Traffic Signal Design and Drawing Preparation Guidelines

THE PORT AUTHORITY OF NY & NJ

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Table of Contents

Traffic Signal Design and Drawing Preparation Guidelines

JUSTIFICATION FOR IMPROVEMENTS 2

DESIGN DOCUMENTS 2

A. Stage 1 & Stage 2 – Preliminary Design Drawings 2

B. Stage 3 – Final Design 2

C. Stage 4 – Construction Services 2

DRAWING PREPARATION 3

DESIGN CRITERIA 4

A. Phase Numbering Convention 4

B. Traffic Signal Poles and Foundations 4

C. Traffic Signal Controllers 5

D. Signal Displays 6

E. Signal Phasing and Timing 7

F. Vehicle Detection 7

G. Traffic Signal Pullbox and Splice Box Installations 8

H. Conduit Type, Size and Installation 8

I. Traffic Signal Cable Types and Usage 9

SPECIFICATIONS 10

TRAFFIC SIGNAL EQUIPMENT NUMBERING CONVENTION 11

TRAFFIC SIGNAL DETECTION NUMBERING CONVENTION 13

SAMPLE DRAWINGS 14

Sample Drawings

PRELIMINARY DESIGN SAMPLE DRAWINGS

(Stage 1 & Stage 2) Sample Mast Arm Traffic Signal Layout Plan SG001

(Stage 1 & Stage 2) Sample Span Wire Traffic Signal Layout Plan SG002

Sample Single Lane Detection Layouts SG003

Sample Left Turn Lane Detection Layouts SG004

Sample Multi-Lane Detection Layouts SG005

FINAL DESIGN SAMPLE CONTRACT DRAWINGS

Sample Traffic Signal General Notes SG006

Sample Traffic Signal Legend SG007

Sample Traffic Signal Abbreviations SG008

Sample Designer's Checklist SG009

Sample Traffic Signal Wiring Plan (Span Wire) SG010

Sample Traffic Signal Dimension Diagram and Timing Data (Span Wire) SG011

Sample Traffic Signal Load Switch and Actuation Tables (Span Wire) SG012

Sample Traffic Signal Wiring Plan (Mast Arm) SG013

Sample Traffic Signal Dimension Diagram and Timing Data (Mast Arm) SG014

Sample Traffic Signal Load Switch and Actuation Tables (Mast Arm) SG015

Sample Traffic Signal Wiring Plan (Mid-Block Crossing) SG016

Sample Traffic Signal Dimension Diagram and Data Tables (Mid-Block Crossing) SG017

Sample Traffic Signal Removal Plan SG018

Sample Modified Traffic Signal Wiring Plan SG019

Sample Modified Traffic Signal Dimension Diagram and Timing Data SG020

Sample Modified Traffic Signal Load Switch and Actuation Tables SG021

FINAL RECORD SAMPLE DRAWINGS

Sample Final Record TS Drawing ..... FAC-INT

Sample Final Record Traffic Signal Timing ..... FAC-INT

General Procedures

The following information is presented as a guideline for the development of typical traffic signal designs and is not intended to define all potential conditions that may be encountered. All signal design work must be in compliance with the provisions and requirements of the current edition of the *Manual on Uniform Traffic Control Devices (MUTCD)*. Plans and submittals must be coordinated with Traffic Engineering.

Justification for Improvements

Before commencing the traffic signal design process, it must be determined whether improvements are warranted at the candidate location. To avoid the operational and safety issues that can result from unnecessary traffic signals, a comprehensive engineering study is required with procedures described below:

1. ***New traffic signals*** – perform an engineering study, which includes a traffic signal warrant analysis per *MUTCD* Chapter 4C. Obtain an authorization from the Chief Traffic Engineer prior to initiating traffic signal design.
2. ***Modifying existing traffic signals*** – prepare conceptual sketches of proposed improvements and/or modifications (including supporting documentation such as HCS, Synchro, SimTraffic, etc.) and include how they will address site-specific problems or deficiencies.
3. ***Removing existing traffic signals*** – confirm that the traffic signal is not warranted per *MUTCD* Chapter 4C. If none of the warrants are met, prepare a summary of findings (including support documentation) and recommendations. If one or more warrants are met, investigate and evaluate alternatives to traffic signals via engineering studies.

Additional clarification on the requirements for obtaining approvals for improvements to traffic signals is available in the document entitled, **"Port Authority Intersection Signalization Procedures."** This document can be obtained from the Port Authority Traffic Engineering.

Design Documents

A. Stage 1 & Stage 2 – Preliminary Design Drawings

A Stage 1 & Stage 2 Design Level Traffic Signal Drawing is to be prepared in coordination with Traffic Engineering prior to developing the final contract documents. This plan will present the above-ground features, and should include the following:

1. Vehicular and pedestrian traffic signal layout with pushbuttons (if applicable) and signal head numbering
2. Traffic signal legend
3. Traffic signal mast arm lengths
4. Areas of vehicle detection
5. Final striping and lane usage with dimensions (for traffic signal operations only)
6. Signal phasing diagram
7. Additional features as required
8. Complete Designer's Checklist denoting that all items have been verified (separate sheet)

See drawings SG001 and SG002 for sample traffic signal drawing formats.

B. Stage 3 – Final Design

Stage 3 Contract Documents ("SG") Design Level Traffic Signal Drawings are to be prepared following the guidelines set forth in *Drawing Preparation, Sections C & D*, of this document.

C. Stage 4 – Construction Services

A Stage 4 Final Record Traffic Signal (TS) Drawing and signal timing are to be prepared and shall reflect the final field conditions to be approved by Traffic Engineering. See Intersection Number FAC-INT drawing for Sample Final Record TS drawing and Traffic Signal Timing.

Drawing Preparation

A. Sheet size for traffic signal drawings shall conform to the contract drawing size, which is usually 22”x34”. Drawings will be prepared using a scale of 1” = 20’ (1” = 40’ for 11”x 17” drawings). All drawings shall be prepared using the latest PANYNJ AutoCAD standards.

B. Intersections shall be orientated on the drawings with the northerly direction pointing either up or to the right. The major road must always run horizontal on the plan sheet.

C. The contract set of drawings for traffic signals shall include:

1. General Notes – “SG” drawing
2. Legends and Abbreviations – “SG” drawing
3. Sign Text Data – “T” drawing
4. Signing and Pavement Markings – “T” drawing
5. Traffic Signal Wiring Plans – “SG” drawing
6. Traffic Signal Sequence, Timing and Phasing Diagram – “SG” drawing
7. Detector Table – “SG” drawing
8. Load Switch Table – “SG” drawing
9. Standard PANYNJ details – “SG” drawing
10. Standard details from other agencies and/or jurisdictions (if applicable) – “SG” drawing
11. Details developed specifically for the project (if applicable) – “SG” drawing

D. Contract (“SG”) drawings for traffic signals shall be prepared in accordance with the most current PA traffic signal details and specifications, using the latest PANYNJ AutoCAD standards, and show the following:

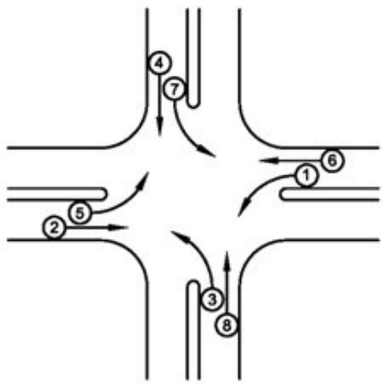
1. Basemapping:
   a. North arrow and bar scale
   b. Street and/or ramp names
   c. Curblines, handicap ramps, drop curbs and driveways
   d. Sidewalks and grass buffer strips
   e. Trees, shrubs and other foliage
   f. Underground and overhead utility information, including pole numbers
   g. Right-of-way and building lines where applicable (excluding side property lines)
   h. Railroad tracks and track side features (e.g., gates, huts, etc.)
   i. Bus shelters and benches
   j. All existing ground-mounted and overhead signing
   k. Existing traffic signals, junction boxes, controller and meter cabinets
   l. Existing electrical service drop location for existing traffic signals
   m. Traffic signal interconnect and communication link
   n. Roadway lighting and load center
   o. Striping; overall roadway width; lane widths and designations
   p. Additional features as required
2. Traffic Signal Wiring Plan:
   a. Vehicular and pedestrian traffic signal layout with pushbuttons (if applicable) and signal head numbering
   b. Traffic signal legend
   c. Foundations for signal poles, controller and meter cabinet
   d. Block wiring diagram
   e. Vehicle detector layout with spacing and/or zone coverage (e.g., inductance loops or video) and designation
   f. Signs mounted on mast arms or span wire
   g. Lateral spacing of vehicular traffic signal heads on mast arms and span wire
   h. Mounting height of clamp or post-mounted traffic signals
   i. Traffic signal controller and meter cabinet with electrical service drop location
   j. Conduit runs, pullboxes and splice boxes
   k. Location of uninterruptible power system (UPS)
   l. Traffic signal interconnect and communication link
   m. Striping (for traffic signal operations only)
   n. Underground and overhead utilities
   o. Roadway lighting
   p. Additional features as required

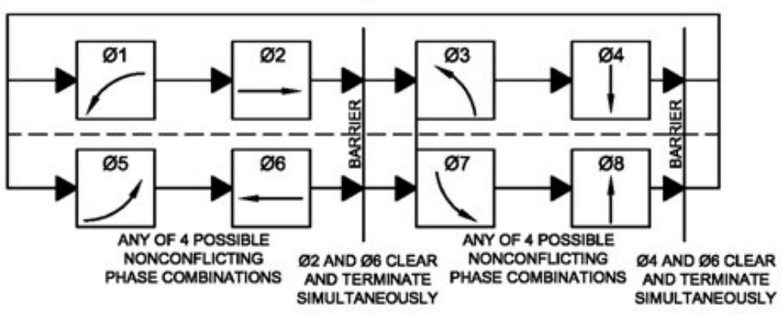
Traffic signal wiring plans shall be designated as “SG” drawings in the contract set. See drawings SG010 – SG021 for sample traffic signal wiring plan and contract drawing formats.

Design Criteria

A. Phase Numbering Convention

Traffic movements shall follow NEMA phasing designation and convention as shown below.





See drawings SG001, SG002, and SG010 – SG021 for the typical utilization of the phase numbering convention shown above.

B. Traffic Signal Poles and Foundations

1. Verify proper lateral and vertical overhead utility clearances with all proposed traffic signal poles, mast arms, and span wire, per the National Electrical Safety Code and other State requirements.
2. Structural loading calculations shall be prepared for traffic signal poles, foundations, and span wires to be reviewed by PANYNJ Structures and PANYNJ Geotech.

B. Steel Traffic Signal Structures

Structures shall be designed in accordance with the latest edition of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals. Design in accordance with the following:

1. Design Life: 50 years
2. Minimum values to be used in Equation 3.8.3-1:
   a. Basic Wind Speed: 110 mph
   b. Gust Effect Factor: 1.14
   c. Height and Exposure Factor, Kz: 0.94
   d. Wind Importance Factor, Ir: 1.00
3. All steel traffic signals shall be designed for fatigue in accordance with the provisions described in Chapter 11 of the AASHTO Specifications. Design shall include the following equivalent static load effects: Galloping, Vortex Shedding(as applicable), Natural Wind Gust, and Truck Induced Gust. Fatigue category determination shall be as follows:
   a. For structures with mast arm lengths 55’ long and longer: Fatigue Category I
   b. For Structures with mast arm lengths 50’ long and shorter: Fatigue Category II

C. Aluminum Traffic Signal Structures

Structures shall be designed in accordance with the latest edition of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals. Design in accordance with the following:

1. Design Life: 25 years
2. Minimum values to be used in Equation 3.8.3-1:
   a. Basic Wind Speed: 110 mph
   b. Gust Effect Factor: 1.14
   c. Height and Exposure Factor, Kz: 0.94
   d. Wind Importance Factor, Ir: 0.77
3. Fatigue shall be waived.

The Consultant shall analyze the aluminum signal structure with the proposed attachments and shall compute and verify the top of foundation (i.e. bottom of structure) loads against the loads provided in the standard drawings. The Consultant shall use the computed loads or the loads shown in the standard drawing (whichever controls) for designing the foundations and anchor bolts and show them in the contract plans.

For uniformity of appearance and inventory every effort shall be made to use the signal dimensions and sizes as shown on the standard details. The standard details describe a minimum design load configuration. For comparison purposes, a worksheet is available to assess the magnitude of load effects on proposed structures against the load effects generated by the configuration described in the standard

details. The worksheet provides a qualitative comparison only and is not intended as a substitution for design.

4. For designs using poles and mast arms, both types of materials (i.e., steel and aluminum) are acceptable within the same installation.

   a. Mast arm lengths shall range from a minimum of 15 feet up to a maximum of 65 feet, measured in five foot increments. Aluminum mast arms and poles may be used for mast arm lengths between 15 and 25 feet. Steel mast arms and poles must be used for mast arm lengths between 30 and 65 feet.

   b. Steel and aluminum cantilevered traffic signal structures shall be designed and manufactured in accordance with the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries, and traffic Signals, 5th Edition, 2009. The Fatigue criteria for the design of aluminum cantilevered structures as presented in these AASHTO specifications is waived.

5. For traffic signal installations that will use traffic signal poles and mast arms, the following information is furnished to provide guidance in the selection of traffic signal poles and foundations at PANYNJ intersections.

   a. Traffic signal pole, type “T” shall be used with foundation type “SFT”.

   b. Traffic signal pole, type “K” shall be used with foundation type “SFK”.

   c. Traffic signal pole, type “S” shall be used with foundation type, “STF”.

   d. Traffic signal pedestal poles shall be used with foundation type, “SPF.” Standard pole height for post top mounted traffic signal heads is 12 feet. The standard pole height for pedestrian signal heads is 8 feet.

   e. Vertical clearance to vehicular traffic signal heads installed over roadways shall typically range from 16’-6” to 17’-0”, as measured from the highest point of the roadway surface to the bottom of the signal head housing. Vertical clearances less than 16’-6” may be necessary due to site conditions (i.e., flight path restrictions, overhead structures, etc.); however, a minimum clearance of 15’-6” must be provided. At facilities where overheight vehicles are anticipated (such as Port Newark/Elizabeth PA Marine Terminals), all vehicular signal heads shall be mounted to provide a vertical clearance between 17’-6” and 18’-0”. The vertical clearance shall be specified on the design details. The height at which the 15’ and 20’ arms are attached to the T-pole and the 25’ arm is attached to the K-pole limits the maximum vertical clearance to 16’-6” and 17’-6” respectively when the pole is set 2’-8” from the curb. At this offset the low chord of the arm may control the vertical clearance if a greater clearance to the signal head is desired.

   f. Foundations for all traffic signal poles shall be located as far as practical from the edge of the traveled way without adversely affecting the visibility of the signal indications or obstructing the passage of persons either on the sidewalk or within the access from the sidewalk to the crosswalk. At a minimum, the center for all aluminum traffic supports shall be offset 2’-8” (32”) from the curb face. Where practical, all steel poles shall be located out of the clear zone (refer to the *American Association of State Highway and Transportation Officials (AASHTO) Roadside Design Guide*). The use of traffic barriers may be considered based on field conditions, where poles cannot be located outside of the clear zone. All steel traffic signal supports shall be offset a minimum of 10’ from the curb face. In addition, reference should be made to the *Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)* and *Public Rights-of-Way Accessibility Guidelines (PROWAG)* to ensure that the proper clearance is met for all passage areas around any signal pole base.

   g. Soils testing and structural calculations are required for all foundations installed in accordance with the PANYNJ Geotech procedure, and must be signed by a structural engineer and reviewed by PA Structures and PA Geotech.

6. Pole and mast arm finishes will be dictated by the facility on a case-by-case basis.

7. Spare equipment including poles, mast arms and hardware will be dictated by the facility on a case-by-case basis.

8. For traffic signal installation applications that will use poles and span wire, the following information is furnished to provide guidance for the selection and design at PANYNJ intersections.

   a. In order to provide reserve capacity to support the installation of additional signal equipment in the future, all span poles and foundations shall be designed to support 125% of the signal loads that are shown on the plans.

   b. Span pole height shall be calculated utilizing the following criteria:

      (i) Minimum vertical clearance shall be as stated in Design Criteria Section B.4.e.

      (ii) Height of signal heads being installed.

      (iii) One foot allowance for a signal hanger bracket.

      (iv) Span wire sag equal to 5% of span length shall be provided.

      (v) 18 inch allowance for the distance between the top of the span pole and the span wire attachment point.

      (vi) Existing intersection grades must be evaluated prior to selection of span pole height.

      (vii) The pole height shall be specified in even two-foot increments, and shall be the sum of the above values rounded up to the next two-foot increment to provide for future signal requirements.

      (viii) The designer shall specify the height of pole, design load capacity of the poles, footing capacity, and footing width on the design details.

C. Traffic Signal Controllers

The Port Authority standard controller is the Eagle Siemens EPAC NEMA TS-2/Type 2, in compliance with NTCIP standards, or approved equal. The controller shall be capable of transmitting and receiving all of the NTCIP functions to and from the PA Traffic Signal Management System.

The location of the traffic signal controller should be based on the following criteria:

- Offset the controller as far away from the travelled way as practical.
- Location should reduce vulnerability to vehicular crashes.
- Location should not restrict sidewalk accessibility.
- Door on cabinet should open away from traffic to provide the controller maintenance personnel optimal visibility of the signal indications.
- Consider elevating the critical electrical components above the flood elevation.

D. Signal Displays

Polycarbonate signal heads are preferred except where aluminum signals are required, such as for post top-mounted signals and end-mount free-swinging signals. The material type for all sections shall be specified on the contract drawings. Upper tether wires are required for all span wire installations. The minimum requirements set forth in the *MUTCD* shall be met.

1. *Vehicular Signals*:

   a. 12 inch signal sections are required for all vehicular signals, in accordance with the *MUTCD*.

   b. All signal sections shall be LED-type.

   c. It is recommended that two vehicular traffic signal faces be provided for the primary far-side indication for each intersection approach. A near-side vehicular traffic signal face should be provided for stop bar definition, unless geometric or other site constraints exist that precludes its installation. Mast arm traffic signals should have a “near left” / “far right” orientation where practical.

   d. The use of supplemental signal faces should be considered to improve signal visibility where geometric conditions limit visibility. If required, supplemental signal faces should be clamp or post-top-mounted 12 feet above finished roadway grade, unless site conditions dictate a different mounting height. Post top-mounted signals shall not have more than 3 signal sections. Signal faces with 4 signal sections and above shall be clamp mounted on the appropriate traffic signal support.

   e. Span wire signals shall utilize a separate yellow and green arrow signal section arranged in a “doghouse” configuration next to the yellow and green ball when the phasing dictates protected/permissive turning movements. For overhead mast arm installations, the preference is a “doghouse” signal; however a 4-section bi-modal arrow signal may be used.

   f. In areas with overhead sign structures, the signal faces should be designed such that they are not obstructed from the view of approaching vehicles by the structure.

   g. Backplates shall be installed on signal faces to improve signal visibility where conditions present visual distractions (due to sun glare, lighting, signs, buildings, etc.).

2. *Pedestrian Signals and Pushbuttons*:

   a. The use of pedestrian signal heads shall be determined on a site by site basis, according to guidance provided in the *MUTCD.*

   b. Pedestrian signal faces shall be LED units that display a solid Walking Person and Upraised Hand symbols in accordance with the symbol designs that are set forth in the *Standard Highway Signs and Markings Book* and the *MUTCD*. Symbol height shall be 11 inches.

   c. The use of pedestrian interval countdown displays shall be standard for all traffic signal designs. Any accessible pedestrian signals and detectors (e.g., audible tones, tactile arrows, vibrotactile devices, speech messages, etc.) may be considered if appropriate. If used, the requirements of *MUTCD* Chapter 4E shall apply.

   d. Pedestrian signal faces should be mounted eight feet above the sidewalk elevation. If site conditions warrant, pedestrian signals may be mounted to a maximum of 10 feet above the sidewalk elevation to improve visibility.

   e. Pedestrian pushbuttons shall be utilized based upon the following signal operational criteria:

      (i) Semi-Actuated Traffic Signals

         (a) Pushbuttons should be provided to actuate the pedestrian phases associated with minor street approaches equipped with vehicle detectors.
         (b) Pushbuttons are not required on the major street. The major street will operate with pedestrian recall.

      (ii) Fully-Actuated Traffic Signals

         (a) Pushbuttons should be provided on all approaches.
         (b) Pedestrian recall will not be provided in the signal operation.

      (iii)Fixed Time (Pre-Timed) Traffic Signals

         (a) No pushbuttons are needed.
         (b) Pedestrian recall should be provided for the major and minor streets.

   f. Where pedestrian signals are provided, pedestrian pushbuttons shall include signs (R10-3) with appropriate arrow indication [L or R] for crossing path mounted above the pedestrian pushbuttons. Other signs may be used if found to be more appropriate for the specific location.

   g. Where pedestrian signals are not provided, but pedestrian pushbuttons are used, signs (R10-4) shall be provided. The pushbuttons shall provide the minimum green time for a pedestrian crossing, in accordance with the current *MUTCD*.

   h. Pushbuttons must be of the LED latching type.

   i. Pedestrian pushbuttons should be capable of easy activation and conveniently located near each end of the crosswalk (per the *MUTCD*). Pushbuttons shall be placed between 1.5 feet and 6 feet from the curb face and should be no further than 10 feet from the curb face where physical constraints exist. As the pushbuttons must be accessible and installed in accordance with the *ADAAG/ PROWAG* reach ranges, extension of the sidewalk may be necessary to accommodate these requirements.

3. *Visors and Louvers*
   a. Vehicular signal sections should be installed with open tunnel visors.
   b. Where adjacent approaches to an intersection join at an angle of 60 degrees or less, the use of geometrically programmed louvers, angle visors, programmable traffic signal heads or other visibility limiting techniques should be considered. To avoid swinging, which may affect visibility, the designer should consider fix-mounting these signal heads.

E. Signal Phasing and Timing

1. When determining the number of signal phases and the use of protected versus protected/permitted left turn phases, the designer shall consider safety, capacity, geometric and traffic conditions. The use of protected and protected/permitted left turns shall be evaluated on a case-by-case basis. Traffic Engineering shall make the final determination.
2. Signal timing values shall be developed based on an operational analysis of the intersection.
3. Yellow and All–Red times shall be calculated based on the latest edition of the PA Standard Procedures, utilizing the latest version of the PA Traffic Signal Yellow Change and Red Clearance Intervals Worksheet.
4. Pedestrian "Walk" and flashing "Don't Walk" times shall be calculated in accordance with the latest edition of the PA Pedestrian Intervals Worksheet.
5. The criteria for coordinated signals shall consider:
   a. Improving throughput capacity along a roadway corridor.
   b. Controlling queues at closely spaced intersections.
6. The phasing of the intersection should be such that any potential of a yellow-trap situation is eliminated.
7. The following information is to be provided as part of the signal timing:
   a. Minimum Green time (initial): seven seconds minimum for turn slots and side street through movements; 15 seconds minimum for main street through movement.
   b. Maximum Green time.
   c. Yellow time.
   d. All Red time.
   e. Vehicle Extension (typically 2 sec.) for actuated phases.
   f. Pedestrian "Walk" and flashing "Don't Walk" time for each pedestrian phase.
   g. Timing plan number.
   h. Cycle.
   i. System offsets and reference point (for coordinated traffic signal systems only).
   j. Time of day schedule.
   k. When designing a traffic signal within the vicinity of an at-grade railroad (RR) crossing, it must be investigated whether RR pre-emption will be incorporated into the signal operation. Intersection and queuing analyses must be performed to determine if vehicles stopped at a red signal will queue onto the RR tracks. A pre-signal shall be utilized to prevent vehicles from queuing on RR tracks.
8. The new controller shall be compatible with the PA Centralized Traffic Signal Management System.

