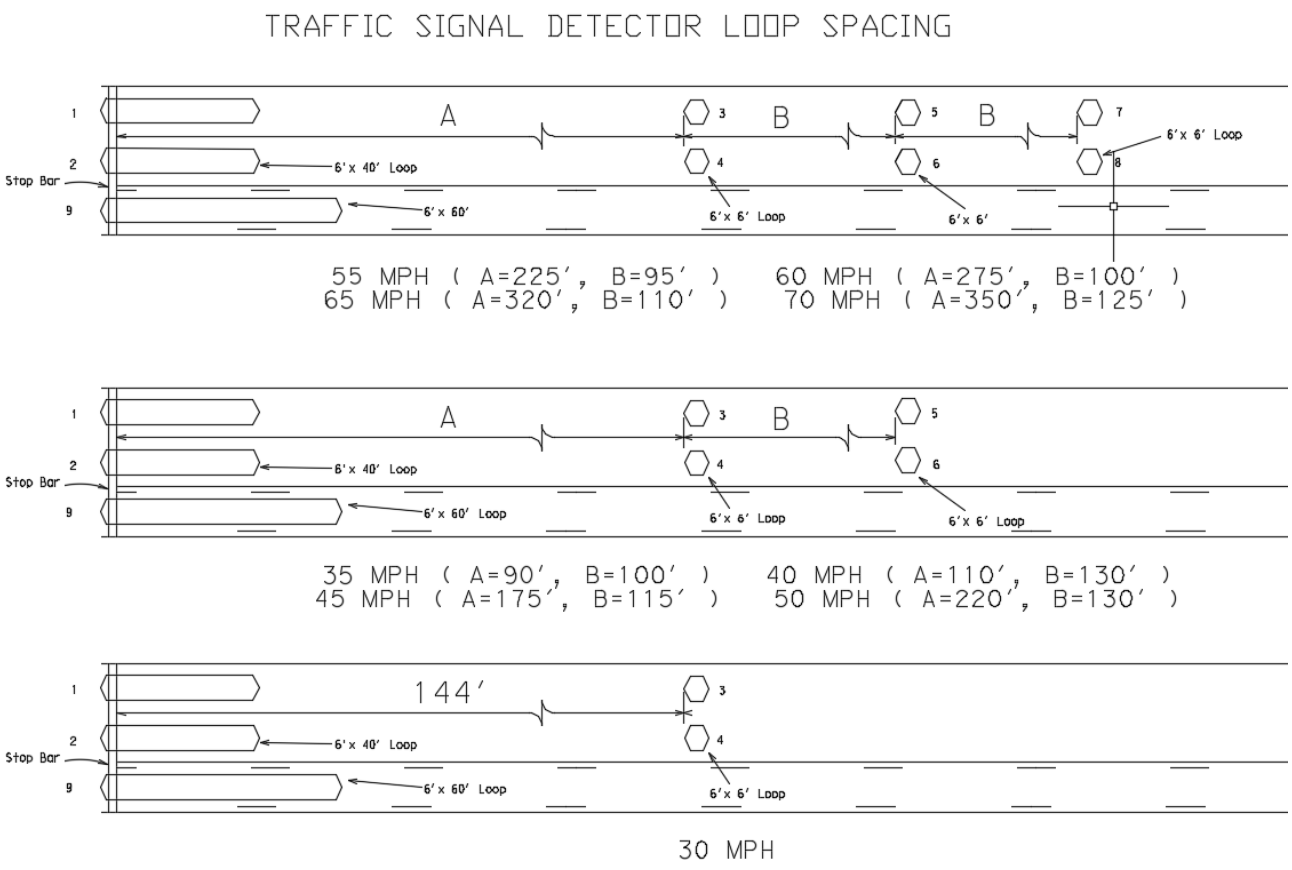
4.2 Expected Vehicle Detection Abilities

4.2.1 Stopbar detection

Some detectors record vehicles whether stopped (presence mode) or in motion (pulse mode). In presence mode, the detector produces a call whenever a vehicle is located within the detection zone. A stopbar detectors may also operate in a “delayed-call” mode, where it will not place a vehicle call until the detection zone has been occupied for a period of time that is set in the controller.

4.2.2 Setbacks

An extended-call detector has a “carryover input”, meaning that it holds or stretches the call of a vehicle for a period of seconds that has been set in the controller Setback detectors are used to extend the green phase for vehicles approaching the intersection near the end of minimum green. This will allow these vehicles to be served by a green extension rather than having to come to a stop in the dilemma zone. The City of Austin spaces their setback detectors based on speed and use the spacing between detectors as shown below:



4.2.3 Exit detection

The detection system should detect individual vehicles leaving the intersection (e.g., a vehicle making a westbound left turn should be detected in a southbound lane after the turn has been made).

4.2.4 Queue Detection

The detection system will allow detection of backups into the intersection and the ability to hold an exit detection call. This is to determine if there is a backup into the intersection or a queue and allow signal phasing changes, if they exist. Queue detection can typically be achieved by a combination of stopbar and exit detection.

4.2.5 Detector Communications

Communication back to a central location such as the MMC is required. This can be done using city-maintained network infrastructure such as cell modems or the fiber network. If using city network infrastructure, the detection system must be able to have a static IP address assigned to it. If using a cloud-based system that is maintained by the manufacturer, all network abilities should be isolated and no bridging should happen between city network and an outside entity unless agreed upon by an engineer.

4.2.6 SDLC

The detection system should have outputs that are relayed to the controller via Synchronous Data Link Control (SDLC) in an accepted connector type (typically a 25-pin male connector that connects to the field module of a 2070 controller). The cable should be included as part of the detection system. At the minimum, there should be 64 assignable and independent outputs to the 2070 signal controller.

4.2.7 Independent Functionality

One detector output from the provided system should not be tied directly to another detector output. For example, Zone B and Zone C both are both detectors for Phase 2 Eastbound but will output to detectors 3 and 5 independently.

4.2.8 Vehicle Classification

Vehicle classification is preferred but not typically required. Cases in which classification is required is in shared bicycle/automobile lanes, transit focused intersections, or any intersections where signal phasing changes and/or is dependent on the type of vehicle (bicycle heads for bicycle movements, transit heads for bus phases).

4.3. Data Collection Capabilities

The detection system must provide enough information to the controller through basic detection actuations for data collection such as relative volumes and occupancy. If the information provided to the controller is not enough for these values, the detection system must be capable of providing this data through an automated process such as an API.

Additionally, the status of a detection system and individual sensors should be capable of being checked through an automated process, ideally an API. For example, a request to the video detection system must provide an image (or some indication that the sensor itself is working) and, if applicable, an “okay” response from the processing unit managing the individual sensors. If a sensor and/or the central processing unit is not working, some sort of health status should be inferred.

4.4. Vehicle Detection Types

Most aerial detection types are preferred if they are 95% accurate or higher. All detection and supporting infrastructure (cable, processing unit, cameras, etc.) must be able to withstand outdoor conditions such as long-term sunlight exposure, significant hot and cold temperatures, dust, wind, etc. Additionally, the detection type must match the planned signal infrastructure (span wire intersections, long cable runs, abnormal geometry). Preferred detection for an intersection will depend on a number of factors, including roadway conditions and visibility of approach lanes from the signal poles and mast arms. What type of detection to be used for each signal approach will be discussed at the pre-design meeting.

4.4.1. Aerial Detection

Video - Most video solutions are accepted, provided that the solution meets the requirements above. The City of Austin typically uses standard video detection. Additionally, fisheye video detection may be allowed if approved by the City of Austin for a particular location.

Radar - Most radar systems are acceptable but require prior City approval. Any radar system used must not be affected by outside electromagnetic interference or interfere with each other with atypical intersection geometry.

Thermal - Most thermal detection systems are accepted but require prior City approval.

4.4.2. Embedded Detection

Loops - Embedded induction loops may be used for vehicle detection if the surface is not expected to change within 5 years. There should be lane-by-lane detection (e.g. all the loops should not be tied together) and some method to change sensitivity remotely as needed. Additionally, all modes of transportation should be detected (bicycles, motorcycles, electric scooters, etc.).

Wireless Embedded Detection - The City of Austin does not accept any detection system for standard signal actuation that uses embedded units communicating wirelessly to a central unit

