

- 2.14 **PERFORMANCE TESTING:** The District of Columbia reserves the right to receive on demand a test report from an independent laboratory certifying that the equipment supplied meets all technical specifications at no cost to the District of Columbia.
- 2.15 **REJECTION:** The District of Columbia reserves the right to reject an entire shipment if ten percent (10%) or more of the devices prove to be defective within 30 days of receipt.
- 2.16 The vehicle signal head shall be capable of being mounted on a span wire, on a pole, on a post top, or on a mast arm.
3. **SIGNAL HEAD VISORS**
- 3.1 A signal head visor shall be provided for each section.
- 3.2 Each visor shall enclose the entire face of the signal section except the bottom. A tunnel visor shall be provided.
- 3.3 Each visor shall be constructed from ultraviolet stabilized virgin polycarbonate resin.
- 3.4 Unless otherwise specified, the exterior color of the visor shall be battleship gray, as described in Section 2.5. The inside of the visor shall be dull black. A federal black exterior may be required in certain specified applications.
- 3.5 Each visor shall feature slotted mounting tabs for easy attachment to the signal head housing. Stainless steel screws shall used to affix the visor to the signal head housing.
- 3.6 The tunnel visor for each pedestrian signal head section shall be minimum 8 inches long.
- 3.7 Each pedestrian signal section ordered shall contain two (2) tunnel visors; one to be attached to the housing and the other to be packaged separately with all mounting hardware.

#### TECHINAL SPECIFICATION Vehicle Signal Backplate

1. The purpose of this specification is to describe the minimum acceptable design and functional requirements for backplates for vehicle signal heads. Backplates complying to these specifications shall be available for Section 3, 4 Section, and 5 Section 12 inch traffic signal heads in arrays approved.

by and shown in the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD).

## 2. MATERIAL

- 2.1 The backplate shall be manufactured from polycarbonate materials. Specifically, the backplate shall be produced from virgin ABS containing 60% styrene, 20% rubber and 20% acrylic. It shall contain ultraviolet inhibitors and stabilizers for protection against ultraviolet degradation.
- 2.2 The backplate shall have a minimum thickness of 0.125 inches and must meet a falling dart impact test of 16ft/lb.
- 2.3 The backplate shall meet or exceed Underwriters Laboratories UL94 Test H.B.
- 2.4 The backplate shall have a minimum tensile stress of 5300 psi at 73 degrees Fahrenheit.
- 2.5 The backplate shall be fabricated for cold weather applications. It shall have a haircell finish on one side and a smooth finish on the other side.
- 2.6 The backplate shall be colored dull black. This color shall be impregnated throughout the entire backplate so as to prevent varying shades and tones.

## 3. FABRICATION

- 3.1 The backplate shall be one piece, vacuum formed with a haircell finish on the front side. All surfaces shall be flat and straight without blisters, buckling or warping.
- 3.2 All outside and inside edges shall be formed with a 0.50 to 0.625 inch flange (inside dimension) turned away from the front surface. Flanges shall be straight, uniform and have a consistent flange dimension throughout.
- 3.3 The backplate shall be designated to fit each manufacturer's vehicle signal head, and it shall be contoured to the signal head to eliminate gaps between the backplate and the signal housing and to allow for attachment to the signal head.
- 3.4 There shall be a minimum 5 inch border beyond both sides, the top bottom of the signal head. Each exterior corner shall be constructed with a 3 inch radius.
- 3.5 The finished back plate shall be pre-drilled to fit the vehicle signal head for which it is designated, or it shall contain drill starts for field drilling.
- 3.6 Each back plate shall be designated to properly fit manufacturer's vehicle signal heads.

## 4. HARDWARE

- 4.1 Each back plate shall include all necessary nuts, bolts, and washers for assembling the back plate and attaching it to the signal head.
- 4.2 All hardware shall be stainless steel with a permanent dull black finish.

- 2.7 A terminal block with capacity to accommodate a minimum of eight (8) wires shall be provided in the middle section of the signal head assembly. The terminal block shall be capable of securing conductors at least 12 AWG in diameter.
- 2.8 Each section of the signal head shall be manufactured and reinforced to withstand winds up to 80 miles per hour without showing any deflection in the vertical plane or obvious structural failure.
- 2.9 The signal heads will be equipped with plastic serrated locking rings to enable field installation and connection with metallic upper and lower mounting hardware.
- 2.10 Each signal head section shall feature a mechanism for attaching the slotted mounting tabs from the tunnel visor.
- 2.11 Each signal head section shall feature cored holes for back plate mounting.
- 2.12 **PRE-FABRICATION SUBMITTAL:** Prior approval from the District of Columbia is required before signal housing are fabricated. Color chips shall be submitted at least one week prior to the start of the manufacturing process.
- 2.13 **WARRANTY:** The manufacturer shall warrant the housing to be free from defects in material and workmanship for a period of two (2) years from the date of shipment. Any failure of the device within this period will be repaired by the manufacturer at no cost to the District of Columbia.
- 2.14 **PERFORMANCE TESTING:** The District of Columbia reserves the right to receive on demand a test report from an independent laboratory certifying that the equipment supplied meets all technical specifications at no cost to the District of Columbia.
- 2.15 **REJECTION:** The District of Columbia reserves the right to reject an entire shipment if ten percent (10%) or more of the devices prove to be defective within 30 days of receipt.

### 3. SIGNAL HEAD VISOR

- 3.1 A Signal head visor shall provided for each signal section
- 3.2 Each visor shall enclose the entire face of the signal section except the bottom. A tunnel visor shall be provided.
- 3.3 Each visor shall be constructed from ultraviolet, stabilized virgin polycarbonate resin.
- 3.4 Unless otherwise specified, the exterior color of the visor shall be battleship grey, as described in Section 2.4. The inside of the visor shall be dull black. A federal black exterior color may be required in certain specified applications.
- 3.5 Each visor shall feature slotted mounting tables for easy-attachment to the signal head housing. Stainless steel screws shall be used to affix the visor to the signal head housing.
- 3.6 The tunnel visor for each vehicle signal head section shall be a minimum of 10 inches long.
- 3.7 Each vehicle signal section ordered shall contain two (2) tunnel visors; one to be attached to the housing and the other to be packaged separately with all mounting hardware.

**TECHNICAL SPECIFICATION**  
**Conventional Polycarbonate Pedestrian Signal Head**

1. The purpose of this specification is to describe the minimum acceptable design and operating requirements for pedestrian signal heads. The pedestrian signal head shall feature two (2) sections mounted one above the other. Each section shall be capable of accepting a 12 inch LED (Light Emitting Diode) module insert with legends to control pedestrian traffic.
2. **SIGNAL HEAD HOUSING**
  - 2.1 As a minimum, the signal heads shall meet or exceed the requirements set forth in the latest standard of the Institute of Transportation Engineers (ITE).
  - 2.2 The signal heads shall be constructed from ultraviolet stabilized virgin polycarbonate resin.
  - 2.3 The signal heads shall have a minimum thickness of 0.100 inches.
  - 2.4 The signal head shall feature two (2) sections mounted one above the other with an opening between the two sections capable of accommodating at least three 0.75 diameter cables.
  - 2.5 Unless otherwise specified, the color of the signal head shall be the battleship grey, MVC 1417, GE LEXAN Number 70402. This color shall be impregnated throughout the body of the signal head. Federal black may be required in certain specified applications.
  - 2.6 The signal head shall be nominal 12 inch square for both the upper and the lower sections. The upper section will feature the "RAISED HAND" LED insert and the bottom section will feature the "WALKING PERSON" LED insert.
  - 2.7 The upper section of the signal head will feature a terminal block with capacity to accommodate internal and external wires to ensure proper operation. The terminal block shall be capable of securing conductors at least 12 AWG in diameter.
  - 2.8 The signal head shall feature stainless steel hardware, where appropriate.
  - 2.9 The signal head will be equipped with plastic serrated locking rings to enable field installation and connection with metallic upper and lower mounting hardware.
  - 2.10 Each signal head section shall feature a mechanism for attaching the slotted mounting tabs from the tunnel visor.
  - 2.11 Each signal head section shall be manufactured and reinforced to withstand winds up to 80 miles per hour without showing any deflection in the vertical plane or obvious structural failure.
  - 2.12 **PRE-FABRICATION:** Submittal: Prior approval from the District of Columbia is required before signal housings are fabricated. Color chips shall be submitted at least one week prior to the start of the manufacturing process.
  - 2.13 **WARRANTY:** The manufacturer shall warrant the housing to be free from defects in material and workmanship for a period of two (2) years from the date of shipment. Any failure of the device within this period will be repaired by the manufacturer at no cost to the District of Columbia.

- 4.3 When mounted on bases provided on the signal head, self tapping screws and applicable washers shall be provided. When mounting the back plate by drilling through the signal head body, the proper quantity of the following shall be provided: #8-32 x 0.75 inch pan head screw, 0.625 inch x 1 inch elongated washer, and #8 Hex, locknut with nylon insert.

## TECHNICAL SPECIFICATION

### Mast Arm Mount Signal Bracket

1. The purpose of this specification is to describe the minimum acceptable design and operating requirements for brackets used to mount conventional and optically programmable traffic signal heads to mast arms. The brackets shall be capable of supporting all vertical traffic signal configurations permitted by the Manual on Uniform Traffic Control Devices (MUTCD) and they shall be adaptable to fit all mast arms currently in use within the District of Columbia.
2. GENERAL
  - 2.1 The bracket shall consist of upper and lower arms, a vertical support tube, a mast arm clamp screws, and all necessary hardware including bolts, washers, gaskets, etc. to allow for assembly of the signal to the bracket and the bracket to the mast arm.
  - 2.2 The bracket shall attach to the signal in a clamping manner holding the signal both top and bottom in order to ensure maximum rigidity. A standard bracket shall accommodate vehicle signal heads from all major signal manufacturers.
  - 2.3 The bracket shall be capable of accommodating all vertical traffic signal configurations permitted for 12 inch vehicle signal heads by MUTCD. This shall include 3 Section 12 inch signals, 4 Section 12 inch signals and 5 Section 12 inch signals. All signals are stacked in a vertical plane with one section mounted above the other except the 5 Section 12 inch signal which features two adjacent columns of two sections mounted one above the other with one section mounted directly above the other two so that the total assembly is three sections tall and two sections wide and so that the center of the top section coincides with the line vertically dividing the two columns.
  - 2.4 The bracket shall be completely adjustable and capable of being adjusted at least in the following four manners: (1) vertically to adjust height of signal above the roadway, (2) rotational around the bracket axis, (3) rotational about the mast arm, and (4) rotational right and left from a vertical plane.
  - 2.5 The bracket shall feature Type 201 stainless steel band to fasten the bracket to the supporting arm or structure. The bracket shall be easily adjustable to fit all sizes of round, octagonal, elliptical or other similar shaped mast arms without special tools or equipment.
  - 2.6 All electrical wiring shall be completely concealed within the bracket. The vertical support shall be a gusseted "C" shaped extruded aluminum tube to accommodate the signal cable regardless of vertical positioning of the tube.

### 3. MATERIAL AND DESIGN

- 3.1 The upper and lower arms shall be cast from 319 aluminum or equivalent. The lower bracket arm shall be internally threaded to accommodate the threaded vertical support tube. The lower arm shall be furnished with ABS plastic covers which will slide and snap into position without the use of fasteners or tools. Upper and lower arms shall have 72 tooth serrations cast into the arm to assure a positive lock with the signal housing and shall be secured about their rotational axis with stainless steel set screws. Both upper and lower arms shall have tri-bolt arrangement for attachment to the signal housing. The opening in the lower arm shall accommodate a minimum 1-7 conductor 14 AWG signal cable conforming to IMSA Specifications 19-1 with accommodations for minimum cable bending radius.
- 3.2 The vertical support tube shall be a double gusseted tube extended from 6063-T6 aluminum alloy and have a cross section in the shape of the letter C. The minimum exterior diameter of the tube shall be 1 1/2 inches and the wall thickness shall be adequate to structurally accommodate all vehicle signal heads currently in use in the District of Columbia. The interior of the tube shall be of sufficient capacity to accommodate 1-7 conductor 14 AWG signal cable conforming to IMSA Specification 19-1 with accommodations for minimum cable bending radius. Each tube shall be complete with a vinyl closure strip and shall be threaded on one end to accommodate the lower arm assembly.
- 3.3 The mast arm clamp assembly shall feature male and female halves. Both halves shall be cast from 356-T6 aluminum alloy or equivalent. The male clamp half shall be secured with the female half, utilizing a spring steel retainer ring. This assembly shall provide an unobstructed center of 2 3/8 inch minimum diameter, allowing for 360 degree rotation of the clamp assembly. There shall be no internal cross bracing assembly obstructing the center opening.
- 3.4 The mast arm clamp assembly shall be equipped with two (2) stainless steel bands, 5/8" wide, 0.045" thick, and 29" long. The stainless steel bands shall have a minimum tensile strength of 100,000 psi. A setscrew secured buckle shall be utilized in securing the band.
- 3.5 A clamp screw shall be used to attach the stainless steel bands to the clamp kit. The clamp screw shall be 7/16"-14 x 3" one piece unit drop forged from C-1045 carbon steel or 410 stainless steel with a minimum tensile strength of 80 KSI. The clamp screw shall be formed with a slot sized to accept a 5/8" band.
- 3.6 Each bracket shall include all necessary hardware to accomplish a complete, secure installation. All necessary bolts, washers, gaskets, etc. shall be provided to allow the assembly of the signal to the bracket and the bracket to the mast arm.

### 4. FINISH

- 4.1 All aluminum parts shall have an Alodine 1200, or equivalent, finish.
- 4.2 All steel parts shall have a yellow zinc di-chromate finish.

**TECHNICAL SPECIFICATION**  
**Light Emitting Diode (LED) Countdown Pedestrian Signal Modules**

1. The purpose of this specification is to describe the minimum acceptable design and operating requirements for 12-inch (300-mm) Light Emitting Diode (LED) pedestrian signal modules intend for use where countdown displays are required. The specific items included in this specification include the 12-inch overlay-lunar white walking person and Portland orange raised hand LED module and the 12-inch ~~lunar white~~ countdown LED module.

*portland orange*

2. GENERAL DESCRIPTION

- 2.1 This specification covers two separate LED Modules. The first type features the Portland orange raised hand overlaid on the lunar white walking person arrayed in a module. The second type features the ~~lunar~~ *portland orange* white countdown display.
- 2.2 Each module is to be used in place of the incandescent lamp, reflector, socket, gasket, and lens assembly of the standard 12-inch (300mm) pedestrian signal section. Each LED module shall consist of an assembly that utilizes LED's as the light source in lieu of an incandescent lamp for use in pedestrian signal sections.
- 2.3 Pedestrian LED modules shall be engineered to fit in all ITE compliant conventional pedestrian signal housings. They shall fit in the conventional polycarbonate pedestrian signal head housing, as used in the District of Columbia, and as described in detail in an accompanying technical specification. Unless otherwise noted, pedestrian signal sections are 12 inch square.
- 2.4 Each LED Module shall utilize appropriate technology to achieve the required color and shall be the ultra bright type rated for 100,000 hours of continuous operation from -40°C to +74°C.
- 2.5 Each LED module shall be rated for a minimum useful life of 48 months. All modules shall meet all parameters of this specification during this period.
- 2.6 Each individual LED module shall be wired such that a catastrophic loss or failure of one LED will result in the loss of not more than 5 percent of the signal module light output.
- 2.7 The WALKING PERSON and the RAISED HAND symbols shall conform to all applicable requirements of the Manual on Uniform Traffic Control Devices (MUTCD).
- 2.8 The WALKING PERSON and the RAISED HAND shall be overlaid in a special configuration which centers both within the module and provides clear and distinct illumination when either symbol is in use.
- 2.9 The Walking PERSON and the RAISED HAND overlaid module shall feature internal circuitry and wiring which prevent both from being illuminated at the same time.

