REGIONAL TRANSPORTATION COMMISSION

Regional Traffic Guidelines
Revised September 2023

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STANDARD PAVEMENT MARKINGS

This guideline is intended to provide regional uniformity in the placement of pavement markings. It is intended to be an aid in the preparation of pavement marking plans for projects within Washoe County. Manual of Uniform Traffic Control Devices (MUTCD), latest edition, requirements should be followed in all cases.

Lane Markings

Center Lines:

4" broken yellow line, 10' long with a 30' space.
4" solid double yellow line.
4" solid yellow line around raised center medians – 1' off edge of oil.

Edge Lines:

6" solid white line should be used to separate bike lanes from vehicle travel lanes.
8" solid white edge line to separate bike lane from a right turn lane.
4" solid white line should be used on the right side of the bike lane if no curb exists, to delineate a bike lane or on road segments that do not have bike lanes (Shoulder line).

Lane Lines:

4" broken white line, 10' long with a 30' space.
6" or 8" solid white line.
4" solid double white line.

Dotted Lines:

8" or dotted yellow or white line 2' long with a 4' space for same line width of line extension of lane lines.

Bike Lane:

6" dotted white line 2' long with a 4' space for crossing traffic lane.
6" solid white line should be used to separate bike lanes from vehicle travel lanes.
5' minimum or 6' maximum width unless otherwise approved by maintaining agency this dimension does not include gutter width.

Channelization Lines:

8” solid white line. (Turn pockets)

Lane Drop Markings:

8” dotted white line 3’ long with 9’ gap.

Auxiliary Pavement Markings

Crosswalks:

Layout per NDOT Standard Detail ST- 7 District 2 & 3.

Stop Bars:

24”- solid white line placed 4’ minimum or match existing in advance of a crosswalk at controlled intersections.

City of Reno: 12” solid white line for non-signalized intersections.

Yield Lines:

Isosceles triangles (shark’s tooth) per MUTCD Section 3B.16, 20’ – 50’ (based on maintaining agency and site conditions) in advance of a crosswalk at multi-lane uncontrolled intersections or multi-lane mid-block crossings and prior to dotted line at roundabout entry. The following guidelines should be used for dimensions of the isosceles triangles:

1) 12”x18” triangles will be reserved for multi-use paths
2) 24”x36” triangles are used for roadways.

Place R1-5 sign on multi-lane roadway and W11-2 with downward arrow plaque (W16-7P) on single lane roadway.

Arrows and “ONLY”:

8’ high white turn lane arrows and two way left turn lanes (TWLTL). Layout per NDOT Standard Detail ST-6.

“ONLY” marking for use on a trap lane and alternate with arrow pavement markings

Transverse Markings:

Diagonal (45 degrees) white or yellow lines at 10’ center to center.

Speed Limit:

“15 MPH” shall not be used in conjunction with School Reduced Speed Limit signage, or at other locations where 15 MPH speed limit is not in effect at all times.

School:

“SCHOOL” shall be used in conjunction with S1-1 School signs, when used to establish a school zone. “SCHOOL” shall not be used at other locations, including but not limited to in conjunction with School Reduced Speed Limit signage.

Bicycle Markings

Check with maintaining agency regarding use of bike lane markings including Sharrow markings.

6’ high white bike rider symbol and directional arrow per 2009 MUTCD Fig. 9C-3 NDOT Standard Detail ST-4 placed 65’ on the far side of major intersections and spaced 1300’ apart in addition to conflict areas. Place a bike lane sign (R7-9) near the bike rider symbol. If needed to accommodate parking, use the (R3-17) sign with an appropriate supplemental sign (see figure 9C-5, 2009 MUTCD) near bike rider symbol.

Sharrow markings could be used on roadway segments with speeds less than 35mph on bike routes with no bike lanes. Signage should be R4-11 “Bikes may use full lane”.

Roundabout Markings

See MUTCD current edition

REGIONAL TRAFFIC SIGNAL EQUIPMENT

General

Contact maintaining agency for equipment specifications. New Traffic signal activation shall occur at an off-peak time that minimizes impacts to the traveling public, based on engineering judgement and in consideration of agency staff availability.

Intersection and Midblock Safety Lighting

Where possible separate luminaires shall be provided to supply positive lighting for crosswalk areas use NDOT Detail TS-27. Additional lighting may be required for midblock crossings and other conflict areas (raised island delineation, changes in operations, accel/decel lanes, etc).

City of Sparks LED lighting specifications:

Shall be LED only and placed such that it provides a minimum of 2.0 FC of average illuminance at the sidewalk. All LED style lighting fixtures shall meet the following minimum criteria regardless of manufacturer:

1. The housing shall be all metal with the exception of the lens.
2. The housing shall be silver in color except where heat dissipation components are involved.
3. There shall be a minimum 10 year warranty.
4. The unit shall provide a Type IV Medium optical spread utilizing a minimum of 80 LED units.
5. Each complete and assembled fixture shall require no more than 190 System Watts.
6. The fixture shall be capable of utilizing Universal 120-277V Line Power.
7. The fixture shall have Corrected Color Temperature (CCT) of 4000K.
8. The fixture shall not exceed 700 mA Drive Current.
9. The fixture shall be Illuminating Engineering Society of North America (IESNA) LM-79-08 compliant.
10. The unit shall be constructed in such a manner that it can be mounted to a standard 2” ID horizontal pipe with +/- 5 degree adjustment with no specially constructed mounts or wire splicing methods.
11. No optional shorting cap receptacle allowed.

City of Reno LED lighting specifications:

Luminaire fixtures shall be Cree STR-LWY3MHT08EULSV700 or approved equal

Photocell shall be mounted at the metered service.

Signal Heads

All traffic signal heads shall be dull black in finish, outfitted with louvered back plate with a 2" retro-reflective border, tunnel visors with a ¾ slot, open to the bottom. Plumbizer for mast arm mounts shall be located between the red and yellow signal indication unless noted differently on the plans.

Light Emitting Diodes (LED)

Tinted (City of Sparks indicate no green tinted lenses) XL or XOD. All pedestrian signal indications shall be pedestrian countdown signals that conform with ITE PTCSI -2 requirements, EPACT 2005 compliant and fully MUTCD compliant.

Video Detection & Cameras

Contact maintaining agency for video detection system manufacturer.

Loop Detection

Contact maintaining agency regarding use of preformed loops under PCC or AC pavement.

Emergency Vehicle Detection

Contact maintaining agency.

Prior to acceptance, all preemption equipment shall be field tested in accordance to the manufacture's recommendations.

Signal Poles

Utilize all State of Nevada standard poles including Type 1A, 1B, 7, 28, 30, 30A, 30B, 35, 35A & 35B. All standard poles over 10'0" shall be equipped with three (3) hand holes, one (1) at the base of the pole and one (1) opposite the mast arm on back of pole, and a 27" hand hole terminal compartment on the back side of the pole, with the top of the hole six feet from ground level, placed 180 degrees (180°) from the mast arm. Pedestrian Push Buttons (PPB) shall be placed so as not to conflict with the terminal compartment. PPB shall not

be placed on terminal compartment cover. Signal poles shall be installed in accordance with all State of Nevada specifications and standard plans.

Controller

Contact maintaining agency for controller manufacturer.

Cabinets

The complete controller cabinet shall be delivered to the maintaining agency for testing and burn-in by the supplier no later than two (2) weeks prior to turning on the signal. Refer to ITS section for Communications Hub Cabinet requirements.

Pull Boxes

Use State of Nevada No.3½, No.5, and No.7 within roadway. Refer to Intelligent Transportation System (ITS) section for, ITS Pull Box and ITS Vault which are required to be used for fiber optic cable infrastructure. Utilize a ground-able fully traffic rated (HS 20) pull box with bolt down (steel cover) unless indicated otherwise. Pull box lids shall be label accordingly. Examples include: “County Electrical”, “County Traffic Signal,” “City Electrical”, or “City Traffic Signal”. Refer to NDOT standards for NDOT installation within NDOT jurisdictions.

Pedestrian Push Button

PROWAG compliant units, contact maintaining agency for specific model.

Metered Service Cabinet

Metered service cabinets with battery backup shall be separate from the controller cabinet and placed to minimize possibility of accidental knock-down.

Battery Backup

The system shall be a 24-volt or 48-volt system and bear a 508 UL label. The system shall supply a minimum uninterrupted continuous service for a minimum two hours with a minimum 6.5 hours of flash. BBS for signal indications only, no safety lighting.

Traffic Signal Interconnect Options

Refer to Intelligent Transportation System (ITS) section for fiber optic infrastructure requirements for interconnects between multiple traffic signal cabinets. Contact maintaining agency to use other options such as radio or cell modems.

Conduit

Signal conduit shall be a minimum of 3” ID, other conduit (detector lead-in, interconnect, etc) shall be a minimum 3” ID. Utilize “Schedule 40” (PVC) for all underground runs. Utilize rigid metal for exposed conduit to 18” below grade. Rigid metal conduit shall be used under driveway sections, railroad and riser sections. All conduits shall have a single locate wire coated or detectable mule tape. Check National Electric Code (NEC) for maximum number of

wires/cables in conduit.

Internally Illuminated Street Name Signs (IISNS)

All signs shall be single-faced with case-sensitive lettering and rigid mounted directly onto mast arm utilizing an approved method. Contact maintaining agency for “CITY” logo which shall be located on the left side of the sign face with appropriate block numbers, arrows, etc., for all signs. Logo shall not exceed height of upper-case lettering. Signs shall be a 120 volt system.

Conductor/Cable

Utilize IMSA rated color-coated cables and conductors. Each NDOT Type 28, 30, 30A, 30B 35, 35A & 35B signal poles shall be fed, at a minimum, by a single 25 conductor, No. 14 cable. Each Pedestrian Push Button shall be fed by a single 5 conductor, No. 14 cable for each push button installed. NDOT Type 1A and 1B poles shall be fed, at a minimum, by a single 15 conductor, No. 14 cable.

Controller Cabinet

Contact maintaining agency for detailed equipment specifications.

https://cityofsparks.us/resources/resource/traffic-eng/

https://www.reno.gov/government/departments/public-works/forms-publications

INTELLIGENT TRANSPORTATION SYSTEM (ITS)

General

A. The purpose of this section is to provide uniform guidelines and design criteria for the project development process in the development of ITS infrastructure. The guideline will facilitate the design of basic ITS elements in document preparation for Plans, Specification, and Engineer's Estimate in the City of Reno, City of Sparks, and Washoe County.
B. Refer to latest NDOT standard specifications for associated requirements within NDOT right-of-way.

Contractor System Integrator Requirements

A. This work requires a system Integrator to be responsible for making all the communications and electronic systems, subsystems and individual devices work as a complete and functioning system. The system Integrator shall consist of one person with all the skills listed under the section Requirements for System Integrator. The system integrator is responsible for all hardware and firmware configurations/programing, as well as making sure that all the individual parts and components make a complete and operating system as indicated on the plans and these specifications.

B. Requirements for System Integrator: System Integrator shall install and configure the complete ITS systems combining new devices and infrastructure associated with this Project with existing ITS components, including hardware and software, resulting in an inclusive end-to-end solution. The System Integrator shall have the following minimum qualifications:
    1. B.S. or B.A. degree in Electrical Engineering, Electronic Engineering, Computer Science, Mathematics, or related discipline.
    2. Experience implementing intelligent transportation systems involving computer and communications hardware, software, and firmware.
    3. Ability to participate directly in the integration of hardware, software, and communications elements.
    4. Proficiency in software/hardware implementation, configuration, and troubleshooting.
    5. Proficiency in the development of test plans, procedures, and

techniques. Possesses a thorough knowledge of diagnostics techniques specifically relevant to the hardware and software subsystems furnished to this project.

6. Possesses at least a working knowledge of each of the following: computer operating system principles, LAN/WAN network elements, wireline and wireless communications equipment, CCTV camera subsystems, Fiber Optic communications equipment, TCP/IP communications protocols, network architectures, security appliances and data communications equipment.

7. Possesses the ability to provide technical project direction.

8. Proficiency in the use of project management methodologies and techniques.

9. Possesses strong organizational, analytical, and problem-solving skills.

10. The System Integrator shall be available to be contacted by the Engineer during business days from 6am through 6pm for the life of this contract and shall be capable of being on-site within 4 hours of notification.

11. Submit a resume of the qualified System Integrator for approval no more than 14 days from NTP.

12. The system integrator shall configure the Network Switches for signal and ITS field device cabinets per manufacturer's recommendations and compatible with existing connected network architectures to provide the following network characteristics:

    a) Configure Field Hardened Ethernet Switches within field cabinets, sharing a common fiber path between network switches to share a common subnet (i.e., VLAN) in a multi-drop ring topology, unless otherwise noted on the plans.

    b) Furnish and install interface cabling and interface standard adapters needed to interconnect the network switches with the existing devices. Provide all jumper cables necessary to complete this requirement.

    c) Provide all required rack mounting hardware and cabling associated with the interface modules, network switch chassis,

power supplies, and fiber optic connections per the project plans.

13. System integrator is responsible for coordinating with the owning agencies to make all fiber connections through fiber patch panels using fiber jumpers. System integrator is also responsible for coordination with layer three switch installations at each agency where fiber optic cables will be terminated according to project plans.

ITS Conduit Requirements

A. Conduit Material:

1. Fiber optic conduit systems are typically constructed with PVC or HDPE as approved by the City of Reno, City of Sparks. Or the County. All conduits shall have smooth inner and outer walls. PVC conduits are rated by wall thickness and crush resistance. Schedule 40 is typically used for all PVC applications, unless noted otherwise in the Plans.
2. In City of Sparks utilize “Schedule 80” (PVC) for all underground runs. Rigid metal conduit shall be used under driveway sections and riser sections. All spare conduits shall have a single 12 AWG (min) copper tracer wire coated with a 30-mil (min) polyethylene jacket designed specifically for buried use.

B. Conduit Installation:

1. Conduit runs shown on the Plans may be changed to avoid underground obstructions with written approval by the Engineer and at no additional cost to the owner.
2. Only communications cables (i.e., fiber optic, CAT 6A and other copper-based communications cables) are allowed to be installed within ITS conduits, with the associated pull tape and bonding conductor. Power conductors, traffic signal cables, and other types of cable infrastructure shall be installed within a separate conduit for those systems.
3. Conduit bends, except factory bends, shall have a radius of not less than six times the inside diameter of the conduit. Where factory bends are not used, conduit shall be bent, without crimping or flattening, using the longest radius practicable.
4. A 1250-pound pull tape shall be installed in all empty conduits which are to receive future cables. At least 5 feet of pull tape slack shall be coiled up at each termination.
5. A green #8 AWG copper conductor functioning as both a bonding conductor and locator wire shall be installed in all conduits. When cables are being installed within a conduit than this bonding/locator wire shall be installed with the other cable(s). At least 5 feet of bonding/locator wire slack shall be coiled up at

each termination. The bonding/locator wire shall be made mechanically and electrically secure to form a continuous system and shall be effectively bonded to the ground rod within the cabinets, poles, and pull boxes.

6. Existing underground conduit to be incorporated into a new system shall be cleaned with a mandrel or cylindrical wire brush, blown out with compressed air, and capped watertight until ready to connect to the new conduit system.
7. Conduit shall be laid to a depth of not less than 36 inches below finished grade.
8. Conduit runs parallel to curbs shall be placed adjacent to back of curb, except were in conflict with existing facilities. If conduit is to be placed in street the preferred location is at the lip of gutter.
9. Conduit stubs from pole or cabinet bases shall extend at least 6 inches from face of foundation and at least 18 inches below top of foundation.
10. Rigid nonmetallic type conduit shall not be used for drilling or jacking. Installation of rigid nonmetallic type conduit under existing pavement will be permitted if a hole larger than the conduit is predrilled and the conduit installed by hand. Bottom of trenches for rigid nonmetallic conduit shall be relatively free of sharp irregularities which would cause pinching and excessive bending of the conduit. The trench shall be excavated to 4 inches below the invert grade of the conduit and backfilled with a granular material with 100 percent passing the 3/8 inch size sieve except where backfilled with concrete. A cradle shall be shaped in the granular material cushion to support the conduit. The first 6 inches of backfill over the top of the conduit shall be of this granular material. The top 6 inches shall be backfilled and compacted as shown on the Plans or as directed by the Engineer.
11. Where conduit is to be installed between the pole base and the underground pull box the conduit may be nonmetallic.
12. Rigid metallic type conduit shall be used for all conduit runs extending above ground. Underground portions of rigid metallic type conduit shall be spirally wrapped with a corrosion protection polyvinyl chloride or polyethylene pressure sensitive tape, applied with a suitable primer. The wrap shall have a nominal thickness of 20 mils, consisting of either one layer of 20 mil tape or two separate layers of 10 mil tape. A single wrap of 10 mil tape with a half lap will not be acceptable. When the rigid metallic type of conduit extends above ground, the wrapping shall extend to a minimum height of 4 inches above finished ground.
13. Rigid metallic type conduit shall be used for all bridge crossing.

Expansion couplings shall be used when crossing expansion joints within the structure.

14. Conduit terminating in standards or pedestals shall extend not more than 2 inches vertically above the foundation and shall be sloped towards the handhold opening. Conduit entering through the side of nonmetallic pull boxes shall terminate not more than 2 inches inside the box wall and not less than 2 inches above the bottom and shall be sloped toward the top of the box to facilitate pulling of conductors. Conduit entering through the bottom of a pull box shall terminate 1 to 2 inches above the bottom and shall be located near the end walls to leave the major portion of the box clear. At all outlets, conduits shall enter from the direction of the run.
15. Conduit for future use in structures shall be threaded and capped. Conduit leading to soffit, wall, or devices below the grade of the pull box shall be sealed by means of a sealing fitting and sealing compound, except that sealing fitting and sealing compound will not be required where conduit terminates in a structure or pull box. Conduits passing through fire rated walls shall be fire stopped with an approved material. Expansion couplings shall be used when crossing expansion joints within the structure.
16. Where conduits pass through the abutment concrete, the conduits shall be wrapped with two layers of 10-pound asphalt-felt building paper, securely taped or wired in place.
17. Conduit run on the surface of structures shall be secured with galvanized malleable iron clamps spaced not more than 5 feet apart.
18. Where pull boxes are placed in metallic type conduit runs, the conduit shall be fitted with threaded bushings, bonded, made mechanically and electrically secure to form a continuous system, and shall be effectively grounded. The bonding conductor shall be copper wire or copper braid of the same cross-sectional area as a # 8 AWG or larger conductor.
    a) Bonding of metallic conduit in concrete pull boxes shall be by means of galvanized grounding bushings and bonding jumper.
    b) Bonding of metallic conduit in metallic pull boxes shall be by means of locknuts, one inside and one outside of the box.
19. Where a metallic conduit system parallels, or crosses, a permanent water system, the bonding jumpers shall be installed at intervals not exceeding 500 feet.
20. At service points, grounding of metal conduit, service equipment, and neutral conductor shall be accomplished as required by the Code and serving utility, except the grounding conductor shall be a #8 AWG minimum size.