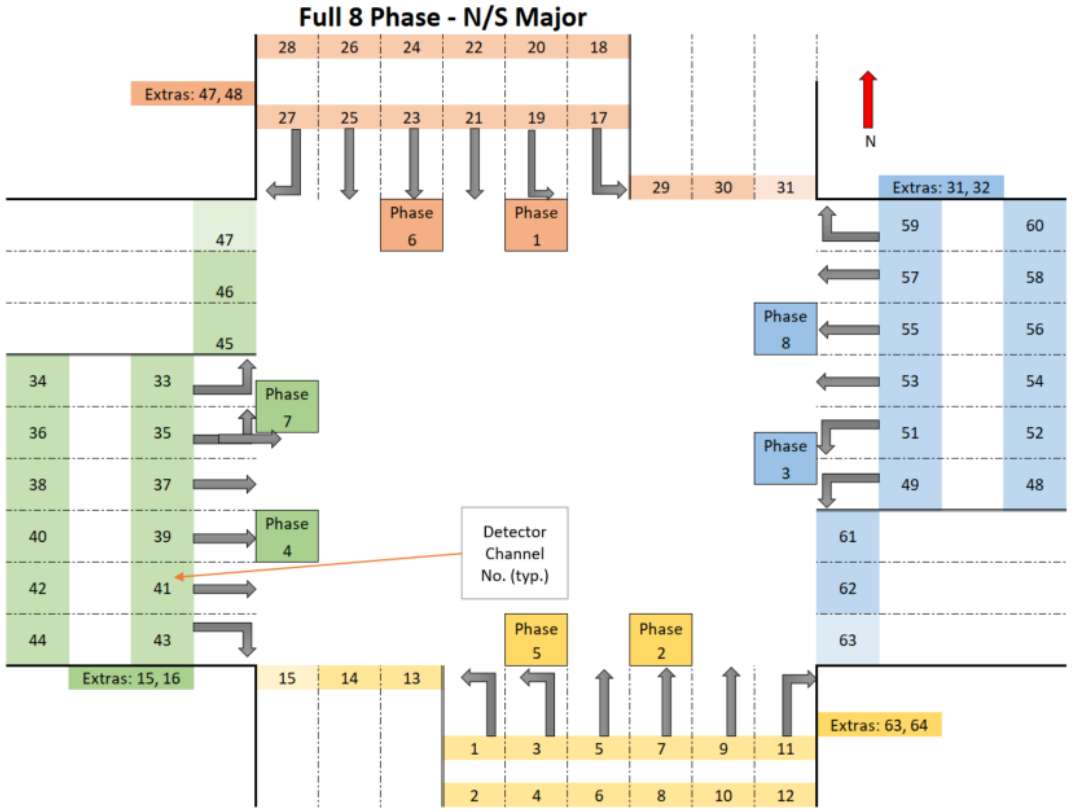
4.4.3 Other Forms of Detection

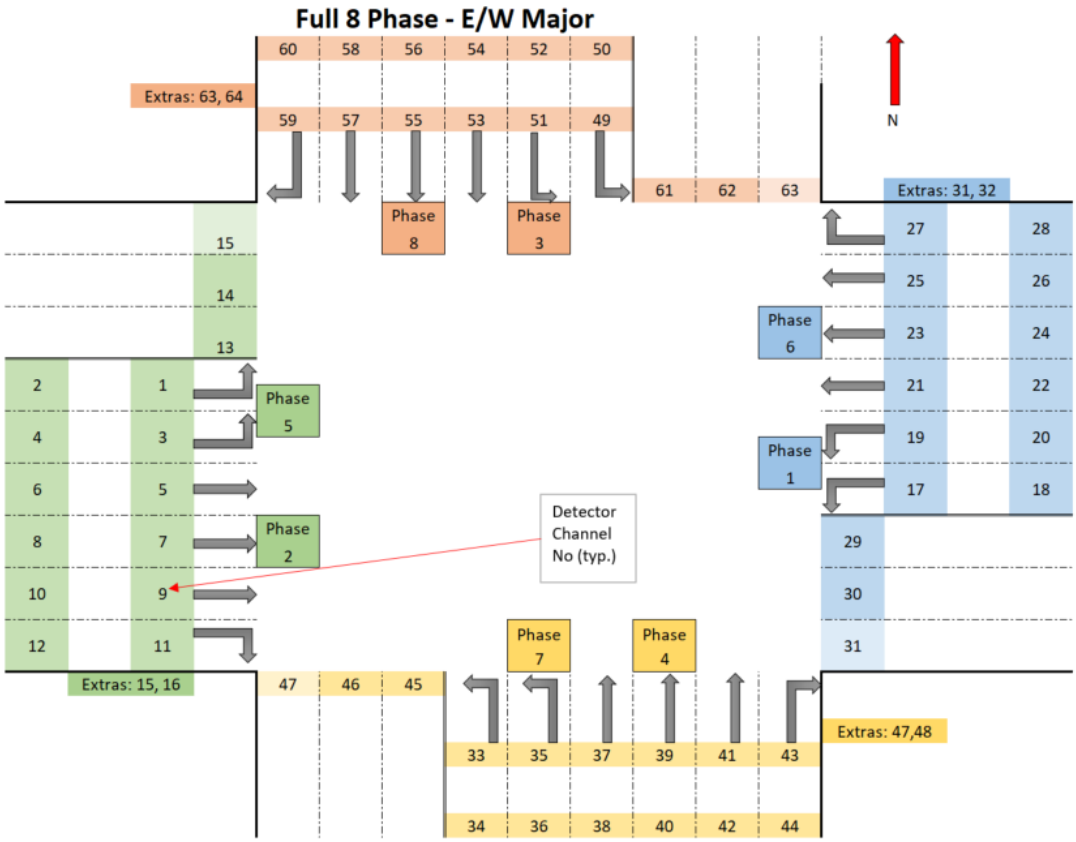
Other forms of detection may be allowed on a case-by-case basis with City of Austin approval.

4.5. Vehicle Detection Schema and Layouts

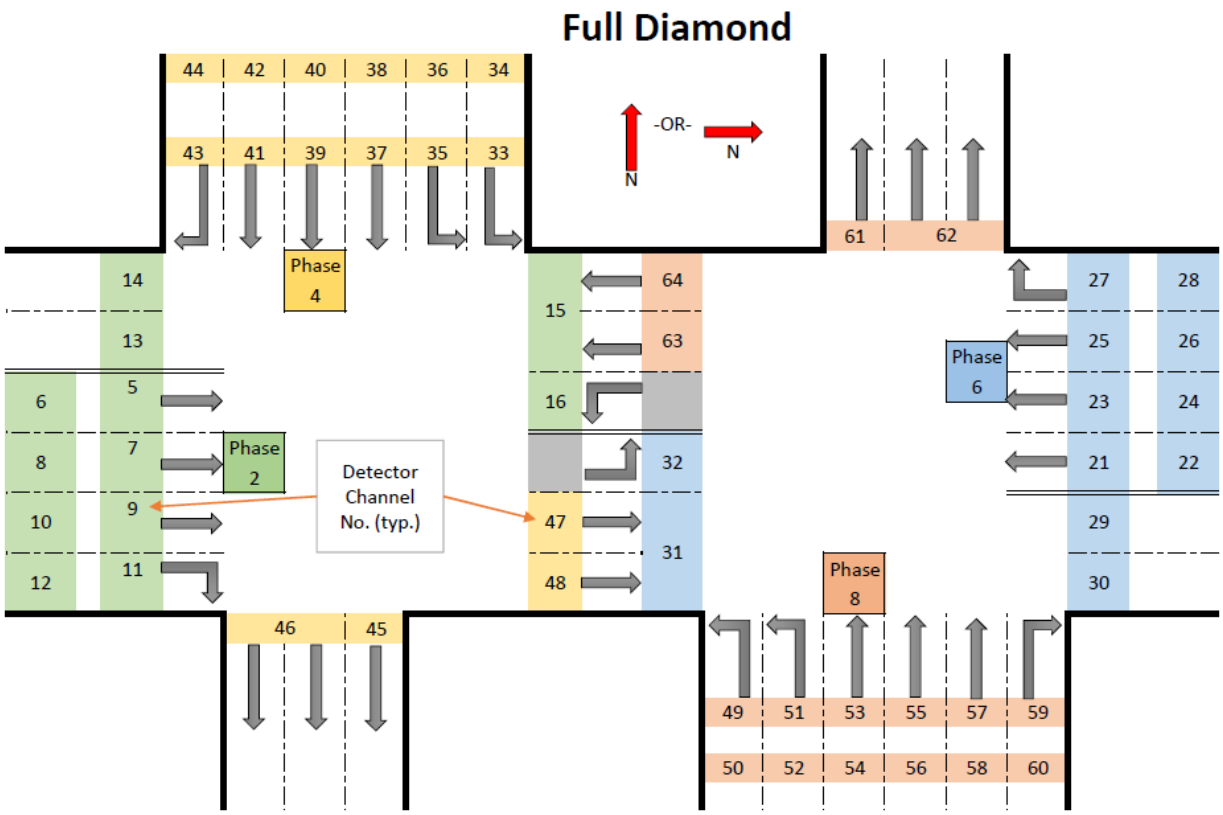
The City of Austin uses a specific phase assignment and detector channel for each intersection. Typical detection schemas are provided in the following figures:

4.5.1 Single Intersections





4.5.2 Diamond Interchanges



4.6. Pedestrian Accommodations

All pedestrian infrastructure, especially crosswalks, should be accessible to all people, no matter their age or capability. Many aspects of pedestrian infrastructure—for example, curb ramps, pavement markings, crossing times, detectable warnings, and others—are the result of the Americans with Disabilities Act (ADA), which mandates that all public environments must accommodate people with disabilities.

Both the TMUTCD and PROWAG provide baseline requirements and recommendations for the design features and installation of pedestrian detections.

4.6.1. Pedestrian Detection Types

Pushbuttons shall have all ADA-compliant features including the following: 2-inch pressable surface area, less than 2 lbf. required force, visual LED confirmation, locator tone, audible voice message, and raised directional arrow. Examples include Polara's iNX and XAV, Campbell's Guardian, and others.

A touchless pushbutton is a detection option that can be activated without pressing a button and it shall have all ADA-compliant features as a regular pushbutton plus a built-in sensor for non-contact actuation. Examples include Polara's iNX with iDetect (iDX) and Campbell's Guardian Wave.

Passive detection devices can sense when a pedestrian is waiting at a crosswalk and automatically send a signal to switch to a pedestrian WALK phase. There are generally two types of passive detection technology: microwave and infrared. A sensor unit is installed near the top of the pole and pointed towards the detection area. A delay can be built into either of the devices so that the WALK signal is called only if the pedestrian stays within the detection zone for a certain amount of time. The delay helps to prevent pedestrians who walk by the detection zone from

accidentally activating the WALK signal. Also, the directional sensing capability allows the WALK signal to call only when the pedestrian walks along the assigned direction. Any such system requires City testing and approval.

4.6.2. Pedestrian Pushbutton and Detection Location

Pushbutton height should be 3.5 feet, but not more than 4 feet from the adjacent landing to the center of the pushbutton. Landing is a level ground free of obstructions that is at least as wide as the curb ramp and at least 3 ft long. Directional arrow of the pushbutton shall point parallel to crosswalk. Passive detection shall be installed only as a supplemental to pushbutton not as a stand-alone detection.

4.6.3. Accessibility Guidelines

Detectable warning shall be across the width of the ramp and 2 ft deep. Detectable warning shall be installed at the back of the curb. City preference is Continental Style crosswalks at traffic signals. Crosswalk bars shall be 2 feet in width, parallel to lane lines, and placed on the lane lines and in the center of the travel lanes. Longitudinal length of the crosswalk bars is typically 10 feet, but may be adjusted based on consultation with City staff.

4.6.4. Pedestrian Accommodations at Mid-block Crossings

RRFBs are a MUTCD-compliant (The Federal Highway Administration (FHWA) released Interim Approval 21 on March 20, 2018) supplemental traffic control device designed to increase driver awareness of pedestrians crossing roadways at marked mid-block crossings. The beacons consist of rectangular shaped amber LEDs installed below pedestrian warning signs. The beacons remain “dark” until a pedestrian desiring to cross the street pushes the pushbutton to activate the flashing lights. The lights flash in an irregular flash pattern that is similar to emergency flashers on police vehicles. The flashing lights are intended to attract the driver’s attention and reinforce the driver’s duty to yield to pedestrians in the marked crosswalk.

The City of Austin “Crossing Guidelines” provides a selection matrix for applicability of RRFBs, along with additional potential improvements at uncontrolled crossing locations. It is provided on the following page.

---------- This Space Intentionally Blank ----------

Crossing Matrix for uncontrolled crossings

Vehicle Speeds and Volumes

Roadway Configuration*	Vehicle AADT <9,000			Vehicle AADT 9,000 - 15,000			Vehicle AADT >15,000		
	≤30 mph	>30 and <40 mph	≥40 mph	≤30 mph	>30 and <40 mph	≥40 mph	≤30 mph	>30 and <40 mph	≥40 mph
2 lanes (1 lane in each direction)	[1] 2 3 [4] 5 6 7 9	[1] 3 5 [6] 7 9	[1] 3 5 [6] 7 9	[1] 3 [4] 5 6 7 9	[1] 3 [4] 5 6 7 9	[1] 3 5 [6] 7 9	[1] 3 [4] 5 6 7 9	[1] 3 5 [6] 7 9	[1] 3 5 [6] 9
3 lanes with raised median (1 lane in each direction)	[1] 2 3 [4] 5 [6] 7 9	[1] 3 [4] 5 [6] 7 9	[1] 3 5 [6] 7 9	[1] 3 [4] 5 6 7 9	[1] 3 [4] 5 [6] 7 9	[1] 3 5 [6] 7 9	[1] 3 [4] 5 [6] 7 9	[1] 3 5 [6] 7 9	[1] 3 5 [6] 9
3 lanes w/o raised median (1 lane in each direction with a two-way left-turn lane)	[1] 2 3 [4] 5 6 7 9	[1] 3 [4] 5 6 7 9	[1] 3 5 6 9	[1] 3 [4] 5 6 7 9	[1] 3 [4] 5 6 7 9	[1] 3 4 5 6 9	[1] 3 [4] 5 6 7 9	[1] 3 5 6 9	[1] 3 5 6 9
4+ lanes with raised median (2+ lanes in each direction)	[1] 3 [4] 5 [6] 7 8 9	[1] 3 [4] 5 [6] 7 8 9	[1] 3 4 5 [6] 8 9	[1] 3 [4] 5 [6] 7 8 9	[1] 3 [4] 5 [6] 7 8 9	[1] 3 5 [6] 8 9	[1] 3 5 [6] 7 8 9	[1] 3 5 [6] 8 9	[1] 3 5 [6] 8 9
4+ lanes w/o raised median (2+ lanes in each direction)	[1] 3 [4] 5 6 7 8 9	[1] 3 [4] 5 6 7 8 9	[1] 3 5 6 8 9	[1] 3 [4] 5 6 7 8 9	[1] 3 [4] 5 6 7 8 9	[1] 3 5 6 8 9	[1] 3 5 6 7 8 9	[1] 3 5 6 8 9	[1] 3 5 6 8 9

*Treat one-way streets as if they were a single leg of a two-way street (e.g. treat a multi-lane one-way street the same as a multilane street with raised median).