- 2.10 The countdown module shall conform to the following minimum requirements
- 2.10.1 The countdown numbers shall feature 2 digits. Two rows of LED's shall be provided for each digit.
  - 2.10.2 Countdown logic circuitry uses A.C. power to derive timing data from the intersection traffic signal controller. The timer shall be microprocessor based
  - 2.10.3 The unit shall feature a mechanism such as a multiposition dip switch to enable the user to select specific modes for countdown functions. The unit shall be capable of displaying countdown numbers during the WALK and pedestrian clearance intervals and/or during the pedestrian clearance interval only.
  - 2.10.4 The unit shall feature a test switch which displays "8" for 2 seconds before going blank.
  - 2.10.5 The unit shall automatically adjust to the programmed intervals of the traffic signal controller. During transition between timing plans, the unit shall be dark for NO MORE than two (2) signal cycles while the unit adjusts to the new timing patterns. The WALK and DON'T WALK displays in the adjacent module shall continue to operate during this transition.
  - 2.10.6 The unit shall be capable of displaying numbers ranging from 00 to 99. Each number shall be 7 inches tall.

- 2.11 The WALKING PERSON, RAISED HAND and countdown displays shall be designed to be clearly visible and legible under any lighting conditions from a distance of 200 feet anywhere within a 15 degree cone centered about optical axis.

### 3. ELECTRICAL REQUIREMENTS

#### 3.1 Power Consumption

- 3.1. The maximum power consumption requirements measured in watts for each module display are as follows

<u>MODULE</u>	<u>25°C</u>	<u>74°C</u>
"RAISED HAND"	10.0W	12.0W
"WALKING PERSON"	12.0W	15.0W
"COUNTDOWN"	12.0W	15.0W

#### 3.2 Operation Voltage

- 3.2.1 Each module shall operate from a 60MH±3HZ AC line over a voltage ranging from 95 volts to 135 volts. Fluctuations of line voltage shall have no visible effect upon the luminous intensity of the indications.

- 3.2.2 The operating voltage of the modules shall be 120 Volts AC. All operating parameters shall be measured at this voltage.
- 3.2.3 LED circuitry shall prevent perceptible flicker to the unaided eye over the 95 to 135 voltage range.
- 3.3 The LED signal module shall have a power factor of 0.90 or greater at a nominal rated voltage at 25° C after 60 minutes of operation.
- 3.4 Total harmonic distortion (current and voltage) induced into an AC power line by an LED signal shall not exceed 20 percent at the rated voltage at 25°
- 3.5 The signal module on-board circuitry shall include voltage surge protection to withstand high-repetition noise transients as stated in Section 2.1.6 of the NEMA Standard TS-2 dated 1992.
- 3.6 Each LED module and associated on-board circuitry shall be in compliance with Federal Communications Commission (FCC) noise regulations and must meet FCC Title 47, Subpart B, Section 15 regulations concerning the emission of electronic noise.
- 3.7 The LED modules shall be U.S. EPA-Energy Star compliant. Power consumption of these LED modules shall not exceed the maximum allowed by the EPA.
- 3.8 All wiring and terminal blocks must meet the requirements of Section 13.02 of the ITE Publication Equipment And Material Standards, Chapter 2 (Vehicle Traffic Control Signal Heads).
- 3.9 Each LED module shall be operationally compatible with controller assemblies and peripheral equipment including solid state load switches, flashers, and conflict monitors currently used in the District of Columbia. Current controller specifications are available for review at the specific request of the contractor or vendor.
  - 3.9.1 When a current of 20mA AC or less is applied to the unit, the voltage read across the two leads shall be 15 VAC or less.
- 3.10 Each LED module shall feature control circuitry to prevent current flow through the LED module in the off state to avoid any false indication as may be perceived by the human eye during daylight and evening hours.

#### 4. ENVIRONMENTAL REQUIREMENTS

- 4.1 Each LED module shall be rated for use in operating temperatures in the range of -40°C (-40°F) to +74°C (+165°F). Each LED module shall meet all specifications throughout this temperature range.
- 4.2 Each LED module shall be protected against dust and moisture intrusion in conformance with NEMA Moisture Resistant Standard 250-1991 for Type 4 enclosures to protect all internal components.

#### 5. CONSTRUCTION

- 5.1 Each LED Module shall be a single, self-contained device, not requiring on-site assembly for installation into an existing pedestrian signal housing.
- 5.2 The power supply for the LED module shall be integral to the unit.
- 5.3 The circuit board and the power supply shall be contained inside the module.

- 5.4 Each LED module shall incorporate a printed circuit board containing all required LEDs and circuit components. The LEDs shall be mounted and soldered to the printed circuit board.
- 5.5 Each LED module shall feature two 39-inch long 20AWG minimum wire lead with strain relief and spade terminals for connection to the terminal block of the signal heads. One of the conductors shall contain white insulation to signify neutral. The color of other conductor shall be different and shall be used to differentiate between the "RAISED HAND" and the "WALKING PERSON" LED modules. The two conductors shall be 600 Volt, 20 AWG minimum, jacketed wires conforming to the National Electric Code, rated for service at +105°C.
- 5.6 Each LED module shall feature a rigid housing for protection in shipping, handling and installation and a one-piece neoprene gasket. Screw-in type products are expressly prohibited for LED modules.
- 5.7 The assembly and manufacturing process for the LED signal assembly shall be designed to ensure that all internal components are adequately supported to withstand mechanical shock and vibration from high winds and other sources.
- 5.8 Each LED module shall be watertight when properly installed in a pedestrian signal housing. Each LED module shall utilize the same mounting hardware used to secure the incandescent lens and gasket assembly, and shall only require a screwdriver or a standard installation tool to complete the mounting.
- 5.9 Each LED module shall weigh less than 5 pound

## 6. MATERIALS

- 6.1 Materials used for the lens and signal module shall conform to the appropriate ASTM specification for the materials.
- 6.2 Enclosures containing either the power supply or electronic components of the signal module shall be made of UL94VO flame retardant materials. The module lens does not need to comply with this requirement.
- 6.3 The lens for the "RAISED HAND" LED Module and the "WALKING PERSON" LED module shall be clear with a textured surface to reduce glare.
- 6.4 Each LED module lens shall be UV stabilized plastic capable of withstanding ultra violet direct sunlight for a minimum period of 5 years without exhibiting evidence of deterioration.
- 6.5 The external lens surface shall be smooth with no raised features, so as to minimize the collection of dirt, debris, and other particulate contaminants, which may impact luminous intensity, and to facilitate periodic cleaning. External lens facets are prohibited.

## 7. MODULE IDENTIFICATION

- 7.1 Each LED module shall have the manufacturers name, trademark, model number, serial number, date of manufacture (month and year) and lot number as identification permanently marked on the back of the module. This

- identification is required, and is in addition to any other identification that may be required in contract special provisions by the District of Columbia.
- 7.2 Rated voltage and rated power in Watts and Volt Amperes shall also be permanently marked on the back of each LED module.
- 7.3 Each LED module shall have prominent and permanent markings for correct indexing and orientation within a signal head housing. The markings shall consist of an up arrow, or the word "UP" or "TOP" to ensure that the LED module is inserted into the signal head housing with the correct orientation.
- 7.4 As detailed in Section 5.5 of this specification, conductors connecting the LED module to the signal head housing terminal block shall be color coded to differentiate between the "RAISED HAND", the "WALKING PERSON", and the "COUNTDOWN" LED module.

### 8. PHOTOMETRIC REQUIREMENTS

- 8.1 Each "RAISED HAND" LED module shall provide an average luminous intensity of 3,750 candela per square meter throughout the useful life and over the operating temperature range.
- 8.2 Each "WALKING PERSON" LED module shall provide an average luminous intensity of 5,300 candela per square meter throughout the useful life and over the operating temperature range.
- 8.3 Each "Countdown" LED module shall provide an average luminous intensity of 5300 candela per square meter throughout the useful life and over the operating temperature range.
- 8.4 The uniformity ratio of an illuminated symbol shall not exceed 4 to 1 between the highest luminance area and the lowest luminance area in the LED module.
- 8.5 The color output of each LED module shall conform to the requirements of Section 5.3 in the ITE Publication Equipment and Material Standards, Chapter 3, (Pedestrian Traffic Control Signal Indications). *and the Countdown LED module*
- 8.5.1 The "RAISED HAND" within the LED module shall be Portland orange. Not greater than 0.390, not less than 0.331, nor less than 0.997  
-x
- 8.5.2 The "WALKING PERSON" ~~and the Countdown~~ LED shall be lunar white.  
X: not less than 0.290 nor greater than 0.330  
Y: not less than 1.5x-0.175, or greater than 1.5x-0.130
- 8.5 Both the "RAISED HAND" and the "WALKING PERSON" LED modules shall be filled with LED's to give the appearance that the entire image is illuminated when energized. Outlined images will not be permitted.
- 8.6 The height of the "RAISED HAND" and the "WALKING PERSON" images on the module shall not be less than 250 mm and the width of each image shall not be less than 165 mm.

### 9. QUALITY ASSURANCE

- 9.1 The modules shall be manufactured in accordance with a manufacturer quality assurance (QA) program. The QA program shall include two types of quality assurance: (1) design quality assurance and (2) production quality assurance. The production quality assurance shall include statistically controlled routine tests to ensure minimum performance levels of the modules built to meet this specification, and a documented process of how problems are to be resolved.
- 9.2 QA process and test results documentation shall be kept on file for a minimum period of seven years.
- 9.3 LED signal module designs not satisfying design qualification testing and the production quality assurance testing performance requirements described below shall not be labeled, advertised, or sold as conforming to this specification.
- 9.4 Design Qualification Testing
  - 9.4.1 Design Qualification testing shall be performed by the manufacturer or an independent testing lab hired by the manufacturer on new LED module designs, and when a major design change has been implemented on an existing design.
  - 9.4.2 A major design change is defined as design change (electrical or physical) which changes any of the performance characteristics of the module, results in a different circuit configuration for the power supply, or changes the layout of the individual LED's in the module.
  - 9.4.3 A quantity of two units for each design shall be submitted for Design Qualification Testing.
    - 9.4.3.1 Test units shall be submitted to the District of Columbia after the manufacturer's testing is complete.
    - 9.4.3.2 Manufacturer's testing data shall be submitted with test units for the District of Columbia verification of Design Qualification Testing data.
  - 9.4.4 Burn In.
    - 9.4.4.1 The sample modules shall be energized for a minimum of 24 hours, at 100 percent on-time duty cycle, at a temperature of +74°C (+165°F) before performing any design qualification testing.
    - 9.4.4.2 Any failure of the module, which renders the unit non-compliant with the specification after burn-in, shall be cause for rejection.
  - 9.4.5 For Design Qualification Testing, all specifications will be measured including, but not limited to:
    - 9.4.5.1 Rated Initial Luminous Intensity. Measured over the operating temperature range.
    - 9.4.5.2 Chromaticity (Color). Measured over the operating temperature range.
    - 9.4.5.3 Electrical.

All specified parameters shall be measured and used for quality comparison of production quality assurance on production modules (rated power, etc.)
    - 9.4.5.4 Equipment Compatibility.

Modules shall be tested for compatibility with the controller unit, conflict unit, conflict monitor, and load switch. Each signal module shall be connected to the output of a standard load switch connected to an AC voltage supply between the values of 95 and 135 VAC with the input to the load switch in the "off" position. The AC voltage developed across each LED signal module so connected shall not exceed 10 Vrms as the input AC voltage is varied from 95 Vrms to 135 Vrms.

9.4.5.5 Mechanical vibration testing shall be as per MIL-STD-883, Test Method 2007, using 3-four-minute cycles along each x, y, and z axis, at a force of 2.5 Gs, with a frequency sweep from 2 HZ to 120 HZ. The loosening of the lens, of any internal components, or other physical damage shall be cause for rejection.

9.4.5.6 Temperature cycling shall be performed as MIL-STD-883, Test method 1010. The temperature range shall be per "Environment Requirements". A minimum of 20 cycles shall be performed with a 30 minute transfer time between temperature extremes and a 30 minute dwell time at each temperature. Module(s) being tested shall be energized and functioning throughout the duration of the test. Failure of a module to function properly or any evidence of cracking of the module lens or housing after temperature cycling shall be cause for rejection.

9.4.5.7 Moisture resistance testing shall be performed on all modules mounted in a standard type "A" pedestrian housing per NEMA Standard 250-1991 for Type 4 enclosures. Any evidence of internal moisture after testing shall be cause for rejection.

#### 9.5 Production Quality Control Testing

9.5.1 The following Production Quality Assurance shall be performed on each new module prior to shipment. Failure to meet requirements of any of these tests shall be cause of rejection. Test results shall be retained by the manufacturer for seven years.

9.5.2 Burn-in period shall consist of each signal module being energized at rated voltage of a 30 minute stabilization period before the measurement is made.

9.5.3 Each module shall be tested for rated initial intensity after burn-in.

9.5.3.1 A single point measurement, with a correlation to the intensity requirements of Section 1.04 of the VTSCB for circular modules, may be used.

9.5.3.2 The ambient temperature for this measurement shall be +25°C (+77°F).

9.5.3.3 Each module not meeting minimum luminous intensity requirements of 3,750 cd/m<sup>2</sup> for the raised hand symbol and 5,300 cd/m<sup>2</sup> for the walking person symbol shall be cause for rejection.

9.5.4 Each module shall be tested for required power factor after burn-in.

- 9.5.5 Each module shall be measured for current flow in amperes after burn-in. The measured current values shall be compared against rated values resulting from design qualification measurements under "Design Qualification Testing". The current flow shall not exceed the rated value.
- 9.5.6 Each module shall be visually inspected for any exterior physical damage or assembly anomalies. Careful attention shall be paid to the surface of the lens to ensure there are no scratches (abrasions), cracks, chips, discoloration, or other defects. Any such defect shall be cause for rejection.
- 9.6 The manufacturer shall be required to undertake Design Qualification and Production Quality Control testing as specified in Section 9.4 and 9.5 of these specifications and report all results to the District of Columbia through the contractor. Procurement and installation of LED modules prior to the receipt and acceptance of test results by the District of Columbia is done at the contractors risk.

