TRAFFIC PATTERNS

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Subject: Foster City Traffic Signal Assessment 2017

Introduction

There are 25 signalized intersections within the City of Foster City. 3 of the 25 signalized intersections are co-owned with the California Department of Transportation – Caltrans at the SR-92 intersections on Chess Drive, Metro Center Boulevard, and Edgewater Boulevard. Two new traffic signals are currently under construction in the north area of the city, bringing the total of traffic signals in the City to 27 shortly after the start of the new year.

This study is being prepared at the request of the City as part of a citywide transportation study that includes planning for bicycle and pedestrian facilities near schools, master planning for bicycle facilities along arterial, and focused intersection studies around the City. The focused traffic signal assessment in this study aims to inventory the existing traffic signal infrastructure network and to identify opportunities to improve the efficiency of the network through either equipment or operations enhancements.

Background

Modern traffic signal systems include several different elements:

1) Traffic Signal Controllers

   The Traffic Signal Controller is the "brain" of a signalized intersection. The controller is basically a computer that processes detection inputs from the field and then sends "output assignments" to turn off and on traffic signal indications (Red, Yellow, Green) and to Walk/Don't Walk controls for pedestrians.

   Foster City uses a modern traffic signal controller from Trafficware but the field hardware is reaching the end of us its useful life and upgrades to the Intersection Control Firmware (ICF) have not taken place regularly limiting the amount of advanced traffic signal timing features that can be implemented. Think of the ICF as the equivalent of the operating system of a computer. The current ICF of the traffic signal controllers in the field is the equivalent of Windows 2000.

2) Communications Network

Typically made up of twisted copper pair - signal interconnect cables (SIC) or fiber optic (FO) cables, the communications network provides a hardwire linkage between the field and the office where staff can monitor and manipulate traffic signal timing. Modern traffic signal networks use industry-standard Ethernet communications, similar to those used for computer systems.

Foster City has a 6-pair SIC interconnect cable that reaches most traffic signals in the City. The two new traffic signal currently under construction in the City will also receive SIC linkages to ensure that they are "online" and communicating to the City's traffic signal Central Computer System upon activation.

3) Advanced Traffic Management System (ATMS) – Central Computer System Software

The ATMS is the central computer system that communicates to the field traffic signal controllers and stores data to help in future traffic forecasting and traffic signal timing development. Typically located on a dedicated server(s), a modern ATMS uses Ethernet protocols to link User Work Stations to traffic signal controllers in the field allowing city staff to manipulate traffic signal timing.

Various Add-On modules are available for an ATMS including:

- *Video Relay Server* - to temporarily "Buffer" video from traffic cameras. The ATMS also allows users to launch real-time video streams from traffic cameras from directly within the ATMS applications. With modern ATMS systems, video relay servers can also buffer video for future use for typically up to two (2) weeks before video streams override themselves and are typically deployed in conjunction with police enforcement to provide buffered video for both traffic and public safety/emergency operations center functions.

- *Traffic Adaptive* – a special module that lets the ATMS track and dynamically modify traffic signal timing on its own (within predefined parameters set by the local traffic engineer). Traffic Adaptive modules can help traffic operations on major arterials such as E. Hillsdale Boulevard and Foster City Boulevard.

- *Connected Vehicles* – a module that shared traffic signal timing data with connected and autonomous vehicles, including detection data that can lead to reduced bicycle- and pedestrian crashes by notifying motorists and self-driving vehicle regarding the position of bicyclists and pedestrians ahead on the roadway.

Foster City has limited ATMS functionality due to the lack of Ethernet-based communications. The 6-Pair SIC currently in use limits the City to 9,600-baud rate communications equivalent to dial-up modem speeds on early personal computers. ATMS functionality is currently limited to the monitoring and adjustment of traffic signal timing parameters only.

4) Traffic Signal Field Hardware

The field hardware includes the elements that are familiar to the public, traffic signal poles, vehicle and pedestrian signal indications, and pedestrian pushbuttons. There are also elements that help to operate the field hardware that are not readily apparent to the public including inductive pavement detection loops or video detection systems.

Foster City has an aging field hardware inventory, but the traffic signal poles themselves are in great condition, a testament to the strong maintenance efforts of the City. The traffic signal and pedestrian housings though are showing their age with various levels of oxidation due to the city's close proximity to the San Francisco Bay.

Existing Foster City Traffic Signal Equipment and System

Foster City uses Trafficware brand traffic signal controllers, although the controllers continue to operate functionally while they are reaching the end of their useful life, typically between 10-15 years. The age of the Foster City traffic signal controllers varies from 11-17 years of age. There is no record of the ICF operating system having ever been updated since the original deployment. Although it is not uncommon for cities to ever updated their ICF firmware, regular semi-annual updates help to ensure that cities have the most current traffic signal timing strategies available to them, including traffic signal timing features that are specific towards improved bicycle and pedestrian operations.

Updating ICF firmware with older traffic signal systems can require that traffic signals be placed into Flash mode during the software updates. Newer traffic signal systems that operate on Ethernet communications allow ICF updates without the need for Flash operations in the field and can be done remotely from the ATMS.

Regarding traffic signal network communications, the Foster City traffic signal network is in need of a substantial upgrade to help modernize its infrastructure. Communications network upgrades can be one of the costliest elements of a traffic signal system but fortunately, the City is already connected so underground conduit networks already exist. The City will need to consider, and this report aims to guide the City in the discussion, how best to upgrade its network and potentially introducing the enhancement of additional city services. Later in this report we will discuss options that include a broadband equipment upgrade equivalent to Digital Subscriber Line (DSL) features similar to those found in home networks through local phone providers or an upgrade to fiber optic cables to maximize broadband opportunities that can also interconnect other city facilities.

The existing Foster City ATMS will require an immediate upgrade. The current ATMS system, Streetwise, is no longer supported by Trafficware and limits the communications capabilities of the City. In addition, if the City upgrades its traffic signal controllers in the field without upgrading the supporting ATMS system, the City may limit the ability to remotely implement traffic signal timing features that are enabled within new controllers, but not supported within an older ATMS. The existing ATMS is currently stationed on a computer within the Public Works Department - Engineering Division of City Hall, rather

than a formal server, which puts at jeopardy the information that the system collects in the event of a computer failure.

To help the City in providing an immediate assessment of its traffic signal network, the following exhibits are provided:

Exhibit A *Map of the Foster City Traffic Signal Network* including existing communications cable linkages

Exhibit B Detailed *Traffic Signal System Field Inventory* that highlights the age and type of equipment currently in use in the field, equipment focused within the traffic signal cabinet.

Existing Foster City Traffic Signal Operations

The legacy Streetwise ATMS system limits the City's ability to implement modern traffic signal operations strategies such as traffic adaptive operations. Traffic Adaptive traffic signal features typically include a module within the traffic signal controller that is actively capturing and submitting traffic data back to a second module located on the ATMS servers with additional computer processing power; this can only happen with improved Ethernet communications. The Streetwise ATMS system does not offer Traffic Adaptive timing capabilities nor does it offer Ethernet communication capabilities.

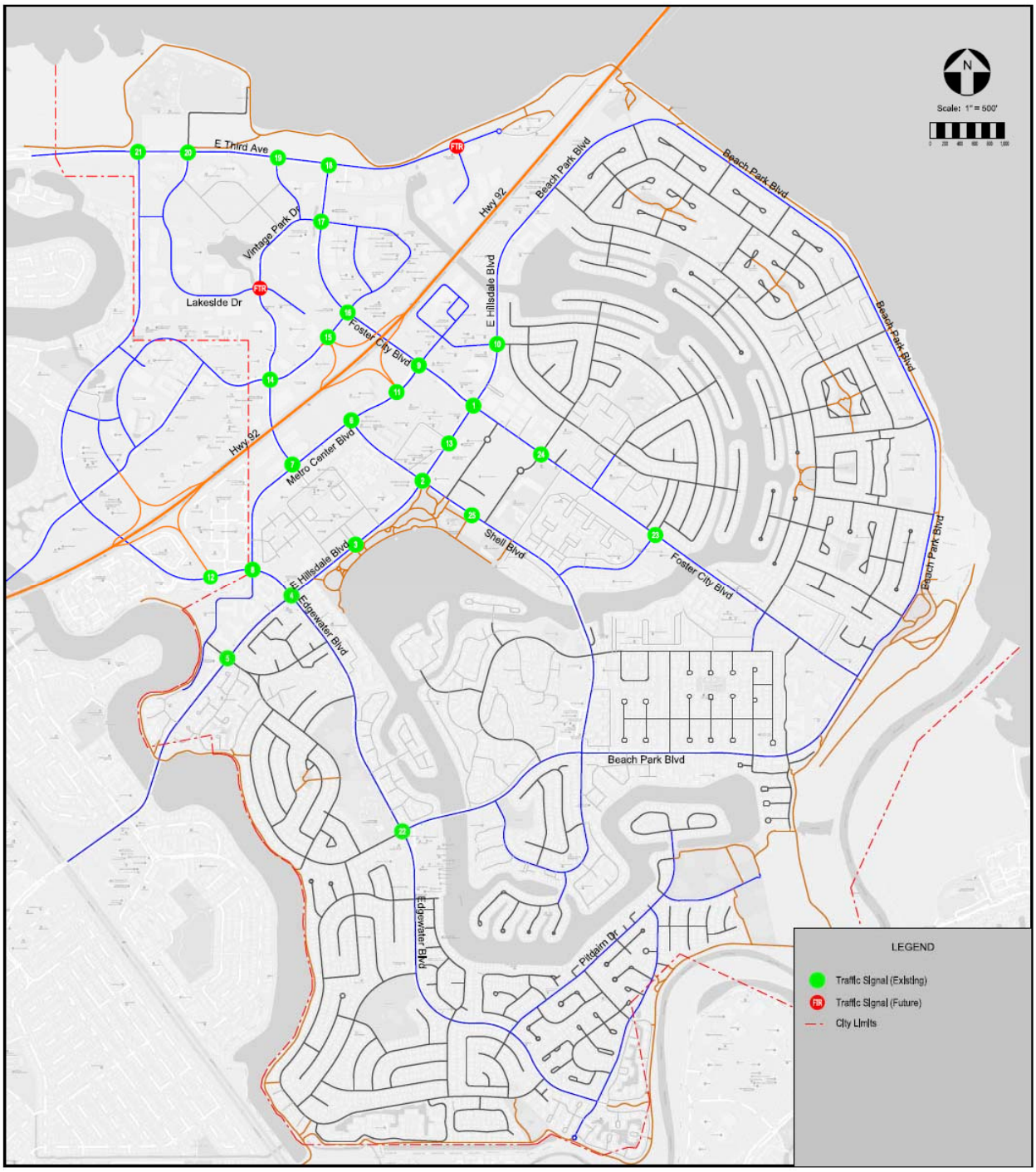
The City's Bicycle, Pedestrian, and Intersection Evaluation Study (CIP 301-664) in which this focused traffic signal system assessment is being conducted includes a Safe Routes to School study that primarily recommends Suggested Walking and Biking routes for the schools within Foster City along with Hot Spot intersection improvements. Several signalized intersections overlap with Suggested Walking and Biking Routes and specific traffic signal timing features such as Early Pedestrian Release to let pedestrians move ahead of turning vehicles are being recommended. An upgrade to the ATMS will allow the City to implement scheduled traffic signal timing strategies that are student pedestrian-focused as part of the upgrade.

Nearly two-thirds of the City's traffic signals currently operate using video detection systems by FLIR-Traficon. The use of video detection equipment helps to reduce roadway operations costs by eliminating the need to replace inductive pavement loops that are more prone to failure or being impacted by construction activities. Video detection systems also introduce the opportunity for bicycle detection and differentiation to help implement bicycle-specific traffic signal timing features. The existing FLIR-Traficon requires a software upgrade in order to introduce bicycle detection capabilities. The existing firmware that operates on the video detection equipment in the field have not been upgraded since their installation.

The existing video detection in the City can also help allow for quick deployment of traffic adaptive systems because video detection offers the capability to provide robust detection capabilities, the secret sauce that helps to help ensure successful traffic adaptive system operations. Video detection systems are recommended when deploying traffic adaptive systems to maximize detection zone areas. Example of bicycle-specific signal timing strategies that can be deployed in combination with bicycle detection

hardware such as video detection systems include Early Green or Green Extension to help bicyclists safely clear an intersection and Dynamic Minimum Green to give bicyclists more time to clear an intersection. Robust detection also allows for Smart City – Connected Vehicle Systems capabilities that are discussed further within this report.

Figure 1
Foster City – Traffic Signal Network Map



Analysis

Traffic Patterns recommends the replacement of several pieces of field auxiliary equipment to help modernize its traffic signal infrastructure.

Traffic Signal Controllers

Traffic Patterns recommends replacement of the existing traffic signal controllers with controllers with traffic signal controllers that utilize standard Ethernet communications. Which controller the City chooses for the future may depend on its preferred ATMS System functions. There are three main traffic signal controller manufacturers in the US Market, in alphabetical order:

Econolite: One of the largest traffic signal hardware manufacturers in the United States but presences in Northern California is limited. Last citywide or countywide deployment in the Northern California includes the County of Sacramento in 2010.

McCain: Located in Southern California, McCain is a dominant manufacturer in traffic signal cabinets and other auxiliary equipment. There are no recent Northern California installations within the past 10 years.

Trafficware: The largest traffic signal controller supplier in the San Francisco Bay Area with recent installations in the City of Palo Alto and active deployment in the City of Fremont. Bay Area Cities similar to Foster City that had legacy Streetwise Systems but upgraded to the most current Trafficware systems include Concord, Fairfield, and Pittsburg.

The City's Trafficware controllers are a good controller option for the City to simply upgrade and take advantage of new features now available within the most current Intersection Control Firmware and supporting Advanced Traffic Management System – Central Computer System.

Traffic Patterns recommends a competitive bidding process with the additional controller suppliers to ensure the best pricing and also to give the City an opportunity to familiarize themselves with ATMS features that vary by manufacturer. Additional features that should be desired in the traffic signal controllers include NEMA TS2- Type 2 connections (discussed further in this report) that will allow the new traffic signal controllers to operate within the City's legacy traffic signal cabinets.

Traffic signal controller replacement should be coordinated with replacement of the Traffic Signal Central System to minimize downtime for traffic signal coordination and monitoring capabilities by city staff. Traffic signal coordination downtime can further minimized by coordinated replacement with communications upgrades.

Traffic Signal Cabinets

The traffic signal cabinet houses the traffic signal controller and other auxiliary equipment that operate the signalized intersection. The City currently utilizes legacy NEMA TS-1 cabinets. NEMA TS-1 cabinets are an original NEMA standard for traffic signal cabinets from the 1980's and use hard wire point-to-point connections within the cabinet. These cabinets types are extremely reliable and although the City's current inventory is aged (average age of 26 years) the City can probably expect a minimum of 10-years more from each of these cabinets if maintained properly. 30 years of age would be considered the end of useful life for a traffic signal cabinet.

NEMA TS-1 cabinet environments just offer limited maintenance and troubleshooting capabilities compared to the modern NEMA TS-2 cabinet environments. NEMA TS-2 cabinets are considered the most modern traffic signal cabinets currently on the market and they can easily be retrofitted onto existing cabinet foundations. These cabinets utilize Bus Interface Units (BIUs) to transfer data between different areas of the cabinet to the traffic signal controller, similar to how a modern computer transfers data between chipsets on a motherboard and add-on peripherals. The NEMA TS-2 cabinets also maximize detection input opportunities (64-channels) and offer robust maintenance features that can be viewed at the ATMS. Think of a detection channel as an input from the field requesting a Green indication or Walk display for service. The better the detection, the better the traffic signal operation.

Active traffic signal deployments within the City at E Third Avenue & Lincoln Centre Drive and Vintage Park Drive & Lakeside Drive will deploy new NEMA TS-2 cabinet standard.

Traffic Patterns recommends replacing the oldest NEMA TS-1 cabinets in the City that are more than 20 years old to prioritize maintenance funding, 19 total. The new cabinets can be installed onto the existing cabinet foundations to reduce construction costs. At the E Hillsdale Boulevard & Fire Station traffic signal, the existing traffic signal cabinet is a small Size G cabinet that should be upgraded to a minimum Size M to allow for additional traffic signal infrastructure.

Traffic signal cabinet replacement can include community-engagement opportunities including Public Art elements with decorative wraps that are common amongst the San Francisco Bay Area.

Conflict Monitor Units (CMUs) vs Malfunction Monitor Units (MMUs)

CMUs are used in older NEMA TS-1 traffic signal cabinet types to monitor conflicting Red and Green movements and voltage of Red indications. MMUs are used in modern NEMA TS-2 traffic signal cabinet types and monitor conflicting Red, Yellow, Green, and Pedestrian indications and offer additional maintenance features to help troubleshoot an intersection. MMU's includes an Ethernet port to allow an ATMS to remotely monitor and communicate to the unit and provide engineering and maintenance staff with additional intersection health information.

An MMU can be used in a legacy NEMA TS-1 traffic signal cabinet but a CMU cannot operate in a newer NEMA TS-2 cabinet.

Traffic Patterns recommends that MMUs be provided at all signalized intersections at the time of the traffic signal controller replacement. As the City upgrades traffic signal cabinets, the MMUs can be transferred to new cabinets. MMUs are typically certified annually by the maintenance firm of each agency. An additional 3 MMUs (10%) should be sufficient to allow for replacement during certification testing and for emergency repair supply. At the E Hillsdale Boulevard & Fire Station intersection there is no existing CMU, as part of upgrading the traffic signal cabinet as discussed in the previous section, a new MMU can be deployed concurrently with the traffic signal cabinet upgrade.

Emergency Vehicle Preemption

Emergency Vehicle Preemption equipment allows first responders including fire trucks, ambulances, and police vehicles to preempt a signalized intersection for a green indication to help the emergency vehicle move though a signalized intersection in efforts to reduce emergency vehicle response times. Emergency vehicle preemption does not override pedestrian service, minimum green vehicle service, or rail service. There are two main technology options are EV Preemption: Optical and Radio technologies.

Optical preemption technology uses coded light waves to validate emergency vehicles. On an emergency vehicle, a strobe light-like emitter is installed. Optical receivers are installed on each approach of a signalized intersection. Newer optical preemption equipment also offers GPS coding capabilities while legacy equipment, like that in Foster City, does not.

Radio preemption uses radio waves to validate emergency vehicles. Only one receiver is typically required at each intersection and the equipment validates in which direction the emergency vehicle is approaching.

In Foster City, all 25 existing signalized intersections have optical preemption equipment. The two new traffic signals currently under construction are both designed with optical preemption equipment capabilities.

Traffic Patterns recommends retaining the existing optical equipment technology moving forward and as traffic signal cabinets are replaced, new auxiliary cabinet equipment can be provided to ensure modernization of the preemption equipment and compatibility with emitters on existing city emergency vehicles. Fire and Police staff should review and provide input on this recommendation to ensure that the existing optical equipment is compatible with Mutual Aid Agreements with neighboring agencies.

Battery Back-up Systems (BBS)

20 of the City's 25 signalized intersections currently include Battery Back-Up Systems to help the traffic signals to continue to operate in the event of a power failure and the remaining 5 operate include back-up generators. BBS systems typically let an intersection operate in normal operation for up to two hours and then transition to a Red Flash mode in the event of an extended duration power failure for another 8-10 hours.

Traffic Patterns recommends that the City install BBS systems at all of its signalized intersections. Only five intersections currently lack BBS systems so deployment as part of an upcoming maintenance schedule may be the most efficient method. Newer BBS systems deployed in Foster City include a BBS integrated into the service pedestal that houses the PG&E service meter for the traffic signal. For the 5 remaining intersections, the BBS systems can be installed within the existing traffic signal cabinets through the use of an add-on extension base to the traffic signal cabinets. This will allow the city to remove the back-up power generators.

Video Detection Equipment

16 of 25 existing traffic signals in the City of Foster City currently operate with video detection systems. The City uses legacy Traficon video detection equipment that although operating properly in the field, the products will require replacement as they fail. Traficon was acquired by FLIR in the mid-2,000's and replaced the image sensors of the detection equipment with thermal image sensors that use a combination of video and thermal heat signatures to more accurately detect objects, including vehicles and bicyclists. The existing legacy Traficon equipment in the field can detect bicycle detection but the software algorithms in the equipment lack bicycle differentiation. Simple software upgrades to the existing Traficon gear would introduce bicycle detection and differentiation capabilities to the City. Software upgrade would include contracting with the current video detection vendor to install the software directly in the field, this can be done with minimal interruption to traffic during non-peak hour periods of the day.

Flir Trifense Camera

Used in New Deployments in Foster City, CA

Video detection as a traffic signal operations system is the most common application on the market place for cities looking for alternatives to traditional inductive loops as video detection systems help to reduce operations costs in the field from loop replacements and they allow for simple video detection zone changes to accommodate construction activities or roadway marking changes.

Modern video detection systems typically include Ethernet network capabilities but this capability is currently not available with the legacy Traficon equipment. Peripherals can be added to the existing equipment to introduce video buffering capabilities for remote traffic management but a solid Ethernet backbone to transmit video data back to an ATMS Central Computer System does not exist within the City.

Traffic Patterns recommends a software upgrade of the existing legacy Traficon equipment to help the City introduce Bicycle Detection and Differentiation capabilities to the City's traffic signal network. New traffic signals currently under construction already require the use of new FLIR combination image and thermal image sensors. New traffic signal and major traffic signal modification projects should also require the newer FLIR equipment.

The locations with legacy Traficon video detection equipment overlap with locations that include aged traffic signal cabinets. ***Traffic Patterns recommends that as part of the traffic signal cabinet replacements in the future, that new FLIR video detection equipment be provided at the same time to help modernize the detection systems.*** The combination thermal and image sensor capabilities of the new FLIR systems should work well for Foster City given its proximity to the San Francisco Bay which is more prone to inclement fog that can impact video detection systems, including the current legacy Traficon equipment. New FLIR equipment operate on Ethernet cables between image sensors in the field and processing equipment within the traffic signal cabinet so a minor rewire in the field will be

required as part of the transition but cable upgrades can be integrated into on-going maintenance operations to help simplify deployment.

In order for the City to take full advantage of video detection equipment for features such as traffic adaptive systems or traffic data collection (including bicycle counts) for future planning purposes, concurrent upgrades to the traffic signal cabinets, ATMS Central Computer System, and the communications network will need to take place. When these elements are all in the place, the City will also be able to consider advanced traffic management modules including Connected Vehicle applications that will allow the City to share traffic data, in real-time, to support autonomous and connected vehicles.

Traffic Signal Communications Networks

Foster City's existing traffic signal communications network operations over twisted-copper pair cables using aged 9,600-baud modems, equivalent to dial-up modems on early Personal Computers in the 1990s. For the transmission of traffic signal status data only, such a network is acceptable but it limits an agency's ability to deploy more advanced signal management strategies that rely on real-time Ethernet communications.

Fortunately for the City, most of the traffic signal are interconnected using a twisted-copper pair cable. In addition, the two new traffic signals currently under construction will be networked using the same twisted copper pair cables. The City has two immediate alternatives to introduce high-speed broadband communications to the City using Ethernet protocols:

Option A Ethernet Over Copper Upgrade, Similar to DSL Technology

The existing 6-pair Signal Interconnect Cable (SIC) that connects the existing traffic signal network can be retained and "Ethernet Over Copper" transceivers, equivalent to DSL Modems in a home, can be installed to create an Ethernet backbone with limited bandwidth. The bandwidth generated would be sufficient to continue transmission of traffic signal status data and introduce the ability to introduce data for other traffic signal elements such as Malfunction Monitoring Unit's (MMUs), Battery Battery Back-Up Systems, and a limited amount of traffic cameras. Traffic camera deployment with DSL modems is limited because Live Traffic Video is bandwidth intensive and DSL Modems can't offer enough bandwidth to sustain traffic camera deployment citywide.

This solution would be the most cost-effective option for the City limiting the network upgrade costs to transceivers only. Locations not already online can be brought on using cellular-based ethernet modems. Two modems are required per intersection, one in the field and another in the traffic operations center. Cellular-based ethernet modems will introduce monthly operating costs to maintain the cellular connections. Traffic camera deployment at intersections with cellular-based modems is not recommended as the units do not offer enough bandwidth to support real-time traffic camera feeds and would also increase the monthly operating costs of the cellular connection with limited results.

Actelis Ethernet-over-Copper Field Hardened Switch

Option B Fiber Optic Backbone Upgrade

With the existing SIC cables and underground conduits already in place, the City can consider the option of pulling out the existing SIC cables and replacing them with a fiber optic cables. New network switches will be required to "light up" the fiber optic cables and provide the Ethernet protocol capabilities, but the fiber optic cable can also be used to link city facilities directly with one another. Fiber optic cables will offer the City more bandwidth capabilities compared to Ethernet Over Copper equipment, and the bandwidth can be used to introduce traffic monitoring capabilities citywide, wherever the cables traverse. Traffic camera video buffering can include existing video detection as well as Pan/Tilt/Zoom closed circuit television (CCTV) cameras for use during citywide emergency or incident management.

Intersections not already online can be brought on immediately using cellular-based ethernet modems as a cost-savings measure. If the City seeks to bring them on with fiber as well, the traffic signal conduit network would need to be expanded to those intersections.

Traffic Patterns recommends the City consider a Phased implementation of Option B which includes deployment of a fiber optic backbone. Design can begin immediately and the construction can be staged to coincide with replacement of traffic signal controllers and other communications equipment to reduce downtime of traffic signal coordination and remote monitoring capabilities of city staff.

Fiber Optic Cables offer Higher Bandwith
for Traffic Signal Networks

ATMS – Central Computer System

The driving decision on which traffic signal manufacturer to partner with for the City's next traffic signal system will be the its desired Advanced Traffic Management System (ATMS) – Central Computer System capabilities. Currently, the City uses the same manufacturer, Trafficware, for its traffic signal controllers and its ATMS Central Computer System, but the ATMS Central Computer System is two generations behind the most current system offered by Trafficware, ATMS.now.

Using one manufacturer for both traffic signal controllers and the ATMS Central Computer System offers a community with multiple benefits:

1) *Continuity.* It guarantees that all the traffic signal data sets that are on the traffic signal controller in the field can be monitored and manipulated remotely from a Traffic Management Center (TMC). When the manufacturers of the traffic signal controllers and ATMS Central Computer System are different, the cost of software modification to introduce additional traffic signal monitoring capabilities is increased and it places the city in a negotiation position between manufacturers with conflicting interests.

2) *Improved Add-On Modules*. Most ATMS Central Computer System manufacturers offer a robust Add-On Modules for their systems that take advantage of software on the field traffic signal controllers to introduce improved traffic signal timing strategies. A City needs only determine which Add-On Modules are important to the community. Examples of popular Add-On Modules include Traffic Adaptive Signal Timing, Traffic Response Signal Timing, Connected Vehicle and Autonomous Vehicle Data Sharing, Asset Management, Transit Signal Priority, and expanded Video or Changeable Message Sign capabilities. Each of these modules can include a software module that operates on a dedicated server in the TMC and an additional software module that operates on the traffic signal controller in the field; both software elements work in conjunction with one another over robust Ethernet communications.

3) Although the option to use traffic signal controllers and an ATMC Central Computer manufactured by different vendors is available, ***Traffic Patterns recommends using maintaining a network where the traffic signal controller and ATMS Central Computer System are made by the same manufacturer.*** This will help simplify the upgrade process for the City and provide the City with a suite of ATMS Central Computer System modules to choose from over time.

Trafficware offers the City of Foster City local support through its Bay Area distributor, Western Pacific Signal located in San Leandro, CA. An upgrade to the most current Trafficware hardware is an option but the cost would be no different than an upgrade to any another comparable manufacturer. The two most applicable traffic signal controller and ATMS Central Computer System solutions for the City of Foster City include Trafficware (current system) and Econolite. McCain noted earlier in this report is not recommended as there are no recent local installations in the Bay Area. ***Traffic Patterns recommends a competitive bidding process for its new traffic signal system to ensure the most competitive pricing and to let the bidding process serve as an education process for City staff to help identify and learn about the various traffic signal system solutions that are on the market.***

A new ATMS Central Computer System with offer the City with the following benefits:

- Modern Ethernet communications to the field (if the near-term or long-term recommendations in the subsequent section are implemented)
- Improved User Interface (UI) to access special functions such as traffic signal coordination, basic timing data access and modification capabilities, historical traffic data queries and report, and user account privileges
- Module Options for features such as Traffic Response or Traffic Adaptive capabilities
- Connected Vehicle system capabilities

Only the Trafficware ATMS.now solution will offer the City the following additional capabilities:

- Synchro traffic signal coordination software exchange to allow immediate development of traffic signal timing plans by City staff. Synchro is the industry standard traffic signal timing development software.
- Use of SynchroGreen Traffic Adaptive software, restricted only to Trafficware controllers and ATMS Central Computer Systems.

If traffic signal timing will not be conducted by the City regularly using its own internal City resources, a direct link to Synchro may not be a critical decision factor. Future consultant support to the City can utilize the data to gather data and then develop and implement new traffic signal timing strategies using the ATMS Central Computer System.

The ATMS Central Computer System consists of various elements located within the TMC. The equipment listed in Table 1 would be the likely elements in a Citywide Traffic Signal System Upgrade projects for the City's TMC. It should be noted that the City's existing TMC is limited to a Personal Computer located in one of the cubicle offices at City Hall. Part of planning a Citywide Traffic Signal System Upgrade for the City should include considerations for development of a focused TMC either at City Hall or the Public Works Corporation Yard at Lincoln Centre Drive.

Table 1
Foster City Citywide Traffic Signal System Upgrade
Probable List of ATMS Central Computer System Equipment

Computer Servers (6 Total)

- ATMS Server (1)
- ATMS Add-On Modules (2)
- Video Relay Server (3)

Computer Work Stations (6 Total)

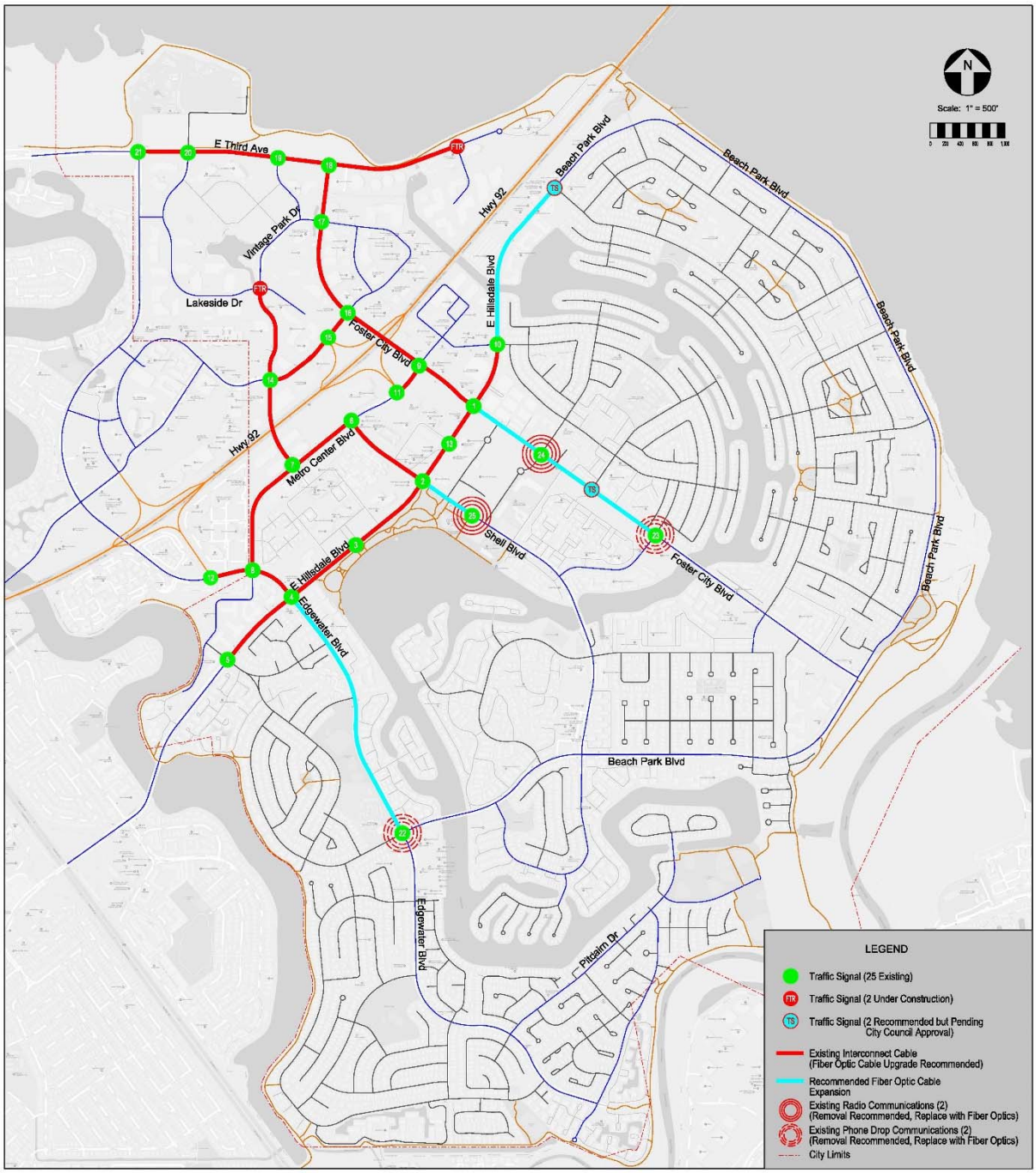
- City Hall (2)
- Public Works (1)
- Emergency Operations Center (1)
- Police Dispatch (1)
- Police Traffic Unit (1)

Network Equipment

- Master Network Switch (2)
  (City Hall and Public Works Yard)
- Fire Wall at City Hall
  (For City Email and Internet Access)
- Network Server Rack
- Battery Back-Up System for Network Rack

Figure 2 shows the likely Network Scheme for the City of Foster City as it transitions towards Ethernet communications as the backbone for its signal system.

Figure 2
City of Foster City – Proposed Network Map



Connected and Autonomous Vehicles

When considering an upgrade to a traffic signal networks and its ATMS central computer systems some consideration should be given to whether to share traffic signal data with the growing connected and autonomous vehicle industry. Historically, traffic signal networks are closed systems made available only to the agency engineers where the systems are deployed. Although there are various examples, even with the San Francisco Bay Area of agencies trying to share data sets between systems the amount of data shared is limited in nature and restricted in most cases to monitoring only capabilities only as most agencies seek to retain the ability to adjust traffic signal timing strategies within their own jurisdictions.

Foster City has an opportunity to introduce traffic signal timing data as a Public Utility as part of a Citywide Traffic Signal System upgrade project. The sharing traffic signal timing data is of great interest to the private sector whom is seeking to introduce new marketplace solutions focused around making traffic patterns more efficient. Locally with the Bay Area, the City of Palo Alto is the first city in the world to be sharing all of its traffic signal timing data with private sector, including active detection data. Private sector partners with the City of Palo alto include Google, Ford, BMW, Toyota, and Audi, to name just a few.

The private sector has led the industry in developing traffic data sharing solutions with mobile device data sets including solutions such as Google Maps, Apple Maps, etc. These solutions are viewed as both positive and impactful to communities depending on whether is traffic directed into or away from the community during commute or incident traffic scenarios. These popular mobile device applications rely on cellular data for mobile device subscriptions and use travel time to estimate delay and congestion on roadways and proprietary algorithms to try and redirect motorists to less congested roadways. What these types of solutions lack though is “Prediction” capabilities that are based on both historical and real-time traffic signal data. The City of Foster City proactively sharing its traffic signal timing data sets can be an opportunity to advise private sector partner on traffic signal timing changes that may help to redistribute traffic away from neighborhoods and back onto arterial streets that are better suited to handle higher volume traffic patterns.

There are two primary methods to share traffic signal timing and detection data:

- Cloud Data Broadcasting
  Traffic signal and detection data is broadcast online from either the ATMS Central Computer System or from if no central computer system is available. Cloud data broadcasting directly from the ATMS Central Computer System is a relatively low-cost application limited only to the cost of an Add-On module without the need for an additional field hardware at the signalized intersections themselves.

- Dedicated Short Range communications (DSRC)
  Using DSRC radios at the traffic signal cabinet, traffic signal timing data is broadcast in the field and then collected and interpreted by vehicles with recipient on-board DSRC radio. The DSRC broadcast is limited to the range of the DSRC radios, about 1,000 FT, and a connected or autonomous vehicle must be within the broadcast range to receive the data. Most agencies will

not deploy DSRC radios in the field without grants due to the high cost of DSRC radios, and although the DSRC data sets known as Signal Phasing and Timing (SPaT) data uses an open communication protocol, how the equipment pulls the data from the traffic signal controller and repackages it for broadcasting is proprietary.

Cloud Data Broadcasting

Private companies leading the market in 3rd party data broadcast solutions include Trafficware, Technical Traffic Services (TTS) and Connected Signals. Trafficware has an Add-On modules to its ATMS Central Computer System that was first developed for the City of Palo Alto. TTS and Connected Signal rely on local agencies to provide them with access to data either in the field or at the ATMS central computer system where proprietary equipment is then installed and a limited number of data sets are then rebroadcast back to each company's respective private cloud servers through what is known as UDP (User Datagram Protocol) Broadcasting.

When the traffic data sets are broadcast directly a local agency through an Add-On module by the ATMS central computer system manufacturer, an agency can retain control of whom receives the data. When proprietary equipment is added to the ATMS central computer system for a UDP broadcast by a 3rd party an agency will lose control of traffic signal data and how that data is used by the private sector. If the City of Foster City chooses to include Cloud Data Broadcasting capabilities it will need to decide on whether to manage the broadcast on its own or through a 3rd party. 3rd Party software developers typically promise future revenue-sharing if the data gains revenue in the future but there is no case study currently on the market where the traffic data has generated any revenue sharing back to a local agency and the likely large data consumers of the data sets (i.e., Google, Apple, etc.) typically see this type of data as a Public Data element that should not be paid for. So although traffic signal timing data is viewed as a potential Public Utility, it is still too early in the market sector development of Connected and Autonomous Vehicle traffic data to see whether it will generate future revenue so the reason for doing it is true only to do so for now is support the marketplace development.

Cloud Data Broadcasting as noted previously can be done relatively low-cost limited to only the cost of the Add-On module to the ATMS central computer system. Trafficware is the only traffic signal system manufacturer that offers a connected vehicle data sharing module at this time. The module was developed for the City of Palo Alto in 2015 as part of their citywide traffic signal system upgrade project in partnership with input from private sector partners including all the automobile manufacturers, Google, and several in-vehicle detection system developers.

The largest benefit to Cloud Data Broadcasting though includes the ability to include Detection Data for improved bicycle and pedestrian safety. DSRC Technology and its SPaT data sets do not currently include detection data sharing capabilities.

DSRC Technology

DSRC Technology was conceived in the 1990's and developed through the 2000's. It is the recommended technology of the Federal Highway Administration (FHWA) but deployments across the country are limited to corridor demonstration projects in large urbanized areas. There are not any citywide DSRC deployments anywhere in the country to Traffic Pattern's knowledge at the time of the writing of this report. DSRC equipment for a typical signalized intersection can range up to $10,000-15,000 per intersection before installation costs.

DSRC data sets that are broadcast from the radios are known as Signal Phasing and Timing Data (SPaT). The radios offer two-way communications between vehicles and the radios for the intersection to broadcast data related to:

- Signal State (Red, Yellow, Green) of each intersection approach
- Geometric Intersection description
- Signal Requests Messages from Emergency Vehicle preemption or transit signal priority

A vehicle with DSRC capabilities can share data with other vehicles including their position data (to reduce crash opportunities). In the future, it is anticipated that vehicles can share environmental data such as roadway hazard data (i.e., potholes). There is currently no example of the roadway hazard data consumption but the technology opportunity is available.

When DSRC enabled vehicle communications with one another this is known as Vehicle to Vehicle (V2V) communications. When a DSRC enabled vehicles shares information with the environment this is known as V2X communications and this is a large growing private sector market.

Traffic Patterns recommends that the City at least consider Connected Vehicle module solutions in its decisions to upgrade its traffic signal infrastructure, including making Connected Vehicle Modules as an Evaluation Factor in future RFP process for new traffic signal systems. This solution whether Cloud Data Broadcast or using DSRC Technology will rely on a robust field communications infrastructure, typically a fiber optic medium to ensure quick data exchange between field hardware and computer networks. Between the two approaches, Cloud Data Broadcasting would be the most cost-effective solution as long as the City's selected ATMC Central Computer System can offer an Ad-On module of a 3rd party software solution.

On-going operations costs for Connected Vehicle modules will vary depending on whether Data Broadcast or DSRC approaches are selected. On-going costs for Data Broadcasts will be limited to server maintenance costs. DSRC on-going costs will include the maintenance of field equipment in the traffic signal cabinet and hardware in the field including radio antennas.

Traffic Signal Field Hardware

Most of the discussion within this report has focused on the traffic signal auxiliary hardware that operates a traffic signal such as the controller, communications infrastructure, and the ATMC Central Computer System that allow an agency to remotely monitor and manipulate traffic signal timing. The motoring publics and bicyclists/pedestrians experience is tied directly to traffic signal field hardware that they can see such as the traffic signal poles and the vehicle and pedestrian signals that regulate their movement so an in-depth discussion on those elements is important as future citywide traffic signal upgrade elements are considered.

Oxidized Pedestrian Push Buttons and Traffic Signal Framework.

Foster City, CA

Traffic signal poles have a 30-50 year life span and typically do not require replacement unless they are damaged in incidents or as part of a nature disasters or if a roadway reconfiguration requires their modification to help align vehicle/pedestrian signal indications with new geometric changes of a roadway. The vehicle and pedestrian signals though have a much lower lifespan of about 25 years and this lifespan can be reduced when the indications are not properly maintained or receive constant exposure to harsh environments.

In Foster City, a majority of the traffic signal vehicle and pedestrian signal framework is oxidized and in need of replacement. ***Traffic Patterns recommends prioritizing replacement of the vehicle and pedestrian signal framework and the LED indications***. With the traffic signal pole hardware in good shape, replacement of the traffic signal and pedestrian framework and indications will give the City's traffic signal network a clean and refreshed look.

Traffic Patterns conducted a field assessment of all 25 existing traffic signals in preparation of this study and documented the field equipment that requires replacement due to severe oxidation. The findings are included within the exhibit section of this report.

Pedestrian signals should include pedestrian count timers to help advise pedestrians regarding the amount of time remaining to complete their intersections crossings.

Accessible Pedestrian Signals (APS) are required federal mandates as part of major traffic signal modification projects to help provide additional audible and tactile information for pedestrians with visual or hearing impediments. In most cases, a rewire of the underground traffic signal conduit network is required to install APS equipment to manufacturer's recommendation installation practices, specifically that each APS unit in the field (the push button that a pedestrian depresses to notify the traffic signal controller that they are waiting to cross the street) be hardwired individually back to the

traffic signal cabinet. Traditional pedestrian push buttons use conductors that are spliced several times and can cause communications problems with newer APS equipment. ***Traffic Patterns recommends that the City install APS equipment at each of its existing 25 signalized intersections.*** The two new traffic signals currently under construction in North Foster City are already being built with APS equipment.

Internally Illuminated Street Name Signs (IISNS) are another traffic signal field element that should be considered during the Citywide Traffic Signal System upgrade. IISNS assist motorists in identifying street names at intersections during evening hours and they are especially beneficial to aging motorists. All 25 of the City's existing traffic signals currently used older IISNS that use fluorescent tubes. Newer IISNS are LED based and have a thinner profile. Upgrading the signs to the new thinner profile signs will ensure less maintenance needs on the signs as part of an upgrade and introduce the opportunity to provide artwork on the signs such as City Logo. ***The City has an existing Capital Improvement Program (CIP) project to replace Internally Illuminated Street Name Signs across the City.*** The two new traffic signals under currently under construction in North Foster City will be built using thin-profile LED signs.

Accessible Pedestrian Signal (APS) with Audible Locator Tone and Commands for Visually-Impaired Pedestrians.

Sample LED Internally Illuminated Street Name Sign. Current standard in Foster City, CA

Conclusions and Recommendations

Traffic Patterns recommends the City move forward with establishment of one Capital Improvement Program (CIP) Project for a *Citywide Traffic Signal System Upgrade*. The project can be implemented in phases through smaller contracts or through the use of one prime contractor. Only design contract will be required for communications systems design.

TRAFFIC SIGNAL FIELDHARD IMPROVEMENTS

- Vehicle Signal Framework Replacement
- Pedestrian Signal Framework Replacement
- Traffic Signal Cabinets and Auxiliary Equipment Replacement
- Accessible Pedestrian Signal (APS) Upgrades
- Video Detection Equipment Upgrades

COMMUNICATIONS INFRASTRUCTURE

- Fiber Optic Communications Upgrade Design & Construction
  (Includes expansion of fiber optic network to traffic signals currently communicating via wireless equipment)
- Fiber Optic Switches for Traffic Signals and Central Office

TRAFFIC SIGNAL CONTROLLERS, ITS AND CENTRAL SYSTEM

- Traffic Signal Controller Replacement
- Traffic Signal Central System Upgrade
- Traffic Signal Central System Add-On Modules for Adaptive Traffic Control and Connected Vehicle Systems
- Traffic Signal Central System Communications Equipment (Servers, Network)
- Fire Wall IT Equipment
- Traffic Camera Deployment (Pan/Tilt/Zoom Cameras)
- Traffic Signal Retiming

City of Foster City
Traffic Signal System Upgrade
Budgetary Cost Estimate

Task No.	Project Description	Unit	Unit Cost	Est. Cost
1	Communications Network (Fiber Optic Backbone)			
1.1	Design (Fiber Optic Upgrade)	1	$50,000	$50,000
1.2	Construction	1	$1,500,000	$1,500,000
2	Traffic Signal Hardware Upgrade (Vehicle/Ped Signals)			
2.1	Design	1	$25,000	$25,000
2.2	Construction	25	$65,000	$1,625,000
3	Traffic Signal Hardware Upgrade (IISNS)			
3.1	Construction	100	$5,000	$500,000
4	Traffic Signal Hardware Upgrade (Traffic Signal Cabinets)			
4.1	Construction	25	$65,000	$1,625,000
5	Traffic Signal Hardware Upgrade (Accessible Pedestrian Signals)			
5.1	Construction	25	$40,000	$1,000,000
6	Traffic Signal Central Computer System			
6.1	RFP Development Process	1	$7,500	$7,500
6.2	Traffic Signal Controllers	25	$6,500	$162,500
6.3	Servers/Software	1	$250,000	$250,000
6.4	Fiber Optic Switches	25	$2,500	$62,500
6.5	Fiber Optic Network Switch	2	$12,000	$24,000
6.6	Traffic Cameras	10	$6,500	$65,000
6.7	Auxiliary Equipment	25	$2,000	$50,000
6.8	Central Computer System Add-On Service Modules	2	$100,000	$200,000
6.9	Traffic Signal Retiming	15	$4,000	$60,000
7	Video Detection Upgrades			
7.1	Traficon Firmware Upgrades	16	$500	$8,000
7.2	Flir Video Detection Upgrades	9	$50,000	$450,000
			Cost Estimate:	$7,664,500
			Contingency (10%):	$766,450
			Recommended Budget Planning Cost:	$8,430,950

City of Foster City
Traffic Signal System Inventory

No.	Intersection	Traffic Signal Controller							Conflict Monitor			Video Detection Manufacturer				Emergency Vehicle Preemption			Traffic Signal Cabinet					Battery Back-Up System		Communications		Notes
		Make	Model No.	Firmware	Serial No.	Fabrication Date	~Age (Years)	Ethernet Ready?	Make	Model No.	Ethernet Ready?	Make	Model	No. Modules	Ethernet Ready?	Make	Model	No. Modules	Make	Size	Type	Fabrication Date	~ Age (Years)	Make	No. Batteries	Online?	Cable Type	
1	E Hillsdale Blvd & Foster City Blvd	Naztec	980	v61.2s	0629-014-0124	7/22/2016	11	No	TCT	LNM-12	No	Traficon	v3.1	4	No	Opticom	752	2	Traconex	P	TS-1	Dec-90	27	-	-	Yes	SIC	Generator Backup Power
2	E Hillsdale Blvd & Shell Blvd	Naztec	980	v61.4i	0443-023-3054	10/23/2004	13	No	TCT	LNM-12	No	Traficon	v3.1	4	No	Opticom	752	2	Traconex	P	TS-1	Feb-90	27	-	-	Yes	SIC	Generator Backup Power
3	E Hillsdale Blvd & Center Park Ln	Naztec	980	v61.4i	0413-030-3504	10/23/2004	13	No	TCT	LNM-12	No	Traficon	v3.0	2	No	Opticom	752	2	Traconex	P	TS-1	Jul-85	31	Clary	6	Yes	SIC	
4	E Hillsdale Blvd & Edgewater Blvd	Naztec	980	v61.2s	0526-008-4757	6/24/2005	12	No	SSD	NM12	No	Traficon	v3.1	4	No	Opticom	752	2	Naztec	P	TS-1	Apr-08	8	-	-	Yes	SIC	Generator Backup Power
5	E Hillsdale Blvd & Altair Ave	Naztec	980	v61.2s	0632-002-0124	8/10/2000	17	No	TCT	LNM-12	No	-	-	-	-	Opticom	752	2	Traconex	P	TS-1	Feb-90	27	Clary	6	Yes	SIC	Inductive Loop Detection
6	Metro Center Blvd & Shell Blvd	Naztec	980	v61.2s	0632-012-0124	8/10/2000	17	No	TCT	LNM-12	No	-	-	-	-	Opticom	752	2	Traconex	P	TS-1	Jul-85	32	Clary	6	Yes	SIC	Inductive Loop Detection
7	Metro Center Blvd & Vintage Park Dr	Naztec	980	v61.2s	0632-005-0124	8/10/2006	11	No	TCT	LNM-12	No	-	-	-	-	Opticom	752	2	Traconex	P	TS-1	Sep-85	32	Clary	6	Yes	SIC	Inductive Loop Detection
8	Edgwater Blvd & Metro Center Blvd	Naztec	980	v61.2s	0632-013-0124	8/10/2006	11	No	iDC	NM12	No	-	-	-	-	Opticom	752	2	Traconex	P	TS-1	Jul-85	31	-	-	Yes	SIC	Inductive Loop Detection Generator Backup Power
9	Foster City Blvd & Metro Center Blvd	Naztec	980	v61.2s	0632-001-0124	8/10/2006	11	No	TCT	LNM-12	No	Traficon	v3.1	4	No	Opticom	752	2	Traconex	P	TS-1	Jun-87	30	Clary	6	Yes	SIC	
10	E Hillsdale Blvd & Pilgrim Dr	Naztec	980	v61.2s	0633-012-0124	8/16/2006	11	No	TCT	LNM-12	No	Flir	VIP 3D.1s	4	Yes	Opticom	752	2	Traconex	P	TS-1	Feb-88	29	Clary	6	Yes	SIC	
11	Metro Center & State Route 92-OSH	Naztec	970	v61.2p	-	-	-	-	iDC	210	No	Traficon	3.1 (4) 2 I/O (2)	5	No	Opticom	752	2	Traconex	332	Caltrans	Apr-85	32	Tesco	6	Yes	SIC	
12	Edgwater Blvd & State Route 92	Naztec	970	v61.2s	-	-	-	No	EDI	210	No	Traficon	v3.1	3	No	Opticom	752	2	Traconex	332	Caltrans	Apr-85 (est.)	32	Clary	6	-	-	Communications Not Field Verified
13	Fire Station Emergency Signal	Traconex	390	-	-	-	-	No	EDI	NSM-3L	No	-	-	-	-	Opticom	752	1	Traconex	G	TS-1	Oct-90	27	-	-	-	-	No Loops. Fire Preempt Only. No Comm. Generator Backup.
14	Chess Dr & Vintage Park Dr	Naztec	980	v61.2s	0629-025-0124	7/21/2016	11	No	TransyT	12ELRA	No	Traficon	v3.1	4	No	Opticom	752	2	Peek	332	Caltrans	Sep-00	17	Clary	6	Yes	SIC	
15	Chess Dr & State Route 92	Naztec	970	v61.3g	-	-	-	No	EDI	210	No	Traficon	v3.1	4	No	Opticom	752	2	Traconex	P	TS-1	May-87	30	Clary	6	Yes	SIC	
16	Foster City Blvd & Chess Dr	Naztec	980	v61.2s	0629-024-0124	7/21/2016	11	No	Naztec	NM512	No	Traficon	v3.1	4	No	Opticom	752	2	Traconex	P	TS-1	Jan-87	30	Clary	6	Yes	SIC	
17	Foster City Blvd & Vintage Park Dr-Chess Dr	Naztec	980	v61.2s	0629-012-0124	7/22/2006	11	No	EDI	NSM-12	No	Traficon	v3.1	4	No	Opticom	752	2	Traconex	P	TS-1	Jun-87	30	Clary	5	Yes	SIC	
18	Foster City Blvd & E Third Av	Naztec	980	v61.2s	0632-009-0124	8/10/2006	11	No	EDI	NSM-12	No	Traficon	v3.1	3	No	Opticom	752	2	Traconex	P	TS-1	Jun-86	31	Clary	6	Yes	SIC	
19	E Third Av & Marsh Dr	Naztec	980	v61.2s	0629-023-0124	7/21/2006	11	No	TCT	LNM-12	No	-	-	-	-	Opticom	752	2	Traconex	P	TS-1	Nov-86	31	Clary	6	Yes	SIC	
20	E Third Av & Lakeside Dr	Naztec	980	v61.3m	0637-013-0706	9/11/2006	11	No	Naztec	500	No	Traficon	v3.1	2	No	Opticom	262	2	Naztec	P	TS-1	May-08	9	Tesco	6	Yes	SIC	
21	E Third Av & Mariners Island Blvd	Naztec	980	v61.4h	0443-002-3054	10/23/2004	13	No	TCT	LNM-12	No	Traficon	v3.1	4	No	Opticom	752	2	Traconex	P	TS-1	Jun-87	30	Tesco	6	Yes	SIC	
22	Edgwater Blvd & Beach Park Blvd	Naztec	980	v61.2s	0632-014-0124	9/10/2006	11	No	Naztec	500	No	Traficon	v3.2 (2) LAN (1)	3	Yes	Opticom	262	2	Naztec	P	TS-1	Apr-07	10	Clary	6	-	-	No Communications
23	Foster City Blvd & Bounty Dr	Naztec	980	v61.3i	0836-002-9056	4/8/2008	9	No	Naztec	500	No	-	-	-	-	Opticom	752	2	Traconex	P	TS-1	Feb-89	28	Clary	6	Wireless Comm		
24	Foster City Blvd & Balclutha Dr	Naztec	980	v61.2s	0632-011-0124	8/10/2006	11	No	Naztec	NM512	No	-	-	-	-	Opticom	752	2	Naztec	P	TS-1	Jun-03	14	Clary	6	Wireless Comm		
25	Shell Blvd & Recreation Center	Naztec	980	v61.1n	0344-021-0123	11/4/2003	4	No	Naztec	500	No	-	-	-	-	Opticom	752	2	Naztec	P	TS-1	Feb-04	13	Tesco	6	Wireless Comm		
						Avg Controller Age:	11	Years														Avg Cabinet Age:	26	Years				

General Notes and Oversations: - No Intersection Control Firmware Updates since initial controller deployments (+10 years)
(See Intersection Drawings for Location - Traffic signal cabinets 30+ years have reached their useful life and should be prioritized for replacement
specific recommendations: - Traffic signal framework and vehicle/pedestrian fixtures all around town and heavily oxidized
- Most pedestrian push buttons are mounted at non-ADA compliant at heights (40-inch is ADA standard)
- Pedestrian push buttons should be replaced with Accessible Pedestrian Signals with audible elements for pedestrians

Preliminary Recommendations: - Traffic signal controllers should be replaced with modern Advanced Traffic Controllers (ATC) with Ethernet Capabilities.
- Prioritize replacement of aged traffic signal cabinets. Replace with NEMA TS-2 Type 1 cabinets for enhanced maintenance functions.
- Near Term: Add Ethernet over Copper network gear to enable ethernet communications across the City.

Opton A: - Replace Controllers and Install Ethernet over Copper Network Gear in Year 1
- Upgrade cabinets, auxiliary equipment, and Accessible Pedestrian Signals starting Year 2 over 5 Years (5 cabinets per year)
- Upgrade all field hardware over 3 Years (vehicle/pedestrian signals)

Option B: - Upgrade the entire City over 5 years (5 intersections per year) - all intersection equipment (cabinet, auxiliary equipment, field hardware)
- Implement a Fiber Optic Cable replacement project over 5 Years (comm down partially during implementation)

Option C: - Implement a Citywide Field Fixture Replacement Project (oxidized vehicle/pedestrian signals) in Year 1
- Replace SIC cables with Fiber Optic cables in Year (Design in Year 1 and Construction in Year 2)
- Starting in Year 3 after FO Upgrade, replace all controllers citywide and relace Central System
- Starting in year 4 or 5, replace 5 TS cabinets per year for 5 Years to modernize city.

Field Inventory Conducted by:

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PO BOX 25
Danville, CA 94526
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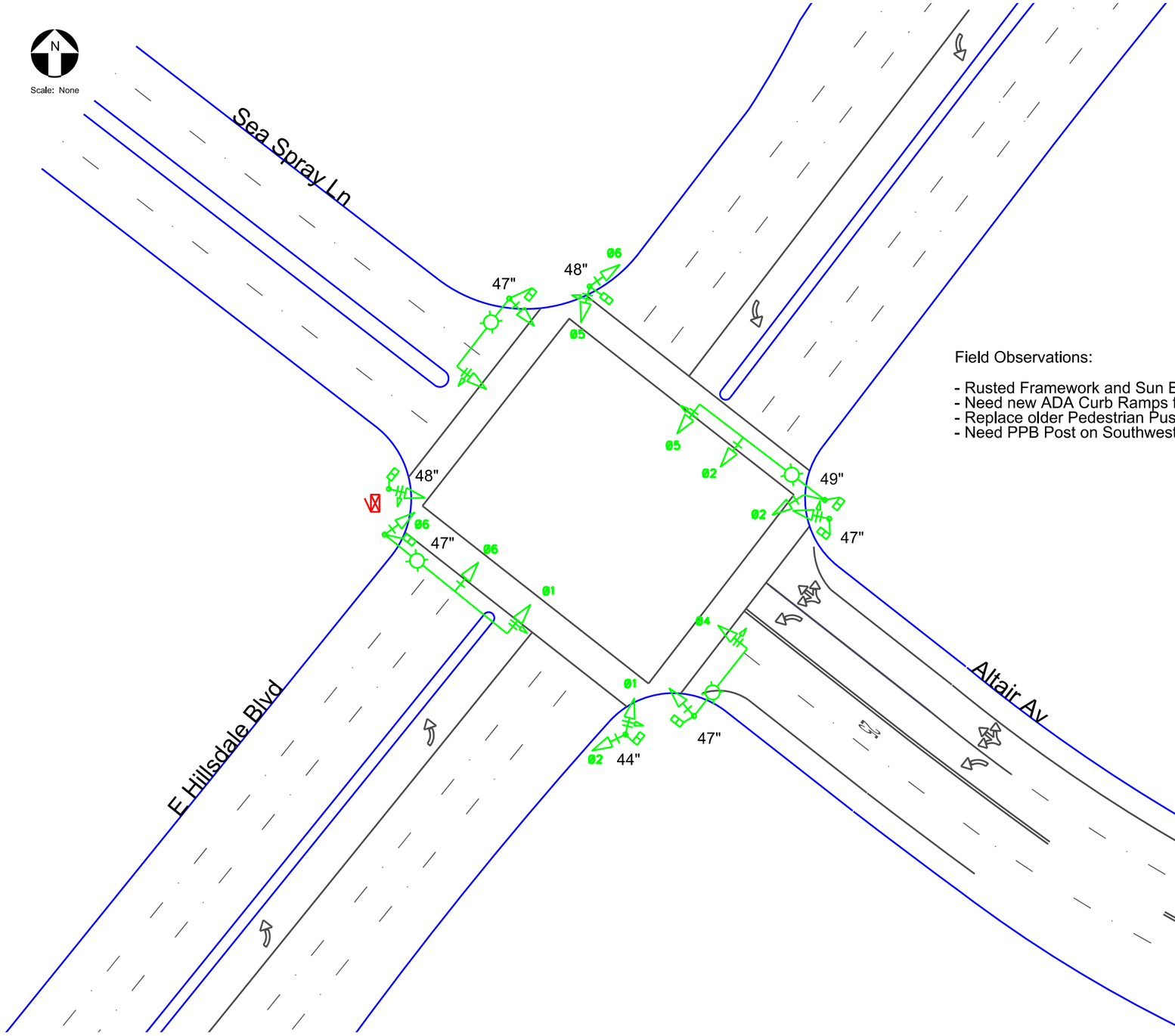
E Hillsdale Blvd & Sea Spray Ln-Altair Av



Field Observations:

- Rusted Framework and Sun Burnt Vehicle/Pedestrian Heads
- Need new ADA Curb Ramps for Pedestrians
- Replace older Pedestrian Push Buttons with Accessible Pedestrian Signals (APS)
- Need PPB Post on Southwest Corner, PPB not ADA accessible

PROJECT NO.	
SCALE:	
SHEET NO.	1
DRAWN BY:	J. RODRIGUEZ
REVIEWED BY:	CITY OF FOSTER CITY
APPROVED BY:	CITY OF FOSTER CITY

CITY OF FOSTER CITY
TRAFFIC SIGNAL
FIELD ASSESSMENT
E HILLSDALE BLVD & SEA SPRAY LN-ALTAIR AV

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REGISTERED PROFESSIONAL ENGINEER
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Exp: 6-30-19
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STATE OF CALIFORNIA

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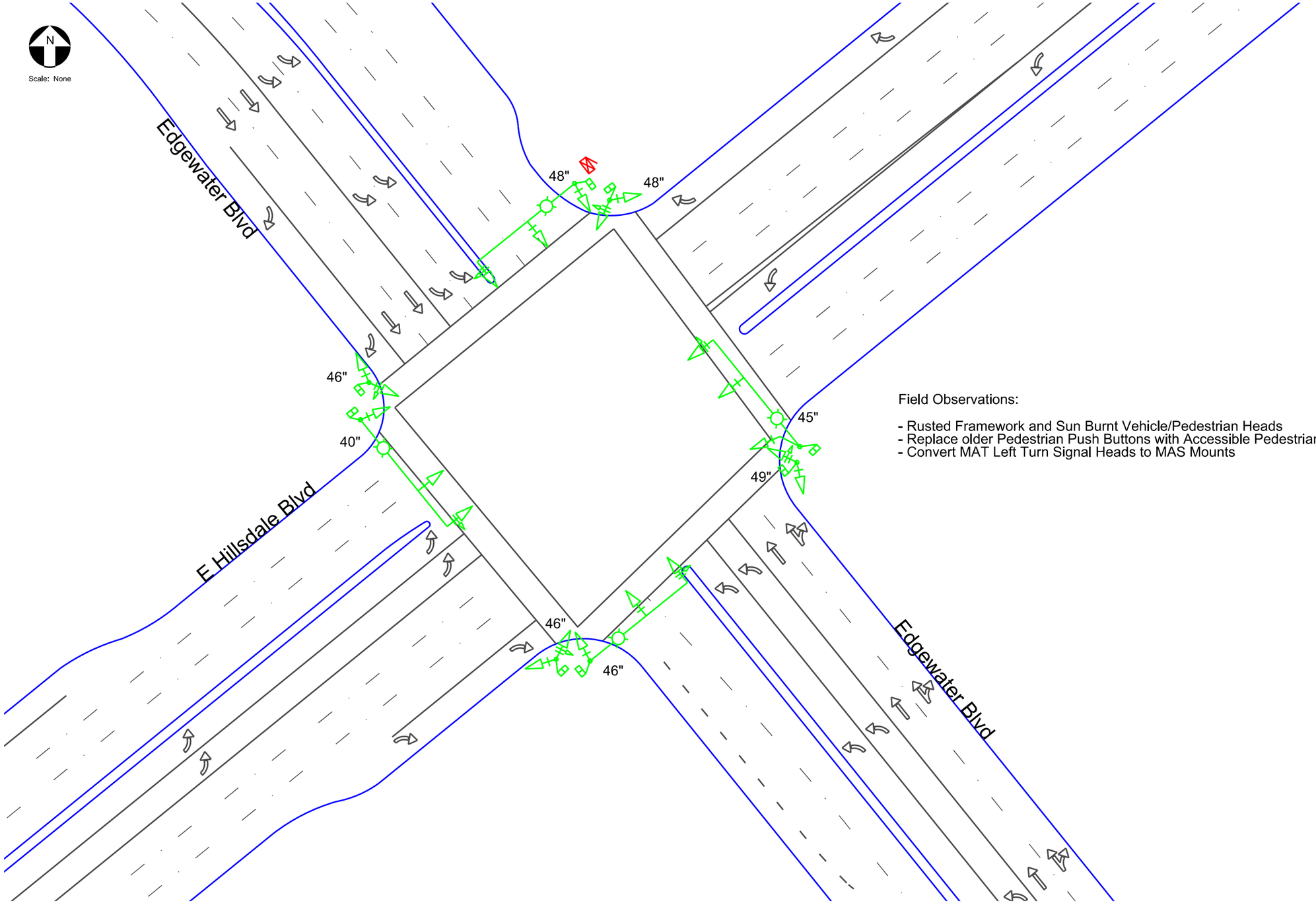

Field Observations:

- Rusted Framework and Sun Burnt Vehicle/Pedestrian Heads
- Replace older Pedestrian Push Buttons with Accessible Pedestrian Signals (APS)
- Convert MAT Left Turn Signal Heads to MAS Mounts

PROJECT NO.

SCALE:

SHEET NO. 2

DRAWN BY: J. RODRIGUEZ

REVIEWED BY: CITY OF FOSTER CITY

APPROVED BY: CITY OF FOSTER CITY

CITY OF FOSTER CITY
TRAFFIC SIGNAL
FIELD ASSESSMENT
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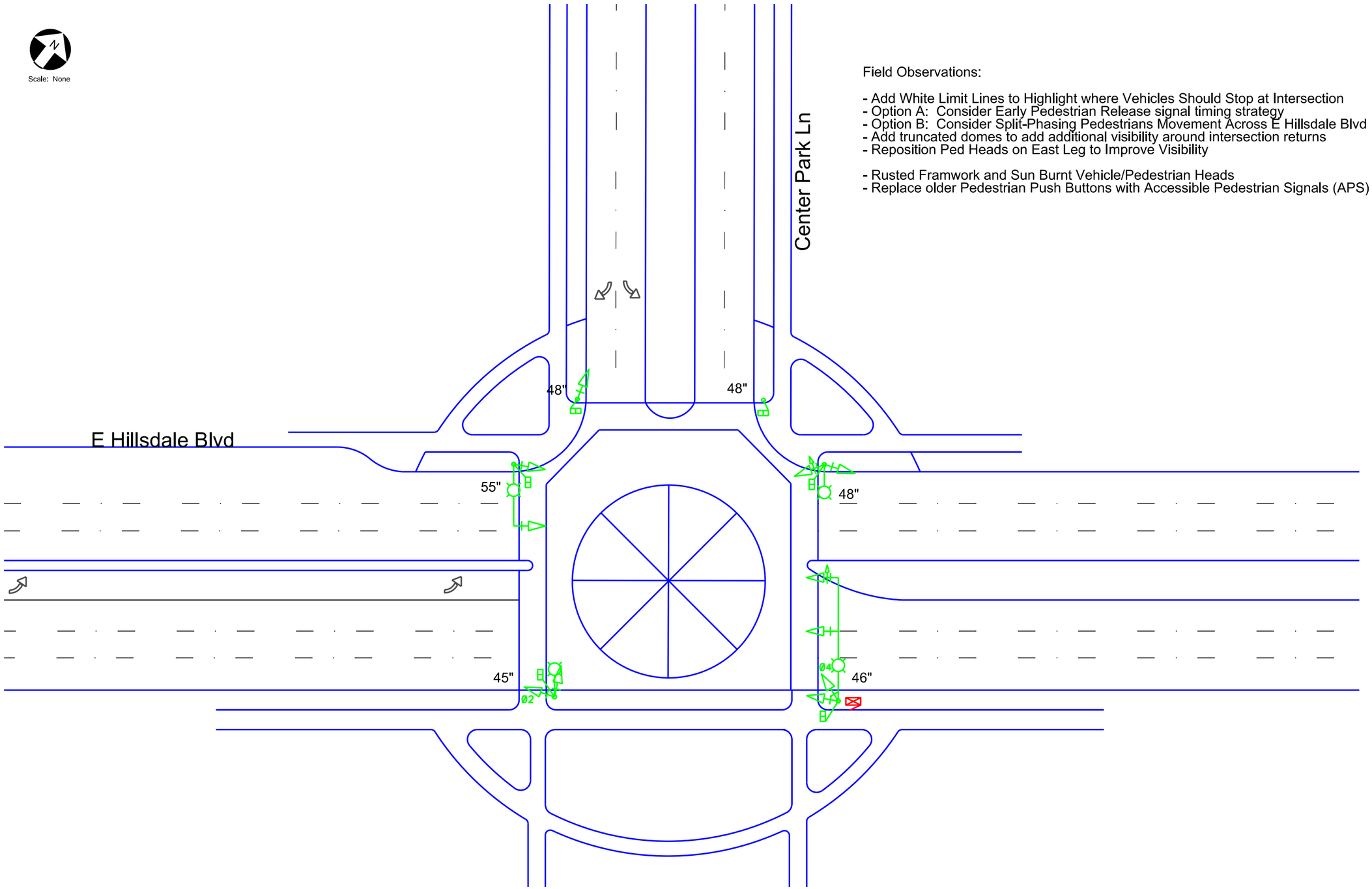
E Hillsdale Blvd & Center Park Ln

Scale: None



Field Observations:

- Add White Limit Lines to Highlight where Vehicles Should Stop at Intersection
- Option A: Consider Early Pedestrian Release signal timing strategy
- Option B: Consider Split-Phasing Pedestrians Movement Across E Hillsdale Blvd
- Add truncated domes to add additional visibility around intersection returns
- Reposition Ped Heads on East Leg to Improve Visibility

- Rusted Framwork and Sun Burnt Vehicle/Pedestrian Heads
- Replace older Pedestrian Push Buttons with Accessible Pedestrian Signals (APS)

PROJECT NO.

SCALE:

SHEET NO. 3

DRAWN BY: J. RODRIGUEZ

REVIEWED BY: CITY OF FOSTER CITY

APPROVED BY: CITY OF FOSTER CITY

CITY OF FOSTER CITY
TRAFFIC SIGNAL
FIELD ASSESSMENT
E HILLSDALE BLVD & CENTER PARK LN

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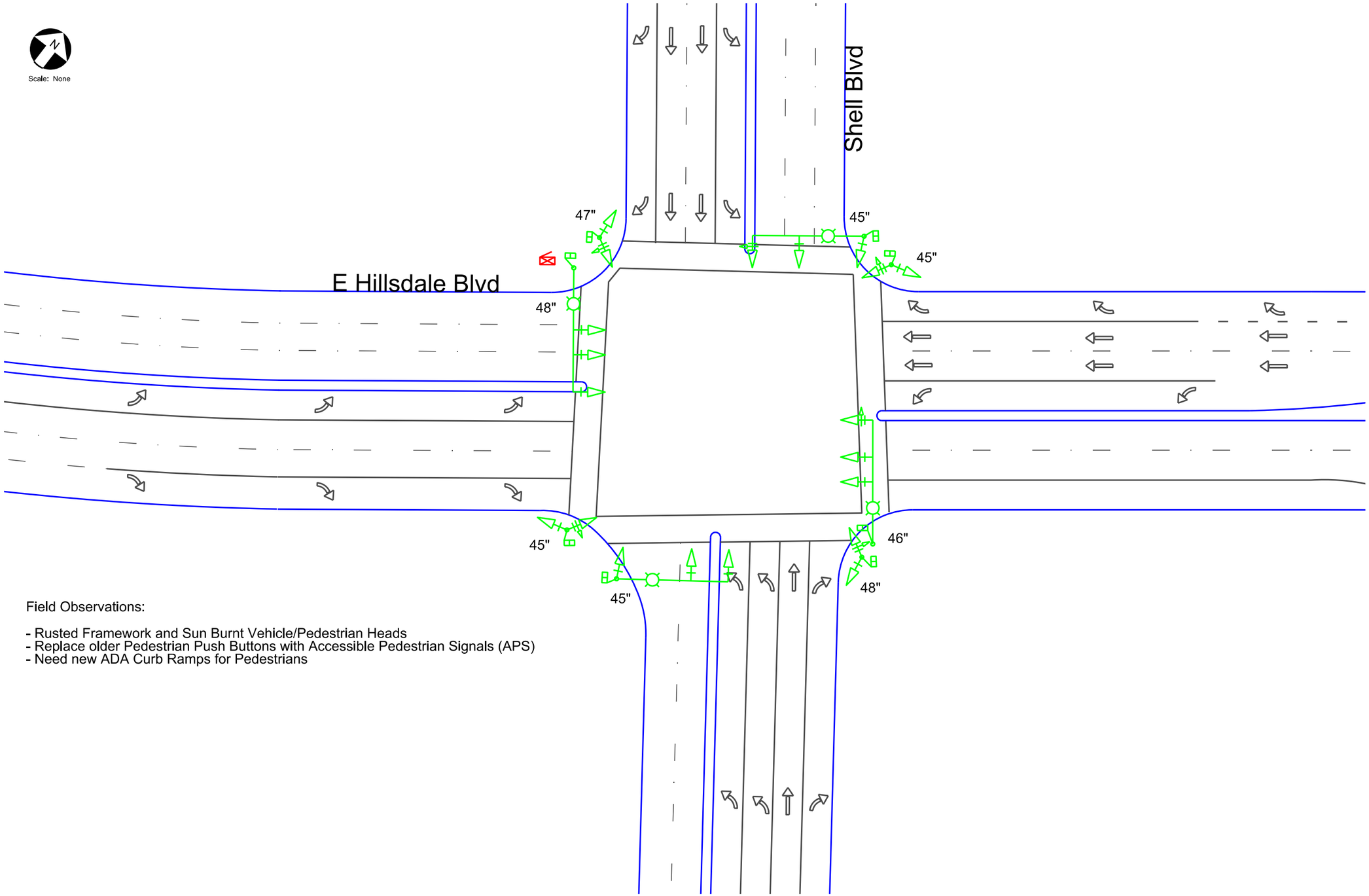
E Hillsdale Blvd & Shell Blvd

Scale: None



Field Observations:

- Rusted Framework and Sun Burnt Vehicle/Pedestrian Heads
- Replace older Pedestrian Push Buttons with Accessible Pedestrian Signals (APS)
- Need new ADA Curb Ramps for Pedestrians

PROJECT NO.

SCALE:

SHEET NO. 4

DRAWN BY: J. RODRIGUEZ

REVIEWED BY: CITY OF FOSTER CITY

APPROVED BY: CITY OF FOSTER CITY

CITY OF FOSTER CITY
TRAFFIC SIGNAL
FIELD ASSESSMENT
E HILLSDALE BLVD & SHELL BLVD

ENGINEER'S STAMP

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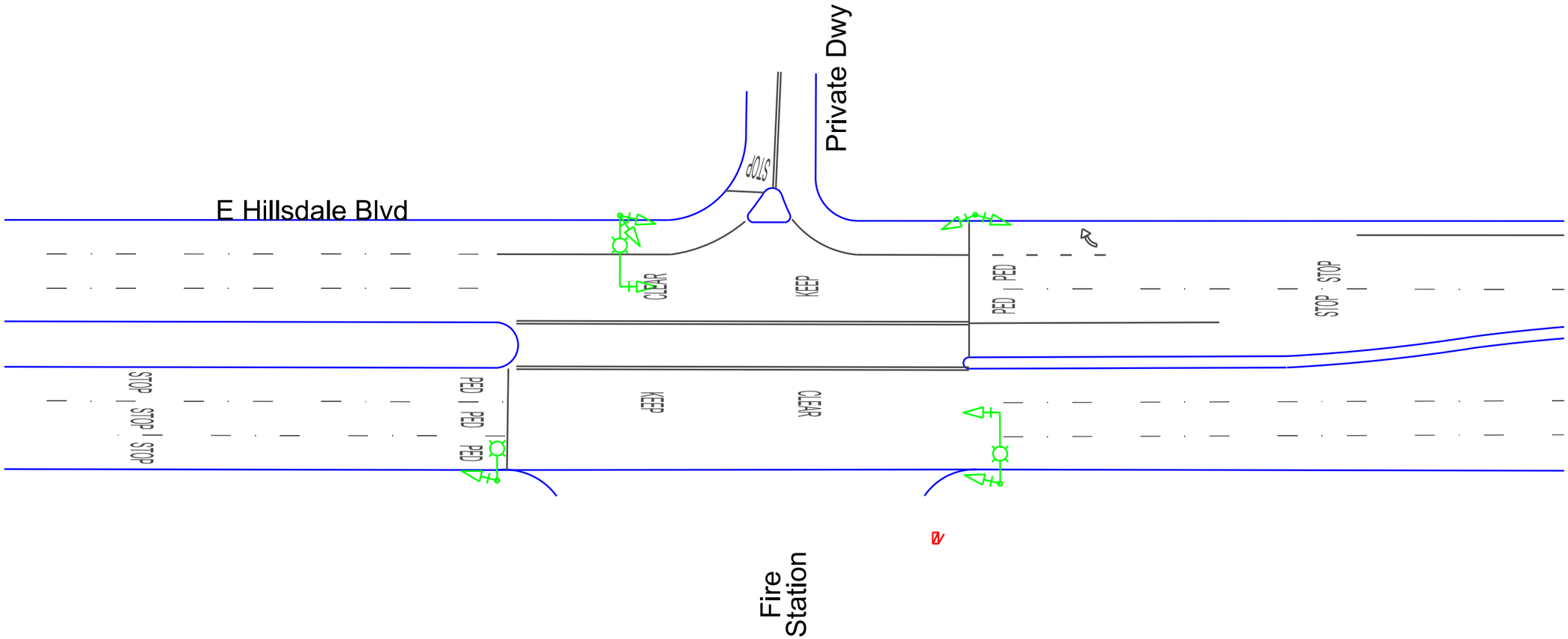
E Hillsdale Blvd & Fire Station

Scale: None

Field Observations:

- Rusted Framework and Sun Burnt Vehicle/Pedestrian Heads
- Older Size G Traffic Signal Cabinet will Require Replacement to Size M to Fit Newer Traffic Signal Controllers
- Replace MAT Vehicle Signals with MAS Vehicle Signals
- Add Push Button in Fire Station to Preempt Traffic Signals (Not Confirmed if Already Existing)



PROJECT NO.

SCALE:

SHEET NO. 5

DRAWN BY: J. RODRIGUEZ

REVIEWED BY: CITY OF FOSTER CITY

APPROVED BY: CITY OF FOSTER CITY

CITY OF FOSTER CITY
TRAFFIC SIGNAL
FIELD ASSESSMENT
E HILLSDALE BLVD & FIRE STATION

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Exp: 6/30/21
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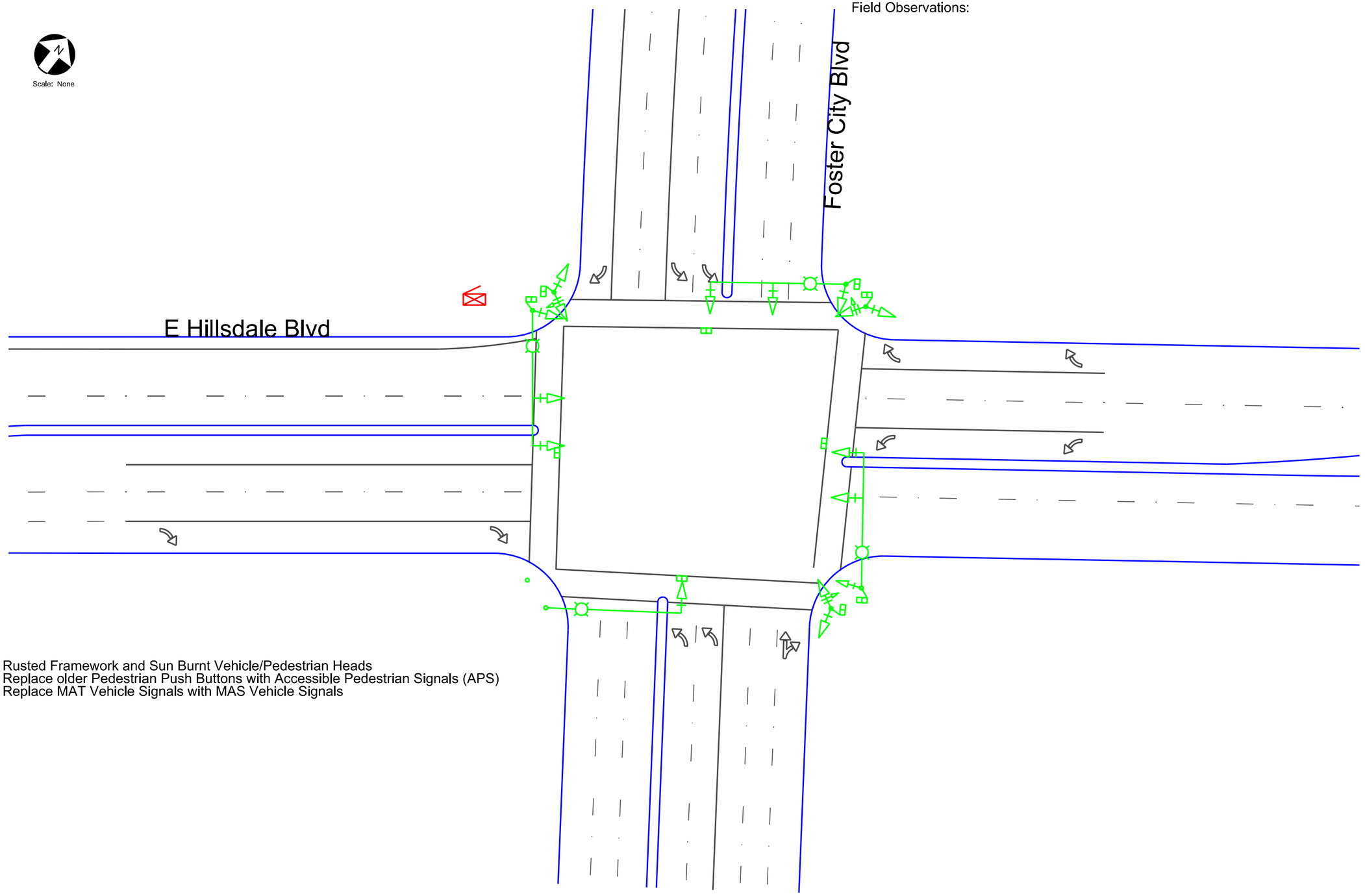
E Hillsdale Blvd & Foster City Blvd

Scale: None

Field Observations:



- Rusted Framework and Sun Burnt Vehicle/Pedestrian Heads
- Replace older Pedestrian Push Buttons with Accessible Pedestrian Signals (APS)
- Replace MAT Vehicle Signals with MAS Vehicle Signals

PROJECT NO.

SCALE:

SHEET NO. 6

DRAWN BY: J. RODRIGUEZ

REVIEWED BY: CITY OF FOSTER CITY

APPROVED BY: CITY OF FOSTER CITY

CITY OF FOSTER CITY
TRAFFIC SIGNAL
FIELD ASSESSMENT
E HILLSDALE BLVD & FOSTER CITY BLVD

ENGINEER'S STAMP

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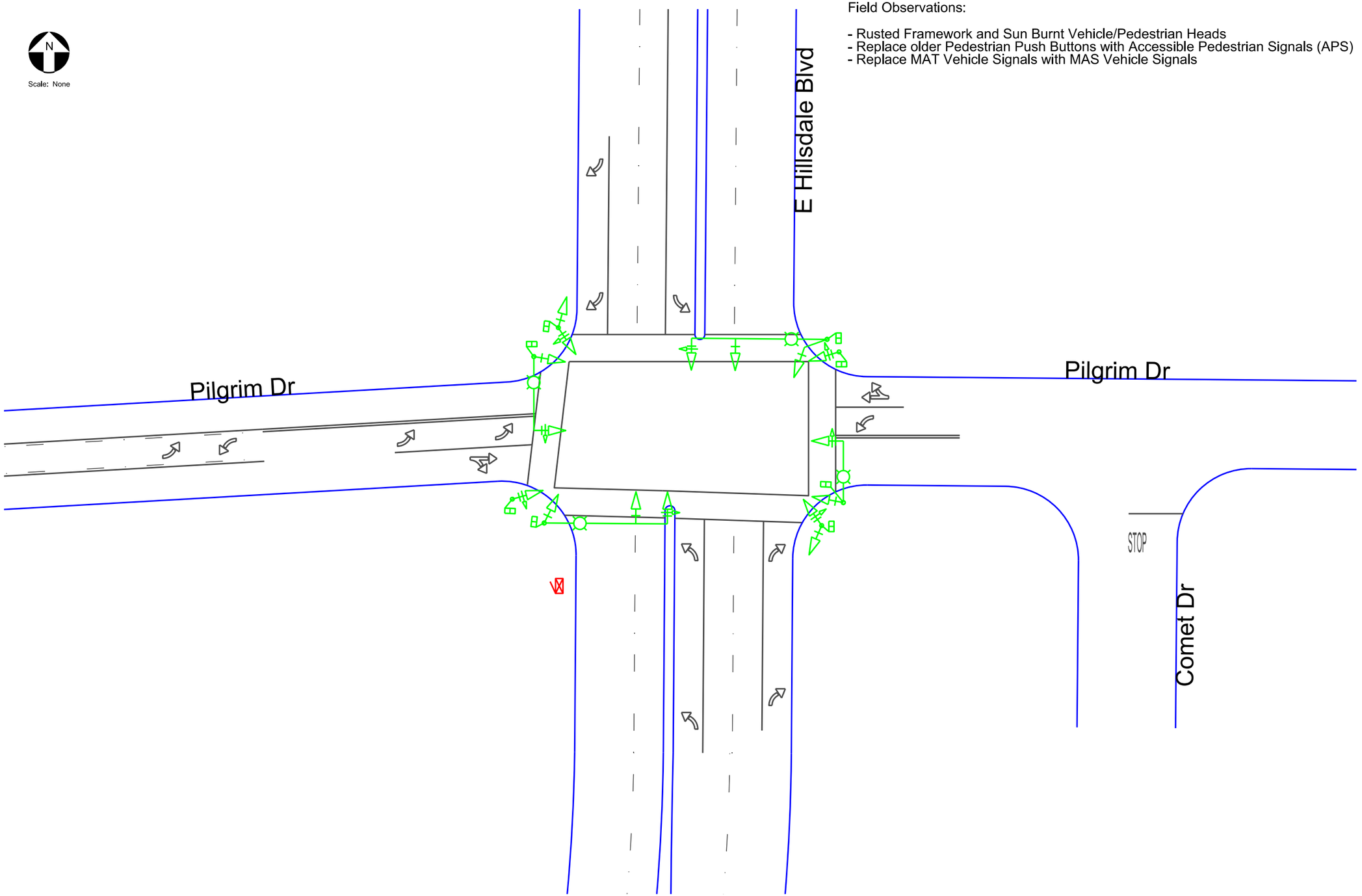
O: (408) 916-8141
www.trafficpatterns.net
Info@trafficpatterns.net

E Hillsdale Blvd & Pilgrim Dr

N

Scale: None



Field Observations:

- Rusted Framework and Sun Burnt Vehicle/Pedestrian Heads
- Replace older Pedestrian Push Buttons with Accessible Pedestrian Signals (APS)
- Replace MAT Vehicle Signals with MAS Vehicle Signals

PROJECT NO.

SCALE:

SHEET NO. 7

DRAWN BY: J. RODRIGUEZ

REVIEWED BY: CITY OF FOSTER CITY

APPROVED BY: CITY OF FOSTER CITY

CITY OF FOSTER CITY
TRAFFIC SIGNAL
FIELD ASSESSMENT
E HILLSDALE BLVD & PILGRAM DR

ENGINEER'S STAMP

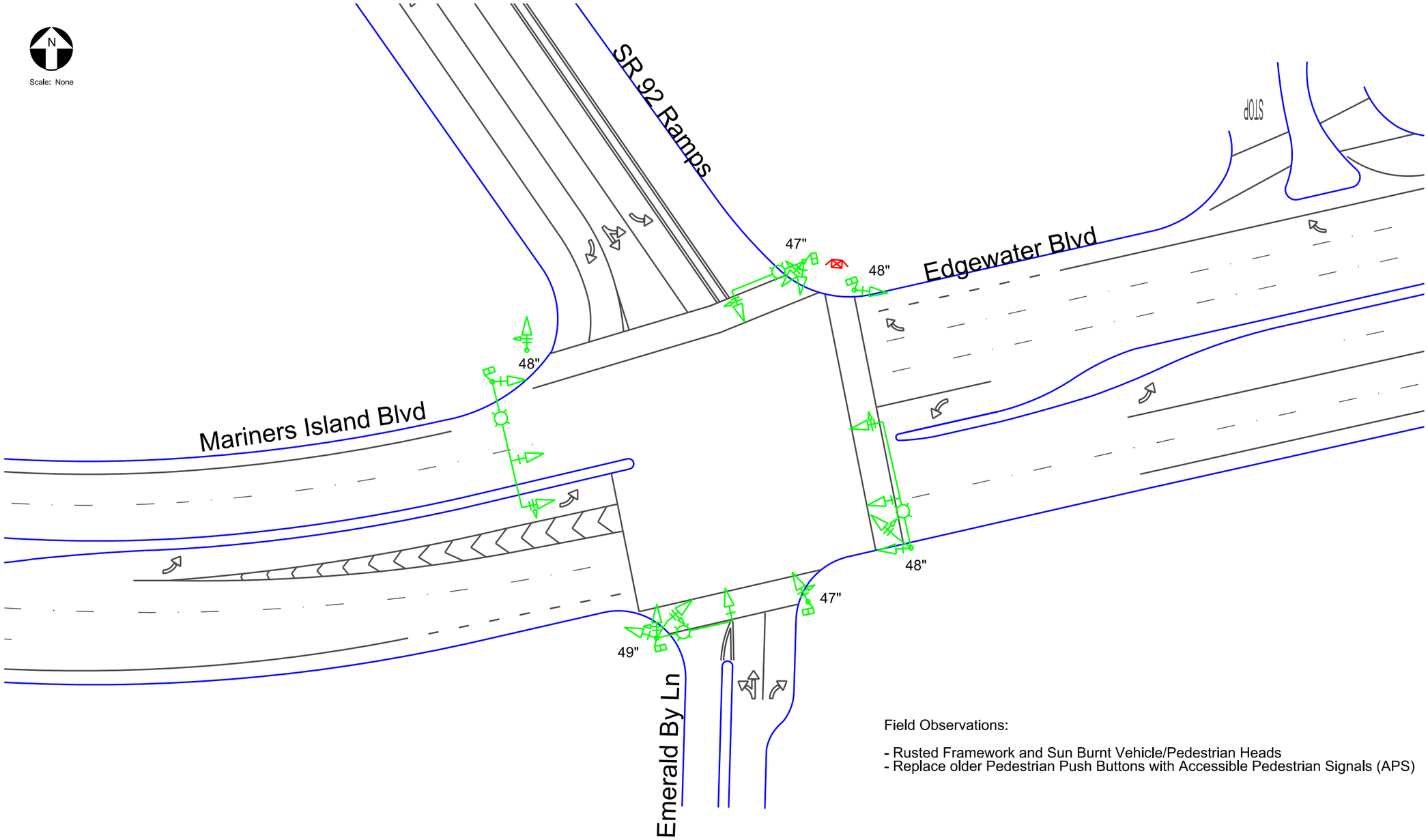
REGISTERED PROFESSIONAL ENGINEER
JAIME O. RODRIGUEZ
TR2284
Exp: 6/30/21
TRAFFIC
STATE OF CALIFORNIA

REVISIONS

NO.	DESCRIPTION	DATE

Traffic Patterns
P.O. Box 25
Danville, CA 94526
O: (408) 916-8141
www.trafficpatterns.net
Info@trafficpatterns.net

Mariners Island Blvd & SR 92 Ramps-Emerald Bay Ln



Field Observations:

- Rusted Framework and Sun Burnt Vehicle/Pedestrian Heads
- Replace older Pedestrian Push Buttons with Accessible Pedestrian Signals (APS)

PROJECT NO.

SCALE:

SHEET NO. 8

DRAWN BY: J. RODRIGUEZ

REVIEWED BY: CITY OF FOSTER CITY

APPROVED BY: CITY OF FOSTER CITY

CITY OF FOSTER CITY
TRAFFIC SIGNAL
FIELD ASSESSMENT
MARINERS ISLAND BLVD - EDGEWATER BLVD
& SR-92 - EMERALD BAY LN

ENGINEER'S STAMP

REGISTERED PROFESSIONAL ENGINEER
JAIME O. RODRIGUEZ
TR2284
Exp: 6-30-19
TRAFFIC
STATE OF CALIFORNIA

REVISIONS

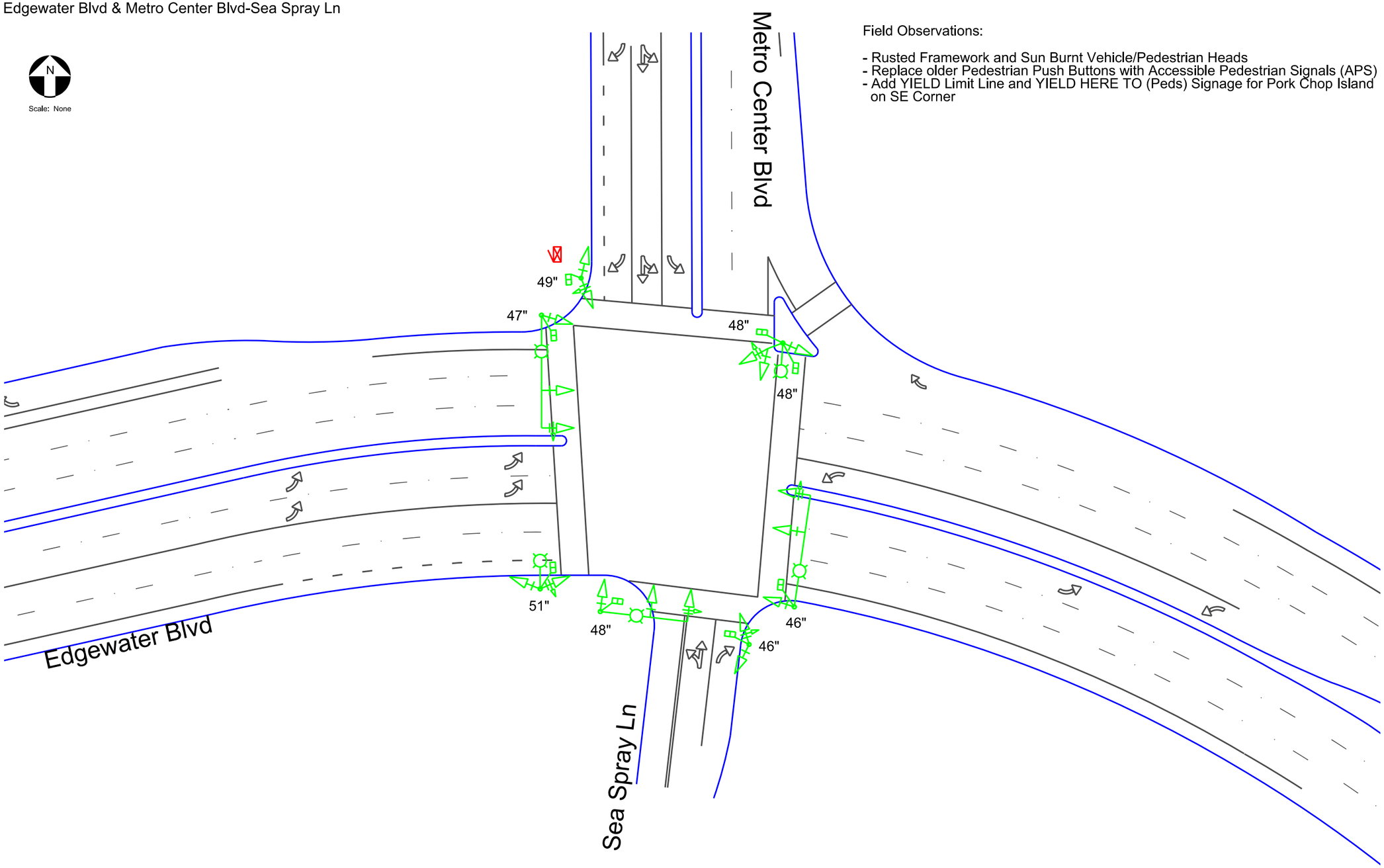
NO.	DESCRIPTION	DATE

Traffic Patterns
P.O. Box 25
Danville, CA 94526
O: (408) 916-8141
www.trafficpatterns.net
Info@trafficpatterns.net

Edgewater Blvd & Metro Center Blvd-Sea Spray Ln

N

Scale: None



Field Observations:

- Rusted Framework and Sun Burnt Vehicle/Pedestrian Heads
- Replace older Pedestrian Push Buttons with Accessible Pedestrian Signals (APS)
- Add YIELD Limit Line and YIELD HERE TO (Peds) Signage for Pork Chop Island on SE Corner

PROJECT NO.	
SCALE:	
SHEET NO.	9
DRAWN BY:	J. RODRIGUEZ
REVIEWED BY:	CITY OF FOSTER CITY
APPROVED BY:	CITY OF FOSTER CITY

CITY OF FOSTER CITY

TRAFFIC SIGNAL FIELD ASSESSMENT

EDGEWATER BLVD & METRO CENTER BLVD-SEA SPRAY LN

ENGINEER'S STAMP

REGISTERED PROFESSIONAL ENGINEER JAIME O. RODRIGUEZ TR2284 Exp: 6/30 TRAFFIC STATE OF CALIFORNIA

REVISIONS

NO.	DESCRIPTION	DATE

Traffic Patterns
P.O. Box 25
Danville, CA 94526
O: (408) 916-8141
www.trafficpatterns.net
Info@trafficpatterns.net

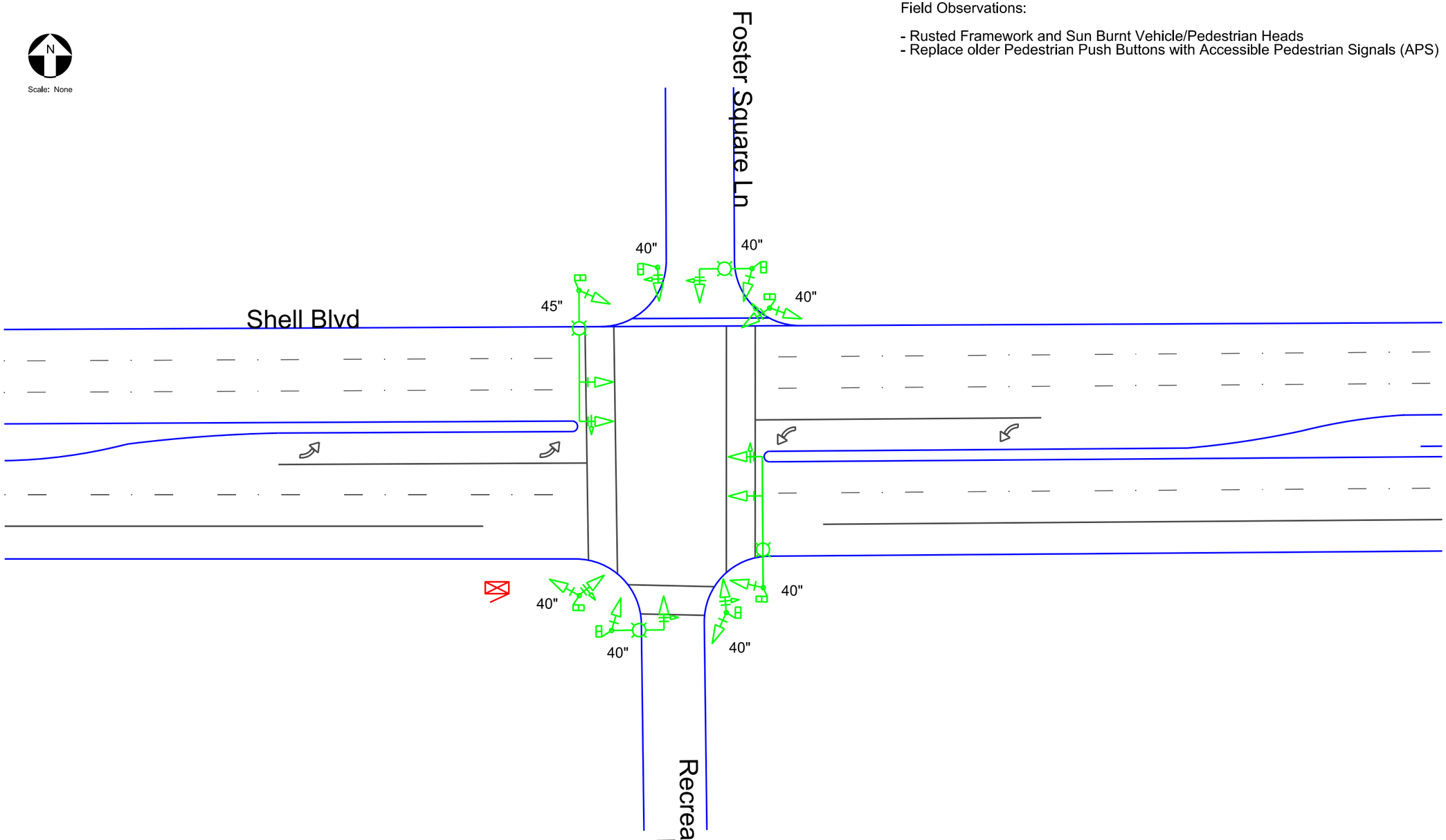
Shell Blvd & Foster Square Ln-Community Center Dwy

N

Scale: None

Field Observations:

- Rusted Framework and Sun Burnt Vehicle/Pedestrian Heads
- Replace older Pedestrian Push Buttons with Accessible Pedestrian Signals (APS)



PROJECT NO.

SCALE:

SHEET NO. 10

DRAWN BY: J. RODRIGUEZ

REVIEWED BY: CITY OF FOSTER CITY

APPROVED BY: CITY OF FOSTER CITY

CITY OF FOSTER CITY
TRAFFIC SIGNAL
FIELD ASSESSMENT
SHELL BLVD &
RECREATION CENTER-FOSTER SQUARE LANE

ENGINEER'S STAMP

REGISTERED PROFESSIONAL ENGINEER
JAIME O. RODRIGUEZ
TR2284
Exp: 6-30-19
TRAFFIC
STATE OF CALIFORNIA

REVISIONS

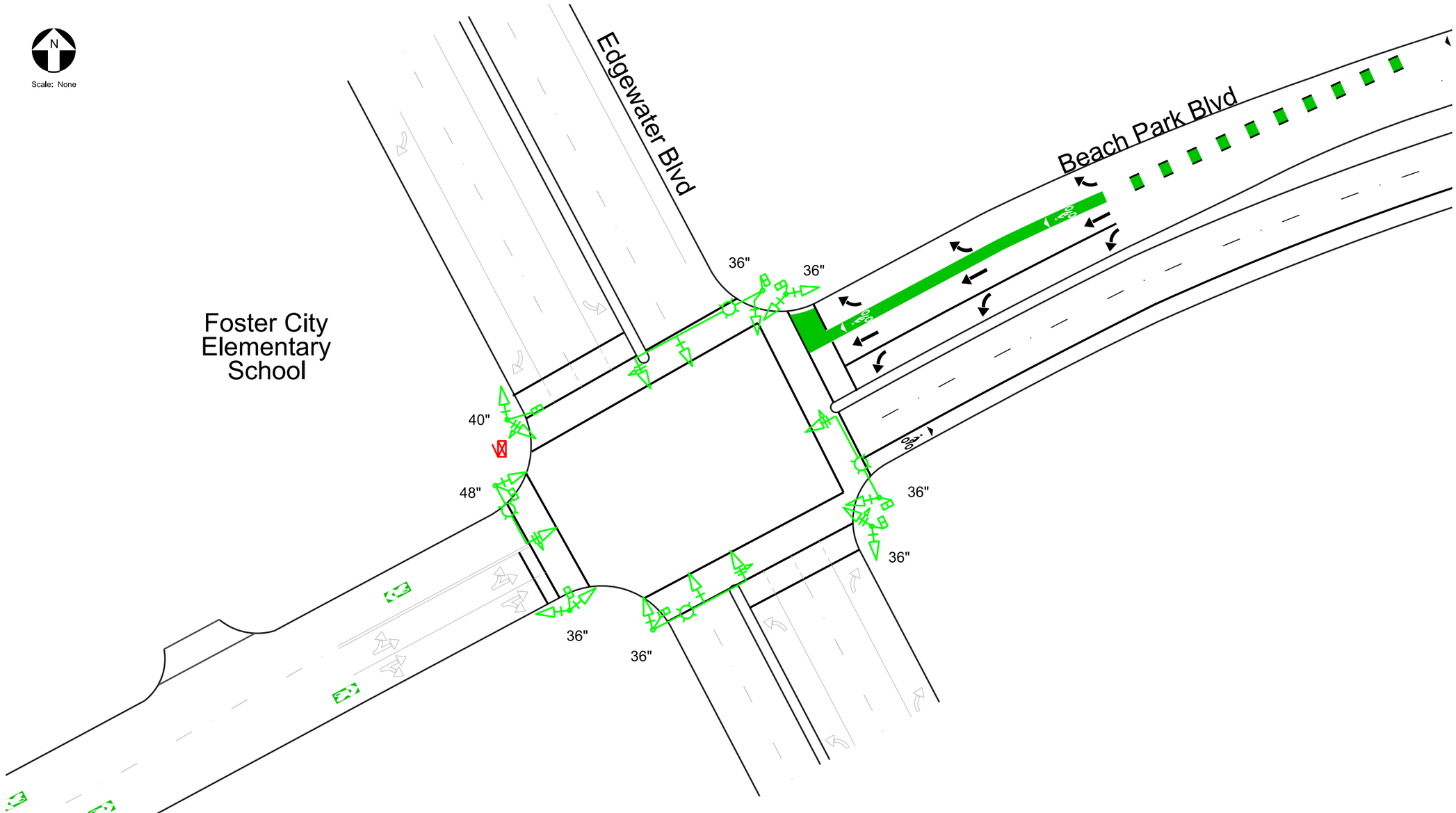
NO.	DESCRIPTION	DATE

Traffic Patterns
P.O. Box 25
Danville, CA 94526
O: (408) 916-8141
www.trafficpatterns.net
Info@trafficpatterns.net

Beach Park Blvd & Edgwater Blvd

N

Scale: None



Field Observations:

- Rusted Framework and Sun Burnt Vehicle/Pedestrian Heads
- Replace MAT Vehicle Signals with MAS Vehicle Signals
- Add White Advance Limit Lines to All Crosswalks
- Add Bike Lane (WB) and Sharrows (EB) on Beach Park Blvd Approaches

PROJECT NO.

SCALE:

SHEET NO. 11

DRAWN BY: J. RODRIGUEZ

REVIEWED BY: CITY OF FOSTER CITY

APPROVED BY: CITY OF FOSTER CITY

CITY OF FOSTER CITY
TRAFFIC SIGNAL
FIELD ASSESSMENT
BEACH PARK BLVD & EDGEWATER BLVD

ENGINEER'S STAMP

REGISTERED PROFESSIONAL ENGINEER
JAIME O. RODRIGUEZ
TR2284
Exp: 6/30/19
TRAFFIC
STATE OF CALIFORNIA

REVISIONS

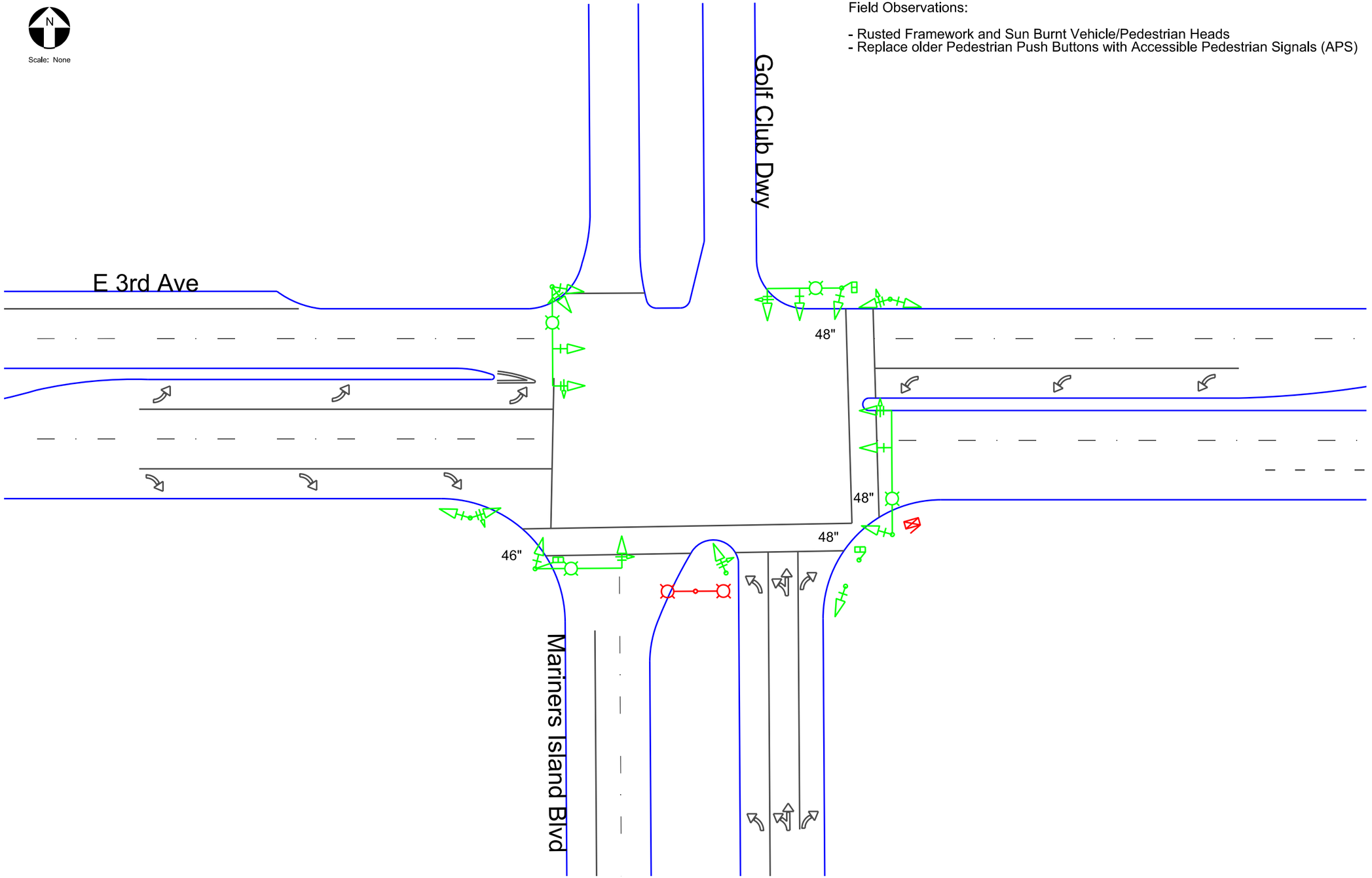
NO.	DESCRIPTION	DATE

Traffic Patterns
P.O. Box 25
Danville, CA 94526
O: (408) 916-8141
www.trafficpatterns.net
Info@trafficpatterns.net

E 3rd Ave & Mariners Island Blvd-Golf Club Dwy

N

Scale: None



Field Observations:

- Rusted Framework and Sun Burnt Vehicle/Pedestrian Heads
- Replace older Pedestrian Push Buttons with Accessible Pedestrian Signals (APS)

PROJECT NO.

SCALE:

SHEET NO. 12

DRAWN BY: J. RODRIGUEZ

REVIEWED BY: CITY OF FOSTER CITY

APPROVED BY: CITY OF FOSTER CITY

CITY OF FOSTER CITY
TRAFFIC SIGNAL
FIELD ASSESSMENT
E THRID AVENUE &
MARINERS ISLAND BLVD

ENGINEER'S STAMP

REGISTERED PROFESSIONAL ENGINEER
JAIME O. RODRIGUEZ
TR2284
Exp. 6/30/21
TRAFFIC
STATE OF CALIFORNIA

REVISIONS

NO.	DESCRIPTION	DATE

Traffic Patterns
P.O. Box 25
Danville, CA 94526
O: (408) 916-8141
www.trafficpatterns.net
Info@trafficpatterns.net

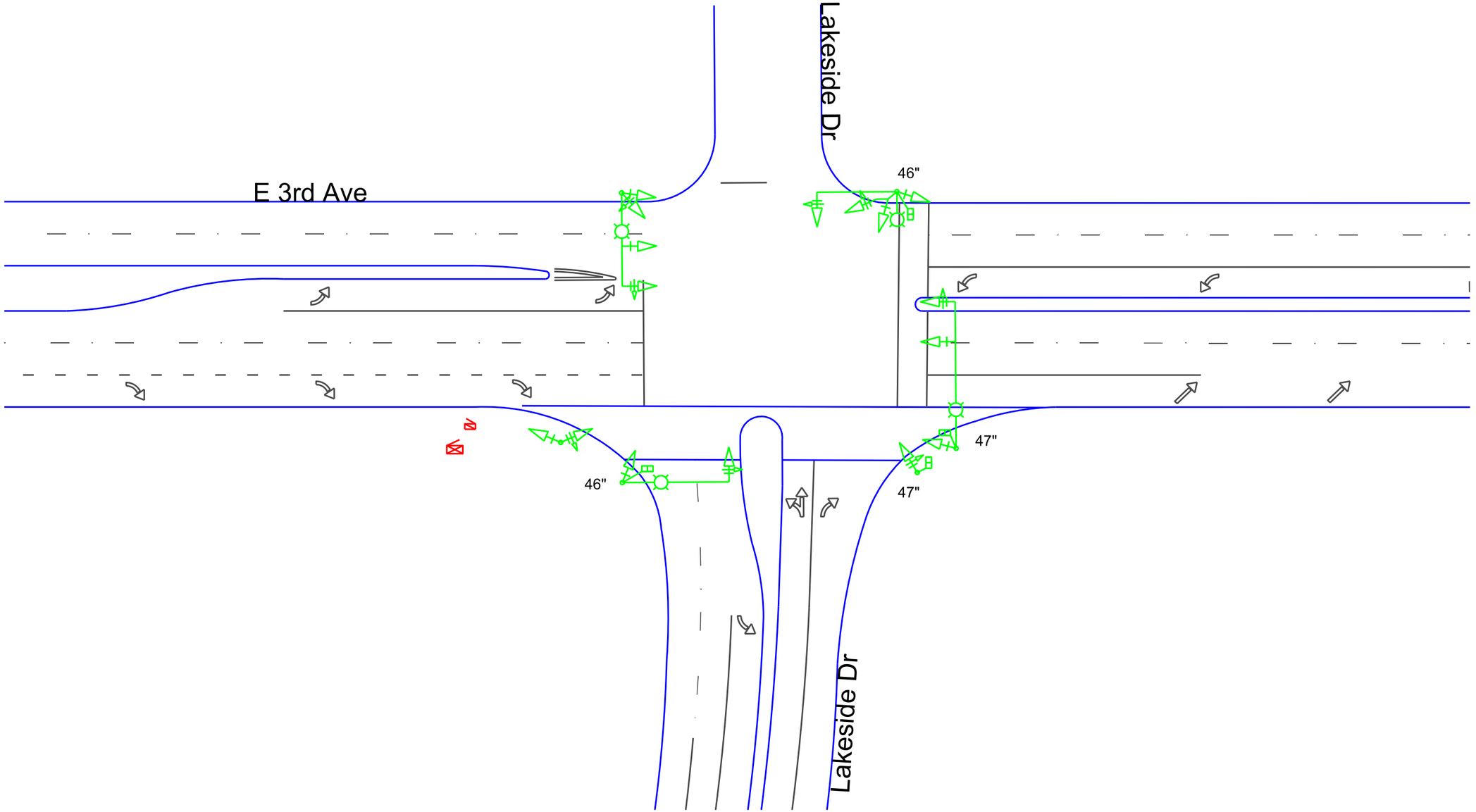
E 3rd Ave & Lakeside Dr

N

Scale: None

Field Observations:

- Rusted Framework and Sun Burnt Vehicle/Pedestrian Heads
- Replace older Pedestrian Push Buttons with Accessible Pedestrian Signals (APS)
- Replace MAT Vehicle Signals with MAS Vehicle Signals



PROJECT NO.

SCALE:

SHEET NO. 13

DRAWN BY: J. RODRIGUEZ

REVIEWED BY: CITY OF FOSTER CITY

APPROVED BY: CITY OF FOSTER CITY

CITY OF FOSTER CITY
TRAFFIC SIGNAL
FIELD ASSESSMENT
E THIRD AVENUE & LAKESIDE DRIVE

ENGINEER'S STAMP

REGISTERED PROFESSIONAL ENGINEER
JAIME O. RODRIGUEZ
TR2284
Exp: 6/30/19
TRAFFIC
STATE OF CALIFORNIA

REVISIONS

NO.	DESCRIPTION	DATE

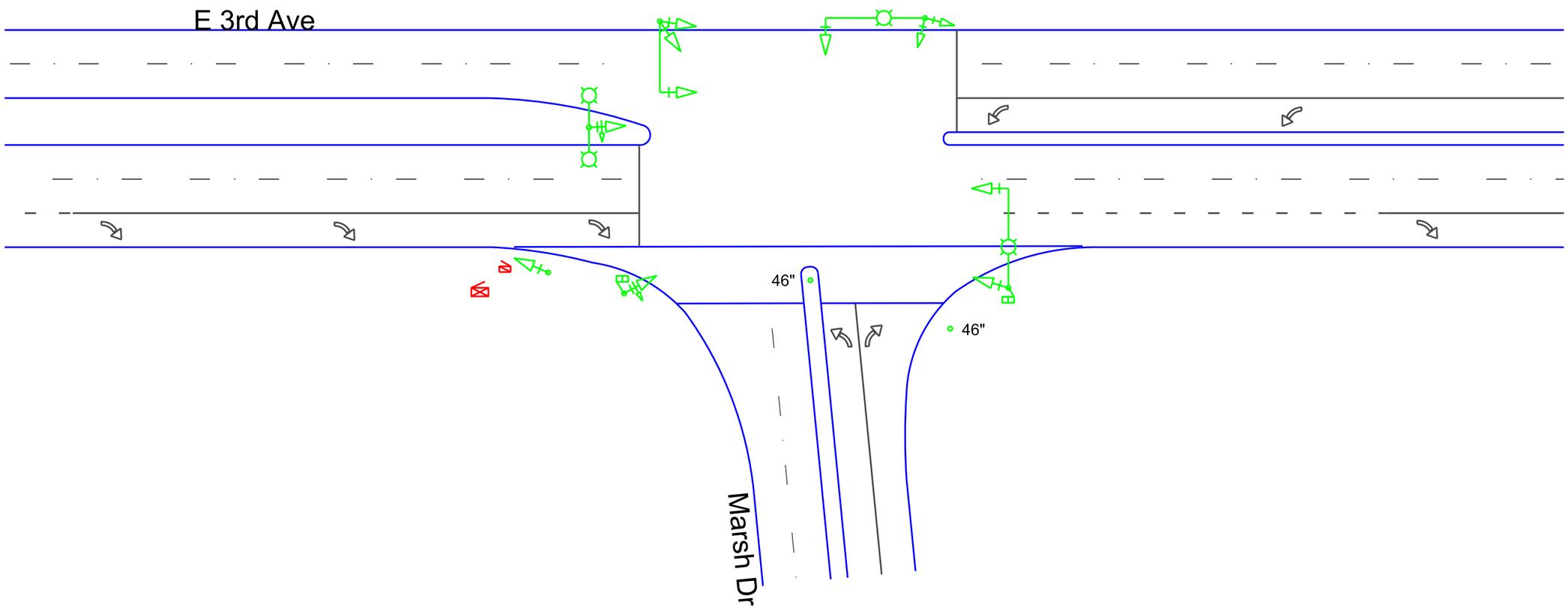
Traffic Patterns
P.O. Box 25
Danville, CA 94526
O: (408) 916-8141
www.trafficpatterns.net
Info@trafficpatterns.net

E 3rd Ave & Marsh Dr

Scale: None

Field Observations:

- Rusted Framework and Sun Burnt Vehicle/Pedestrian Heads
- Replace older Pedestrian Push Buttons with Accessible Pedestrian Signals (APS)
- Replace MAT Vehicle Signals with MAS Vehicle Signals



PROJECT NO.

SCALE:

SHEET NO. 14

DRAWN BY: J. RODRIGUEZ

REVIEWED BY: CITY OF FOSTER CITY

APPROVED BY: CITY OF FOSTER CITY

CITY OF FOSTER CITY
TRAFFIC SIGNAL
FIELD ASSESSMENT
E THIRD AVENUE & MARSH DRIVE

ENGINEER'S STAMP

REGISTERED PROFESSIONAL ENGINEER
JAIME O. RODRIGUEZ
TR2284
Exp: 6/30/19
TRAFFIC
STATE OF CALIFORNIA

REVISIONS

NO.	DESCRIPTION	DATE

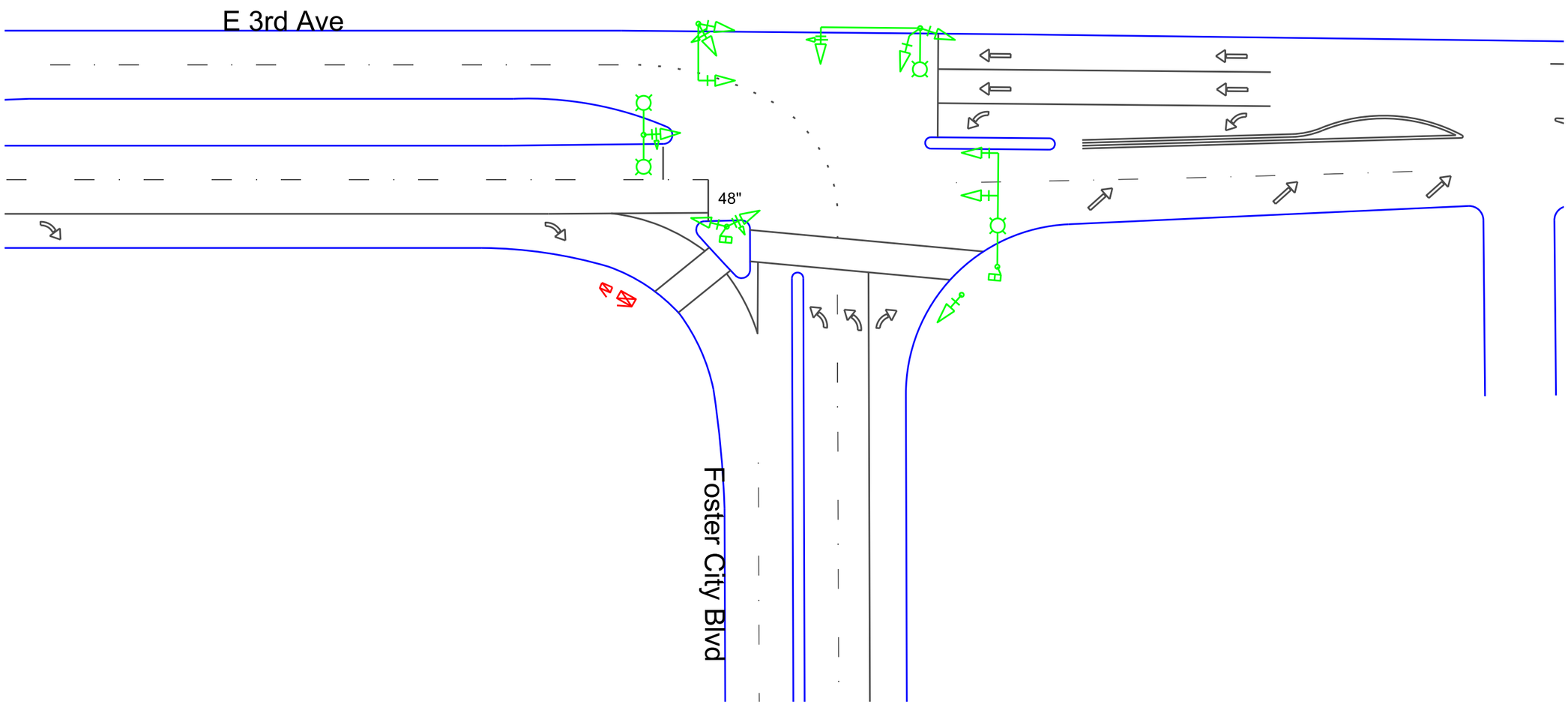
Traffic Patterns
P.O. Box 25
Danville, CA 94526
O: (408) 916-8141
www.trafficpatterns.net
Info@trafficpatterns.net

E 3rd Ave & Foster City Blvd

Scale: None

Field Observations:

- Rusted Framework and Sun Burnt Vehicle/Pedestrian Heads
- Replace older Pedestrian Push Buttons with Accessible Pedestrian Signals (APS)
- Missing Backplates on Vehicle Signals facing Foster Citiy Blvd on Mastarm



PROJECT NO.

SCALE:

SHEET NO. 15

DRAWN BY: J. RODRIGUEZ

REVIEWED BY: CITY OF FOSTER CITY

APPROVED BY: CITY OF FOSTER CITY

CITY OF FOSTER CITY
TRAFFIC SIGNAL FIELD ASSESSMENT
E THIRD AVENUE & FOSTER CITY BLVD

ENGINEER'S STAMP

REGISTERED PROFESSIONAL ENGINEER
JAIME O. RODRIGUEZ
TR2284
Exp: 6-30-19
TRAFFIC
STATE OF CALIFORNIA

REVISIONS

NO.	DESCRIPTION	DATE

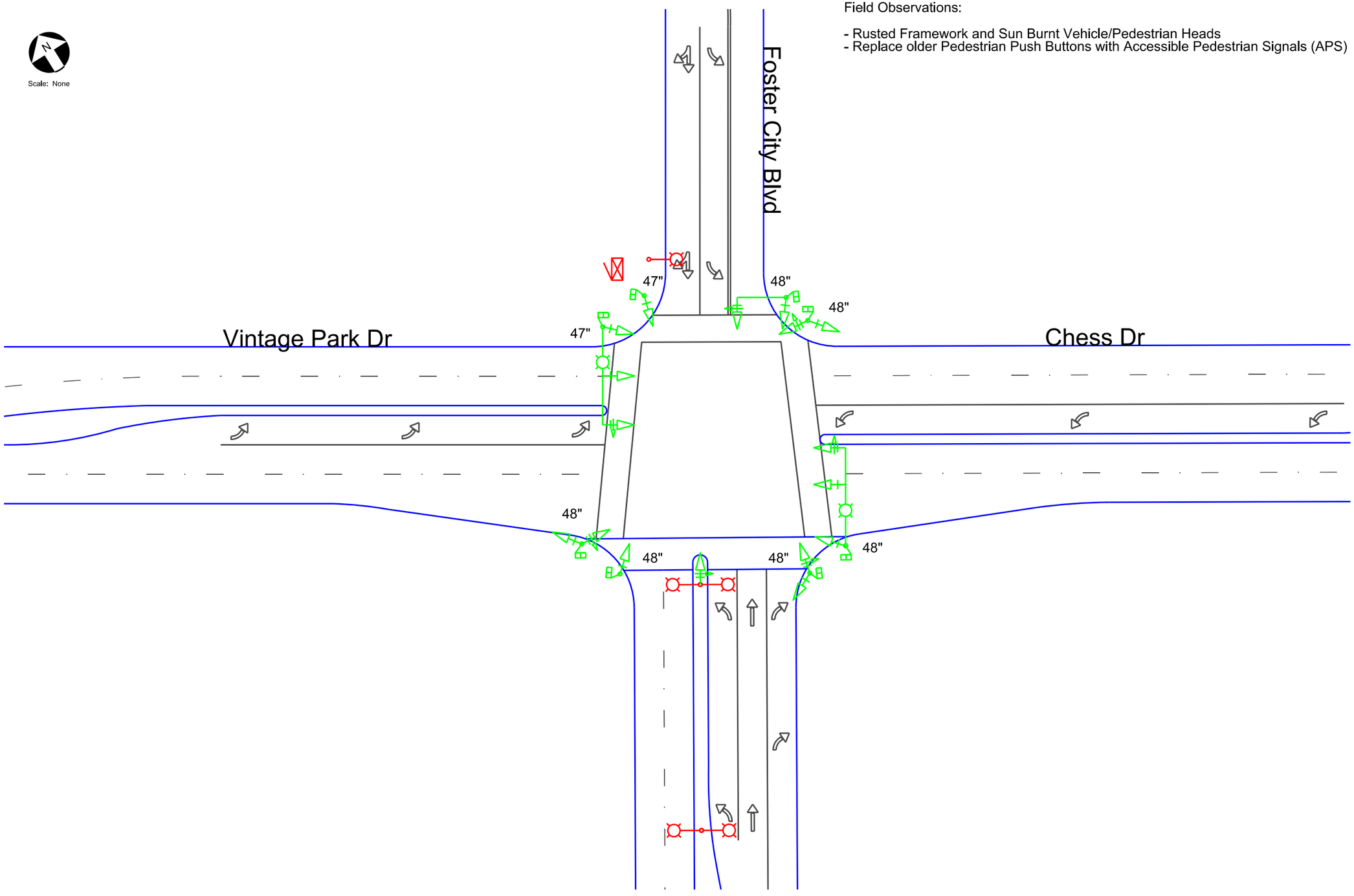
Traffic Patterns
P.O. Box 25
Danville, CA 94526
O: (408) 916-8141
www.trafficpatterns.net
Info@trafficpatterns.net

Foster City Blvd & Vintage Park Dr-Chess Dr

Scale: None

Field Observations:

- Rusted Framework and Sun Burnt Vehicle/Pedestrian Heads
- Replace older Pedestrian Push Buttons with Accessible Pedestrian Signals (APS)



PROJECT NO.

SCALE:

SHEET NO. 16

DRAWN BY: J. RODRIGUEZ

REVIEWED BY: CITY OF FOSTER CITY

APPROVED BY: CITY OF FOSTER CITY

CITY OF FOSTER CITY
TRAFFIC SIGNAL
FIELD ASSESSMENT
FOSTER CITY BOULEVARD &
VINTAGE PARK DRIVE-CHESS DRIVE

ENGINEER'S STAMP

REGISTERED PROFESSIONAL ENGINEER
JAIME O. RODRIGUEZ
TR2284
Exp. 6/30/18
TRAFFIC
STATE OF CALIFORNIA

REVISIONS

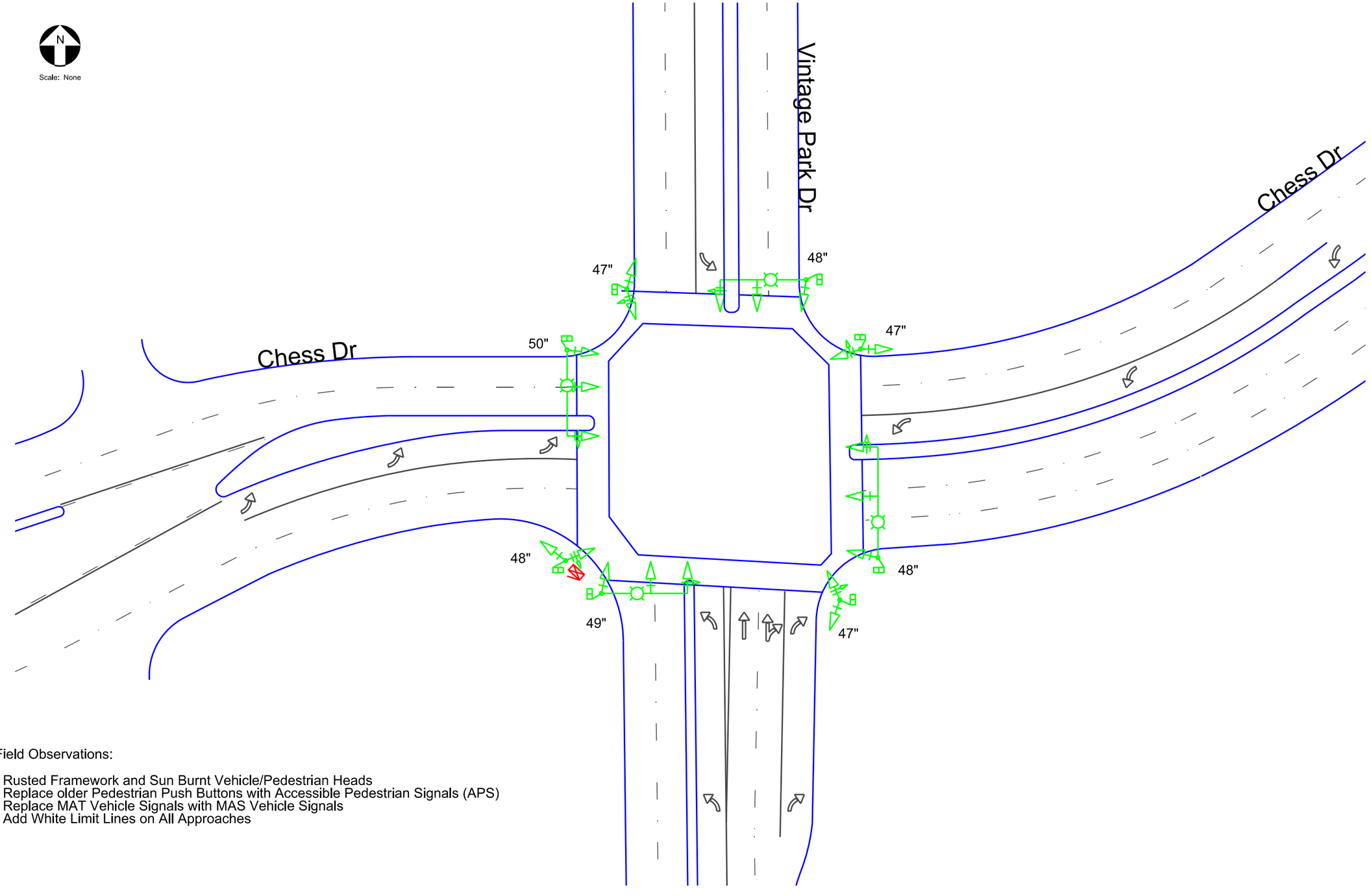
NO.	DESCRIPTION	DATE

Traffic Patterns
P.O. Box 25
Danville, CA 94526
O: (408) 916-8141
www.trafficpatterns.net
Info@trafficpatterns.net

Chess Dr & Vintage Park Dr

N

Scale: None



Field Observations:

- Rusted Framework and Sun Burnt Vehicle/Pedestrian Heads
- Replace older Pedestrian Push Buttons with Accessible Pedestrian Signals (APS)
- Replace MAT Vehicle Signals with MAS Vehicle Signals
- Add White Limit Lines on All Approaches

PROJECT NO.

SCALE:

SHEET NO. 17

DRAWN BY: J. RODRIGUEZ

REVIEWED BY: CITY OF FOSTER CITY

APPROVED BY: CITY OF FOSTER CITY

CITY OF FOSTER CITY
TRAFFIC SIGNAL
FIELD ASSESSMENT
CHESS DRIVE & VINTAGE PARK DRIVE

ENGINEER'S STAMP

REGISTERED PROFESSIONAL ENGINEER
JAIME O. RODRIGUEZ
TR2284
Exp: 6/30/19
TRAFFIC
STATE OF CALIFORNIA

REVISIONS

NO.	DESCRIPTION	DATE

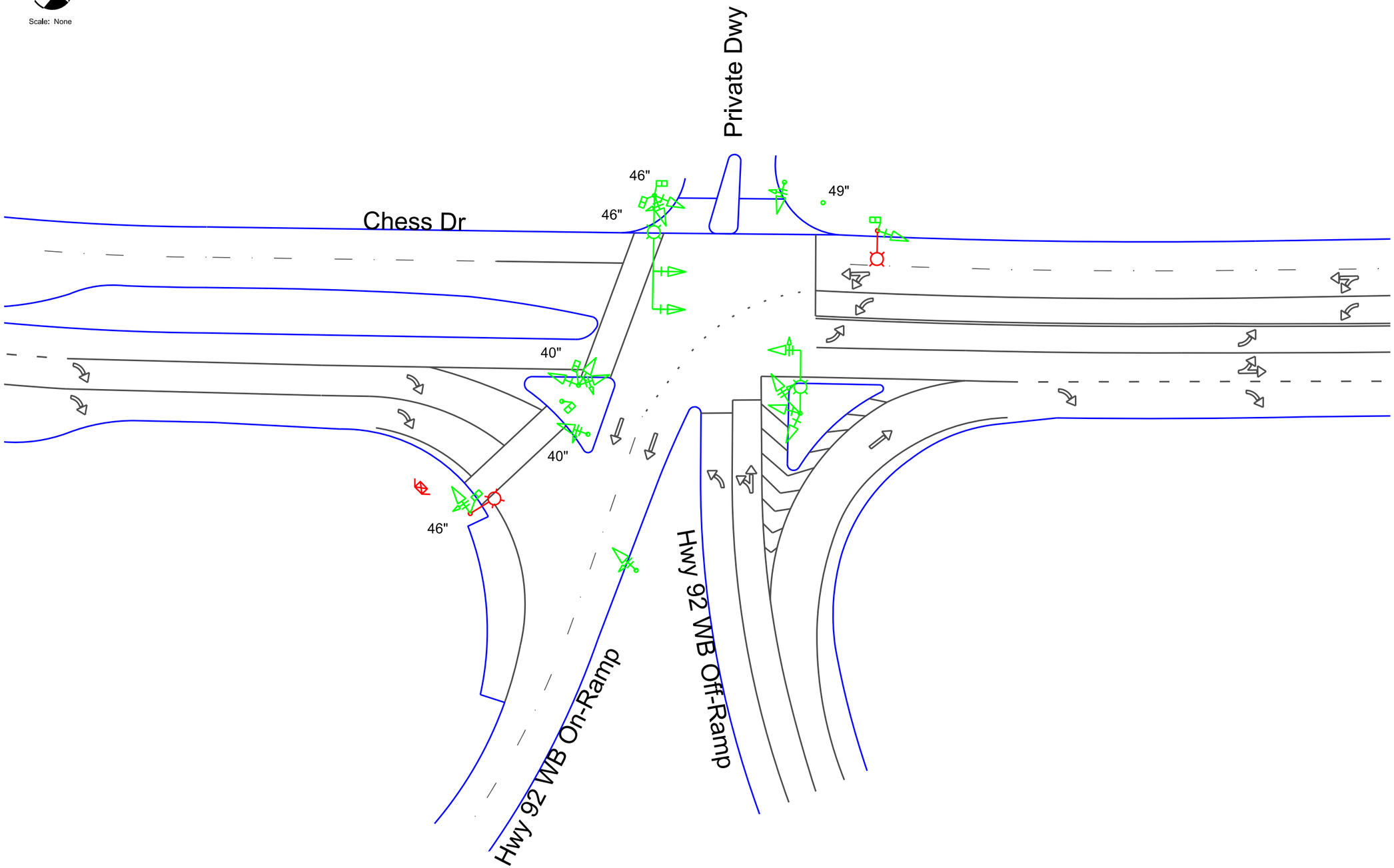
Traffic Patterns
P.O. Box 25
Danville, CA 94526
O: (408) 916-8141
www.trafficpatterns.net
Info@trafficpatterns.net

Chess Dr & Hwy 92 WB Ramps

Scale: None

Field Observations:

- Rusted Framework and Sun Burnt Vehicle/Pedestrian Heads
- Replace older Pedestrian Push Buttons with Accessible Pedestrian Signals (APS)



PROJECT NO.

SCALE:

SHEET NO. 18

DRAWN BY: J. RODRIGUEZ

REVIEWED BY: CITY OF FOSTER CITY

APPROVED BY: CITY OF FOSTER CITY

CITY OF FOSTER CITY
TRAFFIC SIGNAL
FIELD ASSESSMENT
CHESS DRIVE &
HWY 92 WB RAMPS

ENGINEER'S STAMP

REGISTERED PROFESSIONAL ENGINEER
JAIME O. RODRIGUEZ
TR2284
Exp: 6/30/19
TRAFFIC
STATE OF CALIFORNIA

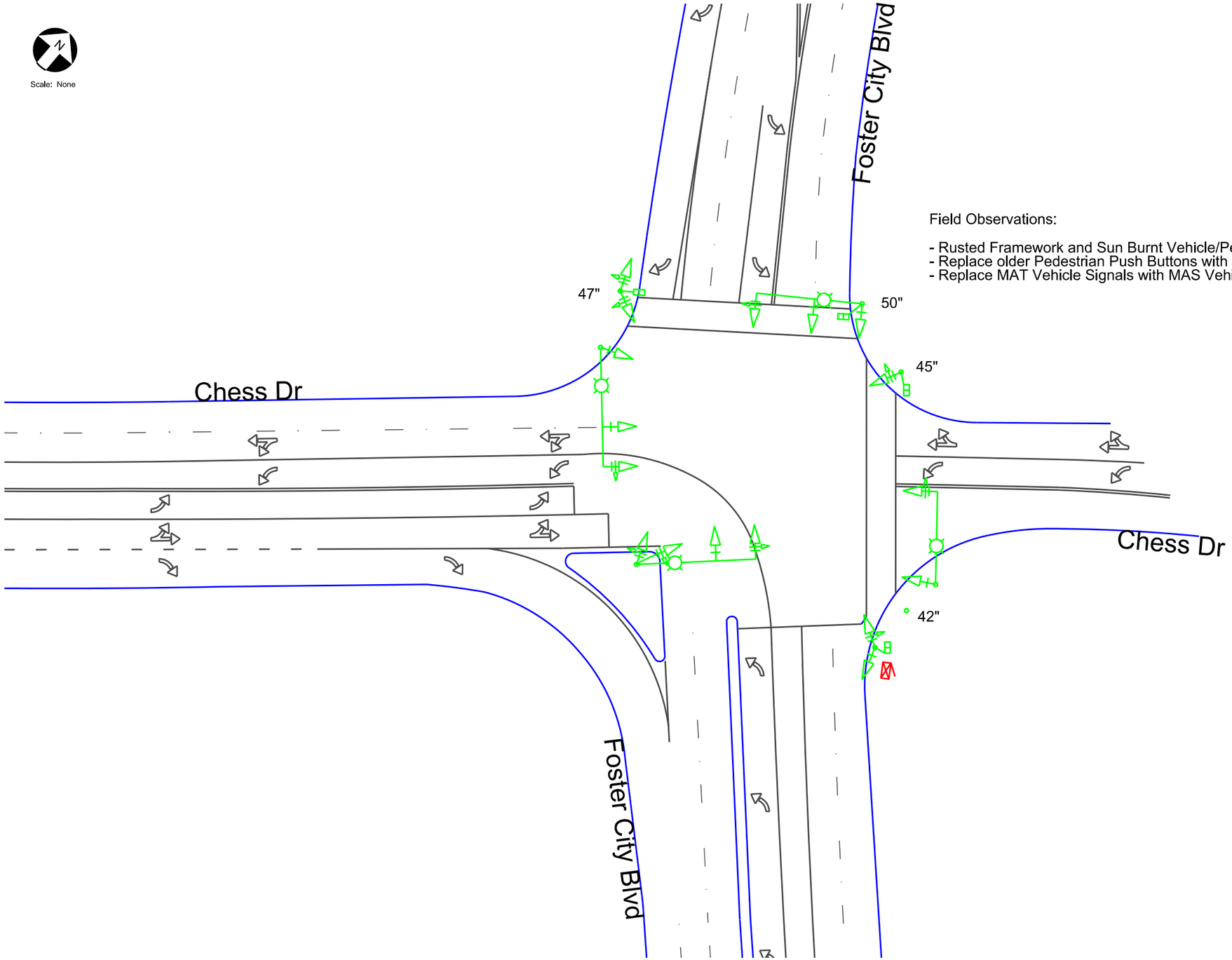
REVISIONS

NO.	DESCRIPTION	DATE

Traffic Patterns
P.O. Box 25
Danville, CA 94526
O: (408) 916-8141
www.trafficpatterns.net
Info@trafficpatterns.net

Foster City Blvd & Chess Dr

Scale: None



Field Observations:

- Rusted Framework and Sun Burnt Vehicle/Pedestrian Heads
- Replace older Pedestrian Push Buttons with Accessible Pedestrian Signals (APS)
- Replace MAT Vehicle Signals with MAS Vehicle Signals

PROJECT NO.

SCALE:

SHEET NO. 19

DRAWN BY: J. RODRIGUEZ

REVIEWED BY: CITY OF FOSTER CITY

APPROVED BY: CITY OF FOSTER CITY

CITY OF FOSTER CITY
TRAFFIC SIGNAL
FIELD ASSESSMENT
FOSTER CITY BLVD & CHESS DRIVE

ENGINEER'S STAMP

REGISTERED PROFESSIONAL ENGINEER
JAIME O. RODRIGUEZ
TR2284
Exp: 6/30/19
TRAFFIC
STATE OF CALIFORNIA

REVISIONS

NO.	DESCRIPTION	DATE

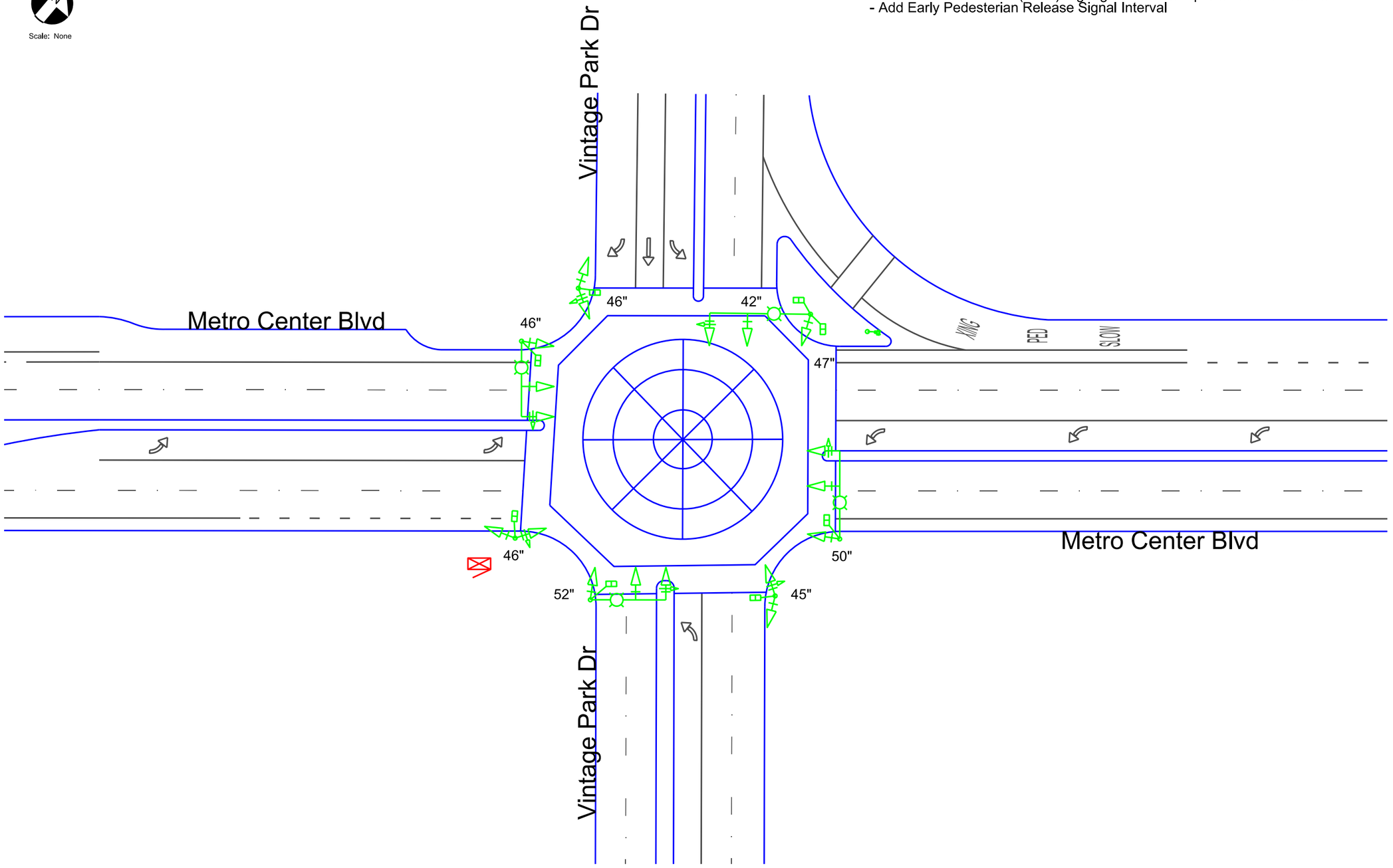
Traffic Patterns
P.O. Box 25
Danville, CA 94526
O: (408) 916-8141
www.trafficpatterns.net
Info@trafficpatterns.net

Metro Center Blvd & Vintage Park Dr

Scale: None

Field Observations:

- Rusted Framework and Sun Burnt Vehicle/Pedestrian Heads
- Replace older Pedestrian Push Buttons with Accessible Pedestrian Signals (APS)
- Add YIELD Limit Line for Pork Chop Island on NE Corner
- Add YIELD HERE TO (Peds) Signage at Pork Chop Island on NE Corner
- Add Early Pedesterian Release Signal Interval



PROJECT NO.

SCALE:

SHEET NO. 20

DRAWN BY: J. RODRIGUEZ

REVIEWED BY: CITY OF FOSTER CITY

APPROVED BY: CITY OF FOSTER CITY

CITY OF FOSTER CITY
TRAFFIC SIGNAL
FIELD ASSESSMENT
METRO CENTER BLVD &
VINTAGE PARK DRIVE

ENGINEER'S STAMP

REGISTERED PROFESSIONAL ENGINEER
JAIME O. RODRIGUEZ
TR2284
Exp. 6/30/21
TRAFFIC
STATE OF CALIFORNIA

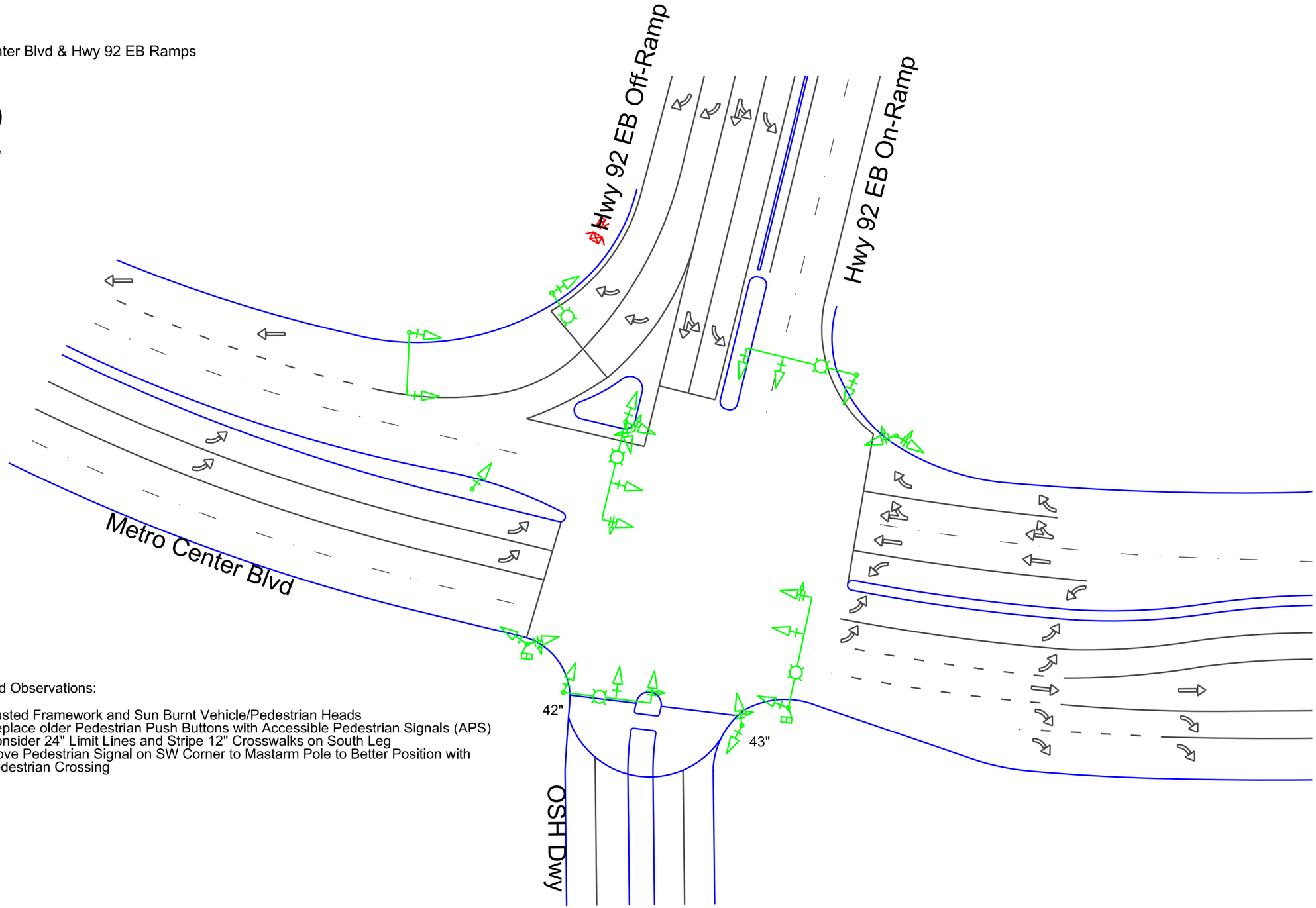
REVISIONS

NO.	DESCRIPTION	DATE

Traffic Patterns
P.O. Box 25
Danville, CA 94526
C: (408) 916-8141
www.trafficpatterns.net
Info@trafficpatterns.net

Metro Center Blvd & Hwy 92 EB Ramps

Scale: None



Field Observations:

- Rusted Framework and Sun Burnt Vehicle/Pedestrian Heads
- Replace older Pedestrian Push Buttons with Accessible Pedestrian Signals (APS)
- Consider 24" Limit Lines and Stripe 12" Crosswalks on South Leg
- Move Pedestrian Signal on SW Corner to Mastarm Pole to Better Position with Pedestrian Crossing

PROJECT NO.

SCALE:

SHEET NO. 21

DRAWN BY: J. RODRIGUEZ

REVIEWED BY: CITY OF FOSTER CITY

APPROVED BY: CITY OF FOSTER CITY

CITY OF FOSTER CITY
TRAFFIC SIGNAL
FIELD ASSESSMENT
METRO CENTER BLVD & HWY 92 EB RAMPS

ENGINEER'S STAMP

REGISTERED PROFESSIONAL ENGINEER
JAIME O. RODRIGUEZ
TR2284
Exp: 6/30/19
TRAFFIC
STATE OF CALIFORNIA

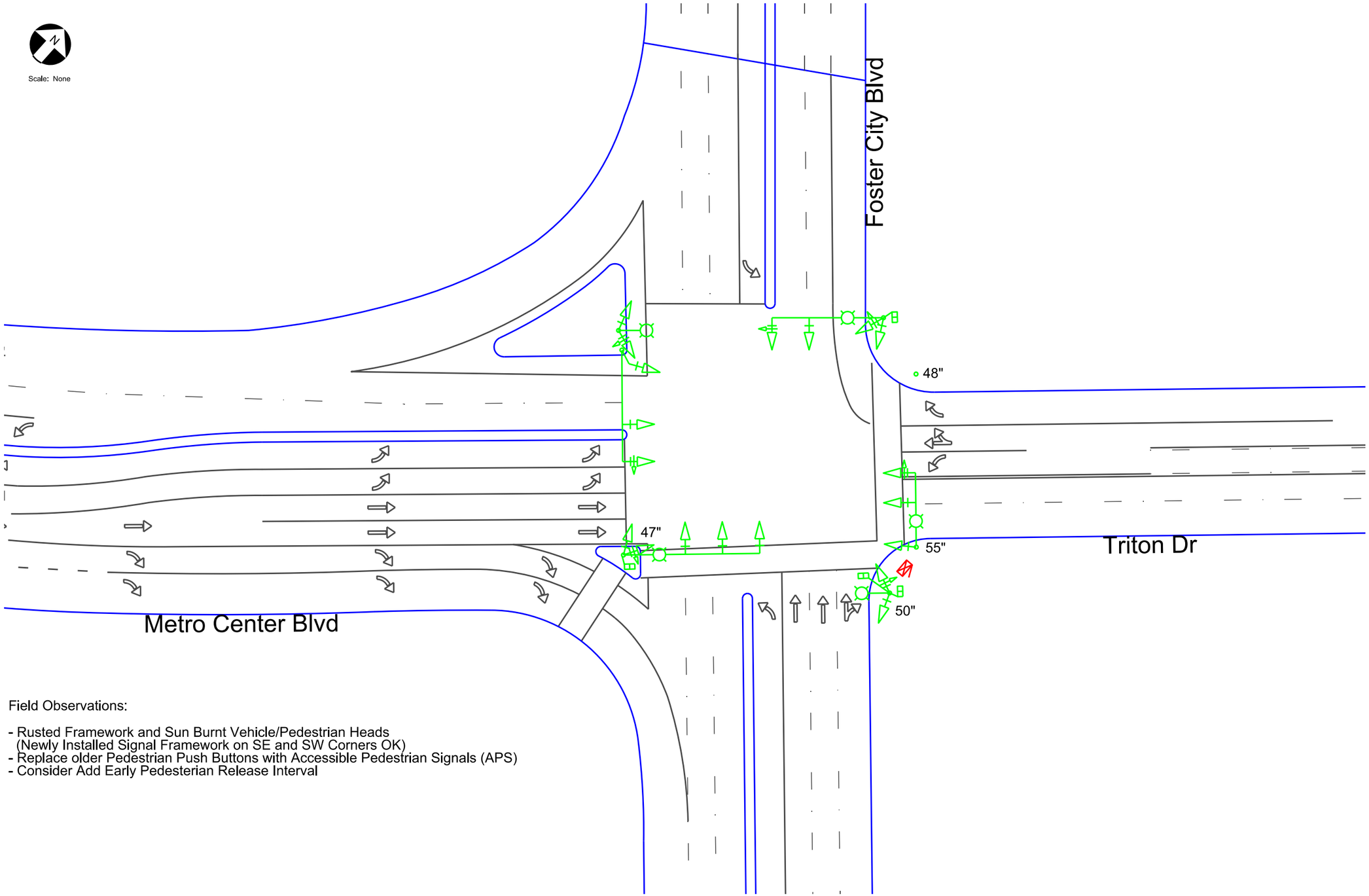
REVISIONS

NO.	DESCRIPTION	DATE

Traffic Patterns
P.O. Box 25
Danville, CA 94526
O: (408) 916-8141
www.trafficpatterns.net
info@trafficpatterns.net

Foster City Blvd & Metro Center Blvd-Triton Dr

Scale: None



Field Observations:

- Rusted Framework and Sun Burnt Vehicle/Pedestrian Heads (Newly Installed Signal Framework on SE and SW Corners OK)
- Replace older Pedestrian Push Buttons with Accessible Pedestrian Signals (APS)
- Consider Add Early Pedesterian Release Interval

PROJECT NO.

SCALE:

SHEET NO. 22

DRAWN BY: J. RODRIGUEZ

REVIEWED BY: CITY OF FOSTER CITY

APPROVED BY: CITY OF FOSTER CITY

CITY OF FOSTER CITY
TRAFFIC SIGNAL
FIELD ASSESSMENT
FOSTER CITY BLVD &
METRO CENTER BLVD-TRITON DR

ENGINEER'S STAMP

REGISTERED PROFESSIONAL ENGINEER
JAIME O. RODRIGUEZ
TR2284
Exp: 6/30/19
TRAFFIC
STATE OF CALIFORNIA

REVISIONS

NO.	DESCRIPTION	DATE

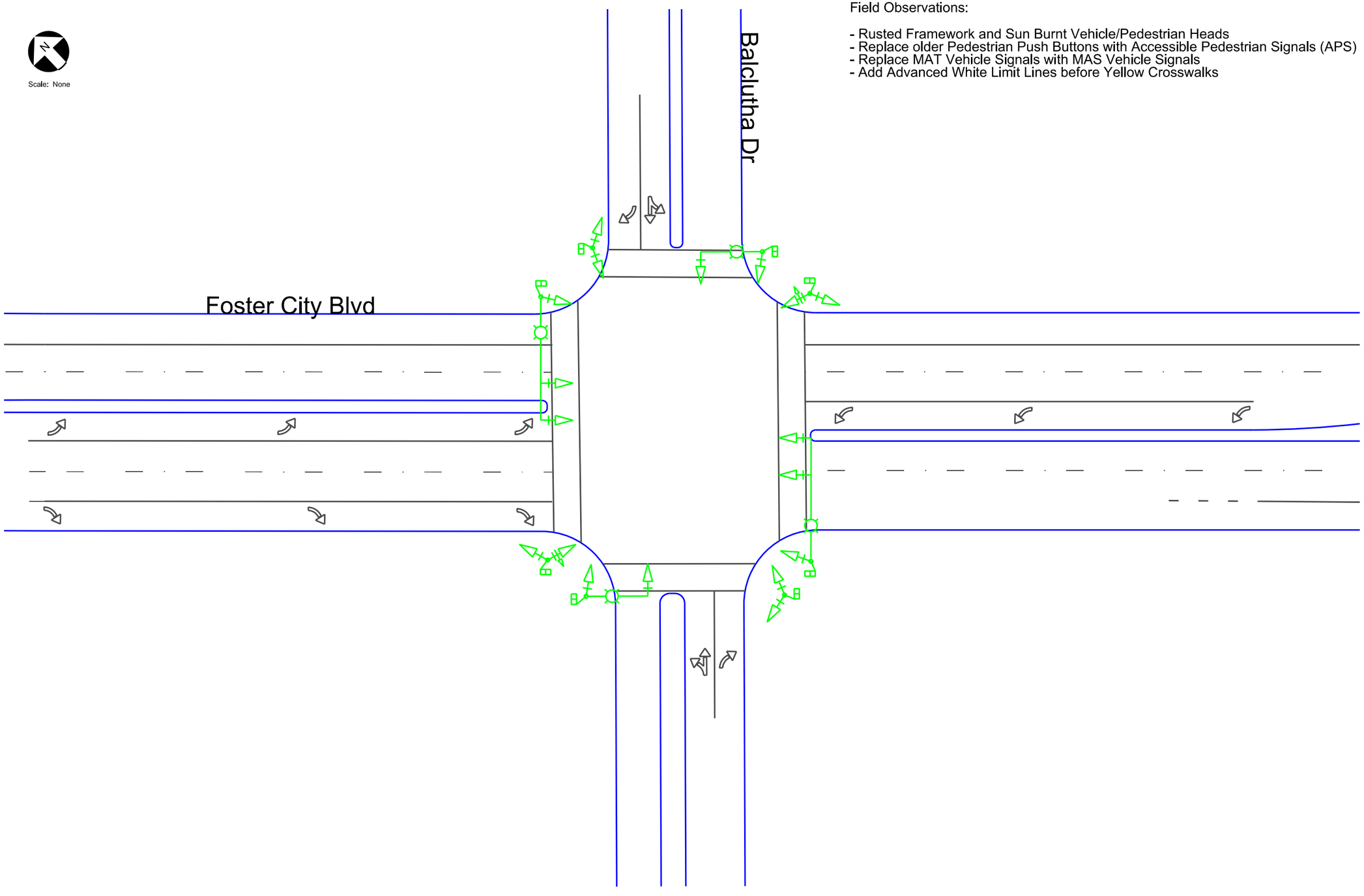
Traffic Patterns
P.O. Box 25
Danville, CA 94526
O: (408) 916-8141
www.trafficpatterns.net
Info@trafficpatterns.net

Foster City Blvd & Balclutha Dr

Scale: None

Field Observations:

- Rusted Framework and Sun Burnt Vehicle/Pedestrian Heads
- Replace older Pedestrian Push Buttons with Accessible Pedestrian Signals (APS)
- Replace MAT Vehicle Signals with MAS Vehicle Signals
- Add Advanced White Limit Lines before Yellow Crosswalks



PROJECT NO.

SCALE:

SHEET NO. 23

DRAWN BY: J. RODRIGUEZ

REVIEWED BY: CITY OF FOSTER CITY

APPROVED BY: CITY OF FOSTER CITY

CITY OF FOSTER CITY
TRAFFIC SIGNAL
FIELD ASSESSMENT
FOSTER CITY BLVD & BALCLUTHA DR

ENGINEER'S STAMP

REGISTERED PROFESSIONAL ENGINEER
JAIME O. RODRIGUEZ
TR2284
Exp: 6-30-19
TRAFFIC
STATE OF CALIFORNIA

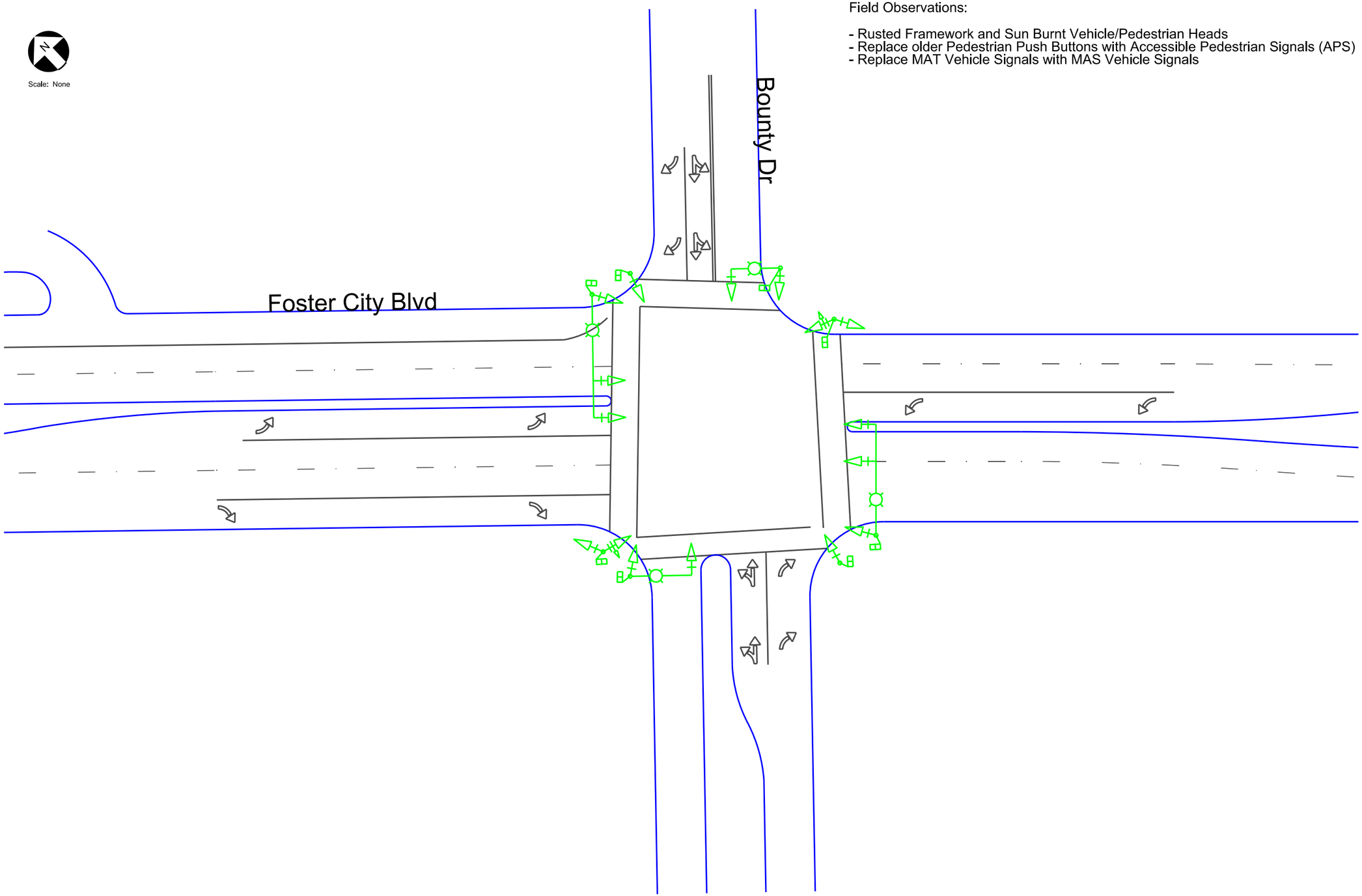
REVISIONS

NO.	DESCRIPTION	DATE

Traffic Patterns
P.O. Box 25
Danville, CA 94526
O: (408) 916-8141
www.trafficpatterns.net
Info@trafficpatterns.net

Foster City Blvd & Bounty Dr

Scale: None



Field Observations:

- Rusted Framework and Sun Burnt Vehicle/Pedestrian Heads
- Replace older Pedestrian Push Buttons with Accessible Pedestrian Signals (APS)
- Replace MAT Vehicle Signals with MAS Vehicle Signals

PROJECT NO.

SCALE:

SHEET NO. 24

DRAWN BY: J. RODRIGUEZ

REVIEWED BY: CITY OF FOSTER CITY

APPROVED BY: CITY OF FOSTER CITY

CITY OF FOSTER CITY
TRAFFIC SIGNAL
FIELD ASSESSMENT
FOSTER CITY BLVD & BOUNTY DR

ENGINEER'S STAMP

REGISTERED PROFESSIONAL ENGINEER
JAIME O. RODRIGUEZ
TR2284
Exp: 6/30/18
TRAFFIC
STATE OF CALIFORNIA

REVISIONS

NO.	DESCRIPTION	DATE

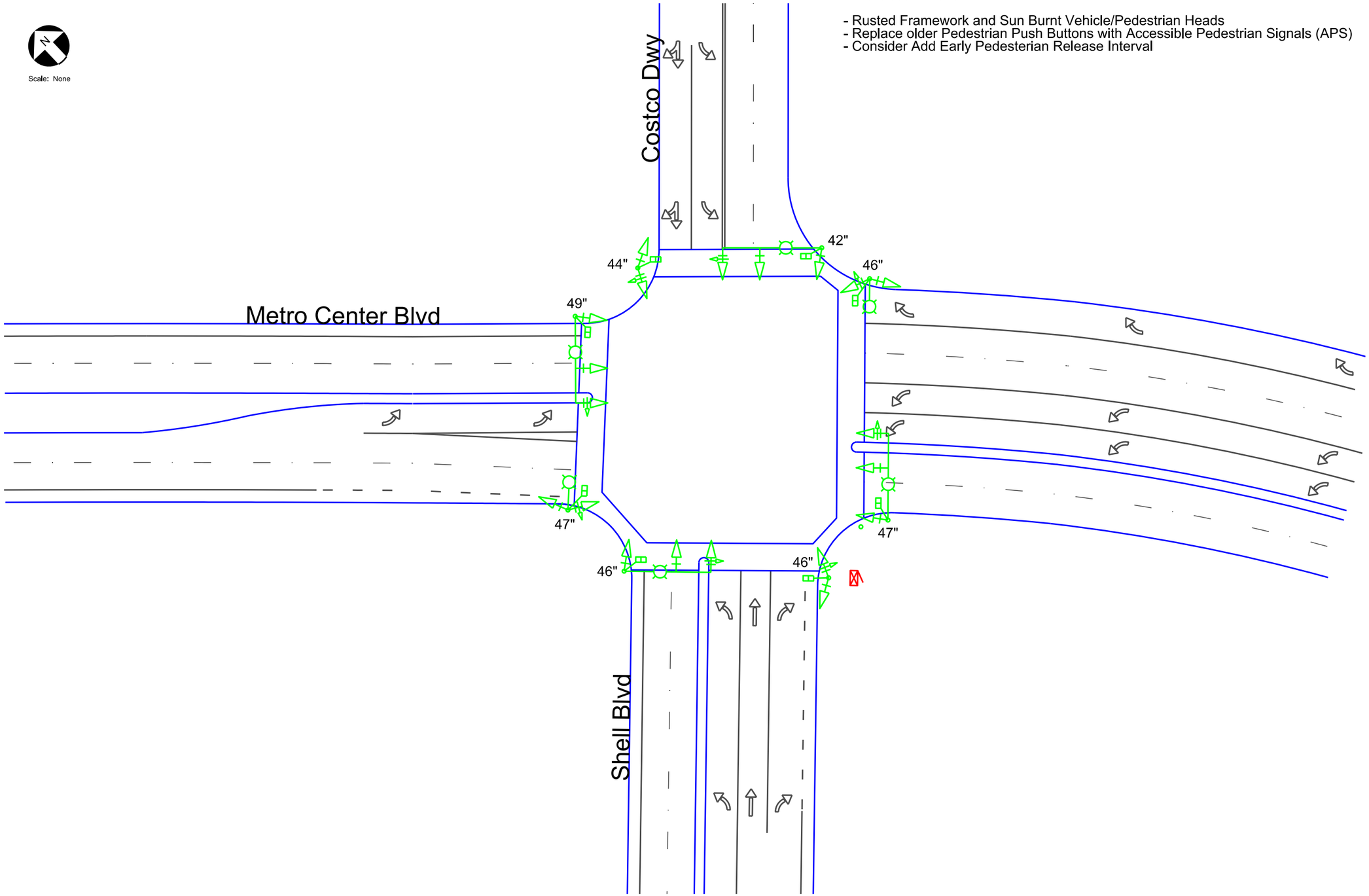
Traffic Patterns
P.O. Box 25
Danville, CA 94526
O: (408) 916-8141
www.trafficpatterns.net
Info@trafficpatterns.net

Metro Center Blvd & Shell Blvd-Costco Dwy

Scale: None

Field Observations:

- Rusted Framework and Sun Burnt Vehicle/Pedestrian Heads
- Replace older Pedestrian Push Buttons with Accessible Pedestrian Signals (APS)
- Consider Add Early Pedesterian Release Interval



PROJECT NO.

SCALE:

SHEET NO. 25

DRAWN BY: J. RODRIGUEZ

REVIEWED BY: CITY OF FOSTER CITY

APPROVED BY: CITY OF FOSTER CITY

CITY OF FOSTER CITY
TRAFFIC SIGNAL
FIELD ASSESSMENT
METRO CENTER BLVD & SHELL BLVD

ENGINEER'S STAMP

REGISTERED PROFESSIONAL ENGINEER
JAIME O. RODRIGUEZ
TR2284
Exp. 6/30/24
TRAFFIC
STATE OF CALIFORNIA

REVISIONS

NO.	DESCRIPTION	DATE

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