Legend:

1. **Visibility enhancements:** Contenental crosswalk markings, parking restrictions on crosswalk approach, adequate nighttime lighting, and crossing warning signs.
2. **Raised crosswalk:** Should typically only be used in combination with other countermeasures recommended in the cell. TCM provides additional design guidance.
3. **Advance Stop Here for Pedestrian sign and stop line:** Should typically only be used in combination with other countermeasures recommended in the cell.
4. **In-street sign or delineator post on lane line:** Should always be used in combination with a marked crosswalk when a crosswalk is the only chosen treatment.
5. **Curb extension:** Should typically only be used in combination with other countermeasures recommended in the cell, or in place of a crossing island when a crossing island isn't feasible. See TCM for additional guidance on where curb extensions are required.
6. **Crossing Island:** Should be used in combination with RRFB or PHB, if feasible, when those treatments are recommended. For crossings of roadway configurations with existing raised medians, the median should functionally serve as a crossing island.
7. **Rectangular Rapid Flashing Beacon (RRFB)**
8. **Lane Conversion**
9. **Pedestrian Hybrid Beacon (PHB)**

Given the set of conditions in a cell:

- **#** — Signifies that the countermeasure is a candidate treatment at an uncontrolled crossing location.
- Signifies that the countermeasure should always be considered, but not required, based upon engineering judgement, which may include the presence of vulnerable users or other characteristics of the location.
- Signifies that countermeasure should always occur in conjunction with other identified countermeasures, when feasible.
- Signifies that countermeasure should always be considered as the first treatment, if feasible.
- The absence of a number signifies that the countermeasure is generally not an appropriate treatment, but exceptions may be considered following engineering judgement.

5. Plan Development

5.1 General

This section discusses the minimum requirements for Traffic Signal plan sets needed before the City of Austin will approve the project for construction. Included in the plan sets are the City Standard Specifications and Standard City Detail Sheets. In addition, the Austin Transportation Department maintains Special Specifications and Special Provisions. The adopted version of each of these documents can be found at the following locations:

- City of Austin Standard Specifications https://library.municode.com/tx/austin/codes/standard_specifications_manual?nodeId=AUSTIN_TX_STANDARD_SPECIFICATIONS_TECHNICAL_MANUAL_SERIES_800URTR
- City of Austin Standard Detail Sheets https://library.municode.com/tx/austin/codes/standards_manual?nodeId=CITY_AUSTIN_TEXASST_SERIES_800TRCO
- Austin Transportation Department Special Specifications – Working with Suzanne Harm to include on the AMD Sharepoint Page
- Austin Transportation Department Special Provisions– Working with Suzanne Harm to include on the AMD Sharepoint Page

5.2 Typical Plan Set Components

Signal Design plans shall contain at least the following sheets:

- Title Sheet
- General Notes Sheet(s)
- Quantity Estimate Sheets
- Existing Conditions Sheets
- Proposed Geometric Modifications Sheets
- Proposed Signal Layout Sheets
- Proposed Signal Layout Details Sheets
- Conduit and Conductor Schedule Sheets
- Elevation Drawings Sheets
- Signs and Markings Sheets
- City Standard Detail Sheets
- Special Detail Sheets

Final signal plans should be prepared on 11” x 17” plan sheets.

The scale for the "Intersection Layout" should be 20 scale. Interconnect layouts can be 100 scale. Each sheet of the plan must be properly identified in the lower right corner showing the Project Title, Sheet Title, Firm Name and Texas PE Board Firm Registration Number, Designer Name, and Sheet Number (Sheet XX of XX). All design sheets in the plan set are required to include a north arrow, graphic scale, and legend.

The licensed professional engineer responsible for or under whose supervision the work is performed shall sign the title sheet.

5.2.1 Title Sheet

A title sheet is required for all traffic signal plans. It includes information such as the title block, project location, governing specifications, etc. A sample title sheet is shown below. An 11”x17” example is provided in the Appendix.

5.2.2 General Notes Sheet(s)

Plan sheets must include general notes, including the standard Arterial Management General Notes and any special notes the designer needs include. A copy of the notes is provided in the Appendix.

GENERAL NOTES

1. IT IS THE CONTRACTOR'S RESPONSIBILITY TO PROVIDE ALL INCIDENTAL EQUIPMENT AND MATERIALS NECESSARY TO RESULT IN A COMPLETE AND OPERATIONAL TRAFFIC SIGNAL. ANY ITEMS REQUIRED, BUT OMITTED, ARE THE RESPONSIBILITY OF THE CONTRACTOR AND WILL BE SUBSIDIARY TO THE APPROPRIATE BID ITEM.
2. THE EXISTENCE OF UTILITIES, EITHER UNDERGROUND OR OVERHEAD, INDICATED ON THE PLANS ARE TAKEN FROM THE BEST RECORDS AVAILABLE AND ARE APPROXIMATE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO LOCATE ALL UTILITIES (PRIVATE AND PUBLIC) PRIOR TO COMMENCING WORK. THE CONTRACTOR IS FULLY RESPONSIBLE FOR ANY DAMAGE CAUSED BY HIS FAILURE TO LOCATE, PRESERVE, AND PROTECT THESE UTILITIES.
3. ANY EXISTING PAVEMENT, CURBS, SIDEWALKS, AND DRIVEWAYS DAMAGED OR REMOVED DURING CONSTRUCTION MUST BE REPLACED TO CITY OF AUSTIN STANDARDS.
4. COORDINATE WITH AUSTIN ENERGY AND SEEK THEIR APPROVAL TO ENSURE THAT NO CONFLICT EXISTS BETWEEN THE SIGNAL EQUIPMENT AND OVERHEAD ELECTRIC LINES. ALL SIGNAL EQUIPMENT MUST HAVE A 6 FEET CLEARANCE FROM NEUTRAL AND 10 FEET CLEARANCE FROM POWER LINES. CONTRACTOR WILL FOLLOW OSHA REQUIREMENTS WHEN WORKING CLOSE TO ELECTRIC LINES.
5. INSTALL ALL INFRASTRUCTURE AS SHOWN ON THE PLANS. ANY CHANGES MUST BE APPROVED BY THE INSPECTING ENGINEER IN THE FIELD.
6. SIGNAL POLE, PEDESTAL POLE, CONTROLLER FOUNDATION, AND PULL BOX LOCATIONS MUST BE LOCATED/MARKED IN THE FIELD BY THE CONTRACTOR AND APPROVED BY THE INSPECTING ENGINEER PRIOR TO INSTALLATION. CONTACT BRIAN CRAIG AT 512-974-4061 WITH TWO WEEKS NOTICE.
7. ALL SIGNAL FOUNDATIONS MUST BE INSPECTED AND APPROVED BY THE INSPECTING ENGINEER PRIOR TO CONTRACTOR POURING CONCRETE. CONTACT BRIAN CRAIG AT 512-974-4061 WITH 2 DAYS NOTICE.
8. ALL PROPOSED SIGNAL HEADS MUST BE WRAPPED IN BURLAP UNTIL READY FOR OPERATION.
9. CONTACT CITY (BRIAN CRAIG AT 512-974-4061) PRIOR TO INSTALLATION OF WIRING FOR THE TRAFFIC SIGNAL. THE CITY CREW WILL CONNECT THE WIRES TO THE SIGNAL CONTROLLER.
10. ALL NEW CONDUITS UNDER ROADWAYS AND DRIVEWAYS MUST BE BORED. CONDUITS UNDER NATURAL GROUND MAY BE TRENCHED AND BURIED; HOWEVER, THE CONTRACTOR MUST BACKFILL, COMPACT, AND RESTORE TRENCHED AREA TO ORIGINAL CONDITION AND MATCH EXISTING SURFACE CONDITION TO THE DENSITY OF ADJACENT AREA.
11. CLEAN AND RESTORE THE CONSTRUCTION AREA TO ORIGINAL CONDITIONS PRIOR TO FINAL INSPECTION.
12. SIGNAL HEADS WILL BE 12" LED WITH SPECIFIED ALUMINUM HOUSING AS SHOWN IN THE PLANS. BACKPLATES WILL BE REFLECTIVE.
13. ALL SIGNAL EQUIPMENT MUST BE INSTALLED AS PER CITY OF AUSTIN STANDARDS AND SPECIFICATIONS.
14. 2070 CONTROLLER, 332 CABINET, CONFLICT MONITOR, AND BATTERY BACKUP SYSTEM WILL BE PROVIDED AND INSTALLED BY CITY.
15. COORDINATE WITH AUSTIN ENERGY TO SET UP ELECTRIC SERVICE FOR THE TRAFFIC SIGNAL. COORDINATION IS SUBSIDIARY TO ITEM 1032, ELECTRICAL SERVICE.
16. PEDESTRIAN SIGNAL HEADS MUST BE LED COUNTDOWN TYPE AND PEDESTRIAN PUSH BUTTONS (APS UNITS) MUST BE ACCESSIBLE AND ADA COMPLIANT. IF TWO ACCESSIBLE PUSH BUTTONS ARE SPACED LESS THAN 10' APART OR ON SAME POLE, EACH ACCESSIBLE PUSH BUTTON WILL HAVE THE FOLLOWING FEATURES:
    i) PUSH BUTTON LOCATOR TONE
    ii) A TACTILE ARROW
    iii)A SPEECH WALK MESSAGE FOR THE WALKING PERSON INDICATION, AND
    iv) A SPEECH PUSH BUTTON INFORMATION MESSAGE.
    THE APS WILL BE PROGRAMMED BY A MANUFACTURES REPRESENTATIVE IN ACCORDANCE WITH SPECIFICATIONS AND TMUTCD.
17. FURNISH AND INSTALL 1 ADVIDIA A-300 CCTV CAMERA SYSTEM AT EACH PROPOSED TRAFFIC SIGNAL. THIS WORK IS SUBSIDIARY TO ITEM 840, TRAFFIC SIGNAL INSTALLATION.
18. CITY WILL INSTALL WIRING INSIDE CONTROLLER CABINET.
19. CITY WILL PROGRAM SIGNAL CONTROLLER AND IMPLEMENT SIGNAL TIMING IN FIELD.

EXAMPLE

NO.	DATE	REVISION	APPROVED

PRELIMINARY
FOR INTERIM REVIEW ONLY. NOT FOR PERMITTING, BIDDING, OR CONSTRUCTION.
Prepared by or under the Direct Supervision of
NAME, P.E. 00000
1/27/2020

COMPANY LOGO HERE

austin MOTION 2016 MOBILITY BOND

PROJECT TITLE
INTERSECTION
TRAFFIC SIGNAL
GENERAL NOTES

DESIGN	DESIGN CHK	GRAPHICS	GRAPHICS CHK	#

SHEET XX OF XX

5.2.3 Quantity Estimate Sheets

Estimated quantities must be included on separate sheets for clarity.