21. The location of ends of all conduits in structures, or terminating at curbs, shall be marked by a “Y” at least 3 inches high cut into the face of curb, gutter, or wall, directly above the conduit and above grade line.
22. Conduit Warning Tape: Conduit warning tape shall be installed a minimum of 12-inches above top of conduit. Warning tape shall be a minimum four-mil composite reinforced thermoplastic, with a minimum width of 3 inches and minimum length of 5 feet. Warning tape shall be highly resistant to alkalis, acids, and other destructive agents found in the soil. Warning tape shall have a continuous printed message warning of the location of underground conduits. The message shall be in permanent ink specifically formulated for prolonged underground use and shall bear the words “CAUTION – COMMUNICATION CABLE BURIED BELOW” in black letters on orange background for communication conduits. Where both electric and communications conduits are in a single trench, both warning tapes, as described above, shall be provided.
23. Trench Excavation: Subsection 305.02 - “Maximum Length of Open Trench” of the 2012 Standard Specifications for Public Works Construction (SSPWC) Revision 8 (i.e., Orange Book), is herewith amended to add the following paragraphs:
    a) Unless otherwise directed by the Design Engineer and approved by the Agency, there shall be no unprotected open trench remaining at the end of the working day. At the end of the working day, any open trench shall be protected by plating or other means approved by the Engineer and the Agency of jurisdiction.
    b) Refer to latest NDOT standard specifications for associated requirements within NDOT right-of-way.
24. Directional Drill:
    a) The contractor shall furnish install conduit by trenchless methods as follows:
        1) New conduit to be installed under existing pavement, existing box culvert, curbs and gutters, sidewalks, established landscaping or decomposed granite not otherwise impacted by construction at locations only specifically indicated on the project plans as “Directional Drill”.
        2) The Contractor shall identify the x, y, z coordinates for installations at 50'-foot intervals and at the center of the pull boxes that the conduit passes through.
    b) Conduit installation methods identified in the plans as “Directional Drill” may be completed by trenching methods, if approved in advance by the Engineer as a means of facilitating installation or mitigating potential damage to

existing surface and subsurface elements.

c) Prior to beginning trenchless installation methods, the contractor shall complete the necessary potholing, and submit the proposed profile to the Engineer for approval. Installation shall be performed in accordance with industry standards and as directed by the Engineer.
d) The contractor shall pothole where/when crossing existing utilities as identified via USA Dig lines marked in the field during construction. Pothole quantities should be based on plans and utility coordination during design.
e) The contractor's installation process shall utilize the "walkover" locating system or other Engineer approved equivalent, for determining the installation profile. The installation equipment shall register the depth, angle, rotation and directional data. At the surface, equipment shall be used to gather the data and relay the information to the equipment operator. Excavation and backfill of excavated pits shall be in accordance with the requirements of the RTC Standard Specifications.
f) When enlargement of an installation hole is necessary, the hole shall be at least 25 percent larger than the conduit to be installed, unless otherwise specified by the Engineer. Pulling equipment such as grips, pulling eyes, and other attachment hardware external to the conduit will be permitted as long as a wooden dowel is placed inside the conduit to prevent it from collapsing at the point of attachment when pull tension is at its peak. A swivel shall be used with pulling hardware when pulling back the conduit into the installation path.
g) Drilling fluid shall be pumped down the hole to provide lubrication for the conduit as it is pulled in. The pulling tension for installing conduit into the installation path shall not exceed 75 percent of the conduit manufacturer's tensile strength rating in order to prevent the conduit from "necking down" or deforming.
h) Final installation profiles shall be submitted to the Engineer along with the surveyed x, y, z Coordinates for approval.
i) Further design, permitting, and construction requirements found under City of Reno Guidelines for Horizonal Directional Drilling (HDD) document shall be followed: https://www.reno.gov/home/showpublisheddocument?id=81754

25. Fiber Optic Conduit Installations Requirements:
    a) In addition to the previous requirements, conduits for fiber optic cable installations shall also meet the following minimum requirements, unless approved otherwise by the owning agency:

1) A quantity of two 3-inch conduits between an underground ITS Pull Boxes and ITS Vaults (e.g., the typical ITS conduit run).
2) A quantity of three 3-inch conduits when installed between an ITS Vault and a signal/ITS cabinet, and between an ITS Vault and a traffic signal homerun pull box.

C. Innerduct Use and Material:

1. If there is limited conduit and there is a desire to allocate spare capacity for adding future cables, the use of innerduct may be required on the design plans.
2. The contractor shall furnish and install innerduct in the conduits as shown on the plans. The innerduct shall be used to separate cables and provide for future addition of cables.
3. Materials
   a) 1-Inch Innerduct
      1) Use 1-inch innerduct made of Polyethylene (PE). The 1 inch innerducts shall have a maximum outside diameter of 1.327 inches and a nominal inside diameter of 1 inch. The duct shall be free of pinholes, voids or other imperfections. The innerduct shall be furnished in one continuous length to complete each run between pull boxes, without splices or couplings.
   b) 3 Cell Innerduct
      1) The 3 Cell Innerduct shall be Maxcell Edge Detectable 3.00”, or approved equal. Provide 3 Cell Innerduct with pre-installed 1250LB pull tape in each cell. Use 3 Cell Innerduct that is pre-lubed for lower friction during innerduct and cable installation, and resistant to ground chemicals and petroleum products.
   c) A green #8 AWG copper conductor functioning as both a bonding conductor and locator wire shall be installed in all conduits, either inside or outside the innerduct. The use of a multi-cell innerduct with a sewn-in solid copper wire shall not be used in place of this bonding/locator wire. If this bonding/locator wire needs to be removed when installing cables, then a new bonding/locator wire shall be installed with the cable(s). At least 5 feet of bonding/locator wire slack shall be coiled up at each termination. The bonding/locator wire shall be made mechanically and electrically secure to form a continuous system and shall be effectively bonded to the ground rod within the cabinets, poles, and pull boxes.
   d) A 1250LB pull tape shall be installed within each innerduct and within each cell of a multi-cell innerduct. If this pull tape needs to be removed when installing cables, then a new pull tape shall be installed with the cable(s). At least 5 feet of pull

tape slack shall be coiled up at each termination.

D. Innerduct Installation:

1. The contractor shall provide certification that the innerduct furnished and installed is in conformance with the manufacturer standard and these specifications.
2. Innerduct shall be pulled in new and existing conduit, as shown on the plans. Innerduct shall be pulled with minimum dragging on the ground or pavement. The contractor shall ensure that the tensile load on the innerduct does not exceed the allowed maximum by using a break-away technique and/or a pulley system with numeric readout which includes a means of alerting the installer when the pulling tension approaches the manufacturer's maximum pulling tension.
3. The contractor shall ensure that the innerduct is protected from sharp edges.
4. The contractor shall ensure that the innerduct is protected from excessive bends. The contractor shall not cause the innerduct to violate the minimum bending radius for which the innerduct was designed. The contractor shall be responsible for all damages caused from violations and shall remove and install new innerduct at no additional cost.
5. The contractor shall ensure that a swivel is used when pulling the multi-cell innerduct through a conduit to prevent the multi-cell innerduct from twisting. The contractor shall ensure the factory installed pull tapes within each cell are free-float during installation.
6. During pulling, the innerduct shall be continuously lubricated as it enters the conduit. Pre-lubrication may be necessary. The lubricant used shall be compatible with the innerduct material.
7. The manufacturer's recommended pulling speed and pulling tension shall not be exceeded. Each innerduct shall extend a minimum of 12 inches into the pull box.
8. All unused innerduct and cells shall contain pull tape from pull box to pull box. Each pull tape shall terminate at the end of the innerduct/cell with a minimum of 5 feet of coiled slack in each pull box.
9. The bonding/locator wire traveling through a conduit, innerduct or cell of a multi-cell innerduct shall terminates in the pull box with at least 5 feet of bonding/locator wire slack. The bonding/locator wire shall be made mechanically and electrically secure to form a continuous system and shall be effectively bonded to the ground rod within the cabinets, poles, and pull boxes.
10. Each innerduct shall be secured in the inside of the pull box to reduce the likeliness of recoil into conduit.

ITS Pull Box Requirements

A. Pull boxes for ITS fiber optic cable installations shall be standard pull boxes as shown on the RTC-ITS standard details, unless the pull box is located within NDOT R/W in which case the NDOT-ITS standard details will be used.

B. The standard ITS Pull Box is the minimum size pull box that can be used for ITS installations. All No. 7 ITS Pull Boxes shall be a single unit, 24-inches in depth (i.e., no extensions allowed for achieving the 24-inch depth).

C. The standard ITS Vault or Street Rated ITS Vault is required at the following locations:
    1. At existing traffic signal intersections where fiber optic cable is installed after removal of existing copper interconnect cable.
    2. At all underground locations requiring splicing of fiber optic cables (i.e., Trunk-to-Trunk, Trunk-to-CDCA, etc.)
    3. At the ends of all Trunk fiber optic cable runs to facilitate the installation of a splice closure for protecting the end of the fiber cable and support future splicing needed to extend the fiber optic cable run beyond the project limits.

D. All standard ITS Vault and Street Rated ITS Vault are required to be installed with two racks and hooks on each of the two long sides.

E. Covers for ITS Pull Boxes and ITS Vaults shall be permanently marked per the owning agency (e.g., RENO FIBER, SPARKS FIBER, or COUNTY FIBER), unless installed for NDOT where the cover shall be marked per NDOT requirements.

F. ITS pull boxes shall be installed per the RTC-ITS standard details, unless otherwise directed by the owning agency, except for NDOT owned pull boxes which shall follow the NDOT requirements.

G. Install ITS pull boxes at the locations shown on the plans, in long runs spaced at not over 1000 ft, and there shall not be more than 360-degrees of conduit bends (horizontal and vertical) between any two connective pull points (i.e., pull box, vault, pole, and cabinet pull points).

H. Place the tops of pull boxes installed in the ground or in sidewalk areas flush with the surrounding finished grade or top of adjacent curb. Where practical, place pull boxes shown in the vicinity of curbs adjacent

to the back of curb, and adjacent to standards along the side of the foundations as shown on the plans

Fiber Optic Cable Installer Requirements

A. This work requires a fiber optic cable installer to be responsible for installing all fiber optic cables, performing fiber optic splices, and performing fiber optic cabling system testing to be accepted as a complete and functioning system. The fiber optic cable installer shall consist of one person with all the skills listed under the section Requirements for Fiber Optic Cable Installer.

B. Requirements for Fiber Optic Cable Installer:
    1. Five years of experience implementing fiber optic communications infrastructure for intelligent transportation system.

    2. Ability to support the System Integrator in configuring and connecting to system hardware and communications elements.

    3. Proficiency in end-to-end fiber optic cabling system installations, including fiber optic cable installation, fusion splicing, fiber termination panel configuration, testing, and troubleshooting according to industry standards and these special provisions.

    4. Proficiency in the development of test plans, procedures, and techniques. Possesses a thorough knowledge of diagnostics techniques specifically relevant to fiber optic cabling systems subsystems furnished to this project.

    5. Possesses at least a working knowledge of each of the following: Fiber Optic communications equipment and network architectures.

    6. Possesses the ability to provide technical project direction.

    7. Proficiency in the use of project management methodologies and techniques.

    8. Possesses strong organizational, analytical, and problem-solving skills.

    9. The Fiber Optic Cable Installer shall be available to be contacted by the Engineer during business days from 6am through 6pm for the life of this contract and shall be capable of being on-site within 4 hours of notification.

10. Submit a resume of the qualified Fiber Optic Cable Installer for approval no more than 14 days from NTP.

Fiber Optic Cabling System Requirements

A. Single Mode Fiber Optic (SMFO) Cables (Trunk Cable)

11. Use only dielectric, SMFO cables that are of loose tube gel-free construction, with a waterblocking swellable material, designed for outdoor and limited indoor use and suitable for installation in underground conduit and field cabinets. Use cable that complies with the requirements of RUS 1755.900 and complies with Telcordia GR2O-CORE and TIA/EIA-4720000-A standards, except as modified herein.
12. Provide the required slack of 100 feet for each cable direction in each ITS Vault (200 feet if pulling through vault, 100 feet if cable ends in vault) and 30 feet in each ITS Pull Box.
13. Use SMFO cable that complies with the following requirements:

PROPERTY	REQUIREMENT
Number of fibers	Minimum of 72 fiber strands, with 6 buffer tubes of 12 fiber strands each.
Core diameter	8.2 micrometer
Cladding diameter	125 +/- 0.7 micrometer
Core-to-cladding offset	Less than or equal to 0.8 micrometer
Cladding non-circularity	Less than or equal to 0.7%
Maximum attenuation	0.35 dB/km at 1310 nm; 0.25 dB/km at 1550 nm
Attenuation uniformity	No point discontinuity greater than 0.1 dB at either 1310 nm or 1550 nm
Mode-field diameter (matched cladding)	9.3 +/- 0.5 micrometer at 1310 nm; 10.5 +/- 1.0 micrometer at 1550 nm
Maximum chromatic dispersion	3.2 ps/(nm x km) from 1285 nm to 1330 nm and < 18 ps/(nm x km) at 1550 nm
Fiber polarization mode dispersion	0.5 ps/(km)$^{1/2}$
Fiber coating	Dual layered, UV cured acrylate applied by the fiber manufacturer
Coating diameter	245 micrometer +/- 5 micrometer
Minimum storage temperature range	- 40 °F to + 158 °F (-40 °F to +70 °C)
Minimum operating temperature range	- 40 °F to + 158 °F (-40 °F to +70 °C)
Rated life	Certify a 20-year life expectancy when installed to manufacturer's specifications

14. Buffer Tubes:
    a) Each buffer tube shall be filled with a non-nutritive to fungus, electrically nonconductive, water-blocking material that is free from dirt and foreign matter.

b) The water-blocking material shall allow free movement of the fibers, without loss of performance, during installation and normal operation including expansion and contraction of the buffer tubes.
c) The water-blocking material shall be readily removable with conventional nontoxic solvents.
d) Buffer tubes shall be stranded around a central member using the reverse oscillation or "S-Z" stranding process.
e) The use of filler rods in the fiber optic cable when required to lend symmetry to the cable section is mandatory.

15. Central Strength Member: The fiber optic cable shall have a central strength member designed to prevent buckling of the cable.
16. Cable Core: The fiber optic cable shall utilize a dry water-blocking material to block the migration of moisture inside the cables.
17. Tensile Strength Members:
    a) The fiber optic cable shall have tensile strength members designed to minimize cable elongation due to installation forces and temperature variation.
    b) Underground fiber optic cable shall withstand a 2700N (600 lbf) tensile load where the change in attenuation does not exceed 0.2 dB during loading and 0.1 dB after loading (per EIA-455-33).
    c) The cable shall be rated for an installed tensile service load of 890N (200 lbf) or more.
18. Cable Jacket:
    a) The fiber optic cable jacket shall be constructed of a high or medium density polyethylene (HDPE/MDPE) jacket that has been applied directly over the tensile strength members and water-blocking material.
    b) The preferred method for sheath removal is a quick access system. Acceptable jacket systems must consist of at least one ripcord designed for easy sheath removal.
    c) This cable will be rated for use in both underground and overhead installations.
19. Environmental: The cable shall be capable of withstanding the following conditions without damage or decrease in function:
    a) Total immersion in water with natural mineral and salt contents.
    b) Salt spray or salt-water immersion for extended periods.
    c) Insect spray and varmint repellents.
20. Provide the following information on a weatherproof tag firmly attached to the reel:
    a) Factory order number
    b) Job number

c) Ship date
d) Manufacturer's cable code
e) Type of cable (single mode, outdoor, indoor)
f) Beginning and ending length markings
g) Measured length and attenuation

21. Install SMFO cables continuous and without splices between allowable splice points as identified on the plans and specified herein. Only splice fibers at underground splice closures and fiber optic splice units that are housed in communications hubs and buildings. Perform all final length measurements and order cable accordingly.
22. When removing cable from the reel prior to installation, place it in a "figure-eight" configuration to prevent kinking or twisting. Take care to relieve pressure on the cable at crossovers by placing cardboard shims (or equivalent method) or by creating additional "figure-eight" loops.
23. Carefully handle SMFO cable. Do not pull cable along the ground or over or around obstructions. Do not pull cable over edges or corners, over or around obstructions, or through unnecessary curves or bends. Do not bend SMFO cable beyond the 6.22 inch minimum radius under no stress and 9.33 inch minimum radius under stress at any time. Use manufacturer approved pulling grips, cable guides, feeders, shoes and bushings to prevent damage to the cable during installation.
24. Furnish the SMFO cable manufacturer's recommended procedures, maximum pulling tension, a list of the cable manufacturer's approved pulling lubricants, and the lubricant manufacturer's procedures for use. Adhere to manufacturer's installation procedures when installing fiber optic cable. Use lubricants in quantities and in accordance with the procedures recommended by the lubricant manufacturer.
25. If the cable is pulled by mechanical means, obtain approval for the cable pulling equipment. Use pulling cable equipment that has a mechanism to ensure that the maximum allowable pulling tension is not exceeded at any time during installation.
26. Furnish attachment hardware, installation guides, and other necessary equipment, not specifically listed herein, as necessary to install the fiber optic cable.

B. Communications Distribution Cable Assembly (CDCA)

1. The CDCA is to be used between the fiber optic Trunk and controller cabinet (also known as traffic signal cabinet or field device cabinet) at lengths predetermined by the Contractor, with the required slack of 100 feet in each ITS Vault and 25 feet in each No.7 ITS Pull Box, as well as the 20 feet of slack neatly coiled in the field device cabinet.

2. Provide and install Single Mode (OS2) CDCA ITS drop cable or equivalent which is a factory terminated cable with epoxy filled patch panel with 12 fiber optic Lucent Connector (LC) connectors. Additionally, an approved Single-Panel Housing (SPH) pigtailed 12 strand LC duplex, single-mode (OS2), single fiber, 250-micrometer can be approved for specific applications by the owning agency.
3. The CDCA drop cable shall be designed with an Optical Fiber Non-Conductive Riser (OFNR)-rated, all-dielectric cable that is ultraviolet-resistant and fully waterproof for outdoor applications. Cable shall have a single 3.0 mm buffer tube containing 12 color-coded fibers. Cable shall have a maximum attenuation of 0.40 dB/km at a 1310nm wavelength and 0.30 dB/km at a 1550nm wavelength.
4. Each LC connector shall have a maximum insertion loss of 0.4dB, less then -55dB reflectance, and UPC ferrule polish.
5. Adhere to manufacturer's installation procedures when installing the CDCA drop cable. Use lubricants in quantities and in accordance with the procedures recommended by the lubricant manufacturer.
6. Do not bend CDCA drop cable beyond the minimum bend radius of the cable, per the cable manufacturer’s recommendations, at any time. Use manufacturer approved pulling grips, cable guides, feeders, shoes and bushings to prevent damage to the cable during installation.
7. Keep protective covers on the ends of connectors at all times until the associated jumper cable is connected to the port.
8. Furnish and install jumper cable to make a complete installation.