## 10. OPERATIONAL REQUIREMENTS

- 10.1 The countdown timer will be designed to either count down to zero the accumulated sum of the pedestrian "WALK" and "CLEARANCE" (flashing don't walk) times or count down to zero only the "CLEARANCE" time. The countdown display shall always be dark during the steady don't walk indication. The mode of operation shall be selected through an easily accessible multi-position dip switch. All units procured for this contract shall be delivered configured to countdown to zero from the pedestrian clearance time.
- 10.2 The module, when connected to the appropriate pedestrian signal switch pack outputs, shall have an automatic learn mode in order to learn and store the pedestrian times in its memory, and to self adjust for subsequent changes in pedestrian timing. The individual "WALK" and "CLEARANCE" times shall be stored in two separate counters.
- 10.2.1 Following power restoration to the unit after a power outage of greater than two (2) seconds, the unit will remain dark for one pedestrian cycle to learn, acquire the current pedestrian timing, replace any values that were stored in memory prior to the power outage with the newly acquired times, and display the newly acquired times on the next pedestrian cycle.
- 10.2.2 The unit shall detect changes in pedestrian timing during normal operation, and act upon them as described below:
- 10.2.2.1 The countdown timer will automatically re-program itself should it detect any increase in pedestrian timing. The increased timing shall be displayed on the subsequent pedestrian cycle.

- 10.2.2.2 The countdown timer will ignore any shortened pedestrian cycle that produces a shortened pedestrian clearance time equal to or less than two seconds.
- 10.2.2.3 The countdown timer will detect any reductions in pedestrian timing detected (such as those occurring during a traffic preemption cycle) and display on the subsequent pedestrian cycle the timing stored in its memory prior to the shortened pedestrian cycle.
- 10.2.2.4 The countdown timer will reprogram itself should it detect two consecutive identical shortened pedestrian cycles and display this timing on the next pedestrian cycle.
- 10.3 The unit shall be designed to suspend any timing and go dark when, for any reason, the switch pack output displays a steady don't walk condition during the timing of a pedestrian "WALK" or "CLEARANCE" period and if the module has not yet arrived at the zero count in the cycle.
- 10.4 The countdown timer shall be capable of timing consecutive complete pedestrian cycles outputted by the traffic signal controller.
- 10.5 The unit shall be designed to operate during and following a preemption cycle as described in this section.
  - 10.5.1 The countdown timer shall recognize if the "WALK" or "CLEARANCE" times have been truncated or shortened.
    - 10.5.1.1 During some preemption events the "WALK" indication, if displayed, would be truncated by the traffic signal controller and then proceed immediately to time the full pedestrian "CLEARANCE" cycle. Should this condition be detected, the timer module shall detect the Termination of the "WALK" and the beginning of the pedestrian "CLEARANCE" and begin timing the clearance time stored in its memory toward zero.
    - 10.5.1.2 During other preemption events the "WALK" indication, if displayed, would be truncated by the traffic signal controller and then proceed immediately to time a shortened pedestrian "CLEARANCE" cycle. Should this condition be detected, the timer module shall detect the termination of the "WALK" and the beginning of the pedestrian "CLEARANCE" and begin timing the clearance time stored in its memory toward zero. Once the switch pack output displays a steady "DON'T WALK" indication during the timing of this pedestrian "CLEARANCE" and if the module

has not arrived at the zero count in the cycle, the timer will be designed to go dark.

10.5.1.3 In preemption cases which immediately eliminate both the "WALK" and the "CLEARANCE" outputs, the pedestrian indication will immediately cycle to a steady "DON'T WALK" display. In such instances, the countdown timer shall recognize the steady "DON'T WALK" indication and the timer will be designed to go dark.

10.5.2 At the cycle immediately following a preempted cycle, the countdown timer shall display the correct timing parameters as initially programmed and not be affected by the reduced time. If the reduced time is less than two seconds, the countdown timer shall ignore this and continue to display the correct time, as initially programmed.

10.6 The countdown timer shall be designed to retain the pedestrian timing stored in the memory for all power outages of less than one second and to continue timing this pedestrian timing. Memory may or may not be retained for power outages between one and two seconds duration. The unit will resume operation as described in Paragraph 11.2 for power outages greater than two seconds in duration.

## 11. WARRANTY

11. 11.1 The manufacturer shall provide a written warranty against defects in materials and workmanship for a minimum period of 60 months after acceptance of the modules.
11. 11.2 Replacement LED modules shall be provided on a one for one basis promptly after receipt of LED modules that have failed at no cost to the District of Columbia.
11. 11.3 All warranty documentation shall be submitted to the District of Columbia prior to the random sample testing.
11. 11.4 The warranty period shall begin on the date the LED module is energized and placed into service at the intersection, or ninety (90) days after delivery of the module to the District of Columbia, whichever occurs first.

**TECHNICAL SPECIFICATION**  
**PEDESTRIAN PUSH BUTTON**

The purpose of this specification is to define the minimum acceptable requirements for pedestrian push buttons.

The housing of the pedestrian push buttons shall be constructed from cast aluminum, painted battleship gray.

The unit shall be designed for installation on fluted signal poles.

The unit shall contain a micro-switch designed for at least one million operations.

The micro-switch closure shall occur when a plunger-type assembly is pushed.

The plunger shall be stainless steel or polished aluminum.

The unit shall be designed to ground an input into the controller and will not carry any live current.

The unit shall be designed without a sign enclosure.

## SPECIFICATIONS FOR MICROWAVE VEHICLE DETECTOR

1. PURPOSE

1.1 The purpose of these specifications is to describe minimum acceptable requirements for microwave vehicle detectors.

2. GENERAL TECHNICAL REQUIREMENTS

2.1 The unit shall be capable of detecting a motion of every type of vehicle permitted to operate in the public roadway.

2.2 The unit shall be capable of detecting motion in one direction, and ignoring motion in the opposite direction of that being detected.

2.3 The range of detection shall be from 3 feet to 100 feet.

2.4 The cone of the detector shall be based upon a 16 degree field view. For example, at a distance of 60 feet from the detector, the field of the detection should be 18.5 feet wide.

2.5 The detector shall be equipped with two field adjustment controls; one control shall be for range, and the other shall be for time delay extension.

2.6 The extension timer shall be capable of extending the detector output for at least 0.5 seconds to 7.5 seconds. Extension shall begin with the termination of the detected vehicle output and shall continue for the duration of the selected extension time interval.

2.7 No individual component of this detector shall be of such design, fabrication, nomenclature, or other identification as to preclude the purchase of said component from any wholesale electronic distributor.

2.8 One (1) isolation module with 12 VAC output shall be supplied with each microwave vehicle detector unit in order to ensure operation of this detection device with the Type 170 Microprocessor Based Traffic Signal Controller.

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**SPECIFICATION FOR  
Urban (30 X 41 INCH)  
DRIVER FEEDBACK SIGN**

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**Electronic Only  
James M. Cheeks, Jr.  
Transportation Operations Administration  
District Department of Transportation**

## SPECIFICATION FOR URBAN (30 x 41 INCH) DRIVER FEEDBACK SIGN

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### 1. General

The Driver Feedback Sign is a sign with a dynamic display that provides motorists real-time feedback of their vehicle's speed via radar speed detection. By providing this feedback, it is intended that motorists will better obey the speed limit and overall safety will be enhanced. The vehicle speed is to be detected via a radar module mounted within the sign enclosure. This document outlines the basic requirements for an Urban 30 x 41 inch Driver Feedback Sign.

### 2. Sign Face

2.1. The design of the Driver Feedback Sign shall be in harmony with that of the MUTCD Speed Limit (R2-1) in terms of relative layout and size.

2.1.1. The sign face shall be one of the following sheeting:

2.1.1.1. White reflective sheeting, full cubed micro-prismatic, ASTM proposed Type XI .

2.1.1.2. Fluorescent Yellow Green reflective sheeting, full cubed micro-prismatic, ASTM proposed Type XI .

2.1.1.3. Fluorescent Orange reflective sheeting, full cubed micro-prismatic, ASTM proposed Type XI .

2.1.2. The legend shall read "YOUR SPEED".

2.1.3. "YOUR SPEED" shall be printed in two lines of 5 inch high black letters.

### 3. Speed Display

3.1. The display shall be capable of displaying amber and red numerals.

3.2. The display shall have an integral strobe utilizing white LEDs with user configurable strobe patterns featuring a decaying pulse synchronized with the flashing numerals.

3.3. The display LED's intensity shall be rated 30° half angle, 8000 CDA/Square Meter for RED LEDs and 10,000 CDA/Square Meter for Amber LEDs.

3.4. The LED Intensity shall be controlled automatically by an Integrated Photocell for self-dimming utilizing pulse width modulation. This system adjusts the LED intensity for daytime, dusk, twilight, nighttime and adverse weather.

3.5. Numeric characters shall be 15 inches in height.

3.6. The display shall have four programmable speed thresholds.

## SPECIFICATION FOR URBAN (30 x 41 INCH) DRIVER FEEDBACK SIGN

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- 3.6.1. The lowest speed threshold (minimum display speed) shall have a default setting of 5 MPH. No speeds are displayed below the minimum display speed threshold.
- 3.6.2. The second speed threshold (speed limit) is typically set to the speed limit. The display shall be independently programmable between the minimum display threshold and the speed limit threshold as follows.
  - 3.6.2.1. The display shall be programmable to display speed as amber numerals.
  - 3.6.2.2. The display shall be programmable to display speed as flashing amber numerals.
  - 3.6.2.3. The display shall be programmable to display speed as flashing amber numerals with a synchronized white strobe.
  - 3.6.2.4. The display shall be programmable to display speed as red numerals.
  - 3.6.2.5. The display shall be programmable to display speed as flashing red numerals.
  - 3.6.2.6. The display shall be programmable to display speed as flashing red numerals with a synchronized white strobe.
- 3.6.3. The third speed threshold (excessive speed) is typically set to 5 to 10 MPH over the speed limit. The display shall be independently programmable between the speed limit threshold and the excessive speed threshold as follows.
  - 3.6.3.1. The display shall be programmable to display speed as amber numerals.
  - 3.6.3.2. The display shall be programmable to display speed as flashing amber numerals.
  - 3.6.3.3. The display shall be programmable to display speed as flashing amber numerals with a synchronized white strobe.
  - 3.6.3.4. The display shall be programmable to display speed as red numerals.
  - 3.6.3.5. The display shall be programmable to display speed as flashing red numerals.
  - 3.6.3.6. The display shall be programmable to display speed as flashing red numerals with a synchronized white strobe.
- 3.6.4. The highest speed threshold (maximum display speed) is typically set 20 to 30 MPH over the speed limit.
  - 3.6.4.1. Above the maximum display threshold the sign shall be programmable to display the programmed maximum display speed threshold or the programmed speed limit threshold or blank.

## SPECIFICATION FOR URBAN (30 x 41 INCH) DRIVER FEEDBACK SIGN

3.6.4.2. The display shall be independently programmable above the excessive speed threshold as follows.

3.6.4.2.1. The display shall be programmable to display speed as amber numerals.

3.6.4.2.2. The display shall be programmable to display speed as flashing amber numerals.

3.6.4.2.3. The display shall be programmable to display speed as flashing amber numerals with a synchronized white strobe.

3.6.4.2.4. The display shall be programmable to display speed as red numerals.

3.6.4.2.5. The display shall be programmable to display speed as flashing red numerals.

3.6.4.2.6. The display shall be programmable to display speed as flashing red numerals with a synchronized white strobe.

### 4.0 Power

4.1 The sign shall be powered by 12 VDC nominal (10.5 VDC to 16 VDC, maximum 24 VDC).

4.1.1 The sign shall draw 54 Watts power maximum.

4.1.1.1 Typical average power during daylight – 15 Watts.

4.1.1.2 Typical average power during night – 6 Watts.

4.1.1.3 Typical daily average power (24 hour operation) - 9Watts (216 Watt-Hours / Day)

4.2 An optional AC module shall be available

4.3 An optional Solar Kit shall be available.

4.4 An optional Battery Charger Kit shall be available. The Battery Charger System shall enable the sign to be run with a variety of AC power voltages typically available in street lamp poles. The battery charger system shall be designed to power sign operation 24 hours per day, seven days per week—including a reserve capacity in the event power is disrupted for up to four days.

### 5.0 Mechanical

5.1 The sign shall consist of an aluminum sign blank 30 inches wide by 41 inches high and an aluminum bracket to house the Electronic Control System on the rear side of the sign blank.

## SPECIFICATION FOR URBAN (30 x 41 INCH) DRIVER FEEDBACK SIGN

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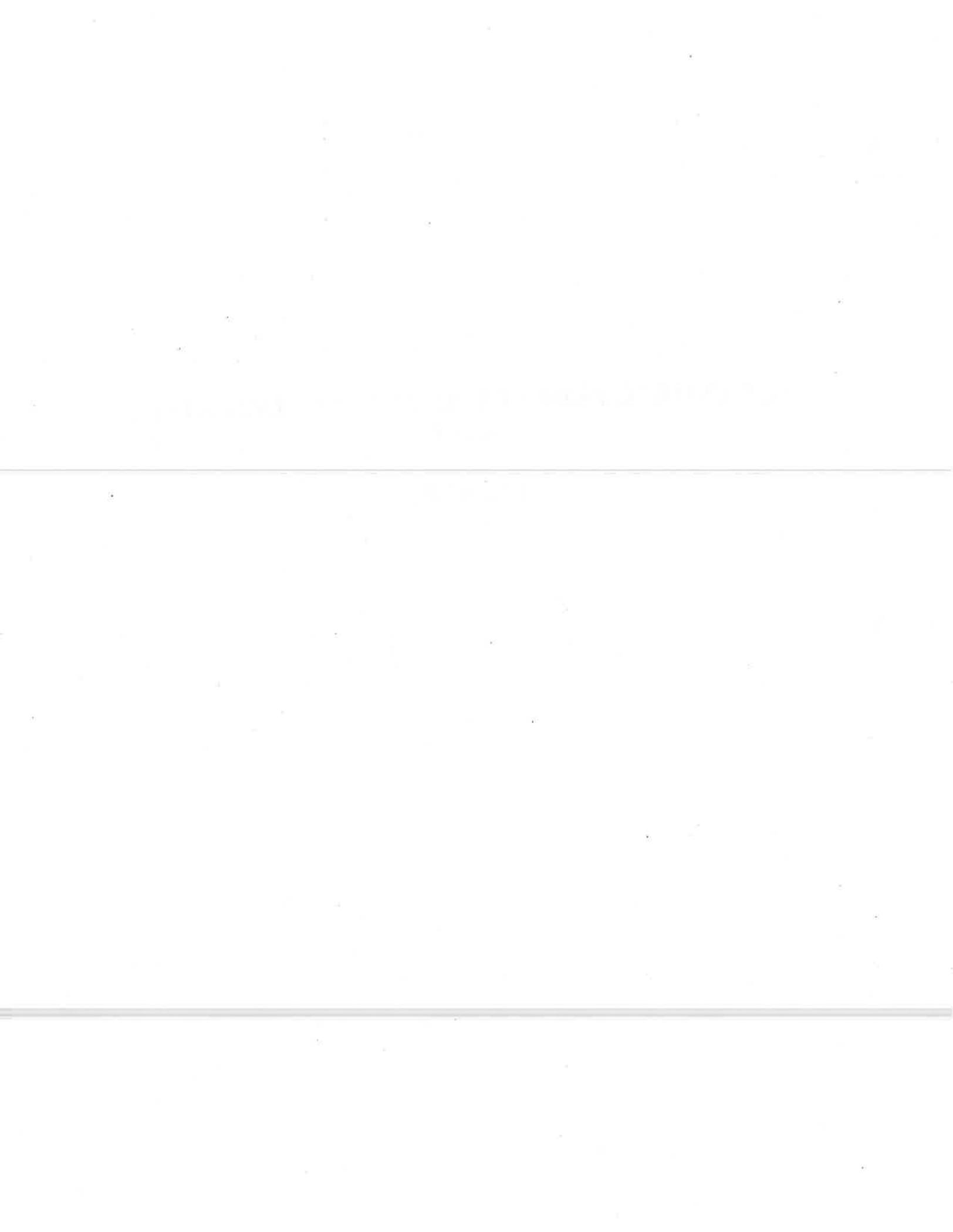
- 5.2 The sign shall be 3.25 inches thick maximum.
  - 5.3 The sign shall weigh 38 pounds maximum.
  - 5.4 The sign shall have a means to secure the Electronics Control System to make it theft resistant with a user-provided lock.
  - 5.5 The sign shall have an environmentally sealed, removable Electronics Control System that contains all of the electronics in the sign. The Electronics Control System shall be easily removable for ease of installation and maintenance.
- 6.0 Electronics Control System
- 6.1 The Electronics Control System shall be capable of sensing the speed of approaching vehicles with the built-in K-band radar and displaying it on the built-in LED display.
  - 6.2 The Electronics Control System shall be vandal and tamper resistant by utilizing high impact polycarbonate on the speed display face.
  - 6.3 The Electronics Control System shall weigh 13 pounds maximum.
  - 6.4 The Electronics Control System shall be equipped with a Blue Tooth wireless connection. The Blue Tooth wireless connection shall allow the user to connect to a laptop with Blue Tooth connection capability or an optional PDA to program the sign and download speed data from the sign.
    - 6.4.1 The Blue Tooth wireless connection shall have a range of 30 feet in front of the sign.
    - 6.4.2 The Blue Tooth wireless connection shall be capable of communicating at speeds of 19.2 K baud.
  - 6.5 The Electronics Control System shall be capable of scheduling up to 10 events per day for 365 days.
    - 6.5.1 The Electronics Control System shall allow individual event scheduling for the radar, display module or communications device power.
    - 6.5.2 The Electronics Control System shall allow individual event scheduling for speed limit changes, display modes including strobe effects.
    - 6.5.3 The Electronics Control System shall allow individual event scheduling for “stealth” mode for collecting “before speed data.”
  - 6.6 The Electronics Control System shall be capable of logging up to 70 days of speed data.

## SPECIFICATION FOR URBAN (30 x 41 INCH) DRIVER FEEDBACK SIGN

- 6.6.1 The Electronics Control System shall be capable of logging the highest and lowest speed in a sampling period.
- 6.6.2 The Electronics Control System shall be capable of logging a count in each 10 minute period to indicate how long vehicles were detected in the 10 minute period.

**ACCESSIBLE PEDESTRIAN SIGNAL MATERIALS  
LIST**

**(1 PAGE)**





# THE HISTORY OF THE UNITED STATES

The history of the United States is a complex and multifaceted story. It begins with the early Native American civilizations, such as the Mayans, Aztecs, and Incas, who built great empires in the Americas. The arrival of European explorers in the late 15th century marked the beginning of a new era. The United States was founded in 1776, and its history is marked by significant events, including the American Revolution, the Civil War, and the rise of the industrial revolution. The country has grown from a small colony to a global superpower, and its history continues to shape the world today.

The early years of the United States were characterized by a spirit of independence and a desire for self-governance. The American Revolution was a pivotal moment in the country's history, leading to the adoption of the Constitution and the establishment of a democratic government. The Civil War, which lasted from 1861 to 1865, was a defining moment in the nation's history, as it resolved the issue of slavery and preserved the Union. The industrial revolution brought about significant changes in the way people lived and worked, and it led to the growth of a middle class.

The United States has a rich and diverse cultural heritage, and its history is a testament to the resilience and ingenuity of its people. The country has played a leading role in the world, and its values of freedom, democracy, and equality have inspired people around the globe. The history of the United States is a story of progress and achievement, and it is a story that continues to unfold.

**DRAWINGS FOR TEAR-DROP FLXTURES**

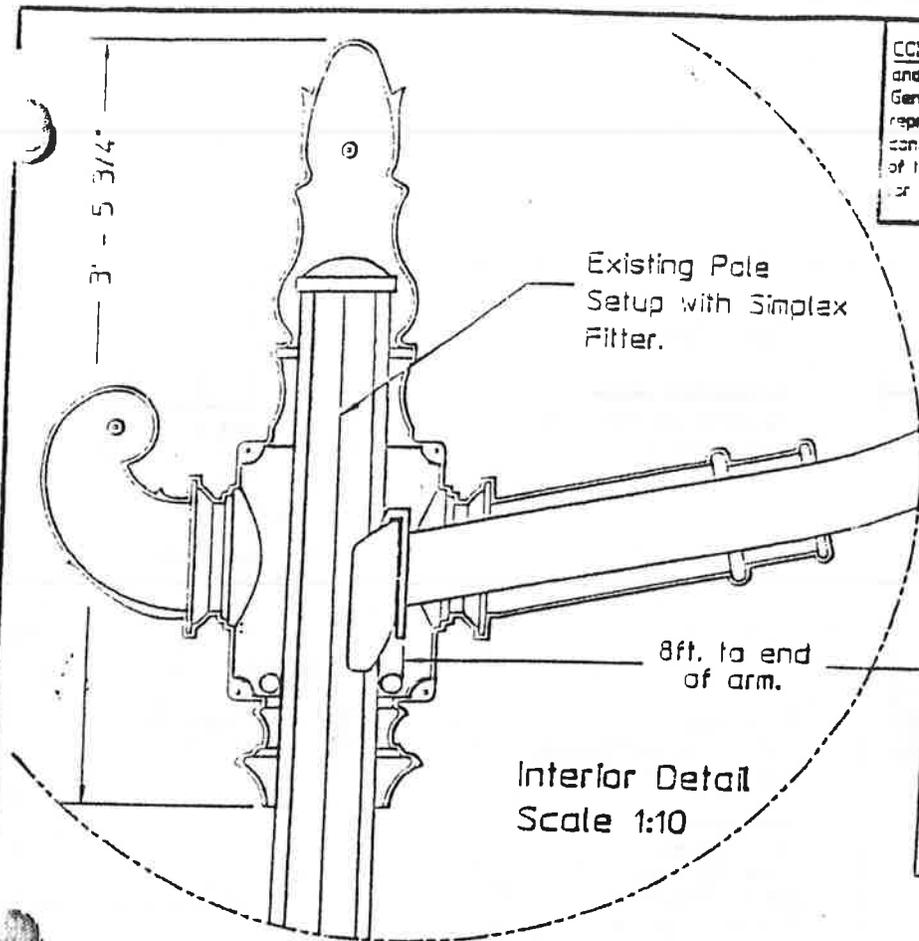
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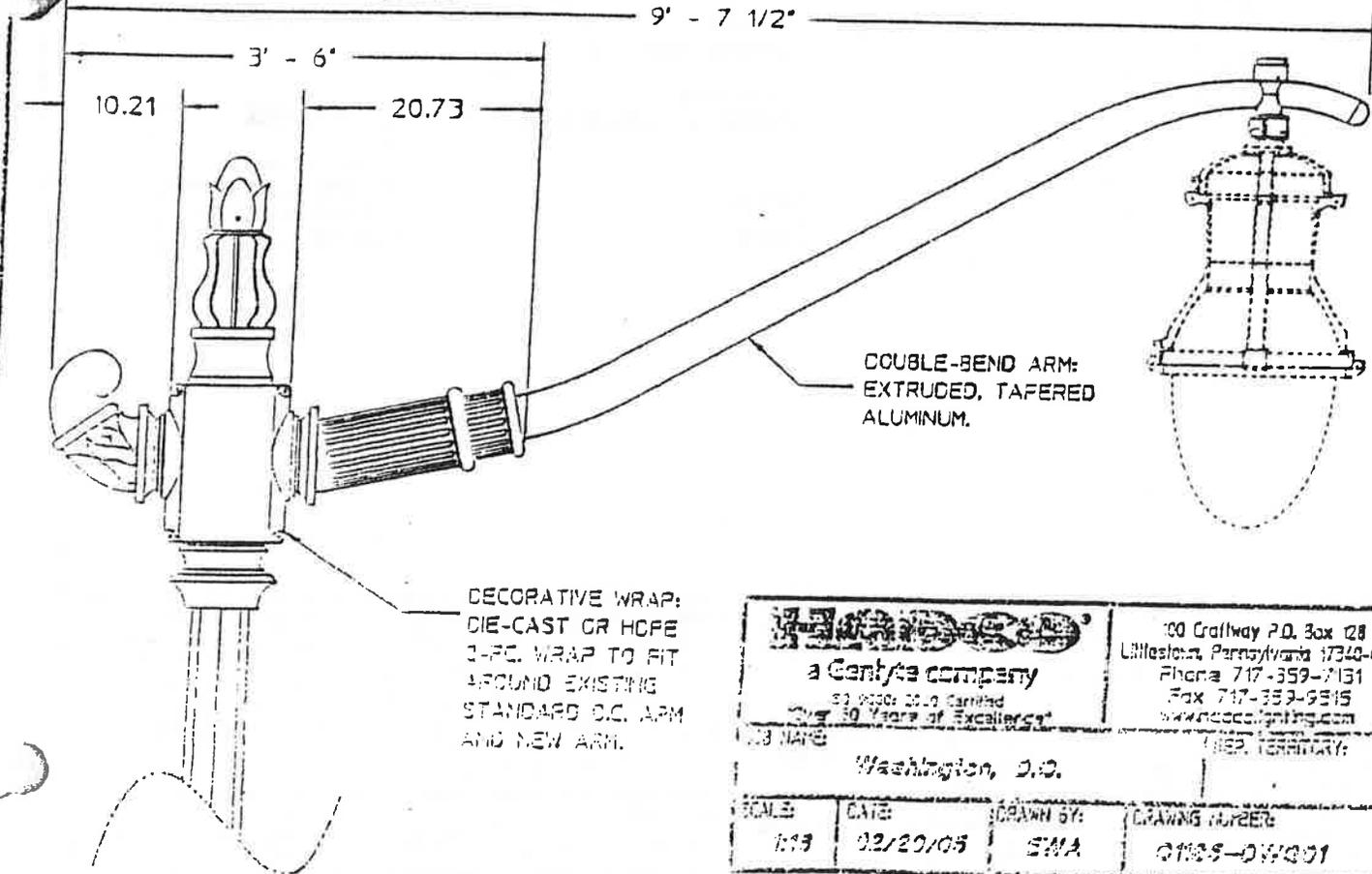
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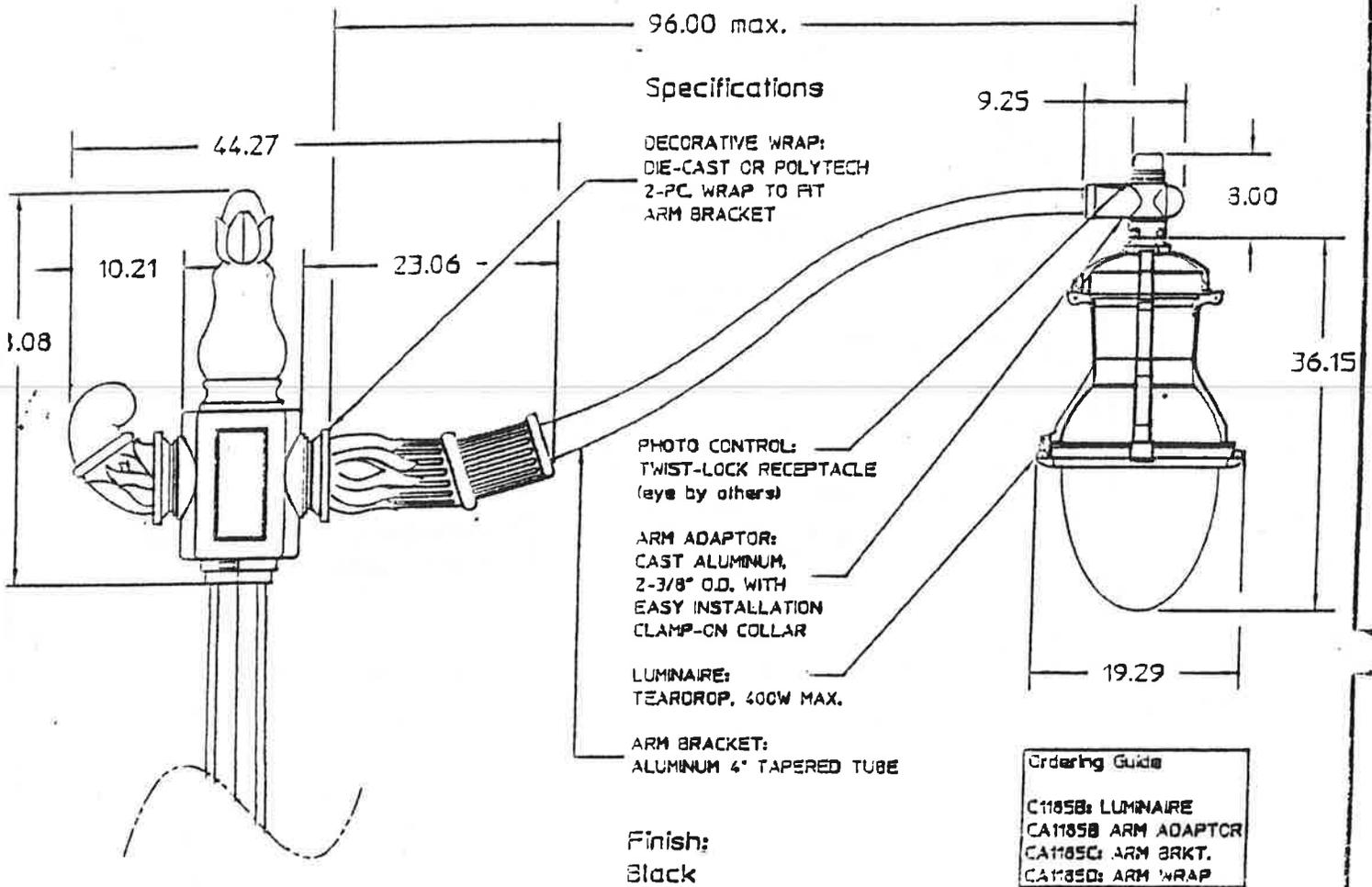
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**Ordering Guide:**  
 CA1185: Double-bend bracket  
 CA1185A: Decorative wrap



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	BY: <b>EVA</b>		



# Full Specification (Complete Assembly) Drawing



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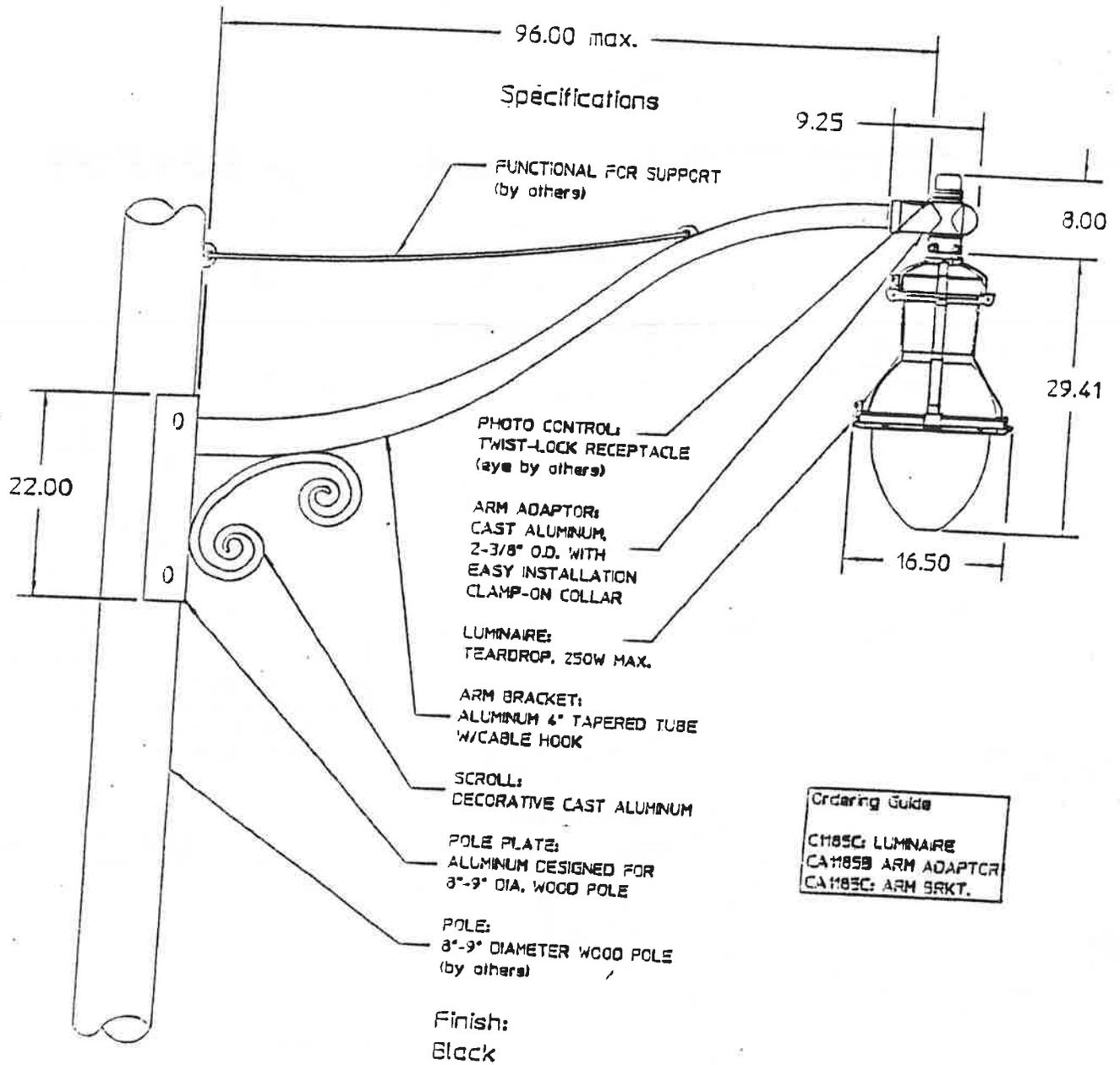
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BY:	DATE:

DRAWING NUMBER:  
**C1185-DW007**



Ordering Guide  
 CM185C: LUMNAIRE  
 CA185B: ARM ADAPTOR  
 CA185C: ARM BRKT.

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Finish:  
 (specify)

TWIST-LOCK PHOTO CONTROL (BY OTHERS)

(2) 1/2-20 STAINLESS STEEL SET SCREWS

**Ordering Guide**  
 SA8664 ADAPTOR

TWIST-LOCK PHOTO CONTROL RECEPTACLE

BLACK, WHITE, & GREEN OUT WIRES

FIXTURE PITCH SET SCREW

CAST ALUMINUM  
 3" OD X 2-1/2" ID X 2-7/8" LG  
 HORIZONTAL ARM  
 MOUNTING ADAPTOR

(2) 3/8-16  
 STAINLESS STEEL  
 CLAMP BOLTS

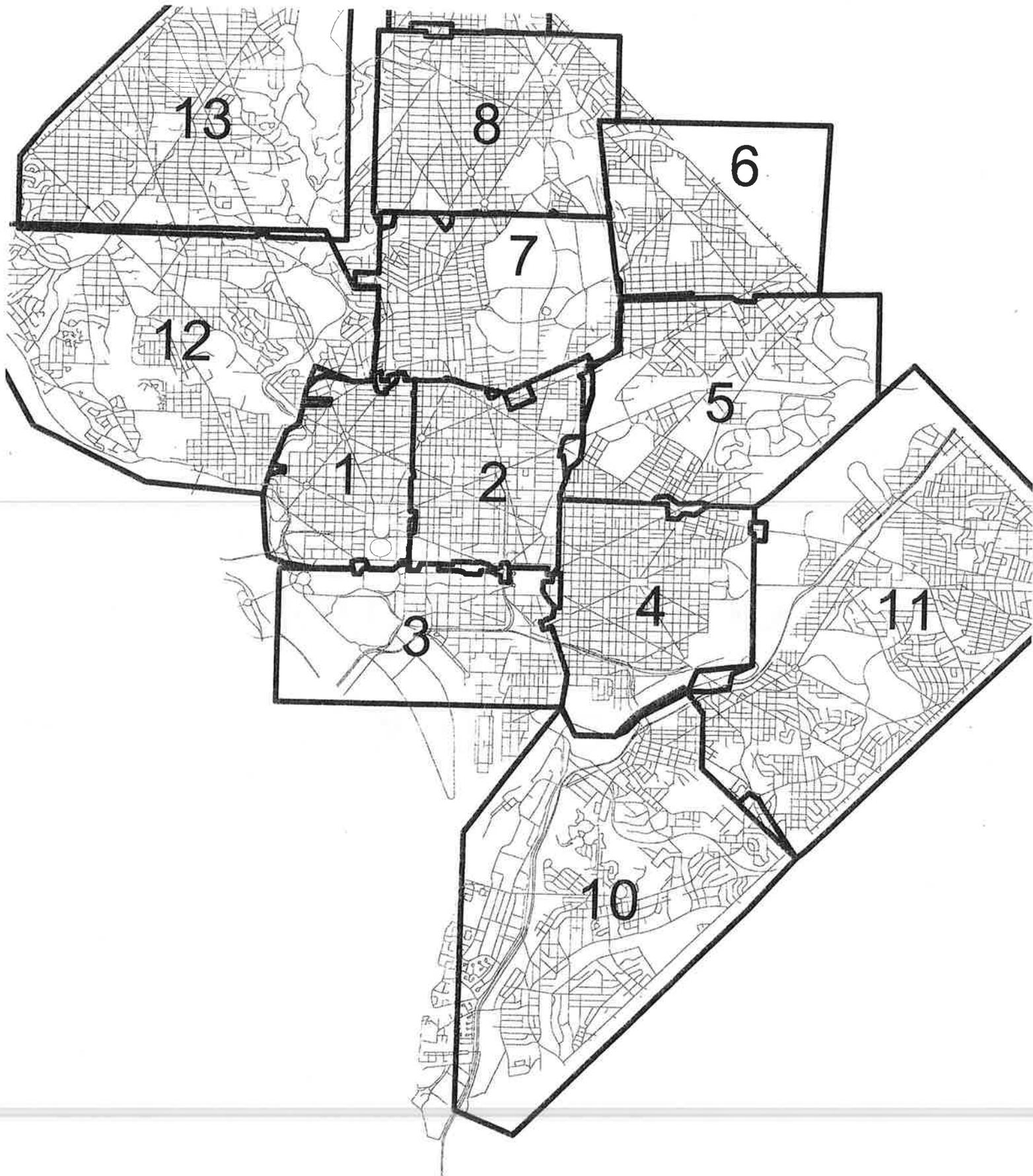
FIXTURE ORIENTATION SET SCREW

CAST ALUMINUM  
 CLAMP COLLAR  
 FOR EASY INSTALLATION

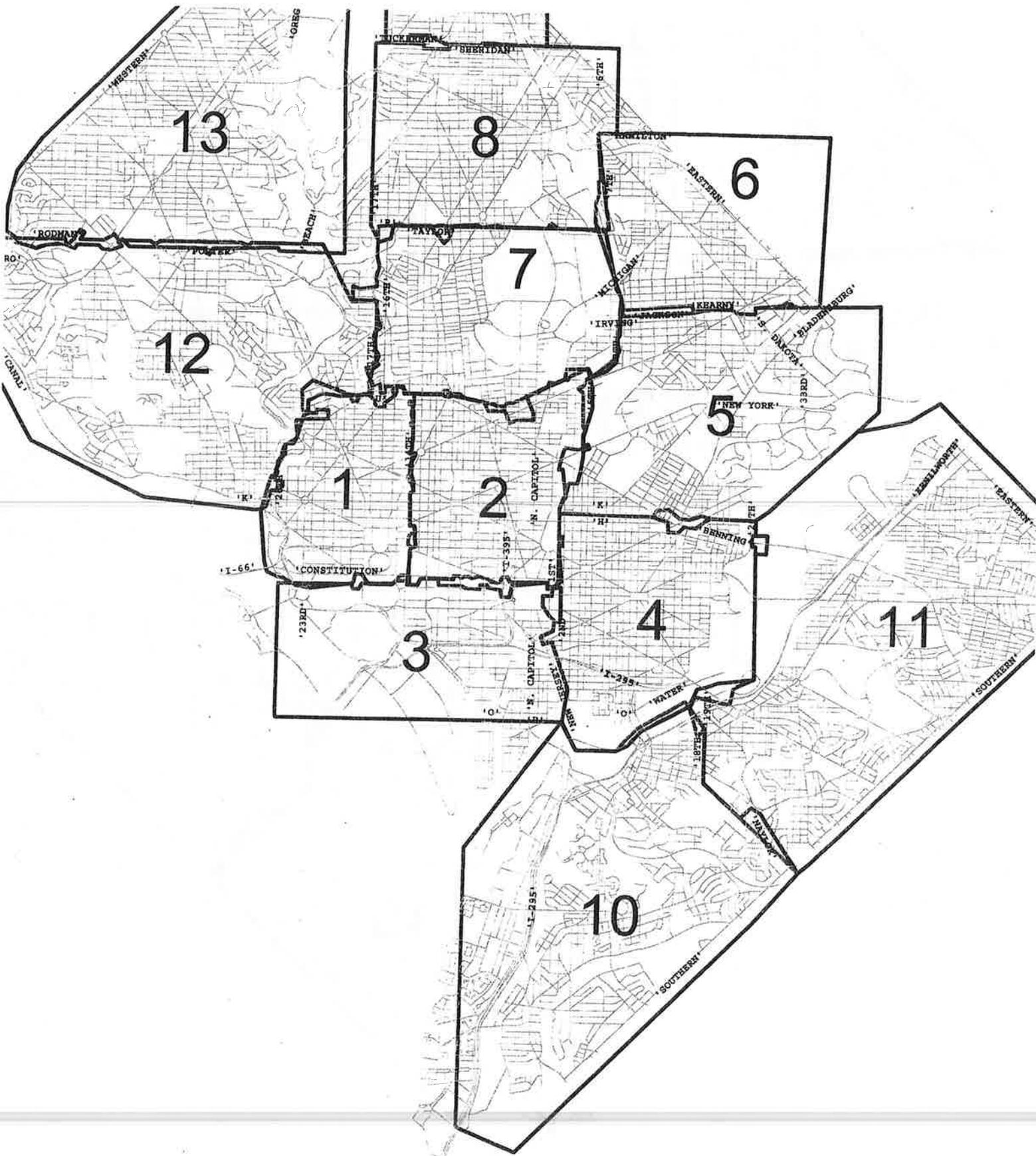
3 PRONG MALE DISCONNECT TO FIXTURE

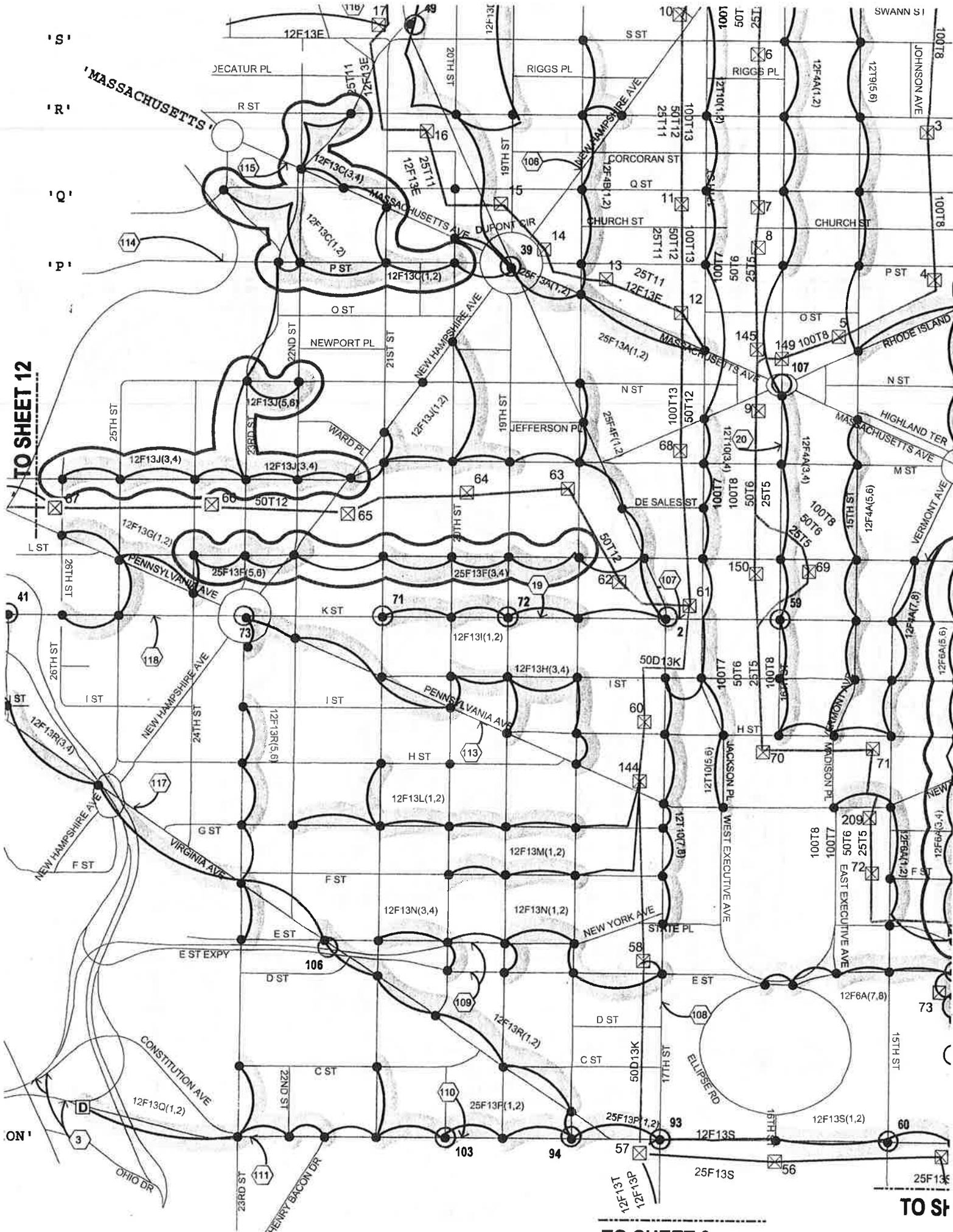
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		BY: TAG	DATE: 11.04.04

# Citywide Communication Network







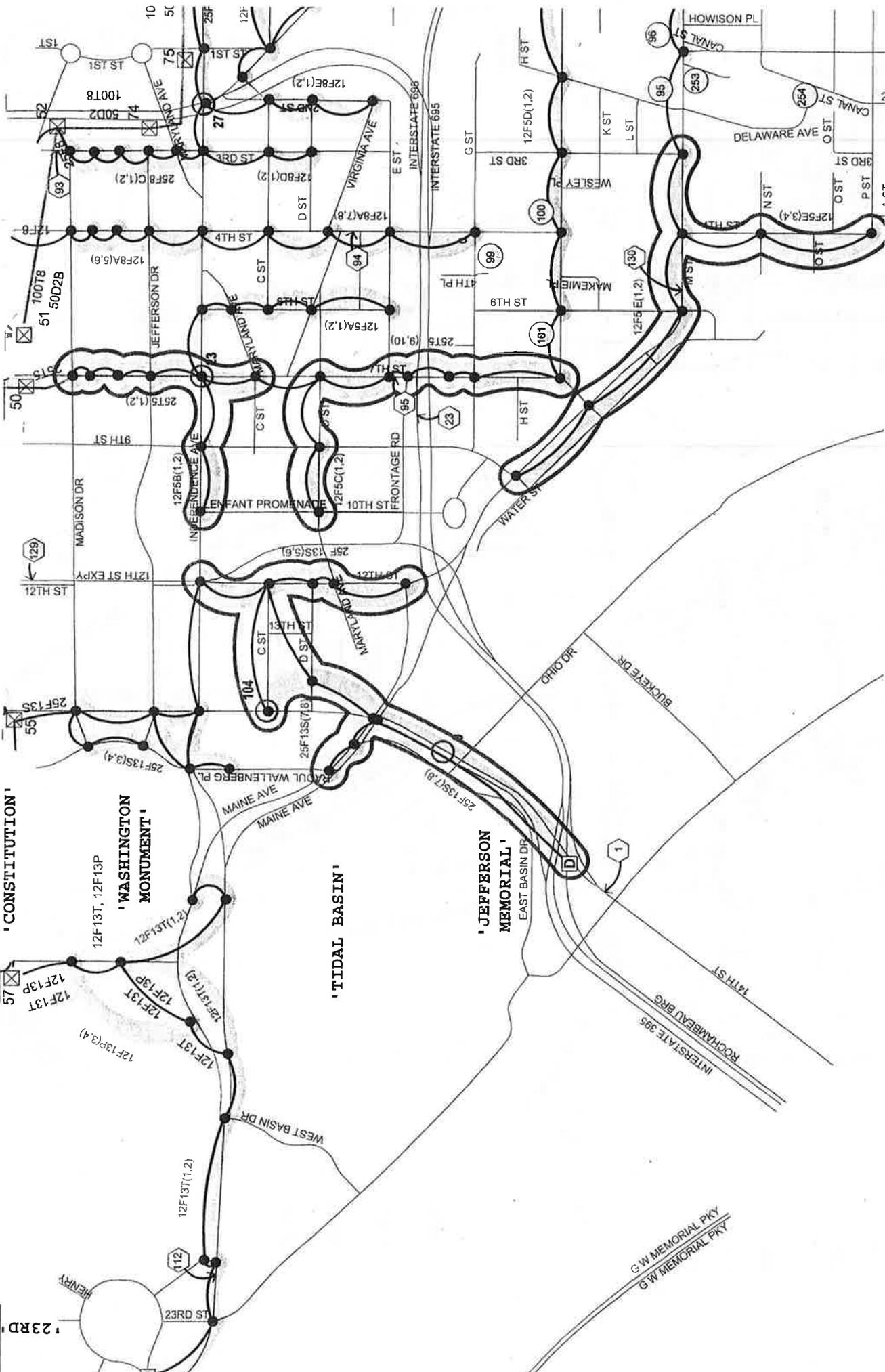


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 'WASHINGTON MONUMENT'

'TIDAL BASIN'

'JEFFERSON MEMORIAL'

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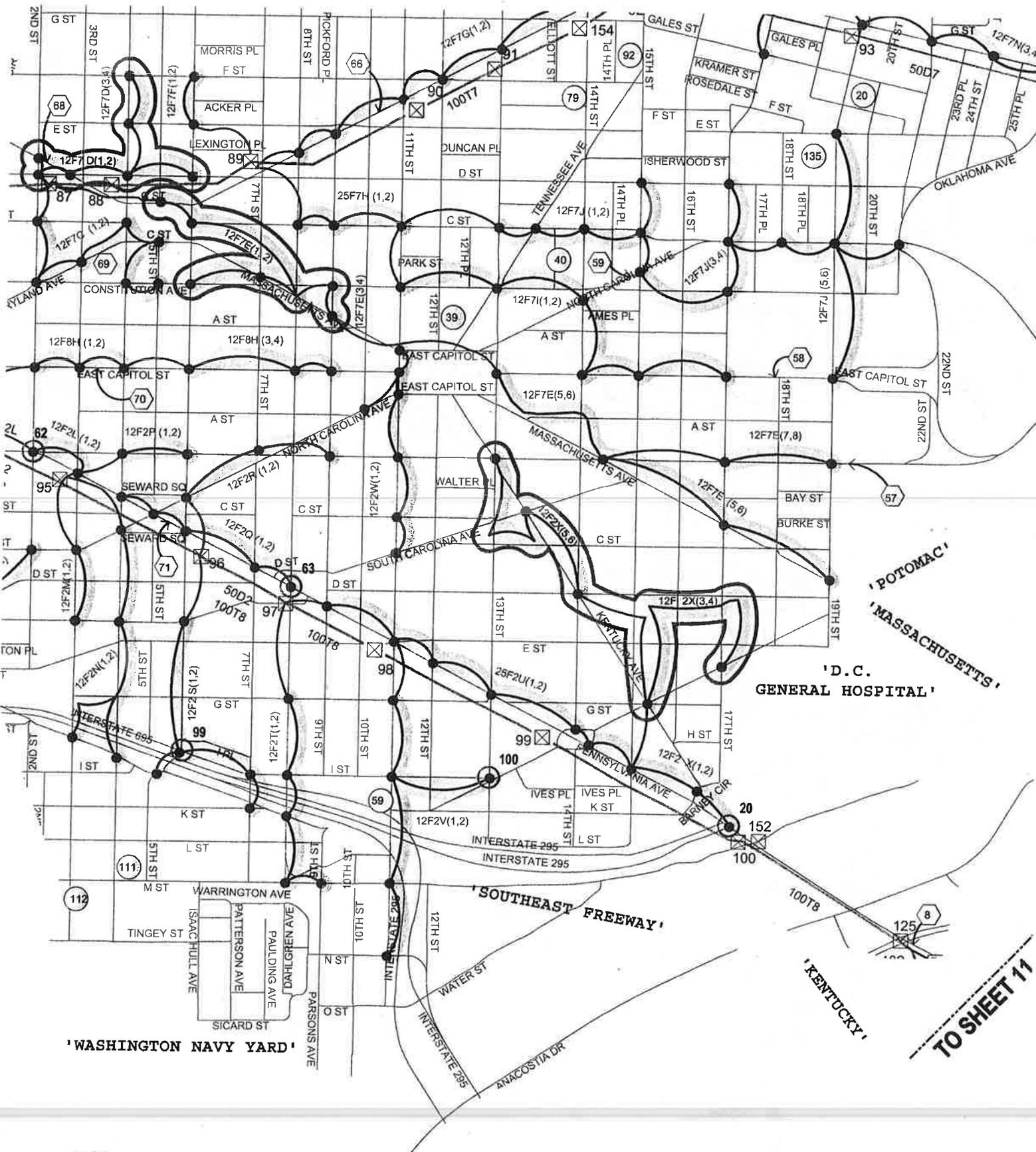
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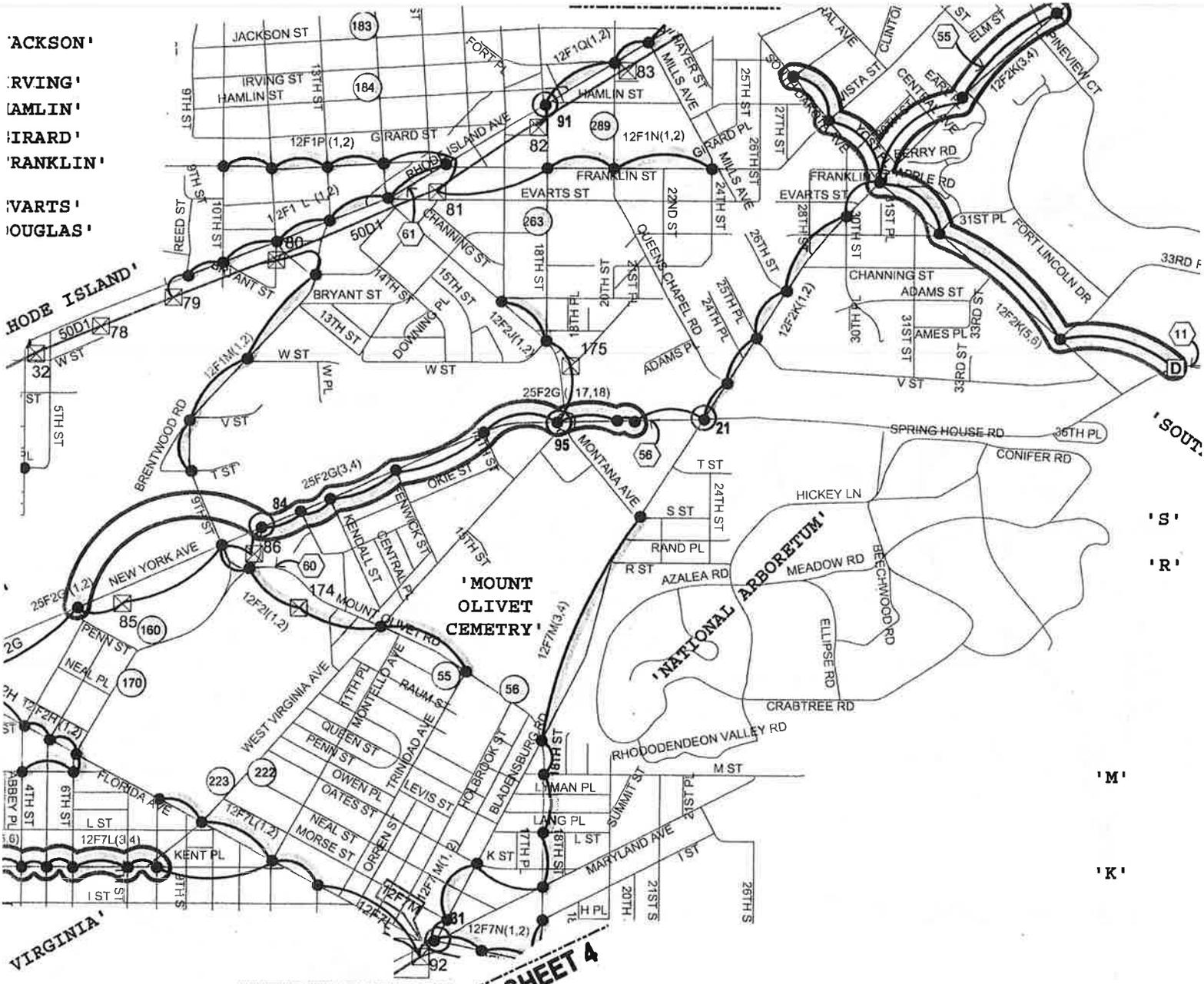
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TO SHEET 6



TO SHEET 4

TO SHEET 4

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'RVING'  
'AMLIN'  
'IRARD'  
'RANKLIN'  
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'OUGLAS'

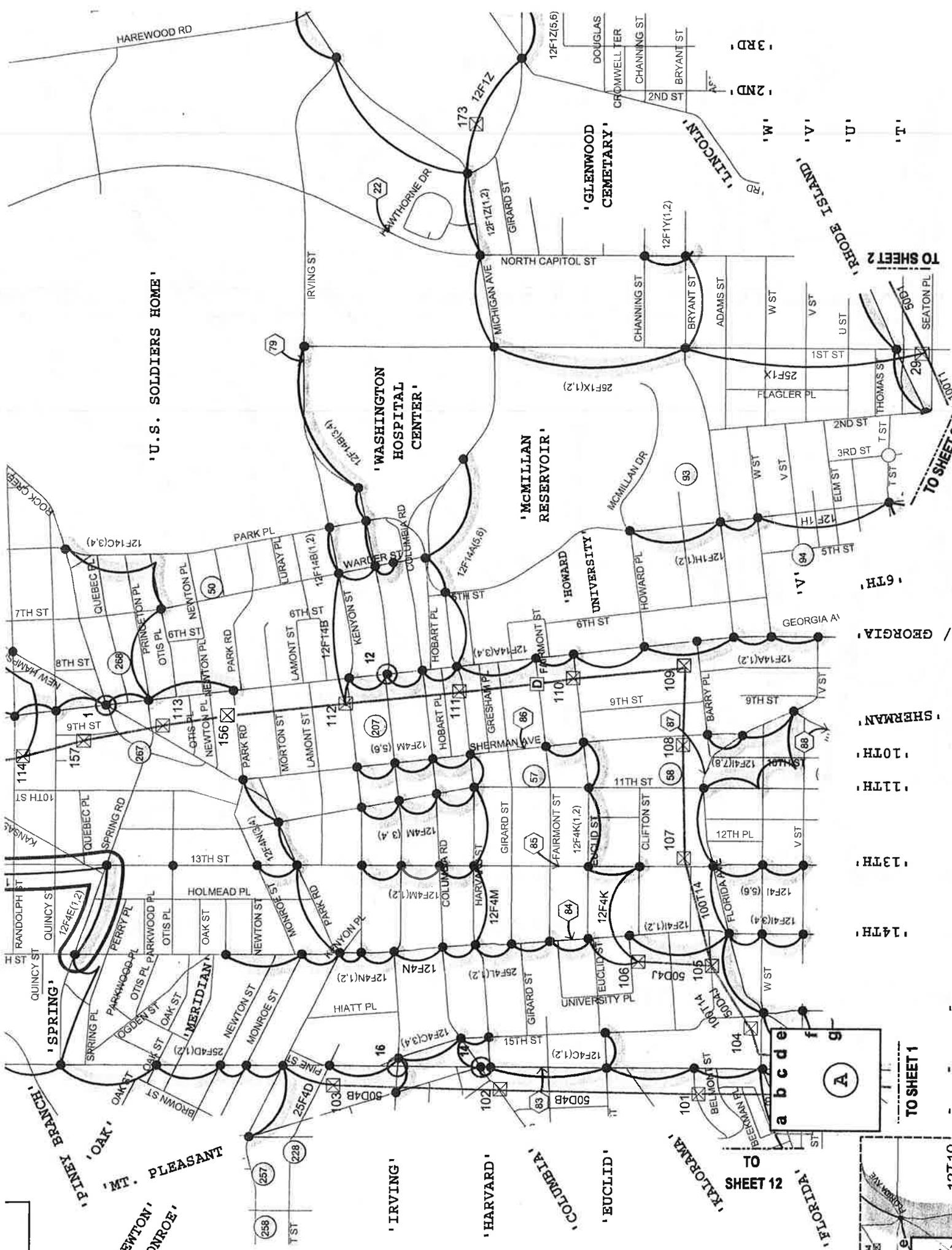
'RHODE ISLAND'

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'S'  
'R'

'M'  
'K'

'5TH' 'MARYLAND' 'BLADENSBURG' 'FLORIDA' '17TH' '21ST' '26TH'





'U.S. SOLDIERS HOME'

'WASHINGTON HOSPITAL CENTER'

'McMILLAN RESERVOIR'

'GLENWOOD CEMETARY'

'HOWARD UNIVERSITY'

'6TH'

'7TH / GEORGIA'

'SHERMAN'

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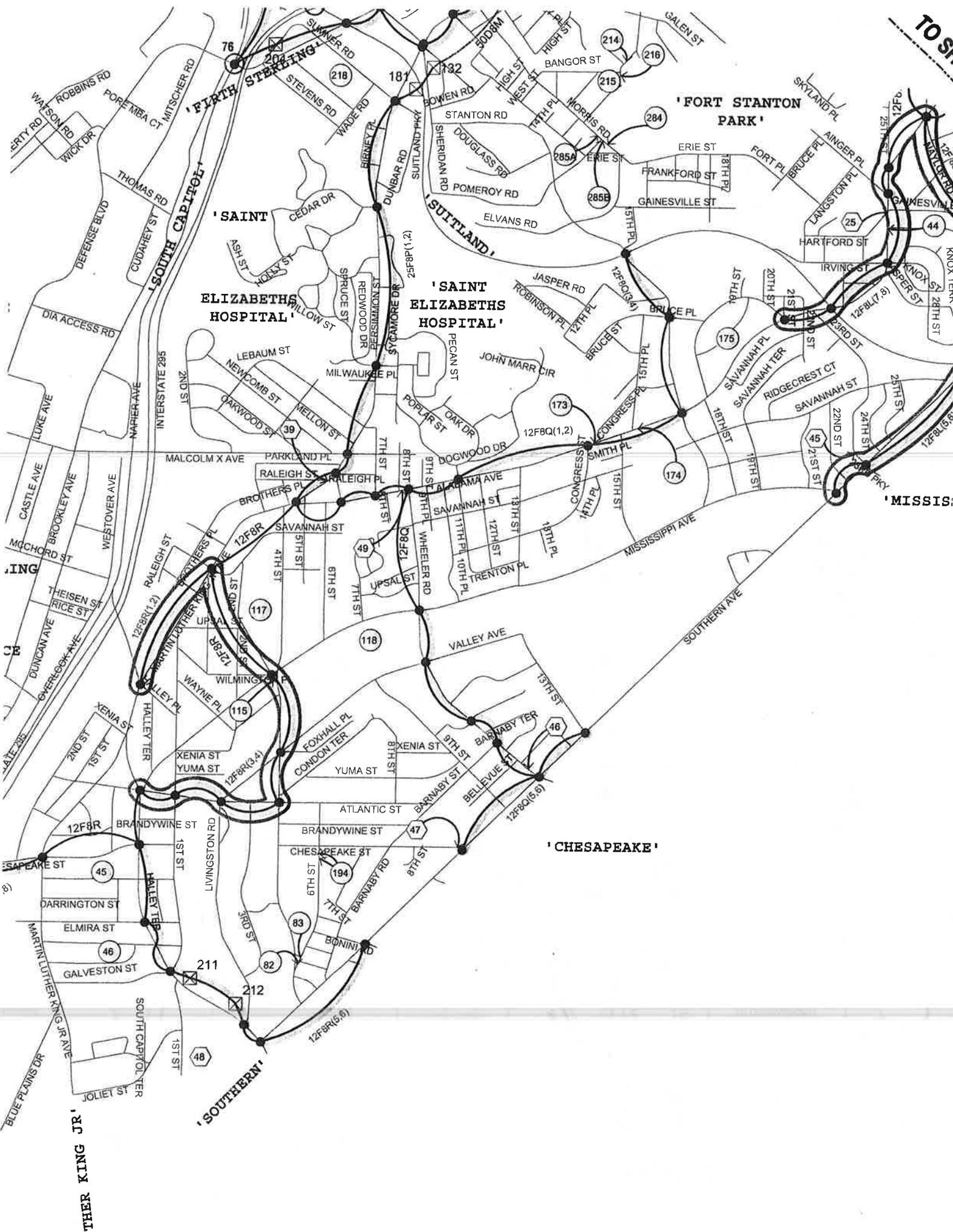
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'FORTH STERLING'

'FORT STANTON PARK'

'SAINT ELIZABETHS HOSPITAL'

'SAINT ELIZABETHS HOSPITAL'

'MISSISSIPPI AVE'

'CHESAPEAKE'

'SOUTHERN'

MARTIN LUTHER KING JR. AVE

ING

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SAPEAKE ST

DARRINGTON ST

ELMIRA ST

GALVESTON ST

JOLIET ST

SOUTH CAPITOL TER

BLUE PLAINS DR

MARTIN LUTHER KING JR. AVE

2ND ST

1ST ST

THEISEN ST

RICE ST

DUNCAN AVE

OVERLOOK AVE

WILMINGTON ST

WAYNE PL

WILMINGTON ST

THEISEN ST

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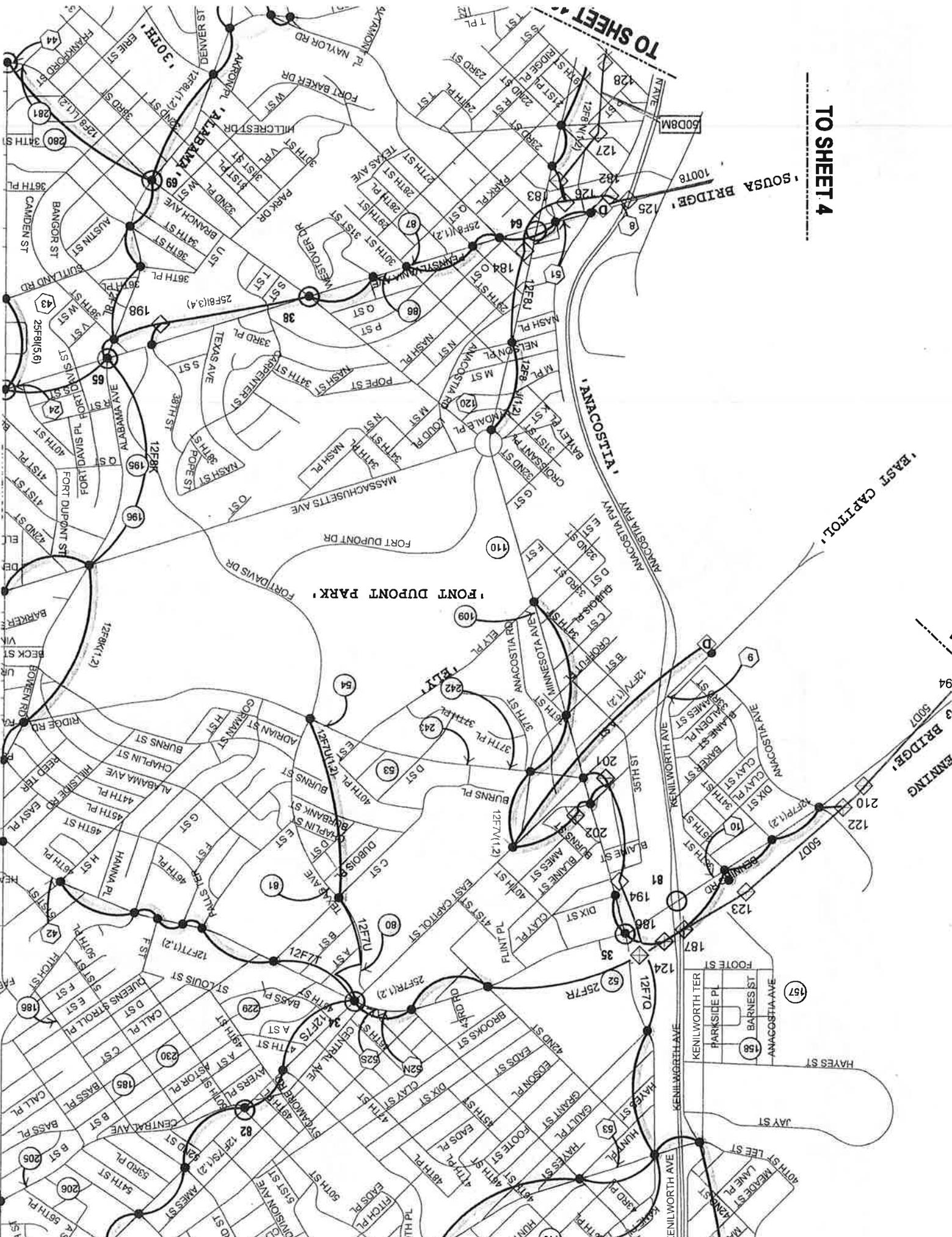
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OVERLOOK AVE

WILMINGTON ST

WAYNE PL

WILMINGTON ST



TO SHEET 4

TO SHEET 4

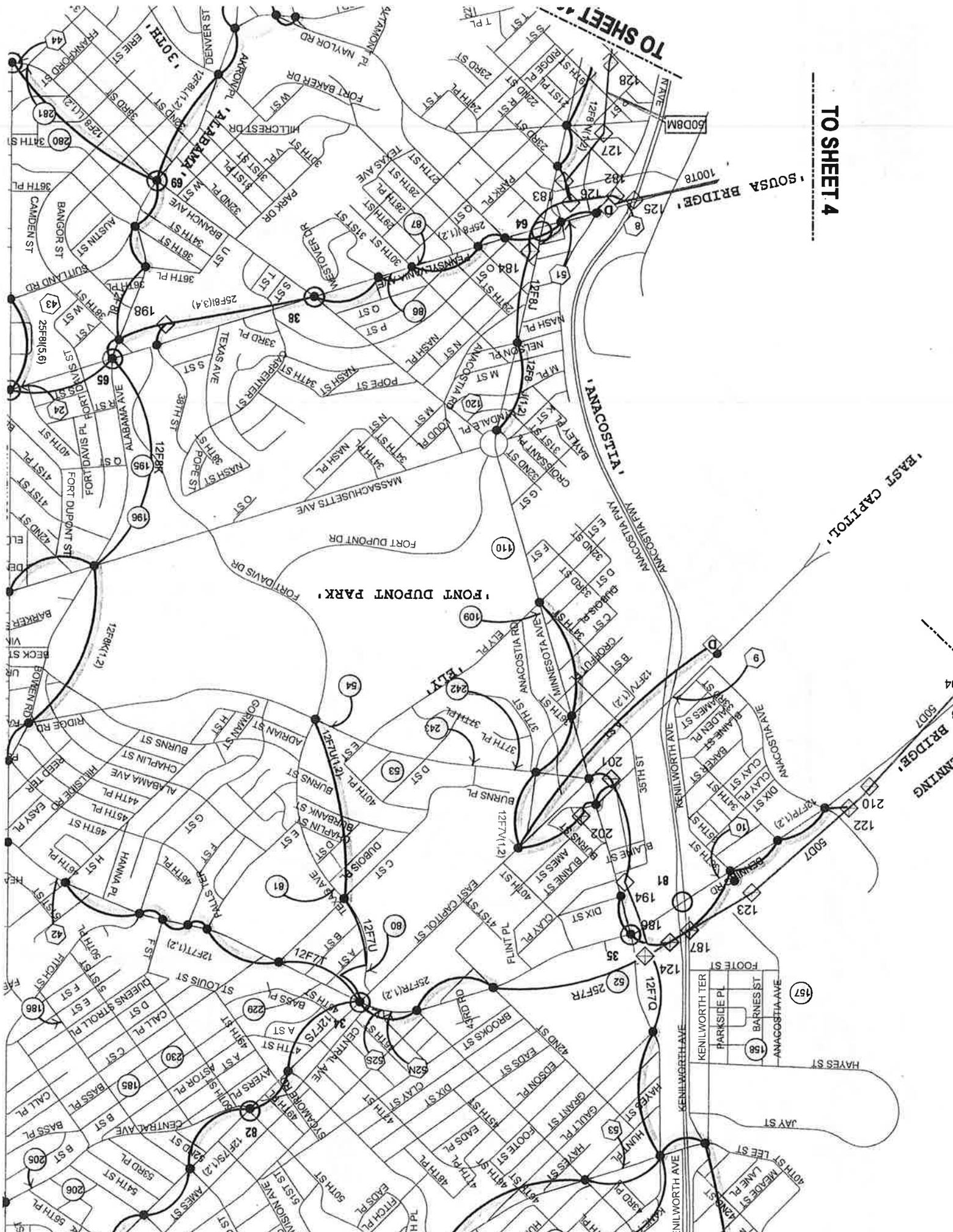
FONT DUPONT PARK

ANACOSTIA

SOSA BRIDGE

ANNING BRIDGE

EAST CAPITOL



TO SHEET 4

TO SHEET 4

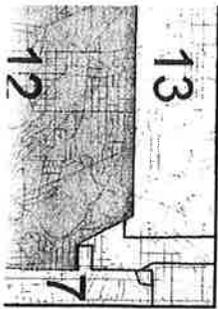
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SOSA BRIDGE

ANNING BRIDGE

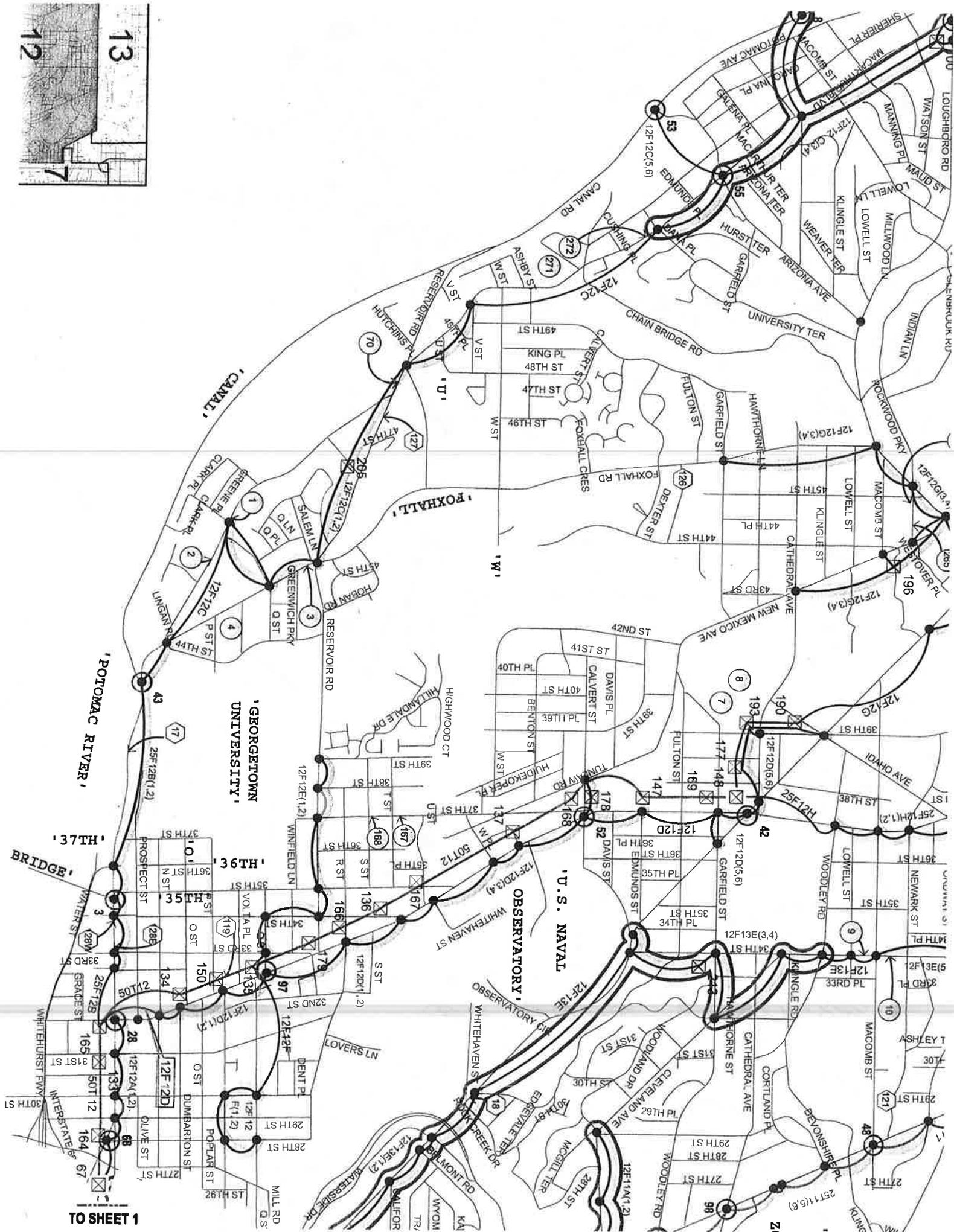
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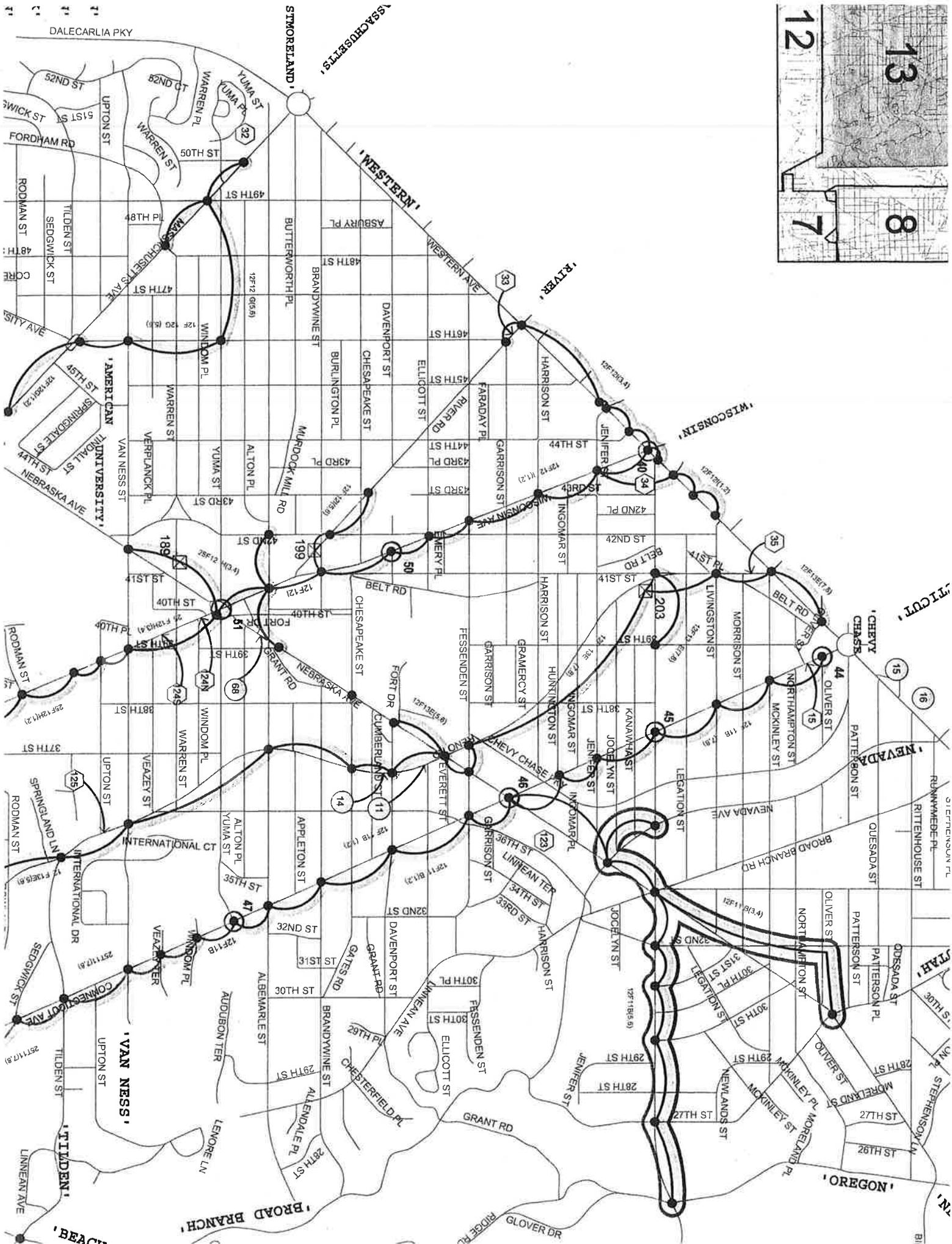
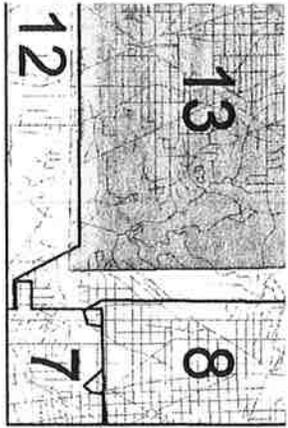
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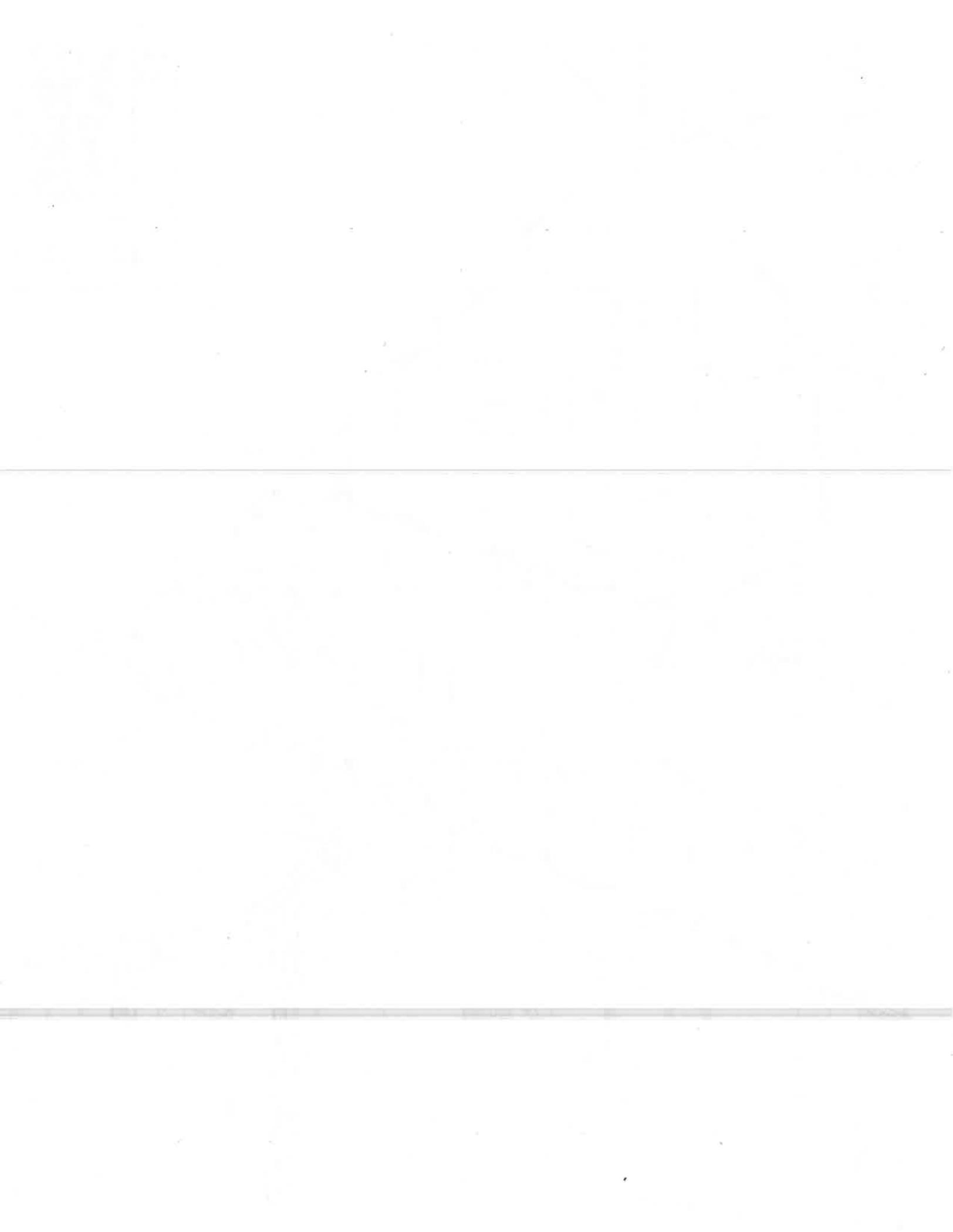
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TO SHEET 1

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# Actelis Networks

# Actelis Networks ML688



## Carrier Ethernet Over Copper™

The ML688 Ethernet Access Device (EAD) from Actelis Networks® is a copper Add-Drop EAD that enables delivery of high-speed Carrier Ethernet services over existing copper and fiber infrastructure with speeds up to 100 Mbps of symmetrical Ethernet traffic. An 8 copper pair model, the ML688 takes in the copper pairs and allows them to be split into two directions, thereby allowing multiple nodes to be connected to each other over copper in a linear chain or ring configuration. Each node has full switching capabilities and can drop and add Ethernet traffic at each location while transferring the rest of the traffic through. The ML688 EAD can also be deployed as a mini-CO supporting EADs. With its superior performance, extensive functionality and low cost, the ML688 EAD offers rapid service delivery and allows for complete utilization of the existing network infrastructure.

The ML688 EAD is interoperable with any standard Ethernet switch, router or hub. Compliant with Metro Ethernet Forum (MEF) specifications, ML688 EAD systems seamlessly integrate into carrier Ethernet networks. Equipped with 4 10/100Base-T Ethernet interfaces and an optional 1000Base-FX Small Form Factor (SFP) port, the ML688 EAD allows assignment of a service or a customer per port. The ML688 EAD model lets service providers create an intelligent Ethernet access edge with bandwidth limiting per ingress port and traffic shaping on the Ethernet Access uplink (HSL).

Powered by Actelis Networks' award-winning EFMplus™ technology, the rate, reach and reliability are increased significantly using advanced Dynamic Spectrum Management

(DSM) techniques. This technology provides the best rate/reach performance and most resilient fiber-quality transmission, ensuring carrier-class reliability.

The ML688 EAD provides 802.1q VLAN-aware wire-speed bridging, double tagging (VLAN stacking) for end-user VLAN transparency, L2 (Ethernet priority), L3 (ToS/Diff-Serv) classification with four traffic classes, RSTP/STP, Link Aggregation, bandwidth monitoring, Multicast/Broadcast limiting and advanced OAM.

The ML688 EADs can be managed In- and Out-of-Band by the MetaASSIST™ View graphical craft application and via the multi-platform Element Management System, MetaASSIST EMS. The management protocols include standard TL1 command line interface and SNMP using standard MIBs for seamless integration with third-party Network Management Systems (NMS).

The ML688 EADs provide full Carrier Ethernet over Copper access functionality, including basic traffic management and QoS application at the edge. One hundred percent compatible with Carrier Ethernet switching equipment in the CO, the ML688 EAD provides basic bandwidth management and QoS at the edge, making the most efficient use of the bandwidth in the copper access network.

## Highlights

- Support for 2 High Speed Copper Links
- IEEE 802.3ah Ethernet in the First Mile (EFM) 2Base-TL Solution
- MEF Certified Ethernet Capabilities
- Rapid Service Deployment
- Superior Rate, Reach & Reliability
- Low Delay and Jitter for Voice and Video Transmission
- Worldwide Spectral Compliancy
- OSMINE, NEBS III, FCC, UL, CE
- Environmentally Hardened

## Applications

- Security Cameras
- Traffic cameras
- Railway connectivity (ticketing, arrival info, security cameras, etc)
- Traffic Management (Security and traffic cameras)
- Private Campus Network ring

## Markets Served

- RBOCs, PTTs, Independent Operators, Competitive Operators
- Federal, State and Local Government Agencies
- Education, Health Care, Utilities, Private Campuses