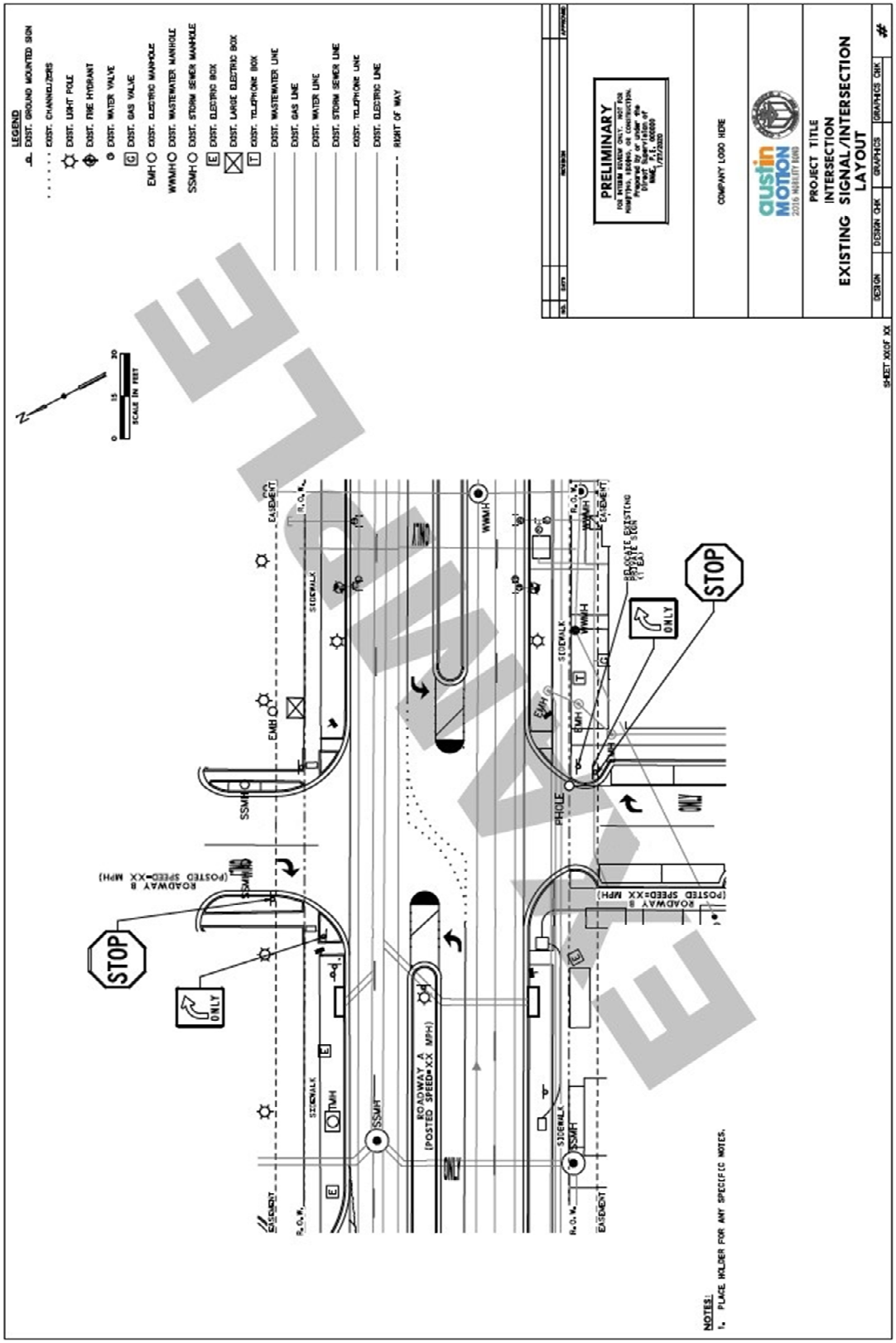
TRAFFIC SIGNAL QUANTITY SUMMARY

CONTRACTOR SUPPLIED ITEMS			
ITEM	DESCRIPTION	UNIT	QUANTITY
840S-TSI	TRAFFIC SIGNAL INSTALLATION	EA	1
*	ADVIDIA A-300 CCTV CAMERA	EA	1
*	#6 BLACK AC (SERVICE)	LF	1
*	#6 WHITE AC (SERVICE)	LF	1
*	#10/2C LUMINAIRE POWER CABLE	LF	1
*	#6 BARE (GROUNDING FOR POWER)	LF	1
*	#8 BARE (GROUNDING FOR ALL OTHER)	LF	1
841S-TSR	TRAFFIC SIGNAL REMOVAL	EA	1
844S-1	CLASS 1 TRENCHING FOR TRAFFIC SIGNAL CONDUIT	LF	1
844S-2	CLASS 2 TRENCHING FOR TRAFFIC SIGNAL CONDUIT	LF	1
844S-3	CLASS 3 TRENCHING FOR TRAFFIC SIGNAL CONDUIT	LF	1
SP844S-1BC	CLASS 1 TRENCH FOR TRAFFIC SIGNAL CONDUIT BEHIND CURB	LF	1
SP844S-2BC	CLASS 2 TRENCH FOR TRAFFIC SIGNAL CONDUIT BEHIND CURB	LF	1
SP844S-3BC	CLASS 3 TRENCH FOR TRAFFIC SIGNAL CONDUIT BEHIND CURB	LF	1
SP844S-1IS	CLASS 1 TRENCH FOR TRAFFIC SIGNAL CONDUIT IN THE STREET	LF	1
SP844S-2IS	CLASS 2 TRENCH FOR TRAFFIC SIGNAL CONDUIT IN THE STREET	LF	1
SP844S-3IS	CLASS 3 TRENCH FOR TRAFFIC SIGNAL CONDUIT IN THE STREET	LF	1
SS1004-PSM	RIGID ALUMINUM CONDUIT COMPLETE IN PLACE	EA	1
SS1006-PH	POT HOLE FOR UTILITIES	VF	1
SS1008-PB	ACCESSIBLE PEDESTRIAN PUSH BUTTONS	EA	1
SS1008-PSC	ACCESSIBLE PEDESTRIAN - SIGNAL CONTROL UNIT	EA	1
SS1008-PBE	ACCESSIBLE PEDESTRIAN - PUSH BUTTONS EXTENSION	EA	1
SS1020-20C	TRAFFIC SIGNAL CABLE, FURNISH AND INSTALL, 20C	LF	1
SS1020-5C	TRAFFIC SIGNAL CABLE, FURNISH AND INSTALL, 5C	LF	1
SS1020-7C	TRAFFIC SIGNAL CABLE, FURNISH AND INSTALL, 7C	LF	1
SS1020-DTP	TRAFFIC SIGNAL CABLE, FURNISH AND INSTALL, DOUBLE TWISTED PAIR	LF	1
SS1020-C5E	TRAFFIC SIGNAL CABLE, FURNISH AND INSTALL, CAT 5E	LF	1
SS1026-1	REMOVE POLE	EA	1
SS1026-2	REMOVE MAST ARM	EA	1
SS1026-3	REMOVE POLE FOUNDATION	EA	1
SS1026-4	REMOVE PED POLE FOUNDATION	EA	1
SS1026-5	REMOVE CONTROLLER FOUNDATION	EA	1
SS1028-1	SET POLE	EA	1
SS1028-2	HANG MAST ARM	EA	1
SS1032-ES-CS	OVERHEAD ELECTRICAL SERVICE-CITY STD. NO METER	EA	1
SS1032-ES-CSM	OVERHEAD ELECTRICAL SERVICE-CITY STD. WITH METER	EA	1
SS1032-UES-CS	UNDERGROUND ELECTRICAL SERVICE-CITY STD. NO METER	EA	1
SS1032-UES-CSM	UNDERGROUND ELECTRICAL SERVICE CITY STD. WITH METER	EA	1
SS1032-EE	ELECTRICAL ENCLOSURE(GROUND MOUNTED)	EA	1
SS1040-T	RADAR VEHICLE DETECTION SYSTEM, 3 APPROACH INTERSECTION, COMPLETE IN PLACE	EA	1
SS1040-Q	RADAR VEHICLE DETECTION SYSTEM, 4 APPROACH INTERSECTION, COMPLETE IN PLACE	EA	1

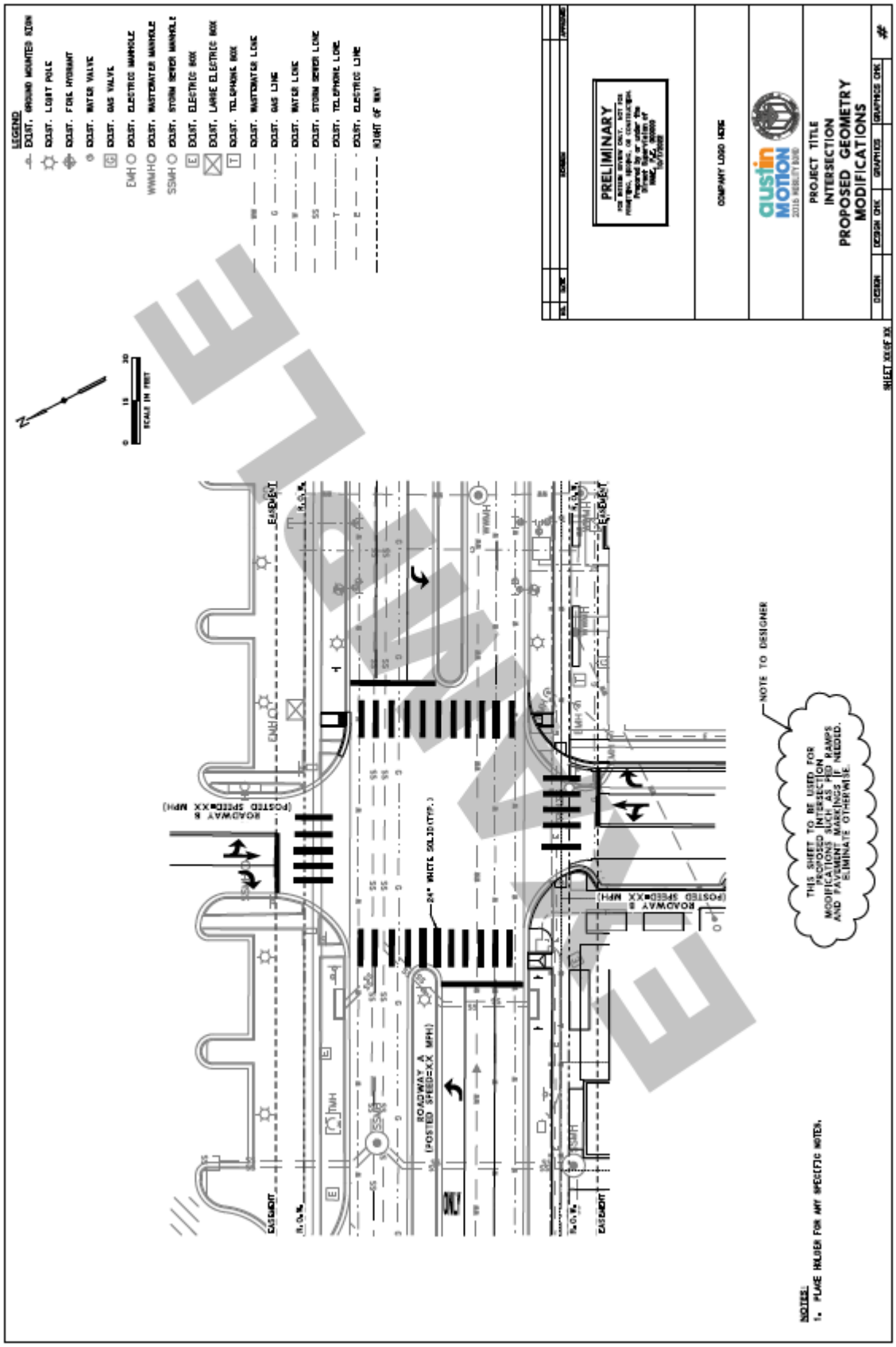
CITY SUPPLIED ITEMS			
ITEM	DESCRIPTION	UNIT	QUANTITY
SS1010-ATC-CU	2070 ATC CONTROLLER UNIT COMPLETE IN PLACE	EA	1
SS1012-C	CALTRANS 332, CABINET FOR 2070 CONTROLLER COMPLETE IN PLACE	EA	1
SS1014-SCM	SIGNAL CONFLICT MONITOR COMPLETE IN PLACE	EA	1
-	BATTERY BACKUP SYSTEM	EA	1
-	CONTROLLER FIRMWARE LICENSE	EA	1

Notes:
1. * SUBSIDIARY TO ITEM 840S-TSI.
2. ** REFER TO SMART CELL SIGNAL FOUNDATION STANDARD FOR FOUNDATIONS.