C. Fiber Optic Termination Panel

1. At ITS Hub Cabinet and within agency owned building locations, use fiber optic termination panels that are properly sized for the required number of splices and couplers needed to terminate all fibers within the cable, or cables, which are being terminated at the panel.
2. The termination panel housing (also referred to as the Closet Connector Housing, or CCH) shall comply with the following minimum requirements:
   a) Designed for rack mounting in a standard EIA 19-inch.
   b) Maximum height = 4 Rack Units (RU) using 1.75-in EIA hole spacing.
   c) Designed to support 12 connector panels (i.e., cassettes or modules).
   d) Blank covers installed on unused connector panel slots.
   e) Removable front and rear enclosure doors with a tinted polycarbonate front door.

f) Cable strain relief brackets, routing clips and guides.
g) Have provisions for minimum of four SMFO cable entries.

3. Connector Panels:
   a) Connector Panels shall be designed to fit within the approved termination panel housing (i.e., the CCH).
   b) Each connector panel shall provide a minimum of 6 duplex couplers (12-ports per panel) with LC Duplex type UPC connector on each end. Maximum acceptable attenuation per LC connector shall be 0.3 dB per ANSI/TIA-568-C.3 specification.
   c) Each connector panel shall provide an internal splice tray support a minimum of 12 splices (heat shrink, single fiber type) with splice protectors.
   d) Each connector panel shall provide a minimum of 12 color coded fiber pigtails to be connected between the 12 LC couplers and the 12 splice protector slots within each connector panel cassette/module.
   e) Connector panel shall be provided with port numbers (1 through 12) and connector panel labels that are coordinated with the Fiber Assignment Table that is provided with the termination panel housing (i.e., the CCH).

D. Fiber Optic Jumper Cable

1. Use jumper cables that meet the following requirements:
   a) 250 µm buffering of each fiber
   b) 900 µm buffering of each fiber applied after the initial 250 µm buffering
   c) Maximum factory measured insertion loss of 0.5 dB per EIA/TIA 455-171
   d) Less than 0.2 dB loss when subjected to EIA/TIA-455-1B, 300 cycles, 0.5 kg
   e) Aramid yarn strength member
   f) Rugged 3 mm (approximate) PVC sheathing
   g) Minimum bend radius of 320 mm following installation, 640 mm during installation
   h) Minimum tensile strength of 444 N
   i) LC Connectors factory terminated with strain relief
   j) Comply with NEC requirements for indoor cable when used indoors
   k) Rated by the manufacturer for use in outdoor field cabinets

2. Use either single fiber or duplex jumper cables. Provide permanent markings on duplex jumper cables that provide a visual distinction between the two fibers. Provide strain relief for jumper cables at both ends and elsewhere as needed. Adhere to

manufacturer recommended installation and minimum bend radius requirements.

E. Splice Closure

1. Use underground splice closures that have the capacity to accommodate a minimum of 300 single fusion splices each for splice closure receiving one or more 144-SMFO cables. At all other splice closure locations (i.e., locations receiving one or more 72-SMFO cables) use underground splice closures that have the capacity to accommodate a minimum of 156 single fusion splices each.
2. Each splice closure shall be provided with enough splice trays to accommodate the minimum splice capacity referenced (i.e., 300 and 156 single fusion splices respectively). Use splice trays that accommodate heat-shrink fusion splices.
3. Use splice closures that have a reliable dual seal design with both the cable jackets and core tubes sealed, without the use of water-blocking material. Use splice closures that can be opened and completely resealed without loss of performance or need for a resealing kit.
4. Use cylindrical, butt-end style underground splice closures to protect splices that are housed in pull boxes. The unit shall be capable of being opened and resealed without the need to purchase a resealing kit using a dome-to-base clamp with o-ring. Use corrosion resistant, water-tight splice closures that meet the requirements of GR-771-CORE. Ensure that the splice closure seals, bonds, anchors, and provides efficient routing, storage, organization, and protection of fiber optic cable and splices.
5. Use fiber optic splice closures capable of being installed within the standard ITS Vaults at locations where fiber splices are required and at locations where a fiber optic cable ends (e.g., a Trunk cable at the end of the project limits).
6. Use fiber optic splice closures with end cap supporting a minimum of six cable entry ports sized to support 4 Trunk cables (i.e., 72 SMFO or greater) and 2 branch cables (i.e., 12 fiber CDCA) to accommodate splicing per plans and for future trunk and branch cables to be spliced. Use cable entry ports with a compressed gel cable sealing type.
7. Use fiber optic splice closures with 6 cable attachments, six ground feed-through lugs, and valve for flash testing included.
8. Secure splice closures in pull boxes using the racks and hooks. Orient the splice closure such that the end cap is at least 6 inches below the opposite end.

F. Splicing Method

1. Use only fusion splicing for all splices. All splices and connectors shall be prepared in accordance with the manufacturer's recommendations. Each splice between two new fibers shall introduce less than 0.10 dB attenuation. For splices between one new and one existing, or reconnection of two existing fibers, the maximum allowable attenuation shall be 0.30 dB.
2. Protect each splice in a protective sleeve and secure in the splice tray. Completely re-coat bare fibers with a protective heat-shrink coating prior to placement in a sleeve or housing. Install the heat-shrink coating in such a manner as to protect the fiber from scoring, dirt accumulation, moisture intrusion, and micro-bending.
3. Do not deviate from the splice details shown on the plans without approval.
4. Only perform full-cable splices at locations shown on the plans.
5. Perform full-cable terminations at ITS Hub cabinets and agency building locations. Route SMFO cables to the designated fiber optic termination panel and through the rear of the panel. Secure the fiber optic cable sheath and central member outside of the termination panel. Route buffer tubes into the splice tray area of the associated connector panel module using spiral wrap to group and protect buffer tubes. Plug all entry holes not utilized.
6. Within the splice area, separate the buffer tubes and route each buffer tube to a splice tray. Secure buffer tubes in splice trays and splice each fiber of the buffer tube to a corresponding fiber optic pigtail. Route pigtails from the splice tray area to the rear side of the respective fiber optic patch panel area, within each fiber optic distribution panel housing. Use spiral wrap (or similar approved method) to group and protect the pigtails routed from each splice tray to the corresponding patch panel blade.

G. Terminations

1. Ensure that the attenuation at each termination (inclusive of two connectors and coupler) does not exceed 0.7 dB. Keep protective covers on couplers until jumper or pigtails are installed.

H. Labeling

1. Provide labeling in a neat, professional manner using permanent methods and durable products specifically designed for each label scenario. Obtain approval for label method and appearance prior to each label scenario. At a minimum, provide the following labeling:
   a) Label all cables at pull boxes, cabinets, racks, and other points of entry with the appropriate cable identification

number. Use permanently marked, removable cable sleeves.
b) Label both ends of fiber optic jumper cables and pigtails.
c) Sequentially label the jumper cable (front) side of patch panels in a consistent manner throughout the project.

I. Cable Management

1. Group and neatly tie cables to the sides of racks and pull boxes when applicable. Coil, tie, and stow slack or excess cable. Trim loose ends of cable ties. Provide strain relief for fiber optic cable, jumper cables, and pigtails.
2. At ITS Hub cabinets and agency buildings, horizontally route jumper cables from the front face of the fiber optic termination panel to either side of the rack. Stow jumpers within the horizontal cable rings of the fiber optic termination panel. Next, bundle the jumper cables using spiral wrap, and vertically route them down the side of the rack and through the floor. Beneath the rack, group the jumper cables into sub-bundles for each rack destination. Route sub-bundles beneath the floor to the appropriate equipment rack and up the sides of the rack. Break out individual jumper cables from the sub-bundles and route them horizontally to the equipment. If there is not a raised floor in the agency building, follow the same installation method using cable trays above the racks. Add additional cable trays as necessary to achieve the required connectivity between racks and between wall-mounted equipment and racks.
3. Route bundles of jumper cables between equipment racks as needed.

J. Testing Requirements

1. The Contractor shall be responsible for providing all fiber optic cabling system testing and the fiber optic cabling system shall meet the certification, factory, and stand-alone test requirements specified herein.
2. Contractor shall provide calibration of the Power Meter and OTDR equipment and submit calibration certificates that show the calibration was performed no less than 1 year ago.
3. The Contractor shall use the Power Meter Test Form illustrated below for recording the power meter results:

POWER METER TEST FORM

Total Fibers in Cable: Buffer Tube: String Binder: Test Date:

Tester Name and Company: Owning Agency Inspector:

Strand	Termination Location Descriptions	New Splice		Existing Splice		Cable			Total Allowed Loss	Measure Loss	Pass/Fail
		# of Splices	Allowed loss = 0.1 dB x # of splices	# of Connectors	Allowed Loss = 0.5 dB x # of connectors	Cable Length feet	1330nm Allowed Loss = feet x (0.35dB/Km) / (3,281 ft/Km)	1550nm Allowed Loss = feet x (0.25dB/Km) / (3,281 ft/Km)	dB	dB	Y/N
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											

4. The contractor may request the Microsoft Excel spreadsheet of this form from the Engineer. If the spreadsheet is not available, then the contract shall create one to use.
5. Fiber optic cable shall meet the following test requirements:
   a) Pre-Installation Testing:

      The contractor shall inspect all cable upon delivery, and prior to installation. Cables that are found to have visual damage shall be tested using an OTDR per the following section prior to installation.

   b) Post-Installation Testing:

      Fiber optic cable shall successfully pass the following tests, demonstrating acceptable attenuation and connectivity. The contractor shall make corrective actions for unacceptable losses at no additional cost to the project. Failed splices and connections shall be remade and re-tested for compliance. The contractor shall replace cable in its entirety that is not compliant with these specifications at no additional cost to the project.

      Each fiber optic strand, within the SMFO Cables (Trunk Cable), shall introduce less than 0.35 dB/km of attenuation at 1310 nm and 0.25 dB/km of attenuation at 1550 nm.

      Each fiber optic strand, within the CDCA Cables, shall introduce less than 0.40 dB/km of attenuation at 1310 nm and 0.30 dB/km of attenuation at 1550 nm.

Each splice between two new fibers shall introduce less than 0.10 dB of attenuation. Each splice between one new and one existing, or two existing fibers, shall introduce less than 0.30 dB of attenuation.

Each fiber connection shall introduce less than 0.30 dB of attenuation (i.e., total for both connectors to the center coupler), and 0.40 dB for CDCA connections. When testing with a launch cable with a fiber connector, the contractor can use the extra loss of this connector in the loss calculations, for example, the connector at the panel and the connector at the launch reel will be .30dB + .30dB, and the splice on the pigtail can allow for .10 dB, giving a .70 dB allowable loss at the panel when testing with the OTDR.

1) Power Meter Test:

   Power meter tests shall be conducted by the contractor after installation of the fiber optic cable, splicing, and termination panel connections.

   The contractor shall conduct Power Meter Tests for each fiber to measure installed fiber cable attenuation and demonstrate correct panel termination continuity, for example, fiber path #1 at site A matches up with fiber path #1 at site B.

   Power Meter Tests shall be performed on each fiber strand path between fiber termination panels. The contractor shall ensure that the light source and meter are calibrated and referenced to a zero reading when directly connected to each other, ensuring an accurate loss reading.

   Power Meter Tests shall be performed in accordance with Method A.3 of TIA/EIA-526-7 – “Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant.” Testing shall be conducted at the cable ends in both directions using 1310 and 1550 nm wave lengths.

   The contractor shall provide power meter testing results on a Power Meter Test Form that is pre-approved by the Engineer prior to testing.

2) OTDR Tests:

   OTDR testing shall be conducted by the contractor after

successful completion of the power meter test. All OTDR traces shall be provided in the test documentation submittal in their native format or “raw” state as they are saved on the OTDR hard drive. For example, the bi-directional .trc files on an EXFO OTDR shall be submitted above and beyond the pdf’s generated from the OTDR traces.

OTDR tests shall be performed in accordance with TIA/EIA-455-8 for all fibers, including new fibers, dark fibers, and existing fibers in splice enclosures that the contractor works in.

The contractor shall perform OTDR tests at both 1310 nm and 1550 nm using a launch cable of a length recommended by the OTDR manufacturer. The contractor shall enter the proper OTDR parameters for operation, including wavelength, index of refraction of fiber to be tested, and pulse length. The contractor shall adjust the sensitivity to 0.05 decibel and the resolution to display the complete fiber under test. Each loss event in the OTDR table shall be set to at least 2 decimal places. The contractor shall set the range of the OTDR to capture the complete fiber trace. The contractor shall set the number of averages or time of averages on the OTDR to ensure a smooth trace with no noise at the end of the trace.

The contractor shall submit OTDR traces which clearly annotate the location of each loss event at a minimum of 2 decimal places and identify the maximum allowable loss and the measured loss for each event (i.e., connector, splice, and fiber path length). The contractor shall provide a table of bi-directional splice losses for each fiber at each splice point and the table shall also include the connector losses at each termination panel for each fiber for review. All measured losses that exceed the maximum allowable loss shall be clearly identified on the bi-directional splice loss table until corrective measures have been performed by the contractor and all fiber paths successfully pass the OTDR test criteria. Failed splices shall be remade and re-tested for compliance. Failed connectors shall be cleaned, and replaced if necessary, and re-tested for compliance. Failed cable segments shall be replaced and re-tested for compliance.

OTDR tests shall be performed as follows:

(a) Bi-directional OTDR testing:

The contractor shall test each fiber strand path between fiber termination panels, in both directions, at 1310 nm and 1550 nm utilizing a fiber launch reel to ensure the reflective connector in the patch panel is measured.

In the event that a cable is pulled from point A to point B, with or without splices, but neither end is terminated, rather the ends are in a pull box for a future connection, the contractor shall test each unterminated fiber strand at each end to determine the bi-directional splice losses between the unterminated cables. There will be no front-end connector loss measurements since the cable is not terminated.

(b) Uni-directional OTDR testing:

The contractor shall test each fiber strand connected to a fiber termination panel at one end and un-terminated in a splice closure at the other end utilizing a fiber launch reel at the terminated end to ensure the reflective connector in the patch panel is measured.

Communication Hub Cabinet Requirements

A. See RTC ITS Standard Details attached. These cabinets are to meet the criteria of standard NDOT ITS cabinets including:
   1. EIA 19-Inch Rack
   2. Front & Rear Doors
   3. Fiber Optic Termination Panels
   4. Field Hardened Ethernet Switch (Hub)
   5. Power Supply and battery backup shall be per the typical traffic signal cabinet standards.
   6. Jumper cables shall be outdoor rated CAT 6 with RJ-45 connectors or single mode fiber with LC connectors, unless otherwise required by the network appliance being connected.

Field Hardened Network Device Requirements

A. Furnish, install, and test the Field Hardened Ethernet Switch. The

Ethernet Switch shall consist of an Ethernet switch and any required cables, surge protection, power supplies, Small Form Factor Pluggable (SFPs), connections, mounting hardware, and various accessories as needed. The switches for this project shall be fully compatible and interoperable with the switch(s) installed on previous RTC ITS Projects at the local agency including switches that that have SFPs to handle SMFO and Multi-Mode Fiber Optic (MMFO) to tie into existing MMFO locations.

B. Materials

1. Field Hardened Ethernet Switch (Cabinet) shall be a Ruggedcom, RS900G series switch, or approved equal, meeting the following requirements:
   a) Ruggedcom, RS900G series
      1) Switch shall be approved by City of Sparks and Engineer
2. Supply a Field Hardened Ethernet Switch (Hub) from the following or approved equal:
   a) Ruggedcom, RSG2488
      1) SFP quantity as shown on splice details with SFPs to accommodate the distances required between fiber optic switches, with one extra SFP per type provided.
      2) A minimum of 6 copper non-blocking ports: 10/100/1000TX
      3) A minimum of 16 fiber non-blocking ports: Gigabit Ethernet Ports
      4) Switch shall be approved by City of Sparks and Engineer
3. In locations in the field that have equipment that require a serial interface supply an Ethernet switch that also includes a serial port.
4. The field switch shall be a managed switch and comply with the following standards:
   a) Institute of Electrical and Electronic Engineers (IEEE) 802.IQ Local and Metropolitan Area Networks – Virtual Bridged Local Area Networks.
   b) IEEE 802.1P: Traffic Class Expediting and Dynamic Multicast Filtering – Draft 8.
   c) IEEE 802.3X: IEEE Standards for Local and Metropolitan Area Networks; Specifications for 802.3 Full Duplex Operation.
   d) IEEE 802.1W: IEEE Standards for Local and Metropolitan Area Networks – Common Specifications – Part 3; Media Access Control (MAC) Bridges – Amendment 2 Rapid Configuration.
   e) Federal Communications Commission (FCC) Rules and Regulations Vol. II, Part 15 for Class A Equipment Electronic Compatibility and Susceptibility (Product electromagnetic compatibility is required).
   f) National Electronics Manufacturers Association (NEMA) TS – 2

Traffic Control Equipment. The following clauses apply:
1) 2.1.2: Operating Voltage.
2) 2.1.3: Operating Frequency.
3) 2.1.4: Power Interruption.
4) 2.1.5: Temperature and Humidity, as modified herein.
5) 2.1.6: Transients, Power Service.
6) 2.1.7: Transients, Input-output terminals.
7) 2.1.8: Non-destruct Transient Immunity.
8) 2.1.12: Vibration.
9) 2.1.13: Shock.

g) Underwriters Laboratory (UL) 60950 Safety Requirements for Information Technology (IT) Equipment (applicable to equipment safety).

5. The field switch (non hub) shall:
   a) Be 4 port (minimum) 10/100/1000 Base TX RJ-45.
   b) Have a minimum of (2) 1000 Base FX LC fiber optical ports.
   c) Have a standard serial port when field conditions warrant
   d) Operate non-blocking, at full wire speed.
   e) Support remote reset and remote management.
   f) Support IGMP snooping.
   g) Support IP Multicast filtering.
   h) Support remote turn on/off Base TX ports.
6. The field switch (non hub) shall also meet the following functionality and requirements:
   a) 10/100/1000 Base TX port shall connect via RJ-45 connector. The ports shall operate as half-duplex or full-duplex (IEEE 802.3x) over 100m segment lengths and provide auto-negotiation and crossover detection.
   b) Each 1000 Base Fiber Transmission (FX) port shall connect via fiber connectors and 9/125um single-mode fiber. Fiber connectors shall be available as LC. The ports shall operate as full duplex (IEEE 802.3x) over 15 km segment lengths.

7. The field switch shall provide the following advanced Layer 2 functions: IEEE 802.1Q VLAN with support for a minimum of 128 Virtual Local Area Networks (VLAN), IEEE 802.1P priority queuing, IEEE 802.1W rapid spanning tree (required), IEEE 802.3X flow control greater than or equal to 1,028, support automatic address learning of a minimum 4,096 Medium Access Control (MAC) addresses and greater than or equal to 1,028 static MAC address.
8. The field switch shall provide the following port security function: ability to configure static MAC addresses, ability to disable automatic address learning per ports; known hereafter as secure port, secure ports only forward statically configured MAC

addresses, trap and alarm upon any unauthorized MAC address and shutdown for programmable duration.

