

NOTES

772-P01 Descriptions: The signalized intersections or signalized pedestrian crossings are referred to as the following bid items:

Remove Overhead Flashing Beacon: Intersection of University Avenue with State Street

Salvage & Install Flashing Beacon: Salvage the U-post Mounted Rectangular Rapid Flashing Beacon at the intersection of University Avenue with Centennial Drive and install at intersection of University Avenue with State Street

Flashing Beacon - Site 1: Rectangular Rapid Flashing Beacon at Intersection of University Avenue with Stanford Road

Revise Traffic Signal System - Site 1: Intersection of University Avenue with Columbia Road

Traffic Signal System: Intersection of University Avenue with Oxford Street/Centennial Drive

Flashing Beacon - Site 2: Pedestrian Hybrid Beacon at the intersection of University Avenue between Harvard Street and Cambridge Street

Flashing Beacon - Site 3: Pedestrian Hybrid Beacon at the intersection of University Avenue with Hamline Street

IT System: Fiber Optic Interconnect from Oxford Street to Columbia Road

772-P02 Sole Source Equipment: Contractor shall provide equipment listed in the sole source letter approved by the City of Grand Forks and NDDOT. Items used on this project include:

Traffic Signal System, Flashing Beacon - Site 2, Flashing Beacon - Site 3

- Econolite Cobalt RM with Transit Key/2M Series NEMA TS2/INTCIP
- Emergency Vehicle Preemption and Transit Priority Equipment Global Traffic Technologies' GPS based Opticom Systems
- Econolite Controller Cabinet 332/332D, pre-wired with ancillary components including RENO A&E Traffic Signal Conflict Monitor with Ethernet
- Vehicle and Pedestrian Signal Heads - General Electric GTX LED
- ADA Components including:
 - Polara Bulldog Pedestrian Buttons
 - Polara EZ Comm System
 - AAPS Pedestrian System
 - Advisor Advanced APC Pedestrian Controller
 - Priosk SMP2 High Visibility Pedestrian Station

IT System

- Ruggedcomm Rugged Switch RS900G
- Hybrid Single/Multimode Fiber Optic Cable

772-P03 Remove Overhead Flashing Beacon: Existing equipment shall remain the property of the City of Grand Forks. Deliver signal poles, mast arms, signal heads, controllers, cabinets, pedestrian heads, pushbuttons, and other miscellaneous traffic signal components to the City Public Works Facility at 724 N 47th St. Coordinate with Rick Hanson, Electrical Division Manager at (701)738-8796 or (218)779-4362. Include all costs associated for delivering and

stacking equipment in the price bid for "Remove Overhead Flashing Beacon".

772-P04 Salvage & Install Flashing Beacon: Salvage the U-post mounted Rectangular Rapid Flashing Beacon (RRFB) and store until ready for installation. Include all costs associated for salvage, store, and installation in the price bid for "Salvage & Install Flashing Beacon".

772-P05 Flashing Beacon - Site 1: The price bid for "Flashing Beacon - Site 1" shall include all labor and equipment necessary for the Rectangular Rapid Flashing Beacon (RRFB) to be fully operational as shown in the plans upon construction completion. This includes, but is not limited to, the installation of the following features where applicable; Type II signal standards and foundation, flashing RRFB lights, controller, APS push buttons, and all ancillary hardware, all cable, conduit, junction boxes, and appurtenances to install the flashing beacon completely. The RRFB shall be JSF Technologies 9400 Series or approved equal. The control enclosure shall be installed as shown in the plans and shall not be battery powered or solar powered. The Contractor shall provide shop drawings for the flashing beacon to the Engineer prior to ordering materials.

Program the flash rate and illuminated period of each flash in accordance with the most current version of the MUTCD and NDDOT standards.

772-P06 Revise Traffic Signal System - Site 1: The price bid for "Revise Traffic Signal System - Site 1" shall include all labor and equipment necessary for the installations of flashing yellow arrow signal heads, 5' mast arm extensions, and no right turn on red LED blank out signs.

772-P07 Traffic Signal System, Flashing Beacon-Site 2, Flashing Beacon-Site 3: The price bid for "Traffic Signal System", "Flashing Beacon - Site 2" and "Flashing Beacon - Site 3" shall include all labor and equipment necessary for each signal system to be fully operational as shown in the plans upon construction completion. This includes, but is not limited to, the installation of the following features where applicable; traffic signal standards, mast arms, feed point type IV pad mounted, pedestrian pushbuttons, pushbutton posts and signs, vehicular and pedestrian heads, video detection system (if shown in plans), controller, controller battery back-up, cabinet, foundations, revisions to the existing fiber optic interconnect system, along with all cable, conduit, junction boxes, pull boxes, and appurtenances to install the traffic signal completely. This also includes the removal of the existing wiring and any other abandoned features that may conflict with the proposed Traffic Signal System improvements. This also includes connections with lighting as noted elsewhere.

772-P08 Field Verification: Verify all features labeled "Existing" are approximately located. Verify the location of all proposed signal and lighting features including all proposed conduit to avoid conflict with any utilities or any other features potentially encountered in the field.

772-P09 Signal Testing and Initial Operation: When not in operation, the signal head shall be hooded with a material that will allow the signal heads, when lit, to be seen dimly by personnel testing the signals. The hood shall remain in place until the signal is authorized to be operated. The cost of testing shall not be bid separately, but shall be included in the price for "Traffic Signal System", "Flashing Beacon - Site 2" and "Flashing Beacon - Site 3".

SYN	DATE	DESCRIPTION	APPR

UNIVERSITY AVENUE RECONSTRUCTION (COULEE TO COLUMBIA) & MEDIANS/LIGHTING (COULEE TO 42ND ST)
CITY OF GRAND FORKS
GRAND FORKS, ND

SIGNAL & FIBER NOTES - UNIVERSITY AVE

DRAWING TYPE	CONST
PREPARED BY	TS
CHECKED / APPROVED	MB / JM
DATE	MAY 2019
PROJECT NUMBER	00105-2017-015
SHEET	40 of 70
DRAWING	T40

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NOTES

772-P10 Traffic Signal Controller: Furnish the controller cabinet and auxiliary control equipment furnished from a manufacturer whose Econolite Cobalt RM with Transit Key/2M Series NEMA TS2/NTCIP operates on Centrac Software which has been approved by the City of Grand Forks. The price bid for "Traffic Signal System", "Flashing Beacon - Site 2" and "Flashing Beacon - Site 3" includes all labor, materials and equipment required to install the new controller, including but not limited to the emergency vehicle pre-emption unit, cabinet, new detector amplifiers (furnished and installed), other ancillary signal components (such as load switches, conflict monitors, etc.) and controller cabinet components connected as required to make the new controller equipment operational with the existing and proposed signal equipment.

772-P11 Grand Forks Traffic Signal Cabinet: Use Econolite 332D, pre-wired with ancillary components including a RENO A&E Traffic Signal Conflict Monitor with Ethernet port. Adhere to the City of Grand Forks Cabinet Specifications as specified in the plans at Traffic Control Corporation. The price bid for "Traffic Signal System", "Flashing Beacon - Site 2" and "Flashing Beacon - Site 3" includes all costs, labor, materials and equipment necessary for furnishing and installing the cabinet.

772-P12 Concrete Controller Cabinet Pad: The price bid for "Traffic Signal System", "Flashing Beacon - Site 2" and "Flashing Beacon - Site 3" includes a new concrete pad to mount the proposed traffic signal cabinet. Size the concrete pad for a Type 332D Cabinet as specified in the plans.

772-P13 Battery Backup System: Provide a battery backup system for the Traffic Signal System. The price bid for "Traffic Signal System" includes all costs, labor, materials and equipment necessary for furnishing and installing the battery backup system. Include the following minimum requirements:

- Provides full battery backup for the traffic controller in normal or flash operation
- Flash activation contacts to ensure the longest possible battery life
- Rack mountable for installation in a 332D Cabinet or NEMA rated outdoor pad mounted enclosure, as required
- Power conditioning and transient filtering
- True Sine wave output with ±2% voltage regulation
- Power management and diagnostic functions
- Ethernet port with software to monitor or download data logs of the battery backup system
- Suitable for operation from -40°F to 120°F
- Battery backup for a minimum of 3 hours of flash operation
- Capable of running the intersection for 30 minutes at 1000 watts and then switch to flash operation to conserve power
- The UPS shall include an external bypass switch rated at 30 amp 250 VAC and shall use 30 amp relays.

772-P14 Emergency Vehicle Pre-emption and Transit Priority: Use GTT Global GPS Vehicle Preemption; model 764 phase selector, Model 1010 GPS Radio Unit containing a GPS receiver with Antenna and a 2.4 Ghz Spread Spectrum Transceiver with Antenna and Model 1070 GPS Installation Cable.

The location of the GPS EVP detector as denoted in the plans may vary based upon GPS signal availability. No splices are allowed between the controller cabinet and the EVP Equipment on the pole/arm. All indicator lamps are LED.

Compatible with the other EVP equipment used within the City of Grand Forks. Provide all labor and equipment necessary for the emergency vehicle preemption system to be fully operational. Notify City of Grand Forks fire chief Peter O'Neill (701-746-2566) and city electrician Rick Hanson (701-738-8796) when the proposed signalized intersection EVP system is tested and operable. The price bid for "Traffic Signal System", "Flashing Beacon - Site 2" and "Flashing

Beacon - Site 3" includes all costs, labor, materials and equipment necessary for furnishing and installing the EVP system.

772-P15 Conflict Monitor: The traffic signal controller conflict monitor shall be a RENO A&E model, Ethernet connection. A complete controller conflict monitor test shall be performed by the Contractor prior to unveiling the traffic heads. All materials, labor and equipment necessary to conduct the conflict monitor testing shall be included in the price bid for "Traffic Signal System", "Flashing Beacon - Site 2" and "Flashing Beacon - Site 3".

772-P16 Controller Monitoring Unit and/or Communication Module: The volume density controller shall be provided with a communication hookup which provides a duplex data link with a central control computer. The communications hookup shall be PC compatible. A controller monitoring unit and/or communication module shall be installed in the controller. The monitor unit shall be installed and connected to the controller and conflict monitor so as to monitor conflict monitor flash, pre-emption status, cabinet door open, phase on and status bits required for central control intersection display, and detector diagnostics. The unit shall be capable of providing a traffic map and of uploading and downloading information into the controller from a PC, central control computer or a laptop in the field, or a telephone line. All costs, labor, materials and equipment necessary for furnishing and installing this item shall be included in the price bid for "Traffic Signal System", "Flashing Beacon - Site 2" and "Flashing Beacon - Site 3".

772-P17 Shop Drawings: Furnish shop drawings and a complete listing of materials proposed for installation. Provide two copies to the City of Grand Forks Traffic Engineer, plus any additional sets that need approval and that are to be returned for the Contractor's use. Provide the Engineer with proof of purchase, and delivery and manufacturing schedules for traffic signal materials indicating that acquisition of these materials is consistent with progress and completion requirements of this contract.

772-P18 Traffic Signal Head Mountings: Furnish piping to mount the vehicle and signal heads to the side of the poles. Do not mount heads directly to the pole or on the face of the pole directly adjacent to the street. No banding permitted. The price bid for "Traffic Signal System", "Flashing Beacon - Site 2" and "Flashing Beacon - Site 3" includes all costs, labor, materials and equipment necessary for installing traffic signal heads.

772-P19 Traffic Signal Standards Base. Provide traffic signal standards with "T" transformer base type standards.

772-P20 Combination Signal and Light Standard: Provide signal poles with luminaire extensions as shown in plans. Luminaire mast arm and scroll to match Lighting Unit Type A (See Lighting Plans), or approved equal.

772-P21 Vehicular Traffic Signal Heads: Use 12 inch vehicular signal heads with aluminum housings for each section. Equip all sections with General Electric GTX LED illuminating elements conforming to the Institute of Transportation Engineers Equipment and Materials Standards and Specifications. Price bid for "Traffic Signal System", "Flashing Beacon - Site 2" and "Flashing Beacon - Site 3" includes all costs, labor, materials and equipment necessary for furnishing and installing the vehicular traffic signal heads.

772-P22 Pedestrian Signal Heads: Equip with LED illuminating elements displaying the pedestrian signals as shown. Price bid for "Traffic Signal System", "Flashing Beacon - Site 2" and "Flashing Beacon - Site 3". include all costs, labor, materials, and equipment necessary for furnishing and installing the pedestrian signal heads.

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CITY OF GRAND FORKS
GRAND FORKS, ND

SIGNAL & FIBER NOTES - UNIVERSITY AVE

DRAWING TYPE	CONST
PREPARED BY	TS
CHECKED / APPROVED	MB / JM
DATE	MAY 5, 2019
PROJECT NUMBER	00105-2017-015
SHEET	41 of 70
DRAWING	T41

NOTES

772-P23 Conduit: Install conduit at the locations shown on the plans. Bore conduit under existing pavement. Dig potholes to verify that the conduit avoids the existing utility as necessary. Price bid for "Traffic Signal System", "Flashing Beacon - Site 1", "Flashing Beacon - Site 2", and "Flashing Beacon - Site 3" include furnishing and installing conduit, pushing and boring conduit, digging potholes and restoring the potholes with new material that ties into the existing surround material. Seal all conduits with duct seal at the controller cabinet and at the traffic signal standard foundations. Conduit types may be either schedule 40 PVC or HDPE conduit with a wall thickness equivalent to schedule 40 (Refer to NDDOT specification). HDPE conduit shall be UL listed.

772-P24 Pull Boxes: Follow the specification outlined in the NDDOT standard drawing D770-3 and be PVC with steel casting including a traffic resistant cast iron cover.

TYPE	LABEL	LABEL LOCATION
Communication Cable	Comm./address of other end	Within 12" of conduit
Pedestrian Push Button	Phase/location (i.e. NW, SW, etc.)	Within 6" of terminals
Video Camera Cables	Detection zone (i.e. D2-1, D2-2, etc.)	Within 6" of terminals
Control Cable	Cable number & location (i.e. NW, SW, etc.)	Within 12" of conduit
Opticom Cable	Pre-empt number/location (i.e. NW, SW, etc.)	Within 6" of terminal

772-P25 Label All Field Cables: All labeling materials must be approved by the City. Labels must be readable without moving the cables. When installing cable bundles in conduit, bundles will not be taped. Label all field cables with the cable designations:

TYPE LABEL LOCATION
 Communication Cable Comm./address of other end Within 12" of conduit
 Pedestrian Push Button Phase/location (i.e. NW, SW, etc.) Within 6" of terminals
 Video Camera Cables Detection zone (i.e. D2-1, D2-2, etc.) Within 6" of terminals
 Control Cable Cable number & location (i.e. NW, SW, etc.) Within 12" of conduit
 Opticom Cable Pre-empt number/location (i.e. NW, SW, etc.) Within 6" of terminal
 Price bid for "Traffic Signal System", "Flashing Beacon - Site 1", "Flashing Beacon - Site 2", and "Flashing Beacon - Site 3". includes all costs, labor, materials and equipment necessary for labeling field cables.

772-P26 Pedestrian Pushbuttons, Housing, and Signs: Pedestrian push buttons, housings and signs shall be furnished with the ability to be bolted directly to the traffic signal standards. Bandit shall not be permitted. The pushbuttons should be 3" round and vandal resistant, solid state pressure sensitive non move Piezo yellow pedestrian push button station with visual and audible press and release feedback with a 5" X 7" frame up. TS 2 compliant switch rated for 100 X 106 operations with a 75 ms closure with a mounting for 4 bolts. The housings are for a 3 inch round push button with a 4 bolt (2.60 +/- .05") circle and displays a 5" X 7" sign. The top of the push-button signs shall not extend above the top of the pedestrian push-button post Complete with mounting hardware and signs compatible with the provided housings shall be provided. The pedestrian push buttons shall meet ADA and MUTCD minimum requirements, specified for pedestrian countdown pushbuttons. All costs of material, delivery, and installation for pedestrian push buttons, housing, and signs shall be included in the price bid for "Traffic Signal System", "Flashing Beacon - Site 1", "Flashing Beacon - Site 2", and "Flashing Beacon - Site 3".

772-P27 Additional Conduit: Install one additional 4-inch diameter conduit in the controller cabinet/feedpoint foundation. The direction of the conduit will be determined in the field by the engineer. Cap all conduit. Price bid for "TRAFFIC SIGNAL SYSTEM" include all costs to supply and install the additional conduit.

772-P28 Conductor Color Continuity: Maintain conductor color continuity where any 14 AWG 12 conductor cables are connected to 14 AWG 5 and/or 14 AWG 3 conductor cables within the terminal block of a traffic signal standard.

772-P29 Law Enforcement Confirmation Light: Provide blue omni-directional LED law enforcement confirmation lights that are visible from 360° when mounted on the signal heads. Provide a lens for the confirmation light in which the blue tint is integrated into the lens. Blue coating is not allowed. Provide lights that are manufactured specifically for use as law enforcement confirmation lights and have been used for that purpose at intersections within the United States. Mount the confirmation lights on a riser to the traffic signal heads. Provide unbrushed aluminum risers that are capable of adjusting the height and angle of the confirmation lights. The confirmation lights must be visible above or below the signal head backplate. The riser must not protrude or be visible above or below the signal head backplate. Provide a connection between the riser and traffic signal head that is weatherproof and will not allow moisture into the traffic signal head. Connect the confirmation lights to the red indication in the corresponding traffic signal head. Place anti-seize compound on all threaded components. Include all costs associated with furnishing and installing the law enforcement confirmation lights in the price bid for "Traffic Signal System".

772-P30 IT System: The bid price for "IT SYSTEM" includes all labor and equipment necessary to interconnect the traffic signal at Oxford and two pedestrian hybrid beacons to the traffic signal controller cabinet at University Avenue and Columbia Road as shown in plans. This includes but is not be limited to all fiber optic cable, pull boxes, conduit, future conduit, conduit sweeps into existing pull boxes and connections required for the interconnected system to be fully operational, furnishing and installing Ethernet switches and fiber splice boxes/enclosures sized for all fibers at each signalized intersection, and removing a portion of the existing fiber optic cable, protecting it and salvaging it for reinstallation as shown in the plans.

772-P31 Fiber Optic Pull Boxes: Provide polymer concrete type pull boxes for the fiber optic interconnect. Clearly mark the cover as "Fiber Optic" as required. Provide Fiber Pull Boxes with dimensions no less than 24" x 36" and Fiber Splice Faults with dimensions no less than 30" x 48" for fiber optic cables. Provide pull boxes and splice faults with a bottom extension to obtain a depth of 26". Duct seal all conduits entering and exiting pull boxes. Fiber splicing is only allowed in splice vaults as identified in the plans. Only cut the fibers that are to be spliced. Include all costs, labor, materials and equipment necessary for furnishing and installing this item in the price bid for "IT System".

772-P32 Ethernet Switch: The Ethernet Switch shall be produced by RuggedComm and shall be model type RuggedSwitch RS900G-2L, contain dual fiber optic Gigabit Ethernet ports, and have two (2) single-mode fibers with LC connectors in and out included for the for the connections. Price bid for "IT SYSTEM" includes all costs, labor, materials and equipment necessary for furnishing and installing the Ethernet switch.

772-P33 IP Address: The Contractor shall coordinate with the City of Grand Forks to obtain any required IP addresses during installation.

772-P34 Tracer Conduit: The interconnect cable conduit shall have a tracer conductor installed and labeled in each controller cabinet. The tracer conductor shall consist of a No. 14 AWG - Type THW single conductor as specified in Standard Specification section 895.03A1. The conductor shall be continuously unspliced from control cabinet to control cabinet. The cost of furnishing and installing this conductor shall not be bid separately but shall be included in the price bid for "IT SYSTEM."

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UNIVERSITY AVENUE RECONSTRUCTION (COULEE TO COLUMBIA) & MEDIANS/LIGHTING (COULEE TO 42ND ST)
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 GRAND FORKS, ND
 SIGNAL & FIBER NOTES - UNIVERSITY AVE

DRAWING TYPE	CONST
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SHEET	42 of 70
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772-P35 Interconnect Cable: The fiber optics interconnect cable shall include one (1) 24 multimode (12 pairs) and 24 single-mode hybrid fiber optic hardware for aerial and duct application, compatible with Daisy-chain operation, for the purpose of controlling traffic in a coordinated closed-loop system. The Contractor shall use one (1) pair of single-mode fiber for traffic signal controller interconnection and one (1) pair of single-mode fiber for the entire video detection system. Fibers shall terminate in the appropriate switch within the traffic signal controller and all fiber both single and multi-mode shall be terminated in the panel. The optical cable shall be dielectric, loose-tube, dry block, filled with a single polyethylene jacket and reinforced with aramid yarn. The optical specifications shall meet RUS 7 CFR 1755.900 (PE-90) and Telcordia GR-20 Standards for single-mode cable. Single mode fiber shall be 8.3/125 micrometer in diameter, zero water peak. The attenuation shall be less than or equal to 0.4 dB/km at 1310nm; less than or equal to 0.32 dB/km at 1383 nm and less than or equal to 0.3 dB/km at 1550nm. Multimode fiber shall be 62.5/125 micrometer in diameter, zero water peak. The attenuation shall be less than or equal to 3 dB/km at 850 nm and less than or equal to 1 dB/km at 1550 nm. The temperature range shall be -40⁰C to +70⁰C. The contractor shall provide 25 feet of additional interconnect for each incoming and outgoing conduit run at every pull box, traffic signal controller. The cable manufacturer shall provide the Engineer with documentation indicating the attenuation and bandwidth for individual fibers on each reel within five business days after delivery of the cable. The cable shall again be tested after connectors are installed. Contractor will install new interconnect cable between the cabinet at the new Traffic Signal System, two pedestrian hybrid beacons, and connect into the existing cabinet at Columbia Road & University Avenue. All labor, materials and equipment necessary for fiber optic interconnection shall be included in the price bid for "IT SYSTEM."

772-P36 Maximum Tensile Pull Strength: Do not exceed a maximum tensile strength of 600 pounds when pulling the fiber optic interconnect cable.

772-P37 Controller Testing: Deliver the controller and cabinet to the City Electrician, Rick Hanson (701-738-8796), at the Public Works Department located at 724 N 47th Street. The City Electrician will conduct operational tests and operate the controller for a test period of 30 consecutive days at the Public Works Department shop without any malfunctions of the controllers. Any controller that does not operate satisfactorily for the 30 days will be rejected and replaced. After the controllers have operated satisfactorily for the 30 days, they will be approved by the City of Grand Forks. The price bid "Traffic Signal System", "Flashing Beacon - Site 2" and "Flashing Beacon - Site 3" includes all labor, materials and equipment necessary for furnishing and installing the controllers, as well as delivery to City Electrician.

772-P38 Signal Timing and Coordination: The contractor is responsible for inputting all necessary data into the traffic signal controller to achieve a fully operational coordinated signal system. This shall include but not be limited to installing all necessary time of day plans, video detection functions, emergency vehicle preemption, and signal interconnection and communication. Contact Mike Bittner with KLJ at (701) 271-4879 prior to programming for field verification and calibration. All labor, materials and equipment necessary achieve this fully operational coordinated signal system shall be included in the price bid "Traffic Signal System", "Flashing Beacon - Site 2" and "Flashing Beacon - Site 3".

772-P39 Malfunction Management Unit: Use RENO A&E model with an Ethernet port. Perform a complete controller malfunction management unit test prior to unveiling the traffic heads. Price bid for "Traffic Signal System", "Flashing Beacon - Site 2" and "Flashing Beacon - Site 3" includes all labor, materials and equipment necessary to furnish and install the unit and to conduct the malfunction management unit testing.

772-P40 Pedestrian Push Button Units: Install Advisor Advanced Accessible Pedestrian System (AAPS) pedestrian push buttons. Mount each pedestrian sign and pushbutton on one framed enclosure to the signal pole or bolt directly to the pedestrian pushbutton post. Bandit is not permitted. Do not extend the top of the pushbutton signs above the top of the pedestrian

pushbutton post. Include the Advisor Advances APC Pedestrian Controller and compatibility remote network ether connection for real time monitoring and control of operating parameters. SMP2 High Visibility Pedestrian Station for standalone pushbutton posts. Price bid for "Traffic Signal System", "Flashing Beacon - Site 1", "Flashing Beacon - Site 2", "Flashing Beacon - Site 3" includes all costs, labor, materials and equipment necessary for furnishing and installing the pedestrian pushbutton units.

772-P41 Signal Standard Paint Color: Paint all Traffic Signal System components in accordance with the following:

- Transformer base-black
- Mast arm-black
- Signal Standards - black
- Signal head mounting hardware-black
- Signal housing-black
- Pedestrian pushbutton post - black
- Pedestrian pushbutton housing - black
- Use #27038 of Federal Standard No. 595B for the color black.

772-P42 Excavation and Restoration: Any Excavation required to install conduit, connect conduit to existing conduit sweeps, install pull boxes, foundations or any other feature proposed in the plans is included in the prices bid "Traffic Signal System", "Flashing Beacon - Site 1", "Flashing Beacon - Site 2", "Flashing Beacon - Site 3" and "IT SYSTEM". This includes restoring the excavated area with the appropriate fill material. The fill material shall match the surrounding surface material. At locations where the surrounding material is earth, include earth fill with 6" of topsoil and seed or sod. At locations where the surround material is concrete, tie into the existing concrete. All removed material whether concrete or earth is the property of the Contractor and be disposed of accordingly. Compaction and density controls are in accordance with Section 203.04 E.2 of the Standard Specifications AASHTO T-99.

772-P43 Wire Splicing: No splicing will be allowed in pull boxes. Splicing may only take place in the signal base.

772-P44 Feed Point-Type IV Pad Mounted: Connect the traffic signal controller to the new feed point. Install a new 50 amp breaker Type BR at the feed point for traffic control signal purposes.

The feed point will have two for Roadway Lighting and Traffic Signals. Contact Deb Thompson with Xcel Energy (701-795-5229). Coordinate with the utility company to establish the service connection to ensure a fully operational traffic signal controller feed point at this location.

All utility company costs for the new feed point shall be paid by the Contractor. Furnish and install new conduit from the new controller cabinet to the new feed point. Furnish and install #6 U.S.E. cable between the new controller and the new feed point. Price bid for "Traffic Signal System", "Flashing Beacon - Site 1", "Flashing Beacon - Site 2", and "Flashing Beacon - Site 3" includes all costs, labor, materials and equipment required for feed point connections.

Provide 14 gauge #304 stainless steel cabinet of adequate size to house the specified number of circuits and equipment shown on the feed point detail. Tie transformer ground into cabinet grounding lug and neutral lug.

Provide enclosures with a subpanel for complete dead-front access to all, main disconnect handles, circuit breaker handles and toggle test switches. Use plug in type breakers with specified amperage, 10,000 AIC.

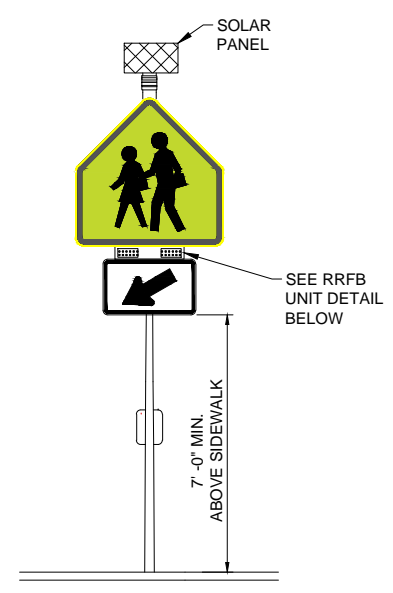
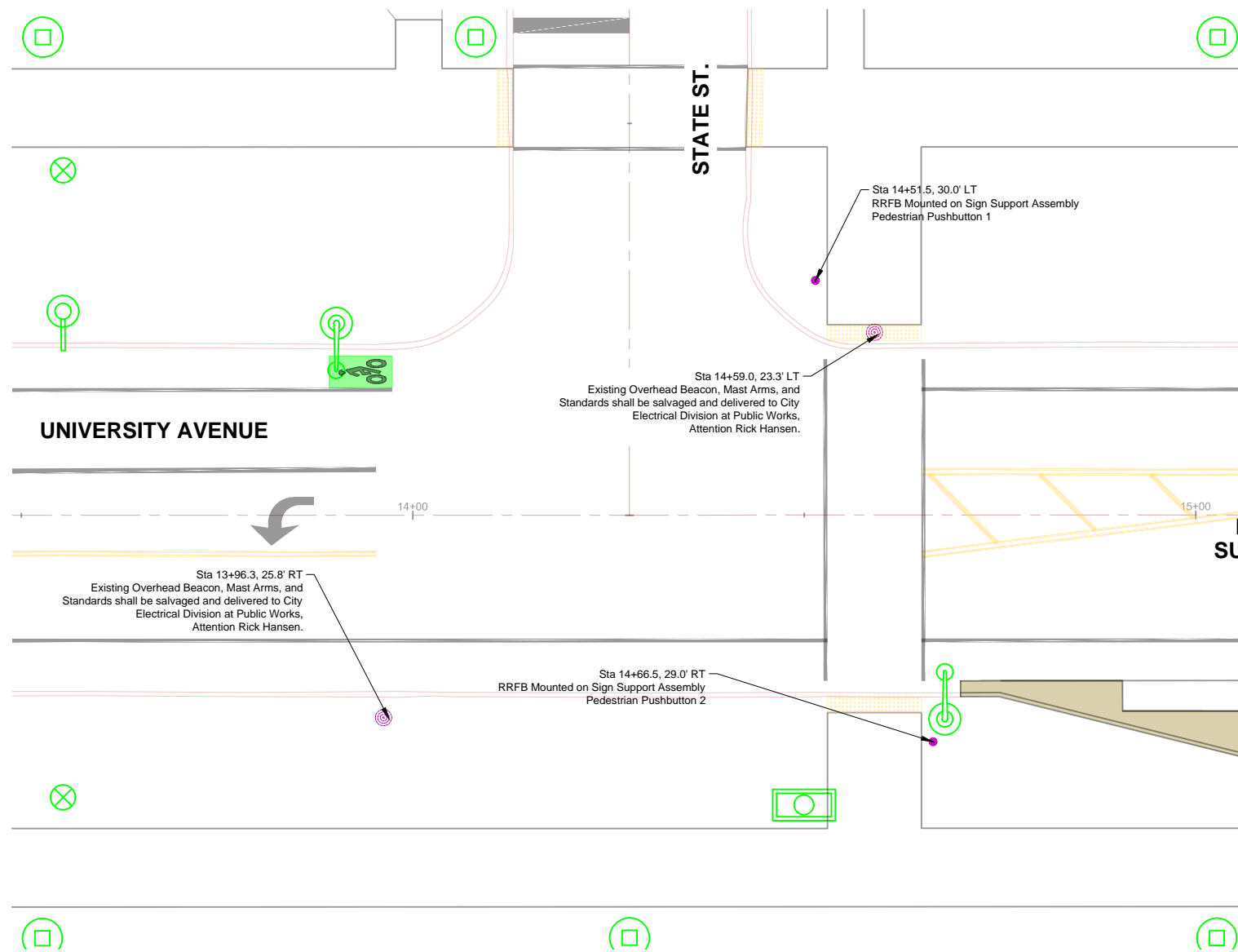
Mount photoelectric (PE) cells externally on the feed point cabinet, facing east or north. Use EEI/NEMA type PE sockets. Provide PE control with a time delay of at least 15 seconds and rated for 240 volt.

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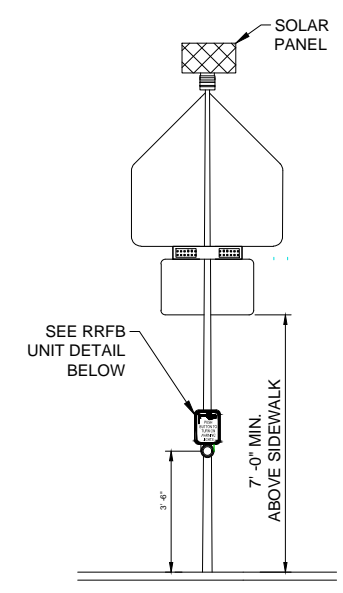
UNIVERSITY AVENUE RECONSTRUCTION (COULEE TO COLUMBIA) & MEDIANS/LIGHTING (COULEE TO 42ND ST)
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PROJECT NUMBER	00105-2017-015
SHEET	43 of 70
DRAWING	T43

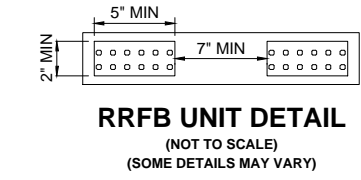
SIGNAL & FIBER NOTES - UNIVERSITY AVE



RRFB MOUNTED ON SIGN SUPPORT ASSEMBLY DETAIL BACK SIDE
 (NOT TO SCALE)
 (SOME DETAILS MAY VARY)



RRFB MOUNTED ON SIGN SUPPORT ASSEMBLY DETAIL SIDEWALK SIDE
 (NOT TO SCALE)
 (SOME DETAILS MAY VARY)



RRFB UNIT DETAIL
 (NOT TO SCALE)
 (SOME DETAILS MAY VARY)



- Legend**
- RRFB MOUNTED ON SIGN SUPPORT ASSEMBLY
 - EXISTING SIGNAL STANDARD
 - PEDESTRIAN LIGHTING (SEE ELECTRICAL SECTION)
 - ROADWAY LIGHTING (SEE ELECTRICAL SECTION)

GENERAL NOTES

1. RELOCATE AND INSTALL RRFB MOUNTED ON SIGN SUPPORT, ONCE REMOVED, FROM CENTENNIAL DRIVE.
2. FURNISH AND INSTALL S1-1 FLUORESCENT YELLOW- GREEN (36"x36")
3. PEDESTRIAN PUSH BUTTON & RRFB CONTROLLER CABINET SHALL BE MOUNTED PER MANUFACTURER SPECIFICATION USING VANDAL PROOF HARDWARE.
4. PAID FOR UNDER ITEM "SALVAGE & INSTALL FLASHING BEACON" ALL WIRING AND HARDWARE REQUIRED TO PROVIDE A FUNCTIONING SYSTEM SHALL BE INCIDENTAL.
5. DURATION OF FLASHING WARNING INTERVAL DISPLAYED UPON PEDESTRIAN ACTIVATION SHALL BE NO LESS THAN 23 SECONDS.
6. EXISTING SYSTEM USES RADIO COMMUNICATIONS BETWEEN SIGNS TO ENSURE FLASHERS TURN ON TOGETHER, THIS SHALL BE MAINTAINED WHEN REINSTALLED.

Pedestrian Pushbutton Schedule

Location	Pushbutton & Sign Location on Pole	Direction of Arrow on Sign
Pushbutton 1	East	Right
Pushbutton 2	West	Right



RRFB PUSHBUTTON SIGN
 (NOT TO SCALE)

FOR CONSTRUCTION
05/05/2019

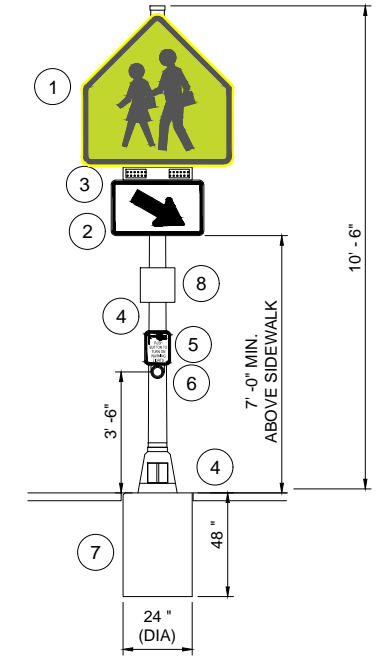
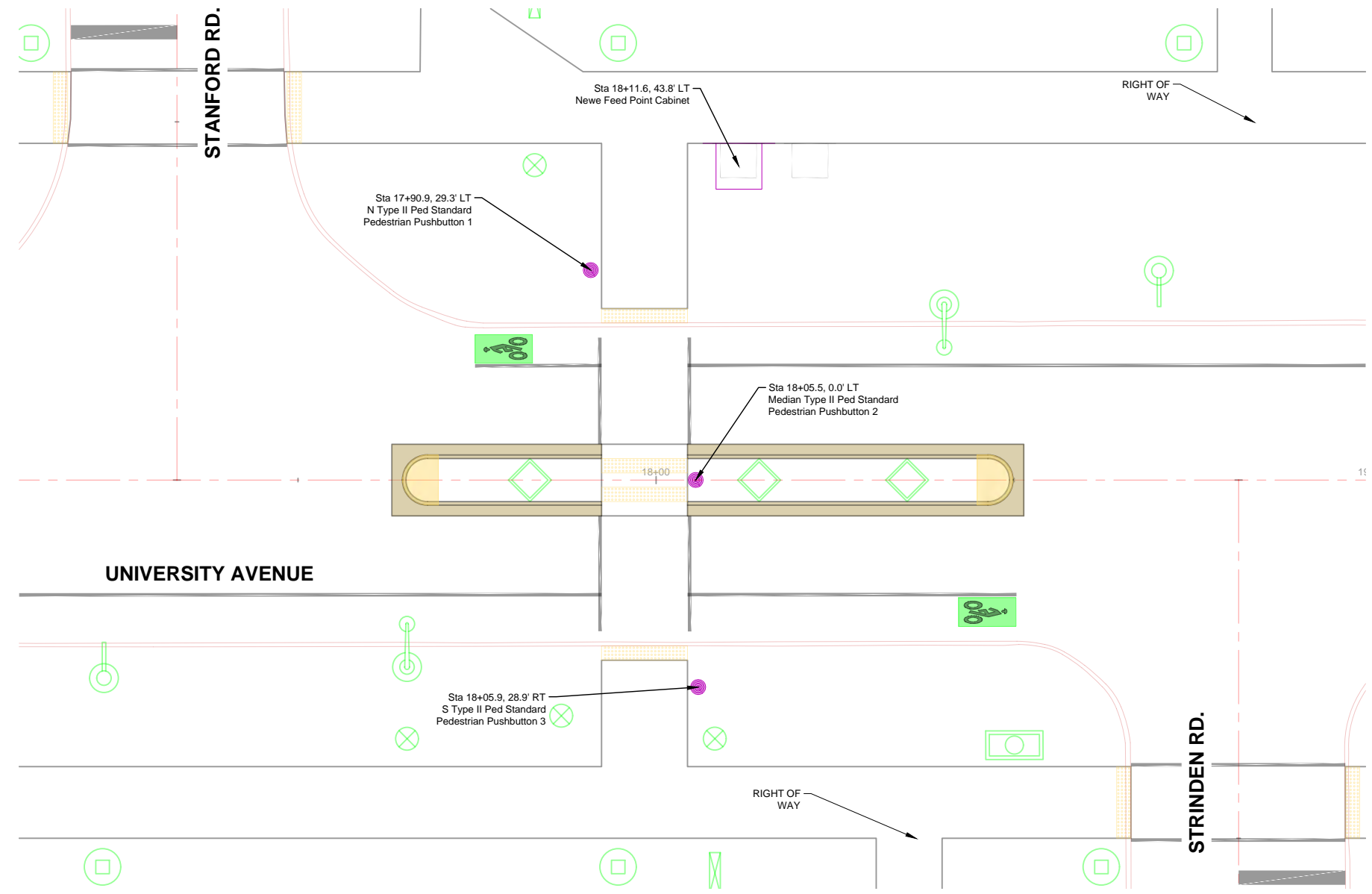
UNIVERSITY AVENUE RECONSTRUCTION (COULEE TO COLUMBIA) & MEDIANS/LIGHTING (COULEE TO 42ND ST)
 CITY OF GRAND FORKS
 GRAND FORKS, ND

SYM.	DATE	DESCRIPTION	APPR.

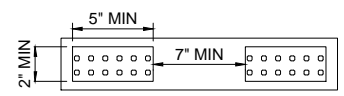


RECTANGULAR RAPID FLASH BEACON LAYOUT - STATE ST

DRAWING TYPE	CONST
PREPARED BY	TS
CHECKED / APPROVED	MB / JM
DATE	MAY 5, 2019
PROJECT NUMBER	00105-2017-015
SHEET	44 of 70
DRAWING	T44



PEDESTAL MOUNTED RRFB ASSEMBLY DETAIL
 (NOT TO SCALE)
 (SOME DETAILS MAY VARY)



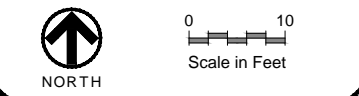
RRFB UNIT DETAIL
 (NOT TO SCALE)
 (SOME DETAILS MAY VARY)

PEDESTAL MOUNTED RECTANGULAR RAPID FLASHING BEACON ASSEMBLY

- SPECIFIC NOTES**
- 1 S1-1 FLUORESCENT YELLOW-GREEN (36" X 36") (MOUNTED BACK-TO-BACK IN MEDIAN LOCATION ONLY)
 - 2 1-W16-7PR FLUORESCENT YELLOW-GREEN (24" X 12") AND 1-W16-7PL FLUORESCENT YELLOW-GREEN (24" X 12") (ARROWS POINTING TOWARD CROSSWALK, MOUNTED BACK-TO-BACK IN MEDIAN LOCATION ONLY).
 - 3 DOUBLE-SIDED RECTANGULAR RAPID-FLASHING BEACON (RRFB) UNIT. INSTALL PER MANUFACTURER'S RECOMMENDATIONS. SEE DETAIL ABOVE.
 - 4 SEE NDDOT STANDARD DRAWING D-772-2 TYPE II TRAFFIC SIGNAL STANDARD FOR PEDESTAL DETAILS.
 - 5 R10-25 BLACK ON WHITE (9" X 12")
 - 6 PEDESTRIAN PUSHBUTTON.
 - 7 SEE NDDOT STANDARD DRAWING D-770-1 "SIGNAL STANDARD FOUNDATION" FOR TYPE II SIGNAL STANDARD FOUNDATION DETAILS.
 - 8 RRFB CONTROLLER CABINET. INSTALL PER MANUFACTURERS RECOMMENDATIONS. ONLY INSTALLED ON NORTH RRFB (STA 18+05.0, 29.6' LT)

GENERAL NOTES

1. ALL WIRING SHALL BE KEPT INSIDE POLE. POLE OPENINGS SHALL BE MADE WATER TIGHT USING APPROVED GASKETS, GROMMETS & SEALANT.
2. PEDESTRIAN PUSH BUTTON & RRFB CONTROLLER CABINET SHALL BE MOUNTED PER MANUFACTURER SPECIFICATION USING VANDAL PROOF HARDWARE.
3. PAID FOR UNDER ITEM "FLASHING BEACON-SITE 1" ALL WIRING AND HARDWARE REQUIRED TO PROVIDE A FUNCTIONING SYSTEM SHALL BE INCIDENTAL.
4. DURATION OF FLASHING WARNING INTERVAL DISPLAYED UPON PEDESTRIAN ACTIVATION SHALL BE NO LESS THAN 23 SECONDS.



- Legend**
- FEED POINT
 - PEDESTAL MOUNTED RRFB
 - PEDESTRIAN LIGHTING (SEE ELECTRICAL SECTION)
 - ROADWAY LIGHTING (SEE ELECTRICAL SECTION)

Pedestrian Pushbutton Schedule		
Location	Pushbutton & Sign Location on Pole	Direction of Arrow on Sign
Pushbutton 1	West	Right
Pushbutton 2	West	Right
Pushbutton 3	East	Right

* Crosswalk sign will be double sided arrow will point to crossing side for oncoming traffic.



RRFB PUSHBUTTON SIGN
 (NOT TO SCALE)

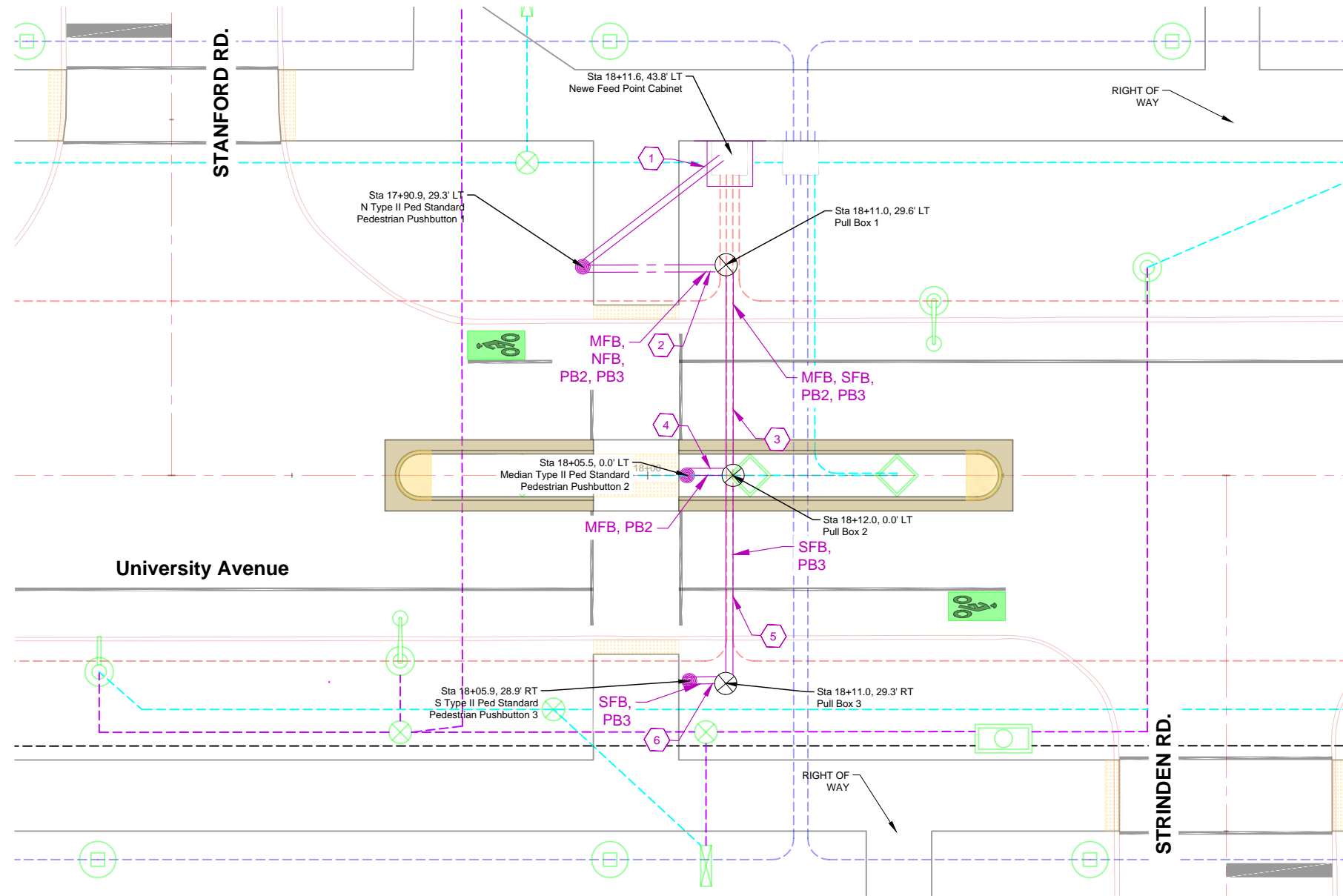
FOR CONSTRUCTION
05/05/2019

SYM	DATE	DESCRIPTION	APPR



UNIVERSITY AVENUE RECONSTRUCTION (COULEE TO COLUMBIA) & MEDIANS/LIGHTING (COULEE TO 42ND ST)
 CITY OF GRAND FORKS
 GRAND FORKS, ND
 RECTANGULAR RAPID FLASH BEACON LAYOUT - STANFORD RD

DRAWING TYPE	CONST
PREPARED BY	TS
CHECKED / APPROVED	MB / JM
DATE	MAY 5, 2019
PROJECT NUMBER	00105-2017-015
SHEET	45 of 70
DRAWING	T45



- Legend**
- FEED POINT
 - PEDESTAL MOUNTED RRFB
 - CABLE & CONDUIT RUN
 - PULL BOX
 - PEDESTRIAN LIGHTING (SEE ELECTRICAL SECTION)
 - ROADWAY LIGHTING (SEE ELECTRICAL SECTION)

CABLE NAMES
 NFB = North Flashing Beacon
 MFB = Median Flashing Beacon
 SFB = South Flashing Beacon
 PB 1 = Pedestrian Pushbutton 1
 PB 2 = Pedestrian Pushbutton 2
 PB 3 = Pedestrian Pushbutton 3

SIGNAL CABLE & CONDUIT SCHEDULE

#	RUN		CONDUIT		CABLE					
	ITEM	STATION, OFFSET	SIZE (IN)	LF	Origin	Destination	# of Cables	SIZE/TYPE	Total LF	TITLE
1	Origin	Feed Point	2	25	Feed Point	RRFB Controller	2	UNDERGROUND CONDUCTOR NO6-TYPE RHW	88	
	Destination	RRFB Controller			Feed Point	RRFB Controller	1	UNDERGROUND CONDUCTOR NO6-TYPE THW	44	
2	Origin	RRFB Controller	2	20	RRFB Controller	Pull Box 1	2	14 AWG 4 CONDUCTOR CABLE	70	MFB, SFB
	Destination	Pull Box 1			RRFB Controller	Pull Box 1	2	16 AWG 2 CONDUCTOR CABLE	70	PB2, PB3
3	Origin	Pull Box 1	3	30	Pull Box 1	Pull Box 2	2	14 AWG 4 CONDUCTOR CABLE	84	MFB, SFB
	Destination	Pull Box 2			Pull Box 1	Pull Box 2	2	16 AWG 2 CONDUCTOR CABLE	84	PB2, PB3
4	Origin	Pull Box 2	2	7	Pull Box 2	Median Type II Pedestrian Std Transformer Base	1	14 AWG 4 CONDUCTOR CABLE	18	MFB
	Destination	Median Type II Ped Std			Pull Box 2	Pushbutton 2	1	16 AWG 2 CONDUCTOR CABLE	21	PB2
5	Origin	Pull Box 2	3	28	Pull Box 2	Pull Box 3	1	14 AWG 4 CONDUCTOR CABLE	40	SFB
	Destination	Pull Box 3			Pull Box 2	Pull Box 3	1	16 AWG 2 CONDUCTOR CABLE	40	PB3
6	Origin	Pull Box 3	2	5	Pull Box 3	South Type II Pedestrian Std Transformer Base	1	14 AWG 4 CONDUCTOR CABLE	16	SFB
	Destination	South Type II Ped Std			Pull Box 3	Pushbutton 3	1	16 AWG 2 CONDUCTOR CABLE	19	PB3

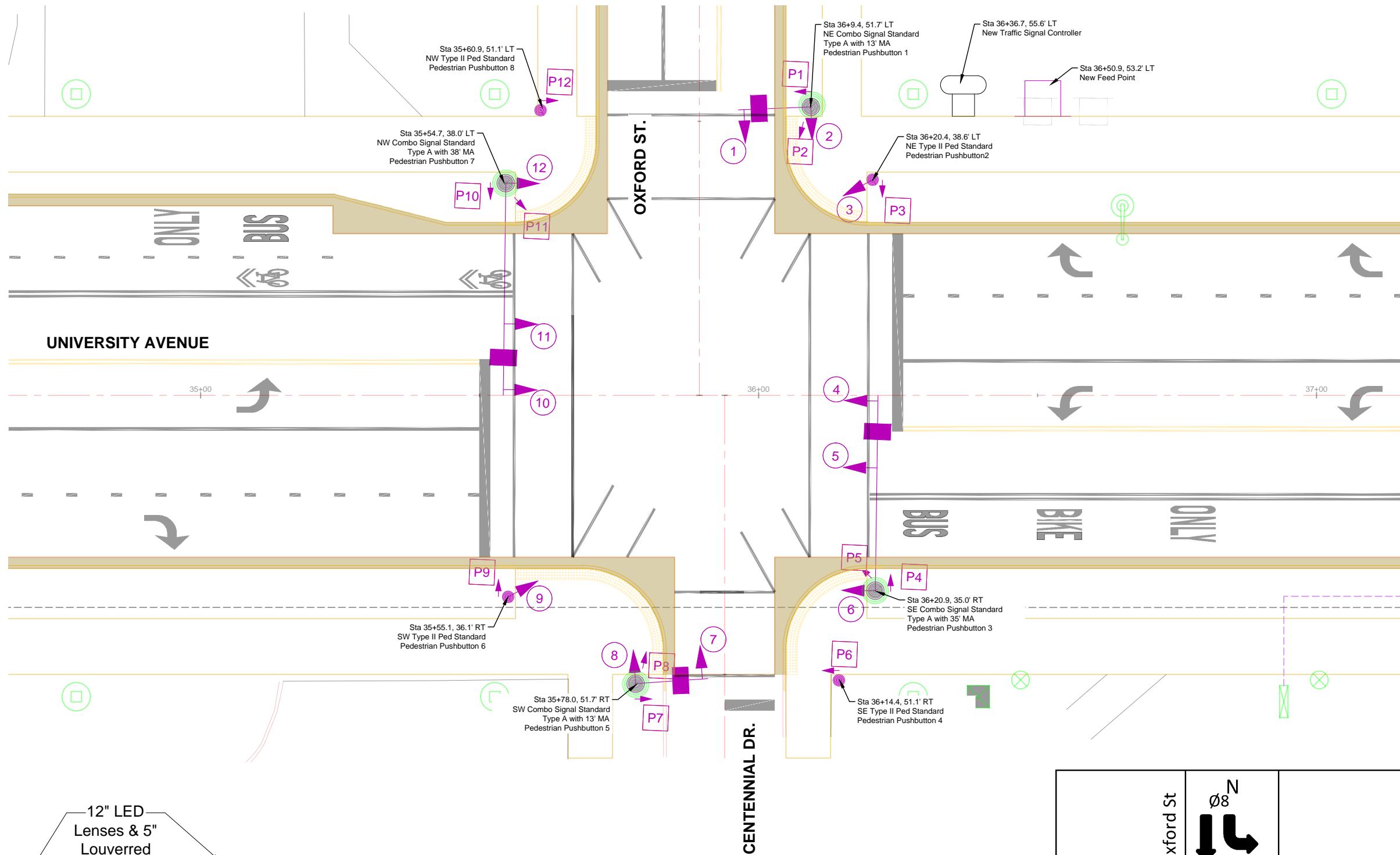
SYM	DATE	DESCRIPTION	APPR



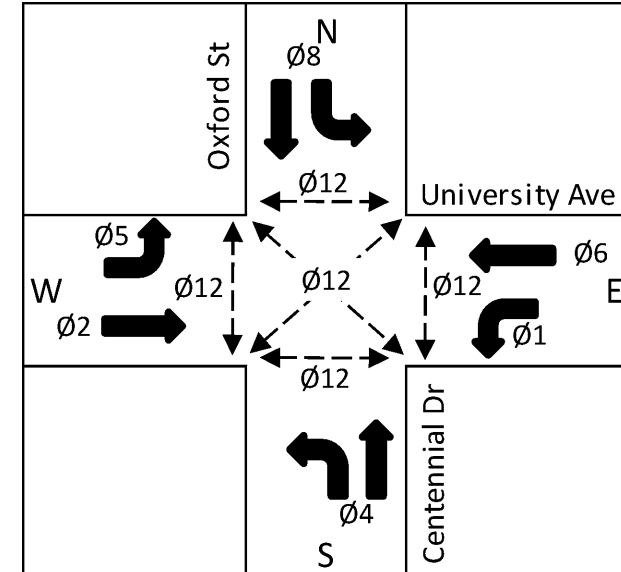
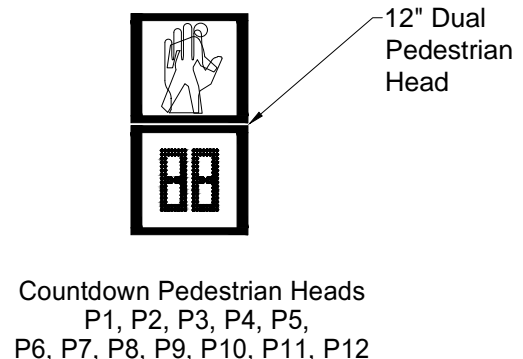
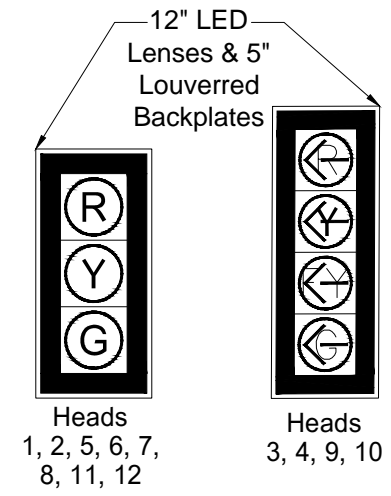
UNIVERSITY AVENUE RECONSTRUCTION (COULEE TO COLUMBIA) & MEDIAN LIGHTING (COULEE TO 42ND ST)
 CITY OF GRAND FORKS
 GRAND FORKS, ND
 CONDUIT & CONDUCTOR LAYOUT - STANFORD RD

DRAWING TYPE
CONST
 PREPARED BY
 TS
 CHECKED / APPROVED
 MB / JM
 DATE
 MAY 5, 2019
 PROJECT NUMBER
 00105-2017-015
 SHEET
 46 of 70
 DRAWING
T46

FOR CONSTRUCTION
 05/05/2019



- Legend**
- SIGNAL CONTROLLER
 - SIGNAL HEAD
 - FEED POINT
 - VIDEO DETECTION UNIT
 - SIGNAL STANDARD
 - PEDESTRIAN STANDARD
 - PEDESTRIAN HEAD
 - COUNTDOWN HEAD



Pedestrian Pushbutton Schedule		
Location	Pushbutton & Sign Location on Pole	Direction of Arrow on Sign
Pushbutton 1	South	Left
Pushbutton 2	West	Right
Pushbutton 3	West	Left
Pushbutton 4	North	Right
Pushbutton 5	North	Left
Pushbutton 6	East	Right
Pushbutton 7	East	Left
Pushbutton 8	South	Right



FOR CONSTRUCTION
 05/05/2019

SYMBOL

DATE

DESCRIPTION

APPROVED

UNIVERSITY AVENUE RECONSTRUCTION (COULEE TO

COLUMBIA) & MEDIANS/LIGHTING (COULEE TO 42ND ST)

CITY OF GRAND FORKS

GRAND FORKS, ND

SIGNAL LAYOUT - OXFORD ST

DRAWING TYPE
 CONST

PREPARED BY
 TS

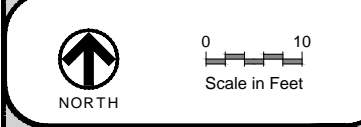
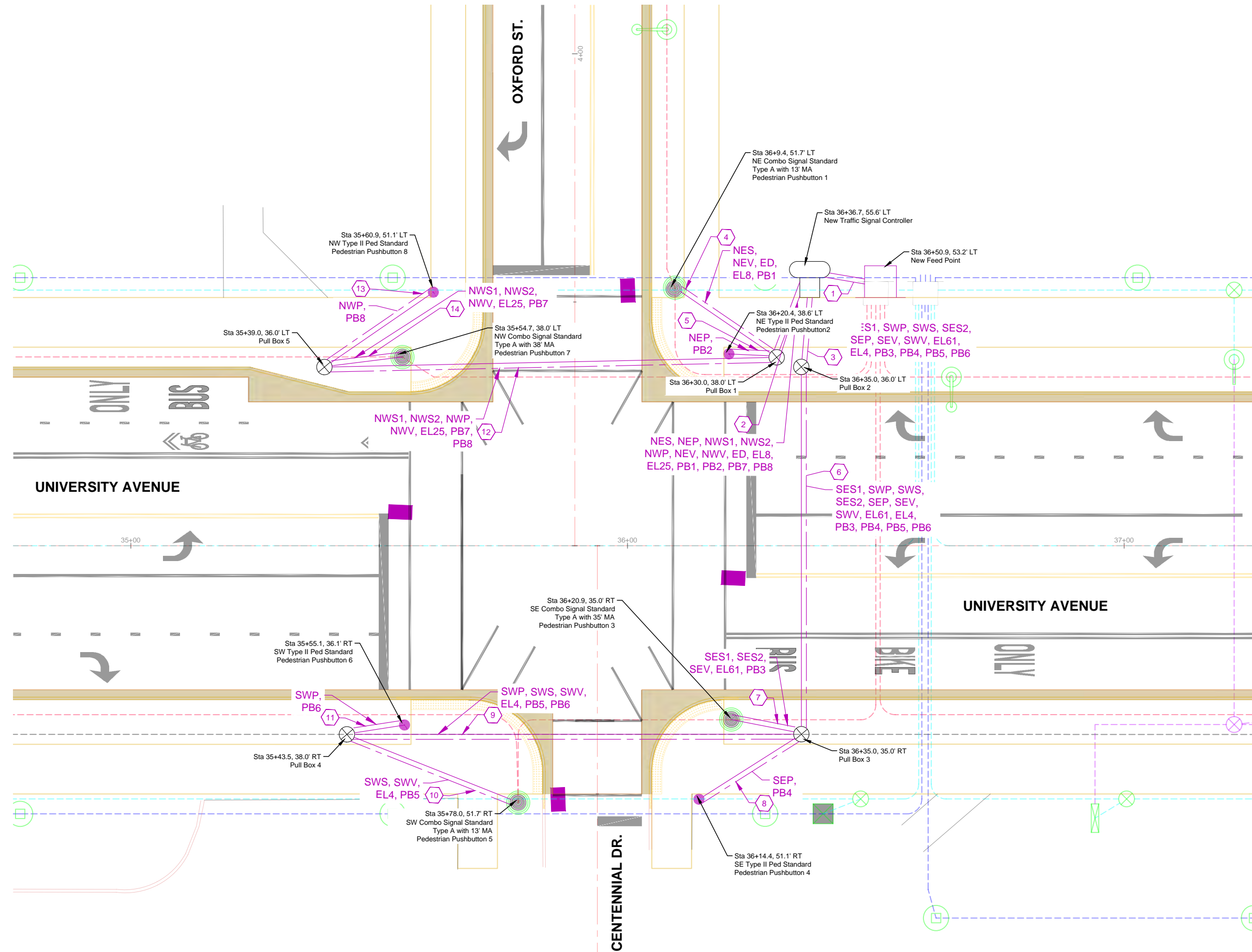
CHECKED / APPROVED
 MB / JM

DATE
 MAY 5, 2019

PROJECT NUMBER
 00105-2017-015

SHEET
 47 of 70

DRAWING
T47



Legend

- SIGNAL CONTROLLER
- FEED POINT
- SIGNAL STANDARD
- PEDESTRIAN STANDARD
- CABLE & CONDUIT RUN
- PULL BOX

CABLE NAMES

- NES = Northeast Combo Signal Standard
- NEP = Northeast Type II Pedestrian Standard
- SES1 = Southeast Combo Signal Standard1
- SES2 = Southeast Combo Signal Standard2
- SEP = Southeast Type II Pedestrian Standard
- SWS = Southwest Combo Signal Standard
- SWP = Southwest Type II Pedestrian Standard
- NWS1 = Northwest Combo Signal Standard1
- NWS2 = Northwest Combo Signal Standard2
- NWP = Northwest Type II Pedestrian Standard
- NEV = Northeast Video Detection Unit
- SEV = Southeast Video Detection Unit
- SWV = Southwest Video Detection Unit
- NWV = Northwest Video Detection Unit
- ED = GPS EVP Detector
- EL25 = Ø2+Ø5 EVP Light
- EL38 = Ø3 EVP Light
- EL47 = Ø4 EVP Light
- EL6 = Ø6 + Ø1 EVP Light
- PB1 = Pedestrian Pushbutton 1
- PB2 = Pedestrian Pushbutton 2
- PB3 = Pedestrian Pushbutton 3
- PB4 = Pedestrian Pushbutton 4
- PB5 = Pedestrian Pushbutton 5
- PB6 = Pedestrian Pushbutton 6
- PB7 = Pedestrian Pushbutton 7
- PB8 = Pedestrian Pushbutton 8

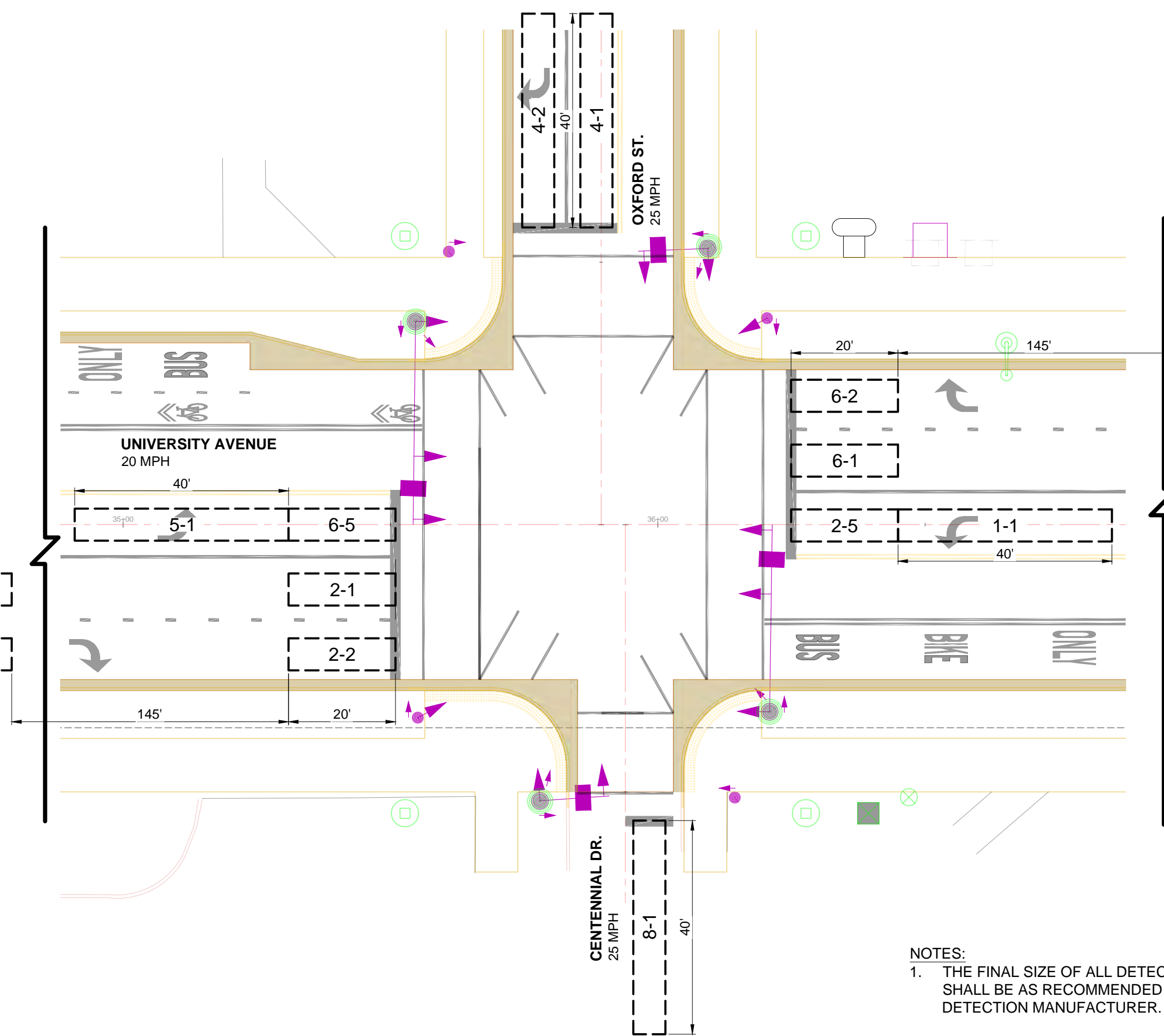
SYM	DATE	DESCRIPTION	APPR



UNIVERSITY AVENUE RECONSTRUCTION (COULEE TO COLUMBIA) & MEDIANS/LIGHTING (COULEE TO 42ND ST)
 CITY OF GRAND FORKS
 GRAND FORKS, ND
 CONDUIT & CONDUCTOR LAYOUT - OXFORD ST

DRAWING TYPE	CONST
PREPARED BY	TS
CHECKED / APPROVED	MB / JM
DATE	MAY 5, 2019
PROJECT NUMBER	00105-2017-015
SHEET	48 of 70
DRAWING	T48

FOR CONSTRUCTION
 05/05/2019



Legend

- SIGNAL CONTROLLER
- SIGNAL HEAD
- FEED POINT
- VIDEO DETECTION UNIT
- SIGNAL STANDARD
- PEDESTRIAN STANDARD
- PEDESTRIAN HEAD
- COUNTDOWN HEAD

DETECTION ZONE SCHEDULE

Phase Number	Distance From Stop Bar (feet)	Length (feet)	Presence Counting	Passage Counting	Queue Counting	Locking Memory	Non-Locking Memory
1-1	20	40	X				X
2-1	0	20			X		X
2-2	145	20		X			X
2-3	0	20	X				X
4-1	0	20	X				X
4-2	0	20	X				X
5-1	20	40	X				X
6-1	0	20		X			X
6-2	145	20		X			X
6-3	0	20	X				X
8-1	0	20	X				X

NOTES:
 1. THE FINAL SIZE OF ALL DETECTION ZONES SHALL BE AS RECOMMENDED BY VIDEO DETECTION MANUFACTURER.

SYMBOL	DATE	DESCRIPTION	APPROVED



UNIVERSITY AVENUE RECONSTRUCTION (COULEE TO COLUMBIA) & MEDIANS/LIGHTING (COULEE TO 42ND ST)
 CITY OF GRAND FORKS
 GRAND FORKS, ND

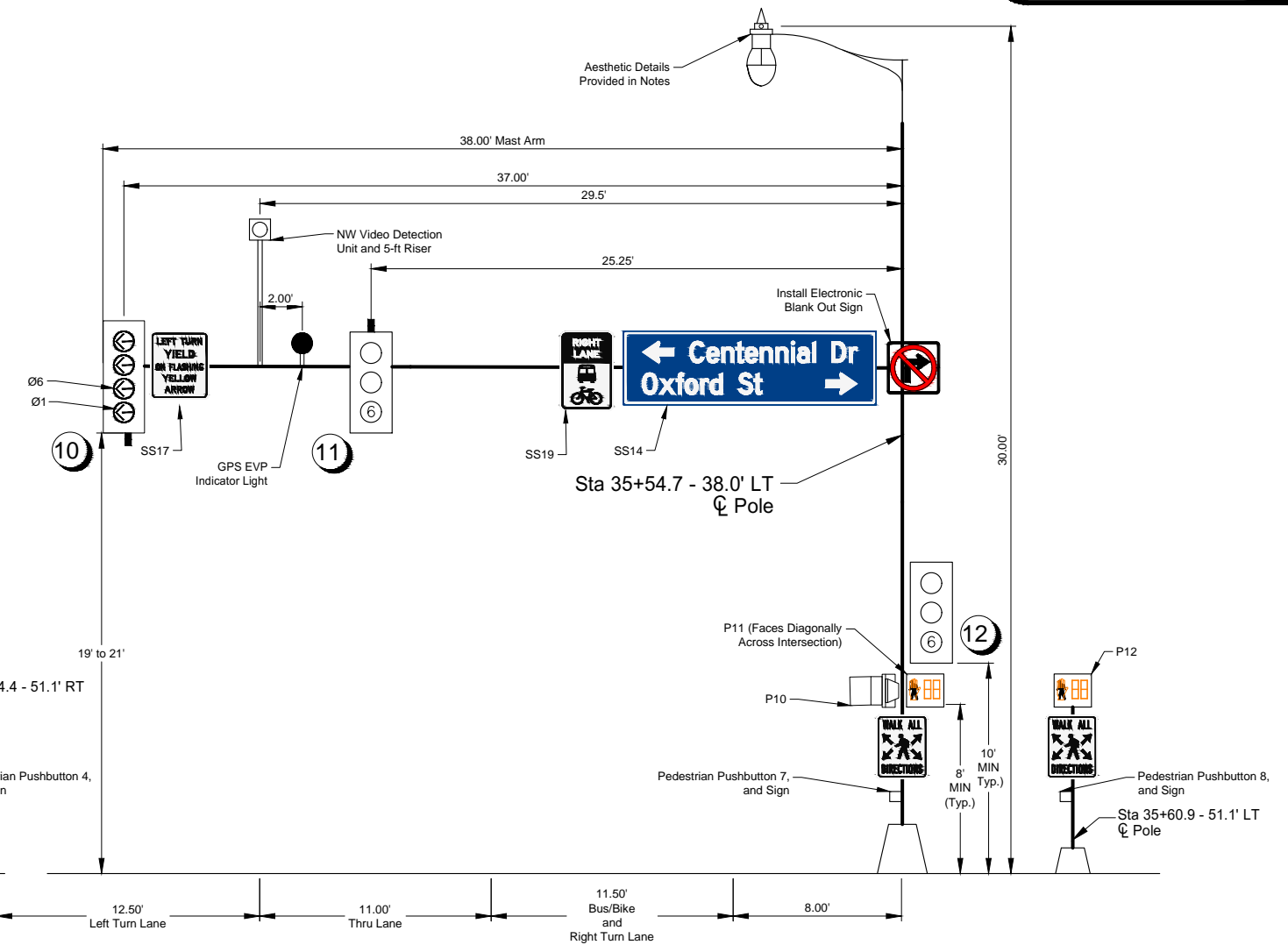
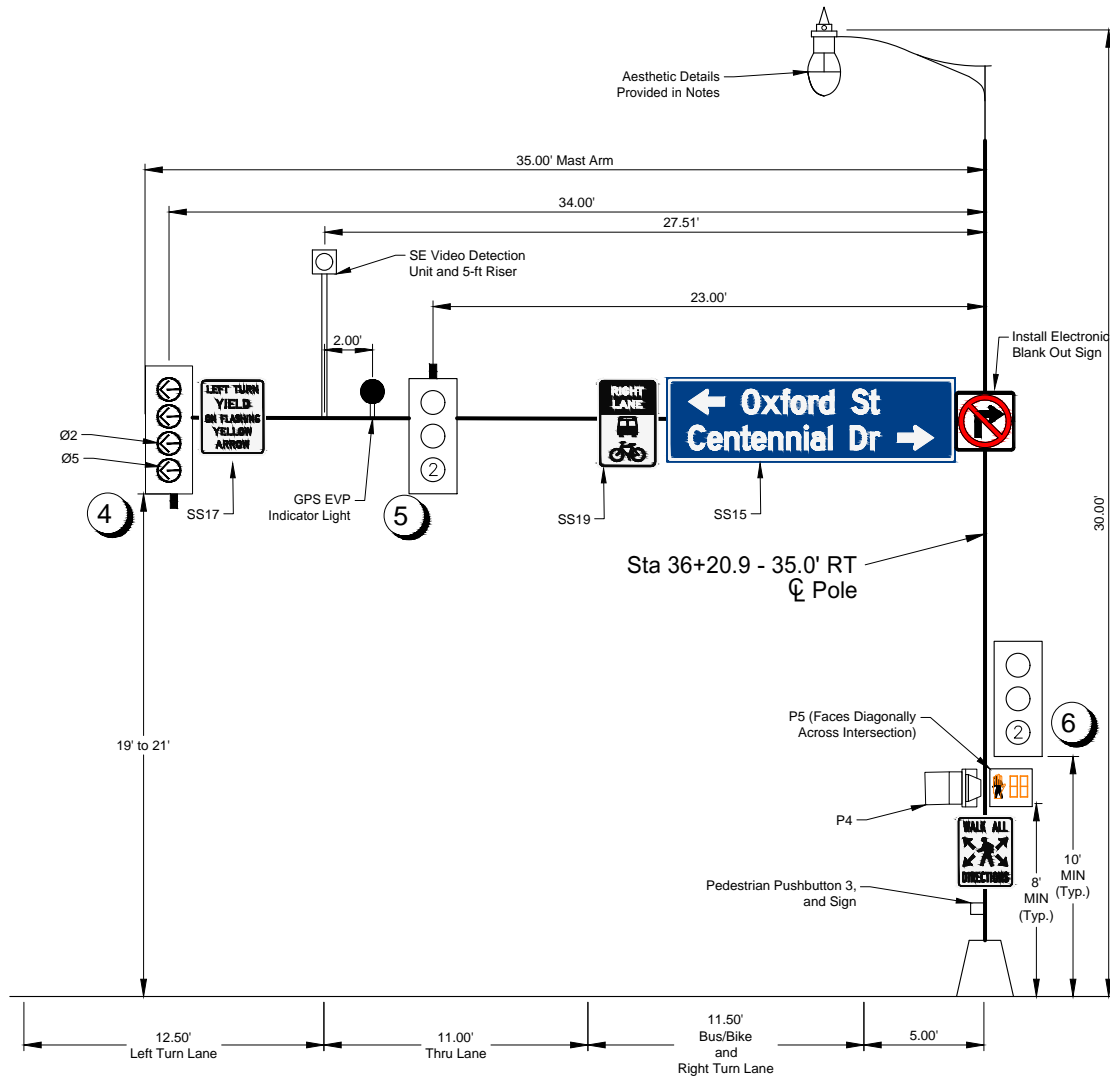
DRAWING TYPE
 CONST
 PREPARED BY
 TS
 CHECKED / APPROVED
 MB / JM
 DATE
 MAY 5, 2019
 PROJECT NUMBER
 00105-2017-015
 SHEET
 49 of 70
 DRAWING

T49

FOR CONSTRUCTION
 05/05/2019

SOUTHEAST SIGNAL STANDARDS

NORTHWEST SIGNAL STANDARDS



Legend

- VIDEO DETECTION CAMERA
- TRAFFIC SIGNAL HEAD W/
ASSOCIATED PHASE
- SIGNAL HEAD NUMBER
- EVP LIGHT
- LAW ENFORCEMENT
CONFIRMATION LIGHT

NOTES:

1. SEE D-754-80 FOR SIGN MOUNTS

SYM	DATE	DESCRIPTION	APPR



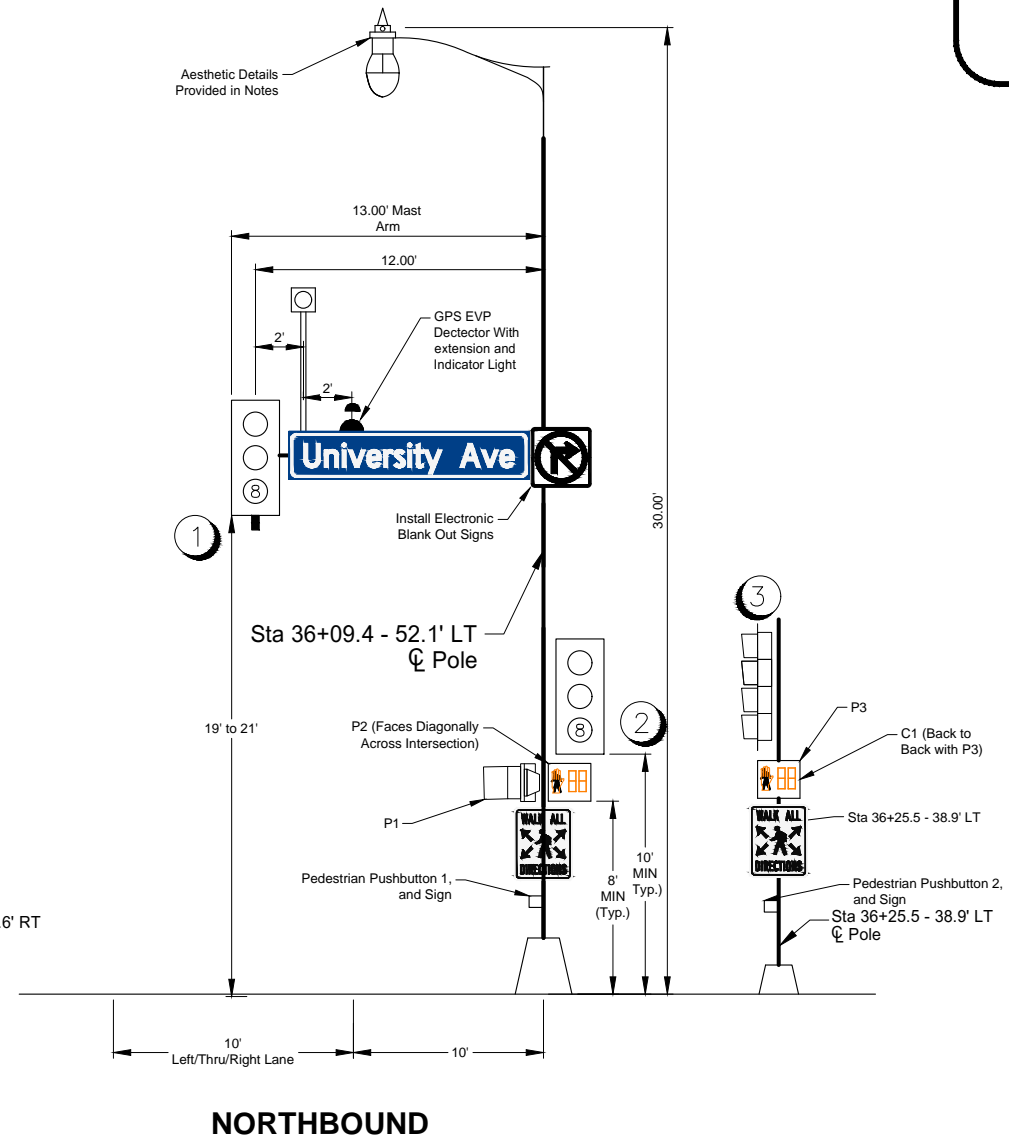
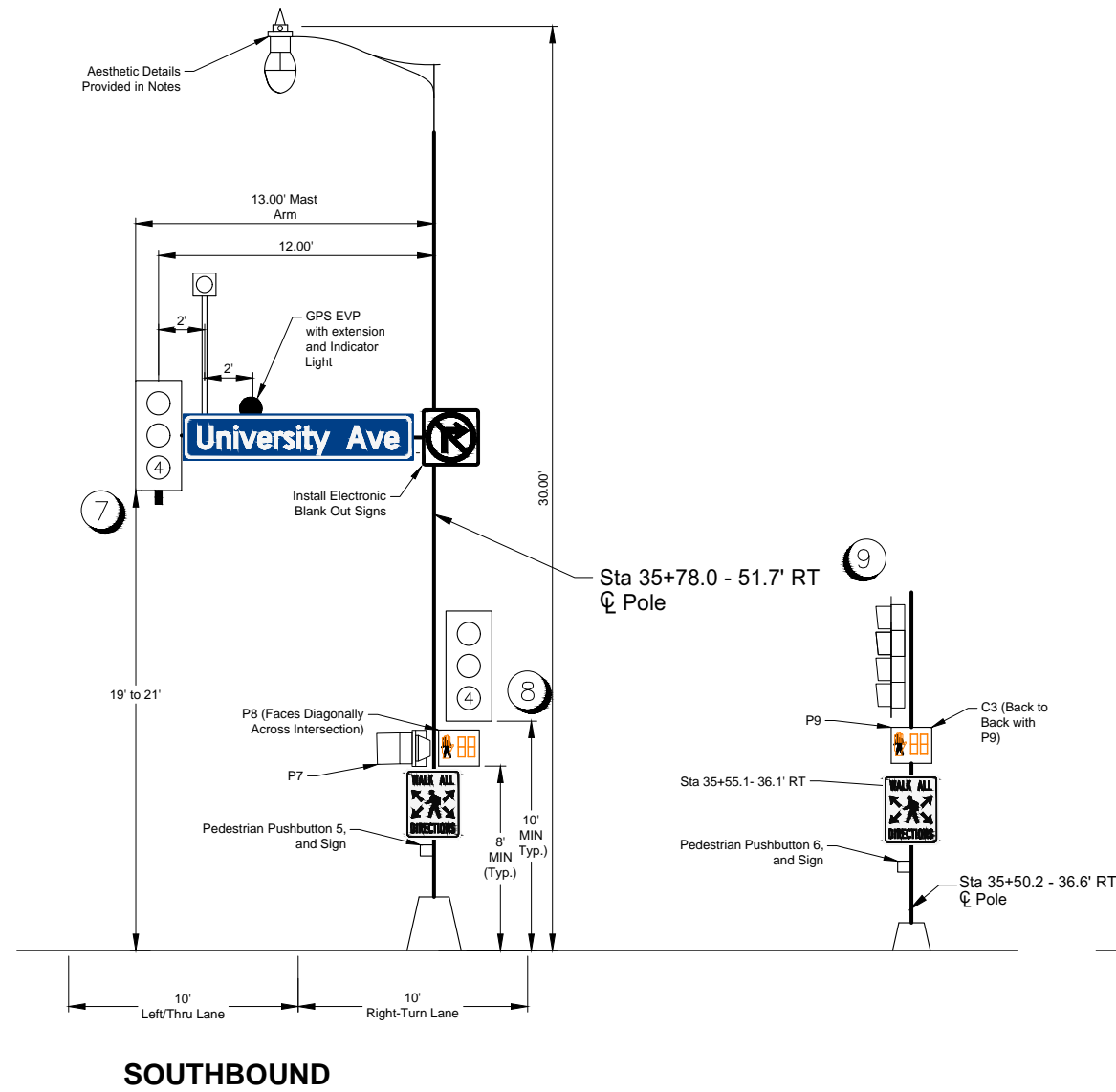
UNIVERSITY AVENUE RECONSTRUCTION (COULEE TO
 COLUMBIA) & MEDIANS/LIGHTING (COULEE TO 42ND ST)
 CITY OF GRAND FORKS
 GRAND FORKS, ND

DRAWING TYPE	CONST
PREPARED BY	TS
CHECKED / APPROVED	MB / JM
DATE	MAY 5, 2019
PROJECT NUMBER	00105-2017-015
SHEET	50 of 70
DRAWING	T50

SIGNAL STANDARDS & HEAD LOCATIONS - OXFORD ST

SOUTHWEST SIGNAL STANDARDS

NORTHEAST SIGNAL STANDARDS



Legend

- VIDEO DETECTION CAMERA
- TRAFFIC SIGNAL HEAD W/ ASSOCIATED PHASE
- SIGNAL HEAD NUMBER
- EVP LIGHT
- LAW ENFORCEMENT CONFIRMATION LIGHT
- EVP DETECTOR

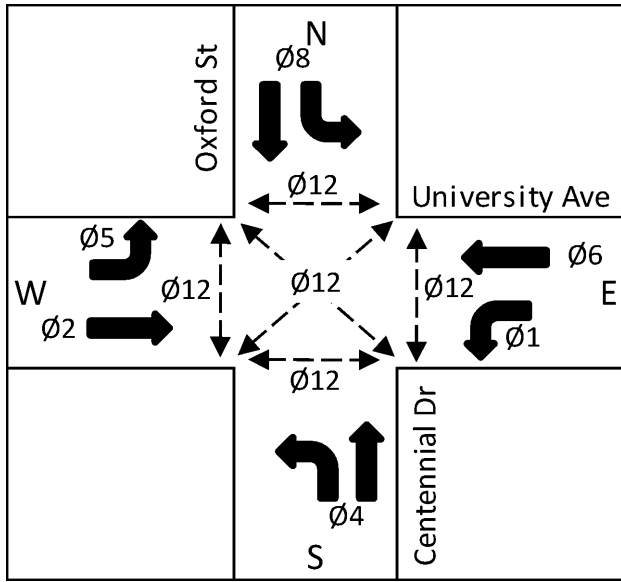
NOTES:
 1. SEE D-754-80 FOR SIGN MOUNTS

SYM	DATE	DESCRIPTION	APPR



UNIVERSITY AVENUE RECONSTRUCTION (COULEE TO COLUMBIA) & MEDIANS/LIGHTING (COULEE TO 42ND ST)
 CITY OF GRAND FORKS
 GRAND FORKS, ND

DRAWING TYPE	CONST
PREPARED BY	TS
CHECKED / APPROVED	MB / JM
DATE	MAY 5, 2019
PROJECT NUMBER	00105-2017-015
SHEET	51 of 70
DRAWING	T51



TIMING PLAN 1

	Phase 1 WB Left	Phase 2 EB ThruRight	Phase 3 Future	Phase 4 SB L/ThruRt	Phase 5 EB Left	Phase 6 WB ThruRight	Phase 7 Future	Phase 8 NB L/ThruRt	Phase 12 Ped Exclusive
SIGNAL INDICATIONS & PHASING									
Corresponding Signal Head(s)	10	5, 6, 10		7, 8	4	4, 9, 10		1, 2	
Right-of-Way Display	GL	FYA, G, G		G, G	GL	GL, G, G		G, G	
Clearance Display Prior to Next Phase	YL	YL, Y, Y		Y, Y	YL	YL, Y, Y		Y, Y	
Corresponding Pedestrian Head(s)									P1-P12
Concurrent Phase	5 or 6	5 or 6		8	1 or 2	1 or 2		4	
Next Phase (Unless Skipped)	2	12		1	6	12		5	1
Overlap Phase									Phase 11*
Overlap - Corresponding Signal Head(s)									P1-P12
Overlap - Right-of-Way Display									Walk
Overlap - Clearance Display Prior to Next Phase									FDW
*Only Used During Certain Timing Plans **Countdown to Phase 12 When Pedestrian Call is in Place									
BASIC INTERVALS (OR FUNCTIONS)									
Minimum Initial	5.0	15.0		10.0	5.0	15.0		10.0	
Minimum Initial with Pedestrian Actuation*									28.0
Passage Time	2.0	5.0		5.0	2.0	5.0		5.0	
Total Split (Green + Yellow + All Red)	15.0	40.0		30.0	15.0	40.0		30.0	33.0
Yellow Change	2.5	2.5		2.5	2.5	2.5		2.5	
Red Clearance	2.0	2.4		3.4	2.5	2.4		3.4	
Walk									5.0
Pedestrian Clearance									23.0

Legend

EB - Eastbound (University Avenue)
 WB - Westbound (University Avenue)
 NB - Northbound (Centennial Drive)
 SB - Southbound (Main Street S)

Y - Yellow Ball Indication
 G - Green Ball Indication
 RL - Right Left Arrow Indication
 YL - Yellow Left Arrow Indication
 FYA - Flashing Yellow Arrow
 GR - Green Right Arrow Indication
 YR - Yellow Right Arrow Indication
 LW - Don't Walk
 FDW - Flashing Don't Walk

VOLUME DENSITY TIMING FUNCTIONS - ONLY APPLICABLE DURING "FREE" (UNCOORDINATED) TIMING PLAN

Added Initial		Computed Initial		Extensible Initial	
Minimum Initial	15.0	Minimum Initial	15.0	Minimum Initial	15.0
Added Initial per Actuation	2.0	Maximum Initial	35.1	Maximum Initial	35.1
Actuations Before Added Initial	6	Actuations to Reach Maximum Initial	10	Actuations to Reach Maximum Initial	10
Passage Time		Minimum Gap		Time to Reduce to Minimum Gap	
Minimum Gap	5.0	Minimum Gap	2.0	Time to Reduce to Minimum Gap	12.0
Reduce Gap Every	2.0	Reduce Gap Every	1.0	Reduce Gap Every	1.0
Reduce Gap Every Second By	0.25	Reduce Gap Every Second By	0.25	Reduce Gap Every Second By	0.27
Reduce Gap By	3.0	Reduce Gap By	3.0	Reduce Gap By	3.0

OTHER CONTROLLER FUNCTIONS

Recall	Minimum	No	No	Minimum	No
Flashing-Normal & Conflict Monitor	Y	R	R	Y	OW
Start-Up Phasing	G	R	R	G	OW
Emergency Vehicle Pre-emption	X	X	X	X	OW
Type of Detector	Presence	Calling	Passage	Refer to Detector Zone Table	
Locking Memory					
Non-Locking Memory					

TIMING PLAN 2

CHANGES FROM TIMING PLAN 1 SHADED IN GREY

	Phase 1 WB Left	Phase 2 EB ThruRight	Phase 3 Future	Phase 4 SB L/ThruRt	Phase 5 EB Left	Phase 6 WB ThruRight	Phase 7 Future	Phase 8 NB L/ThruRt	Phase 12 Ped Exclusive
SIGNAL INDICATIONS & PHASING									
Corresponding Signal Head(s)	10	5, 6, 10		7, 8	4	4, 9, 10		1, 2	
Right-of-Way Display	GL	FYA, G, G		G, G	GL	GL, G, G		G, G	
Clearance Display Prior to Next Phase	YL	YL, Y, Y		Y, Y	YL	YL, Y, Y		Y, Y	
Corresponding Pedestrian Head(s)									P1-P12
Concurrent Phase	5 or 6	5 or 6		8	1 or 2	1 or 2		4	
Next Phase (Unless Skipped)	2	12		1	6	12		5	1
Overlap Phase									Phase 11*
Overlap - Corresponding Signal Head(s)									P1-P12
Overlap - Right-of-Way Display									Walk
Overlap - Clearance Display Prior to Next Phase									FDW
*Only Used During Certain Timing Plans **Countdown to Phase 12 When Pedestrian Call is in Place									
BASIC INTERVALS (OR FUNCTIONS)									
Minimum Initial	5.0	15.0		10.0	5.0	15.0		10.0	
Minimum Initial with Pedestrian Actuation*									33.0
Passage Time	2.0	5.0		5.0	2.0	5.0		5.0	
Total Split (Green + Yellow + All Red)	15.0	40.0		30.0	15.0	40.0		30.0	33.0
Yellow Change	3.0	3.9		3.0	3.0	3.9		3.0	
Red Clearance	2.0	1.7		3.5	2.0	1.7		3.5	
Walk									10.0
Pedestrian Clearance									23.0

VOLUME DENSITY TIMING FUNCTIONS - ONLY APPLICABLE DURING "FREE" (UNCOORDINATED) TIMING PLAN

Added Initial		Computed Initial		Extensible Initial	
Minimum Initial	15.0	Minimum Initial	15.0	Minimum Initial	15.0
Added Initial per Actuation	2.0	Maximum Initial	34.4	Maximum Initial	34.4
Actuations Before Added Initial	6	Actuations to Reach Maximum Initial	10	Actuations to Reach Maximum Initial	10
Passage Time		Minimum Gap		Time to Reduce to Minimum Gap	
Minimum Gap	5.0	Minimum Gap	2.0	Time to Reduce to Minimum Gap	11.0
Reduce Gap Every	2.0	Reduce Gap Every	1.0	Reduce Gap Every	1.0
Reduce Gap Every Second By	0.27	Reduce Gap Every Second By	0.27	Reduce Gap Every Second By	0.27
Reduce Gap By	3.0	Reduce Gap By	3.0	Reduce Gap By	3.0

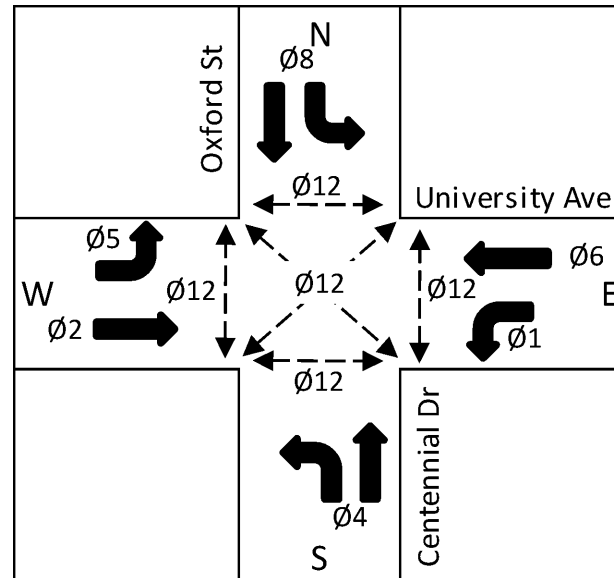
OTHER CONTROLLER FUNCTIONS

Recall	Minimum	No	No	Minimum	No
Flashing-Normal & Conflict Monitor	Y	R	R	Y	OW
Start-Up Phasing	G	R	R	G	OW
Emergency Vehicle Pre-emption	X	X	X	X	OW
Type of Detector	Presence	Calling	Passage	Refer to Detector Zone Table	
Locking Memory					
Non-Locking Memory					

Plotted By: Tracy Steinhilber Date: Friday, May 10, 2019 11:00:23 AM
 Last Saved By: Tracy Steinhilber Date: Friday, May 10, 2019 11:00:23 AM
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UNIVERSITY AVENUE RECONSTRUCTION (COULEE TO
 COLUMBIA) & MEDIANS/LIGHTING (COULEE TO 42ND ST)
 CITY OF GRAND FORKS
 GRAND FORKS, ND
 SIGNAL TIMING PLANS - OXFORD ST

DRAWING TYPE: CONST
 PREPARED BY: TS
 CHECKED / APPROVED: MB / JM
 DATE: MAY 5, 2019
 PROJECT NUMBER: 00105-2017-015
 SHEET: 53 of 70
 DRAWING: T53



Legend

EB - Eastbound (University Avenue)
 WB - Northbound (University Avenue)
 NB - Northbound (Centennial Drive)
 SB - Southbound (Main Street S)

Y - Yellow Ball Indication
 G - Green Ball Indication
 RL - Green Left Arrow Indication
 YL - Yellow Left Arrow Indication
 FYA - Flashing Yellow Arrow
 GR - Green Right Arrow Indication
 YR - Yellow Right Arrow Indication
 DW - Don't Walk
 FFW - Flashing Don't Walk

TIMING PLAN 3

CHANGES FROM TIMING PLAN 1 SHADED IN GREY

	Phase 1 WB Left	Phase 2 EB Thru/Right	Phase 3 Future	Phase 4 SB Lt/Thru/Rt	Phase 5 EB Left	Phase 6 WB Thru/Right	Phase 7 Future	Phase 8 NB Lt/Thru/Rt	Phase 12 Ped Exclusive
SIGNAL INDICATIONS & PHASING									
Corresponding Signal Head(s)	10	5, 6, 10		7, 8	4	4, 9, 10		1, 2	
Right-of-Way Display	GL	FYA, G, G		G, G	GL	GL, G, G		G, G	
Clearance Display Prior to Next Phase	YL	YL, Y, Y		Y, Y	YL	YL, Y, Y		Y, Y	
Corresponding Pedestrian Head(s)									P1-P12
Concurrent Phase	5 or 6	5 or 6		8	1 or 2	1 or 2		4	
Next Phase (Unless Skipped)	2	12		1	6	12		5	1
Overlap Phase									Phase 11*
Overlap - Corresponding Signal Head(s)									P1-P12
Overlap - Right-of-Way Display									Walk
Overlap - Clearance Display Prior to Next Phase									FWW

*Only Used During Certain Timing Plans
 **Countdown to Phase 12 When Pedestrian Call is in Place

BASIC INTERVALS (OR FUNCTIONS)	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8	Phase 12
Minimum Initial	5.0	15.0		10.0	5.0	15.0		10.0	
Minimum Initial with Pedestrian Actuation*				24.9		26.0			38.0
Passage Time	2.0	5.0		5.0	2.0	5.0		5.0	
Total Split (Green + Yellow + All Red)	15.0	40.0		30.0	15.0	40.0		30.0	38.0
Yellow Change	3.0	3.9		3.0	3.0	3.9		3.0	
Red Clearance	2.0	1.7		3.5	2.0	1.7		3.5	
Walk									15.0
Pedestrian Clearance									23.0

VOLUME DENSITY TIMING FUNCTIONS - ONLY APPLICABLE DURING "FREE" (UNCOORDINATED) TIMING PLAN									
<i>Added Initial</i>									
Minimum Initial		15.0				15.0			
Added Initial per Actuation		2.0				2.0			
Actuations Before Added Initial		6				6			
<i>Computed Initial</i>									
Minimum Initial		15.0				15.0			
Maximum Initial		34.4				34.4			
Actuations to Reach Maximum Initial		10				10			
<i>Extensible Initial</i>									
Minimum Initial		15.0				15.0			
Maximum Initial		34.4				34.4			
Added Initial per Actuation		2.0				2.0			
Passage Time		5.0				5.0			
Minimum Gap		2.0				2.0			
Time to Reduce to Minimum Gap		11.0				11.0			
Reduce Gap Every		1.0				1.0			
Reduce Gap Every Second By		0.27				0.27			
Reduce Gap By		3.0				3.0			

OTHER CONTROLLER FUNCTIONS									
Recall		Minimum		No	No	Minimum		No	
Flashing-Normal & Conflict Monitor		Y		R	R	Y		DW	
Start Up Phasing		G		R	R	G		DW	
Emergency Vehicle Pre-emption		x		x	x	x		DW	
Type of Detector	Presence	Refer to Detector Zone Table							
	Calling								
	Passage								
Locking Memory									
Non-Locking Memory									

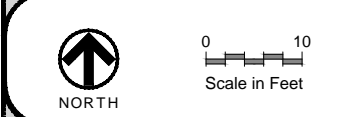
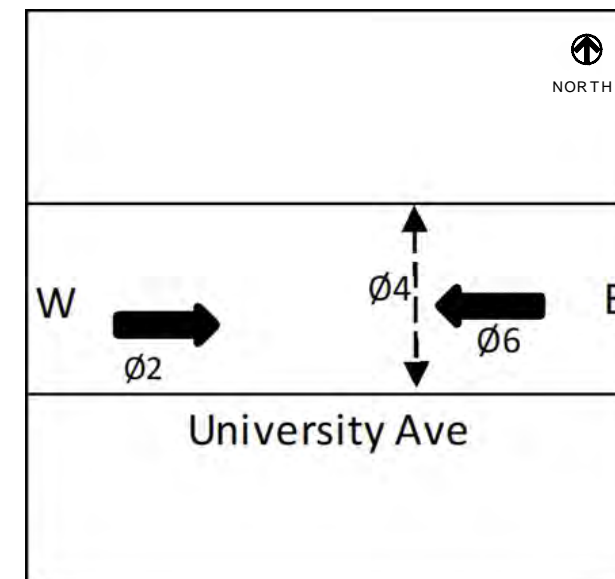
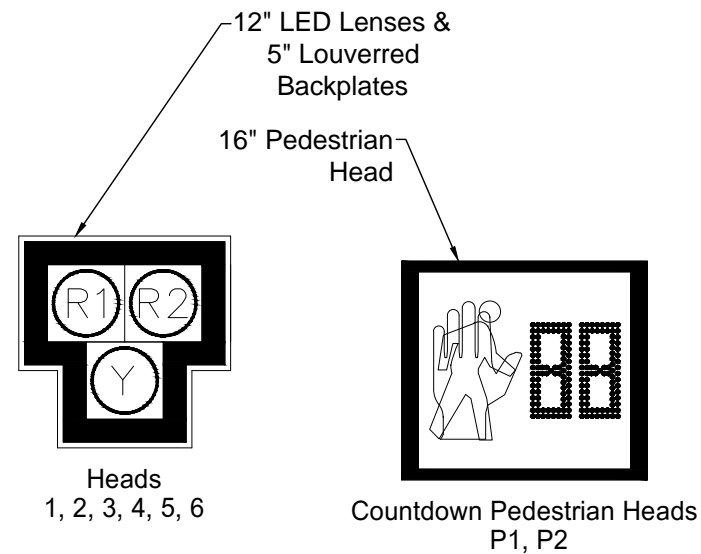
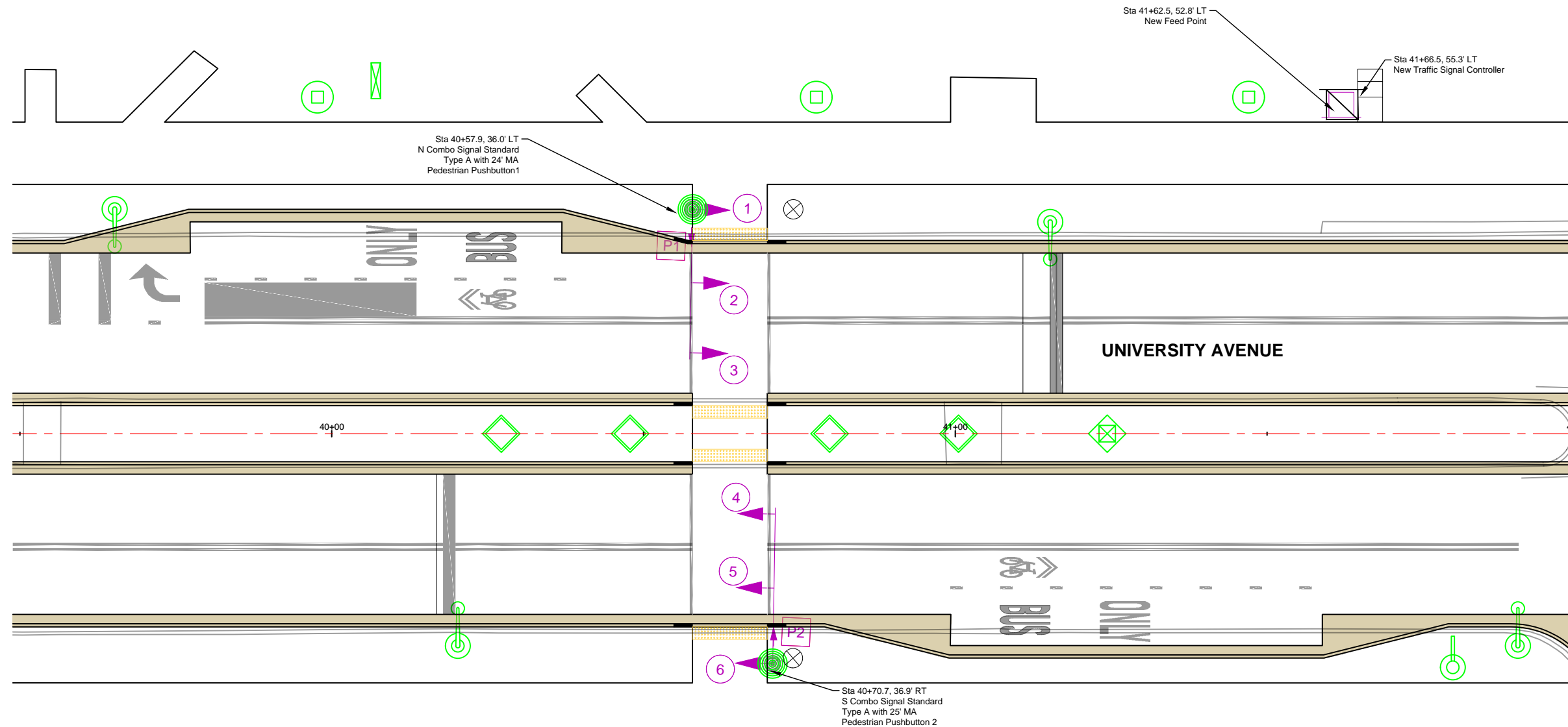
SYM	DATE	DESCRIPTION	APPR



UNIVERSITY AVENUE RECONSTRUCTION (COULEE TO COLUMBIA) & MEDIANS/LIGHTING (COULEE TO 42ND ST)
 CITY OF GRAND FORKS
 GRAND FORKS, ND

DRAWING TYPE
 CONST
 PREPARED BY
 TS
 CHECKED / APPROVED
 MB / JM
 DATE
 MAY 5, 2019
 PROJECT NUMBER
 00105-2017-015
 SHEET
 54 of 70
 DRAWING

T54



- Legend**
- SIGNAL CONTROLLER
 - SIGNAL HEAD
 - FEED POINT
 - VIDEO DETECTION UNIT
 - SIGNAL STANDARD
 - PEDESTRIAN STANDARD
 - PEDESTRIAN HEAD
 - COUNTDOWN HEAD

Pedestrian Pushbutton Schedule

Location	Pushbutton & Sign Location on Pole	Direction of Arrow on Sign
Pushbutton 1	East	Left
Pushbutton 2	West	Left



SYM	DATE	DESCRIPTION	APPR

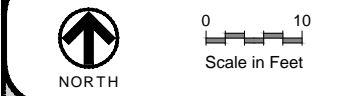
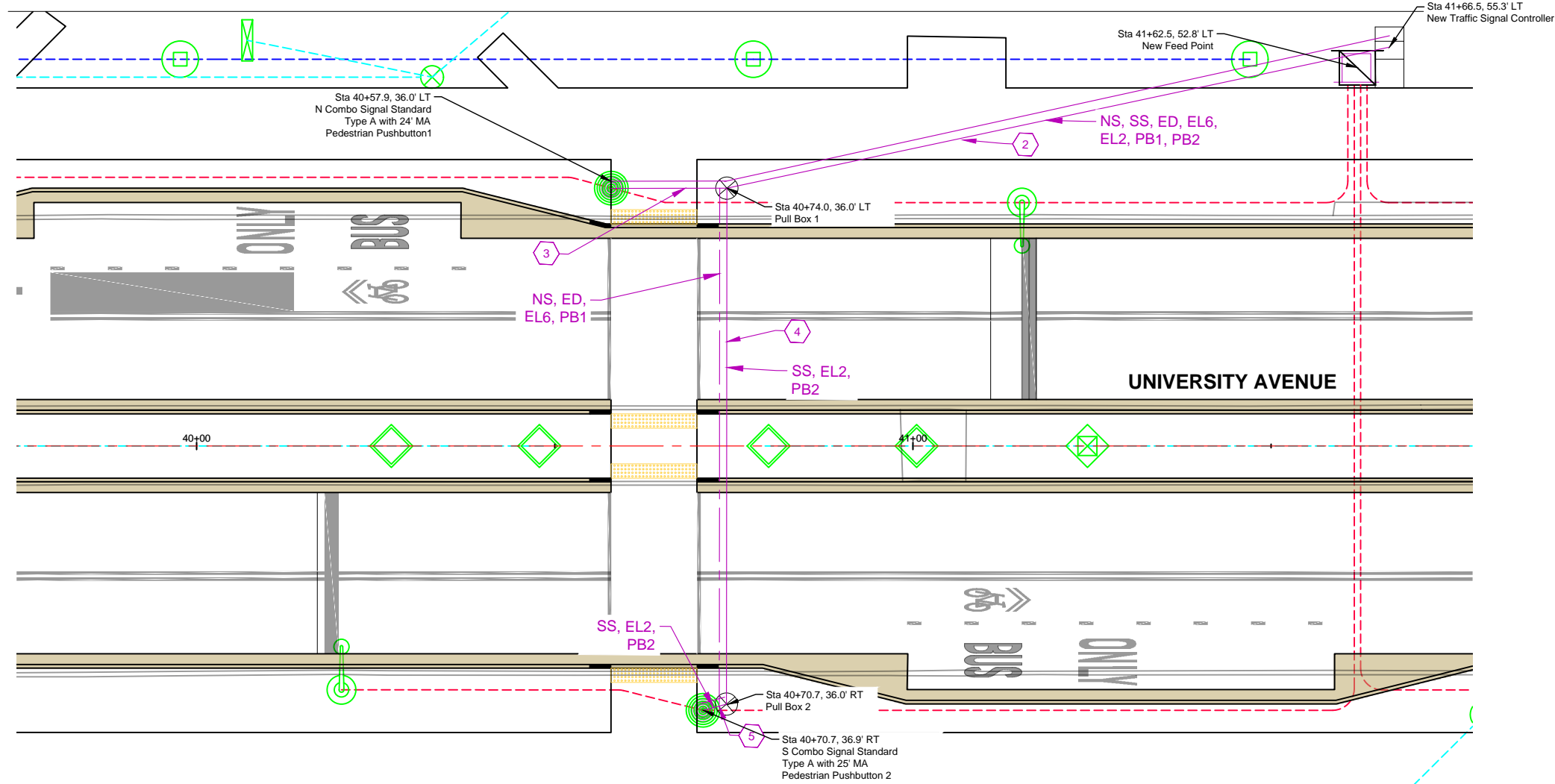


UNIVERSITY AVENUE RECONSTRUCTION (COULEE TO COLUMBIA) & MEDIANS/LIGHTING (COULEE TO 42ND)
 CITY OF GRAND FORKS
 GRAND FORKS, ND

PEDESTRIAN HYBRID BEACON LAYOUT - CHESTER FRITZ LIBRARY

DRAWING TYPE	CONST
PREPARED BY	TS
CHECKED / APPROVED	MB / JM
DATE	MAY 5, 2019
PROJECT NUMBER	00105-2017-015
SHEET	55 of 71
DRAWING	T55

FOR CONSTRUCTION
05/05/2019



Legend

- SIGNAL CONTROLLER
- FEED POINT
- SIGNAL STANDARD
- PEDESTRIAN STANDARD
- CABLE & CONDUIT RUN
- PULL BOX

Conductor		Cable NS (North Combo Signal) (12 No. 14 AWG)		Cable SS (South Combo Signal) (12 No. 14 AWG)	
Base	Tracer	Head	Indication	Head	Indication
1	Black		Spare		Spare
2	White		Neutral		Neutral
3	Red	1, 2, 3	Ø6 Red 1	4, 5, 6	Ø2 Red 1
4	Green		Ground		Ground
5	Orange	1, 2, 3	Ø6 Yellow	4, 5, 6	Ø2 Yellow
6	Blue	1, 2, 3	Ø6 Red 2	4, 5, 6	Ø2 Red 2
7	White	Black	Spare		Spare
8	Red	Black	P1	Ø4 Don't Walk	P2
9	Green	Black		Spare	Spare
10	Orange	Black		Spare	Spare
11	Blue	Black		Spare	Spare
12	Black	White	P1	Ø4 Walk	P2

Origin	Destination	# of Cables	SIZE/TYPE	Total LF
North Combo Signal Std Transformer Base	Vehicle Head 1	1	14 AWG 5 CONDUCTOR CABLE	20
	Vehicle Head 2	1	14 AWG 5 CONDUCTOR CABLE	51
	Vehicle Head 3	1	14 AWG 5 CONDUCTOR CABLE	40
	Pedestrian Head 1	1	14 AWG 3 CONDUCTOR CABLE	17
South Combo Signal Std Transformer Base	Vehicle Head 4	1	14 AWG 5 CONDUCTOR CABLE	52
	Vehicle Head 5	1	14 AWG 5 CONDUCTOR CABLE	40
	Vehicle Head 6	1	14 AWG 5 CONDUCTOR CABLE	20
	Pedestrian Head 2	1	14 AWG 3 CONDUCTOR CABLE	17

CABLE NAMES
 NS = North Combo Signal Standard
 SS = South Combo Signal Standard
 ED = GPS Emergency Preemption Detector
 EL2 = Emergency Preemption Lamp ø2
 EL6 = Emergency Preemption Lamp ø6
 PB1 = Pedestrian Pushbutton 1
 PB2 = Pedestrian Pushbutton 2

SIGNAL CABLE & CONDUIT SCHEDULE

#	RUN		CONDUIT		CABLE						
	ITEM	STATION, OFFSET	SIZE (IN)	LF	Origin	Destination	# of Cables	SIZE/TYPE	Total LF	TITLE	
1	Origin	Feed Point	Sta 41+62.5, 52.8' LT	2	Feed Point	Traffic Signal Controller	2	UNDERGROUND CONDUCTOR NO6-TYPE RHW	38		
	Destination	Traffic Signal Controller	Sta 41+66.5, 55.3' LT		Feed Point	Traffic Signal Controller	1	UNDERGROUND CONDUCTOR NO6-TYPE THW	19		
2	Origin Destination	Traffic Signal Controller Pull Box 1	Sta 40+74.0, 36.0' LT Sta 40+74.0, 36.0' LT	3	96	Traffic Signal Controller	Pull Box 1	2	14 AWG 12 CONDUCTOR CABLE	220	SS, NS
						Traffic Signal Controller	Pull Box 1	1	EMERGENCY VEHICLE DETECTOR CABLE	110	ED
						Traffic Signal Controller	Pull Box 1	2	14 AWG 2 CONDUCTOR CABLE	220	EL6, EL2
						Traffic Signal Controller	Pull Box 1	2	16 AWG 2 CONDUCTOR CABLE	220	PB1, PB2
3	Origin Destination	Pull Box 1 North Combo Signal Std	Sta 40+74.0, 36.0' LT Sta 40+57.9, 36.0' LT	2	16	Pull Box 1	North Combo Signal Std Transformer Base	1	14 AWG 12 CONDUCTOR CABLE	27	NS
						Pull Box 1	Emergency Preemption Detector	1	EMERGENCY VEHICLE DETECTOR CABLE	58.75	ED
						Pull Box 1	North Emergency Preemption Lamp	1	14 AWG 2 CONDUCTOR CABLE	58.75	EL6
						Pull Box 1	Pushbutton 1	1	16 AWG 2 CONDUCTOR CABLE	30	PB1
4	Origin Destination	Pull Box 1 Pull Box 2	Sta 40+74.0, 36.0' LT Sta 40+74.0, 36.0' RT	2	71	Pull Box 1	Pull Box 2	1	14 AWG 12 CONDUCTOR CABLE	83	SS
						Pull Box 1	Pull Box 2	1	14 AWG 2 CONDUCTOR CABLE	83	EL2
						Pull Box 1	Pull Box 2	1	16 AWG 2 CONDUCTOR CABLE	83	PB2
5	Origin Destination	Pull Box 2 South Combo Signal Std	Sta 40+74.0, 36.0' RT Sta 40+70.7, 36.9' RT	2	4	Pull Box 2	South Combo Signal Std Transformer Base	1	14 AWG 5 CONDUCTOR CABLE	15	SS
						Pull Box 2	South Emergency Preemption Lamp	1	14 AWG 2 CONDUCTOR CABLE	47.1	EL2
						Pull Box 2	Pushbutton 2	1	16 AWG 2 CONDUCTOR CABLE	18	PB2

SYMBOL	DATE	DESCRIPTION	APPROVED

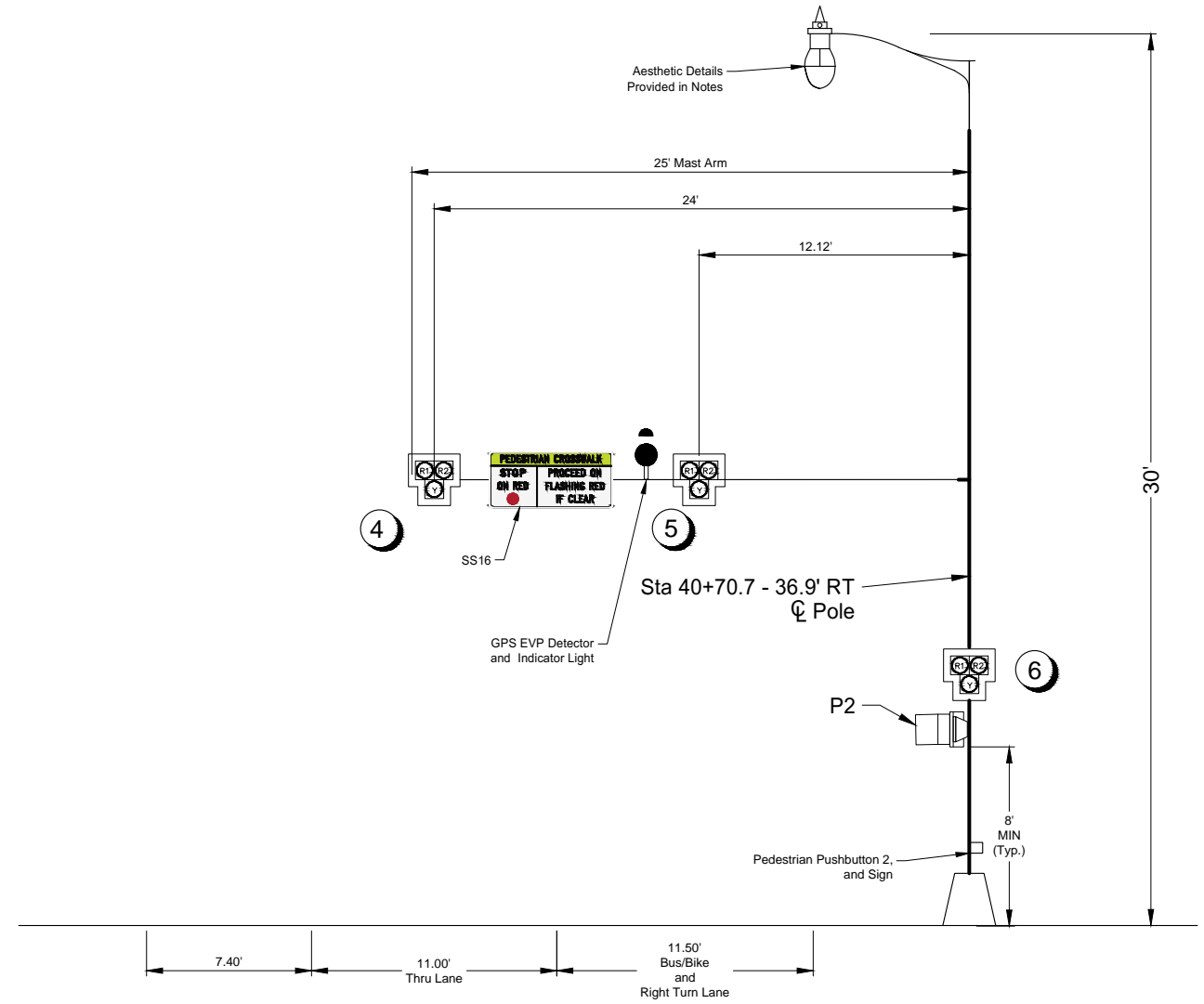
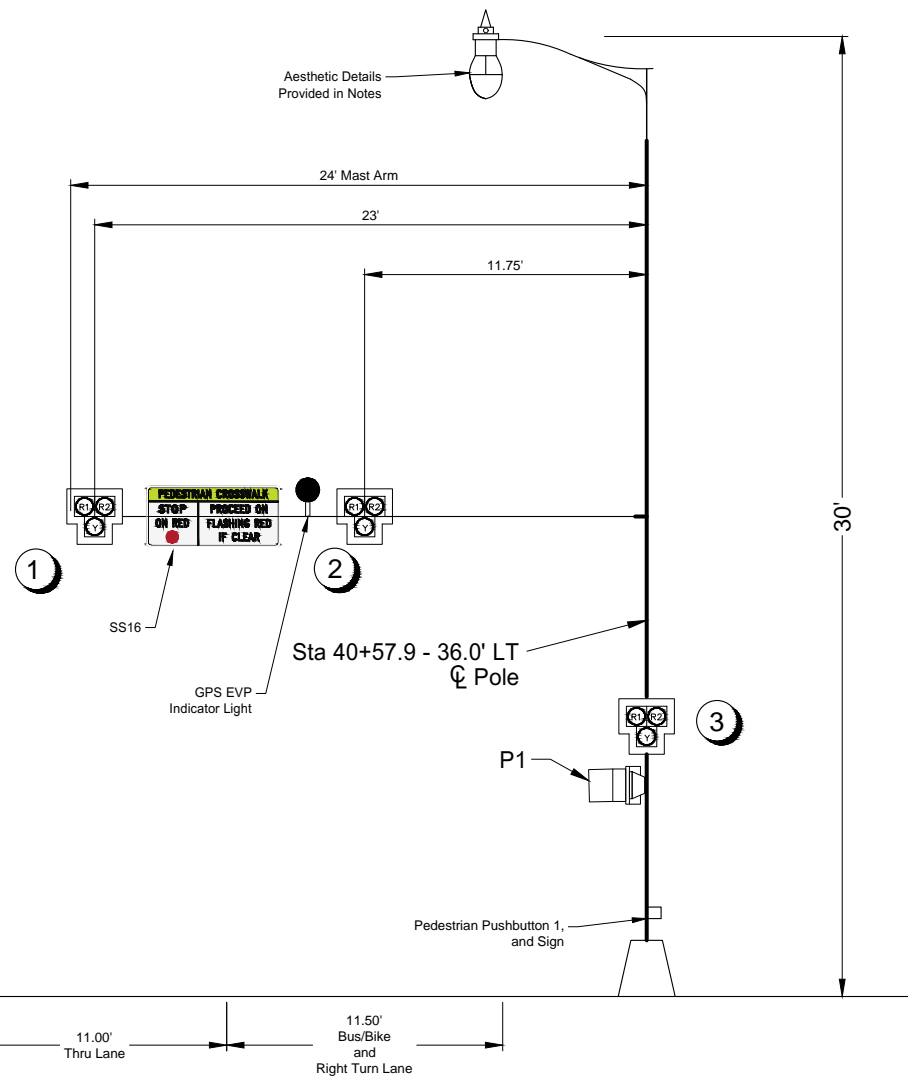


UNIVERSITY AVENUE RECONSTRUCTION (COULEE TO COLUMBIA) & MEDIANS/LIGHTING (COULEE TO 42ND)
 CITY OF GRAND FORKS
 GRAND FORKS, ND
 CABLE & CONDUCTOR LAYOUT - CHESTER FRITZ LIBRARY

DRAWING TYPE	CONST
PREPARED BY	TS
CHECKED / APPROVED	MB / JM
DATE	MAY 5, 2019
PROJECT NUMBER	00105-2017-015
SHEET	56 of 71
DRAWING	T56

NORTH COMBINATION SIGNAL STANDARD

SOUTH COMBINATION SIGNAL STANDARD



Legend

- VIDEO DETECTION CAMERA
- HYBRID BEACON
- SIGNAL HEAD NUMBER
- EVP LIGHT
- EVP DETECTOR

WESTBOUND

EASTBOUND

SYMBOL	DATE	DESCRIPTION	APPROVED



UNIVERSITY AVENUE RECONSTRUCTION (COULEE TO COLUMBIA) & MEDIANS/LIGHTING (COULEE TO 42ND ST)
 CITY OF GRAND FORKS
 GRAND FORKS, ND

DRAWING TYPE	CONST
PREPARED BY	TS
CHECKED / APPROVED	MB / JM
DATE	MAY 5, 2019
PROJECT NUMBER	00105-2017-015
SHEET	57 of 71
DRAWING	T57

PHB STANDARDS & HEAD LOCATIONS - CHESTER FRITZ LIBRARY

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Plotted By: Tracy Slemmon Date: Friday, May 10, 2019 12:52:38 PM
Last Saved By: Tracy Slemmon Date: Friday, May 10, 2019 12:52:38 PM

TIMING PLAN 1

	Phase 2 EB Thru	Phase 4 Pedestrian	Phase 6 WB Thru
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SIGNAL INDICATIONS & PHASING

Corresponding Signal Head(s)	4, 5, 6		1, 2, 3
Corresponding Pedestrian Head(s)		P1 and P2	
Concurrent Phase	6		2
Next Phase	4	2	4

Overlap - Corresponding Signal Head(s)			
Overlap - Right-of-			
Overlap - Clearance Display Prior to Next Phase			

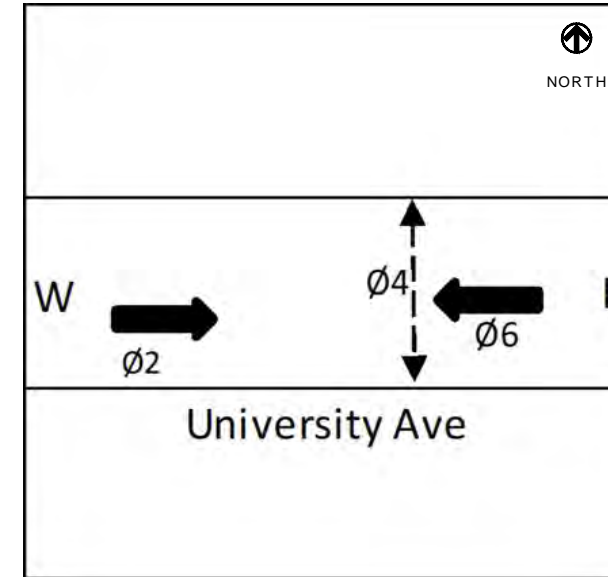
**Countdown to Phase 12 When Pedestrian Call is in Place

SEQUENCE

MAINLINE	PEDESTRIAN	CONTROLLER INPUT	TIMING		
			Phase 2 EB Thru	Phase 4 Pedestrian	Phase 6 WB Thru
Rest/Dark	DW	Walk	8.0		8.0
FY	DW	Ped Clearance	4.0		4.0
Y	DW	Yellow	3.0		3.0
R	DW	Red	2.0		2.0
R	W	Walk		5.0	
WWR	FDW	Ped Clearance		18.0	

OTHER CONTROLLER FUNCTIONS

Recall	Minimum	No	Minimum
Flashing-Normal & Conflict Monitor	Rest/Dark	DW	Rest/Dark
Start Up Phasing	Rest/Dark	DW	Rest/Dark
Emergency Vehicle Pre-emption	x	x	x



Legend

FY = Flashing Yellow Ball
Y = Yellow Ball Indication
R = Dual Red Ball Indication
WWR = Wig-Wag Red Ball Indication
DW = Don't Walk
FDW = Flashing Don't Walk

TIMING PLAN 2

CHANGES FROM TIMING PLAN 1 SHADED IN GREY

	Phase 2 EB Thru	Phase 4 Pedestrian	Phase 6 WB Thru
--	--------------------	-----------------------	--------------------

SIGNAL INDICATIONS & PHASING

Corresponding Signal Head(s)	4, 5, 6		1, 2, 3
Corresponding Pedestrian Head(s)		P1 and P2	
Concurrent Phase	6		2
Next Phase	4	2	4

Overlap - Corresponding Signal Head(s)			
Overlap - Right-of-			
Overlap - Clearance Display Prior to Next Phase			

**Countdown to Phase 12 When Pedestrian Call is in Place

SEQUENCE

MAINLINE	PEDESTRIAN	CONTROLLER INPUT	TIMING		
			Phase 2 EB Thru	Phase 4 Pedestrian	Phase 6 WB Thru
Rest/Dark	DW	Walk	8.0		8.0
FY	DW	Ped Clearance	4.0		4.0
Y	DW	Yellow	3.0		3.0
R	DW	Red	2.0		2.0
R	W	Walk		10.0	
WWR	FDW	Ped Clearance		18.0	

OTHER CONTROLLER FUNCTIONS

Recall	Minimum	No	Minimum
Flashing-Normal & Conflict Monitor	Rest/Dark	DW	Rest/Dark
Start Up Phasing	Rest/Dark	DW	Rest/Dark
Emergency Vehicle Pre-emption	x	x	x

TIMING PLAN 3

CHANGES FROM TIMING PLAN 1 SHADED IN GREY

	Phase 2 EB Thru	Phase 4 Pedestrian	Phase 6 WB Thru
--	--------------------	-----------------------	--------------------

SIGNAL INDICATIONS & PHASING

Corresponding Signal Head(s)	4, 5, 6		1, 2, 3
Corresponding Pedestrian Head(s)		P1 and P2	
Concurrent Phase	6		2
Next Phase	4	2	4

Overlap - Corresponding Signal Head(s)			
Overlap - Right-of-			
Overlap - Clearance Display Prior to Next Phase			

**Countdown to Phase 12 When Pedestrian Call is in Place

SEQUENCE

MAINLINE	PEDESTRIAN	CONTROLLER INPUT	TIMING		
			Phase 2 EB Thru	Phase 4 Pedestrian	Phase 6 WB Thru
Rest/Dark	DW	Walk	8.0		8.0
FY	DW	Ped Clearance	4.0		4.0
Y	DW	Yellow	3.0		3.0
R	DW	Red	2.0		2.0
R	W	Walk		15.0	
WWR	FDW	Ped Clearance		18.0	

OTHER CONTROLLER FUNCTIONS

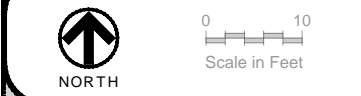
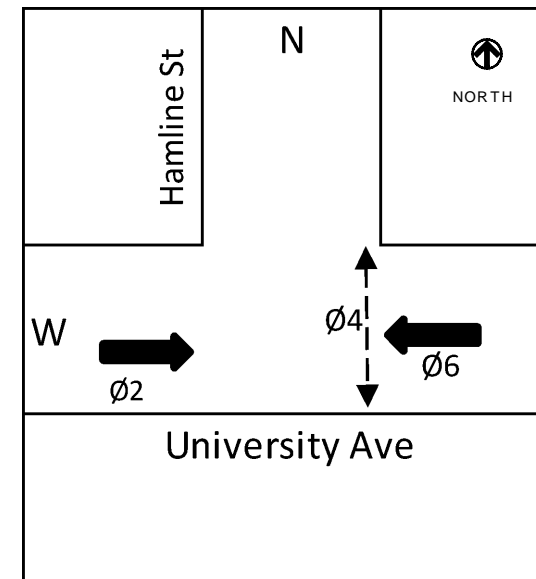
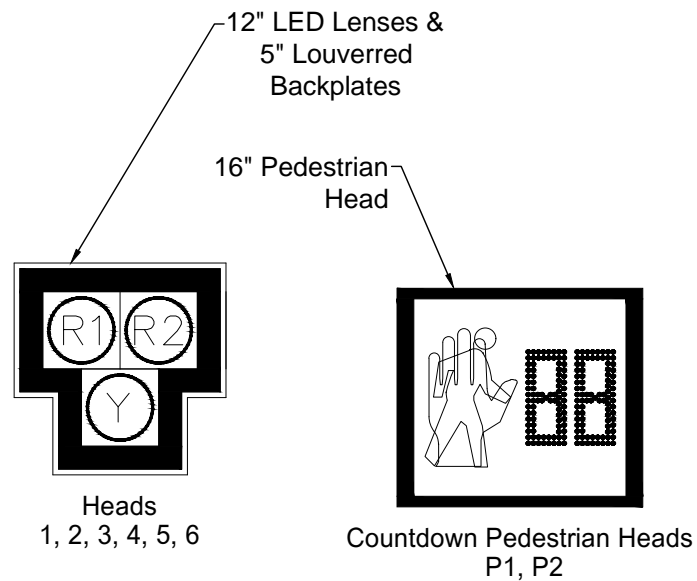
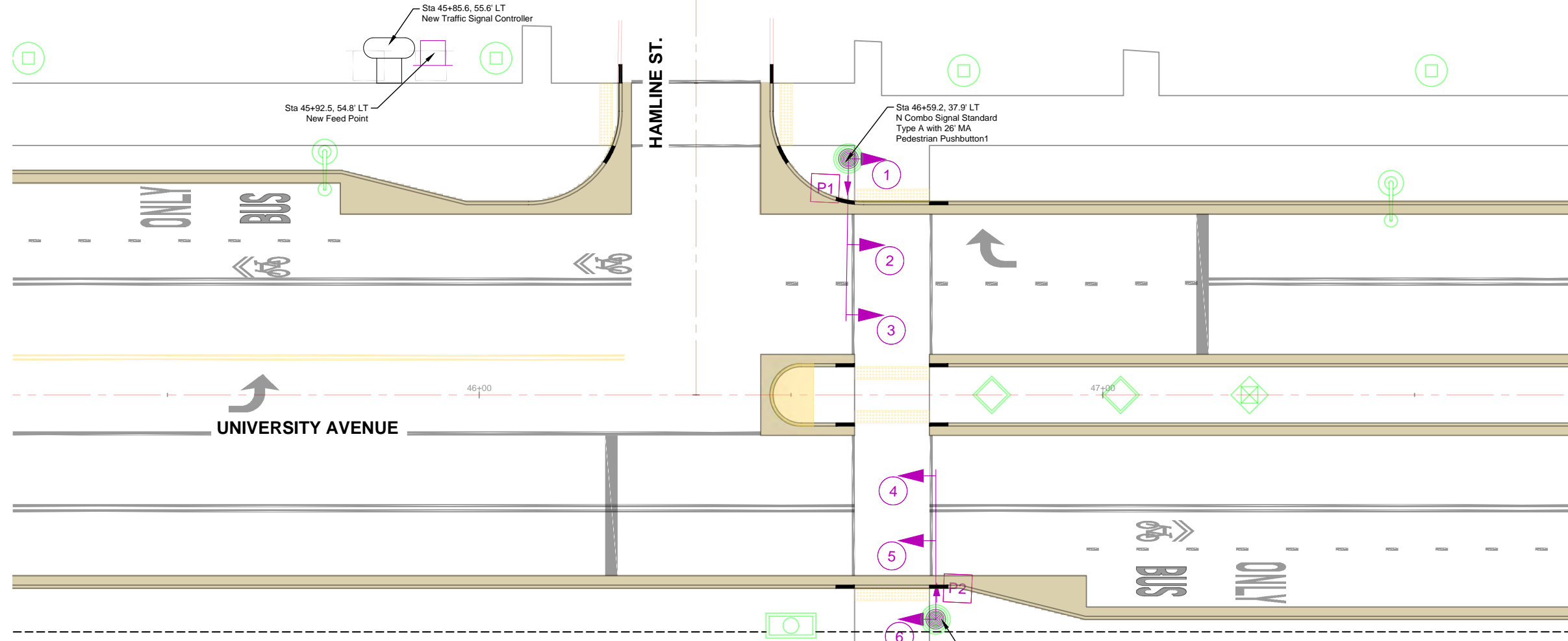
Recall	Minimum	No	Minimum
Flashing-Normal & Conflict Monitor	Rest/Dark	DW	Rest/Dark
Start Up Phasing	Rest/Dark	DW	Rest/Dark
Emergency Vehicle Pre-emption	x	x	x

SYMBOL	DATE	DESCRIPTION	APPROVED



UNIVERSITY AVENUE RECONSTRUCTION (COULEE TO COLUMBIA) & MEDIANS/LIGHTING (COULEE TO 42ND ST)
CITY OF GRAND FORKS
GRAND FORKS, ND

DRAWING TYPE	CONST
PREPARED BY	TS
CHECKED / APPROVED	MB / JM
DATE	MAY 5, 2019
PROJECT NUMBER	00105-2017-015
SHEET	58 of 71
DRAWING	T58



Legend

- SIGNAL CONTROLLER
- SIGNAL HEAD
- FEED POINT
- VIDEO DETECTION UNIT
- SIGNAL STANDARD
- PEDESTRIAN STANDARD
- PEDESTRIAN HEAD

Pedestrian Pushbutton Schedule		
Location	Pushbutton & Sign Location on Pole	Direction of Arrow on Sign
Pushbutton 1	East	Left
Pushbutton 2	West	Left



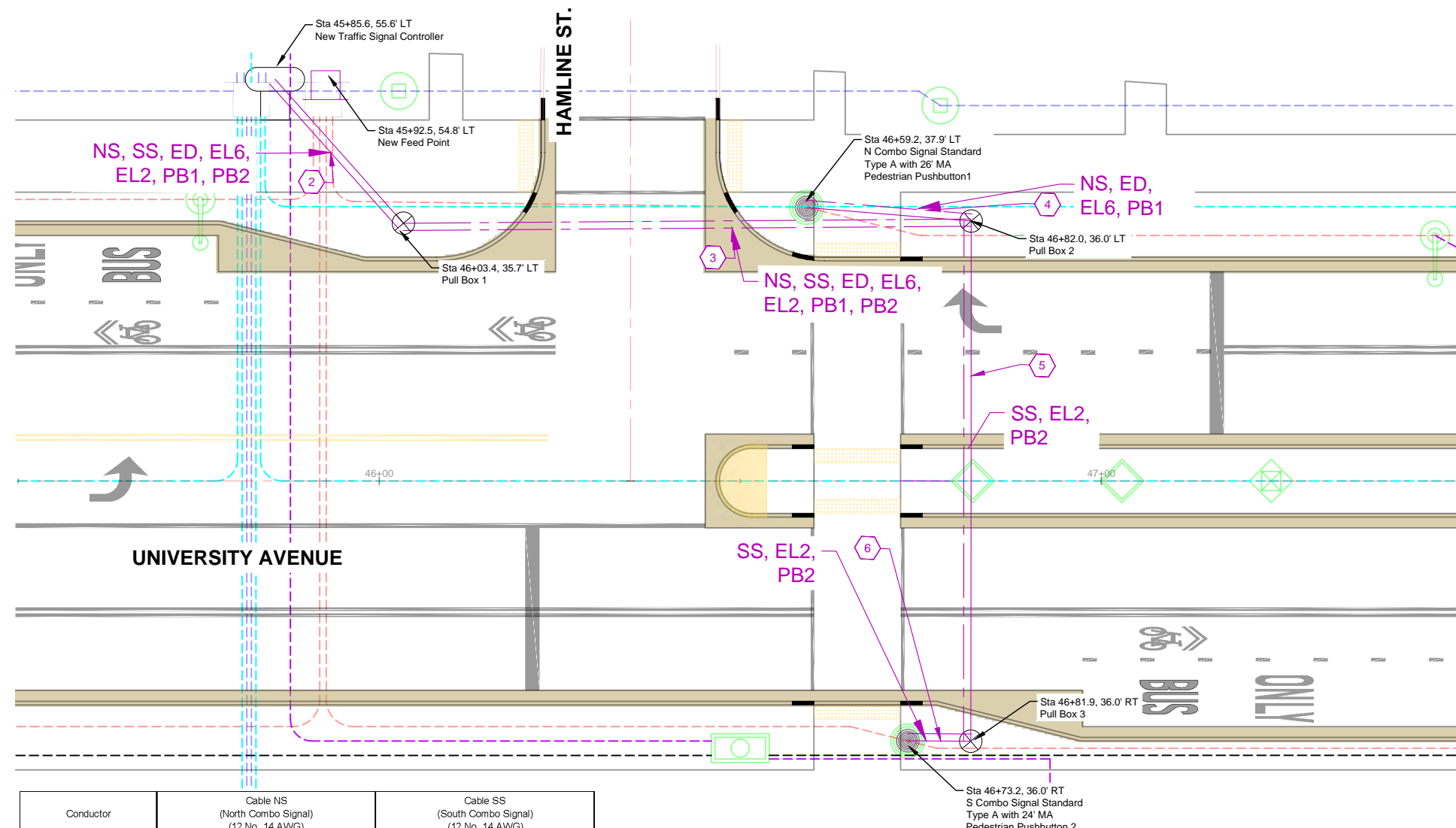
Sign R10-3e
FOR CONSTRUCTION
05/05/2019

SYM	DATE	DESCRIPTION	APPR



UNIVERSITY AVENUE RECONSTRUCTION (COULEE TO COLUMBIA) & MEDIANS/LIGHTING (COULEE TO 42ND ST)
 CITY OF GRAND FORKS
 GRAND FORKS, ND

DRAWING TYPE	CONST
PREPARED BY	TS
CHECKED / APPROVED	MB / JM
DATE	MAY 5, 2019
PROJECT NUMBER	00105-2017-015
SHEET	59 of 70
DRAWING	T59



Conductor		Cable NS (North Combo Signal) (12 No. 14 AWG)		Cable SS (South Combo Signal) (12 No. 14 AWG)	
Base	Tracer	Head	Indication	Head	Indication
1	Black		Spare		Spare
2	White		Neutral		Neutral
3	Red	1, 2, 3	Ø6 Red 1	4, 5, 6	Ø2 Red 1
4	Green		Ground		Ground
5	Orange	1, 2, 3	Ø6 Yellow	4, 5, 6	Ø2 Yellow
6	Blue	1, 2, 3	Ø6 Red 2	4, 5, 6	Ø2 Red 2
7	White	Black	Spare		Spare
8	Red	Black	P1	Ø4 Don't Walk	P2
9	Green	Black	Spare		Spare
10	Orange	Black	Spare		Spare
11	Blue	Black	Spare		Spare
12	Black	White	P1	Ø4 Walk	P2

Origin	Destination	# of Cables	SIZE/TYPE	Total LF
North Combo Signal Std Transformer Base	Vehicle Head 1	1	14 AWG 5 CONDUCTOR CABLE	20
	Vehicle Head 2	1	14 AWG 5 CONDUCTOR CABLE	51
	Vehicle Head 3	1	14 AWG 5 CONDUCTOR CABLE	40
	Pedestrian Head 1	1	14 AWG 3 CONDUCTOR CABLE	17
South Combo Signal Std Transformer Base	Vehicle Head 4	1	14 AWG 5 CONDUCTOR CABLE	52
	Vehicle Head 5	1	14 AWG 5 CONDUCTOR CABLE	40
	Vehicle Head 6	1	14 AWG 5 CONDUCTOR CABLE	20
	Pedestrian Head 2	1	14 AWG 3 CONDUCTOR CABLE	17

SIGNAL CABLE & CONDUIT SCHEDULE

#	RUN		STATION, OFFSET	CONDUIT SIZE (IN)	LF	CABLE					
	ITEM					Origin	Destination	# of Cables	SIZE/TYPE	Total LF	TITLE
1	Origin	Feed Point	0	2		Feed Point	Feed Point	2	UNDERGROUND CONDUCTOR NO6-TYPE RHW	#N/A	
	Destination	Traffic Signal Controller	Sta 46+86.9, 53.6' LT					1	UNDERGROUND CONDUCTOR NO6-TYPE THW	#N/A	
2	Origin	Traffic Signal Controller	Sta 46+86.9, 53.6' LT	3	27	Pull Box 1	Pull Box 1	2	14 AWG 12 CONDUCTOR CABLE	180	SS, NS ED EL6, Eel2 PB1, PB2
						Pull Box 1	Pull Box 1	2	EMERGENCY VEHICLE DETECTOR CABLE	90	
						Pull Box 1	Pull Box 1	2	14 AWG 2 CONDUCTOR CABLE	180	
						Pull Box 1	Pull Box 1	2	16 AWG 2 CONDUCTOR CABLE	180	
3	Origin	Pull Box 1	0	3	78	Pull Box 1	Pull Box 2	2	14 AWG 12 CONDUCTOR CABLE	180	SS, NS ED EL6, Eel2 PB1, PB2
						Pull Box 1	Pull Box 2	1	EMERGENCY VEHICLE DETECTOR CABLE	90	
						Pull Box 1	Pull Box 2	2	14 AWG 2 CONDUCTOR CABLE	180	
						Pull Box 1	Pull Box 2	2	16 AWG 2 CONDUCTOR CABLE	180	
4	Origin	Pull Box 2	Sta 46+77.2, 35.8' LT	2	23	Pull Box 2	North Combo Signal Std Transformer Base	1	14 AWG 12 CONDUCTOR CABLE	34	NS ED EL6 PB1
						Pull Box 2	Emergency Preemption Detector	1	EMERGENCY VEHICLE DETECTOR CABLE	67	
						Pull Box 2	North Emergency Preemption Lamp	1	14 AWG 2 CONDUCTOR CABLE	67	
						Pull Box 2	Pushbutton 1	1	16 AWG 2 CONDUCTOR CABLE	37	
5	Origin	Pull Box 2	Sta 46+77.2, 35.8' LT	3	36	Pull Box 2	Pull Box 3	1	14 AWG 12 CONDUCTOR CABLE	48	SS EL2 PB2
						Pull Box 3	Pull Box 3	1	114 AWG 2 CONDUCTOR CABLE	48	
						Pull Box 1	Pull Box 3	1	16 AWG 2 CONDUCTOR CABLE	48	
6	Origin	Pull Box 3	Sta 46+82.0, 36.4' RT	2	7	Pull Box 1	South Combo Signal Std Transformer Base	1	14 AWG 5 CONDUCTOR CABLE	18	SS EL2 PB2
						Pull Box 1	South Emergency Preemption Lamp	1	14 AWG 2 CONDUCTOR CABLE	50	
						Pull Box 1	Pushbutton 2	1	16 AWG 2 CONDUCTOR CABLE	21	



Legend

- SIGNAL CONTROLLER
- FEED POINT
- SIGNAL STANDARD
- PEDESTRIAN STANDARD
- CABLE & CONDUIT RUN
- PULL BOX

CABLE NAMES
 NS = North Combo Signal Standard
 SS = South Combo Signal Standard
 ED = GPS Emergency Preemption Detector
 EL2 = Emergency Preemption Lamp ø2
 EL6 = Emergency Preemption Lamp ø6
 PB1 = Pedestrian Pushbutton 1
 PB2 = Pedestrian Pushbutton 2

SYMBOL	DATE	DESCRIPTION	APPROVED

KLJ

UNIVERSITY AVENUE RECONSTRUCTION (COULEE TO COLUMBIA) & MEDIANS/LIGHTING (COULEE TO 42ND ST)
 CITY OF GRAND FORKS
 GRAND FORKS, ND

CABLE & CONDUIT LAYOUT - MEMORIAL UNION

DRAWING TYPE
CONST

PREPARED BY
 TS

CHECKED / APPROVED
 MB / JM

DATE
 MAY 5, 2019

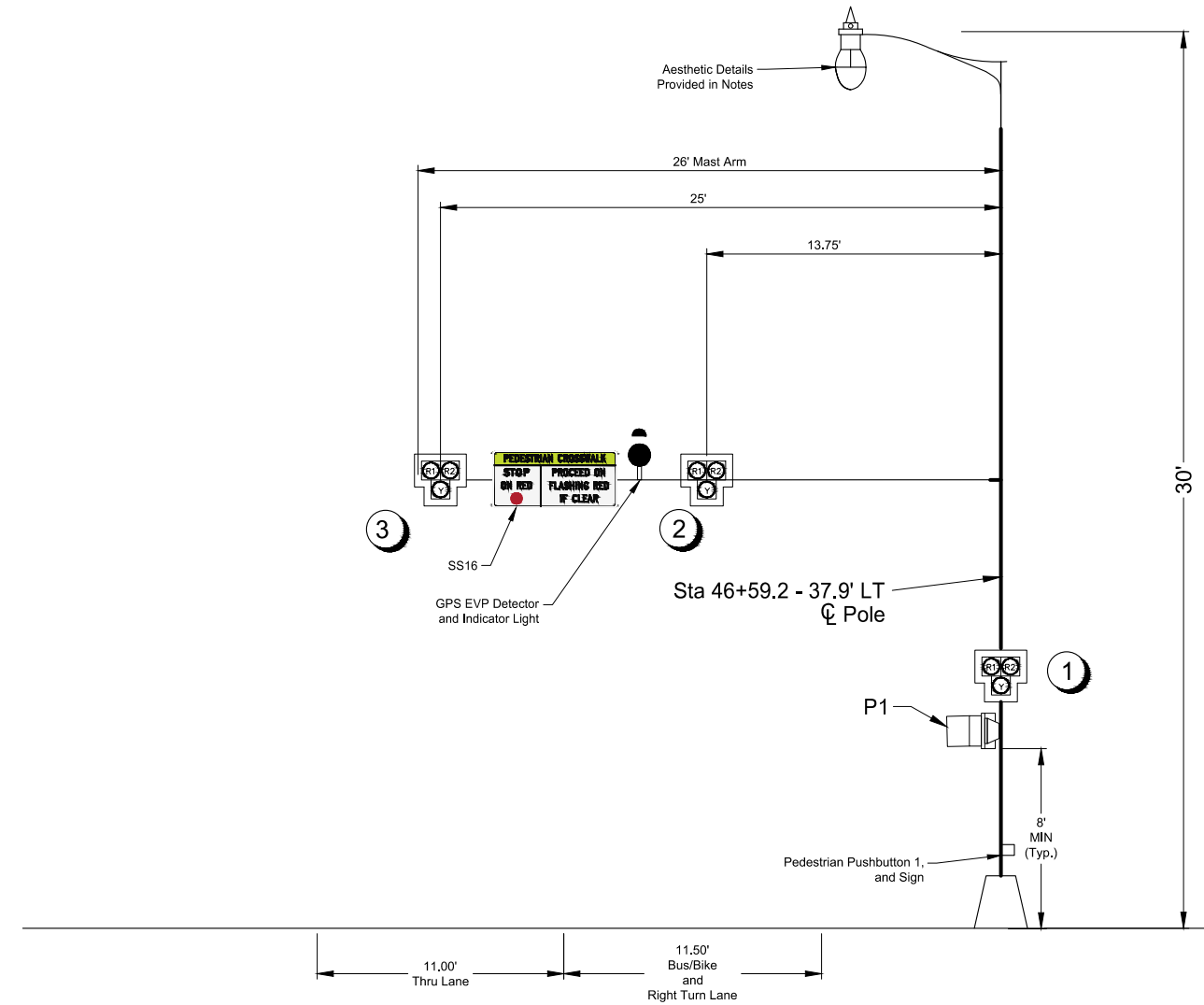
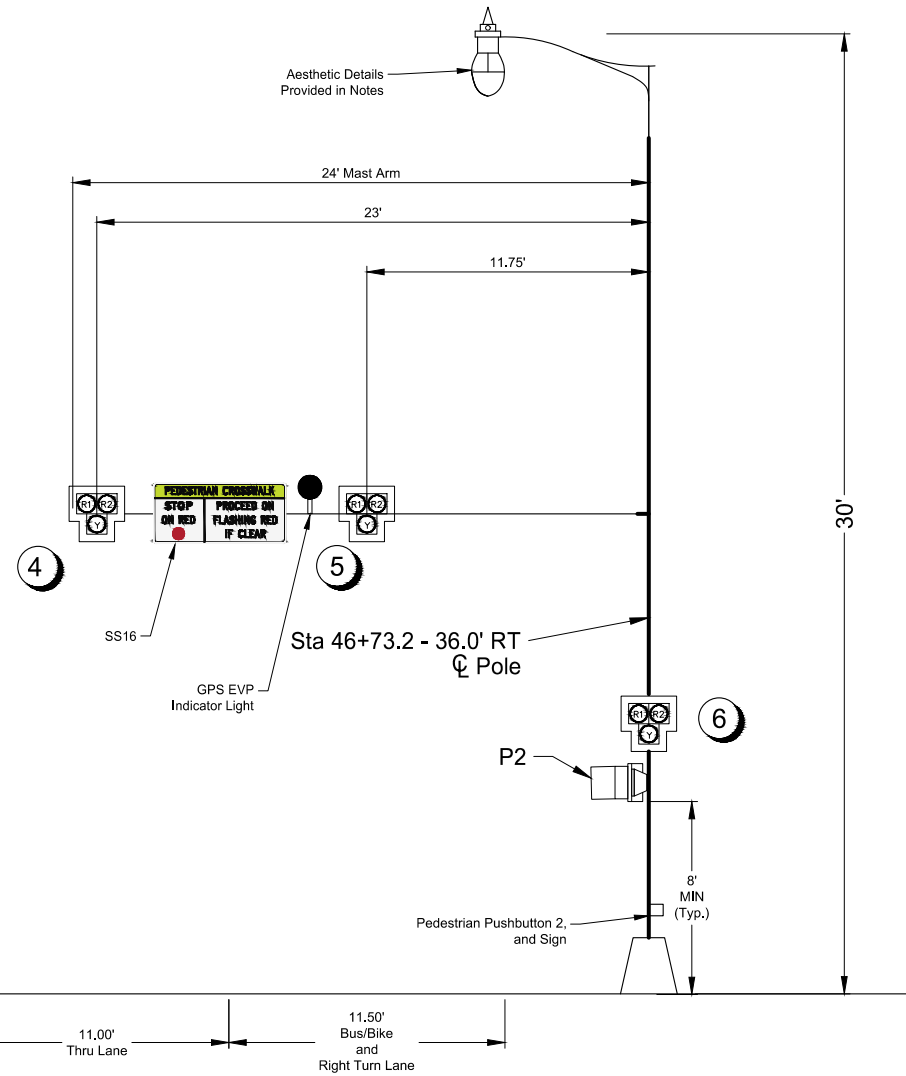
PROJECT NUMBER
 00105-2017-015

SHEET
 60 of 70

DRAWING
T60

SOUTH COMBINATION SIGNAL STANDARD

NORTH COMBINATION SIGNAL STANDARD



Legend

- VIDEO DETECTION CAMERA
- HYBRID BEACON
- SIGNAL HEAD NUMBER
- EVP LIGHT
- EVP DETECTOR

EASTBOUND

WESTBOUND

SYM	DATE	DESCRIPTION	APPR



UNIVERSITY AVENUE RECONSTRUCTION (COULEE TO COLUMBIA) & MEDIANS/LIGHTING (COULEE TO 42ND ST)
 CITY OF GRAND FORKS
 GRAND FORKS, ND

PHB STANDARDS & HEAD LOCATIONS - MEMORIAL UNION

DRAWING TYPE	CONST
PREPARED BY	TS
CHECKED / APPROVED	MB / JM
DATE	MAY 5, 2019
PROJECT NUMBER	00105-2017-015
SHEET	61 of 70
DRAWING	T61

TIMING PLAN 1

	Phase 2 EB Thru	Phase 4 Pedestrian	Phase 6 WB Thru
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SIGNAL INDICATIONS & PHASING

Corresponding Signal Head(s)	4, 5, 6		1, 2, 3
Corresponding Pedestrian Head(s)		P1 and P2	
Concurrent Phase	6		2
Next Phase	4	2	4

Overlap - Corresponding Signal Head(s)			
Overlap - Right-of-			
Overlap - Clearance Display Prior to Next Phase			

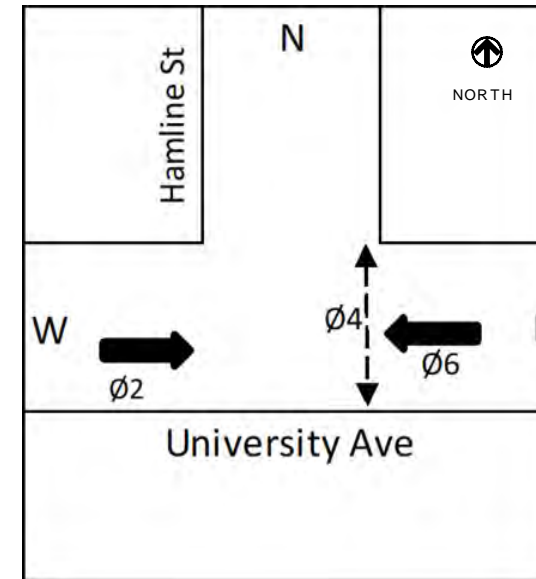
**Countdown to Phase 12 When Pedestrian Call is in Place

SEQUENCE

MAINLINE	PEDESTRIAN	CONTROLLER INPUT	TIMING		
			Phase 2 EB Thru	Phase 4 Pedestrian	Phase 6 WB Thru
Rest/Dark	DW	Walk	8.0		8.0
FY	DW	Ped Clearance	4.0		4.0
Y	DW	Yellow	3.0		3.0
R	DW	Red	2.0		2.0
R	W	Walk		5.0	
WWR	FDW	Ped Clearance		18.0	

OTHER CONTROLLER FUNCTIONS

Recall	Minimum	No	Minimum
Flashing-Normal & Conflict Monitor	Rest/Dark	DW	Rest/Dark
Start Up Phasing	Rest/Dark	DW	Rest/Dark
Emergency Vehicle Pre-emption	x	x	x



Legend

FY = Flashing Yellow Ball
 Y = Yellow Ball Indication
 R = Dual Red Ball Indication
 WWR = Wig-Wag Red Ball Indication
 DW = Don't Walk
 FDW = Flashing Don't Walk

TIMING PLAN 2

CHANGES FROM TIMING PLAN 1 SHADED IN GREY

	Phase 2 EB Thru	Phase 4 Pedestrian	Phase 6 WB Thru
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SIGNAL INDICATIONS & PHASING

Corresponding Signal Head(s)	4, 5, 6		1, 2, 3
Corresponding Pedestrian Head(s)		P1 and P2	
Concurrent Phase	6		2
Next Phase	4	2	4

Overlap - Corresponding Signal Head(s)			
Overlap - Right-of-			
Overlap - Clearance Display Prior to Next Phase			

**Countdown to Phase 12 When Pedestrian Call is in Place

SEQUENCE

MAINLINE	PEDESTRIAN	CONTROLLER INPUT	TIMING		
			Phase 2 EB Thru	Phase 4 Pedestrian	Phase 6 WB Thru
Rest/Dark	DW	Walk	8.0		8.0
FY	DW	Ped Clearance	4.0		4.0
Y	DW	Yellow	3.0		3.0
R	DW	Red	2.0		2.0
R	W	Walk		10.0	
WWR	FDW	Ped Clearance		18.0	

OTHER CONTROLLER FUNCTIONS

Recall	Minimum	No	Minimum
Flashing-Normal & Conflict Monitor	Rest/Dark	DW	Rest/Dark
Start Up Phasing	Rest/Dark	DW	Rest/Dark
Emergency Vehicle Pre-emption	x	x	x

TIMING PLAN 3

CHANGES FROM TIMING PLAN 1 SHADED IN GREY

	Phase 2 EB Thru	Phase 4 Pedestrian	Phase 6 WB Thru
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SIGNAL INDICATIONS & PHASING

Corresponding Signal Head(s)	4, 5, 6		1, 2, 3
Corresponding Pedestrian Head(s)		P1 and P2	
Concurrent Phase	6		2
Next Phase	4	2	4

Overlap - Corresponding Signal Head(s)			
Overlap - Right-of-			
Overlap - Clearance Display Prior to Next Phase			

**Countdown to Phase 12 When Pedestrian Call is in Place

SEQUENCE

MAINLINE	PEDESTRIAN	CONTROLLER INPUT	TIMING		
			Phase 2 EB Thru	Phase 4 Pedestrian	Phase 6 WB Thru
Rest/Dark	DW	Walk	8.0		8.0
FY	DW	Ped Clearance	4.0		4.0
Y	DW	Yellow	3.0		3.0
R	DW	Red	2.0		2.0
R	W	Walk		15.0	
WWR	FDW	Ped Clearance		18.0	

OTHER CONTROLLER FUNCTIONS

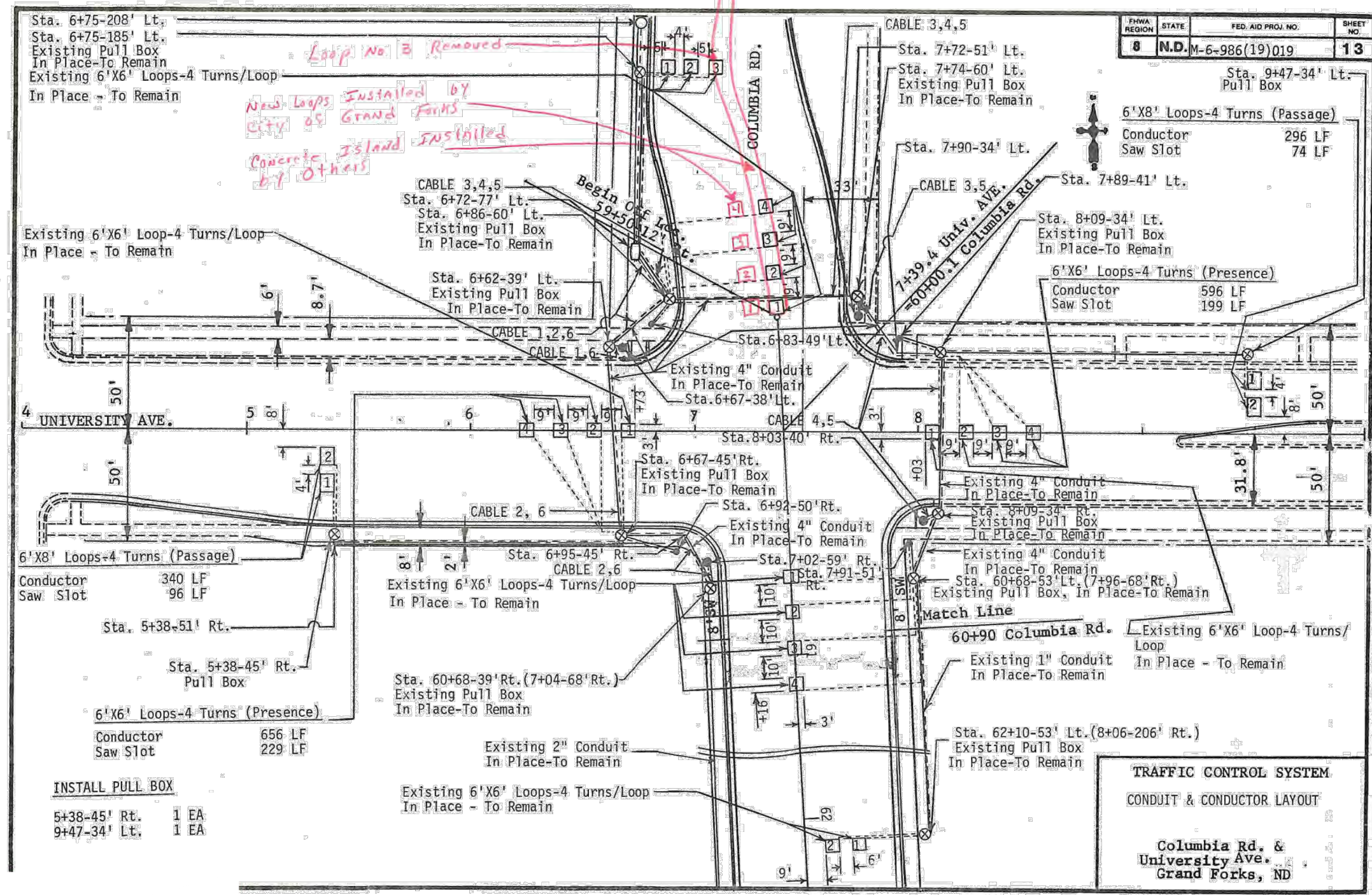
Recall	Minimum	No	Minimum
Flashing-Normal & Conflict Monitor	Rest/Dark	DW	Rest/Dark
Start Up Phasing	Rest/Dark	DW	Rest/Dark
Emergency Vehicle Pre-emption	x	x	x

SYMBOL	DATE	DESCRIPTION	APPROVED



UNIVERSITY AVENUE RECONSTRUCTION (COULEE TO COLUMBIA) & MEDIANS/LIGHTING (COULEE TO 42ND ST)
CITY OF GRAND FORKS
GRAND FORKS, ND

DRAWING TYPE	CONST
PREPARED BY	TS
CHECKED / APPROVED	MB / JM
DATE	MAY 5, 2019
PROJECT NUMBER	00105-2017-015
SHEET	62 of 70
DRAWING	T62



ITEMS SHOWN ABOVE ARE FOR INFORMATIONAL PURPOSES ONLY, CONTRACTOR SHALL FIELD VERIFY ALL PULL BOX AND CONDUIT RUNS.

SYMBOL	DATE	DESCRIPTION	APPROVED



UNIVERSITY AVENUE RECONSTRUCTION (COULEE TO COLUMBIA) & MEDIANS/LIGHTING (COULEE TO 42ND ST)
 CITY OF GRAND FORKS
 GRAND FORKS, ND
 CONDUIT & CONDUCTOR AS-BUILT LAYOUT - FOR INFORMATION ONLY

DRAWING TYPE	CONST
PREPARED BY	TS
CHECKED / APPROVED	MB / JM
DATE	MAY 5, 2019
PROJECT NUMBER	00105-2017-015
SHEET	65 of 70
DRAWING	T65

ITEM DESCRIPTION	UNIT	Flashing Beacon - Site 1 University & Stanford	Flashing Beacon - Site 2 Chester Fritz Library	Flashing Beacon - Site 3 Memorial Union	Revise Traffic Signal System - Site 1 University & Columbia	Traffic Signal System - Site 1 University & Oxford	Salvage & Install Flashing Beacon University and State
CONCRETE FOUNDATION-TRAFFIC SIGNALS	EA	2	2	2	-	8	-
CONCRETE FOUNDATION-FEED POINT-TYPE B	EA	1	1	1	-	1	-
FEED POINT-COMBO LIGHTING & SIGNAL-PAD MOUNT	EA	1	1	1	-	1	-
PULLBOX	EA	3	2	3	-	5	-
2IN DIAMETER RIGID CONDUIT	LF	32	91	30	-	161	-
3IN DIAMETER RIGID CONDUIT	LF	58	95	114	-	296	-
EMERGENCY VEHICLE DETECTOR CABLE	LF	-	169	157	-	96	-
NO16 AWG 2 CONDUCTOR CABLE	LF	234	351	286	-	1307	-
NO14 AWG 4 CONDUCTOR CABLE	LF	228	-	-	-	-	-
NO14 AWG 2 CONDUCTOR CABLE	LF	-	409	345	-	708	-
NO14 AWG 3 CONDUCTOR CABLE	LF	-	34	-	-	102	-
NO14 AWG 5 CONDUCTOR CABLE	LF	-	238	243	-	463	-
NO14 AWG 7 CONDUCTOR CABLE	LF	-	-	-	-	82	-
NO14 AWG 12 CONDUCTOR CABLE	LF	-	330	262	-	1259	-
TYPE II SIGNAL STANDARD	EA	-	-	-	-	4	-
COMBO 13FT MA SIG & LT STD-TYPE A	EA	-	-	-	-	2	-
COMBO 24FT MA SIG & LT STD-TYPE A	EA	-	1	1	-	-	-
COMBO 25FT MA SIG & LT STD-TYPE A	EA	-	1	-	-	-	-
COMBO 26FT MA SIG & LT STD-TYPE A	EA	-	-	1	-	-	-
COMBO 35FT MA SIG & LT STD-TYPE A	EA	-	-	-	-	1	-
COMBO 38FT MA SIG & LT STD-TYPE A	EA	-	-	-	-	1	-
5FT MA EXTENSION	EA	-	-	-	4	-	-
1-WAY 3 SEC HEAD W/12IN LENS-POST MTD	EA	-	-	-	-	4	-
1-WAY 3 SEC HEAD W/12IN LENS-MA MTD	EA	-	-	-	-	4	-
1-WAY 4 SEC HEAD W/12IN LENS-PEDESTAL MTD	EA	-	-	-	-	2	-
1-WAY 4 SEC HEAD W/12IN LENS-MA MTD	EA	-	-	-	4	2	-
1-WAY 3 SEC HEAD BEACON-POST MOUNTED	EA	-	2	2	-	-	-
1-WAY 3 SEC HEAD BEACON-MA MOUNTED	EA	-	4	4	-	-	-
PEDESTRIAN COUNTDOWN SIGNAL HEAD-POST MTD	EA	-	2	2	-	12	-
PEDESTRIAN COUNTDOWN SIGNAL HEAD-PEDESTAL MTD	EA	-	-	-	-	-	-
PEDESTRIAN PUSHBUTTON POST	EA	-	-	-	-	-	-
PEDESTRIAN PUSHBUTTON & SIGN	EA	3	2	2	-	8	-
VIDEO DETECTION CABLE	LF	-	-	-	-	822	-
VIDEO DETECTION SYSTEM (A)	EA	-	-	-	-	1	-
CONTROLLER TYPE 1 (B)	EA	-	1	1	4	1	-
BATTERY BACKUP SYSTEM	EA	-	-	-	-	1	-
EMERGENCY VEHICLE PRE-EMPTION UNIT (C)	EA	-	1	1	-	1	-
RELOCATE FLASHING BEACON-POST MOUNTED	EA	-	-	-	-	-	1

1*

- A. INCLUDES CAMERAS, VIDEO MONITOR, ACCESS POINT AND ALL OTHER EQUIPMENT REQUIRED FOR A FULLY OPERATIONAL VIDEO DETECTION SYSTEM.
- B. INCLUDES CABINET, WORKING SLAB, CONFLICT MONITOR, LOAD SWITCHES, FLASHERS, BUS INTERFACE UNITS AND ALL OTHER EQUIPMENT REQUIRED FOR A FULLY OPERATIONAL TRAFFIC SIGNAL CONTROLLER.
- * INCLUDES ALL ITEMS LISTED IN (B) EXCEPT WORKING SLAB, CONTROLLER, OR CONFLICT MONITOR. WORKING SLAB TO REMAIN INPLACE. CONTROLLER & CONFLICT MONITOR SHALL BE SALVAGED FROM EXISTING CABINET AND REINSTALLED IN NEW CABINET.
- C. INCLUDES DETECTORS, LIGHTS AND ALL OTHER EQUIPMENT REQUIRED FOR A FULLY OPERATIONAL PREEMPTION SYSTEM.

ITEMS SHOWN ABOVE ARE FOR INFORMATIONAL PURPOSES, CONTRACTOR SHALL PROVIDE ALL LABOR AND EQUIPMENT NECESSARY FOR THE SIGNAL SYSTEM TO BE FULLY OPERATIONAL AS SHOWN IN THE PLANS.

772 2160	FLASHING BEACON - SITE 1	1 EA
772 2161	FLASHING BEACON - SITE 2	1 EA
772 2162	FLASHING BEACON - SITE 3	1 EA
772 2906	REVISE TRAFFIC SIGNAL SYSTEM - SITE *	1 EA
772 9811	TRAFFIC SIGNAL SYSTEM - SITE *	1 EA
772 3670	SALVAGE & INSTALL FLASHING BEACON	1 EA

SYM	DATE	DESCRIPTION	APPR



UNIVERSITY AVENUE RECONSTRUCTION (COULEE TO COLUMBIA) & MEDIANS/LIGHTING (COULEE TO 42ND ST)
 CITY OF GRAND FORKS
 GRAND FORKS, ND

TRAFFIC QUANTITIES

DRAWING TYPE	CONST
PREPARED BY	TS
CHECKED / APPROVED	MB / JM
DATE	MAY 5, 2019
PROJECT NUMBER	00105-2017-015
SHEET	66 of 70
DRAWING	T66