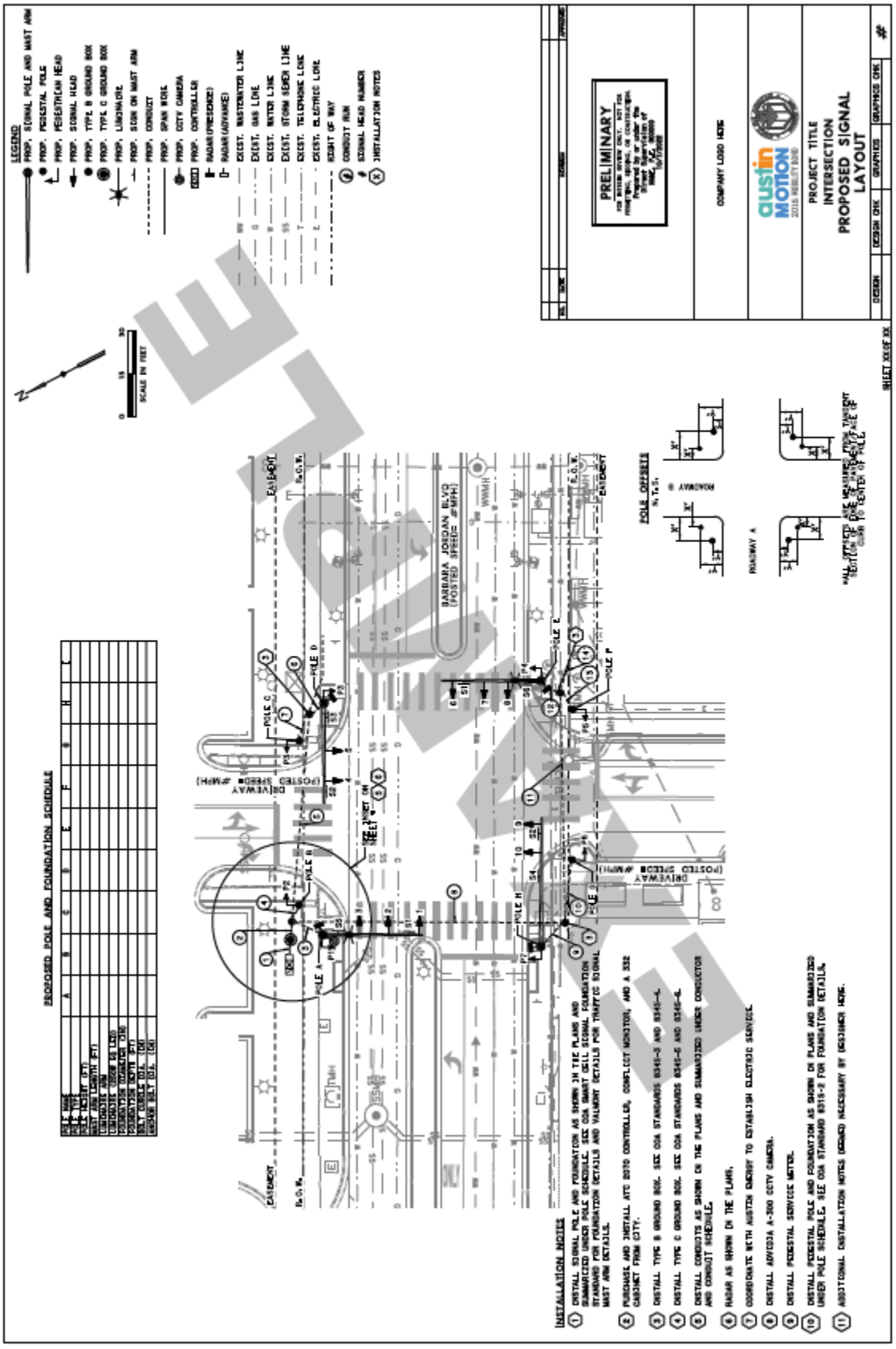
5.2.4 Existing Conditions Sheets

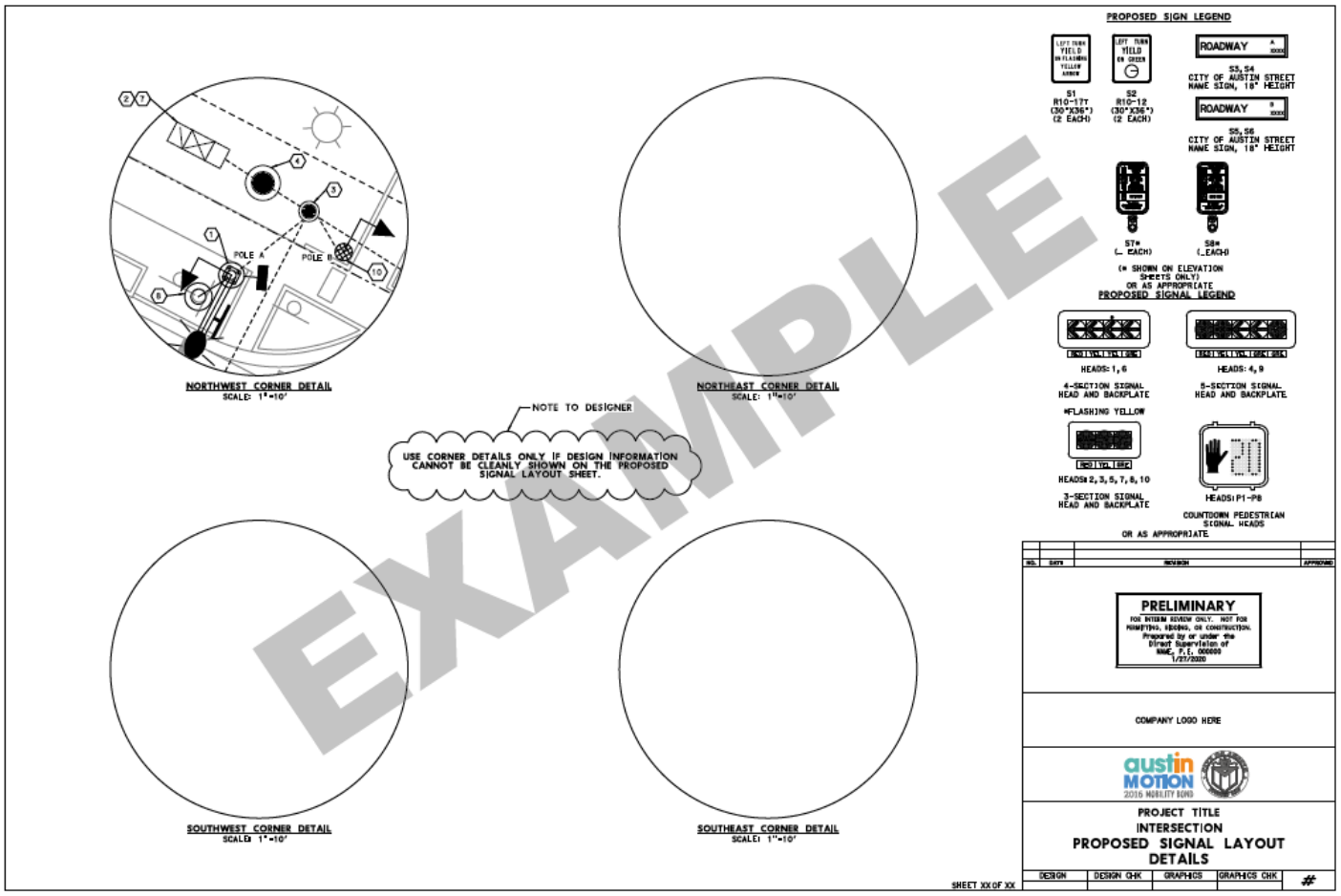


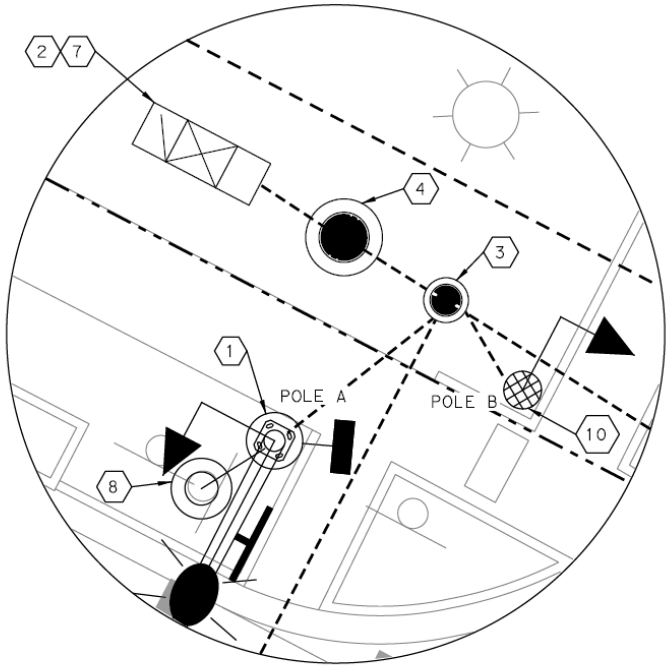
5.2.5 Proposed Geometric Modifications Sheets



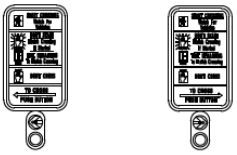
5.2.6 Proposed Signal Layout Sheets







NORTHWEST CORNER DETAIL
SCALE: 1"=10'

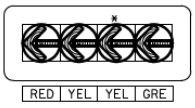


S7*
(_ EACH)

S8*
(_EACH)

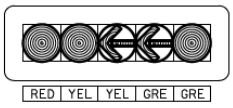
(* SHOWN ON ELEVATION SHEETS ONLY)
OR AS APPROPRIATE