9. The field switch shall provide the following network management functions: SNMPv3, RMON-MIB (RFC 2819), Port Mirroring, Spanning Tree (IEEE 802.1D), Rapid Spanning Tree (IEEE 802.1W).
10. The field switch shall support telnet, Trivial File Transfer Protocol (TFTP) or File Transfer Protocol (FTP), Command Line Interface (CLI) and Simple Network Management Protocol (SNMP).
11. The field switch shall have an integrated web interface. Reset/Reboot and firmware shall be supported via all methods listed above. All parameters and settings (network management, security, Layer 2 features, etc.) shall be user configurable through the maintenance port, web interface Telnet and all other supported remote management tools.
12. The field switch shall allow for stand-alone shelf mounting unit and DIN rail mounting.
13. The field switch shall support the following:
    a) Power: Nominal 120 VAC, 60 Hz. The unit shall be provided with all power conversion and regulation necessary to support electronics operation. The power input circuitry shall be designed to protect the electronics from damage by a power surge or under-voltage condition. Power consumption shall not exceed 20 Watts.
    b) The field switch shall include a power status indicator.
    c) Physical Characteristics:
        1) A minimum of 4 Ports, 10/100/1000 Base TX, RJ-45.
        2) 2 Port, 1000 Base FX, LC.
        3) Serial port (when needed).
        4) The field switch shall not exceed 7.5 inch high x 3 inch wide or 5 inch deep.
        5) The weight shall not exceed 5 lb.
        6) Shelf mount in 19 inch standard equipment rack.
14. Environmental: The field switch shall conform to functional and performance specifications as defined herein when operated in the following environment.
    a) Temperature: -40 ºC to 85 ºC.
    b) Humidity: 5% to 95% relative humidity, non-condensing.
    c) Cooling shall be by convection with case acting as heat sink. No cooling fan shall be used.
15. The field switch shall have the following minimum indicators:
    a) Power: On, Off.
    b) Alarm
    c) Network status per port: Transmit, receive, link, and speed.
16. Status indicators shall be Light Emitting Diode (LED).

17. All connectors, indicators and replaceable components shall be permanently marked and traceable to the supplied documentation, including schematics and parts list. The external markings shall include the product function name, model number, serial number and manufacturer's name.
18. The field switch shall have a minimum Mean Time Between Failures (MTBF) of 40,000 hours.

C. DOCUMENTATION AND WARRANTY

1. Upon delivery, the following minimum documentation shall be provided by the vendor with each switch provided:
   a) Initial configuration (This document shall provide both hardware and software settings).
   b) Setup and configuration manual.
   c) Users manual.
2. All equipment supplied and installed on this project shall be labeled clearly with the project and location designation.
3. Provide a minimum 3 year factory warranty for all Field Hardened Ethernet Switch and all associated cabling. The warranty on equipment and cabling shall be offered by the manufacturer and shall be transferable to the City of Sparks at the time of acceptance. The warranty period for equipment, cabling, and work begins at the time the City of Sparks accepts the system (SAT test)

D. TESTING

1. The Contractor shall be responsible for providing all Field Hardened Ethernet Switch testing requirements specified herein.
2. Demonstrate that the equipment and the systems furnished and installed under this contract function in full compliance with the requirements of the contract documents. Develop and submit test procedures for approval. Conduct tests in the presence of the Engineer using approved test procedures. Submit test results using approved test data forms. The test results will be reviewed for conformance with the requirements of these contract documents. If the equipment or systems fail any part of the test, make necessary corrections and repeat that test.
3. Give notice of the time, date, and place of all tests at least 14 days prior to the date on which a test is planned. Do not conduct tests sooner than 14 days after the associated test procedures are approved. If requested, postpone any test up to seven days in order to accommodate the schedules of the Engineer and Engineer designated representatives. Postponements of tests are not grounds for extension of the contract or for additional compensation. The Engineer may waive the right to witness certain tests.

4. Neither the witnessing of tests, nor the waiving of the right to do so by the Engineer or Engineer designated representatives will relieve the Contractor of the responsibility to furnish and install the work in accordance with the contract documents. Such actions by the Engineer or Engineer designated representatives or approval of any test results by them will not be deemed as acceptance of the equipment or systems tested until successful completion of all the required tests.
5. Ensure that all equipment to be tested is ready for testing prior to the performance of and Engineer witnessing of the tests.
6. Complete and submit approved test data forms containing all of the data taken as well as quantitative results for each test for approval. The test data forms will be the basis for rejection or acceptance of the required test. Have your authorized representative sign all test data forms. When tests are witnessed by the Engineer, obtain the witnessing Engineer's signature on the test data form.
7. The contract period will not be extended for time loss or delays related to testing.
8. Failure of any item to meet the requirements for any test will be counted as a defect and the equipment under test will be subject to rejection. Rejected equipment may be re-tested provided all areas of non-compliance have been corrected and evidence thereof is submitted.
9. For equipment that has failed and subsequently been repaired or modified, prepare and deliver a report that describes the nature of the failure and the corrective action taken. Submit this report for approval prior to shipping the modified equipment. After 3 failing tests remove and replace the faulty equipment.
10. Conduct tests in different stages of the system implementation as follows:
    a) Stand-Alone Test - verify that after installation but prior to interconnection, the equipment operates as specified in the field. Test should include the following:
        1) The Ethernet Switch will be powered up and allowed to initialize, boot and run self- diagnostic tests as defined in the approved test procedures.
    b) Subsystem Test - For each Ethernet Switch location that is installed and interconnected in a system, conduct approved Subsystem Test from an operator workstation in the traffic management center:
        1) All items in the stand-alone test
        2) Transmission of data to the switch being tested and other switches and network devices downstream of the switch
        3) All networked devices sharing the same fiber path or interconnected into the same network circuit responded to

all central software commands.

c) System Acceptance Test (SAT) - The SAT consists of a 30-day period of operation without major failure of Contractor-supplied equipment. Demonstrate that the total system (hardware, firmware, materials, and construction) is properly installed, is free from identified problems, exhibits stable and reliable performance and complies with the contract documents.
d) At least once per week, demonstrate that all Ethernet switches function as tested in the Subsystem Test. During the SAT, control field devices directly connected to the switch and other devices interconnected to the same switch circuit. Obtain access to the Traffic Management Center during normal working hours to conduct this test.
e) Permission to start the test will only be granted after all subsystem testing has been successfully completed. Request in writing the time and date when the test is to start.
f) As part of the SAT, owning agency will be utilizing the system, communicating with traffic signal cabinets, posting messages on DMS's, and operating the CCTVs for monitoring purposes as well as operating of the new system devices.
g) Coordinate all SAT testing activities with the Engineer and City of Sparks operations staff.
h) Ensure that all equipment is maintained in operable condition during the SAT. Troubleshoot, diagnose, identify, isolate, and resolve all hardware and firmware problems and inconsistencies. Formulate possible solutions and implement all corrections needed for Contractor installed equipment. Identify any problems in equipment furnished by others and assist in correcting problems with such equipment.
i) Have a System Engineer on-site to operate the system exercising all functions. Prior to assigning an employee to the project in this capacity, provide resumes of any employee proposed for this role and obtain approval. Make available on-site, key technical personnel familiar with the design and construction of each major system component within 48 hours of notification of a problem.
j) Correct all system documentation errors, omissions, and changes discovered and resulting from the SAT and previous testing. System acceptance will not be considered complete until corrected documentation is submitted.
k) In the event of a failure of a single piece of equipment during the SAT, replace or repair the equipment and restart the 30-day test only for that piece of equipment. If the failure of the single piece of equipment prevents the proper operation of

other equipment, all devices affected by the failure will have the test extended by however many days they were out of service, whether or not these devices have previously been tested and passed before equipment failure occurred.

l) The following conditions constitute a minor system failure and will result in suspension of the 30-day test:
   1) Interference with project operations due to power failure.
   2) Failure to complete the objective of any test scenario due to lack of adequate documentation for equipment supplied by the Contractor. Re-test using revised documentation.

m) After satisfactory remedial action, the 30-day test shall be resumed and extended one day for each restart.

n) The following constitutes a major system failure. Any one of the following conditions will result in reinitialization of the SAT from day zero:
   1) Failure of any hardware or performance item to meet the operational requirements of the specifications for 72 consecutive hours.
   2) Failure of 5% of all field devices or communication equipment within a 14-day period.
   3) Intermittent hardware, software, communication, or operation control malfunctions.

CCTV Camera Requirements

A. Cameras shall be per this specification or approved equal: Advidia - 2.1MP, IP, PTZ, 4.7-94mm (20X) lens, Outdoor, Dome with Pole Mount for Advidia A-200-P (A-200-PM) and CAT 6 Ethernet Cable with distance to reach cabinet. Approved equals shall be integratable into the CCTV viewing software Video Insight Video Management Software (VMS)
B. Camera Pole outside of mounting to existing signal poles: shall conform to NDOT Details and Specification
C. Camera lower device: shall conform to NDOT Details and Specification

TRAFFIC SIGNAL ACTIVATION PROCEDURE

Traffic signal activations shall occur at an off-peak time that minimizes impacts to the traveling public, based on engineering judgement and in consideration of agency staff availability.

Place Changeable Message Signs (CMS) a minimum of 5 days in advance of signal activation. When using a single message, put the same message on the second panel to provide emphasis.

The CMS should read:

SIGNAL
ACTIVE
APRIL 5 or THURS (or 10:00 AM)

(The day of the activation, the message can be revised to identify the time the signal will be turned on.)
Determine if law enforcement is needed to control traffic and contact 3 days prior to activation.
Contracting Agency should contact the following (as appropriate) 2 days in advance of signal activation:

	Phone
NHP	688-2500
Washoe County Sheriff	328-3001
Reno Police	334-2175
Sparks Police	353-2428
Truckee Meadows Fire Protection District	328-3650
NDOT PIO	888-7000
NDOT DISTRICT II	834-8300

24 hours in advance of activation, the Contractor and Maintaining agency should test the signal operation, including advanced flashers when present.

The following personnel shall be present at activation:

Contractor
Signal technicians from maintaining agency
Project Manager for construction contract
Local Traffic Engineer
Traffic signal design engineer
Manufacturers' representatives

Unless otherwise directed by the Engineer, traffic signals shall start following MUTCD requirements.

TRAFFIC SIGNAL DESIGN REVIEW GUIDELINES

Base Plan

Traffic signal design plans should include as a minimum the following design elements:

Utilities, underground and overhead, with a note stating “utilities are shown for information only and shall be field verified by the contractor prior to any work by notifying the call before you dig service”

Nearest transformer for power source (check with NV Energy to make sure it can be used). New power source will require a Design Initiation Agreement (DIA) with NVE. Begin DIA at least three months ahead of advertisement.

Right of way

All intersection approaches for 300 feet, particularly for non-tangent approaches

Curb & gutter, ramp, sidewalk, driveway locations

Note unusual vision obstructions: buildings, trees, bushes, etc.

Bus stops, loading zones or on-street parking

Existing lane layouts, pavement markings

Pole locations outside 10-year right-of-way, if feasible

Overhead utilities - may require lateral shift of poles, or no street light

Conduit runs with note “runs are shown for intent, actual locations shall be as direct as possible”.

Controller cabinet

Location shall not block the view of entire intersection, signals, signs etc.

Cabinet or open cabinet door does not completely block sidewalk with door facing away from intersection.

Locate on corner near to power source, if possible.

Concrete pad in front of cabinet.

Metered service with battery backup separate from controller cabinet, placed to minimize knock-down.

Wiring/cabling

Pullboxes (#5) every 300 feet (advance loops, interconnect), #9 at cabinet, #7 for all other signal cable, #3½ OK for other locations. Interconnect pullboxes shall be spaced every 600’ along a street to facilitate pulling fiber in longer runs.

Pullboxes shall be fully traffic rated with bolt down metal lids with “TRAFFIC” or “INTERCONNECT” stamped or embossed on lids.

Metal lids must be grounded.

Modified pullbox bottom shall be minimum 2’ deep with 6” of clear space between cabling/wires and pullbox lid.

Cable/ Conduit

Conduit/ cable schedule should indicate number and size of conduit by run from pull box to pull box or pull box to pole. 3" minimum ID for all conduit containing traffic signal cable. In any case the % fill of any conduit shall not exceed 26%. Each run shall include number of signal cables and how many conductors for each cable.
A spare conduit shall be provided with traceable pull tape installed and sealed with appropriate material at both ends.
Call out interconnect, lighting, ground wire, and video cable as needed.
Conduit shall have bell ends.

Detection

Loops – show typical loop placement relative to striping. Include utilities to verify there is no conflict.
Video (IF ALLOWED) – maintaining agency will specify manufacturer if video detection is allowed.
Spacing of advanced loop should comply with Detector Handbook.

Controller

Contact maintaining agency for manufacturer.

Signal displays

12" LEDs for all vehicular faces
Slotted back plates with retro-reflective border on all signal heads.
Tunnel visor with ¾ opening(limits nests & ice/snow buildup).
Heads shall be placed per MUTCD requirements.
Pedestrian pushbuttons are indicated by associated phase.
Pedestrian signal head identify phase and quadrant location of mount, typically opposite from mast arm.

Signing

Do not use "LEFT TURN ON GREEN ARROW ONLY" signs (R10-5 & similar)
Use "LEFT TURN YIELD ON (circular green)" for PPLT (R10-12), unless flashing yellow arrow is used.
City of Sparks – install (Yield on Flashing Yellow) for Flashing Yellow Arrow (FYA) adjacent to left turn head.

Internally illuminated signs (IISNS)

Single sided IISNS mounted directly to mast arm (not hanging from bracket).

Green panels with white lettering abbreviated street suffix, such as Blvd, St. shall comply with MUTCD. New installations use “City” logo on left side (Sparks and Reno). Logo shall not exceed height of upper-case lettering.
Use block numbering where available.

Interconnect

Interconnect shall be provided when traffic signals are 60 seconds or less travel time apart.

Miscellaneous

Battery backup system (BBS) required for new traffic signals and shall be placed in metered service cabinet, not controller cabinet.
Retrofit BBS can be controller cabinet mounted.
Emergency flash shall be all-red.
Emergency preemption (1 for each approaching leg unless geometry requires more).

Phase diagram should be included depicting signal operation.

All design shall conform to the requirements of the RTC, City of Reno, City of Sparks, Washoe County or Nevada Department of Transportation as applicable.

Geometric design shall conform to AASHTO’s “A Policy on Geometric Design of Highways and Streets”, latest edition.

Roadway design hourly volumes shall be based upon 20 year traffic projections obtained from the RTC Planning department or from the jurisdictional agency.

Design vehicle shall be WB-67 unless otherwise designated by the jurisdictional agency.

Roadway transitions shall be based on the design speed in accordance with AASHTO and MUTCD design standards.

Within NODT right-of-way reference NDOT Access Management System and Standards, Section 4.4.1.3

See Table E-2 Access Management Standards in the 2040 Regional Transportation Plan for intersection and driveway spacing standards.

TRAFFIC SIGNAL TIMING

Please Note: Traffic signal timing within Washoe County is designed and developed by internal staff at the RTC, City of Reno, City of Sparks and Washoe County.

APPENDIX

A. RTC ITS Standard Details

B. City of Reno Traffic Signal Cabinet Specifications

C. City of Sparks Traffic Signal Equipment

REFERENCES

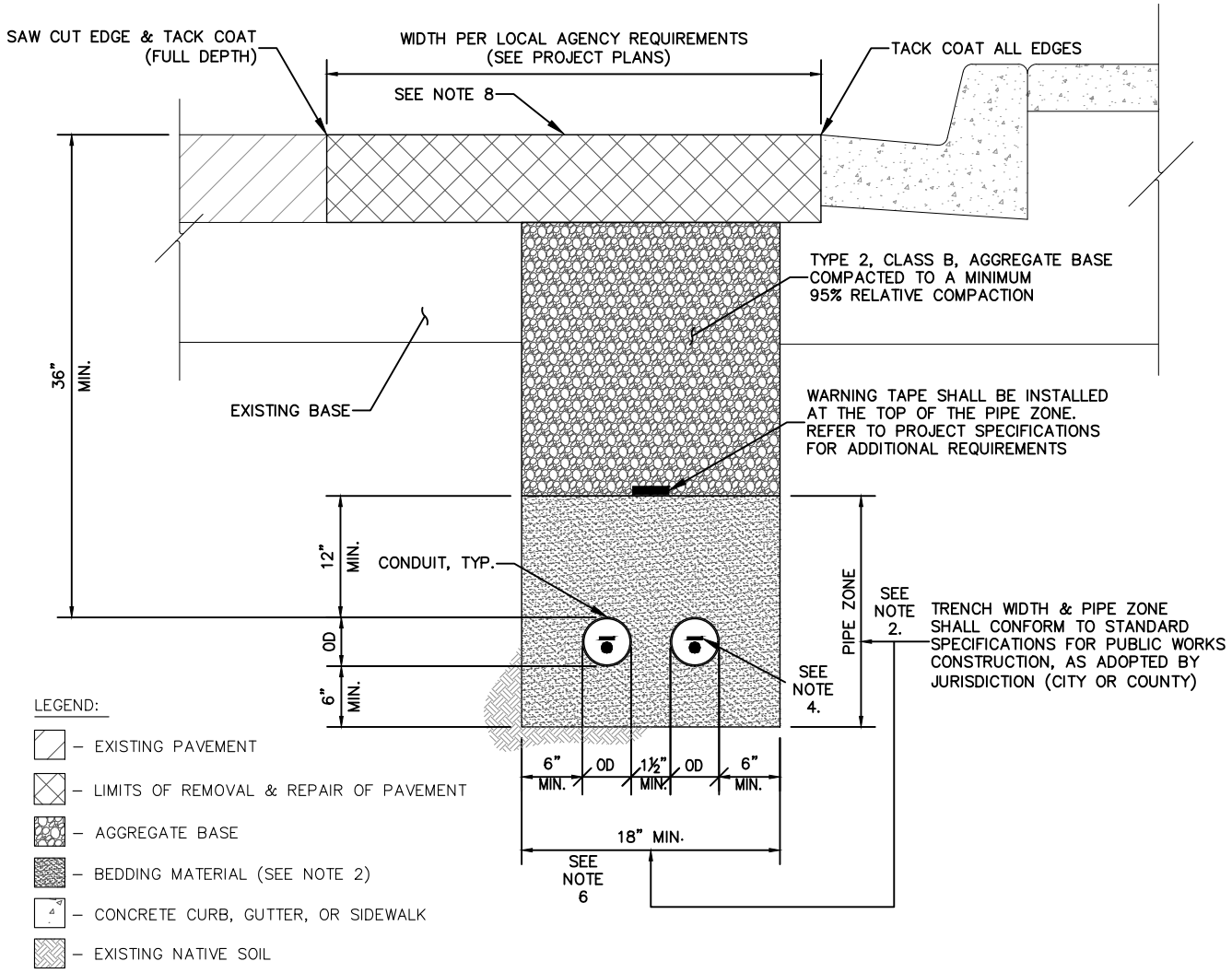
Manual on Uniform Traffic Control Devices, 2009

Traffic Control Devices Handbook, 2nd Edition

State of Nevada 2020 Standard Plans for Road and Bridge Construction2020

Guide for the Development of Bicycle Facilities, AASHTO, 2012

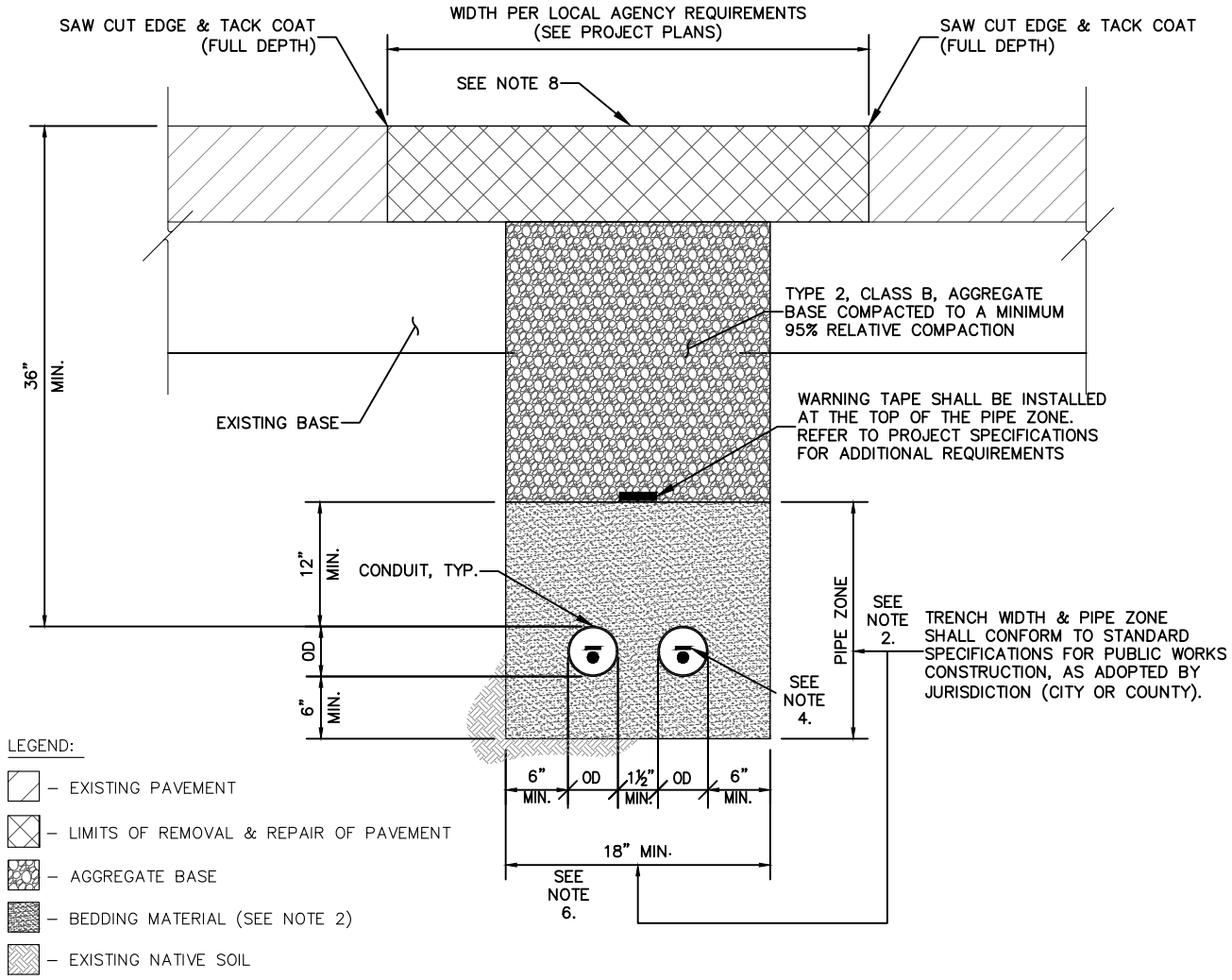
Guide for the Planning, Design and Operation of Pedestrian Facilities, AASHTO, 2004



NOTES:

1. ALL MATERIALS AND INSTALLATION PROCEDURES SHALL BE IN ACCORDANCE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION (SSPWC) AS ADOPTED BY JURISDICTION (CITY OR COUNTY).
2. BEDDING MATERIAL SHALL BE CLASS A. COMPACTED TO MINIMUM 90% RELATIVE COMPACTION, MATERIALS SHALL CONFORM TO SSPWC SECTION 200.
3. CEMENT SLURRY BEDDING/BACKFILL SHALL NOT BE USED.
4. INSTALL LOCATOR WIRE AND PULL TAPE FOR ALL FUTURE, UNUSED, OR FIBER–OPTIC CONDUITS. LOCATOR WIRE SHALL BE GREEN #8 AWG GAUGE COPPER WIRE THAT ALSO FUNCTIONS AS A BONDING CONDUCTOR CONNECTED AT THE PULL BOX & PULLING TAPE SHALL BE RATED FOR 1250 LB.
5. ALL EXCAVATIONS SHALL CONFORM TO THE LATEST O.S.H.A REQUIREMENTS.
6. TOTAL TRENCH WIDTH SHALL BE 6 INCHES WIDER THAN THE OUTSIDE EDGES OF CONDUIT(S) INSTALLED. USE CONDUIT SPACERS TO SEPARATE MULTIPLE CONDUITS IN TRENCH BY AT LEAST 1.5 INCH. PLACE SPACERS AT INTERVALS OF 5 FEET MAXIMUM. CONDUITS SHALL BE CENTERED IN TRENCH.
7. CONDUIT COUPLINGS SHALL BE STAGGERED.
8. MATCH EXISTING STRUCTURAL SECTION (INCLUDING OPEN GRADE) AND REMOVE EXISTING PAVEMENT AND REPLACE WITH NEW LOCAL AGENCY APPROVED MATERIAL OF SAME TYPE EXISTING PAVEMENT DEPTH, BUT NOT LESS THAN 6 INCHES, AND SEAL NEW SURFACE AS DIRECTED BY THE ENGINEER.
9. NEW ASPHALT AND CONCRETE PAVEMENT MATERIAL SHALL CONFORM TO STANDARD SPECIFICATION FOR PUBLIC WORKS CONSTRUCTION, AS ADAPTED BY JURISDICTION (CITY OR COUNTY).
10. UNLESS OTHERWISE PROVIDED FOR IN THE BASE AND SURFACE SUMMARIES, NEW PAVEMENT MATERIAL AND TRENCHING SHALL NOT BE PAID FOR DIRECTLY BUT INCLUDED IN THE PRICE FOR THE CONDUIT.
11. ENGINEER MAY FOR GOOD CAUSE, REQUIRE WIDER PATCH SECTIONS OR OTHERWISE ALTER THE REQUIREMENTS.
12. IF SAW CUT IS WITHIN 2 FEET OF AN EXISTING PAVEMENT EDGE OR EXISTING PATCH, REMOVE EXISTING PAVEMENT TO THAT EDGE AND REPLACE ENTIRE SECTION. SEE PROJECT PLANS.
13. IF SAWCUT EDGES FOR TRENCH FALL WITHIN A WHEEL PATH, SAWCUT SHALL BE EXTENDED TO, AND REMOVAL MADE TO EDGE OF THE TRAVEL LANE. OPTIONALLY THE ENTIRE TRAVEL LANE CAN BE ROTOMILLED TO A DEPTH OF 2 INCHES AND OVERLAYED WITH 2 INCHES OF BITUMINOUS PLANTMIX AS DIRECTED BY THE ENGINEER.
14. CONTRACTOR SHALL BE RESPONSIBLE FOR REPLACEMENT OF LOOP DETECTORS, ADJUSTMENTS OF UTILITIES AND SURVEY MONUMENTS TO GRADE AND INSTALLATION OF TEMPORARY PAVEMENT MARKINGS.
15. LONGITUDINAL TRENCHING IN SHOULDER: IF SHOULDER IS 4–FOOT WIDE OR LESS, REMOVE ALL SURFACE MATERIAL FROM EDGE OF TRAVEL LANE, OR THE SHOULDER IF IT IS PAVED, MARKED SHOULDER, OR THE BIKE LANE IF IT IS PAVED, MARKED BIKE LANE.

	STANDARD DETAILS FOR ITS CONSTRUCTION	DRAWING No.
RTC	ITS CONDUIT TRENCH IN PAVEMENT (LONGITUDINAL)	RTC-ITS-01.01
		APPROVED BY: / DATE: 2/2023



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4. INSTALL LOCATOR WIRE AND PULL TAPE FOR ALL FUTURE, UNUSED, OR FIBER–OPTIC CONDUITS. LOCATOR WIRE SHALL BE GREEN #8 AWG GAUGE COPPER WIRE THAT ALSO FUNCTIONS AS A BONDING CONDUCTOR CONNECTED AT THE PULL BOX & PULLING TAPE SHALL BE RATED FOR 1250 LB.
5. ALL EXCAVATIONS SHALL CONFORM TO THE LATEST O.S.H.A REQUIREMENTS.
6. TOTAL TRENCH WIDTH SHALL BE 6 INCHES WIDER THAN THE OUTSIDE EDGES OF CONDUIT(S) INSTALLED. USE CONDUIT SPACERS TO SEPARATE MULTIPLE CONDUITS IN TRENCH BY AT LEAST 1.5 INCH. PLACE SPACERS AT INTERVALS OF 5 FEET MAXIMUM. CONDUITS SHALL BE CENTERED IN TRENCH.
7. CONDUIT COUPLINGS SHALL BE STAGGERED.
8. MATCH EXISTING STRUCTURAL SECTION (INCLUDING OPEN GRADE) AND REMOVE EXISTING PAVEMENT AND REPLACE WITH NEW LOCAL AGENCY APPROVED MATERIAL OF SAME TYPE EXISTING PAVEMENT DEPTH, BUT NOT LESS THAN 6 INCHES, AND SEAL NEW SURFACE AS DIRECTED BY THE ENGINEER.
9. NEW ASPHALT AND CONCRETE PAVEMENT MATERIAL SHALL CONFORM TO STANDARD SPECIFICATION FOR PUBLIC WORKS CONSTRUCTION, AS ADAPTED BY JURISDICTION (CITY OR COUNTY).
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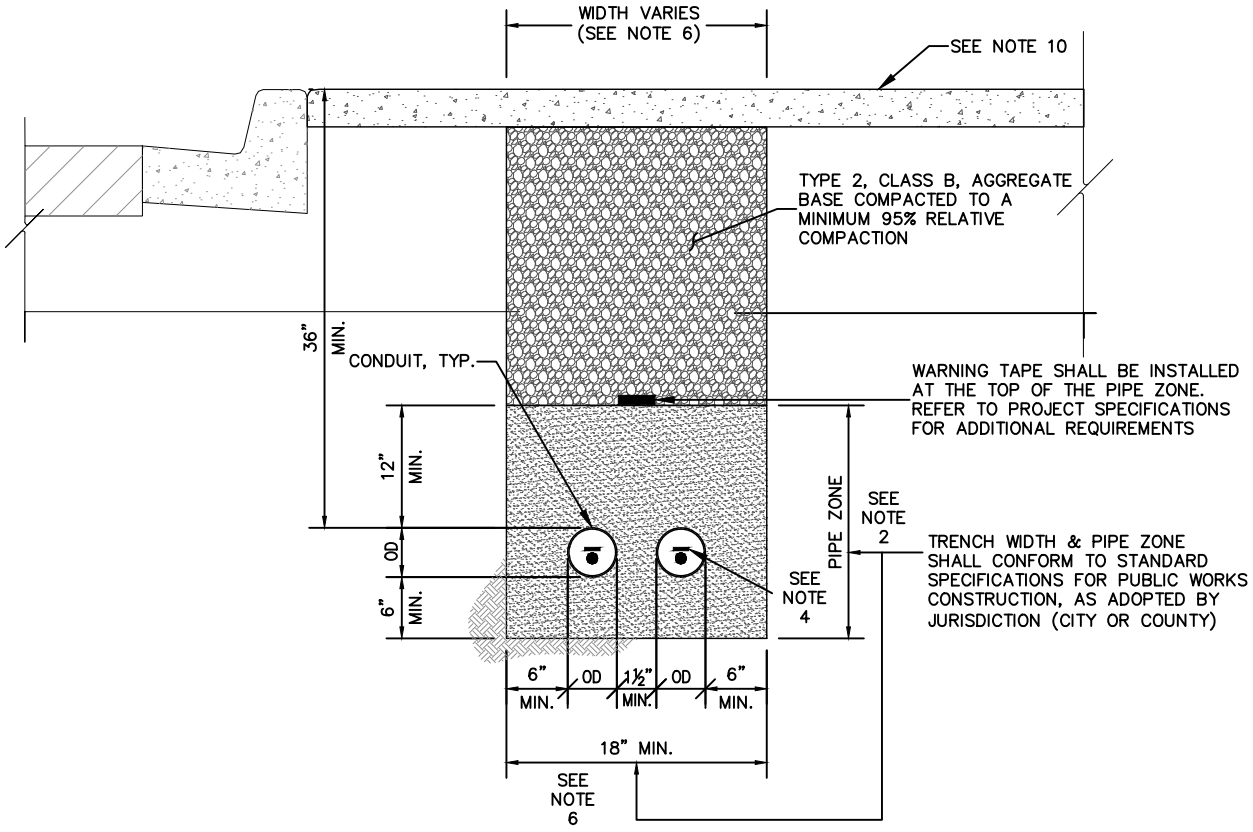
14. CONTRACTOR SHALL BE RESPONSIBLE FOR REPLACEMENT OF LOOP DETECTORS, ADJUSTMENTS OF UTILITIES AND SURVEY MONUMENTS TO GRADE AND INSTALLATION OF TEMPORARY PAVEMENT MARKINGS.

	STANDARD DETAILS FOR ITS CONSTRUCTION	DRAWING No.
RTC	ITS CONDUIT TRENCHING IN PAVEMENT (TRANSVERSE)	RTC-ITS-01.02
		APPROVED BY: / DATE: 2/2023



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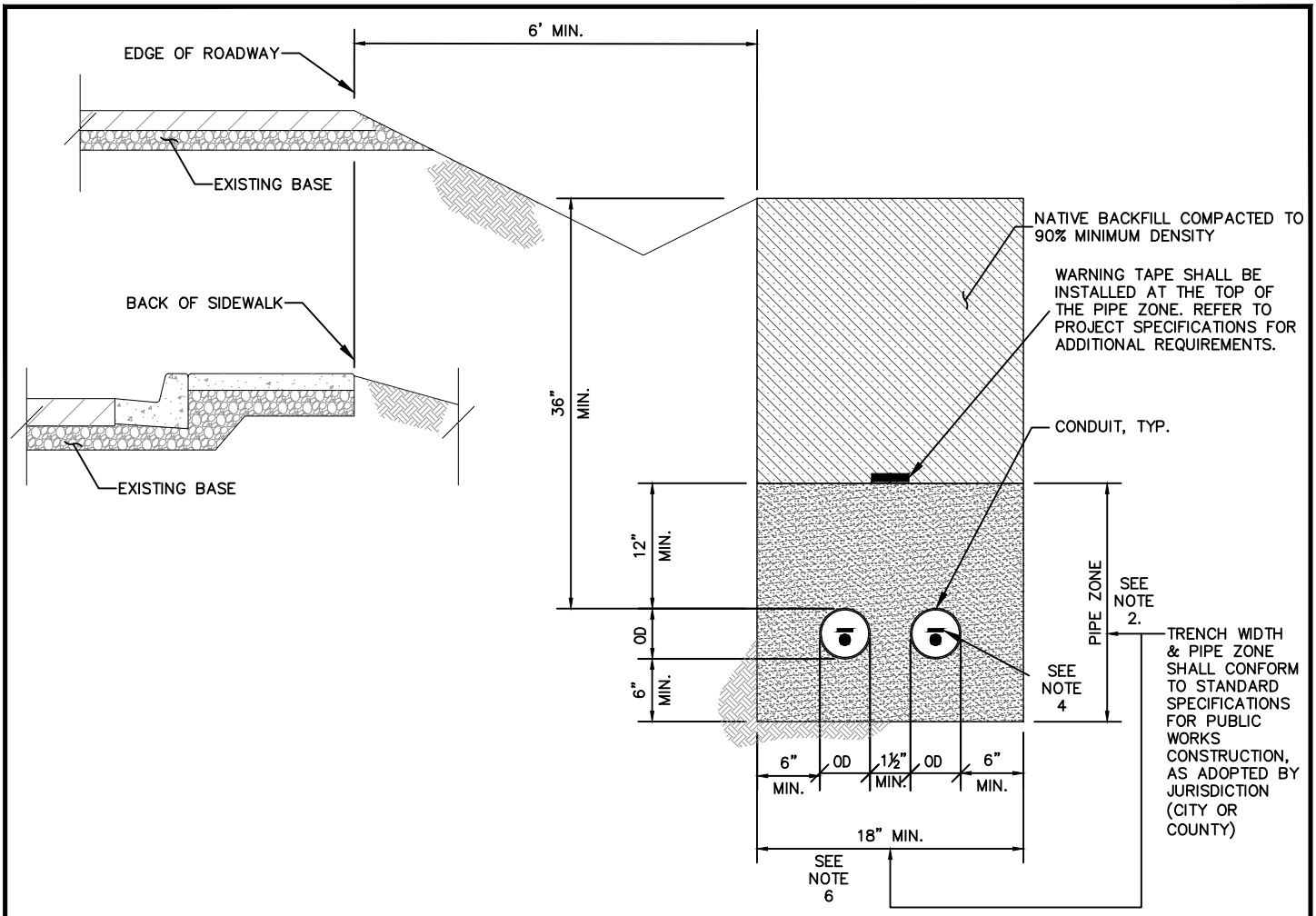
3. CEMENT SLURRY BEDDING/BACKFILL SHALL NOT BE USED.
4. INSTALL LOCATOR WIRE AND PULL TAPE FOR ALL FUTURE, UNUSED, OR FIBER–OPTIC CONDUITS. LOCATOR WIRE SHALL BE GREEN #8 AWG GAUGE COPPER WIRE THAT ALSO FUNCTIONS AS A BONDING CONDUCTOR CONNECTED AT THE PULL BOX & PULLING TAPE SHALL BE RATED FOR 1250 LB.
5. ALL EXCAVATIONS SHALL CONFORM TO THE LATEST O.S.H.A REQUIREMENTS.
6. TOTAL TRENCH WIDTH SHALL BE 6 INCHES WIDER THAN THE OUTSIDE EDGES OF CONDUIT(S) INSTALLED. USE CONDUIT SPACERS TO SEPARATE MULTIPLE CONDUITS IN TRENCH BY AT LEAST 1.5 INCH. PLACE SPACERS AT INTERVALS OF 5 FEET MAXIMUM. CONDUITS SHALL BE CENTERED IN TRENCH.
7. CONDUIT COUPLINGS SHALL BE STAGGERED.
8. RETURN DISTURBED AREA TO MATCH EXISTING GRADE.
9. ENGINEER MAY FOR GOOD CAUSE, REQUIRE WIDER FINISH GRADE RESTORATION IN DISTURBED AREAS. SEE PROJECT PLANS.
10. REFER TO CITY OR COUNTY SPECIFIC STANDARD DETAILS OF CONCRETE PATCH.

LEGEND:

- – EXISTING PAVEMENT
- – EXISTING NATIVE SOIL
- – NATIVE BACKFILL (90% MAX DENSITY)
- – BEDDING MATERIAL (SEE NOTE 2)
- – CONCRETE CURB, GUTTER, OR SIDEWALK

	STANDARD DETAILS FOR ITS CONSTRUCTION	DRAWING No.
RTC	ITS CONDUIT TRENCH BELOW SIDEWALK	RTC-ITS-01.03
		APPROVED BY: / DATE: 2/2023



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7. CONDUIT COUPLINGS SHALL BE STAGGERED.
8. RETURN DISTURBED AREA TO MATCH EXISTING GRADE AND MATERIALS.
9. NATIVE BACKFILL ACCEPTABLE WHEN SPECIFIED ON PLANS OR APPROVED IN WRITING BY THE ENGINEER. NATIVE BACKFILL SHALL NOT CONTAIN ROCKS LARGER THAN 3-INCHES.

LEGEND:

- – EXISTING PAVEMENT
- – EXISTING NATIVE SOIL
- – NATIVE BACKFILL (90% MAX DENSITY)
- – BEDDING MATERIAL (SEE NOTE 2)
- – CONCRETE CURB, GUTTER, OR SIDEWALK

RTC	STANDARD DETAILS FOR ITS CONSTRUCTION	DRAWING No.
	ITS CONDUIT TRENCH IN NATIVE SOIL	RTC-ITS-01.04
		APPROVED BY: / DATE: 2/2023

RTC

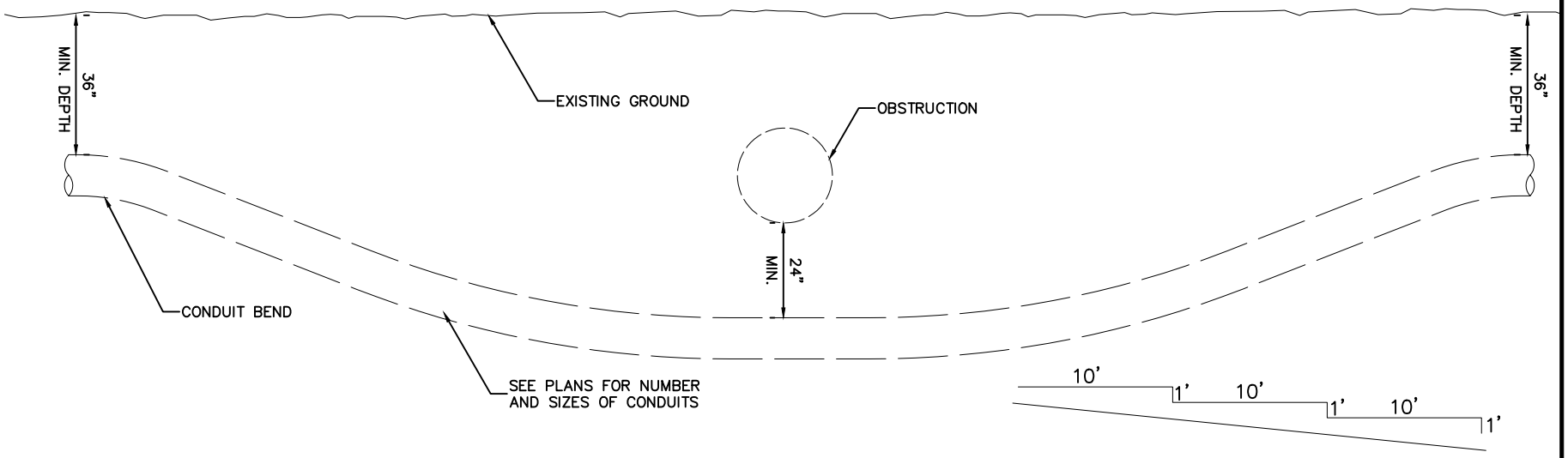
CONDUIT ROUTING
OBSTRUCTION AVOIDANCE

STANDARD DETAILS FOR ITS CONSTRUCTION

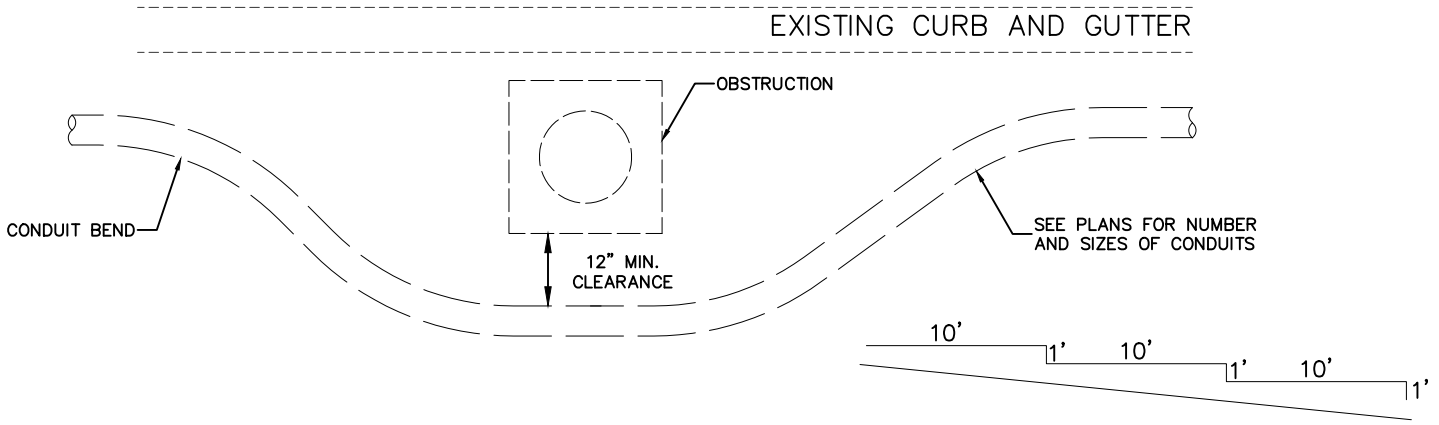
DRAWING No.
RTC-ITS-02.01

APPROVED BY:

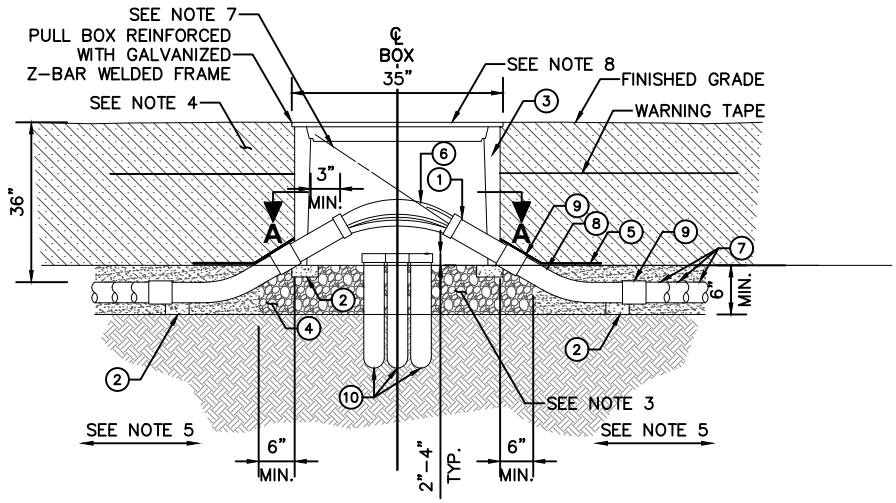
DATE: 2/2023

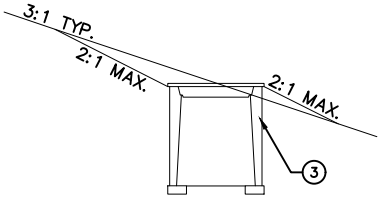


TYPICAL VERTICAL ROUTING OF CONDUIT UNDER AN OBSTRUCTION

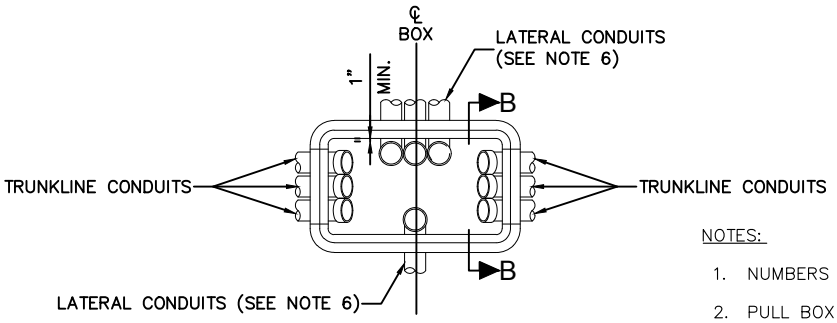


TYPICAL ROUTING OF CONDUIT AROUND AN OBSTRUCTION

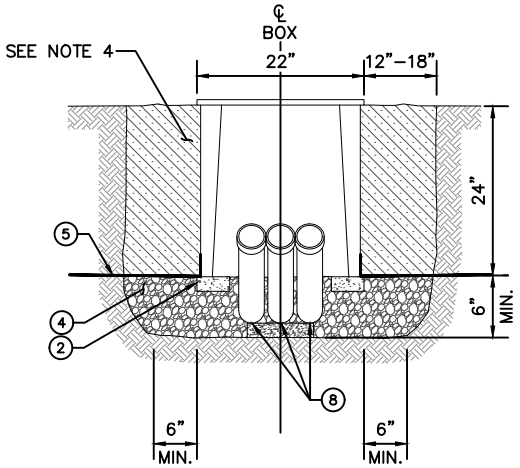




INSTALLATION IN SLOPED AREAS



SECTION A-A



SECTION B-B

MATERIAL LIST	
ITEM	DESCRIPTION
①	BELL END FOR PVC (SEE NOTE 9)
②	CONCRETE BUILDING BLOCK 2"X4"X8"
③	ITS PULL BOX 24" DEEP X 35"L X 22"W
④	AGGREGATE SIZE NO. 57 (SEE NOTE 3)
⑤	30 LB. FELT PAPER (SEE NOTE 10)
⑥	CABLES (SEE NOTE 12)
⑦	CONDUIT QUANTITY AND SIZES PER PLANS
⑧	30 DEGREE ELBOW, 18" RADIUS
⑨	PVC COUPLING
⑩	45 DEGREE PVC ELBOW, 18" RADIUS

NOTES:

1. NUMBERS IN CIRCLES REFER TO ITEMS IN MATERIALS LIST.
2. PULL BOX EXTENSIONS SHALL NOT BE USED UNLESS APPROVED BY THE OWNING AGENCY.
3. BACKFILL WITH NO. 57 AGGREGATE, 6" MINIMUM BELOW PULL BOX AND EXTEND 6" MINIMUM BEYOND PULL BOX EDGES ON ALL 4 SIDES. BACKFILL AROUND SIDES OF PULL BOX WITH SELECT EXCAVATED MATERIAL AND COMPACT AT 95% MAXIMUM DENSITY.
4. NATIVE BACKFILL COMPACTED TO 90% MAXIMUM DENSITY AROUND ALL 4 SIDES OF PULL BOX. NATIVE BACKFILL SHALL NOT CONTAIN ROCKS LARGER THAN 3 INCHES.
5. CONDUIT FROM THE TYPICAL TRENCH SECTION SHALL NOT DEFLECT BY MORE THAN 1 INCH PER FOOT FROM THE ALIGNMENT PRECEDING OR FOLLOWING THE PULL BOX.
6. LATERAL CONDUITS AS REQUIRED. LATERAL CONDUITS SHALL NOT BE USED FOR TRUNKLINE FIBER CABLES (I.E., 72 SMFO OR GREATER STRAND COUNT).
7. TRUNK CONDUITS WITH SHALL BE ALIGNED WITH PULL BOX ℄ TO MINIMIZE BENDING DURING CABLE PULLING.
8. REINFORCED $\frac{1}{2}$" MINIMUM STEEL PLATE COVER WITH EMBOSSED NON-SKID PATTERN. GALVANIZE PLATE AFTER FABRICATION, AND BED WELD COVER LEGEND 1" MIN TO 3" MAX IN HEIGHT. COVER LEGEND SHALL BE PER OWNING JURISDICTION (E.G., "RENO ITS", "SPARKS ITS" OR "COUNTY ITS".
9. SEAL ALL CONDUIT ENDS WITH CONDUIT PLUGS ON EACH CONDUIT AND SEAL ALL INNERDUCT ENTERING THE PULL BOX WITH A DUCT SEALING COMPOUND.
10. USE FELT PAPER TO BLOCK OPENING BETWEEN CONDUITS AND AROUND BASE TO PREVENT BACKFILL MATERIAL FROM ENTERING BOX AND SUMP PIT.
11. PULL BOX COVER, METAL Z-BAR FRAME, METAL RINGS, OR ANY OTHER METALLIC COMPONENT OF THE PULL BOX SHALL BE BONDED TO A NO. 8 AWG OR LARGER COPPER EQUIPMENT GROUNDING CONDUCTOR. BONDING JUMPER SHALL BE BRAIDED COPPER EQUIVALENT TO A NO. 8 CONDUCTOR AND A MINIMUM OF 36" IN LENGTH AND SHALL BE ATTACHED WITH EXOTHERMIC WELDING. PROCESS IS A MOLECULAR BONDING WITH HIGH COPPER CONTENT ALLOYS (IN EXCESS OF 90%), HIGH CORROSION RESISTANCE AND HIGH CONDUCTIVITY, AND APPROVED GROUNDING LUG.
12. ALL POWER AND COMMUNICATIONS CABLE SHALL BE TAGGED WITH CABLE IDENTIFICATION. REFER TO CABLE SPECIFICATIONS FOR CABLE SLACK REQUIREMENTS.

RTC

STANDARD DETAILS FOR ITS CONSTRUCTION

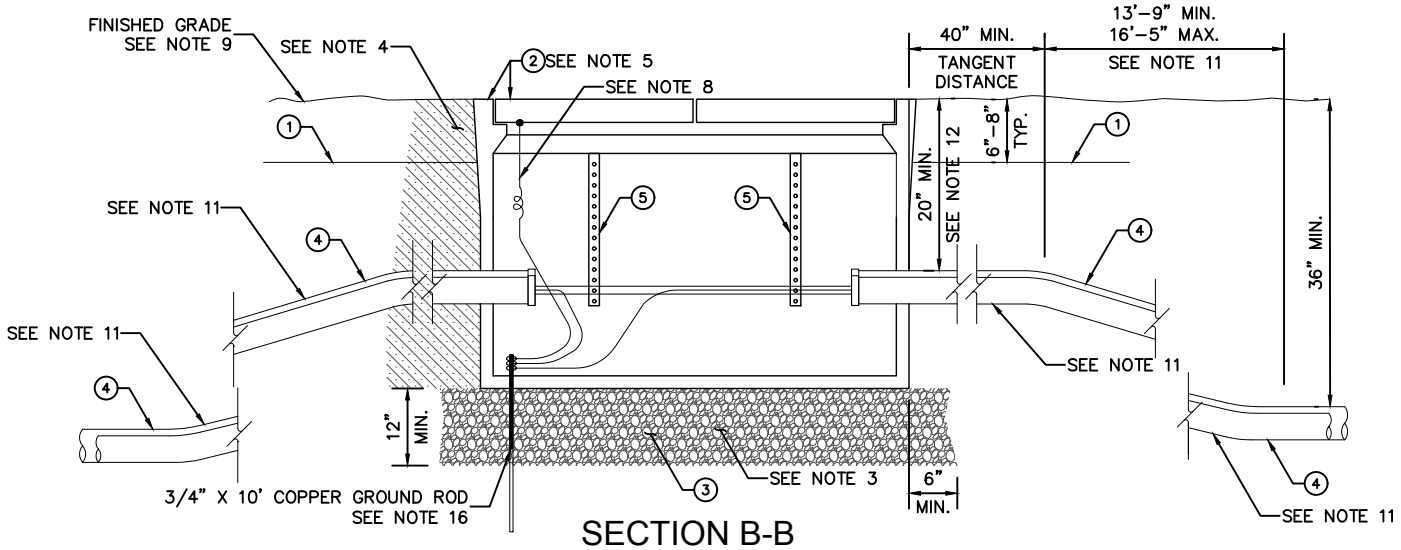
ITS PULL BOX

DRAWING No.

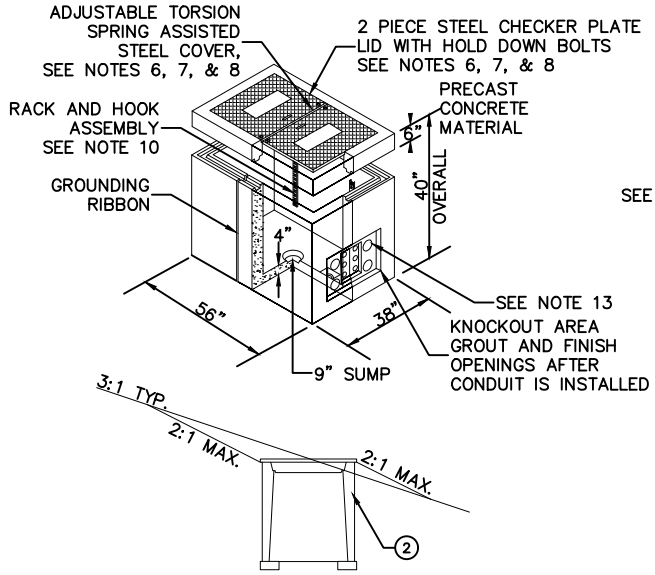
RTC-ITS-03.01

APPROVED BY:

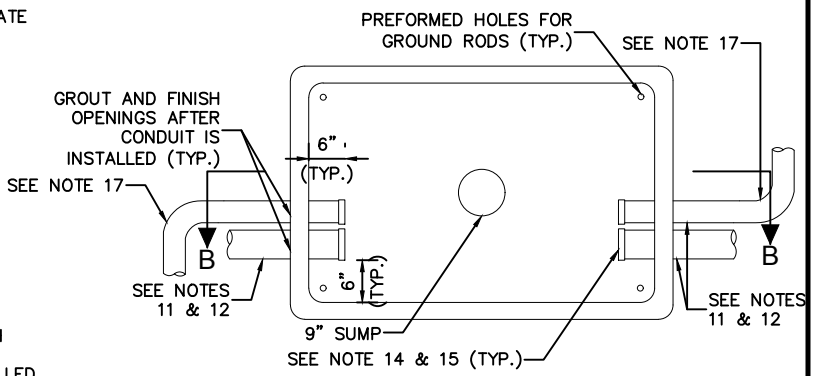
DATE: 2/2023



SECTION B-B



INSTALLATION IN SLOPED AREAS



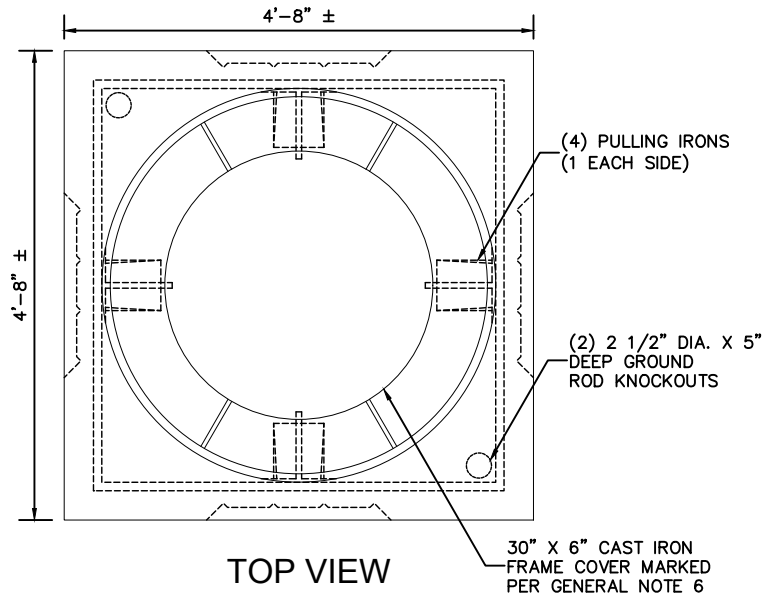
PLAN VIEW

TABLE	
ITEM	DESCRIPTION
1	WARNING TAPE
2	ITS VAULT WITH LID (SEE NOTE 5)
3	AGGREGATE SIZE NO.57 (SEE NOTE 3)
4	CONDUIT QUANTITY AND SIZES PER PLANS
5	RACK & HOOK ASSEMBLY (SEE NOTE 10)

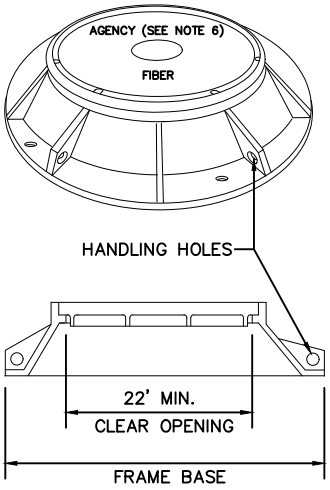
NOTES:

1. FOR USE AT FIBER OPTIC SPLICE POINTS.
2. SUITABLE FOR USE IN OFF STREET LOCATIONS WHERE NOT SUBJECT TO HIGH DENSITY TRAFFIC. IT SHALL NOT BE USED IN TRAVEL OR PARKING LANES.
3. BACKFILL WITH NO. 57 AGGREGATE, 12" MINIMUM BELOW PULL BOX AND EXTEND 6" MINIMUM BEYOND PULL BOX EDGES ON ALL 4 SIDES. BACKFILL AROUND SIDES OF PULL BOX WITH SELECT EXCAVATED MATERIAL AND COMPACT AT 95% MAXIMUM DENSITY.
4. NATIVE BACKFILL COMPACTED TO 90% MAXIMUM DENSITY AROUND ALL 4 SIDES OF VAULT. NATIVE BACKFILL SHALL NOT CONTAIN ROCKS LARGER THAN 3 INCHES.
5. PULL BOX AND STEEL COVER SHALL SUPPORT AASHTO H20-44 TRUCK LOADING WITH MINIMUM INSIDE DIMENSIONS – 30"H X 48"L X 30"W
6. SUPPLY PENTA HEAD BOLTS TO LOCK DOWN LID. ONE PENTA HEAD SOCKET AND RATCHET SHALL BE PROVIDED TO OWNING AGENCY FOR EVERY 10 PULL BOXES.
7. COVER MARKED PER OWNING JURISDICTION (E.G. "RENO FIBER", "SPARKS FIBER", OR "COUNTY FIBER")
8. ALL METAL PULL BOX LIDS SHALL BE GROUNDED. THE BONDING CONDUCTOR SHALL BE A #8 AWG COPPER WIRE (7-STRAND), OR COPPER BRAID OF THE SAME CROSS-SECTIONAL AREA AS A #8 AWG, 8 FEET IN LENGTH, FROM EACH SIDE OF THE COVER TO THE GROUND ROD. FASTEN THE #8 AWG CONDUCTOR TO THE COVER BY EXOTHERMIC WELDING.
9. PULL BOX HEIGHT SHALL MATCH EXISTING FINISHED GRADE.
10. ALL PULL BOXES SHALL BE FURNISHED WITH TWO RACKS AND HOOKS INSTALLED ON EACH OF THE TWO LONG SIDES.
11. CONDUITS FROM THE TYPICAL TRENCH SECTION SHALL NOT DEFLECT BY MORE THAN ONE FOOT PER 10 FEET FROM THE ALIGNMENT PRECEDING OR FOLLOWING PULL BOX ENTRANCE/EXIT.
12. TOP OF CONDUITS ENTERING THROUGH SIDE OF PULL BOX SHALL BE LOCATED AT LEAST 20 INCHES BELOW EXISTING FINISHED GRADE.
13. CONDUITS SHALL ENTER THROUGH KNOCKOUTS
14. SEAL ALL CONDUIT ENDS WITH CONDUIT PLUGS ON EACH CONDUIT AND SEAL ALL INNERDUCT ENTERING THE PULL BOX WITH A DUCT SEALING COMPOUND.
15. ALL CONDUITS SHALL HAVE BELL ENDS.
16. GROUND CONDUCTORS SHALL BE BONDED AND GROUNDED PER SPECIFICATIONS AS REQUIRED.
17. LATERAL CONDUITS SHALL ENTER THROUGH WALLS WITHIN TWO KNOCKOUT AREAS ONLY.
18. ALL POWER CONDUCTORS INSIDE PULL BOX SHALL BE TAGGED "POWER."
19. NUMBERS IN CIRCLES REFER TO ITEMS IN TABLE.

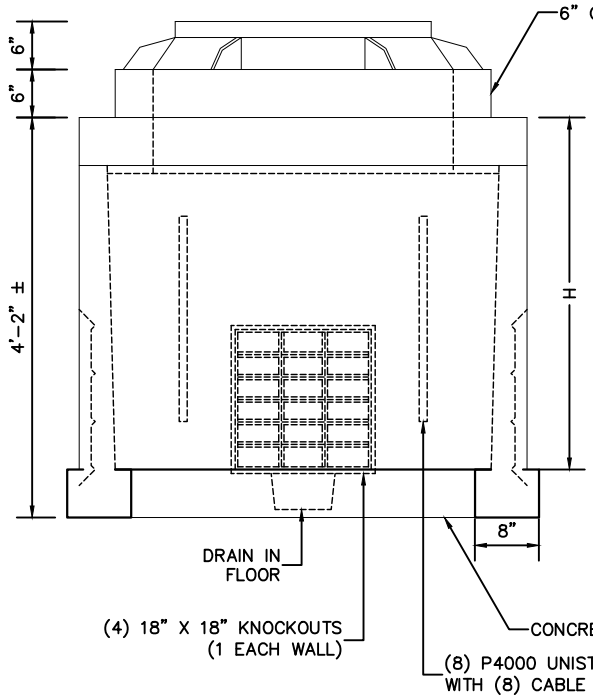
	STANDARD DETAILS FOR ITS CONSTRUCTION	DRAWING No.
RTC	ITS VAULT	RTC-ITS-04.01
		APPROVED BY: / DATE: 2/2023

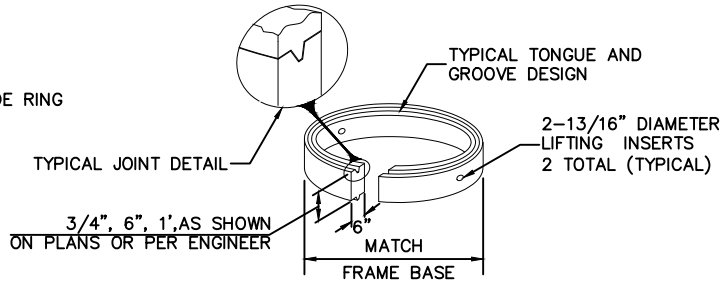


TOP VIEW



STREET RATED ITS VAULT
FRAME AND COVER





STREET RATED ITS VAULT
COLLAR RISER

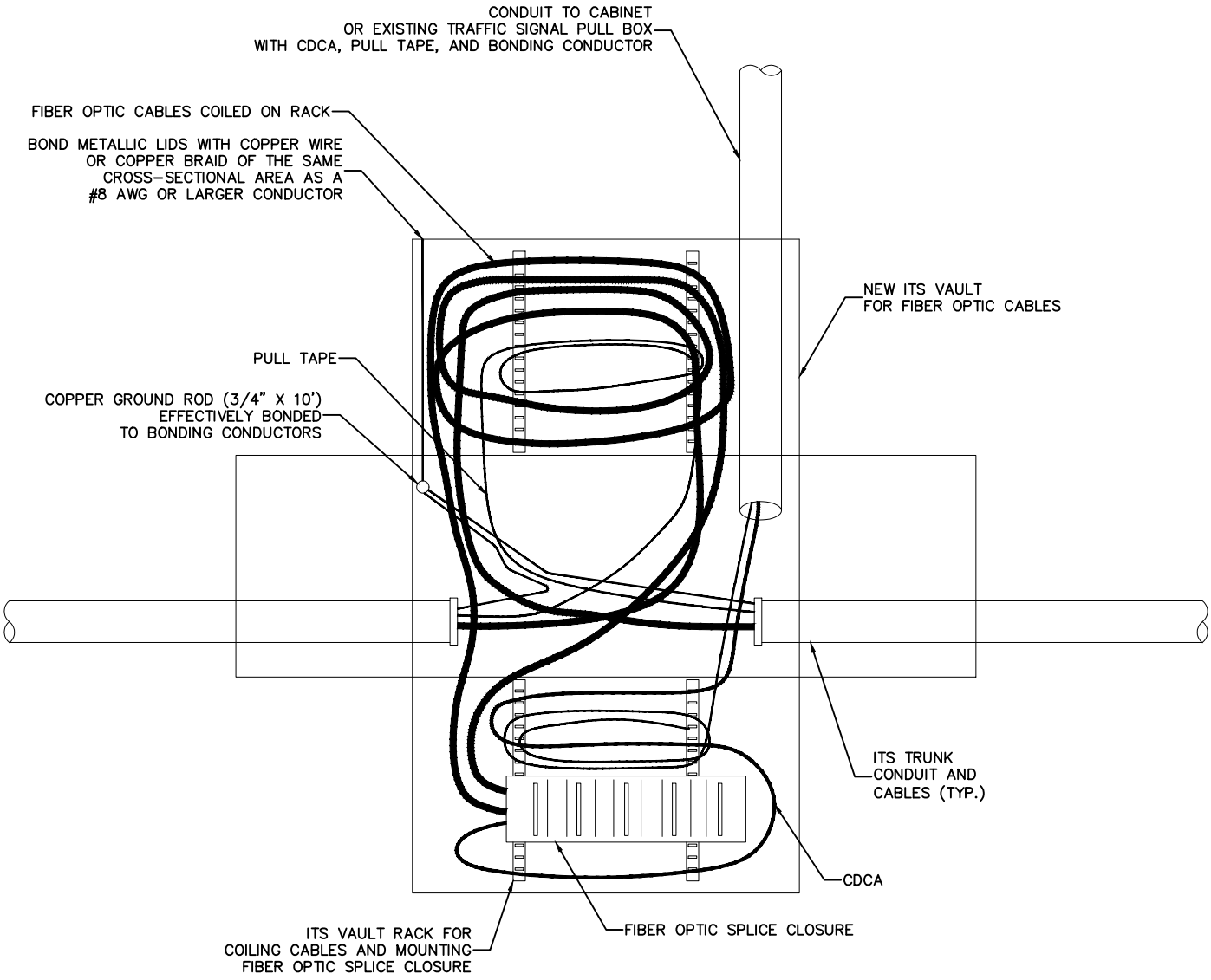
STRUCTURAL NOTES

1.	CONCRETE:	28 DAY COMPRESSIVE STRENGTH fc = 5,000 PSI
2.	REBAR:	ASTM A-615 GRADE 60
3.	MESH:	ASTM A-1064 GRADE 65
4.	DESIGN:	ACI 316-11 BUILDING CODE ASTM C-857 "MINIMUM STRUCTURAL DESIGN LOADING FOR UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURES"
5.	LOADS:	HS20-44 W/30% IMPACT PER AASHTO 80 PSD LATERAL LIVE LOAD SURCHARGE - UP TO 6'-0" DEPTH SOILS: 40 PCF LATERAL SOIL PRESSURE ABOVE WATER TABLE 80 PCF LATERAL SOIL PRESSURE ABOVE WATER TABLE
6.	SOIL COVER:	0' TO 5' (MAX.)
7.	WATER TABLE:	5'-0" BELOW GRADE

GENERAL NOTES:

1. ALL JOINTS SHALL BE SEALED USING CONSEAL CS-101 BUTYL RUBBER ROPE
2. CONTRACTOR TO SUBMIT SHOP DRAWING FOR APPROVAL
3. CONTRACTOR SHALL POUR THE CONCRETE FLOOR, WITH DRAIN, AFTER THE VAULT IS INSTALLED
4. THE CONTRACTOR SHALL GROUT THE KNOCKOUT AREA, AROUND THE CONDUIT, WITH A SMOOTH CONCRETE FINISH AFTER THE VAULT IS INSTALLED
5. MINIMUM TWO (2) FOOT RADIAL CLEARANCE HORIZONTALLY AND VERTICALLY REQUIRED FOR WATER MAINS, SERVICES, AND RELATED WATER FACILITIES
6. COVER MARKED PER OWNING JURISDICTION (E.G., "RENO FIBER", "SPARKS FIBER", OR "COUNTY FIBER")
7. A COMPACTED BASE AND A CONCRETE FOOTING SUPPORT SHALL BE CONSTRUCTED PRIOR TO PLACEMENT OF THE CAST IRON FRAME AS DIRECTED BY ENGINEER.
8. ADJUSTMENTS TO ELEVATIONS SHALL BE MADE WITH COLLAR/RISERS AS REQUIRED. MINIMUM DEPTH 18-INCHES.
9. MINIMUN INSIDE DIMENSION 3'-1"H X 4'-0"W X 4'-0"L

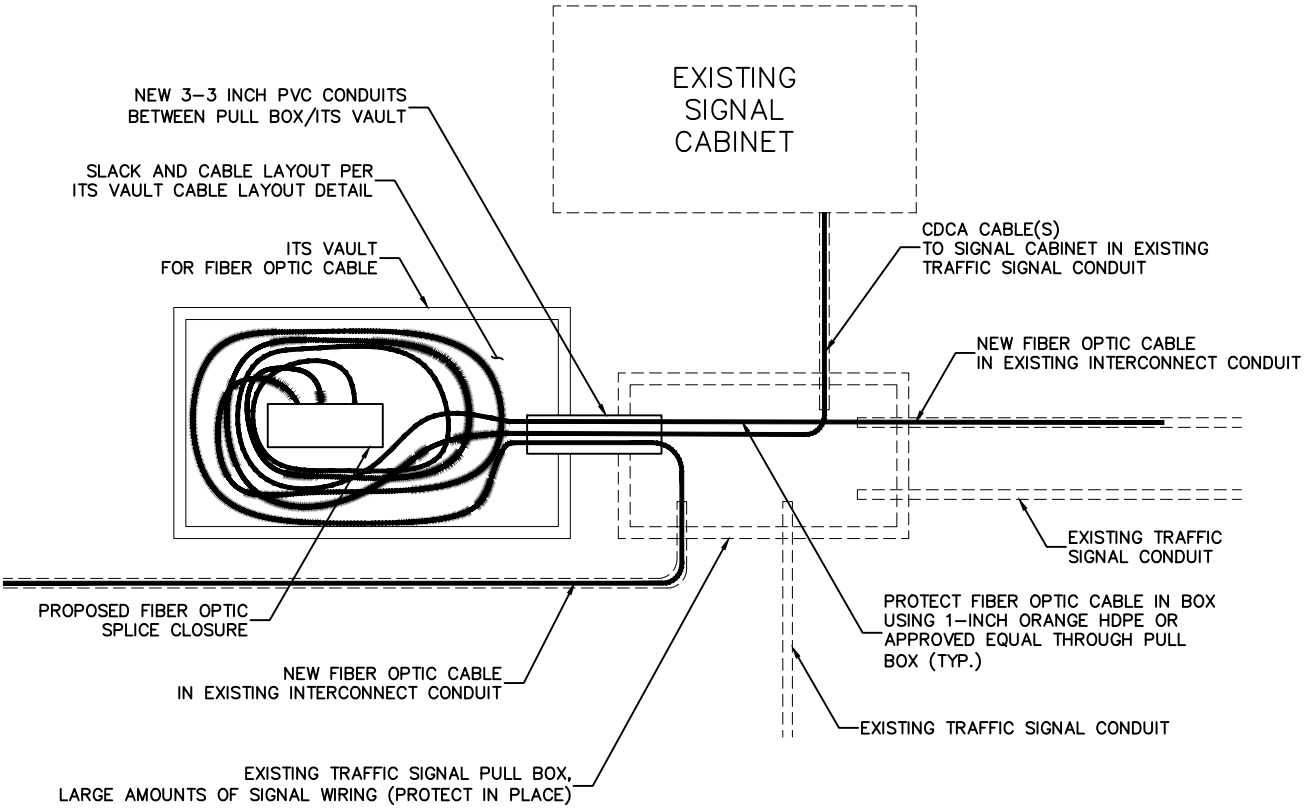
RTC	STANDARD DETAILS FOR ITS CONSTRUCTION	DRAWING No.
	STREET RATED ITS VAULT	RTC-ITS-05.01
		APPROVED BY: / DATE: 2/2023



NOTES:

1. EACH ITS VAULT SHALL BE EQUIPPED WITH 100 FEET MINIMUM OF SLACK PER CONDUIT ENTRANCE FOR EACH TRUNK CABLE AND CDCA.
2. MINIMUM BEND RADIUS FOR ALL CABLES SHALL NOT EXCEED MANUFACTURER'S REQUIREMENTS.
3. THE CONNECTION OF ALL FIBER CABLES (CDCA & TRUNK CABLES) SHALL BE SECURED IN A SPLICE TRAY HOUSED IN THE SPLICE CLOSURE.
4. LIKE CABLES SHALL BE NEATLY COILED, STRAPPED TOGETHER AND ATTACHED TO THE INSIDE WALL OF THE VAULT. FIBER OPTIC CABLES AND SPLICE CLOSURE SHALL BE ATTACHED TO RACKS AND HOOKS.
5. THE CONTRACTOR SHALL ATTACH THE CABLES TO THE RACKING SYSTEM IN ACCORDANCE WITH THE SPECIAL PROVISIONS WITHIN ALL NEW AND EXISTING ITS VAULTS.

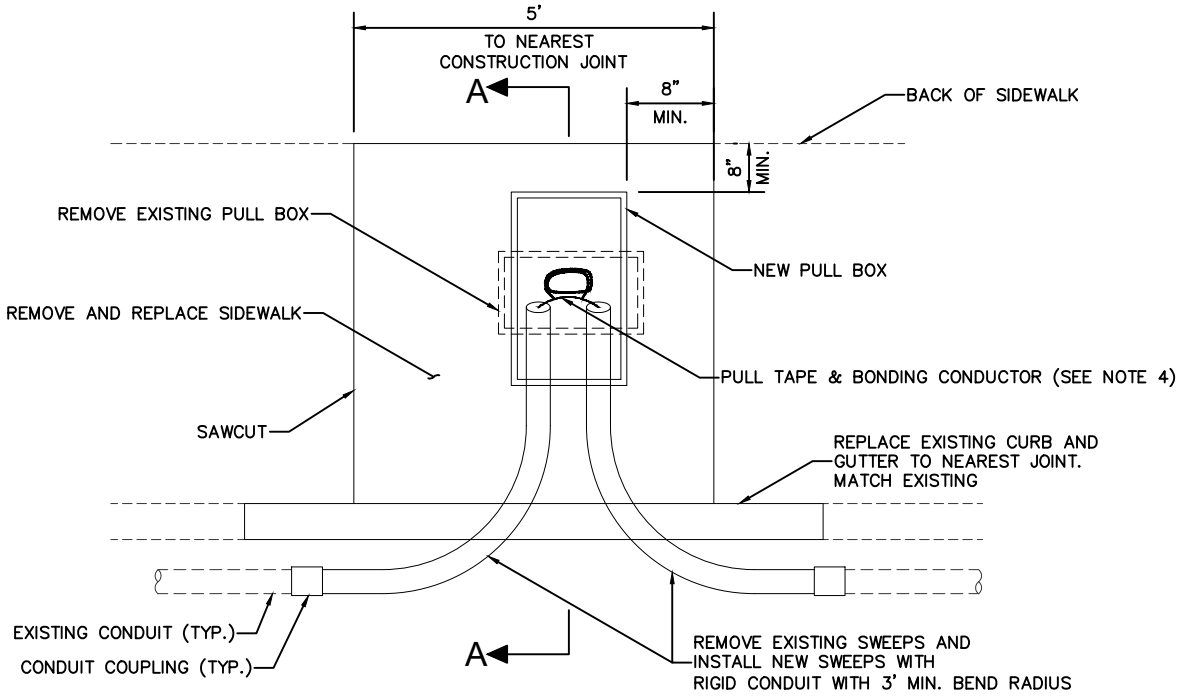
RTC	STANDARD DETAILS FOR ITS CONSTRUCTION	DRAWING No.
	ITS VAULT CABLE LAYOUT	RTC-ITS-06.01
		APPROVED BY: / DATE: 2/2023



NOTES:

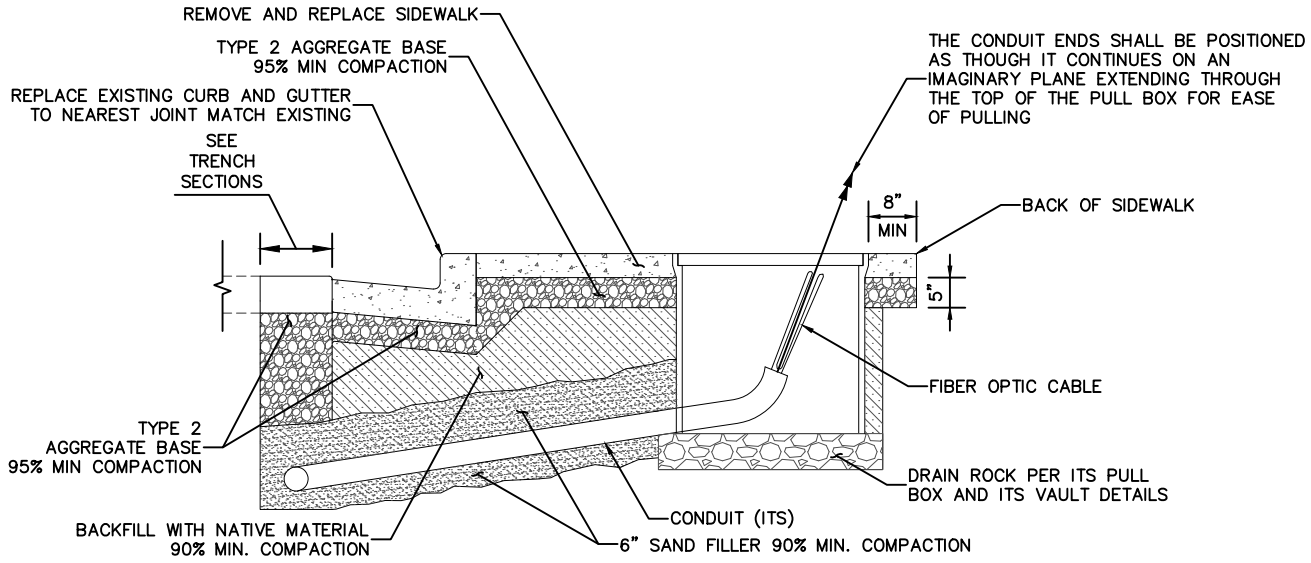
1. CONTRACTOR TO VERIFY LOCATIONS OF EXISTING UTILITIES AND SELECT LOCATION WITHOUT CONFLICT ADJACENT TO EXISTING TRAFFIC SIGNAL PULL BOX.

	STANDARD DETAILS FOR ITS CONSTRUCTION	DRAWING No.
RTC	ITS VAULT FOR INTERCONNECT AT EXISTING SIGNAL LOCATIONS	RTC-ITS-07.01
		APPROVED BY: / DATE: 2/2023



NOTES:

1. ITS PULL BOX AND ITS VAULTS SHALL BE INSTALLED FOR THE ITS SYSTEM IN ACCORDANCE WITH APPLICABLE STANDARDS.
2. ITS PULL BOX OR ITS VAULT COVER SHALL BE INSCRIBED ACCORDING TO APPLICABLE STANDARDS.
3. APPROXIMATE LOCATIONS OF THE PROPOSED ITS PULL BOXES AND VAULTS ARE SHOWN ON THE PLANS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MARKING THE LOCATIONS OF THE PROPOSED PULL BOXES AND VAULTS IN THE FIELD AND THESE LOCATIONS SHALL BE SUBJECT TO APPROVAL BY THE ENGINEER BEFORE INSTALLATION.
4. A 1250–LB PULL TAPE SHALL BE INSTALLED IN ALL CONDUITS WITH AT LEAST 5–FEET OF SLACK IN THE PULL BOX. A GREEN #8 AWG COPPER BONDING CONDUCTOR SHALL BE INSTALLED IN ALL CONDUITS, WITH 5–FEET OF SLACK IN THE PULL BOX, AND BONDED TO THE GROUND ROD WITHIN THE PULL BOX.
5. REFER TO CITY OR COUNTY SPECIFIC STANDARD DETAILS FOR CONCRETE PATCH OR PERMANENT PAVEMENT PATCH.

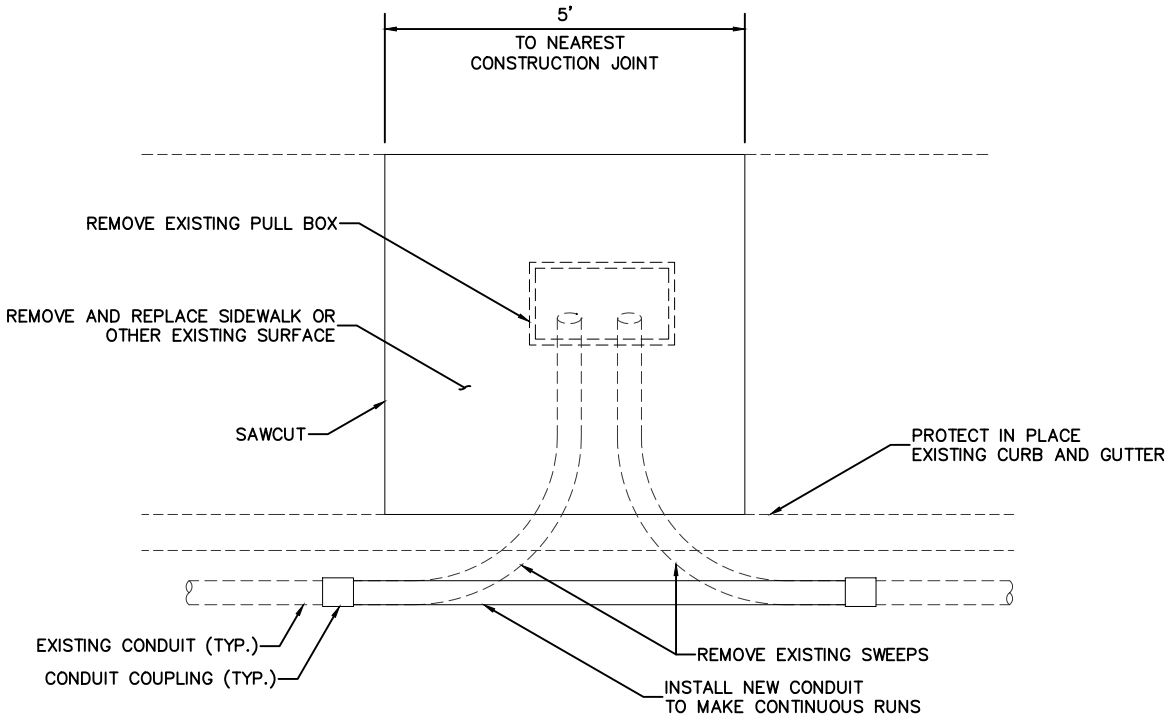


SECTION A - A

NOTES:

1. ITS PULL BOX OR ITS VAULT MAY ALSO BE PLACED NEAR THE BACK OF CURB WITH A MIN. 8" CLEARANCE
2. ITS CONDUIT ENDS MAY ENTER THE BOTTOM OF THE PULL BOX IF NECESSARY

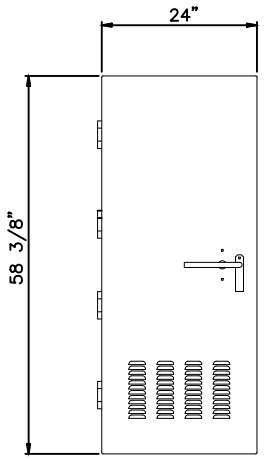
	STANDARD DETAILS FOR ITS CONSTRUCTION	DRAWING No.
RTC	EXISTING PULL BOX REPLACEMENT WITH NEW ITS PULL BOX/VAULT	RTC-ITS-08.01
		APPROVED BY: / DATE: 2/2023



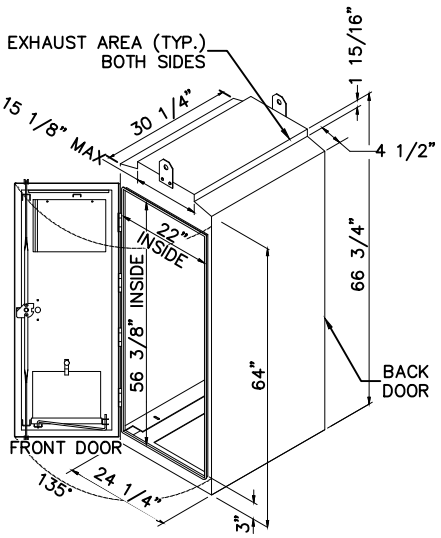
NOTES:

1. REFER TO CITY OR COUNTY SPECIFIC STANDARD DETAILS FOR CONCRETE PATCH OR PERMANENT PAVEMENT PATCH
2. INSTALL A 1250–LB PULL TAPE AND A GREEN #8 AWG COPPER BONDING CONDUCTOR IN ALL CONDUITS, WITH 5–FEET OF SLACK IN THE PULL BOXES AT THE ENDS OF EACH CONDUIT RUN, AND BONDED THE GREEN #8 AWG COPPER BONDING CONDUCTOR TO THE GROUND ROD WITHIN THE PULL BOXES AT EACH END.
3. PAVEMENT PATCHING IN STREET TO BE PAID FOR UNDER PAVEMENT BID ITEM.

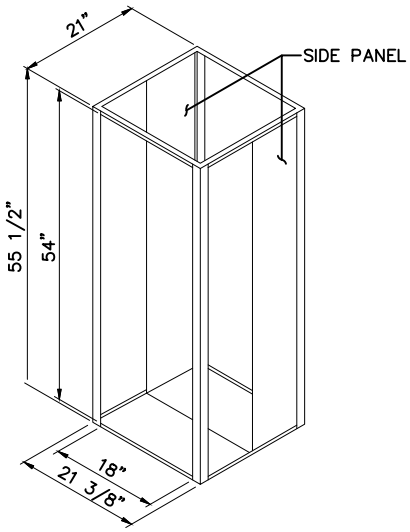
	STANDARD DETAILS FOR ITS CONSTRUCTION	DRAWING No.
RTC	EXISTING PULL BOX REMOVAL AND PATCHING	RTC-ITS-09.01
		APPROVED BY: / DATE: 2/2023



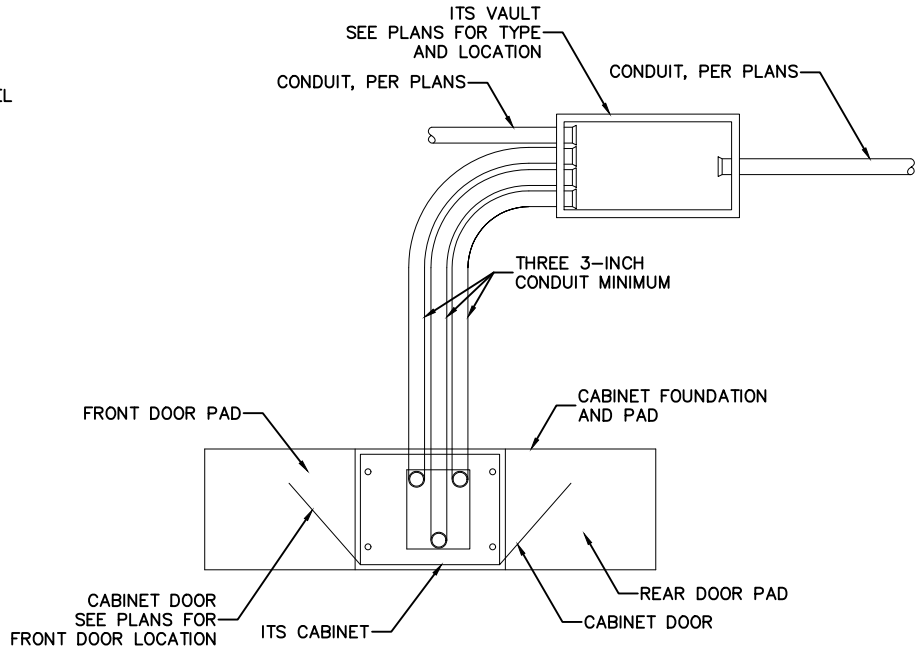
FRONT AND BACK DOOR
FRONT VIEW



ISOMETRIC VIEW



EQUIPMENT RACK
ISOMETRIC VIEW

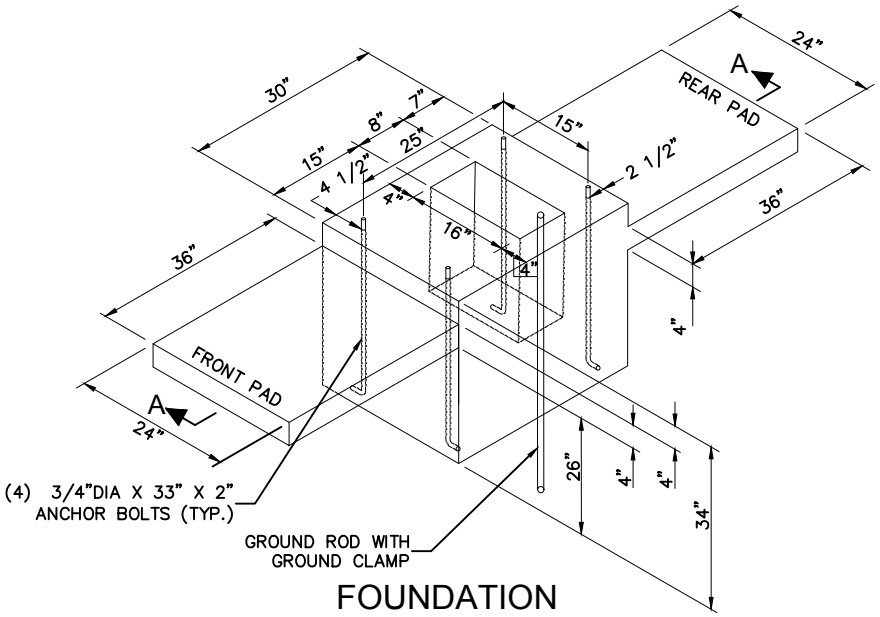


TYPICAL CONDUIT CONFIGURATION DETAIL
FOR ITS CABINET INSTALLATION

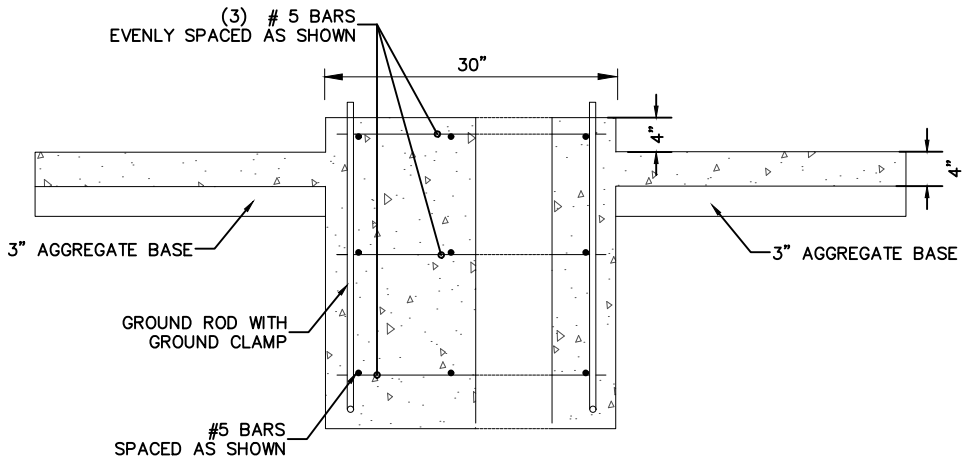
NOTES:

1. CONCRETE SHALL BE 28 DAY COMPRESSION STRENGTH Fc = 4500 PSI.
2. ROUGH BROOM TEXTURE ON FRONT AND REAR PADS.
3. INSTALL GROUND ROD WIRE CONDUIT IN ALL CABINET FOUNDATIONS. GROUND ROD WIRE CONDUIT TO BE USED WHEN AN ADDITIONAL GROUND ROD IS REQUIRED.
4. CABINETS SHALL BE PAINTED INSIDE AND OUT.
5. CABINET SHALL HAVE AN ELECTRONIC INDUSTRY ALLIANCE (EIA) 19-INCH RACK.

	STANDARD DETAILS FOR ITS CONSTRUCTION	DRAWING No.
RTC	COMMUNICATIONS HUB CABINET	RTC-ITS-10.01
		APPROVED BY: / DATE: 2/2023



FOUNDATION



SECTION A-A

RTC	STANDARD DETAILS FOR ITS CONSTRUCTION	DRAWING No.
	COMMUNICATION HUB CABINET FOUNDATION	RTC-ITS-10.02
		APPROVED BY: / DATE: 2/2023