See drawings SG011, SG014, SG017, SG020, and FAC-INT for sample signal timing formats.

F. Vehicle Detection

Detection shall be designed in accordance with the latest edition of the Institute of Transportation Engineers publication, *Traffic Detector Handbook.* Video detection is preferred if the following criteria can be met. Inductance loops or another technology may be considered based on existing or proposed conditions and deemed acceptable by Traffic Engineering.

1. *Video Detection*:

   The following guidelines shall apply:
   a. The video detection zone shall be centered in the respective lane(s) or approach to a multilane roadway.
   b. See drawings SG003, SG004 and SG005 for video detection sample layouts, spacing, offsets and numbering convention.
   c. The designer shall complete the intersection actuation table; see drawings SG012, SG015, and SG021 for sample format.
   d. The placement of the video sensor for the respective areas of detection should be such that there is a clear and unobstructed view of the area so that any false calls are avoided. Installation must be in accordance with PA details.
   e. The video sensor cable (VSC) for video detection shall run continuously from the camera to the detector card in the controller without splicing.
   f. For any installation that will utilize video detection, a fully functional video detection system shall be provided and installed in the controller cabinet, including a mouse and a video monitor unit.
2. *Inductance Loops*:

   The following guidelines shall apply:
   a. Inductance loop detectors shall be designed using the following offsets:
      (i) For lanes that are 12 feet or greater: 3 feet from face of curb or edge of roadway and 3 feet from adjacent lane.
      (ii) For lanes that are 11 feet: 3 feet from face of curb or edge of roadway and 3 feet from adjacent lane.

(iii) For thorough / right lanes less than 10 feet: 2 feet from face of curb or edge of roadway and 3 feet from adjacent lane. For left turn lanes less than 10 feet: 2 feet from adjacent lane and 3 feet from opposing travel lane.

b. Inductance loops operating in presence mode shall be placed no more than 10 feet nor less than 2 feet behind the extended curbline of the intersecting roadway closest to the approach where detection is being placed.

c. If possible, do not design loops that are within one foot of any manhole, water valve or other appurtenance.

d. Calculate the appropriate inductance based on the number of turns for each loop detector as shown in drawings SG012 and SG015.

e. A separate shielded lead–in cable (with drain wire) shall be specified for each loop that is installed. Lead-in cable shall be installed as a "home run" cable (i.e., no splices) from the splice box to the control cabinet.

f. See drawings SG003, SG004 and SG005 for sample loop detector layouts, spacing, offsets and numbering convention.

g. The designer shall complete the intersection actuation table; see drawings SG012 and SG015 for sample format.

h. Only one loop should be wired to each channel of the loop amplifier.

3. *Emerging Technologies:*

a. Alternate technologies may be considered after video detection and inductance loops have been evaluated and deemed ineffective for the site conditions.

G. Traffic Signal Pullbox and Splice Box Installations

1. Pullboxes shall be designed to accommodate traffic signal cables, conduit, and cables for interconnect communication.
2. Splice boxes shall be utilized for splicing inductance loop detectors to loop detector leads.
3. Pullboxes and splice boxes should be designed so that entering conduit runs are as straight as possible.
4. Pullboxes shall be used whenever there is a change in direction of the conduit runs.
5. For long conduit runs (e.g., communication and/or interconnect cable), pullboxes should be installed every 500 feet.
6. Pullboxes shall be designed and located to accommodate up to 6 conduit run terminations.
7. Pullboxes and splice boxes shall be designed using the following conditions to facilitate signal cable or loop detector installation and future signal modification:

a. Pullboxes shall be installed adjacent to signal poles and controller cabinets to provide access to these facilities.

b. Pullboxes shall be installed on each end of conduits installed under paved roadways.

c. Splice boxes shall be installed on intersection approaches that include multiple inductance loop detector installations to provide a suitable location for splicing roadway loop wires to loop lead-in cables.

H. Conduit Type, Size and Installation

1. Conduits shall be either concrete encased PVC (RNMC-C), rigid galvanized steel (RGS) or flexible steel (FSC) and designed using the following criteria:

a. Traffic signal conduit installed underground between pullboxes shall have a minimum of two – 3" diameter PVC conduits encased in concrete. For locations where conduit fill or excessive conduit terminations is an issue, 4" diameter conduits may be used.

b. Traffic signal conduits installed between signal foundations and pullboxes shall confirm to the following:

(i) One – 4" diameter PVC conduit encased in concrete for steel and aluminum mast arm poles.

(ii) One – 3" diameter PVC conduit encased in concrete for pedestal poles.

(iii)Two – 3" diameter PVC conduit encased in concrete for span wire poles.

c. A minimum of three and a maximum of four conduits shall be installed between controller cabinets and adjacent pullboxes. Can use 3" or 4" diameter PVC conduit as required.

d. Traffic signal conduit installed above ground shall be rigid galvanized steel (RGS) to match the size of the underground conduit.

e. Interconnect and/or communication conduit shall be a minimum of 3" diameter PVC.

f. Detector conduit at curb shall be a minimum of one – 1.5" diameter FSC, installed thru-curb, and accommodate up to 3 inductance loop detectors. If more than 3 inductance loop detectors need accommodation, two – 1.5" conduits shall be installed through the curb.

g. Detector conduit between loop splice boxes and signal pull boxes shall be 1.5" diameter RGS.

h. A separate conduit shall be installed for service power. Conduit for electrical service shall be in accordance with the utility supplying electricity to the intersection and should be coordinated with PA Electrical Engineering.

i. All conduit runs crossing a road shall contain an empty conduit.

2. Conduit sizes shall be determined based on a maximum percent fill of 40%, in accordance with the latest edition of the *National Electrical Code*.
3. Grounding of the underground conduit system shall be in accordance with the current edition of the *National Electrical Code*. All grounding shall terminate at the traffic control cabinet's grounding bus. Conduit for loop detector lead does not need grounding.

4. Ground wire is to be installed continuous throughout the traffic signal system and secured to all ground rods, cabinets, pull boxes and traffic signal bases as noted.
5. Conduit runs should be designed to avoid field bends to the greatest extent possible.
6. A conduit run separate from those carrying voltage conductors is required for communication and/or interconnect.

See drawings SG010, SG013, SG016, and SG019 for sample formats.

I. Traffic Signal Cable Types and Usage

1. The standard conductor size for traffic signal cable applications shall be #14 AWG. Voltage drop calculations shall be performed for the longest cable runs. In cases where the voltage drop exceeds five percent, the conductor size for traffic signal cable shall be #12 AWG. The cable shall be continuous from the base of the traffic signal support to the controller without any splices.
2. Traffic signal conductors shall be assigned in accordance with the wire color codes shown in the Master PA Specification List.
3. Cable assignments shall be shown in the block wiring diagram on the Traffic Signal Wiring drawing. The block wiring diagram shall indicate the cable letter for each cable extending from the controller to the traffic signal pole. The letters shall be assigned sequentially to cables terminating at the signal pole farthest from the control cabinet first, then the second farthest, etc. See drawings SG010, SG013, SG016, and SG019 for sample formats.
4. All wires connected to the controller shall be shown in a block wiring diagram, as depicted on drawings SG010, SG013, SG016, and SG019.
5. Vehicular and pedestrian traffic signal heads and pushbuttons shall not be wired together.
6. A separate neutral shall be provided for each phase and overlap of the vehicular signals.
7. The designer shall calculate the wire fill of all conduits to ensure conformance to the *National Electrical Code*. The following cable areas shall be used:

Cable	Cross Sectional Area	
	#14 AWG	#12 AWG
10/C	0.322 sq. in.	0.383 sq. in.
5/C	0.166 sq. in.	0.198 sq. in.
2/C	0.105 sq. in.	0.124 sq. in.
Ground Wire # 8 AWG (Insulated)	0.056 sq. in.	
Loop Detector Lead (LDL) #14 AWG	0.091 sq. in.	
Video Sensor Cable (VSC)	0.200 sq. in.	

8. The designer shall observe the following criteria:
   a. For mast arm installations, all signal indications should be wired individually on a 10/C cable.
   b. For span wire installations, all signal indications should be wired individually on a 10/C cable or a 5/C cable as required. One spare 10/C cable shall be run across the entire span.
   c. All pedestrian indications shall be individually wired on 5/C cable.
   d. All pushbuttons shall be individually wired on a 2/C cable.
   e. If the above criteria cannot be met due to existing or proposed constraints, the following may be considered:
      (i) 3-Section signal heads that would never be considered in the future to be changed to 4 or 5 section heads can be wired on a 5/C cable.
      (ii) Signal indications on the same phase can utilize the same cable. Signal indications for opposing phases should not be wired on the same cable.
      (iii) Neutrals can be shared on signal heads of the same phase.

J. Uninterruptable Power Supply (UPS)

UPS requirements vary per facility. The designer shall contact the facility electrical maintenance shop for UPS requirements for every project.

Specifications

Based on the Master PA Specification List, the designer shall select all appropriate specifications for each project, which will include all traffic signal items for all disciplines (i.e. specifications for traffic, civil, structural, and electrical). If required for non-standard items, a custom “C Spec.” must be prepared.

Traffic Signal Equipment Numbering Convention

Traffic Signal displays shall be numbered in accordance with the following convention for vehicular and pedestrian signal faces. Intersections shall be orientated on the drawings with the northerly direction pointing either up or to the right. The major road must always run horizontal on the plan sheet.

A. For main line arterials with an east-west orientation, vehicular signals shall be numbered using the priorities indicated below (as shown in Figure 1 and Figure 2). Signal faces shall be numbered from left to right on all approaches:

Priority 1: Signal indications for eastbound traffic
Priority 2: Signal indications for westbound traffic
Priority 3: Signal indications for northbound traffic
Priority 4: Signal indications for southbound traffic

Pedestrian signal displays shall be numbered using the priorities indicated below and shall have a "P" prefix to identify them as pedestrian signals. Pedestrian Pushbuttons shall be numbered utilizing the above convention with a "PB" prefix. The face numbers shall be assigned with the same priorities as vehicle signals, and shall be numbered from left to right (from an approaching vehicle perspective) concurrent with the respective vehicle signal priorities:

Priority 1: Southerly Crosswalk
Priority 2: Northerly Crosswalk
Priority 3: Easterly Crosswalk
Priority 4: Westerly Crosswalk

MAJOR STREET
EAST-WEST ORIENTATION

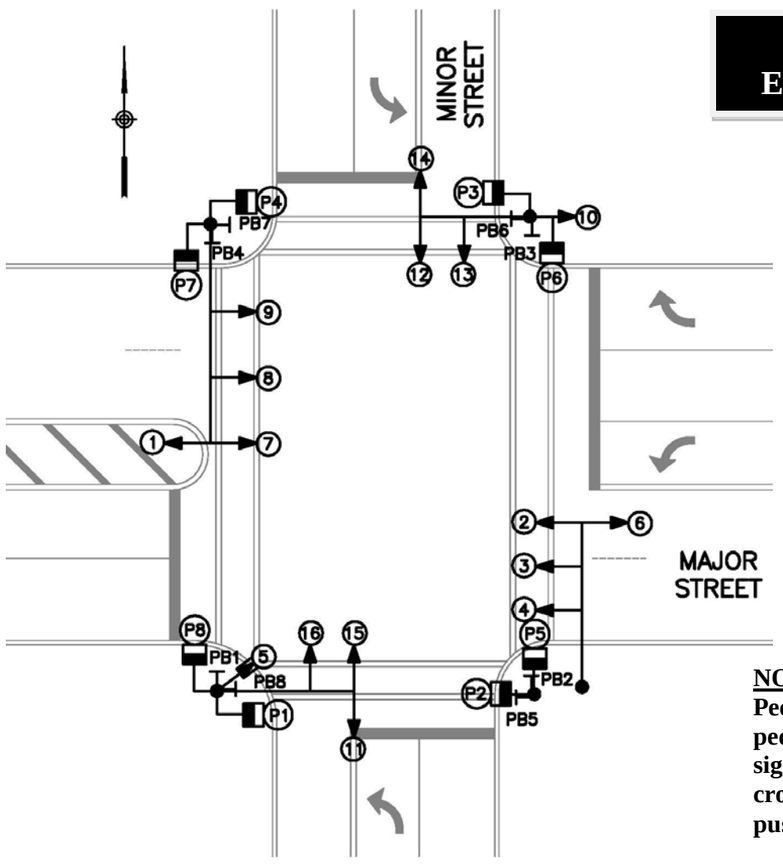


Figure 1: Traffic Signal Numbering Convention - Mast Arm Installation

NOTE:
Pedestrian pushbuttons shall be visible to pedestrians waiting to cross. The pedestrian signs shall show the arrow pointing to the crosswalk actuated by the respective pushbutton.

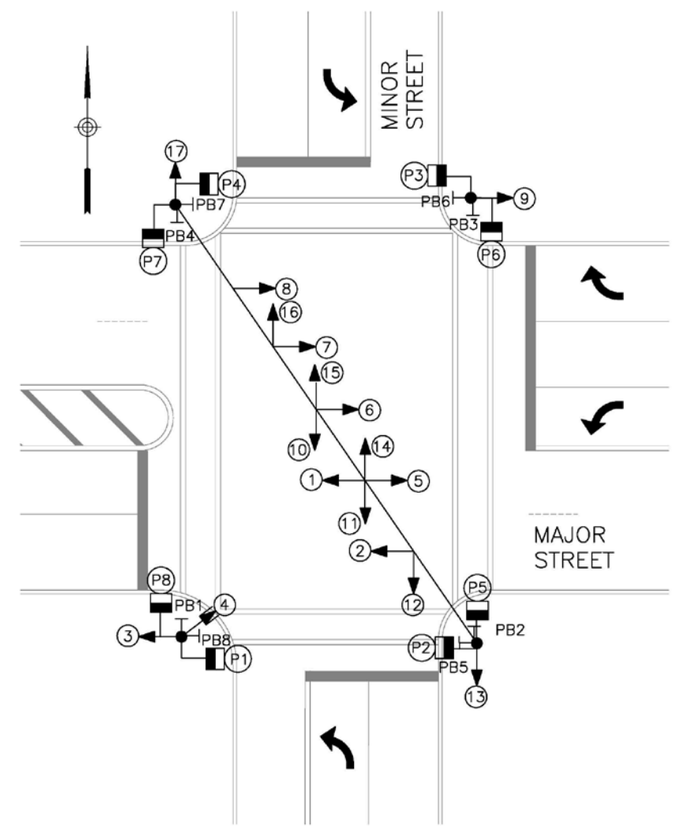


Figure 2: Traffic Signal Numbering Convention – Span Wire Installation

B. For main line arterials with a north-south orientation, vehicular signals shall be numbered using the priorities indicated below (as shown in Figure 3 and Figure 4). Signal faces shall be numbered from left to right on all approaches:

Priority 1: Signal indications for northbound traffic

Priority 2: Signal indications for southbound traffic

Priority 3: Signal indications for westbound traffic

Priority 4: Signal indications for eastbound traffic

Pedestrian signal displays shall be numbered using the priorities indicated below and shall have a "P" prefix to identify them as pedestrian signals. Pedestrian Pushbuttons shall be numbered utilizing the above convention with a "PB" prefix. The face numbers shall be assigned with the same priorities as vehicle signals, and shall be numbered from left to right (from an approaching vehicle perspective) concurrent with the respective vehicle signal priorities:

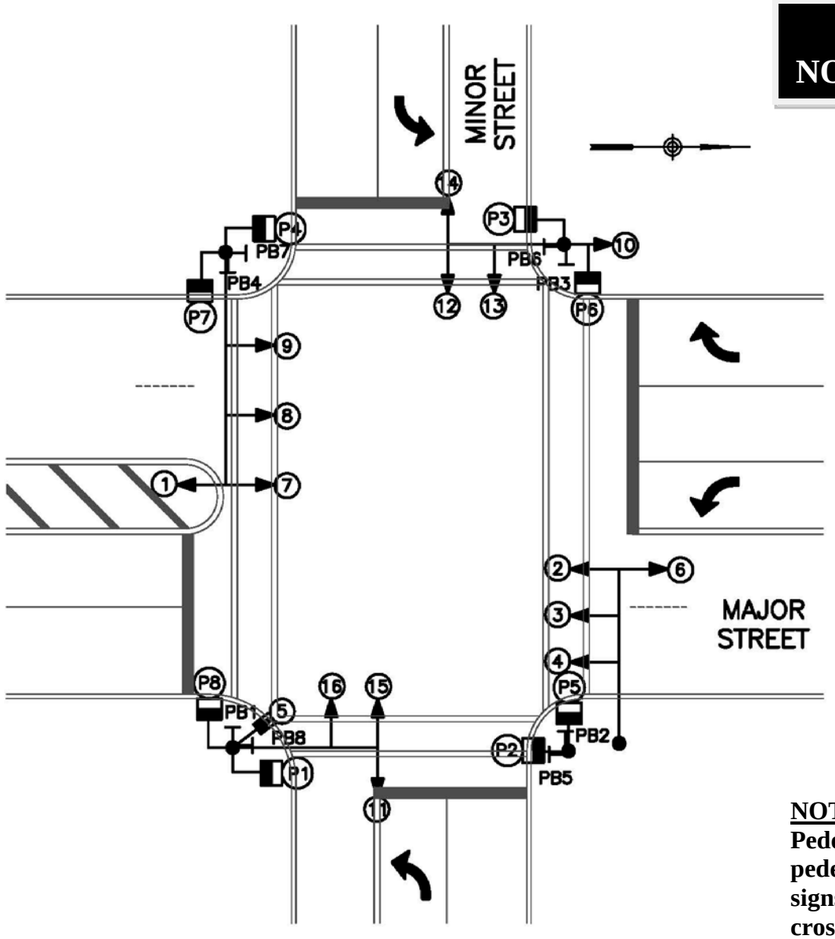
Priority 1: Easterly Crosswalk

Priority 2: Westerly Crosswalk

Priority 3: Northerly Crosswalk

Priority 4: Southerly Crosswalk

MAJOR STREET
NORTH-SOUTH ORIENTATION



NOTE:
Pedestrian pushbuttons shall be visible to pedestrians waiting to cross. The pedestrian signs shall show the arrow pointing to the crosswalk actuated by the respective pushbutton.

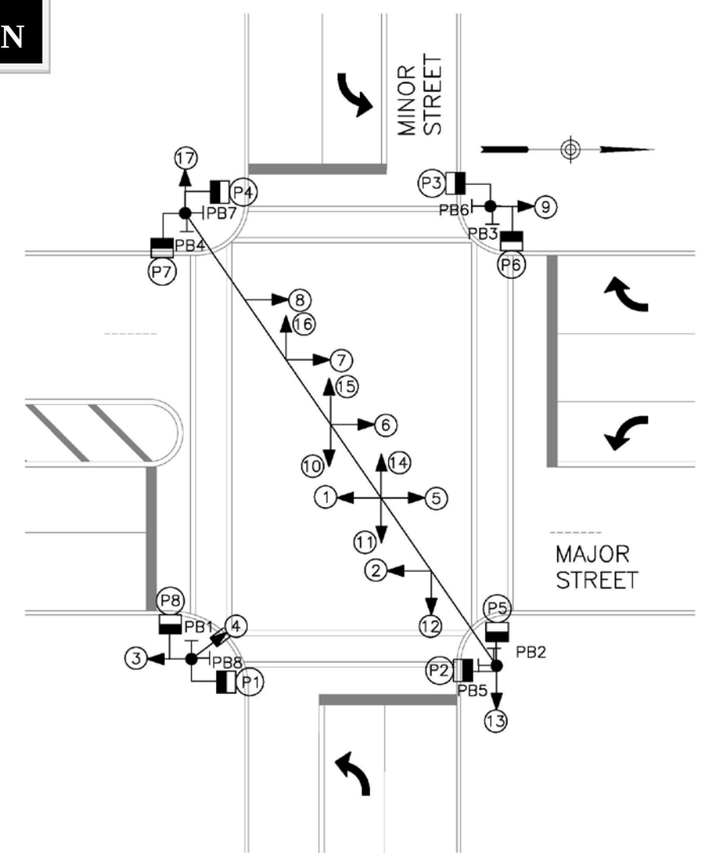


Figure 3: Traffic Signal Numbering Convention - Mast Arm Installation

Figure 4: Traffic Signal Numbering Convention – Span Wire Installation

C. For mid-block crossings, the numbering convention for vehicle and pedestrian signals shall follow the above priorities based on the orientation of the arterial (see Figure 5).

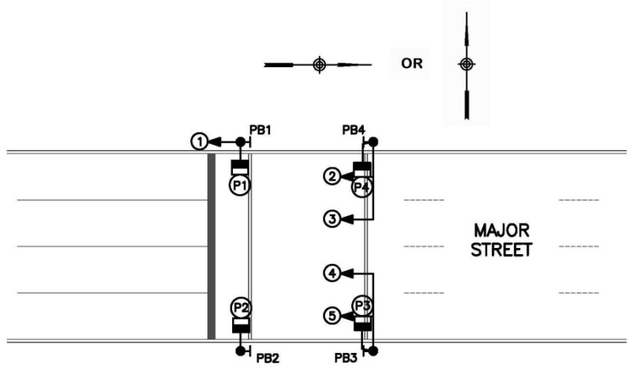


Figure 5: Traffic Signal Numbering Convention – Mid-Block Crossing

Traffic Signal Detection Numbering Convention

The number assigned to each intersection area of detection or detector shall be formatted as follows:

A. Video

First Digit: (V) for video detector

Second Digit: (X) for NEMA phase

Third Digit: (N) for camera number (which should follow the vehicular priority convention)

Fourth Digit: (Y) for detection zone

B. Inductance Loop

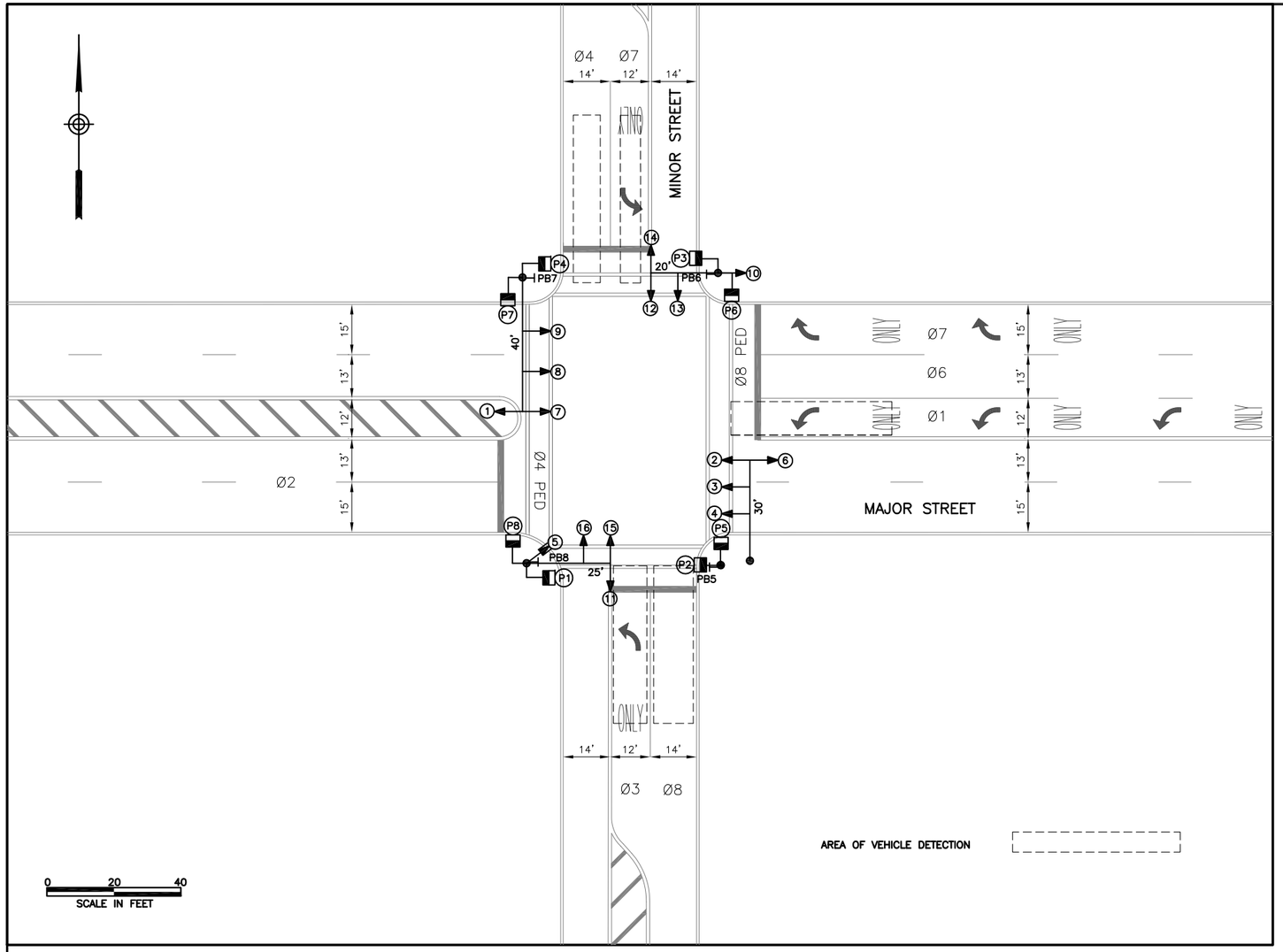
First Digit: (D) for detector.

Second Digit: (X) represents the NEMA phase number associated with the detector.

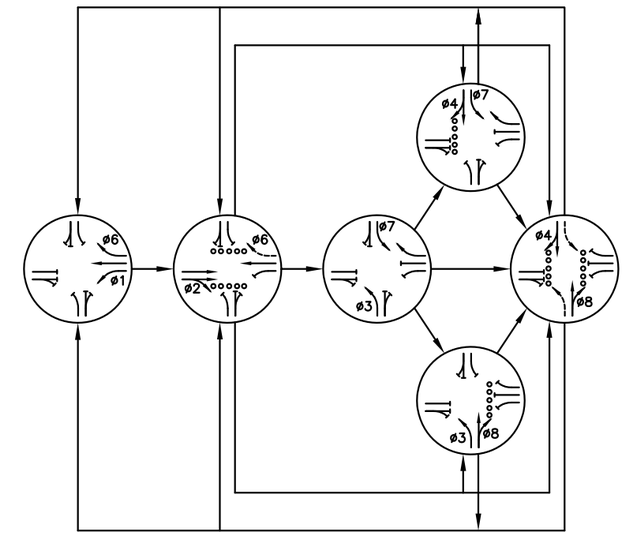
Third Digit: (N) represents the detector unit number associated with each phase (one, two, three, etc.).

Fourth Digit: (Z) represents the detector unit channel assigned to the detector (one or two).

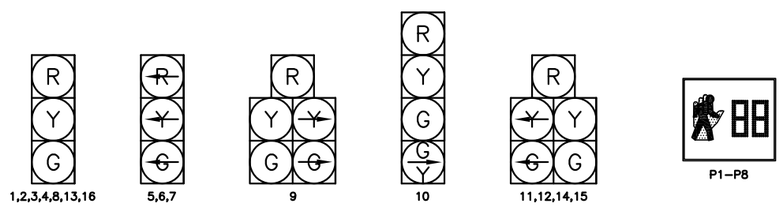
Sample Drawings



PHASING DIAGRAM



SIGNAL LEGEND



SAMPLE OF SEMI-ACTUATED OPERATION

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ENGINEERING DEPARTMENT

TRAFFIC

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TRAFFIC SIGNAL STANDARD DESIGN GUIDELINES

(STAGE 1 AND STAGE 2) SAMPLE MAST ARM TRAFFIC SIGNAL LAYOUT PLAN

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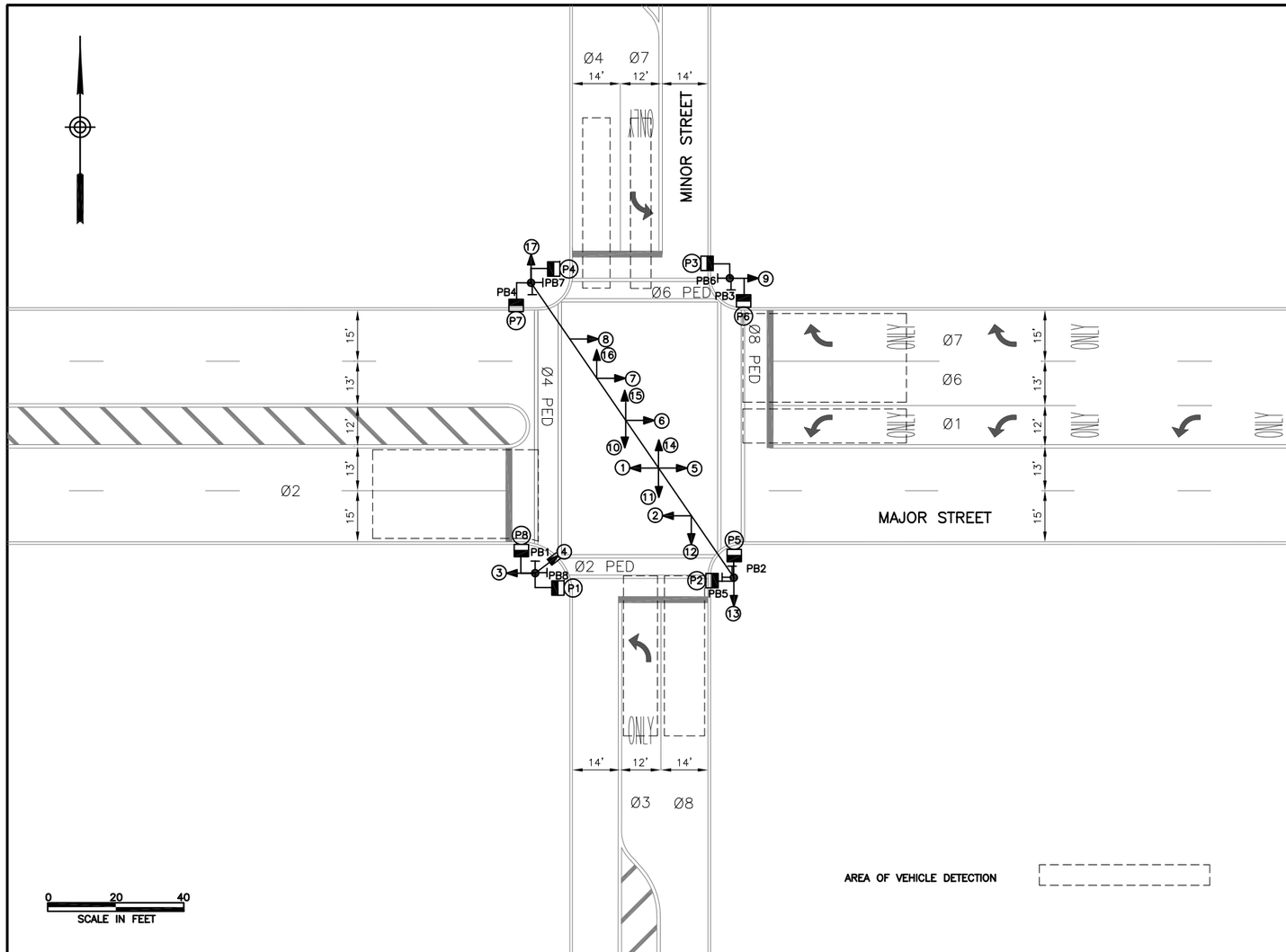
Date **OCTOBER 2012**

Contract Number

Drawing Number **SG001**

PID#



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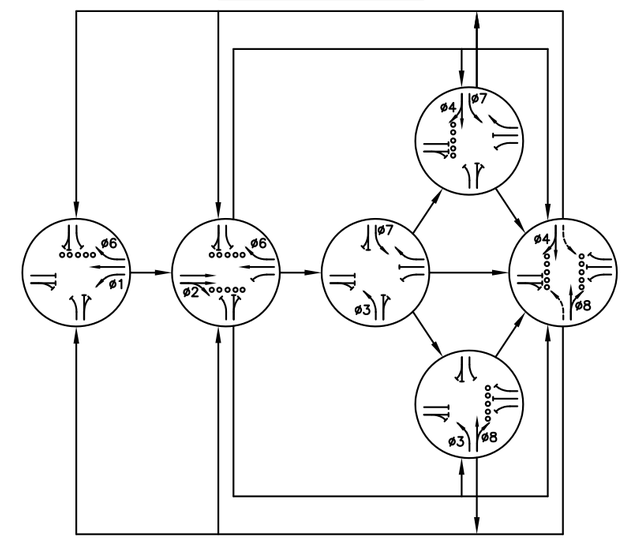
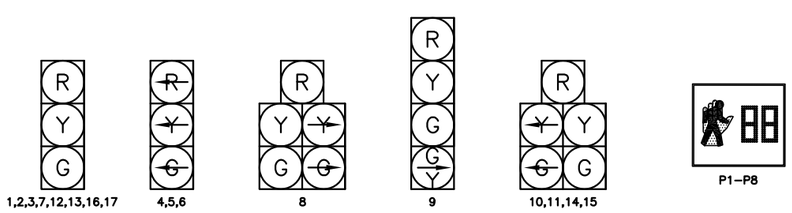


SIGNAL LEGEND



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TRAFFIC SIGNAL STANDARD DESIGN GUIDELINES

(STAGE 1 AND STAGE 2) SAMPLE SPAN WIRE TRAFFIC SIGNAL LAYOUT PLAN

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Contract Number

Drawing Number **SG002**

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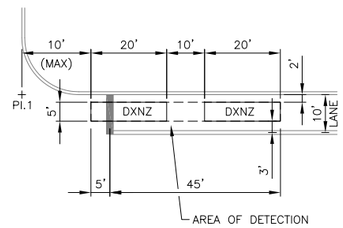
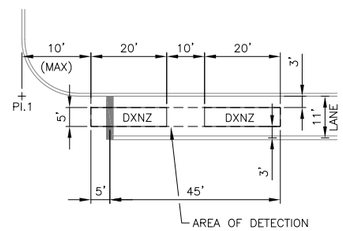
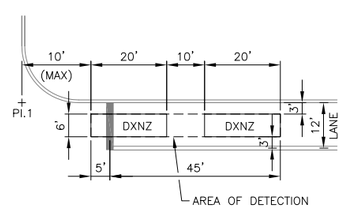
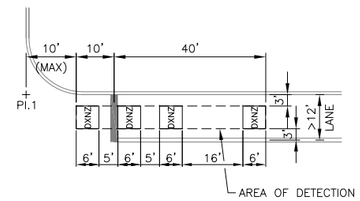
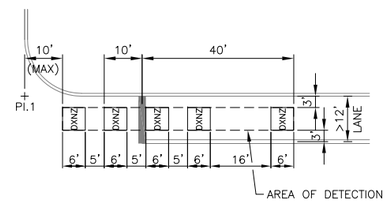


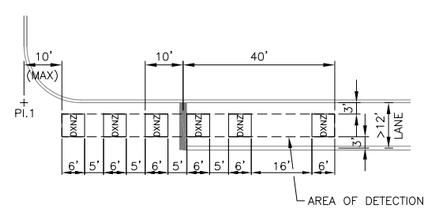




LOOP DETECTOR LAYOUT
SINGLE LANE 12 FEET OR LESS
NTS





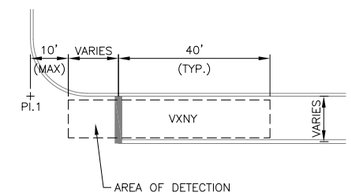


LOOP DETECTOR LAYOUT
SINGLE LANE GREATER THAN 12 FEET
NTS

LOOP DETECTOR NOTES:

THE NUMBER ASSIGNED TO EACH INTERSECTION DETECTOR SHALL CORRESPOND TO A DETECTOR AMPLIFIER CHANNEL AND SHALL BE FORMATTED AS FOLLOWS:

FIRST DIGIT: (D) FOR DETECTOR
SECOND DIGIT: (X) WHERE X REPRESENTS THE NEMA PHASE NUMBER ASSOCIATED WITH THE DETECTOR
THIRD DIGIT: (N) WHERE N REPRESENTS THE DETECTOR UNIT NUMBER ASSOCIATED WITH EACH PHASE (ONE, TWO, THREE, ETC.)
FOURTH DIGIT: (Z) WHERE Z REPRESENTS THE CHANNEL NUMBER FOR EACH LOOP (ONE OR TWO)



AREA OF VIDEO DETECTION
NTS

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THIRD DIGIT: (N) WHERE N REPRESENTS THE CAMERA NUMBER ASSOCIATED WITH THE AREA OF DETECTION
FOURTH DIGIT: (Y) WHERE Y REPRESENTS THE DETECTION ZONE (ONE, TWO, THREE, ETC.)

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TRAFFIC SIGNAL STANDARD DESIGN GUIDELINES

SAMPLE SINGLE LANE DETECTION LAYOUTS

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Contract Number

Drawing Number **SG003**

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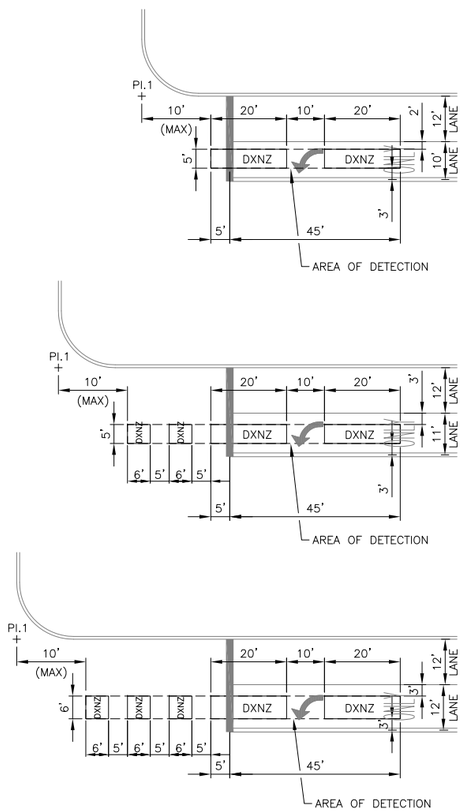
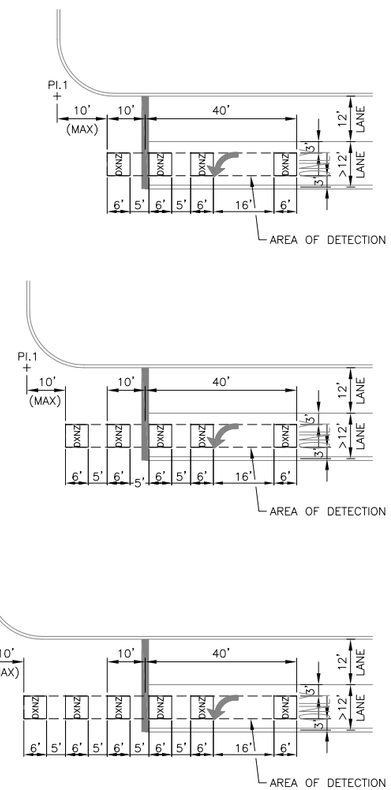


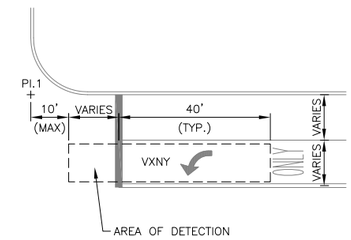
LOOP DETECTOR LAYOUT
LEFT TURN LANE 12 FEET OR LESS

NTS



LOOP DETECTOR LAYOUT
LEFT TURN LANE GREATER THAN 12 FEET

NTS



AREA OF VIDEO DETECTION
LEFT TURN LANE

NTS

LOOP DETECTOR NOTES:

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TRAFFIC SIGNAL STANDARD DESIGN GUIDELINES

SAMPLE
LEFT TURN LANE
DETECTION LAYOUTS

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Contract Number

Drawing Number SG004

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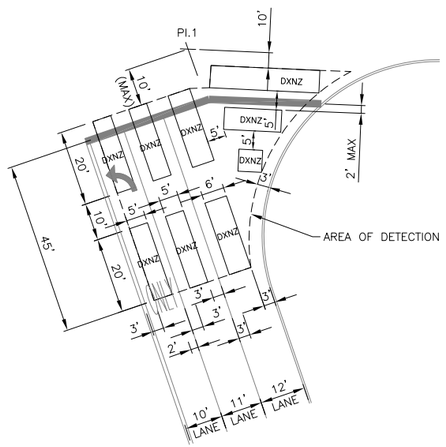

LOOP DETECTOR LAYOUT
MULTI–LANE
NTS

LOOP DETECTOR NOTES:

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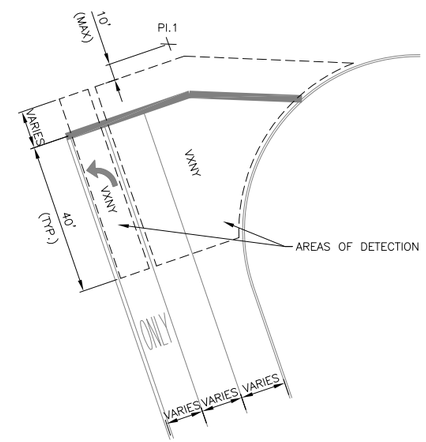

AREA OF VIDEO DETECTION
MULTI–LANE
NTS

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TRAFFIC SIGNAL STANDARD DESIGN GUIDELINES

SAMPLE MULTI-LANE DETECTION LAYOUTS

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Date **OCTOBER 2012**

Contract Number

Drawing Number **SG005**

PID#

GENERAL NOTES (TRAFFIC SIGNALS):

1. PRIOR TO BEGINNING ANY WORK ON THE CONTRACT, NOTIFY THE ENGINEER IN WRITING OF THE DATE MAINTENANCE RESPONSIBILITY OF THE TRAFFIC SIGNAL IS ASSUMED BY THE CONTRACTOR. ASSUME MAINTENANCE RESPONSIBILITY OF THE TRAFFIC SIGNAL UNTIL THE ISSUANCE OF CERTIFICATE OF FINAL COMPLETION BY THE AUTHORITY.

2. EXERCISE CARE WHEN REMOVING AND INSTALLING TRAFFIC SIGNAL EQUIPMENT SHOWN ON THE CONTRACT DRAWINGS. REPAIR OR REPLACE ANY TRAFFIC SIGNAL EQUIPMENT THAT IS DAMAGED DURING THE PERFORMANCE OF THE WORK. NOTIFY THE ENGINEER REGARDING ANY TRAFFIC SIGNAL EQUIPMENT MALFUNCTIONS THAT THE CONTRACTOR DEMONSTRATES TO THE SATISFACTION OF THE ENGINEER ARE NOT THE RESULT OF HIS WORK.

3. MAINTAIN EXISTING TRAFFIC SIGNALS OPERATION DURING CONSTRUCTION. CHANGES TO THE EXISTING TRAFFIC SIGNAL OPERATION SHALL BE AS APPROVED BY THE ENGINEER. TEMPORARY TRAFFIC SIGNALS WILL BE PERMITTED AS APPROVED BY THE ENGINEER AT NO ADDITIONAL COST TO THE AUTHORITY. SUBMIT SHOP DRAWINGS SIGNED BY A NEW YORK STATE/ NEW JERSEY PROFESSIONAL ENGINEER FOR TEMPORARY TRAFFIC SIGNALS THAT INCLUDE SIGNAL LAYOUT, EQUIPMENT, AND PHASING AND TIMING PLANS TO THE ENGINEER FOR APPROVAL.

4. THE TRAFFIC SIGNALS SHALL BE MAINTAINED IN TRAFFIC ACTUATED OPERATION AND ALL VEHICLE DETECTION AND SIGNAL INTERCONNECT, WHERE EXISTING, SHALL BE MAINTAINED. SPLICING OF INDUCTANCE LOOP WIRE, SHIELDED LEAD-IN CABLE AND INTERCONNECT CABLE SHALL BE ALLOWED FOR TEMPORARY REPAIRS DURING CONSTRUCTION ONLY.

5. BAG ALL SIGNAL HEADS THAT ARE OUT OF OPERATION AND VISIBLE TO TRAFFIC.

6. ACCESS TO THE EXISTING CONTROLLER CABINETS SHALL BE REQUESTED THROUGH THE ENGINEER.

7. THE VIDEO DETECTION SYSTEM SHALL BE (specify model number), MANUFACTURED BY (specify vendor) INCLUDING MOUSE AND MONITOR IN EACH CONTROLLER CABINET, NO SUBSTITUTIONS PERMITTED. ALL VIDEO DETECTION EQUIPMENT SHALL BE FURNISHED BY (specify vendor), ALONG WITH INSTALLATION, PROGRAMMING, AND TESTING OF VIDEO EQUIPMENT INSIDE CONTROLLER CABINET, NO SUBSTITUTION ALLOWED. PERSONNEL AT THE (specify location) ELECTRICAL SHOP SHALL BE TRAINED AT THE CONSTRUCTION SITE FOR TWO HOURS IN THE INSTALLATION, SETUP, AND OPERATION OF THE VIDEO DETECTION SYSTEM INSTALLED AT CABINET. NOTIFY THE ENGINEER ONE WEEK IN ADVANCE, IN WRITING, ON WHEN THE TRAINING WILL COMMENCE.

8. PROVIDE AN UNINTERRUPTIBLE POWER SOURCE (UPS) CAPABLE OF SUPPORTING THE LOAD FOR THE EQUIPMENT SHOWN ON THE DESIGN DRAWINGS FOR AN UNINTERRUPTIBLE PERIOD OF (specify number of hours). THE UPS SHALL BE (specify model number), AS MANUFACTURED BY (specify vendor), OR APPROVED EQUAL. MOUNTING FRAME SHALL BE VANDAL RESISTANT.

9. PUSHBUTTON SHALL BE (specify model number) (LATCHING LED MODEL) AS MANUFACTURED BY (specify vendor), OR APPROVED EQUAL. PUSHBUTTON ASSEMBLIES SHALL BE EQUIPPED WITH FRAME FOR "R10 SERIES" PEDESTRIAN CROSSING SIGN.

10. CONTROLLERS SHALL BE EAGLE/SIEMANS EPAC NEMA TS-2/TYPE 2 IN COMPLIANCE WITH NTCIP STANDARDS, OR APPROVED EQUAL. THE CONTROLLER SHALL BE CAPABLE OF TRANSMITTING AND RECEIVING ALL OF THE NTCIP FUNCTIONS TO AND FROM THE SIEMENS i2 TRAFFIC SIGNAL MANAGEMENT SYSTEM. SUBMIT CERTIFICATION FROM THE CONTROLLER MANUFACTURER THAT THE CONTROLLER HAS BEEN FACTORY TESTED TO VERIFY THAT IT MEETS THE REQUIREMENTS OF THE SPECIFICATIONS AND CONTRACT DRAWINGS AND THAT ALL THE NEMA TS2 FUNCTIONS CAN BE MONITORED AND CONTROLLED BY THE SIEMENS i2 TRAFFIC SIGNAL MANAGEMENT SYSTEM. THE TRAFFIC SIGNAL CONTROLLER SHALL ALSO BE EQUIPPED WITH THE FOLLOWING FEATURES:
    A. FIBER OPTIC MODEM (specify model number)
    B. FIBER OPTIC DATA PATCH PANEL (specify model number)
    C. GENERATOR SWITCH HOOK-UP
    D. DATA KEY READER
    E. DATA KEY 2RS-232 PORTS
    F. LATEST SEPAC AND NTCIP SOFTWARE

11. PROGRAM THE CONTROLLER TO PERFORM THE SIGNAL OPERATION AS SHOWN ON THE CONTRACT DRAWINGS. EMPLOY A REPRESENTATIVE OF THE CONTROLLER MANUFACTURER TO PERFORM THE PROGRAMMING.

12. THE CONFLICT MONITOR SHALL BE (specify vendor and model number) OR APPROVED EQUAL.

13. CONDUCT A TRAFFIC SIGNAL PRE-FINAL INSPECTION FOR EACH INTERSECTION IN THE PRESENCE OF THE ENGINEER. UPON COMPLETION OF THE PUNCHLIST ITEMS FROM THE PRE-FINAL INSPECTION, CONDUCT A FINAL INSPECTION IN THE PRESENCE OF THE ENGINEER. NOTIFY THE ENGINEER AT LEAST TWO WEEKS PRIOR TO THE REQUESTED DATES OF BOTH INSPECTIONS. THE SIGNAL OPERATION SHALL UNDERGO A 30-DAY ACCEPTANCE TEST PERIOD AFTER ALL FINAL INSPECTION ITEMS ARE ADDRESSED. FOLLOW PROCEDURES AND PROCESSES AS SPECIFIED IN SECTION 16574C.

14. PRIOR TO THE PRE-FINAL/TURN-ON INSPECTION, SUBMIT A TEST RESULT LETTER TO THE ENGINEER THAT THE CABINET INTERNAL AND REAR BOARD CONNECTIONS, THE CONTROLLER, AND CONFLICT MONITOR HAVE BEEN TESTED.

15. MAKE ANY CORRECTION OR MODIFICATIONS TO THE WORK THAT ARE BE REQUIRED DURING TRAFFIC SIGNAL PRE-FINAL/TURN-ON AND FINAL INSPECTIONS IN ORDER TO COMPLY WITH THE CONTRACT DRAWINGS AT NO ADDITIONAL COST TO THE AUTHORITY.

16. INSTALLATION OF ELECTRICAL SYSTEM SHALL COMPLY WITH REQUIREMENTS AS SPECIFIED IN DIVISION 16 SPECIFICATIONS.

17. TAG ALL WIRES AT POINT OF TERMINATION AT BOTH ENDS AND IN ALL PULL BOXES. SEE CONTRACT DRAWING SG0XX.

18. FURNISH SPARE TRAFFIC SIGNAL EQUIPMENT ACCORDING TO THE FOLLOWING LIST:
    A. (1) CONTROLLER
    B. (1) SIGNAL CONFLICT MONITOR UNIT
    C. (1) VIDEO DETECTION SENSOR (IF APPLICABLE)
    D. (1) VIDEO DETECTION PROCESSOR (IF APPLICABLE)
    E. (2) LOAD SWITCHES
    F. (1) FLASHER UNIT
    G. (1) FLASH TRANSFER RELAY
    H. (1) LOOP DETECTOR AMPLIFIER (IF APPLICABLE)

19. TEST ALL CIRCUITS AND EQUIPMENT FOR PROPER CONNECTIONS BEFORE THE ELECTRICAL SYSTEM IS ENERGIZED (CONTINUITY CHECKS).

20. FURNISH AND INSTALL GROUND WIRE (GND), 1/C #8 AWG, INSULATED (COLOR GREEN) CONTINUOUSLY THROUGHOUT THE TRAFFIC SIGNAL SYSTEM AND SECURE TO ALL GROUND RODS, CABINETS AND TRAFFIC SIGNAL BASES.

21. WHERE EXISTING DUCTBANK IS SHOWN ON THE CONTRACT DRAWINGS AS ABANDONED, REMOVE ALL CABLES AND WIRES FROM THE DUCTBANK AND PLUG EACH CONDUIT OF THE DUCTBANK.

22. UNLESS OTHERWISE SHOWN ON CONTRACT DRAWINGS, CONCRETE SHALL HAVE A MINIMUM 28 DAY COMPRESSIVE STRENGTH (f'c) OF 4000 PSI IN ACCORDANCE WITH SPECIFICATION 03301. SUBMIT MIX DESIGN TO THE ENGINEER FOR APPROVAL.

23. ALL REINFORCING BARS SHALL BE ASTM A615, GRADE 60, 709-01, UNLESS OTHERWISE NOTED.

24. DELIVER ALL REMOVED EXISTING ABOVE GROUND TRAFFIC SIGNAL EQUIPMENT TO THE (specify applicable facility) ELECTRICAL SHOP LOCATED IN (specify location). NOTIFY THE ENGINEER PRIOR TO DELIVERY.

25. DISCONNECT (OR CONNECT) MANUAL CONTROL FOR TRAFFIC SIGNAL CONTROLLER.

26. ALL VEHICULAR AND PEDESTRIAN TRAFFIC SIGNAL INDICATIONS SHALL BE LED.

GENERAL NOTES (PULLBOXES AND SPLICE BOXES):

1. THE LOCATIONS OF THE PULLBOXES AND SPLICE BOXES ARE APPROXIMATE AND ARE SUBJECT TO APPROVAL BY THE ENGINEER PRIOR TO CONSTRUCTION.

2. PULLBOXES AND SPLICE BOXES SHALL NOT BE INSTALLED AT A PEDESTRIAN ACCESS RAMP.

3. IF INSTALLED WITHIN A SIDEWALK, THE PULLBOX AND SPLICE BOXES SHALL BE ALIGNED FLUSH WITH THE SURFACE OF THE SURROUNDING SIDEWALK.

4. PULLBOXES AND SPLICE BOXES INSTALLED IN ROADSIDE BERMS, SIDEWALKS OR MEDIANS, PAVED OR UNPAVED, SHALL BE ALIGNED FLUSH WITH THE SURROUNDING SURFACE.

USER INSTRUCTIONS

1. THE SAMPLE GENERAL NOTES ARE DESIGNED TO BE USED IN THE CONSTRUCTION OF A VARIETY OF DIFFERENT PROJECTS. THE USER (ENGINEER, DESIGNER, TASK LEADER) IS RESPONSIBLE FOR ENSURING THAT THE GENERAL NOTES USED ARE APPROPRIATE FOR THE APPLICATION AND THAT ANY SPECIFIC PROJECT DATA OR INFORMATION IS FILLED IN ACCORDINGLY.

2. ADDITIONAL NOTES MAY BE USED FOR SPECIFIC PROJECT REQUIREMENTS AND SPECIAL CONDITIONS ENCOUNTERED AT THE VARIOUS PORT AUTHORITY FACILITIES.

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TRAFFIC

Title

TRAFFIC SIGNAL STANDARD DESIGN GUIDELINES

SAMPLE TRAFFIC SIGNAL GENERAL NOTES

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Date OCTOBER 2012

Contract Number

Drawing Number SG006

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LEGEND

	NEW	EXISTING	REMOVAL	
TRAFFIC SIGNAL CONTROLLER – GROUND MOUNTED				
TRAFFIC SIGNAL CONTROLLER – POLE MOUNTED				
TRAFFIC SIGNAL PULLBOX				
LOOP DETECTOR SPLICE BOX	SB	SB	SB	
TRAFFIC SIGNAL VEHICULAR HEAD WITH IDENTIFIER	X	X	X	X IS THE VEHICULAR SIGNAL HEAD NUMBER
TRAFFIC SIGNAL VEHICULAR HEAD (LOUVERED) WITH IDENTIFIER	X	X	X	X IS THE VEHICULAR SIGNAL HEAD NUMBER
TRAFFIC SIGNAL PEDESTRIAN HEAD WITH IDENTIFIER	PX	PX	PX	X IS THE PEDESTRIAN SIGNAL HEAD NUMBER
TRAFFIC SIGNAL PEDESTRIAN PUSH BUTTON WITH IDENTIFIER	PBX	PBX	PBX	X IS THE PEDESTRIAN PUSHBUTTON NUMBER
MAST ARM POLE	X	X	X	X IS THE MAST ARM LENGTH
TRAFFIC SIGNAL POLE				
SPAN WIRE WITH STEEL POLES				
TRAFFIC SIGNAL LOOP DETECTOR WITH IDENTIFIER	DXNZ	DXNZ	DXNZ	DXNZ IS THE LOOP DETECTOR IDENTIFIER
VIDEO DETECTION ZONE	VXNY	VXNY		VXNY IS THE VIDEO AREA IDENTIFIER
VIDEO DETECTOR	VX	VX	VX	X IS THE VIDEO SENSOR NUMBER
TRAFFIC SIGNAL UNDERGROUND CONDUIT				
POLE MOUNTED REGULATORY OR WARNING SIGN				
STREET NAME SIGN MOUNTED ON MAST ARM				
STREET NAME SIGN MOUNTED ON SPAN WIRE				
SERVICE MANHOLE	E	E	E	
DUCTBANK				
DUCTBANK ENCASED IN CONCRETE				
PEDESTRIAN MOVEMENT				
VEHICLE MOVEMENT	øX			

DUCTBANK FORMATION – THE NUMBER OF CONDUIT AND ARRANGEMENT FOR EACH DUCTBANK SHALL BE PREPARED FROM THE FOLLOWING SYMBOLS:

- ● DENOTES INSTALLING NEW CONDUIT WITH NEW CABLES OR WIRES
- ○ DENOTES SPARE CONDUITS
- ⊖ DENOTES EXISTING CONDUIT WITH EXISTING CABLES OR WIRES TO REMAIN
- ⊗ DENOTES ABANDONING EXISTING CONDUIT AND THE REMOVAL OF EXISTING CABLES OR WIRES
- DENOTES THE INSTALLATION OF NEW CABLES OR WIRES IN EXISTING CONDUIT WITH THE EXISTING CABLES OR WIRES TO REMAIN
- DENOTES THE INSTALLATION OF NEW CABLES OR WIRES IN EXISTING CONDUIT AFTER THE EXISTING CABLES OR WIRES ARE REMOVED

USER INSTRUCTIONS

1. THE USER (ENGINEER, DESIGNER, TASK LEADER) IS RESPONSIBLE FOR ENSURING THAT ONLY SYMBOLS SPECIFIC TO THE PROJECT ARE PROVIDED ON THIS SHEET AND UTILIZE THE RESPECTIVE SYMBOLS IN THE DESIGN CENTER.

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TRAFFIC SIGNAL STANDARD DESIGN GUIDELINES

SAMPLE TRAFFIC SIGNAL LEGEND

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Contract Number

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ABBREVIATIONS (FOR SG DRAWINGS ONLY)

C	CONDUIT
CCS	CONTROLLER CABINET SKIRT
CFP	CONTROLLER FOUNDATION, TYPE P
DWG	DRAWING
FSC	FLEXIBLE LIQUID–TIGHT STEEL CONDUIT
GND	GROUND
LDL	LOOP DETECTOR LEAD
NO	NUMBER
NTS	NOT TO SCALE
PBA	PEDESTRIAN PUSH BUTTON ASSEMBLY
PI.X	POINT OF INTERSECTION OF CURB LINE EXTENDED
PTS	PEDESTRIAN TRAFFIC SIGNAL (CLAMP MOUNTED ON A SIGNAL POLE)
PV–1	VEHICLE SIGNAL, POST TOP MOUNTED ON A SIGNAL PEDESTAL
PV–2	2 VEHICLE SIGNALS, POST TOP MOUNTED ON A SIGNAL PEDESTAL
RGS	RIGID GALVANIZED STEEL CONDUIT
RNMC–C	RIGID NON–METALLIC CONDUIT, TYPE PVC–H, ENCASED IN CONCRETE
SME	SIDE MOUNT ENCLOSURE
SPF	FOUNDATIONS, TYPE SPF
SFT	FOUNDATIONS, TYPE SFT
SFK	FOUNDATIONS, TYPE SFK
STF	FOUNDATIONS, TYPE STF
SP(XX')	SIGNAL PEDESTAL (POLE HEIGHT ABOVE GROUND)
TSS–T	TRAFFIC SIGNAL SUPPORTS, TYPE T
TSS–K	TRAFFIC SIGNAL SUPPORTS, TYPE K
TSS–S	TRAFFIC SIGNAL SUPPORTS, TYPE S
UPS	UNINTERRUPTIBLE POWER SOURCE
VIP	VIDEO INPUT PROCESSOR
VS (VX)	VIDEO SENSOR (WITH RESPECTIVE SENSOR NUMBER(S))
VSC (VX)	VIDEO SENSOR CABLE (WITH RESPECTIVE SENSOR NUMBER(S))

ABBREVIATIONS (FOR REMOVAL PURPOSES ONLY)

TSH (X)	TRAFFIC SIGNAL HEAD (WITH RESPECTIVE HEAD NUMBER(S))
TSMA–A	TRAFFIC SIGNAL MAST ARM, ALUMINUM
TSMA–S	TRAFFIC SIGNAL MAST ARM. STEEL

TSA–15M–1	TRAFFIC SIGNAL ASSEMBLIES, TYPE 15M–1
TSA–15M–2	TRAFFIC SIGNAL ASSEMBLIES, TYPE 15M–2
TSA–20M–1	TRAFFIC SIGNAL ASSEMBLIES, TYPE 20M–1
TSA–20M–2	TRAFFIC SIGNAL ASSEMBLIES, TYPE 20M–2
TSA–25MK–1	TRAFFIC SIGNAL ASSEMBLIES, TYPE 25MK–1
TSA–25MK–2	TRAFFIC SIGNAL ASSEMBLIES, TYPE 25MK–2
TSA–30S–1	TRAFFIC SIGNAL ASSEMBLIES, TYPE 30S–1
TSA–30S–2	TRAFFIC SIGNAL ASSEMBLIES, TYPE 30S–2
TSA–35S–1	TRAFFIC SIGNAL ASSEMBLIES, TYPE 35S–1
TSA–35S–2	TRAFFIC SIGNAL ASSEMBLIES, TYPE 35S–2
TSA–40S–1	TRAFFIC SIGNAL ASSEMBLIES, TYPE 40S–1
TSA–40S–2	TRAFFIC SIGNAL ASSEMBLIES, TYPE 40S–2
TSA–45S–1	TRAFFIC SIGNAL ASSEMBLIES, TYPE 45S–1
TSA–45S–2	TRAFFIC SIGNAL ASSEMBLIES, TYPE 45S–2
TSA–50S–1	TRAFFIC SIGNAL ASSEMBLIES, TYPE 50S–1
TSA–50S–2	TRAFFIC SIGNAL ASSEMBLIES, TYPE 50S–2
TSA–55S–1	TRAFFIC SIGNAL ASSEMBLIES, TYPE 55S–1
TSA–55S–2	TRAFFIC SIGNAL ASSEMBLIES, TYPE 55S–2
TSA–60S–1	TRAFFIC SIGNAL ASSEMBLIES, TYPE 60S–1
TSA–60S–2	TRAFFIC SIGNAL ASSEMBLIES, TYPE 60S–2
TSA–C–1	TRAFFIC SIGNAL ASSEMBLIES, TYPE C–1
TSA–MM–1	TRAFFIC SIGNAL ASSEMBLIES, TYPE MM–1
TSA–H–1	TRAFFIC SIGNAL ASSEMBLIES, TYPE H–1
2/C	TRAFFIC SIGNAL CABLE, 2 CONDUCTOR
5/C	TRAFFIC SIGNAL CABLE, 5 CONDUCTOR
10/C	TRAFFIC SIGNAL CABLE, 10 CONDUCTOR

DESCRIPTION OF TRAFFIC SIGNAL ASSEMBLY ABBREVIATIONS

1. TRAFFIC SIGNAL ASSEMBLIES SHALL CONSIST OF TRAFFIC SIGNAL ARM, FURNISHED AND INSTALLED ON A TRAFFIC SIGNAL SUPPORT COMPLETE WITH MAST ARM HANGER AND SPIDER ASSEMBLIES, OR MOUNTING BRACKET ASSEMBLY, AS REQUIRED, SAFETY CHAINS, TRAFFIC SIGNAL HEADS, MISCELLANEOUS HARDWARE AND FITTINGS, AND TRAFFIC SIGNAL CABLE FROM THE TERMINAL BLOCK OF EACH SIGNAL FACE TO THE BASE OF THE TRAFFIC SIGNAL SUPPORT.

2. TRAFFIC SIGNAL ASSEMBLIES DESIGNATED WITH THE LETTER M SHALL CONSIST OF ASSEMBLIES HAVING A TRAFFIC SIGNAL ARM OF THE ALUMINUM MAST ARM TYPE WHICH SHALL FIT A SIGNAL POLE, TYPE T.

3. TRAFFIC SIGNAL ASSEMBLIES DESIGNATED WITH THE LETTERS MK SHALL CONSIST OF ASSEMBLIES HAVING A TRAFFIC SIGNAL ARM OF THE ALUMINUM MAST ARM TYPE WHICH SHALL FIT A SIGNAL POLE, TYPE K.

4. TRAFFIC SIGNAL ASSEMBLY DESIGNATED WITH THE LETTER S SHALL CONSIST OF ASSEMBLIES HAVING A TRAFFIC SIGNAL ARM OF THE STEEL MAST ARM TYPE WHICH SHALL FIT A SIGNAL POLE, TYPE S.

5. TRAFFIC SIGNAL ASSEMBLY TYPE C–1 SHALL CONSIST OF ONE TRAFFIC SIGNAL HEAD WITH POLE CLAMP MOUNTING FURNISHED AND INSTALLED ON A TRAFFIC SIGNAL SUPPORT. THE ITEM SHALL ALSO INCLUDE MISCELLANEOUS FITTINGS, THE DRILLING OF THE SUPPORT, INSTALLING THE GROMMET, AND TRAFFIC SIGNAL CABLE FROM THE TERMINAL BLOCK OF EACH SIGNAL FACE TO THE BASE OF THE SUPPORT.

6. TRAFFIC SIGNAL ASSEMBLY TYPE MM–1 SHALL CONSIST OF A MIDMOUNTED TRAFFIC SIGNAL HEAD FURNISHED AND INSTALLED ON A MAST ARM, COMPLETE MOUNTING HARDWARE, DRILLING THE ARM, GROMMET, MIDMOUNT BRACKET ASSEMBLY, SAFETY CHAIN, ONE TRAFFIC SIGNAL HEAD, AND TRAFFIC SIGNAL CABLE FROM THE TERMINAL BLOCK OF EACH FACE TO THE BASE OF THE TRAFFIC SIGNAL SUPPORT.

7. TRAFFIC SIGNAL ASSEMBLIES DESIGNATED WITH THE LETTER H SHALL CONSIST OF FURNISHING AND INSTALLING A TRAFFIC SIGNAL HEAD AT THE END OF AN EXISTING TRAFFIC SIGNAL MAST ARM. THE ITEM SHALL ALSO INCLUDE THE REQUIRED MAST ARM HANGER OR MOUNTING BRACKETS, SAFETY CHAIN, MISCELLANEOUS FITTINGS, AND TRAFFIC SIGNAL CABLE FROM THE TERMINAL BLOCK OF THE TRAFFIC SIGNAL HEAD TO THE BASED OF THE STANDARD.

8. TRAFFIC SIGNAL ASSEMBLIES SHALL CONFORM TO THE FOLLOWING TABLE:

TYPE	ARM LENGTH (FT)	NO. OF SIGNAL HEADS	NO. OF SPIDER ASSEMBLIES
15M–1	15	1	0
15M–2	15	2	1
20M–1	20	1	0
20M–2	20	2	1
25MK–1	25	1	0
25MK–2	25	2	1
30S–1	30	1	0
30S–2	30	2	1
35S–1	35	1	0
35S–2	35	2	1
40S–1	40	1	0
40S–2	40	2	1
45S–1	45	1	0
45S–2	45	2	1
50S–1	50	1	0
50S–2	50	2	1
55S–1	55	1	0
55S–2	55	2	1
60S–1	60	1	0
60S–2	60	2	1
C–1	N/A	1	0
H–1	N/A	1	0
MM–1	N/A	1	0

USER INSTRUCTIONS

1. THE USER (ENGINEER, DESIGNER, TASK LEADER) IS RESPONSIBLE FOR ENSURING THAT ONLY ABBREVIATIONS SPECIFIC TO THE PROJECT ARE PROVIDED ON THIS SHEET IN ACCORDANCE WITH THE PA STANDARD SPECIFICATIONS.

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TRAFFIC SIGNAL STANDARD DESIGN GUIDELINES

SAMPLE TRAFFIC SIGNAL ABBREVIATIONS

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Designed by Drawn by Checked by

Date OCTOBER 2012

Contract Number

Drawing Number SG008

PID#

DESIGNER'S CHECKLIST

TRAFFIC SIGNAL DRAWING CHECKLIST

VERIFY THAT THE FOLLOWING ITEMS WERE CHECKED:

1. OVERHEAD CONFLICTS ☐
2. UNDERGROUND CONFLICTS ☐
3. CONE OF VISION ☐
4. ADVANCE VISIBILITY OF SIGNAL HEADS ☐
5. POLE OFFSETS FIELD VERIFIED ☐
6. HANDICAP RAMP LOCATIONS ☐
7. DRIVEWAY ACCESS IMPACTS ☐
8. NEED FOR CROSSWALKS ☐
9. NEED FOR PEDESTRIAN SIGNALS ☐
10. PEDESTRIAN PUSHBUTTON ACCESSIBILITY ☐

ADDITIONAL NOTES:

PROVIDE RESPONSES TO THE FOLLOWING ITEMS:

11. POSTED/85TH PERCENTILE SPEED _____
12. PART OF COORDINATED SYSTEM _____
13. CROSSWALK WIDTHS _____
14. GUIDERAIL/TRAFFIC BARRIER NEEDED _____
15. PEDESTRIAN SIGNAL MOUNTING HEIGHT _____
16. VEHICLE SIGNAL POLE CLAMPING HEIGHT _____
17. OVERHEAD CLEARANCE OF SIGNAL HEADS _____
18. NEED AESTHETIC COATING FOR HARDWARE _____
19. NEED FOR BACKPLATES _____
20. STEEL MAST ARMS REQUIRED _____
21. TYPE OF SIGNAL VISORS _____
22. NEED FOR LIMITED VISIBILITY SIGNALS _____
23. VOLUME DENSITY OPERATION APPLICABLE _____
24. NEED FOR SYSTEM DETECTORS _____
25. NEED FOR MULTIPLE TIMING PLANS _____
26. NEED FOR PROTECTED TURNS _____
27. NEED FOR RIGHT TURN OVERLAP _____
28. NEED FOR RTOR RESTRICTION _____
29. ARE UPSTREAM SIGNAL HEADS VISIBLE _____
30. MAST ARM SIGN AND MOUNTING TYPE _____
31. MANUAL CONTROL REQUIRED _____
32. NEED FOR UPS _____
33. TYPE OF COMMUNICATION _____

USER INSTRUCTIONS

1. THIS CHECKLIST WILL NOT BE INCLUDED IN THE DRAWING SET, HOWEVER IT MUST BE SUBMITTED AS BACKUP FOR REVIEW BY PA TRAFFIC.

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TRAFFIC SIGNAL STANDARD DESIGN GUIDELINES

SAMPLE DESIGNER'S CHECKLIST

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Designed by Drawn by Checked by

Date OCTOBER 2012

Contract Number

Drawing Number SG009

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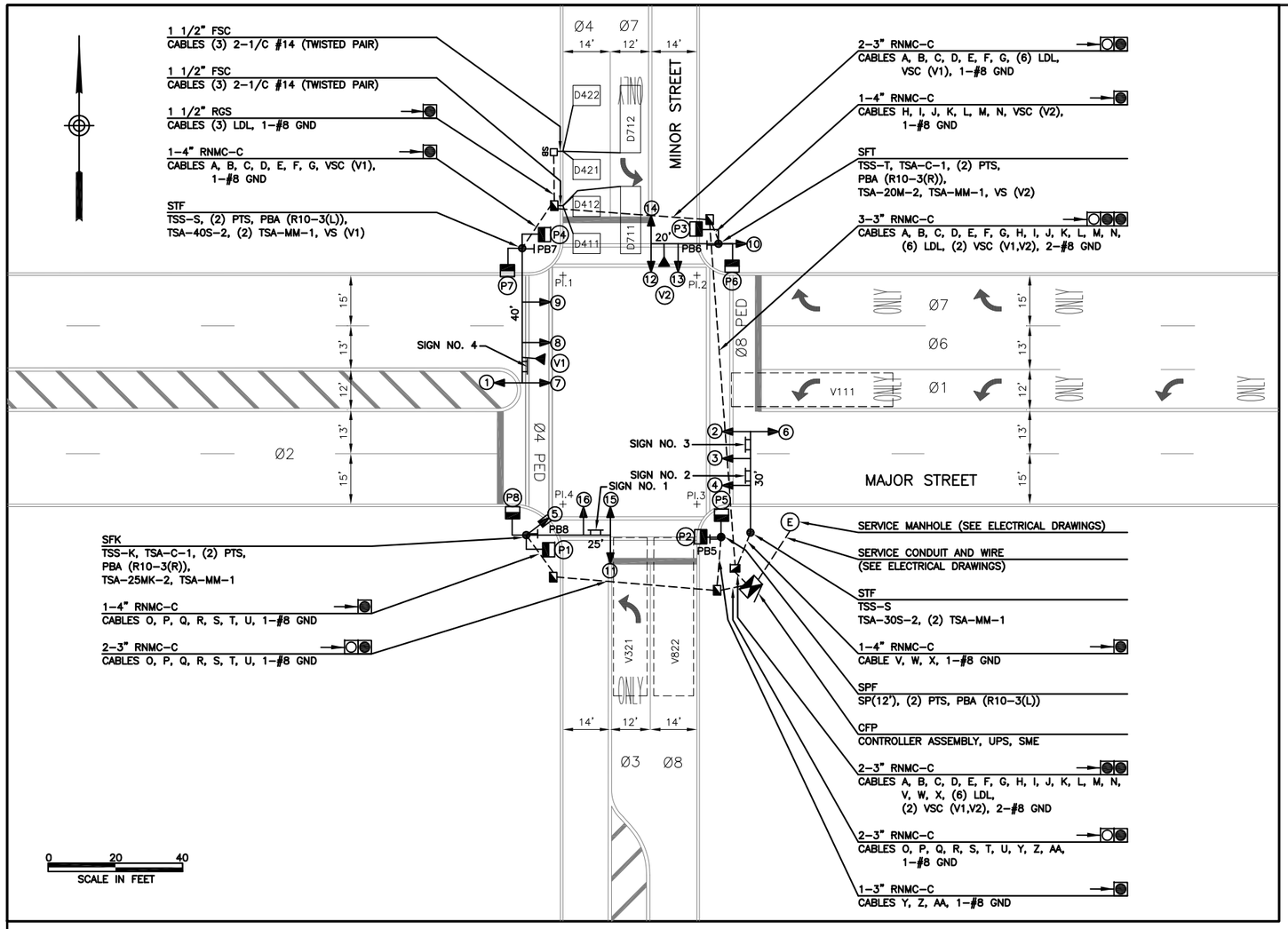
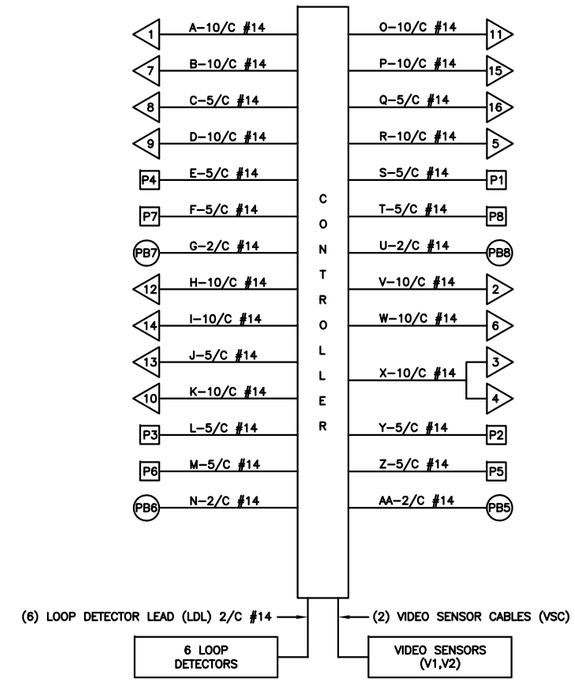


BLOCK WIRING DIAGRAM



LEGEND

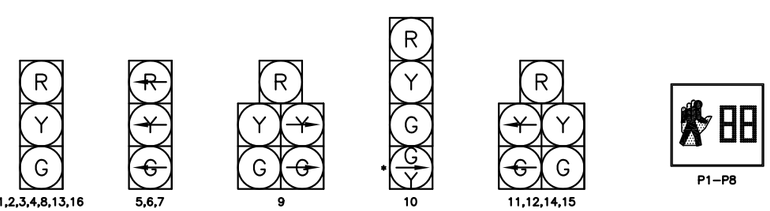
NEW

- VEHICLE SIGNAL HEAD (TYP.)
- PEDESTRIAN SIGNAL HEAD (TYP.)
- PUSH BUTTON (TYP.)

NOTES:

1. THE LOCATIONS OF TRAFFIC POLES AND SIGNALS ARE EXACT AS SHOWN IN THE CONTRACT DOCUMENTS. ANY CHANGES IN TRAFFIC POLE OR SIGNAL LOCATIONS DUE TO FIELD CONDITIONS SHALL BE APPROVED BY THE ENGINEER.
2. VEHICLE SIGNAL HEADS #11, #12, #14, AND #15 SHALL BE ALUMINUM.
3. TRAFFIC SIGNAL INDICATIONS #1, #2, #3, #4, #6, #7, #8, AND #9 SHALL BE EQUIPPED WITH BACKPLATES.
4. ANGLE VISORS SHALL BE FURNISHED AND INSTALLED ON ALL INDICATIONS FOR SIGNAL HEAD #5 TO BLOCK VISIBILITY FROM THE #4 APPROACH.
5. PEDESTRIAN PUSHBUTTONS SHALL BE INSTALLED AT THE ORIENTATION SHOWN, AND SHALL BE VISIBLE TO PEDESTRIANS WAITING TO CROSS. PEDESTRIAN SIGNAL SIGNS R10-3(L/R) SHALL SHOW THE ARROW POINTING TO THE CROSSWALK ACTUATED BY THE PUSHBUTTON.
6. VEHICLE SIGNAL HEADS #5 AND #10 SHALL BE MOUNTED AT 12 FEET.
7. ALL PEDESTRIAN SIGNAL HEADS SHALL BE CLAMP MOUNTED AT 8 FEET.
8. REFER TO SIGN DATA TABLE FOR SIGN DETAILS.
9. SIGN NO. 3 SHALL BE INSTALLED FACING WEST (EASTBOUND TRAFFIC) AND SIGN NO. 4 SHALL BE INSTALLED FACING EAST (WESTBOUND TRAFFIC).
10. THE CONTROLLER CABINET SHALL BE INSTALLED AT AN ORIENTATION AS SHOWN ON THE PLAN.
11. SPARE WIRES SHALL TERMINATE AT THE TERMINAL BLOCK IN THE SIGNAL HEAD.

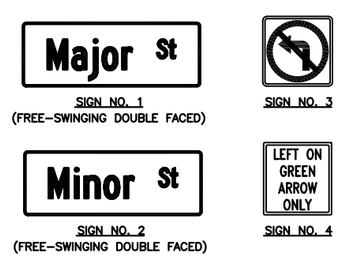
SIGNAL LEGEND



* REPRESENTS BI-MODAL YELLOW/GREEN ARROW SECTION

SIGNAL POLE SIGN LEGEND

MAST ARM SIGN LEGEND



OVERHEAD STREET NAME SIGNS TO MEET FACILITY DETAIL PROVIDED BY PA TRAFFIC.

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ENGINEERING DEPARTMENT

TRAFFIC

Title

TRAFFIC SIGNAL STANDARD DESIGN GUIDELINES

SAMPLE TRAFFIC SIGNAL WIRING PLAN (MAST ARM)

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Designed by	Drawn by	Checked by

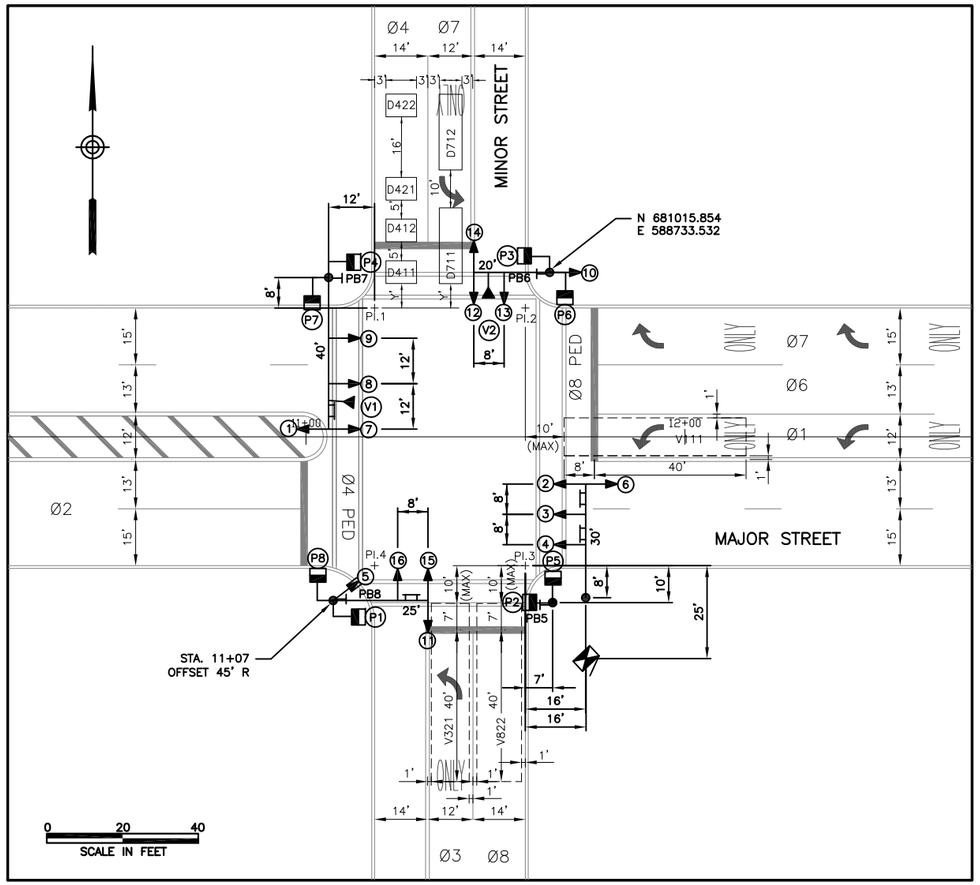
Date OCTOBER 2012

Contract Number

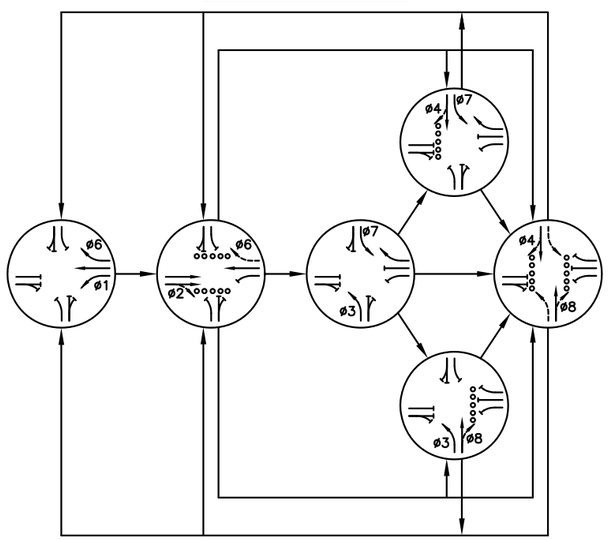
Drawing Number **SG010**

PID#

TRAFFIC SIGNAL DIMENSION DIAGRAM



PHASING DIAGRAM



TRAFFIC SIGNAL TIMING

VEHICLE ACTUATION

PHASE DIAGRAM	PHASE		SIGNAL INDICATIONS 1,2,3,4	5,6,7	8	9,10	11,12	13	14,15	16	P1–P4	P5–P8	TIMING I (SEC)	TIMING II (SEC)	DETECTOR MODE	PHASE RECALL	EXT
	ø1 + ø6	ROW	R	<G–	G	G,–G>	R	R	R	R	DW	DW	7	7–11	NON–LOCK	–	2.0
		CHG	R	<Y–	G	G,–Y>	R	R	R	R	DW	DW	3	3			
		CLR	R	<R–	G	G	R	R	R	R	DW	DW	2	2			
	ø2 + ø6	ROW	G	<R–	G	G	R	R	R	R	W	DW	37–7	37–10	–	MIN. +PED	–
		PED CLEAR	G	<R–	G	G	R	R	R	R	FDW	DW	12	12			
		CHG	Y	<R–	Y	Y	R	R	R	R	DW	DW	4	4			
		CLR	R	<R–	R	R	R	R	R	R	DW	DW	2	2			
	ø3 + ø7	ROW	R	<R–	R	R,–G>	R,<G–	R	R,<G–	R	DW	DW	7–11	7–9	NON–LOCK	–	2.0
		CHG	R	<R–	R	R,–Y>	R,<Y–	R	R,<Y–	R	DW	DW	3	3			
	ø4 + ø8	ROW	R	<R–	R	R	G	G	G	G	DW	DW	7–33	7–28	NON–LOCK	–	2.0
		CHG	R	<R–	R	R	Y	Y	Y	Y	DW	DW	4	4			
		CLR	R	<R–	R	R	R	R	R	R	DW	DW	2	2			

PEDESTRIAN ACTUATION

PHASE DIAGRAM	PHASE		SIGNAL INDICATIONS 1,2,3,4	5,6,7	8	9,10	11,12	13	14,15	16	P1–P4	P5–P8	TIMING I (SEC)	TIMING II (SEC)	DETECTOR MODE	PHASE RECALL	EXT
	ø1 + ø6	ROW	R	<G–	G	G	R	R	R	R	DW	DW	7	7–11	NON–LOCK	–	2.0
		CHG	R	<Y–	G	G	R	R	R	R	DW	DW	3	3			
		CLR	R	<R–	G	G	R	R	R	R	DW	DW	2	2			
	ø2 + ø6	ROW	G	<R–	G	G	R	R	R	R	W	DW	16–7	16–10	–	MIN.	–
		PED CLR	G	<R–	G	G	R	R	R	R	FDW	DW	12	12			
		CHG	Y	<R–	Y	Y	R	R	R	R	DW	DW	4	4			
		CLR	R	<R–	R	R	R	R	R	R	DW	DW	2	2			
	ø3 + ø7	ROW	R	<R–	R	R,–G>	R,<G–	R	R,<G–	R	DW	DW	7–11	7–9	NON–LOCK	–	2.0
		CHG	R	<R–	R	R,–Y>	R,<Y–	R	R,<Y–	R	DW	DW	3	3			
	ø4 + ø8 + ø4 PED. + ø8 PED.	ROW	R	<R–	R	R	G	G	G	G	DW	W	7	7	NON–LOCK	–	2.0
		PED CLR	R	<R–	R	R	G	G	G	G	DW	FDW	21	21			
		VEHICLE EXT	R	<R–	R	R	G	G	G	G	DW	DW	0–5	0			
		CHG	R	<R–	R	R	Y	Y	Y	Y	DW	DW	4	4			
		CLR	R	<R–	R	R	R	R	R	R	DW	DW	2	2			
EMERGENCY FLASH			Y	<R–	Y	Y	R	R	R	R	DARK	DARK					
BACKGROUND CYCLE LENGTH													90	90			
OFFSET													52.0	16.0			

1. Ø4 + Ø8 SHALL ALWAYS PRECEDE Ø1 + Ø6.
2. TIMING I IS TO OPERATE MONDAY – FRIDAY 7:00AM TO 9:00AM AND 4:00PM TO 6:00PM.
   TIMING II IS TO OPERATE AT ALL OTHER TIMES.
3. OFFSET SHALL BE MEASURED FROM THE BEGINNING OF YELLOW TO Ø2 + Ø6 AT THIS INTERSECTION TO THE BEGINNING OF YELLOW TO Ø2 + Ø6 AT THE INTERSECTION OF _____.

Sheet of

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ENGINEERING DEPARTMENT

TRAFFIC

Title

TRAFFIC SIGNAL STANDARD DESIGN GUIDELINES

SAMPLE TRAFFIC SIGNAL DIMENSION DIAGRAM AND TIMING DATA (MAST ARM)

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Designed by Drawn by Checked by

Date **OCTOBER 2012**

Contract Number

Drawing Number **SG011**

PID#

INTERSECTION ACTUATION TABLE

DETECTOR NO.	PHASE	SIZE	MODE	DETECTOR TYPE	NUMBER OF TURNS*	ESTIMATED INDUCTANCE (μh)**	DETECTOR UNIT NO.	CHANNEL
V111	ϕ1	–	PRESENCE	VIDEO	–	–	–	–
V321	ϕ3	–	PRESENCE	VIDEO	–	–	–	–
D411	ϕ4	8' X 6'	PRESENCE	LOOP	5	212	1	1
D412	ϕ4	8' X 6'	PRESENCE	LOOP	5	211	1	2
D421	ϕ4	8' X 6'	PRESENCE	LOOP	5	212	2	1
D422	ϕ4	8' X 6'	PRESENCE	LOOP	5	214	2	2
D711	ϕ7	6' X 20'	PRESENCE	LOOP	3	160	3	1
D712	ϕ7	6' X 20'	PRESENCE	LOOP	3	160	3	2
V822	ϕ8	–	PRESENCE	VIDEO	–	–	–	–
PB5	ϕ8	–	–	PUSH BUTTON	–	–	–	–
PB6	ϕ8	–	–	PUSH BUTTON	–	–	–	–
PB7	ϕ4	–	–	PUSH BUTTON	–	–	–	–
PB8	ϕ4	–	–	PUSH BUTTON	–	–	–	–

* DESIGNER SHOULD ESTIMATE NUMBER OF TURNS FOR CONTRACT (THE MINIMUM INDUCTANCE IS 150)

** BASED UPON THE FOLLOWING CALCULATION:

$$\text{INDUCTANCE (IN } \mu h) = \frac{\text{PERIMETER}}{4} \times [(\text{NUMBER OF TURNS})^2 + \text{NUMBER OF TURNS}] + \frac{\text{LOOP LEAD-IN}}{100} \times 22$$

(LOOP LEAD–IN = LENGTH OF TWISTED LOOP WIRE MEASURED FROM THE LOOP TO THE NEAREST SPLICE BOX)

LOAD SWITCH TABLE

LOAD SWITCH NUMBER	PHASE	FACE NUMBER		INDICATIONS	TERMINAL
LS1	ϕ1	5, 6, 7		~~R~~ ~~Y~~ ~~G~~ NEUTRAL WIRE	LS 1R LS 1Y LS 1G NEUTRAL BUS
LS2	ϕ2	1, 2, 3, 4		R Y G NEUTRAL WIRE	LS 2R LS 2Y LS 2G NEUTRAL BUS
LS3	ϕ3	11, 12		* ~~Y~~ ~~G~~ NEUTRAL WIRE	LS 3R LS 3Y LS 3G NEUTRAL BUS
LS4	ϕ4	14, 15, 16		R Y G NEUTRAL WIRE	LS 4R LS 4Y LS 4G NEUTRAL BUS
LS6	ϕ6	8, 9, 10		R Y G NEUTRAL WIRE	LS 6R LS 6Y LS 6G NEUTRAL BUS
LS7	ϕ7	9,10	14,15	* ~~Y~~ ~~G~~ | * ~~Y~~ ~~G~~ NEUTRAL WIRE	LS 7R LS 7Y LS 7G NEUTRAL BUS
LS8	ϕ8	11, 12, 13		R Y G NEUTRAL WIRE	LS 8R LS 8Y LS 8G NEUTRAL BUS
LS9	ϕ4 PED.	P7, P8		DON'T WALK WALK NEUTRAL WIRE	LS 10R LS 10Y LS 10G NEUTRAL BUS
LS10	ϕ8 PED.	P5, P6		DON'T WALK WALK NEUTRAL WIRE	LS 12R LS 12Y LS 12G NEUTRAL BUS

* CONNECT 115V AC TO APPROPRIATE CONFLICT MONITOR RED CHANNEL INPUT TO PREVENT TRIPPING AND SIGNALS FLASHING.

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ENGINEERING DEPARTMENT

TRAFFIC

Title

TRAFFIC SIGNAL STANDARD DESIGN GUIDELINES

SAMPLE TRAFFIC SIGNAL LOAD SWITCH AND ACTUATION TABLES (MAST ARM)

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Date OCTOBER 2012

Contract Number

Drawing Number SG012

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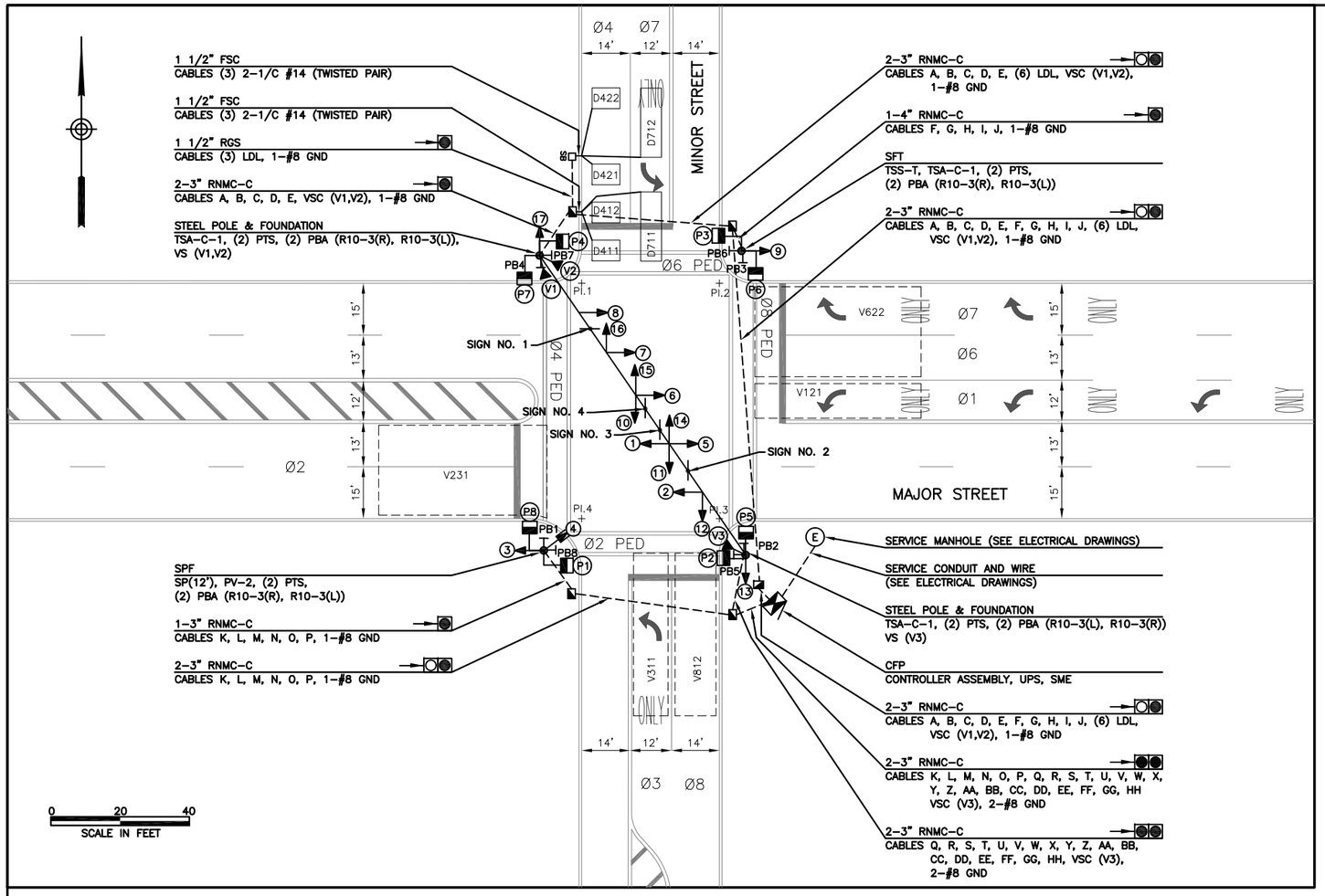
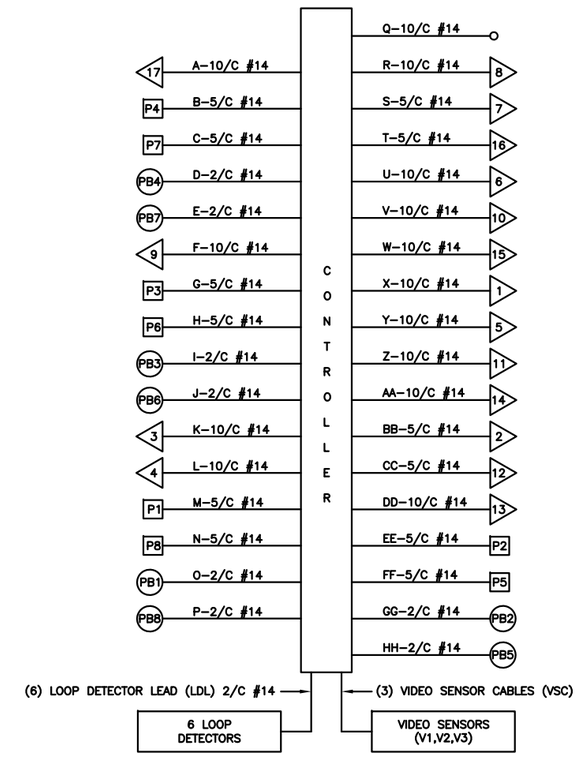


BLOCK WIRING DIAGRAM

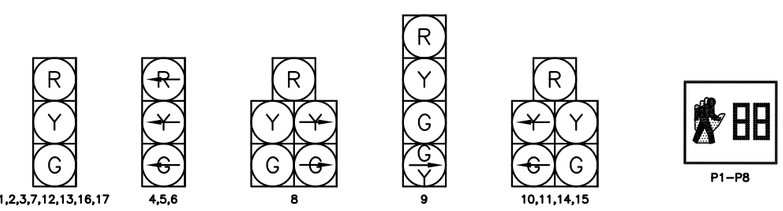


LEGEND

NEW

- VEHICLE SIGNAL HEAD (TYP.)
- PEDESTRIAN SIGNAL HEAD (TYP.)
- PUSH BUTTON (TYP.)
- SPARE (TYP.)

SIGNAL LEGEND



SIGNAL POLE SIGN LEGEND

SIGN LEGEND

OVERHEAD STREET NAME SIGNS TO MEET FACILITY DETAIL PROVIDED BY PA TRAFFIC.

NOTES:

1. THE LOCATIONS OF TRAFFIC POLES AND SIGNALS ARE EXACT AS SHOWN IN THE CONTRACT DOCUMENTS. ANY CHANGES IN TRAFFIC POLE OR SIGNAL LOCATIONS DUE TO FIELD CONDITIONS SHALL BE APPROVED BY THE ENGINEER.
2. ALL TRAFFIC SIGNAL INDICATIONS EXCEPT #3, #4, #9, #13 AND #17 SHALL BE EQUIPPED WITH BACKPLATES.
3. ANGLE VISORS SHALL BE FURNISHED AND INSTALLED ON ALL INDICATIONS FOR SIGNAL HEAD #4 TO BLOCK VISIBILITY FROM THE PHASE 4 APPROACH.
4. VEHICLE SIGNAL HEADS 3 AND 4 SHALL BE ALUMINUM.
5. VEHICLE SIGNAL HEADS #3, #4, #9, #13, & #17 SHALL BE MOUNTED AT A HEIGHT OF 12 FEET.
6. ALL PEDESTRIAN SIGNAL HEADS SHALL BE CLAMPED MOUNTED AT 8 FEET.
7. PEDESTRIAN PUSHBUTTONS SHALL BE INSTALLED AT THE ORIENTATION SHOWN, AND SHALL BE VISIBLE TO PEDESTRIANS WAITING TO CROSS. PEDESTRIAN SIGNAL SIGNS R10-3(L/R) SHALL SHOW THE ARROW POINTING TO THE CROSSWALK ACTUATED BY THE PUSHBUTTON.
8. REFER TO SIGN DATA TABLE FOR SIGN DETAILS.
9. SIGN NO. 3 SHALL BE INSTALLED FACING WEST (EASTBOUND TRAFFIC) AND SIGN NO. 4 SHALL BE INSTALLED FACING EAST (WESTBOUND TRAFFIC).
10. THE CONTROLLER CABINET SHALL BE INSTALLED AT AN ORIENTATION AS SHOWN ON THE PLAN.
11. SPARE WIRES SHALL TERMINATE AT THE TERMINAL BLOCK IN THE SIGNAL HEAD.
12. SPARE CABLE SHALL BE COILED IN THE BASE ON THE FAR SIDE OF THE SPAN (AWAY FROM THE CONTROLLER).

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TRAFFIC SIGNAL STANDARD DESIGN GUIDELINES

SAMPLE TRAFFIC SIGNAL WIRING PLAN (SPAN WIRE)

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Date OCTOBER 2012

Contract Number

Drawing Number SG013

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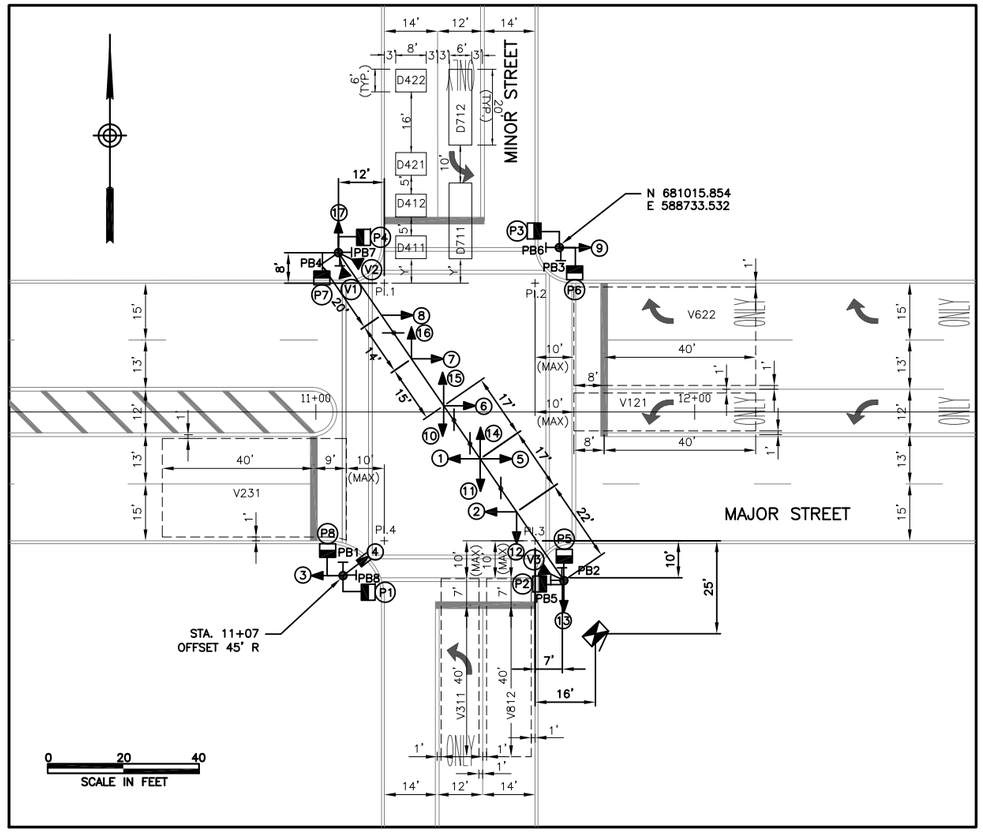
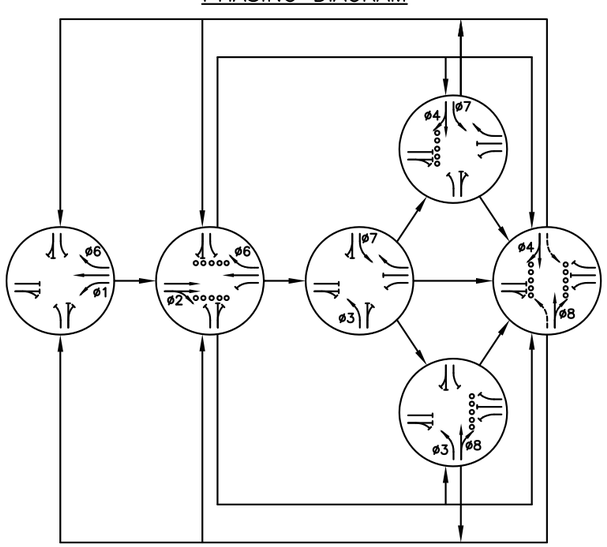
TRAFFIC SIGNAL DIMENSION DIAGRAM



PHASING DIAGRAM



TRAFFIC SIGNAL TIMING

VEHICLE ACTUATION

PHASE DIAGRAM	PHASE		SIGNAL INDICATIONS 1,2,3	4,5,6	7	8,9	10,11	12,13	14,15	16,17	P1,P2	P3,P4	P5–P8	TIMING I (SEC)	TIMING II (SEC)	DETECTOR MODE	PHASE RECALL	EXT
	ø1 + ø6	ROW	R	<G–	G	G	R	R	R	R	DW	DW	DW	7	7–11	NON–LOCK	–	2.0
		CHG	R	<Y–	G	G	R	R	R	R	DW	DW	DW	3	3			
		CLR	R	<R–	G	G	R	R	R	R	DW	DW	DW	2	2			
	ø2 + ø6	ROW	G	<R–	G	G	R	R	R	R	DW	DW	DW	15–25	15–19	NON–LOCK	MIN.	2.0
		CHG	Y	<R–	Y	Y	R	R	R	R	DW	DW	DW	4	4			
		CLR	R	<R–	R	R	R	R	R	R	DW	DW	DW	2	2			
	ø3 + ø7	ROW	R	<R–	R	R,–G>	R,<G–	R	R,<G–	R	DW	DW	DW	7–15	7–9	NON–LOCK	–	2.0
		CHG	R	<R–	R	R,–Y>	R,<Y–	R	R,<Y–	R	DW	DW	DW	3	3			
	ø4 + ø8	ROW	R	<R–	R	R	G	G	G	G	DW	DW	DW	7–33	7–27	NON–LOCK	–	2.0
		CHG	R	<R–	R	R	Y	Y	Y	Y	DW	DW	DW	4	4			
		CLR	R	<R–	R	R	R	R	R	R	DW	DW	DW	2	2			

PEDESTRIAN ACTUATION

PHASE DIAGRAM	PHASE		SIGNAL INDICATIONS 1,2,3	4,5,6	7	8,9	10,11	12,13	14,15	16,17	P1,P2	P3,P4	P5–P8	TIMING I (SEC)	TIMING II (SEC)	DETECTOR MODE	PHASE RECALL	EXT
	ø1 + ø6	ROW	R	<G–	G	G	R	R	R	R	DW	DW	DW	7	7–11	NON–LOCK	–	2.0
		CHG	R	<Y–	G	G	R	R	R	R	DW	DW	DW	3	3			
		CLR	R	<R–	G	G	R	R	R	R	DW	DW	DW	2	2			
	ø2 + ø6 + ø2 PED. + ø6 PED.	ROW	G	<R–	G	G	R	R	R	R	W	W	DW	7	7	NON–LOCK	MIN.	2.0
		PED CLR	G	<R–	G	G	R	R	R	R	FDW	FDW	DW	12	12			
		VEHICLE EXT	G	<R–	G	G	R	R	R	R	DW	DW	DW	0–6	0			
		CHG	Y	<R–	Y	Y	R	R	R	R	DW	DW	DW	4	4			
		CLR	R	<R–	R	R	R	R	R	R	DW	DW	DW	2	2			
	ø3 + ø7	ROW	R	<R–	R	R,–G>	R,<G–	R	R,<G–	R	DW	DW	DW	7–15	7–9	NON–LOCK	–	2.0
		CHG	R	<R–	R	R,–Y>	R,<Y–	R	R,<Y–	R	DW	DW	DW	3	3			
	ø4 + ø8 + ø4 PED. + ø8 PED.	ROW	R	<R–	R	R	G	G	G	G	DW	DW	W	7	7	NON–LOCK	–	2.0
		PED CLR	R	<R–	R	R	G	G	G	G	DW	DW	FDW	20	20			
		VEHICLE EXT	R	<R–	R	R	G	G	G	G	DW	DW	DW	0–6	0			
		CHG	R	<R–	R	R	Y	Y	Y	Y	DW	DW	DW	4	4			
		CLR	R	<R–	R	R	R	R	R	R	DW	DW	DW	2	2			
EMERGENCY FLASH			Y	<R–	Y	Y	R	R	R	R	DARK	DARK	DARK					
													CYCLE LENGTH	56–100	56–86			

1. Ø4 + Ø8 SHALL ALWAYS PRECEDE Ø1 + Ø6.
2. Ø2 + Ø6 SHALL ALWAYS FOLLOW Ø1 + Ø6.
3. TIMING I IS TO OPERATE MONDAY – FRIDAY 7:00AM TO 9:00AM AND 4:00PM TO 6:00PM.
   TIMING II IS TO OPERATE AT ALL OTHER TIMES.
4. THIS INTERSECTION IS FULL ACTUATED FOR PEDESTRIANS. PEDESTRIAN TRAFFIC SIGNALS ARE TO REMAIN DW UNLESS PUSHBUTTON IS ACTUATED.
5. THE SIGNAL SHALL BE SET TO "FREE OPERATION". THIS INTERSECTION IS NOT COORDINATED WITH ANY OTHER TRAFFIC SIGNALS.

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No.	Date	Revision	Approved

ENGINEERING DEPARTMENT

TRAFFIC

Title

TRAFFIC SIGNAL STANDARD DESIGN GUIDELINES

SAMPLE TRAFFIC SIGNAL DIMENSION DIAGRAM AND TIMING DATA (SPAN WIRE)

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Designed by Drawn by Checked by

Date **OCTOBER 2012**

Contract Number

Drawing Number **SG014**

PID#

LOAD SWITCH TABLE

LOAD SWITCH NUMBER	PHASE	FACE NUMBER	INDICATIONS	TERMINAL
LS1	ϕ1	4, 5, 6	~~R~~ ~~Y~~ ~~G~~ NEUTRAL WIRE	LS 1R LS 1Y LS 1G NEUTRAL BUS
LS2	ϕ2	1, 2, 3	R Y G NEUTRAL WIRE	LS 2R LS 2Y LS 2G NEUTRAL BUS
LS3	ϕ3	10, 11	* ~~Y~~ ~~G~~ NEUTRAL WIRE	LS 3R LS 3Y LS 3G NEUTRAL BUS
LS4	ϕ4	14, 15, 16, 17	R Y G NEUTRAL WIRE	LS 4R LS 4Y LS 4G NEUTRAL BUS
LS6	ϕ6	7, 8, 9	R Y G NEUTRAL WIRE	LS 6R LS 6Y LS 6G NEUTRAL BUS
LS7	ϕ7	8,9 / 14, 15	* / * Y / ~~Y~~ ~~G~~ / ~~G~~ NEUTRAL WIRE	LS 7R LS 7Y LS 7G NEUTRAL BUS
LS8	ϕ8	10, 11, 12, 13	R Y G NEUTRAL WIRE	LS 8R LS 8Y LS 8G NEUTRAL BUS
LS9	ϕ2 PED.	P1, P2	DON'T WALK WALK NEUTRAL WIRE	LS 9R LS 9Y LS 9G NEUTRAL BUS
LS10	ϕ4 PED.	P7, P8	DON'T WALK WALK NEUTRAL WIRE	LS 10R LS 10Y LS 10G NEUTRAL BUS
LS11	ϕ6 PED.	P3, P4	DON'T WALK WALK NEUTRAL WIRE	LS 11R LS 11Y LS 11G NEUTRAL BUS
LS12	ϕ8 PED.	P5, P6	DON'T WALK WALK NEUTRAL WIRE	LS 12R LS 12Y LS 12G NEUTRAL BUS

* CONNECT 115V AC TO APPROPRIATE CONFLICT MONITOR RED CHANNEL INPUT TO PREVENT TRIPPING AND SIGNALS FLASHING.

INTERSECTION ACTUATION TABLE

DETECTOR NO.	PHASE	SIZE	MODE	DETECTOR TYPE	NUMBER OF TURNS*	ESTIMATED INDUCTANCE (μh)**	DETECTOR UNIT NO.	CHANNEL
V121	ϕ1	–	PRESENCE	VIDEO	–	–	–	–
V231	ϕ2	–	PRESENCE	VIDEO	–	–	–	–
V311	ϕ3	–	PRESENCE	VIDEO	–	–	–	–
D411	ϕ4	8' X 6'	PRESENCE	LOOP	5	212	1	1
D412	ϕ4	8' X 6'	PRESENCE	LOOP	5	211	1	2
D421	ϕ4	8' X 6'	PRESENCE	LOOP	5	212	2	1
D422	ϕ4	8' X 6'	PRESENCE	LOOP	5	214	2	2
V622	ϕ6	–	PRESENCE	VIDEO	–	–	–	–
D711	ϕ7	6' X 20'	PRESENCE	LOOP	3	160	1	1
D712	ϕ7	6' X 20'	PRESENCE	LOOP	3	160	1	2
V812	ϕ8	–	PRESENCE	VIDEO	–	–	–	–
PB1	ϕ2	–	–	PUSH BUTTON	–	–	–	–
PB2	ϕ2	–	–	PUSH BUTTON	–	–	–	–
PB3	ϕ6	–	–	PUSH BUTTON	–	–	–	–
PB4	ϕ6	–	–	PUSH BUTTON	–	–	–	–
PB5	ϕ8	–	–	PUSH BUTTON	–	–	–	–
PB6	ϕ8	–	–	PUSH BUTTON	–	–	–	–
PB7	ϕ4	–	–	PUSH BUTTON	–	–	–	–
PB8	ϕ4	–	–	PUSH BUTTON	–	–	–	–

* DESIGNER SHOULD ESTIMATE NUMBER OF TURNS FOR CONTRACT (THE MINIMUM INDUCTANCE IS 150)

** BASED UPON THE FOLLOWING CALCULATION:

$$\text{INDUCTANCE (IN } \mu h) = \frac{\text{PERIMETER}}{4} \times [(\text{NUMBER OF TURNS})^2 + \text{NUMBER OF TURNS}] + \frac{\text{LOOP LEAD-IN}}{100} \times 22$$

(LOOP LEAD-IN = LENGTH OF TWISTED LOOP WIRE MEASURED FROM THE LOOP TO THE NEAREST SPLICE BOX)

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THE PORT AUTHORITY OF NY & NJ

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ENGINEERING DEPARTMENT

TRAFFIC

Title

TRAFFIC SIGNAL STANDARD DESIGN GUIDELINES

SAMPLE TRAFFIC SIGNAL LOAD SWITCH AND ACTUATION TABLES (SPAN WIRE)

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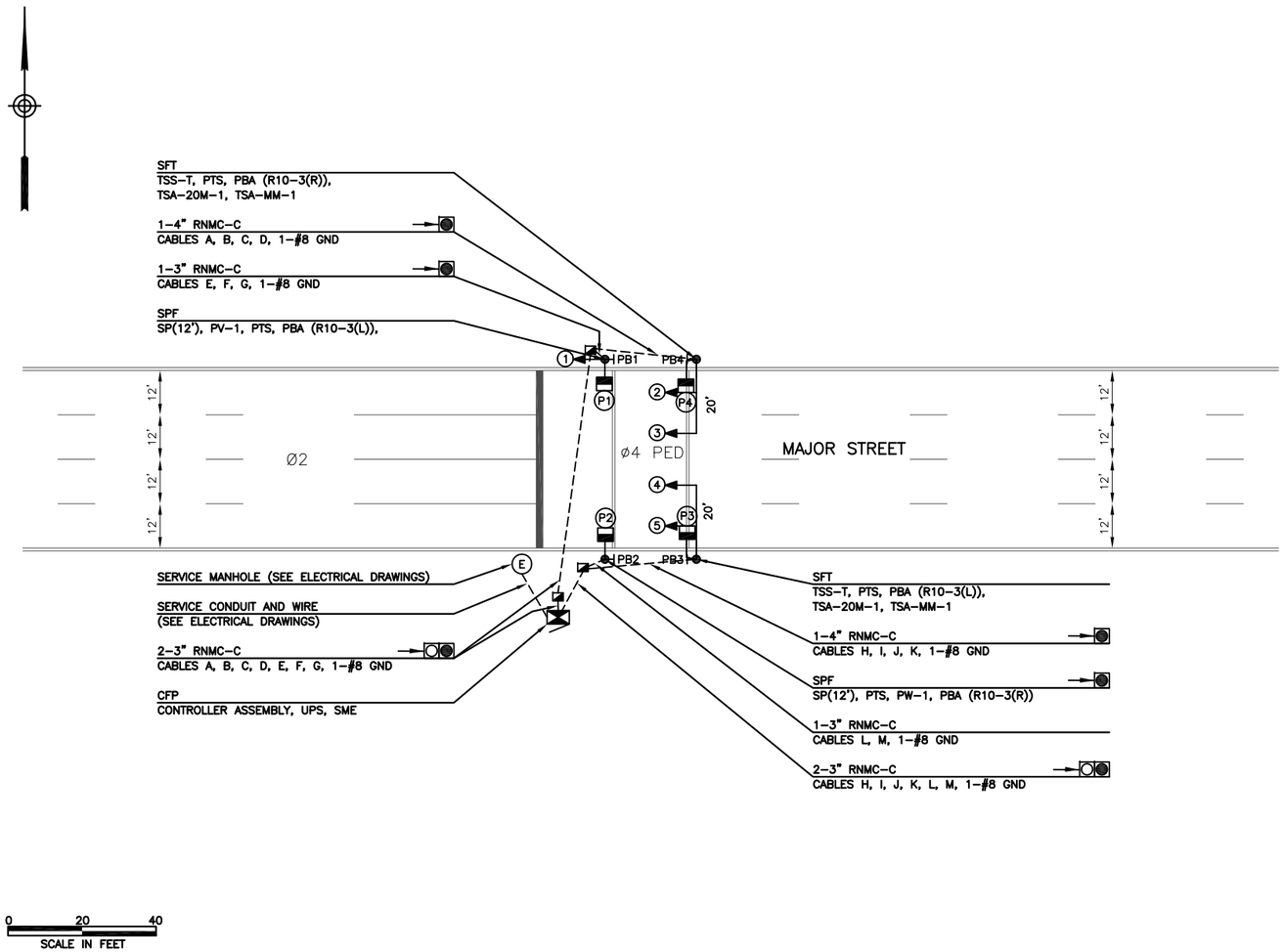
Designed by Drawn by Checked by

Date OCTOBER 2012

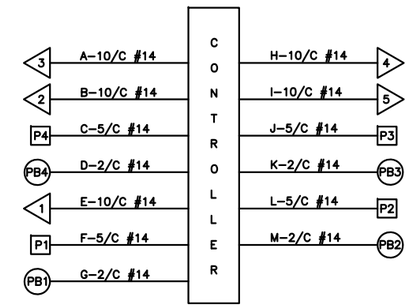
Contract Number

Drawing Number SG015

PID#



BLOCK WIRING DIAGRAM



LEGEND

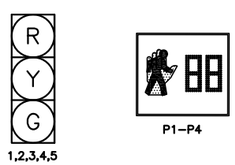
NEW

- VEHICLE SIGNAL HEAD (TYP.)
- PEDESTRIAN SIGNAL HEAD (TYP.)
- PUSH BUTTON (TYP.)

NOTES:

1. THE LOCATIONS OF TRAFFIC POLES AND SIGNALS ARE EXACT AS SHOWN IN THE CONTRACT DOCUMENTS. ANY CHANGES IN TRAFFIC POLE OR SIGNAL LOCATIONS DUE TO FIELD CONDITIONS SHALL BE APPROVED BY THE ENGINEER.
2. ALL TRAFFIC SIGNAL INDICATIONS EXCEPT #1 SHALL BE EQUIPPED WITH BACKPLATES.
3. VEHICLE HEADS NOS. 1, 3 AND 4 SHALL BE ALUMINUM.
4. VEHICLE SIGNAL HEAD #1 SHALL BE MOUNTED AT 12 FEET.
5. ALL PEDESTRIAN SIGNAL HEADS SHALL BE CLAMP MOUNTED AT 8 FEET.
6. THE CONTROLLER CABINET SHALL BE INSTALLED AT AN ORIENTATION AS SHOWN ON THE PLAN.
7. SPARE WIRES SHALL TERMINATE AT THE TERMINAL BLOCK IN THE SIGNAL HEAD.
8. PEDESTRIAN PUSHBUTTONS SHALL BE INSTALLED AT THE ORIENTATION SHOWN, AND SHALL BE VISIBLE TO PEDESTRIANS WAITING TO CROSS. PEDESTRIAN SIGNAL SIGNS R10-3(L/R) SHALL SHOW THE ARROW POINTING TO THE CROSSWALK ACTUATED BY THE PUSHBUTTON.

SIGNAL LEGEND



SIGNAL POLE SIGN LEGEND

Sheet of

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Title

TRAFFIC SIGNAL STANDARD DESIGN GUIDELINES

SAMPLE TRAFFIC SIGNAL WIRING PLAN (MID-BLOCK CROSSING)

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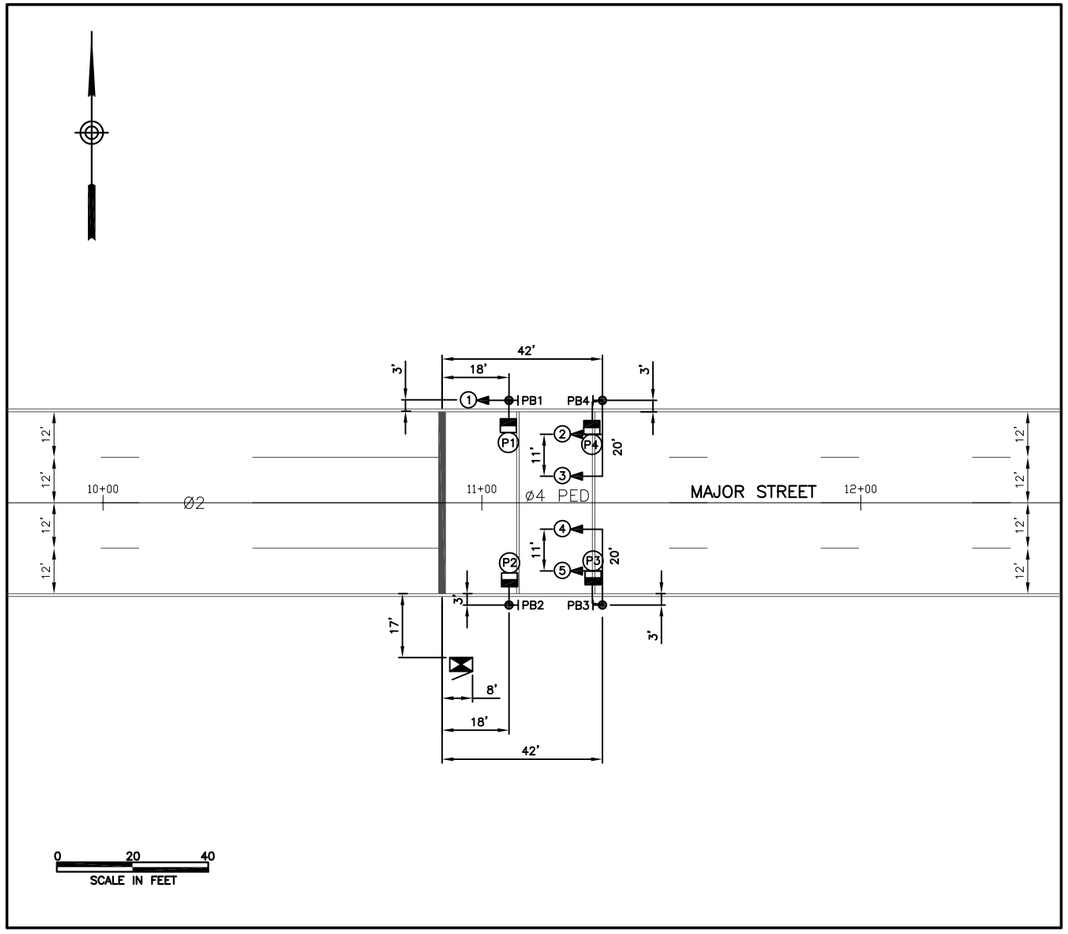
Date **OCTOBER 2012**

Contract Number

Drawing Number **SG016**

PID#

TRAFFIC SIGNAL DIMENSION DIAGRAM

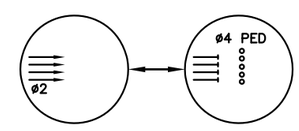


TRAFFIC SIGNAL TIMING

PHASE DIAGRAM	PHASE		SIGNAL INDICATIONS 1,2,3,4,5	SIGNAL INDICATIONS P1,P2	TIMING I (SEC)	TIMING II (SEC)	DETECTOR MODE	PHASE RECALL	EXT
	ø2	ROW	G	DW	15	12	–	MIN.	–
		CHG	Y	DW	4	4			
		CLR	R	DW	2	2			
	ø4 PED	ROW	R	W	7	7	–	–	–
		PED CHG	R	FDW	14	14			
		BUFFER	R	DW	3	3			
EMERGENCY FLASH			Y	DARK					
				CYCLE LENGTH	21–43	18–42			

1. TIMING I IS TO OPERATE MONDAY – FRIDAY 6:00AM TO 9:00PM.
   TIMING II IS TO OPERATE AT ALL OTHER TIMES.
2. THE SIGNAL SHALL BE SET TO "FREE OPERATION". THIS INTERSECTION IS NOT COORDINATED WITH ANY OTHER TRAFFIC SIGNALS.

PHASING DIAGRAM



INTERSECTION ACTUATION TABLE

DETECTOR NO.	PHASE	SIZE	MODE	DETECTOR TYPE	NUMBER OF TURNS*	ESTIMATED INDUCTANCE (µh)**	DETECTOR UNIT NO.	CHANNEL
PB1	ø4 PED	–	–	PUSH BUTTON	–	–	–	–
PB2	ø4 PED	–	–	PUSH BUTTON	–	–	–	–
PB3	ø4 PED	–	–	PUSH BUTTON	–	–	–	–
PB4	ø4 PED	–	–	PUSH BUTTON	–	–	–	–

LOAD SWITCH TABLE

LOAD SWITCH NUMBER	PHASE	FACE NUMBER	INDICATIONS	TERMINAL
LS2	ϕ2	1, 2, 3, 4, 5	R Y G NEUTRAL WIRE	LS 2R LS 2Y LS 2G NEUTRAL BUS
LS9	ϕ4 PED	P1, P2, P3, P4	DON'T WALK WALK NEUTRAL WIRE	LS 9R LS 9Y LS 9G NEUTRAL BUS

Sheet of

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TRAFFIC SIGNAL STANDARD DESIGN GUIDELINES

SAMPLE TRAFFIC SIGNAL DIMENSION DIAGRAM AND DATA TABLES (MID-BLOCK CROSSING)

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Date **OCTOBER 2012**

Contract Number

Drawing Number **SG017**

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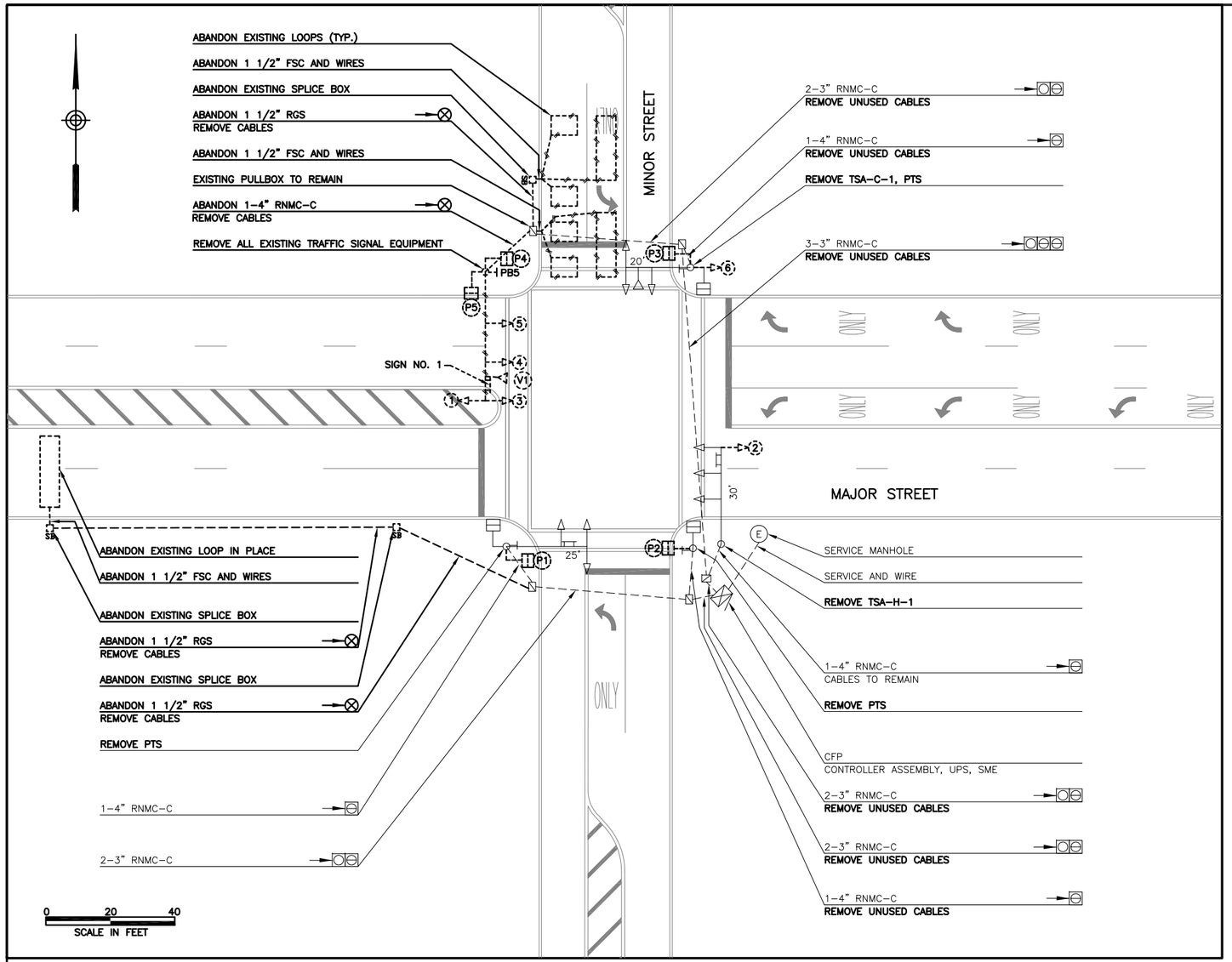

NOTES:

1. ALL REMOVED ABOVE GROUND TRAFFIC SIGNAL EQUIPMENT SHALL BE SALVAGED AND DELIVERED TO THE (specify) FACILITY ELECTRICAL SHOP LOCATED AT (specify location). THE ENGINEER SHALL BE NOTIFIED PRIOR TO DELIVERY.
2. FOUNDATIONS SHALL BE REMOVED TO A DEPTH OF 12 INCHES BELOW GRADE. THE HOLE SHOULD THEN BE FILLED AND COVERED TO GRADE TO MATCH WITH THE FUTURE CONDITIONS OF THE SURROUNDING AREA (SEE CIVIL AND LANDSCAPE DRAWINGS).
3. THOSE LOOPS WITHIN THE PAVING LIMITS SHOULD BE REMOVED AND HAVE BEEN MARKED AS SUCH ON THE CONTRACT DRAWING. ABANDONED LOOPS OUTSIDE THE PAVING LIMITS SHALL REMAIN.
4. REFER TO THE MODIFIED TRAFFIC SIGNAL WIRING PLAN FOR THE RELOCATION OF ANY EXISTING EQUIPMENT.

REMOVAL SIGN LEGEND

SIGN NO. 1

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TRAFFIC SIGNAL STANDARD DESIGN GUIDELINES

SAMPLE TRAFFIC SIGNAL REMOVAL PLAN

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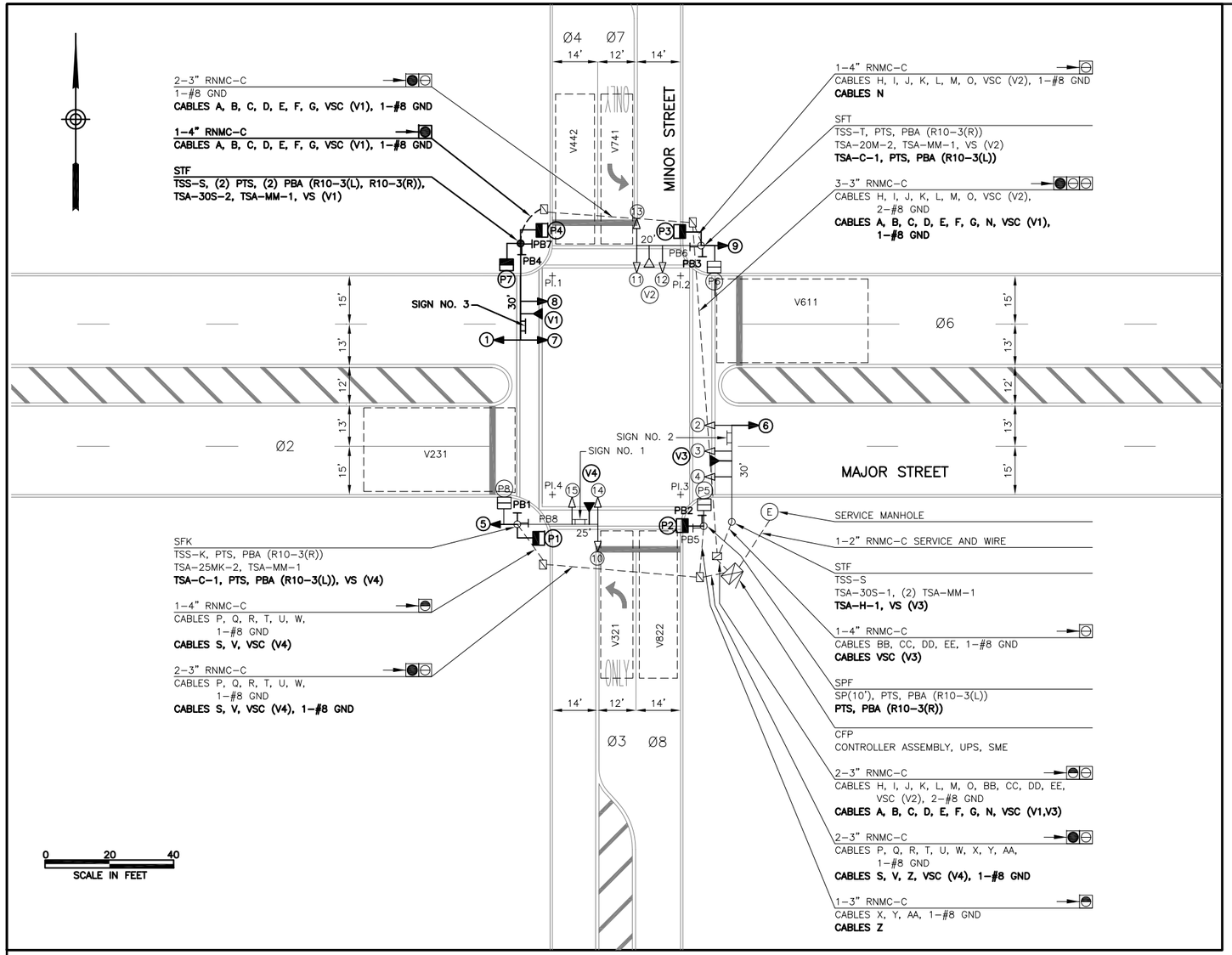
Date **OCTOBER 2012**

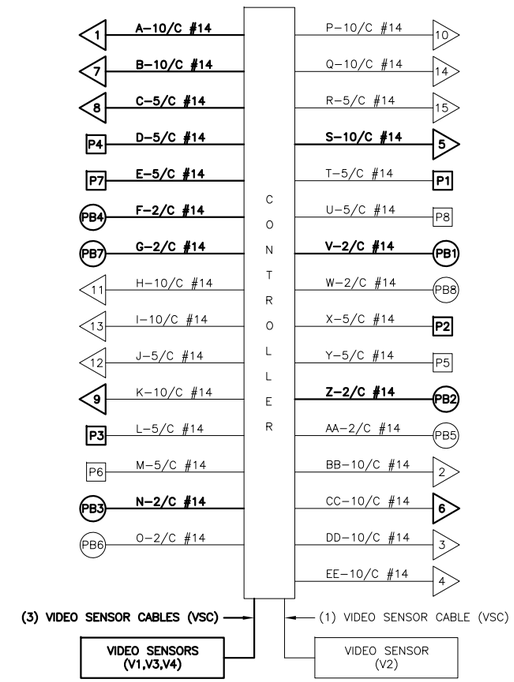
Contract Number

Drawing Number **SG018**

PID#



BLOCK WIRING DIAGRAM



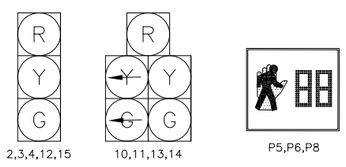
LEGEND

EXISTING	NEW	
▷	▷	VEHICLE SIGNAL HEAD (TYP.)
□	□	PEDESTRIAN SIGNAL HEAD (TYP.)
○	○	PUSH BUTTON (TYP.)

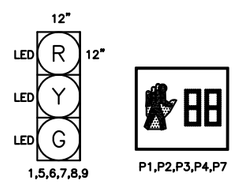
NOTES:

1. THE LOCATIONS OF TRAFFIC POLES AND SIGNALS ARE EXACT AS SHOWN IN THE CONTRACT DOCUMENTS. ANY CHANGES IN TRAFFIC POLE OR SIGNAL LOCATIONS DUE TO FIELD CONDITIONS SHALL BE APPROVED BY THE ENGINEER.
2. TRAFFIC SIGNAL INDICATIONS #6, #7 AND #8 SHALL BE EQUIPPED WITH BACKPLATES.
3. REFER TO SIGN DATA TABLE FOR SIGN DETAILS.
4. VEHICLE SIGNAL HEAD #5 & #9 SHALL BE MOUNTED AT 12 FEET.
5. PEDESTRIAN SIGNAL HEADS P1, P2, P3, P4 & P7 SHALL BE CLAMP MOUNTED AT 8 FEET.
6. SIGN NO. 3 SHALL BE INSTALLED FACING WEST (EASTBOUND TRAFFIC).
7. SPARE WIRES SHALL TERMINATE AT THE TERMINAL BLOCK IN THE SIGNAL HEAD.

EXISTING SIGNAL LEGEND

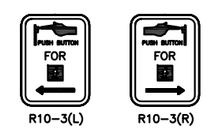


NEW SIGNAL LEGEND



MAST ARM SIGN LEGEND

SIGNAL POLE SIGN LEGEND



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Title

TRAFFIC SIGNAL STANDARD DESIGN GUIDELINES

SAMPLE MODIFIED TRAFFIC SIGNAL WIRING PLAN

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Designed by Drawn by Checked by

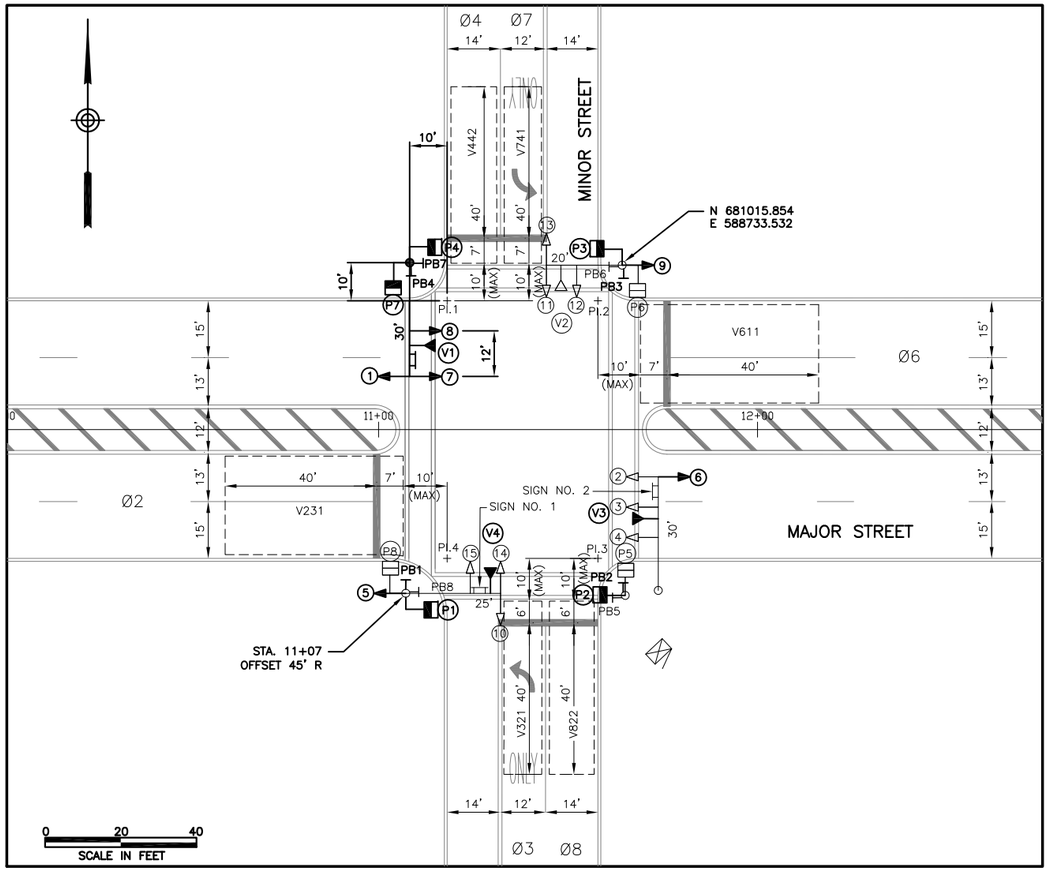
Date **OCTOBER 2012**

Contract Number

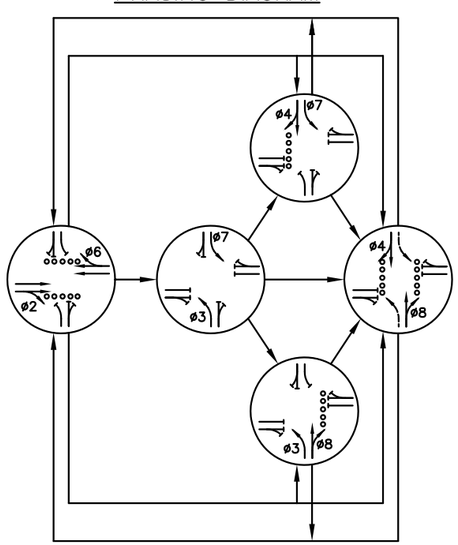
Drawing Number **SG019**

PID#

TRAFFIC SIGNAL DIMENSION DIAGRAM



PHASING DIAGRAM



TRAFFIC SIGNAL TIMING

VEHICLE ACTUATION

PHASE DIAGRAM	PHASE		SIGNAL INDICATIONS 1,2,3,4,5	6,7,8,9	10,11	12	13,14	15	P1–P4	P5–P8	TIMING I (SEC)	TIMING II (SEC)	DETECTOR MODE	PHASE RECALL	EXT
	ø2 + ø6	ROW	G	G	R	R	R	R	DW	DW	15–21	15–21	NON–LOCK	MIN.	2.0
		CHG	Y	Y	R	R	R	R	DW	DW	4	4			
		CLR	R	R	R	R	R	R	DW	DW	2	2			
	ø3 + ø7	ROW	R	R	R,<G–	R	R,<G–	R	DW	DW	10	7–9	NON–LOCK	–	2.0
		CHG	R	R	R,<Y–	R	R,<Y–	R	DW	DW	3	3			
	ø4 + ø8	ROW	R	R	G	G	G	G	DW	DW	7–34	7–28	NON–LOCK	–	2.0
		CHG	R	R	Y	Y	Y	Y	DW	DW	4	4			
		CLR	R	R	R	R	R	R	DW	DW	2	2			

PEDESTRIAN ACTUATION

PHASE DIAGRAM	PHASE		SIGNAL INDICATIONS 1,2,3,4,5	6,7,8,9	10,11	12	13,14	15	P1–P4	P5–P8	TIMING I (SEC)	TIMING II (SEC)	DETECTOR MODE	PHASE RECALL	EXT
	ø2 + ø6 + ø2 PED. + ø6 PED.	ROW	G	G	R	R	R	R	W	DW	7–9	7–9	NON–LOCK	MIN.	2.0
		PED CLR	G	G	R	R	R	R	FDW	DW	12	12			
		VEHICLE EXT	G	G	R	R	R	R	FDW	DW	0–2	0–2			
		CHG	Y	Y	R	R	R	R	DW	DW	4	4			
		CLR	R	R	R	R	R	R	DW	DW	2	2			
	ø3 + ø7	ROW	R	R	R,<G–	R	R,<G–	R	DW	DW	10	7–9	NON–LOCK	–	2.0
		CHG	R	R	R,<Y–	R	R,<Y–	R	DW	DW	3	3			
	ø4 + ø8 + ø4 PED. + ø8 PED.	ROW	R	R	G	G	G	G	DW	W	7	7	NON–LOCK	–	2.0
		PED CLR	R	R	G	G	G	G	DW	FDW	21	21			
		VEHICLE EXT	R	R	G	G	G	G	DW	DW	0–6	0			
		CHG	R	R	Y	Y	Y	Y	DW	DW	4	4			
		CLR	R	R	R	R	R	R	DW	DW	2	2			
EMERGENCY FLASH			Y	Y	R	R	R	R	DARK	DARK					
										CYCLE LENGTH	47–82	44–75			

1. TIMING I IS TO OPERATE MONDAY – FRIDAY 7:00AM TO 9:00AM AND 4:00PM TO 6:00PM.
   TIMING II IS TO OPERATE AT ALL OTHER TIMES.
2. THE SIGNAL SHALL BE SET TO "FREE OPERATION". THIS INTERSECTION IS NOT COORDINATED WITH ANY OTHER TRAFFIC SIGNALS.

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Title

TRAFFIC SIGNAL STANDARD DESIGN GUIDELINES

SAMPLE MODIFIED TRAFFIC SIGNAL DIMENSION DIAGRAM AND TIMING DATA

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Date **OCTOBER 2012**

Contract Number

Drawing Number **SG020**

PID#

LOAD SWITCH TABLE

LOAD SWITCH NUMBER	PHASE	FACE NUMBER	INDICATIONS	TERMINAL
LS2	ϕ2	1, 2, 3, 4, 5	R Y G NEUTRAL WIRE	LS 2R LS 2Y LS 2G NEUTRAL BUS
LS3	ϕ3	10, 11	* ~~Y~~ ~~G~~ NEUTRAL WIRE	LS 3R LS 3Y LS 3G NEUTRAL BUS
LS4	ϕ4	13, 14, 15	R Y G NEUTRAL WIRE	LS 4R LS 4Y LS 4G NEUTRAL BUS
LS6	ϕ6	6, 7, 8, 9	R Y G NEUTRAL WIRE	LS 6R LS 6Y LS 6G NEUTRAL BUS
LS7	ϕ7	13, 14	* ~~Y~~ ~~G~~ NEUTRAL WIRE	LS 7R LS 7Y LS 7G NEUTRAL BUS
LS8	ϕ8	10, 11, 12	R Y G NEUTRAL WIRE	LS 8R LS 8Y LS 8G NEUTRAL BUS
LS9	ϕ2 PED.	P1, P2	DON'T WALK WALK NEUTRAL WIRE	LS 9R LS 9Y LS 9G NEUTRAL BUS
LS10	ϕ4 PED.	P7, P8	DON'T WALK WALK NEUTRAL WIRE	LS 10R LS 10Y LS 10G NEUTRAL BUS
LS11	ϕ6 PED.	P3, P4	DON'T WALK WALK NEUTRAL WIRE	LS 11R LS 11Y LS 11G NEUTRAL BUS
LS12	ϕ8 PED.	P5, P6	DON'T WALK WALK NEUTRAL WIRE	LS 12R LS 12Y LS 12G NEUTRAL BUS

* CONNECT 115V AC TO APPROPRIATE CONFLICT MONITOR RED CHANNEL INPUT TO PREVENT TRIPPING AND SIGNALS FLASHING.

INTERSECTION ACTUATION TABLE

DETECTOR NO.	PHASE	SIZE	MODE	DETECTOR TYPE	NUMBER OF TURNS*	ESTIMATED INDUCTANCE (μh)**	DETECTOR UNIT NO.	CHANNEL
V231	ϕ2	–	PRESENCE	VIDEO	–	–	–	–
V321	ϕ3	–	PRESENCE	VIDEO	–	–	–	–
V442	ϕ4	–	PRESENCE	VIDEO	–	–	–	–
V611	ϕ6	–	PRESENCE	VIDEO	–	–	–	–
V741	ϕ7	–	PRESENCE	VIDEO	–	–	–	–
V822	ϕ8	–	PRESENCE	VIDEO	–	–	–	–
PB1	ϕ2 PED	–	–	PUSH BUTTON	–	–	–	–
PB2	ϕ2 PED	–	–	PUSH BUTTON	–	–	–	–
PB3	ϕ6 PED	–	–	PUSH BUTTON	–	–	–	–
PB4	ϕ6 PED	–	–	PUSH BUTTON	–	–	–	–
PB5	ϕ8 PED	–	–	PUSH BUTTON	–	–	–	–
PB6	ϕ8 PED	–	–	PUSH BUTTON	–	–	–	–
PB7	ϕ4 PED	–	–	PUSH BUTTON	–	–	–	–
PB8	ϕ4 PED	–	–	PUSH BUTTON	–	–	–	–

Sheet of

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ENGINEERING DEPARTMENT

TRAFFIC

Title

TRAFFIC SIGNAL STANDARD DESIGN GUIDELINES

SAMPLE MODIFIED TRAFFIC SIGNAL LOAD SWITCH AND ACTUATION TABLES

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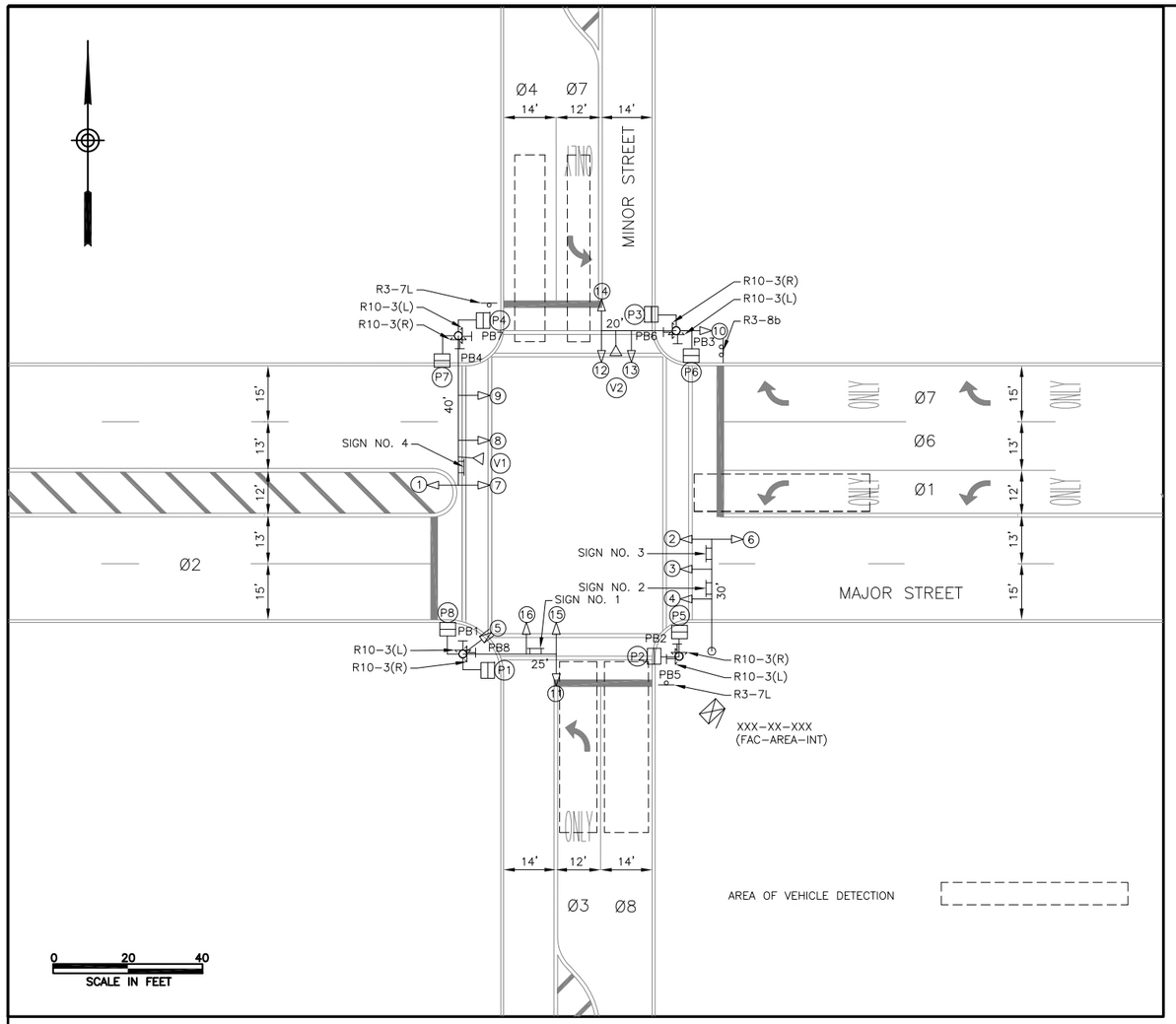
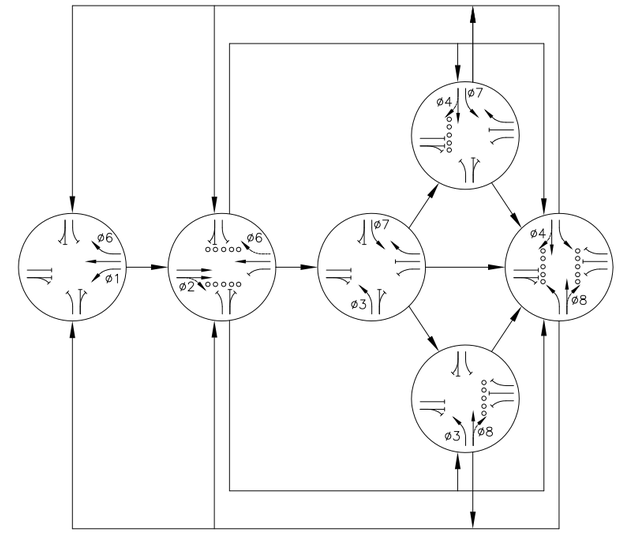
Drawing Number **SG021**

PID#



PHASING DIAGRAM



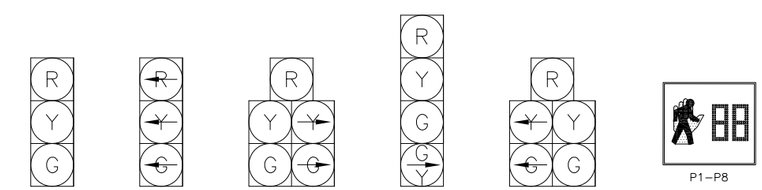
MAST ARM SIGN LEGEND

SIGN NO. 1 | SIGN NO. 2 | SIGN NO. 3 R3-2 | SIGN NO. 4 R10-5

SYMBOL LEGEND

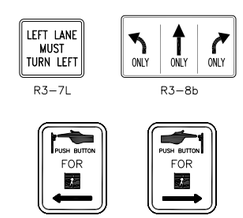
- (X) VEHICULAR SIGNAL HEAD WITH IDENTIFIER
- (VX) VIDEO SENSOR WITH IDENTIFIER
- (PX) PEDESTRIAN SIGNAL HEAD WITH IDENTIFIER
- PBX PEDESTRIAN PUSHBUTTON WITH IDENTIFIER
- MAST ARM SIGN
- X TRAFFIC SIGNAL STANDARD WITH MAST ARM LENGTH
- TRAFFIC CLAMP/POST-TOP MOUNTED SIGNAL
- SIGNAL CONTROLLER AND CABINET GROUND MOUNTED

SIGNAL LEGEND



1,2,3,4,8,13,16 | 5,6,7 | 9 | 10 | 11,12,14,15 | P1-P8

SIGN LEGEND



R3-7L | R3-8b | R10-3(L) | R10-3(R)

Sheet of

THE PORT AUTHORITY OF NY & NJ

No.	Date	Revision	Approved

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TRAFFIC SIGNAL STANDARD DESIGN GUIDELINES

MAJOR STREET AND MINOR STREET (SAMPLE FINAL RECORD TS DRAWING)

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TRAFFIC SIGNAL TIMING

VEHICLE ACTUATION

PHASE DIAGRAM	PHASE		SIGNAL INDICATIONS 1,2,3,4	5,6,7	8	9,10	11,12	13	14,15	16	P1–P4	P5–P8	TIMING I (SEC)	TIMING II (SEC)	DETECTOR MODE	PHASE RECALL	EXT
	ø1 + ø6	ROW	R	<G–	G	G,–G>	R	R	R	R	DW	DW	7	7–11	NON–LOCK	–	2.0
		CHG	R	<Y–	G	G,–Y>	R	R	R	R	DW	DW	3	3			
		CLR	R	<R–	G	G	R	R	R	R	DW	DW	2	2			
	ø2 + ø6	ROW	G	<R–	G	G	R	R	R	R	W	DW	37–7	37–10	–	MIN. +PED	–
		PED CLEAR	G	<R–	G	G	R	R	R	R	FDW	DW	12	12			
		CHG	Y	<R–	Y	Y	R	R	R	R	DW	DW	4	4			
		CLR	R	<R–	R	R	R	R	R	R	DW	DW	2	2			
	ø3 + ø7	ROW	R	<R–	R	R,–G>	R,<G–	R	R,<G–	R	DW	DW	7–11	7–9	NON–LOCK	–	2.0
		CHG	R	<R–	R	R,–Y>	R,<Y–	R	R,<Y–	R	DW	DW	3	3			
	ø4 + ø8	ROW	R	<R–	R	R	G	G	G	G	DW	DW	7–33	7–28	NON–LOCK	–	2.0
		CHG	R	<R–	R	R	Y	Y	Y	Y	DW	DW	4	4			
		CLR	R	<R–	R	R	R	R	R	R	DW	DW	2	2			

PEDESTRIAN ACTUATION

PHASE DIAGRAM	PHASE		1,2,3,4	5,6,7	8	9,10	11,12	13	14,15	16	P1–P4	P5–P8	TIMING I (SEC)	TIMING II (SEC)	DETECTOR MODE	PHASE RECALL	EXT
	ø1 + ø6	ROW	R	<G–	G	G	R	R	R	R	DW	DW	7	7–11	NON–LOCK	–	2.0
		CHG	R	<Y–	G	G	R	R	R	R	DW	DW	3	3			
		CLR	R	<R–	G	G	R	R	R	R	DW	DW	2	2			
	ø2 + ø6	ROW	G	<R–	G	G	R	R	R	R	W	DW	16–7	16–10	–	MIN.	–
		PED CLR	G	<R–	G	G	R	R	R	R	FDW	DW	12	12			
		CHG	Y	<R–	Y	Y	R	R	R	R	DW	DW	4	4			
		CLR	R	<R–	R	R	R	R	R	R	DW	DW	2	2			
	ø3 + ø7	ROW	R	<R–	R	R,–G>	R,<G–	R	R,<G–	R	DW	DW	7–11	7–9	NON–LOCK	–	2.0
		CHG	R	<R–	R	R,–Y>	R,<Y–	R	R,<Y–	R	DW	DW	3	3			
	ø4 + ø8 + ø4 PED. + ø8 PED.	ROW	R	<R–	R	R	G	G	G	G	DW	W	7	7	NON–LOCK	–	2.0
		PED CLR	R	<R–	R	R	G	G	G	G	DW	FDW	21	21			
		VEHICLE EXT	R	<R–	R	R	G	G	G	G	DW	DW	0–5	0			
		CHG	R	<R–	R	R	Y	Y	Y	Y	DW	DW	4	4			
		CLR	R	<R–	R	R	R	R	R	R	DW	DW	2	2			
EMERGENCY FLASH			Y	<R–	Y	Y	R	R	R	R	DARK	DARK					
BACKGROUND CYCLE LENGTH													90	90			
OFFSET													52.0	16.0			

1. Ø4 + Ø8 SHALL ALWAYS PRECEDE Ø1 + Ø6.
2. TIMING I IS TO OPERATE MONDAY – FRIDAY 7:00AM TO 9:00AM AND 4:00PM TO 6:00PM.
   TIMING II IS TO OPERATE AT ALL OTHER TIMES.
3. OFFSET SHALL BE MEASURED FROM THE BEGINNING OF YELLOW TO Ø2 + Ø6 AT THIS INTERSECTION TO THE BEGINNING OF YELLOW TO Ø2 + Ø6 AT THE INTERSECTION OF _____.

Sheet of

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