PROPOSED SIGNAL LEGEND



HEADS: 1, 6

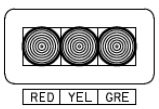
4-SECTION SIGNAL HEAD AND BACKPLATE



HEADS: 4, 9

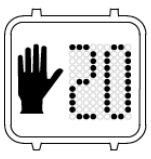
5-SECTION SIGNAL HEAD AND BACKPLATE

*FLASHING YELLOW



HEADS: 2, 3, 5, 7, 8, 10

3-SECTION SIGNAL HEAD AND BACKPLATE

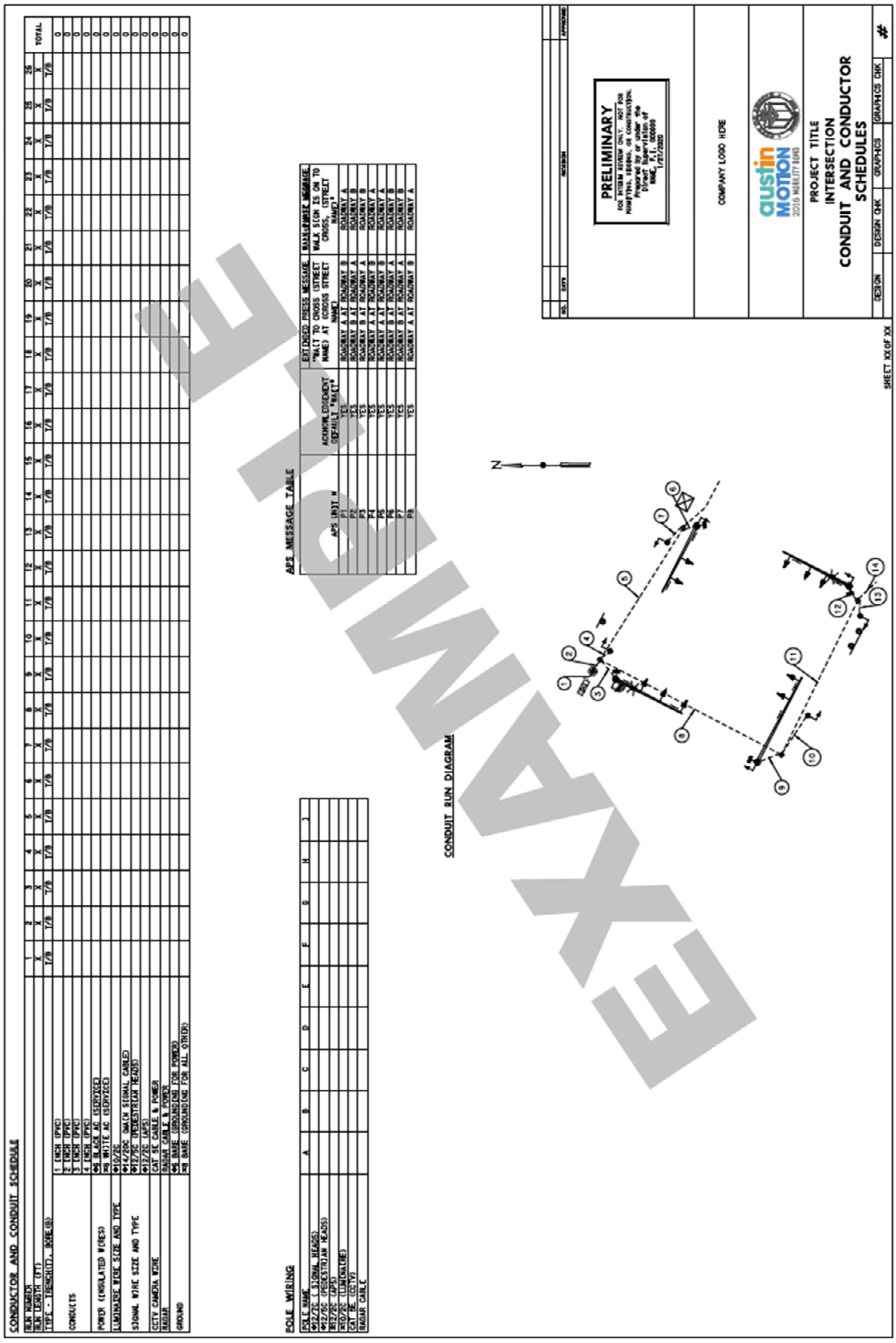


HEADS: P1-P8

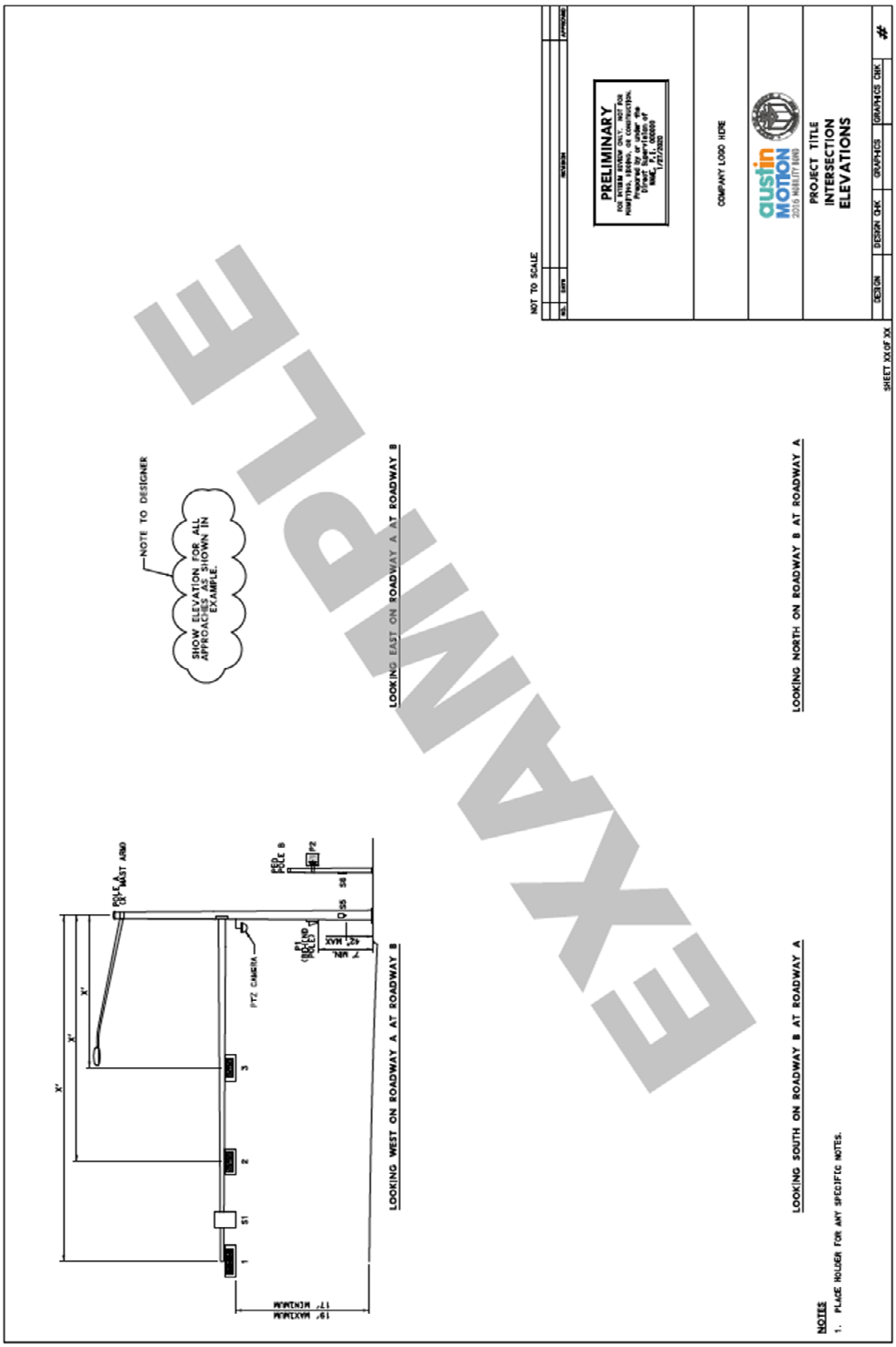
COUNTDOWN PEDESTRIAN SIGNAL HEADS

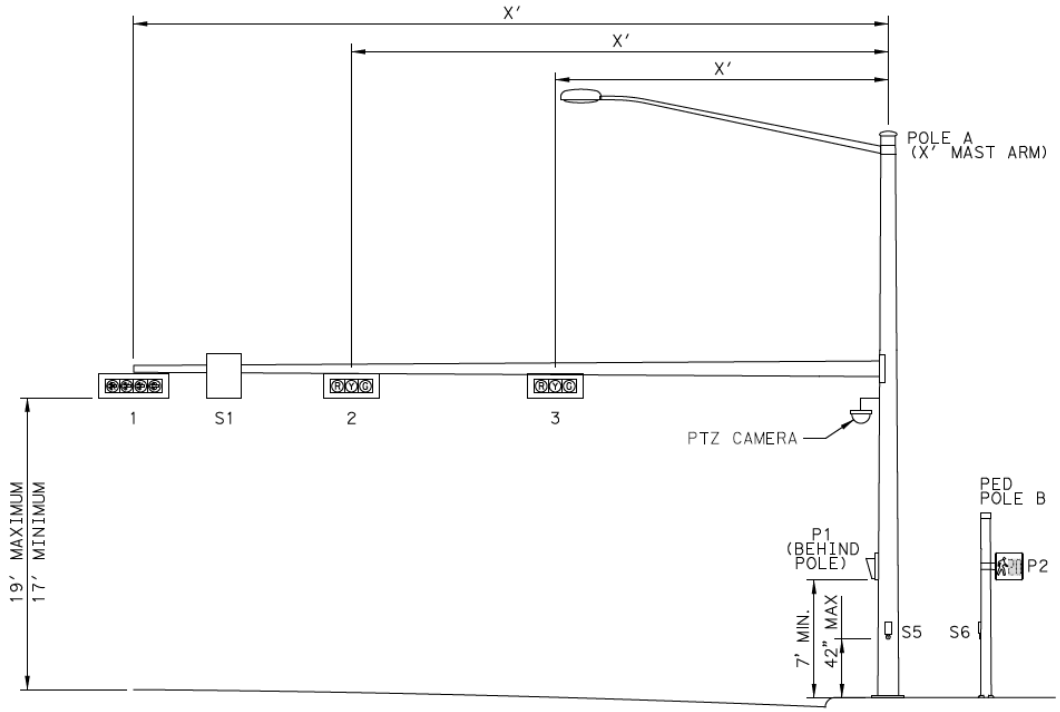
OR AS APPROPRIATE

5.2.7 Conduit and Conductor Schedule Sheets



5.2.8 Elevation Drawings Sheets





LOOKING WEST ON ROADWAY A AT ROADWAY B

5.2.9 Signs and Markings Sheets

Typically proposed signing and marking plans are separate sheets from the signal layout. This can be confirmed during the pre-design and plan review processes.

5.2.10 City Standard Detail Sheets

The City Standard Detail Sheets consist of reference material and designs that are used on City Projects. These include:

- 432 Series – Curb Ramps
- 470 Series – Ramps for Driveways
- 804 Series – Traffic Control
- 824 Series – Ground Mounted Signs
- 830 Series – Poles Mounted Cabinet
- 831 Series – Signal Shaft Foundations and Flashing Beacons
- 832 Series – Rapid Rectangular Flashing Beacons (RRFBs)
- 834 Series – Pull Boxes and Lids
- 835 Series – Trench Details for Signals
- 836 Series – Pedestrian and Vehicular Signal Wiring
- 837 Series – Detectors
- 838 Series – Traffic Signal Electrical Notes and Details
- 839 Series – Signal Structures
- 841 Series – Poles and Foundations

5.2.11 Special Detail Sheets

Special Detail Sheets are items not addressed by the Standard Details and typically focus on items specific to traffic signals that are specialized and / or are updated as technology changes.

5.3 Signal Design Considerations

Issues which the designer should consider at each stage of the signal design process is summarized below:

Design Step	Design Consideration
Pre-Design	Perform site inspection and documentation Coordinate with Arterial Management Construction Inspector Meet with electric service provider in the field Provide documentation of service provider concurrence Attend Preliminary Signal Design Meeting with Arterial Management Division
Design Step 1 Create an Accurate Drawing of the Intersection	The City of Austin uses AutoCAD and all plans are required in this format. Review preliminary design checklist. Review initial design meeting information. Obtain any missing roadway, utility, or other information as needed. Check sight distances Check AutoCAD file(s) for corrupt elements Check truck turning radius for each pole corner. Use WB-60 Design vehicle. Review sidewalk, ramp, and other pedestrian elements. Check field measurements to confirm AutoCAD file. Show future planned or highly likely geometric improvements as dashed lines.
Design Step 2 Confirm Signal Phasing	Consider consistency in corridor operations. Confirm signal phasing with City of Austin Signal Timing Engineers.
Design Step 3 Establish Crosswalks, Stop Lines and Pedestrian Ramps	Type and location of crosswalks Type and location of ramps Locate curb lines Locate stop lines Consider operations / phasing (issues like split phasing) Review pedestrian movements / planned improvements with local agencies Review pedestrian facilities design considerations (see below). Review pedestrian ramps and identify work needed
Design Step 4 Locate Source of Power and Cabinet	Refer to field utility meetings with City Construction Inspectors Refer to meeting notes with Electric Service Provider Show cabinet and conduit to first pull box on plans. Indicate power source, cabinet and conduit on plans.

Design Step	**Design Consideration**
Design Step 5 Determine and Locate Vehicle and Pedestrian Heads and Accessible Pedestrian Buttons	Consider signal operations Review notes from field checklist Review notes from Initial Design meeting Review opposing left turn mast arm and ensure that opposing left turn heads do not block each other Include 1 head for each high speed through lane Review Intersection geometry - consider vehicle paths through intersection to avoid conflicting paths
Design Step 6 Mast Arm Pole Locations	Minimum clearance to existing utilities and face of curb is 3 feet. Check cone of visibility Do not obstruct oncoming traffic's view of signal heads Review clearances to above ground utilities Consider placing poles for future roadway widening. Select pole and mast arm from City Standard Details Select foundation from City Standard Details Provide location and proper cabling for detection Provide conduit and pull boxes for railroad preemption where required
Design Step 7 Locate Conduit and Pull Boxes	Pull boxes at electric service provider pole and cabinet pad. Place pull boxes in line with each other where possible. When boring conduit, place pull boxes perpendicular to roadway alignment Whenever possible, do not place pull boxes in the sidewalk or pedestrian path Place a minimum of one pull box for each signal pole Locate pull boxes away from the roadway to minimize future widening impact Maximum spacing between pull boxes is 300 feet. Install a #6 bare copper ground wire in all traffic signal conduit; when multiple conduit terminate in a pull box all ground wires shall be connected in the manner approved by ATD.
Design Step 8 Labelling the Intersection Layout Sheet(s)	Label each element of the design, including poles, pull boxes, and conduit Provide a clear legend showing the shape and symbol of each Use a sequential numbering / lettering scheme for labels where possible Provide a callout for the electrical service and transformer locations
Design Step 9 Develop Wiring Design	Use standard wiring and terminal block assignment as shown in City details Do not share conductors between signal indications Wire detection and all other specialty devices directly to the cabinet Check voltage drops Show grounding rods and wiring Show interconnect cables Provide conduit and wiring diagram tables Provide a wiring line diagram for the cabinet, pole terminal strip, and devices Provide one spare 7 conductor from the cabinet to the base of each pole

Design Step	Design Consideration
Design Step 10 Size Conduits and Identify Conduits and Conductors with Leader Lines	Maximum conduit fill allowed is 30 percent Use only PVC Schedule 80 conduit Install a minimum of three (3) x 3" conduits across all bores or under pavement No larger than 3" conduit should be used going into a pull box Separate high voltage (120 VAC) from low voltage wiring (e.g. CAT5, loop cable, coax, etc.) Any illumination on the project must have separate conduit runs
Design Step 11 Signal Head Charts	Use clear graphics for display. Use Flashing Yellow operations on all approaches with a left hand storage bay Coordinate with Austin Signal Timing Engineers before finalizing
Design Step 12 General Notes	City Arterial Management Division general notes Include additional notes as needed
Design Step 13	Add other Layouts, Notes, Charts, Etc. as Needed
Design Step 14 Communications Interconnect	Show interconnect elements with the limit of the traffic signal project Ensure that all elements are compatible with City of Austin equipment Label all items for communication separately from other signal items.
Design Step 15 Submittal	Check plan completely Submit a plan set to the City of Austin for review Label the plan set as 90 percent and do not sign or seal
Design Step 16 Submittal	Incorporate City of Austin review comments Resubmit the plans along with a comment response list showing how every comment was addressed
Design Step 17	Provide Record Drawings to the City upon completion of construction

5.3 Signing and Pavement Markings

5.3.1. General

The Austin Transportation Department designs and implements signing and striping in accordance with the TMUTCD and the Transportation Criteria Manual (TCM) Municipal Code adopted by the City of Austin (Section 8).

5.3.2. Intersection Signing

Included in all signal designs are street names signs and applicable no turn, one-way, do not enter signs, and Austin's PHB signs. All other signs such as, lane assignment signs, no turn on red, turning traffic must yield to bikes and peds, special message signs, and others will be determined by the engineer. Signs explaining flashing yellow arrow operation are not used unless directed by the engineer. These items will be discussed in the scoping meeting.

5.3.3. Pavement Markings

All pavement markings shall follow the TMUTCD and TCM. A few specific items to note are:

- Stop bars shall be placed in a location such that vehicles making turns from the opposing street don't have a turning path that would conflict with a queued vehicle stopped at or behind the stop bar. In particular, Capital Metro bus routes should be checked for turning movements at the intersection.
- Pedestrian crosswalks should be marked with continental markings that run long-edge parallel to the direction of vehicular flow and should avoid the wheel path to reduce wheel wear.
- Special consideration will be given to unique pedestrian, bike, or transit accommodations.

These items will be discussed in the initial design meeting.

5.4 Specifications and Tabulation of Quantities

5.4.1. General

Specifications are detailed descriptions of required submittals, materials, and construction techniques needed to install a particular item on a project. They may be Standard Specifications that are routinely used on projects. They may also be Special Specifications, adopted for a specific application. Both Standard Specifications and Special Specifications can be adjusted through a Special Provision.

5.4.2. Specifications

The 800 Series of Specifications in the City of Austin municode library provides City standard specifications to be used and referred to in the design and construction of traffic signals. Plan designers need to be aware of these specifications that may apply to their individual project. The website for the City municode library is provided in Chapter 2 of this manual. Where a specification is not available on the municode site, certain special specifications are maintained by the Arterial Management Division and can be obtained through a link on our Division Web Page at the location below:

https://www.austintexas.gov/department/arterial-management

Where a City standard spec or AMD special spec is not available, the designer is responsible for developing their own. Any special specs developed by the designer must be reviewed and approved by the AMD Construction and Inspection Section prior to use. These specifications are divided into several sections as described below:

- Description

  Provides General Information regarding the item, a description of what the item is and what detail sheets are referenced.

- Submittals

  A listing of samples or cut sheets to be reviewed and approved by the City of Austin prior to using this item on a project. It may include cut sheets, drawings, and/or samples.

- Materials

  Describes the material that is allowed in this item, along with maximum and minimum sizes of components, environmental performance requirements, functional requirements, electrical components, minimum warranty, and overall appearance and size of the device itself.

- Construction Methods

  Instructs the contractor as to how this particular item is to be constructed. If there is a particular sequence of construction that must be followed, it is described here. It also describes any special requirements that must be adhered to when constructing this particular item.

- Measurement

  This section explains the payment schedule. It lists the Item Number, Item Name, and Units. Units define the measurement units used in the pay items. They could include “Furnish”, “Install”, and / or “Furnish and Install” terms. Measurement can be measurement of quantity (e.g. each, per linear foot, etc.)

- Payment

  How the item is paid for, by unit measurement. It generally includes a description of what is included in the total price paid for the item.

- Cross Reference Materials

  Lists other standards, details and exhibits that are applicable to the specified item.

5.4.3. Tabulation of Quantities

The tabulation of quantities is a measurement of the amount of material used to construct the designer’s total plan set. Quantities are separated as specific line items and a description of the material item, including the units. An example of a quantity table is provided below:

QUANTITY SUMMARY

CONTRACTOR SUPPLIED ITEMS					
ITEM	DESCRIPTION	UNIT	W 5TH ST AND GUADALUPE ST	W 5TH ST AND LAVACA ST	TOTAL
803S-MO	BARRICADES, SIGNS, AND TRAFFIC HANDLING	MON	1	1	2
SP824S-A	INSTALL OF TRAFFIC SIGNS ON SIGNAL EQUIPMENT - INSTALL ONLY	EA	2	4	6
SP824S-B	TRAFFIC SIGNS, REMOVE AND REPLACE, RELOCATE SIGNS ON SIGNALS	EA	2	2	4
830S-SCF	TRAFFIC SIGNAL CONTROLLER FOUNDATION	EA		1	1
832S-VSM-3	VEHICULAR SIGNAL INSTALLATION, 3 SECTION, COMPLETE IN PLACE	EA	3	1	4
838S-PSM	PEDESTRIAN SIGNAL INSTALLATION(COUNTDOWN TYPE): COMPLETE IN PLACE	EA	3	4	7
839S-MAP1	TYPE 1 MAST ARM POLE	EA	1		1
840S-TSI	TRAFFIC SIGNAL INSTALLATION	EA	1	1	2
*	RELOCATE EXISTING OPTICOM	EA	1		1
*	OPTICOM CABLE AND POWER	LF	90		90
*	RELOCATE EXISTING CCTV	EA	1	1	2
*	RELOCATE EXISTING DETECTION CAMERA	EA		1	1
SS1008-PB	ACCESSIBLE PEDESTRIAN PUSH BUTTONS	EA	4	4	8
SS1020-S6B	#6 BLACK AC(SERVICE)	LF		30	30
SS1020-S6W	#6 WHITE AC(SERVICE)	LF		30	30
SS1020-6G	#6 BARE(GROUNDING FOR POWER)	LF		30	30
SS1020-8G	#8 BARE(GROUND FOR ALL OTHER)	LF	300	585	885
SS1010-2CT	TRAY CABLE, FURINISH AND INSTALL, #10, 2C	LF	55		55
SS1012-2CT	TRAY CABLE, FURINISH AND INSTALL, #12, 2C	LF	275		275
SS1020-20C	TRAFFIC SIGNAL CABLE, FURNISH AND INSTALL, 20C	LF	40		40
SS1020-5C	TRAFFIC SIGNAL CABLE, FURNISH AND INSTALL, 5C	LF	245	455	700
SS1020-DTP	TRAFFIC SIGNAL CABLE, FURNISH AND INSTALL, DOUBLE TWISTED PAIR	LF	155	345	500
SS1020-C5E	TRAFFIC SIGNAL CABLE, FURNISH AND INSTALL, CAT 5E	LF	90	120	210
SS1026-1	REMOVE POLE	EA	1	2	3
SS1026-2	REMOVE MAST ARM	EA	1		1
SS1026-3	REMOVE POLE FOUNDATION	EA	1	1	2
SS1026-4	REMOVE PED POLE FOUNDATION	EA		1	1
SS1028-2	HANG MAST ARM	EA	1		1
**	30 FT STEEL ST LT POLE	EA	1	4	5
**	INSTALL STREET LIGHT ON FOUNDATION BY OTHERS***	EA	1	4	5

5.5 Traffic Signal Plan Checklists

The following checklist will be used to determine the completeness of the designer's plan set. It consists of checklist for the design plan sheets and detail sheets to be included. Though not specifically listed, all design sheets must include a north arrow, graphical scale, legend and the designers name, seal, company name, and firm registration number. All dimensions are in SAE units unless otherwise noted.

Title Sheet
- See Sample Sheet

General Notes Sheets
- See Sample Sheet

Quantity Estimate Sheets
- See Sample Sheet

Existing Conditions Drawing
- Right of Way
- Curb Lines
- Lane Lines
- Lane Designations
- Existing Signal Equipment (poles, cabinet, pull boxes, conduit)
- Overhead Utilities
- Underground Utilities - handholes, valves, conduit, drainage pipes
- Railroad Tracks, Equipment, & ROW

Proposed Geometry Modifications - Plan View
- Existing Conditions - Faded Back
- Modifications to curbs or ramps
- Detail callouts with dimensions and description
- Any special notes (i.e. See CoA Standard Detail 40X-X)

Proposed Signal Layout - Plan View
- Existing Conditions - Faded Back, No Vegetation Shown
- Proposed Geometry - Lines Only, No Text
- Cabinet Location
- Signal Poles - Labelled with Lettering
- Signal Heads - Labelled with Numbers
- Conduit Runs - Labelled with numbers in octagon
- Signal Pole Location Exhibit
- Proposed Pole and Foundation Schedule
- Signs - Labelled Individually as S-1, S-2, etc.
- Installation Notes

Proposed Signal Layout Details
- Depiction of Signs by Callout
- Depiction of Signal Heads by Callout
- Zoomed in Details of Intersection Corners
- Proposed Signal Phasing

Conduit and Conductor Schedules
- Table of conduits and wiring cables
- Table of pole wiring
- APS Message Table
- Detail focused on Conduit Layout (no background)

Reference to CoA Electrical Details
Electrical Service Type and Location

Elevation Drawings - Profile Views

For each vehicle approach
Signal Poles - type and size callout, clearance callouts
Signal Heads - Labelled individually and tied to key by type
Detection Equipment
CCTV Cameras
Antennas
Preemption Equipment

Signs and Markings

If extensive, a separate sheet should be provided.
If provided, the necessary dimensions are show on this sheet only.

City of Austin Detail Sheets

Traffic Control Series

804S-1 Series - 9 Pages

1. Arterial One Lane Closure (9 Sheets)
2. One Way Arterial Two Way Closure
3. Two Way, Divided Arterial One Lane Closure
4. Bypass Walkway, Sidewalk and Crosswalk Closures
5. Collector / Residential Lane Closures
6. Typical Traffic Control Plan For Shifting Traffic
7. Typical Traffic Control Plan For Shifting Traffic
8. General Notes
9. Device Spacing

804S-1A Series - For City Forces Only - 5 Pages

1. Residential Road Narrows for Centerline Work
2. Residential Road Narrows for CL/Curb Work
3. Temporary Arterial One Lane Closure - Left Lane
4. General Notes
5. Device Spacing

804S-3 Series - 5 Pages

1. Temporary Traffic Control Pavement Markings
2. Temporary Removable Tape, Arrows and Legends
3. Temporary Removable Tape, Arrows and Legends
4. Parking Stalls, Crosswalk and Stop Bars
5. General Notes

804S-2 Series - 8 Pages

1. Collector / Residential Street Flagging Operations
2. Flagger Setup for 2 Lane Roadway
3. Flagger Setup for 2 Lane Roadway
4. Flagger Setup for Vehicles Entering and Exiting Work Site
5. Street Detour Single Direction
6. Street Detour Both Directions
7. Use of Hand Signaling Devices
8. Typical Lengths & Spacing of Devices, Legend and General Notes

804S-4 Series - 9 Pages

1. Safety Fence
2. Safety Fence
3. Large Excavation
4. Work Area Protection
5. Steel Plating
6. Steel Plating
7. Steel Plating
8. Material and Equipment Storage
9. Material and Equipment Storage

804S-5 Series - 13 Pages

1. Channelizing Devices
2. Channelizing Devices
3. Barricades
4. Barricades
5. Traffic Control Signs
6. Traffic Control Signs
7. Traffic Control Signs
8. Typical CMTA/CIP Sign Locations
9. Special Work Zone Signs
10. Special Work Zone Signs
11. Signing and Barricading Crossroad & Driveway
12. General Traffic Control Notes
13. General Traffic Control Notes

Traffic Sign Series

824S-2 Series - 3 Pages

1. Ground Mounted Traffic and Street Name Signs
2. Ground Mounted Traffic and Street Name Signs - Soil
3. Ground Mounted Traffic and Street Name Signs - Concrete

Traffic Signal Series

830-1 - Foundation Details for Base Mounted Controller Cabinet
831S-1 - Traffic Signal Drilled Shaft Foundation
831-2 - Solar Powered Flashing Beacon
832-1 - Rapid Rectangular Flashing Beacon (RRFB)
832-2 - RRFB Placement
832-3 - Solar Powered RRFB
834S-1 - Type A Traffic Bearing Pull Box
834S-2 - Frame and Lid for Type A Pull Box
834S-3 - Type B Pull Box
834S-4 - Ring and Lid For Use With Type B Pull Box
834S-5 - Type C Pull Box With Light Weight Cover
834S-6 - Ring and Lid for Type C Pull Box
834S-7 - Ring and Lid for Traffic Bearing Type C Pull Box
834S-8 - Type D Communications Pull Box and Torsion Assisted Lid
835-1 - Trench Detail For Traffic Signal Conduit
836S-1 - Riser Detail For 50 mm (2”) and 75 mm (3”) Conduit
836S-2 - Overhead Detector Run Detail
836S-3 - Vehicle Detector Placement Detail

838-1 - Traffic Signal Electrical Notes
838-2 – Traffic Signal Electric Service
838-3 – Traffic Signal Phasing
839-1 - Pedestrian and Vehicular Signal Installation Detail
839S-2 - Wood Pole Span Wire Detail
839S-3 - Wood Pole Span Wire Installation Detail
839S-4 - Traffic Signal Structures Mast Arm Details
839S-5 - Traffic Signal Structures Span Wire Details
839-6 – Pedestrian Signal Wiring
841S-3 - Pole Foundation (Ped Pole)

The Below Specs Are Not Officially Adopted in municode Will be posted on AMD Special Detail Page

Traffic Signal Pole Foundation Detail - Aero Solutions
City of Austin Mast Arm Traffic Structures - Special Detail #12 - Valmont
City of Austin Mast Arm & David Extension Traffic Structures - Special Detail #13 - Valmont
City of Austin Mast Arm & David Extension Traffic Structures - Valmont
City of Austin Mast Arm Traffic Structures - Valmont

Curb Ramp Detail Sheets (If curb modifications are being made)

432S-3 Type 1 Curb Ramps - Full Intersection (3 Sheets)
432S-3A Type 1 Curb Ramps - "T" Intersection (2 Sheets)
432S-3B Type 1A/1B Curb Ramps - Full Intersection (3 Sheets)
432S-3C Type 1A/1B Curb Ramps - "T" Intersection (2 Sheets)
432S-3D Combined Curb Ramps - Full Intersection (3 Sheets)
432S-3E Combined Curb Ramps - "T" Intersection (2 Sheets)
432S-3F Combined Sidewalk Curb Ramp With Pavers (2 Sheets)
432S-3G Combined Sidewalk Curb Ramp With Pavers Within Limited Row (2 Sheets)
432S-3H Type 1 Ramps Within PC/PT of Curb and Gutter
432S-5 Type 1 Sidewalk Curb Ramp
432S-5A Type 1A Sidewalk Curb Ramp With Left Flare
432S-5B Type 1B Sidewalk Curb Ramp
470S-1 Curb Cut For Ramp or Driveway (Optional)

5.6 Record Drawings

Include in the plan set a note that the Contractor shall furnish Record Drawings that include any changes in the following:

- Pole locations and types
- Pull box locations
- Mast arm lengths
- Wiring
- Conduit Sizing
- Conduit run locations
- Number and size of conduits
- Electrical service location
- Ramp, curb and sidewalk revisions

Any discrepancy or change(s) between the plan set and how the signal was actually built must be indicated on the Record Drawings.

APPENDICES

A. SAMPLE PLAN SHEETS

THIS SECTION POSTED SEPARATELY

B. ARTERIAL MANAGEMENT DIVISION GENERAL NOTES

1. IT IS THE CONTRACTOR'S RESPONSIBILITY TO PROVIDE ALL INCIDENTAL EQUIPMENT AND MATERIALS NECESSARY TO RESULT IN A COMPLETE AND OPERATIONAL TRAFFIC SIGNAL. ANY ITEMS REQUIRED, BUT OMITTED, ARE THE RESPONSIBILITY OF THE CONTRACTOR AND WILL BE SUBSIDIARY TO THE APPROPRIATE BID ITEM.
2. THE EXISTENCE OF UTILITIES, EITHER UNDERGROUND OR OVERHEAD, INDICATED ON THE PLANS ARE TAKEN FROM THE BEST RECORDS AVAILABLE AND ARE APPROXIMATE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO LOCATE ALL UTILITIES (PRIVATE AND PUBLIC) PRIOR TO COMMENCING WORK. THE CONTRACTOR IS FULLY RESPONSIBLE FOR ANY DAMAGE CAUSED BY THEIR FAILURE TO LOCATE, PRESERVE, AND PROTECT THESE UTILITIES.
3. ANY EXISTING PAVEMENT, CURBS, SIDEWALKS, AND DRIVEWAYS DAMAGED OR REMOVED DURING CONSTRUCTION MUST BE REPLACED TO CITY OF AUSTIN STANDARDS.
4. COORDINATE WITH THE UTILITY PROVIDER AND SEEK THEIR APPROVAL TO ENSURE THAT NO CONFLICT EXISTS BETWEEN THE SIGNAL EQUIPMENT AND OVERHEAD ELECTRIC LINES. ALL SIGNAL EQUIPMENT MUST HAVE A 6 FEET CLEARANCE FROM NEUTRAL AND 10 FEET CLEARANCE FROM POWER LINES. CONTRACTOR WILL FOLLOW OSHA REQUIREMENTS WHEN WORKING CLOSE TO ELECTRIC LINES.
5. INSTALL ALL INFRASTRUCTURE AS SHOWN ON THE PLANS. ANY CHANGES MUST BE APPROVED BY THE INSPECTING ENGINEER IN THE FIELD.
6. SIGNAL POLE, PEDESTAL POLE, CONTROLLER FOUNDATION, AND PULL BOX LOCATIONS MUST BE LOCATED/MARKED IN THE FIELD BY THE CONTRACTOR AND APPROVED BY THE INSPECTING ENGINEER PRIOR TO INSTALLATION. CONTACT BRIAN CRAIG AT 512-974-4061 WITH TWO WEEKS NOTICE.
7. ALL SIGNAL FOUNDATIONS MUST BE INSPECTED AND APPROVED BY THE INSPECTING ENGINEER PRIOR TO CONTRACTOR POURING CONCRETE. CONTACT BRIAN CRAIG AT 512-974-4061 WITH 2 DAYS NOTICE.
8. ALL PROPOSED SIGNAL HEADS MUST BE WRAPPED IN BURLAP OR COMMERCIAL SIGNAL HEAD COVERS UNTIL READY FOR OPERATION.
9. CONTACT CITY (BRIAN CRAIG AT 512-974-4061) PRIOR TO INSTALLATION OF WIRING FOR THE TRAFFIC SIGNAL. THE CONTRACTOR WILL CONNECT THE WIRES TO THE SIGNAL CONTROLLER.
10. ALL NEW CONDUITS UNDER ROADWAYS AND DRIVEWAYS MUST BE BORED. CONDUITS UNDER NATURAL GROUND MAY BE TRENCHED AND BURIED; HOWEVER, THE CONTRACTOR MUST BACKFILL, COMPACT, AND RESTORE TRENCHED AREA TO ORIGINAL CONDITION AND MATCH EXISTING SURFACE CONDITION TO THE DENSITY OF ADJACENT AREA.
11. CLEAN AND RESTORE THE CONSTRUCTION AREA TO ORIGINAL CONDITIONS PRIOR TO FINAL INSPECTION.
12. SIGNAL HEADS WILL BE 12" LED WITH SPECIFIED ALUMINUM HOUSING AS SHOWN IN THE PLANS. BACKPLATES WILL BE REFLECTIVE.
13. ALL SIGNAL EQUIPMENT MUST BE INSTALLED AS PER CITY OF AUSTIN STANDARDS AND SPECIFICATIONS.
14. THE 2070 CONTROLLER, D4 SOFTWARE, 352 CABINET, CONFLICT MONITOR, AND BATTERY BACKUP SYSTEM MUST BE PROVIDED TO THE CITY FOR TESTING A MINIMUM OF TWO WEEKS PRIOR TO INSTALLATION. IT MAY BE POSSIBLE TO PURCHASE THESE ITEMS DIRECTLY FROM THE CITY IF THERE IS ADEQUATE STOCK AVAILABLE IN THE CITY INVENTORY.

15. COORDINATE WITH THE UTILITY PROVIDER TO SET UP ELECTRIC SERVICE FOR THE TRAFFIC SIGNAL. COORDINATION IS SUBSIDIARY TO ITEM 1032, ELECTRICAL SERVICE.
16. PEDESTRIAN SIGNAL HEADS MUST BE LED COUNTDOWN TYPE AND PEDESTRIAN PUSH BUTTONS (APS UNITS) MUST BE ACCESSIBLE AND ADA COMPLIANT. IF TWO ACCESSIBLE PUSH BUTTONS ARE SPACED LESS THAN 10' APART OR ON SAME POLE, EACH ACCESSIBLE PUSH BUTTON WILL HAVE THE FOLLOWING FEATURES:
    a. PUSH BUTTON LOCATOR TONE
    b. A TACTILE ARROW
    c. SPEECH WALK MESSAGE FOR THE WALKING PERSON INDICATION, AND
    d. A SPEECH PUSH BUTTON INFORMATION MESSAGE.

    THE APS WILL BE PROGRAMMED BY A MANUFACTURER'S REPRESENTATIVE IN ACCORDANCE WITH SPECIFICATIONS AND THE TMUTCD.
17. FURNISH AND INSTALL ONE CITY APPROVED CCTV CAMERA SYSTEM AT EACH PROPOSED TRAFFIC SIGNAL. THIS WORK IS SUBSIDIARY TO ITEM 840, TRAFFIC SIGNAL INSTALLATION.

THE CITY WILL PROGRAM SIGNAL CONTROLLER AND IMPLEMENT SIGNAL TIMING IN FIELD.

C. CURRENTLY USED TRAFFIC SIGNAL EQUIPMENT

Detection Systems

- SmartMicro T48 Radar
- ITS Plus
- FLIR – Only with prior approval
- Miovision – Only with prior approval

Communication Equipment

- Prysmian #0048HBS1LAFEAJA 48 strand fiber for pigtails
- Prysmian #0096HBS1LAFEAJA 96 strand fiber for all other runs
- Etherwan EX78934F-0VB+KR-BKZDIN-D with appropriate SFB modules
- Cradlepoint IBR 1700 with 5-in-1 external antenna with 3 year Netcloud subscription
- Intuicom Axial Dual antenna radio

D. PROJECT INTAKE FORM

Arterial Management Project Intake Form

Date: 6/22/22

AMD Coordinator:

Project Type:

Project Description:

Brief description of the project, including who is responsible for design and construction activities.

Location:

Provide either intersection cross-streets or block number

Project Sponsor:

Who identified the need for the project.

Partners:

Funding:

Provide as much information on funding source(s) and amount(s)

Notes: