NATIONAL RENEWABLE ENERGY LABORATORY

Temporary Traffic Control Manual
For
Roadway Construction, Utility Work, and Maintenance Operations

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15013 Denver West Parkway
Golden, CO 80401
Phone 303-275-3000

NREL is a national laboratory of the U.S. Department of Energy
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Temporary Traffic Control Manual

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Temporary Traffic Control Manual

For

Roadway Construction, Utility Work, and Maintenance Operations on the National Renewable Energy Laboratory Campuses

Executive Summary

This manual is issued as a supplement to the Manual on Uniform Traffic Control Devices (MUTCD) and is intended for any Subcontractor, Utility Company, Service Provider, and NREL Staff that perform any work within the NREL roadways which includes streets, parking lots or structures, and pedestrian walkways. The document identifies the minimum needs for traffic control measures and devices required at work sites, establishes responsibility for traffic controls, defines the Temporary Traffic Control Plan (TTCP) review and approval process, and provides typical traffic control applications relevant to the National Renewable Energy Laboratory (NREL) campuses. The primary goal of this manual is to increase awareness of the need for proper traffic control in work zones to ensure safe completion of construction and maintenance operations.

Introduction

Construction and maintenance areas have significantly higher than average accident rates and care should be taken in the design and application of traffic control devices and techniques in these areas. Traffic safety needs to be an integral part of all projects that impact the travelled ways of motorized vehicles, pedestrians, and bicycles through construction and/or maintenance activities. The National Renewable Energy Laboratory has developed this supplemental manual to the MUTCD to aid subcontractors, utility providers, and maintenance personnel in implementing safe and efficient methods for handling traffic in work zones.

A “work zone” is the zone in which an activity occurs that impedes or has the potential to impede the normal traffic flows of motorists, bicyclists, and pedestrians within the NREL roadways. Work zone activities includes items such as construction, maintenance operations, security and emergency preparedness responses and activities, EHS responses and activities, snow clearing and plowing operations, shuttle operations, deliveries and pickups (NREL and commercial), equipment servicing, refilling gas and liquid storage containers, campus events, and any other activity that may interfere with or cause a distraction to normal roadway operations.

The Manual on Uniform Traffic Control Devises (MUTCD) and the Traffic Control Devices Handbook, distributed by the Institute for Traffic Engineers, are the recognized national standards for designing, applying, and planning traffic control devices. This supplement is not intended to replace these publications, only to provide standard practices for specific conditions on the National Renewable Energy Laboratory Campuses. Any TTCP prepared for

the NREL campus should conform to, or be of higher standards than the methods outlined in these publications.

NREL has appointed a Traffic Safety Authority Having Jurisdiction (AHJ) who is responsible for interpreting codes, regulations, and standards, and approving equipment, installations, and/or procedures used at NREL, that pertain to traffic safety including all travelled ways for motor vehicles, bicycles, and pedestrians as well as parking lots/facilities.

Goals

Safety for road users including motorists, motorcyclists, bicyclists, pedestrians, and workers is the primary goal of the Temporary Traffic Control Plan (TTCP) at NREL. To support this goal, a TTCP needs to provide for the reasonably safe and effective movements of vehicles, bicyclists, and pedestrians through a work zone while reasonably protecting the road users, workers, emergency responders, equipment, and property. Traffic control devices at work sites are necessary to protect road users from encountering unexpected requirements and/or difficult maneuvers. Unusual, unrecognized, or unclear traffic control devices can have potentially negative effects on the road users ability to navigate the work zone in a safe and efficient manner.

MUTC Section 6A.01 General

Standard:

The needs and control of all road users (motorists, bicyclists, and pedestrians) within the highway, or on private roads open to public travel, including persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (ADA), Title II, Paragraph 35.130, through a TTC zone shall be an essential part of highway construction, utility work, maintenance operations, and the management of traffic incidents.

Consistency in device appearance and use throughout the NREL campuses will enhance driver understanding of the device meaning and intent and will result in a safer and more effective traffic control mechanism. With this goal in mind, all traffic control devices must meet or exceed the standards in the latest edition of the MUTCD or as provided in this manual where such is more restrictive.

Maintenance of traffic control devices is extremely important for continued effectiveness of the device and its ability to convey its meaning and intent. All traffic control devices installed by any Subcontractor, Utility Company, Service Provider, and NREL Staff shall be regularly inspected and maintained throughout the duration of the work activity to ensure that all required traffic control devices are in their proper places, are functioning as intended, and that all sign faces are clean, legible, and have proper reflectivity. Maintenance includes cleaning or replacing dirty, missing or damaged devices. Any device determined to be in an unacceptable condition by the NREL AHJ or authorized designee shall be promptly removed and replaced.

NREL recognizes that for some short duration activities within the roadway zone it may not be practical to prepare a project specific TTCP. Therefore, the NREL Traffic Safety AHJ has determined that Mobile (less than 30 minutes) or Short Duration work (less than 1 hour) for certain types of activities can be accomplished through the use of prescribed minimum safety procedures and should not require a project specific TTCP. The types of activities envisioned include security and emergency preparedness activities and responses, EHS responses and authorized activities. snow clearing and plowing operations, shuttle operations. minor maintenance activities, landscape repairs, weed control, mowing, utility inspections, NREL S/R and commercial deliveries, mailroom activities, property management activities, etc. Traffic safety requirements are provided in the General Requirements section of this manual for these activities. Additionally, for short-term stationary projects on low volume roadways NREL has developed Typical Applications for use as a TTCP. The Typical Application plans can be used for short-term stationary activities in lieu of a project specific TTCP when authorized by the NREL Traffic Safety AHJ or authorized designee.

Temporary Traffic Control Planning

For all activities affecting the travelled ways for vehicles, bicycles, and pedestrians at NREL, there are several important elements that must be considered and included into the Temporary Traffic Control planning such as:

- Activity Duration
- TTC Devices
- Activity Location
- Personal Protective Equipment (PPE)
- Personnel Training

Activity Duration

Activity Duration is a critical element in determining the Temporary Traffic Control (TTC) requirements and safety procedures as it affects the types of TTC measures that are appropriate for the proposed work activity. The following work durations are used to help define the minimum TTC requirements for work performed at NREL within any travelled way.

Mobile – operations that are typically less than 30 minutes in any specific location and are routine types of activities that occur within the NREL campus. These activities do not require a project specific TTCP to be submitted but do require proper equipment and trained personnel. All work must be completed during daylight hours. The requirements for specific activities are provided later in this section. Typical types of activities include:

- Security and Emergency Preparedness Activities and Responses
- Snow Clearing and Plowing (NREL and Subcontractor)
- Shuttle Services
- Minor maintenance activities not requiring heavy equipment
- Landscape repairs, weed control, mowing, utility inspections
- Signage and Striping

- NREL Shipping/Receiving deliveries and pickups
- NREL Mailroom deliveries and pickups
- EHS responses and hazardous waste pickups

Short Duration – operations that are typically less than 60 minutes in a specific location and are routine types of activities that occur within the NREL campus and affect a fixed location for a slightly longer period than a mobile operation. These activities typically do not require a project specific TTCP to be submitted but do require proper equipment and trained personnel. All work must be completed during daylight hours. The requirements for specific activities are provided later in this section. Typical types of activities include:

- Security and Emergency Preparedness needs and responses
- NREL Shipping/Receiving deliveries and pickups
- NREL Mailroom deliveries and pickups
- NREL Property Management deliveries and pickups
- EHS responses and hazardous waste pickups
- Commercial deliveries and pickups
- Maintenance work (NREL and Subcontractor)
- Construction work (Subcontractor or Utility Provider)

Short-term Stationary– operations that are typically longer than one (1) hour in a specific location but are completed within the same day. These are typically maintenance and construction activities that occur within the NREL campuses as well as campus events. These activities do require a project specific TTCP to be submitted to and approved by the NREL Traffic Safety AHJ prior to commencing any work within the travelled way. The project specific TTCP requirement may be met through use of an NREL approved Typical Application plan where applicable to the project condition and approved the Traffic Safety AHJ or authorized designee. All work must be completed during daylight hours. Typical types of activities include:

- Maintenance work (NREL and Subcontractor)
- Construction work (Subcontractor and Utility Provider)
- NREL campus events (NREL staff, visitors, and vendors)

Intermediate-term Stationary– operations that are typically longer than one (1) day in a specific location but are completed within three (3) days. These are typically maintenance and construction activities that occur within the NREL campus. These activities do require a project specific TTCP to be submitted to and approved by the NREL Traffic Safety AHJ prior to commencing any work within the travelled way. Considerations for leaving TTC measures in place during nighttime conditions must be included in the TTC, however, nighttime work (during hours of darkness between sunset and sunrise) is prohibited unless specifically authorized by the NREL Traffic Safety AHJ or authorized designee. Typical types of activities include:

- Maintenance work (NREL and Subcontractor)

- Construction work (Subcontractor and Utility Provider)

Long-term Stationary– operations that are typically longer than three (3) days in a specific location. These are typically maintenance and construction activities that occur within the NREL campus. These activities do require a project specific TTCP to be submitted to and approved by the NREL Traffic Safety AHJ prior to commencing any work within the travelled way. Considerations for leaving TTC measures in place during nighttime conditions must be included in the TTC, however, nighttime work (during hours of darkness between sunset and sunrise) is prohibited unless specifically authorized by the NREL Traffic Safety AHJ or authorized designee. In addition, the use of more durable and longer term TTC devices and signage is required. Typical types of activities include:

- Maintenance work (NREL and Subcontractor)
- Construction work (Subcontractor and Utility Provider)

TTC Devices

All Temporary Traffic Control (TTC) devices used at NREL must comply with all minimum requirements of the 2009 Edition of the MUTCD and NCHRP 350 criteria. NREL may required enhanced TTC devices where determined appropriate by the Traffic Safety AHJ or authorized designee. The following are minimum requirements for common types of TTC devices:

1. Cones
    a. Cones used for Mobile, Short Duration, and Short-term Stationary activities must be orange and a minimum of 18 inches high. A 4 inch retro-reflective band is encouraged but not required.
    b. Cones used for Intermediate-term Stationary and Long-term Stationary activities must be orange and a minimum of 28 inches high and contain one 4 inch and one 6 inch retro-reflective band
2. Flagger Stop/Slow Paddle must be a minimum of 24” x 24” with a 72 inch high handle and must have a reflective finish with engineer grade material.
3. Safety Vests – A minimum class 2 safety vest is required for all work within the NREL roadways. Attendees at campus events in designated event zones are exempt from this requirement.
4. Sidewalk Barricade/Detour - all sidewalk barricades used to channelize pedestrians must be detectable to users of long canes and visible to persons having low vision. A continuous detectable bottom edge is required on all barricades at location where pedestrian traffic is re-routed.
5. Advance Warning Sign – for all Short-term Stationary, Intermediate-term Stationary, and Long-term Stationary activities, an advance warning sign must be installed 100 feet ahead of the beginning of the work zone in both directions or as approved by the NREL Traffic Safety AHJ or authorized designee. The sign must be a W20-1 sign 36” x 36” and labelled “ROAD WORK AHEAD”.

Activity Location

Activity location is an important consideration on the NREL campuses due to aa variety of roadway traffic volumes on the NREL campuses. Main roadways with higher traffic volumes will have more stringent requirements for Temporary Traffic Control (TTC) measures than lower volume roadways. All roadways on the NREL campuses have speed limits of 25 MPH or less and are considered to be low speed roadways. All roadways on the NREL campus that are considered HIGH Volume roadways will require a TTCP for any work activity except as specifically allowed hereunder for permissible Mobile and Short Duration Operations.

The following list provides the determination by the NREL Traffic Safety AHJ of which roadways are LOW and HIGH volume. Refer to map in Appendix A for graphical depiction of the STM campus roadway designations.

1. **STM Campus HIGH Volume Roadways**
    a. Denver West Parkway
        i. 4-way stop sign at east boundary to East Entrance
        ii. East Entrance to west side of RSF at paver roadway section
        iii. Intersection with Research Road westerly to the west intersection of the Shipping/Receiving Access
    b. South Loop Roadway
        i. Entirety of roadway from Denver West Parkway around the perimeter of the parking structure to Research Road
    c. Research Road
        i. Entirety of roadway from the cul-de-sac at the South Entrance to the intersection with Denver West Parkway
    d. East Loop Roadway
        i. Intersection with Denver West Parkway to the north side of the turnaround at the RSF main entrance
    e. STM Parking Garage
        i. Entirety of parking structure including all accesses and drive aisles
2. **STM Campus LOW Volume Roadways**
    a. East Loop roadway
        i. North side of the turnaround at the RSF main entrance to the intersection with North Loop road
    b. North Loop roadway
        i. Terminus of roadway at the east end of ESIF to the terminus of the roadway near the west end of FTLB including both paver and asphalt sections.
    c. East and West FTLB Access Roads

i. Entirety of both access roadways from the intersection with Denver West Parkway to road terminus

d. Parking Lot Drive Aisles
   i. All surface parking lot drive aisles throughout the STM campus

e. Access Roads to Facilities Building and Bulk Storage
   i. Entirety of access roadways

f. IBRF Loop Road
   i. Entirety of the access loop roadway around the IBRF

g. Shipping Receiving Access
   i. Entirety of the access within the Shipping/Receiving site

h. TTF and OTF Access Roads
   i. Entirety of the access roads servicing the TTF and OTF facilities from the intersections with Denver West Parkway to road terminus

i. VTIF Access Road
   i. Entirety of VTIF access road

j. North Access Road
   i. Entirety of the North Access road that runs behind FTLB, SERF, S&TF, and ESIF from intersection with Denver West Parkway to terminus

k. S&TF Emergency Access Road
   i. Entirety of the access road

l. Denver West Parkway
   i. From the intersection with South Loop Roadway westerly to Research Road intersection including paver, concrete, and asphalt sections

m. Any roadway on STM campus not specifically listed as a HIGH volume roadway is considered LOW volume

3. **NWTC Campus Roadways**

   a. All roadways on the NWTC campus are considered low volume roadways, however, any work performed between the Security entrance and Highway 128 will require a TTCP except for permissible Mobile Operations.

<u>Personal Protective Equipment (PPE)</u>

All workers engaged in any Mobile, Short Duration, Short-term Stationary, Intermediate Stationary, or Long-term stationary activities described in this manual must wear all Personal Protective Equipment required under the EHS Safe Work Permit, Approved Activity Hazard Analysis, Approved Temporary Traffic Control Plan, NREL Subcontract, or NREL policies and procedures. At a minimum, all personnel engaging in activities requiring any form of Temporary Traffic Control must wear a class 2 safety vest with the exception of participants in approved NREL campus events.

Personnel Training

All workers engaged in any Mobile, Short Duration, Short-term Stationary, Intermediate Stationary, or Long-term stationary activities described in this manual must be able to demonstrate that they have received appropriate training for the performance of their duties within an activity zone impacting NREL travelled ways.

General Requirements

All work in travelled ways at NREL that impact any motorist, bicyclist, or pedestrian will require that a Temporary Traffic Control Plan (TTCP) be prepared, reviewed, and approved by the NREL Traffic Safety AHJ or authorized designee unless specifically exempted below. All plans shall meet the minimum requirements of the 2009 edition of the MUTCD and the requirements listed below.

1. **Security and Emergency Preparedness Activities and Responses** shall be considered a Mobile or Short Duration Operation which does not require a project specific TTCP. However, these operations are required to comply with the following minimum safety procedures and equipment:
    a. For emergency responses, personnel should engage emergency lights at scene and deploy appropriate traffic safety measures such as cones, flares, etc. in accordance with their training. In addition, Emergency Responders should notify the NREL Traffic Safety AHJ or authorized designees to assist with additional traffic control measures as needed.
    b. For non-emergency activities and responses requiring a vehicle to be parked in the roadway for less than thirty (30) minutes, emergency response and security vehicles shall engage the vehicle emergency flashers.
    c. For non-emergency activities and responses requiring a vehicle to be parked in the roadway for longer than thirty (30) minutes, additional safety measures as follows are required:
        i. All vehicles shall engage the vehicle emergency flashers, emergency lights, and set a minimum of three orange cones in the roadway. One cone adjacent to the front and rear ends of the vehicle adjacent to the roadway and one cone in the middle of the blocked traffic lane approximately 20 feet behind the vehicle. Cones to be as described in this manual.
        ii. NREL Traffic Safety AHJ or authorized designee shall be notified to assist in determining if additional safety measures may be appropriate based on the situation.
2. **EHS Activities and Responses** shall be considered a Mobile or Short Duration Operation which does not require a project specific TTCP. However, these operations are required to comply with the following minimum safety procedures and equipment:
    a. For emergency responses, personnel should notify NREL Security and Emergency Preparedness to assist with securing the work zone and following the emergency response procedures listed above.

b. For non-emergency activities and responses requiring a vehicle to be parked in the roadway for less than thirty (30) minutes, EHS vehicles shall engage the vehicle emergency flashers.
c. For non-emergency activities and responses requiring a vehicle to be parked in the roadway for longer than thirty (30) minutes, additional safety measures as follows are required:
    iii. All vehicles shall engage the vehicle emergency flashers and set a minimum of three orange cones in the roadway. One cone adjacent to the front and rear ends of the vehicle adjacent to the roadway and one cone in the middle of the blocked traffic lane approximately 20 feet behind the vehicle. Cones to be as described in this manual.
    iv. NREL Traffic Safety AHJ or authorized designee shall be notified to assist in determining if additional safety measures may be appropriate based on the situation.

3. **Snow clearing and plowing operations** on any campus travelled way shall be considered a Mobile Operation which <u>does not require a project specific TTCP</u>. However, these operations are required to comply with the following minimum safety procedures and equipment:
    a. Pickup Truck and UTV mounted Snow Plow Units must be equipped with the following safety equipment at a minimum:
        i. Enclosed cab
        ii. 3-point belt restraint preferred, lap belt required at a minimum
        iii. Lighting package including head lights, tail lights, and brake lights
        iv. Side and rear view mirrors required
        v. Horn
        vi. Reverse lights and back up alarm
        vii. Roof mounted yellow beacon light
        viii. Rear mounted Slow Moving Vehicle triangle sign
        ix. Exceptions to above must be approved by Traffic Safety AHJ or authorized designee
    b. Heavy Equipment (Bobcat, Skid Steer, Forklift, Telehandler, etc) must be equipped with the following safety equipment at a minimum:
        i. Operator restraint
        ii. Roof mounted yellow beacon light
        iii. Horn
        iv. Backup alarm
        v. Rear mounted Slow Moving Vehicle triangle sign
        vi. Must have adequate 360 degree vision for operator to see all directions or must be accompanied by a spotter
        vii. Exceptions to above must be approved by Traffic Safety AHJ or authorized designee

4. **NREL Shipping/Receiving, Mailroom, and Property Management Activities** shall be considered a Mobile or Short Duration Operation which <u>does not require a project specific TTCP</u>. This includes commercial delivery and transport vehicles authorized by NREL Shipping/Receiving to deliver directly to a facility or to refill gases and liquids in approved storage containers. However, these operations are required to comply with the following minimum safety procedures and equipment:
    a. LOW Volume Roadways
        i. For activities requiring an authorized vehicle to be parked in the roadway for less than thirty (30) minutes, vehicles shall engage the vehicle emergency flashers.
        ii. For activities requiring an authorized vehicle to be parked in the roadway for longer than thirty (30) minutes, additional safety measures as follows are required:
            1. All vehicles shall engage the vehicle emergency flashers, and set a minimum of three orange cones in the roadway. One cone adjacent to the front and rear ends of the vehicle adjacent to the roadway and one cone in the middle of the blocked traffic lane approximately 20 feet behind the vehicle. Cones to be as described in this manual.
    b. HIGH Volume Roadways
        i. Follow procedures listed for **Short Duration Activities (less than 1 hour)** on a **HIGH VOLUME ROADWAY** below.

5. **Minor maintenance operations** such as mowing, weed control, minor landscaping, erosion control operations, minor cleanup, etc. where the work is predominantly outside of campus travelled ways but where the maintenance vehicle needs to travel within or cross the travelled roadways for short periods of time shall be considered a Mobile Operation which <u>does not require a project specific TTCP</u>. All work must be performed during daylight hours unless approved by Traffic Safety AHJ or authorized designee. However, these operations are required to comply with the following minimum safety procedures and equipment:
    a. Pickup Truck and UTV Units must be equipped with the following safety equipment at a minimum:
        i. Enclosed cab or Roll Over Protection Structure (ROPS)
        ii. 3-point belt restraint preferred, lap belt required at a minimum
        iii. Lighting package including head lights, tail lights, and brake lights
        iv. Side and rear view mirrors preferred, rearview mirror required at a minimum
        v. Horn
        vi. Reverse lights or back up alarm
        vii. Roof mounted yellow beacon light
        viii. Rear mounted Slow Moving Vehicle triangle sign
        ix. Exceptions to above must be approved by Traffic Safety AHJ or authorized designee

b. ATV Units must be equipped with the following safety equipment at a minimum:
    i. Standard safety equipment supplied with vehicle must be in operable condition
    ii. Rear mounted Slow Moving Vehicle triangle sign
    iii. Exceptions to above must be approved by Traffic Safety AHJ or authorized designee
c. Mowers and other Specialty Lightweight Equipment
    i. Standard safety equipment supplied with vehicle must be in operable condition
    ii. Rear mounted Slow Moving Vehicle triangle sign
    iii. Exceptions to above must be approved by Traffic Safety AHJ or authorized designee
d. Heavy Equipment (Bobcat, Skid Steer, Forklift, Telehandler, etc.) must be equipped with the following safety equipment at a minimum:
    i. Operator restraint
    ii. Roof mounted yellow beacon light
    iii. Horn
    iv. Backup alarm
    v. Rear mounted Slow Moving Vehicle triangle sign
    vi. Must have adequate 360 degree vision for operator to see all directions or must be accompanied by a spotter
    vii. Exceptions to above must be approved by Traffic Safety AHJ or authorized designee

6. **Shuttle Services** shall be considered a Mobile Operation which <u>does not require a project specific TTCP</u>. However, these operations are required to comply with the following minimum safety procedures and equipment:
    a. Shuttles <u>stopping</u> in the roadway as part of routine pickup and drop-off activities which is typically less than 2 minutes at a designated shuttle stop, are not required to engage the vehicle emergency flashers but should pull the vehicle as far to the right edge of the traffic as practical.
    b. Shuttles <u>stopping</u> in the roadway and performing any activity that requires the driver to leave the vehicle or wait longer than 2 minutes at a designated shuttle stop, must engage the vehicle emergency flashers and pull the vehicle as far to the right edge of the traffic as practical.
    c. On HIGH volume roadways, shuttles are not allowed to park/wait and are only allowed to stop for a pickup/drop-off at designated shuttle locations. The only exception is that shuttles are allowed to park/wait up to thirty (30) minutes at the vehicle turnaround in front of the RSF main entrance.

7. **Roadway and parking lot striping and signage** is considered a mobile operation but <u>does require a project specific TTCP</u> to be reviewed and approved by the NREL AHJ or authorized designee prior to commencing work activities. All contractors performing

signage and striping work are encouraged to perform the work outside of normal NREL working hours.

8. **All work within the STM Parking Garage** does require a project specific TTCP to be reviewed and approved by the NREL Traffic Safety AHJ or authorized designee prior to commencing any work or TTC setup operations.

9. **Campus events** involving large gatherings of people or activities that may impact motorized or pedestrian traffic and parking facilities does require a project specific TTCP to be reviewed and approved by the NREL Traffic Safety AHJ or authorized designee.

    a. Attendees of campus events are not required to wear PPE unless performing activities that create a potential safety concern such as directing traffic.

10. **Short Duration Activities (less than 1 hour)** on a **LOW VOLUME ROADWAY** does not require a project specific TTCP to be reviewed and approved but are required to comply with the following:
    a. All vehicles parked in the roadway for up to one (1) hour shall engage the vehicle emergency flashers and set a minimum of three orange cones in the roadway. One cone adjacent to the front and rear ends of the vehicle (including trailer) adjacent to the roadway and one cone in the middle of the blocked traffic lane approximately 20 feet behind the vehicle. Cones to be as described in this manual.
    b. All persons working in the roadway must wear appropriate PPE including a class 2 safety vest.
    c. Types of activities considered short duration include:
        v. Commercial deliveries and pickups
        vi. Minor maintenance activities by NREL staff, Subcontractors, and Utility Providers
        vii. Minor construction activities by NREL staff, Subcontractors, and Utility Providers

11. **Short Duration Activities (less than 1 hour)** on a **HIGH VOLUME ROADWAY** does not require a project specific TTCP to be reviewed and approved but are required to comply with the following:
    a. All vehicles parked in the roadway for up to one (1) hour shall engage the vehicle emergency flashers
    b. A minimum of eight orange cones shall be set in the roadway. One cone adjacent to the front, middle, and rear ends of the vehicle (including trailer) adjacent to the roadway and five additional cones uniformly spaced in a straight line taper from the rear end of the vehicle to the adjacent concrete curb or edge of roadway over a length of 50 feet. Cones to be as described in this manual.
    c. A "ROAD WORK AHEAD" advance warning sign shall be placed 100 feet in advance of the first cone in both directions or at a lesser distance when approved by the NREL Traffic Safety AHJ or authorized designee. Signs to be as described in this manual.

d. Two flaggers with appropriate flagging equipment are required.
e. All persons working in the roadway must wear appropriate PPE including a class 2 safety vest.
f. Types of activities considered short duration include:
    viii. Minor maintenance activities by NREL staff, Subcontractors, and Utility Providers
    ix. Minor construction activities by NREL staff, Subcontractors, and Utility Providers

12. **Short-term Stationary Activities (longer than 1 hour and less than 1 day)** on a **LOW VOLUME ROADWAY** <u>does require a project specific TTCP</u> to be submitted to and approved by the NREL Traffic Safety AHJ prior to commencing any work within the travelled way. The project specific TTCP requirement may be met through use of an NREL approved Typical Application plan where applicable to the project condition and approved the Traffic Safety AHJ or authorized designee. All work must be completed during daylight hours. In addition:
    a. All vehicles parked in the roadway shall engage the vehicle emergency flashers or a roof mounted yellow beacon light.
    b. All persons working in the roadway must wear appropriate PPE including a class 2 safety vest.
    c. Types of activities considered short-term stationary on LOW volume roadways includes:
        x. Short term maintenance activities by NREL staff, Subcontractors, and Utility Providers
        xi. Short term construction activities by NREL staff, Subcontractors, and Utility Providers

13. **Short-term Stationary Activities (longer than 1 hour and less than 1 day)** on a **HIGH VOLUME ROADWAY** <u>does require a project specific TTCP</u> to be reviewed and approved by the NREL Traffic Safety AHJ prior to commencing any work or TTC setup operations.

14. **Intermediate-term Stationary Activities (longer than 1 day and less than 3 days)** on a **ANY ROADWAY** <u>does require a project specific TTCP</u> to be reviewed and approved by the NREL Traffic Safety AHJ prior to commencing any work or TTC setup operations.

15. **Long-term Stationary Activities (longer than 3 days)** on a **ANY ROADWAY** <u>does require a project specific TTCP</u> to be reviewed and approved by the NREL Traffic Safety AHJ prior to commencing any work or TTC setup operations.

16. All TTCP's must be submitted to NREL Traffic Safety AHJ or authorized designee a minimum of three (3) working days prior to commencing installation of TTC devices and signage except as noted below:

    a. Any activity that requires a full closure of a roadway or sidewalk will require a TTCP to be reviewed and approved by the Traffic Safety AHJ. Such TTC plan involving a full closure of any street or sidewalk shall be submitted a minimum of ten (10) working days prior to commencing installation of TTC devices to allow

NREL adequate time to issue site wide notifications and to evaluate alternate access routes.

17. A copy of the approved TTCP must be available at the activity site for inspection by Traffic Safety AHJ or authorized designees. Any changes must be authorized by the Traffic Safety AHJ.
18. Flagging personnel must be properly trained, have proper equipment, and be dressed appropriately.
19. In the event of an emergency situation, notify all emergency responders first, then notify the Traffic Safety AHJ.
20. All temporary traffic control devices shall be immediately removed when the work is completed and the devices are no longer needed.
21. Subcontractors and Utility Providers shall cooperate with NREL to ensure that shuttles and delivery vehicle services are not interrupted during NREL normal working hours unless a full road closure is authorized as part of an approved TTCP.
22. The Traffic Safety AHJ and authorized designees may increase the listed safety requirements for work on <u>any</u> roadway where site conditions warrants a higher level of safety consideration up to and including preparation of a TTCP.
23. Parking
    a. Parking is not allowed on the STM campus except in designated parking spots. Roadways, open space, emergency access lanes, etc. are not to be used for parking unless specifically authorized as part of an approved TTCP by the Traffic Safety AHJ or authorized designee.
    b. Subcontractor parking is only allowed in spaces near the facilities marked as "Construction Contractor Parking" or "Service Contractor Parking". These spots are intended for one primary work vehicle from a Subcontractor that has the tools and equipment needed by the Subcontractor's forces. All other vehicles must be parked in the STM parking garage, the south surface parking lot, or other location approved by Traffic Safety AHJ or authorized designee.
    c. Facility dock use
        i. Subcontractors and NREL staff may only park in the dock area on an "as needed" basis for unloading/loading equipment into a facility and the vehicle must be immediately moved after the loading/unloading operation is completed. A 60 minute maximum timeframe is allowed unless otherwise approved by the Traffic Safety AHJ or authorized designee.
        ii. NREL Shipping/Receiving, Mailroom, and Property Management vehicles and staff may utilize the dock areas on an "as needed" basis for loading/unloading and other approved activities. There is no time limit for use of the dock area by shipping/receiving, mailroom, or property

management staff, however, vehicles should be moved immediately upon completion of approved activities.

iii. Commercial delivery and transport vehicles authorized by NREL Shipping/Receiving staff may utilize the dock areas on an “as needed” basis for loading/unloading, refilling gas/liquid storage containers, and other approved activities. There is no time limit for use of the dock area by commercial delivery and transport vehicles when performing activities authorized by shipping/receiving staff, however, vehicles should be moved immediately upon completion of approved activities.

iv. Other uses may be allowed upon approval by NREL Traffic Safety AHJ or authorized designee

Appendix A

NREL Traffic Safety Points of Contact

NREL Traffic Safety Authority Having Jurisdiction (AHJ):
Bret Cummock
Research Support Facility, A243
Office: (303) 275-4354
Cell: (303) 330-1426

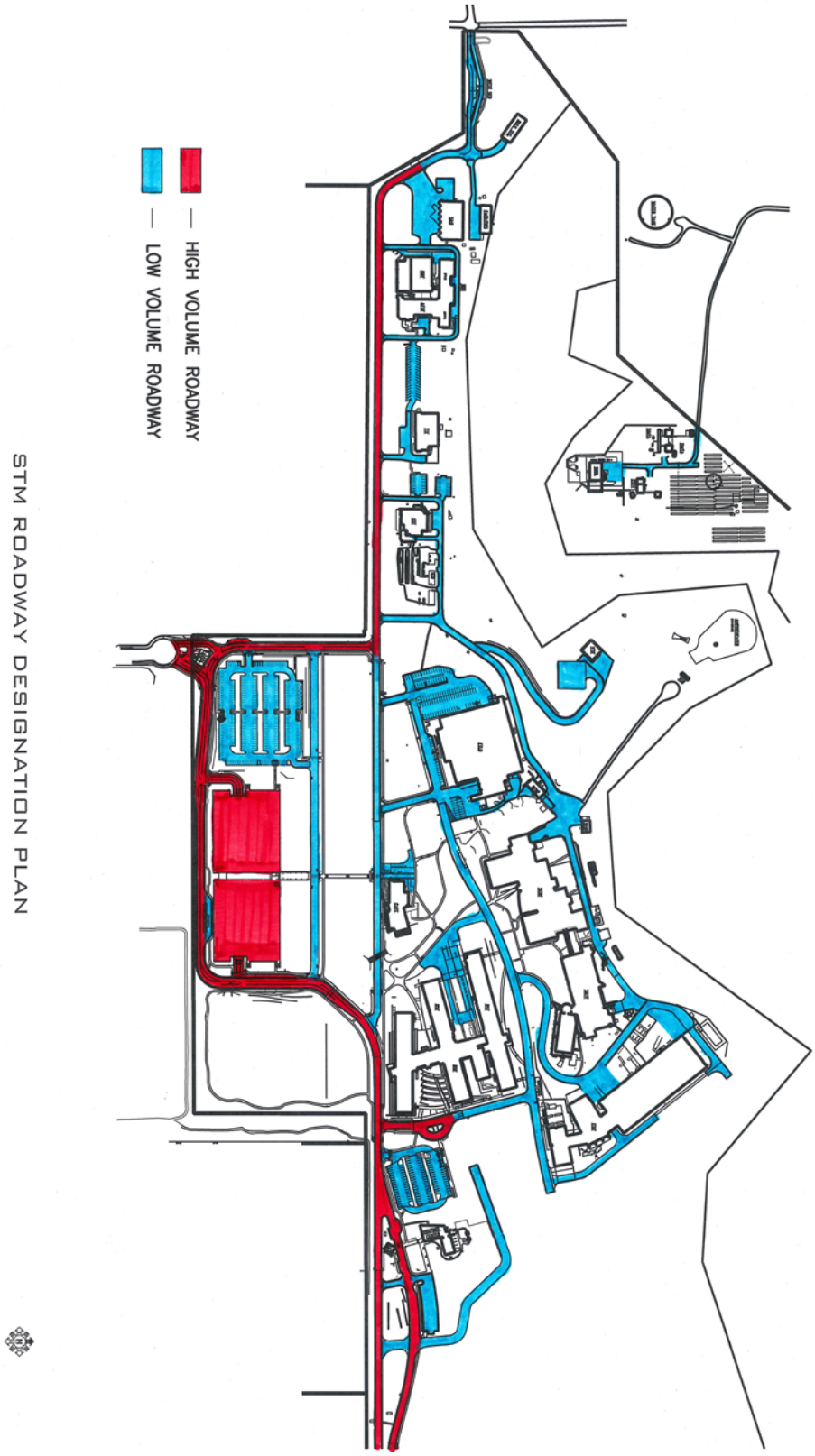
NREL Traffic Safety AHJ Authorized Designee:
John Boysen
Research Support Facility, A234-1
Office: (303) 275-3235
Cell: (720) 641-1107

NREL Traffic Safety AHJ Authorized Designee:
Steve Aldridge
Research Support Facility, A234-2
Office: (303) 384-7262
Cell: (720) 490-0064

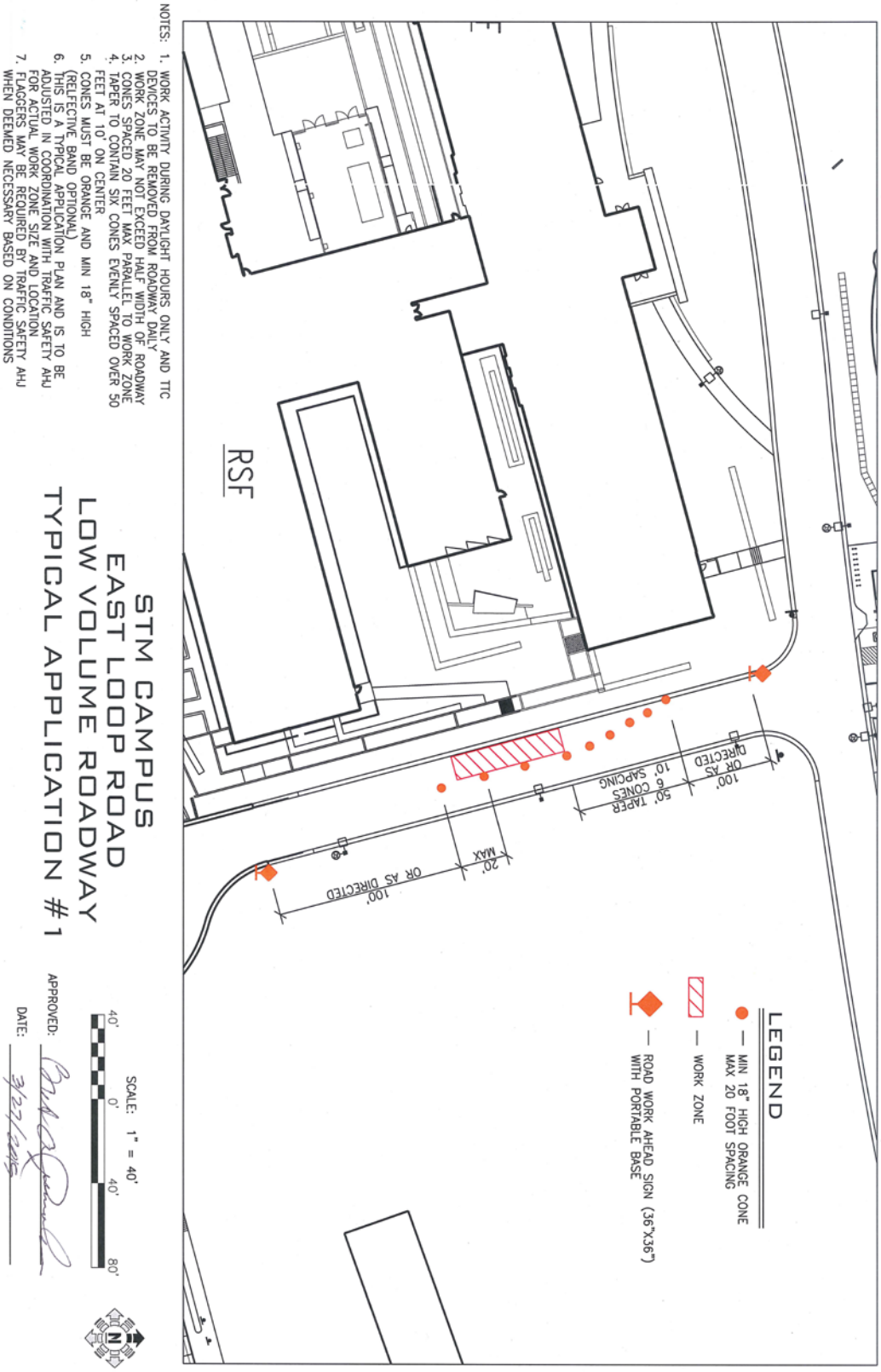
STM Site Building Area Engineer (BAE)
Rob Russell
Research Support Facility, A240-8
Office: (303) 384-7399
Cell: (720) 450-5311

NWTC Building Area Engineer (BAE)
Eric Telesmanich
NWTC Trailer 257, 103
Office: (303) 384-6102
Cell: (303) 598-2791

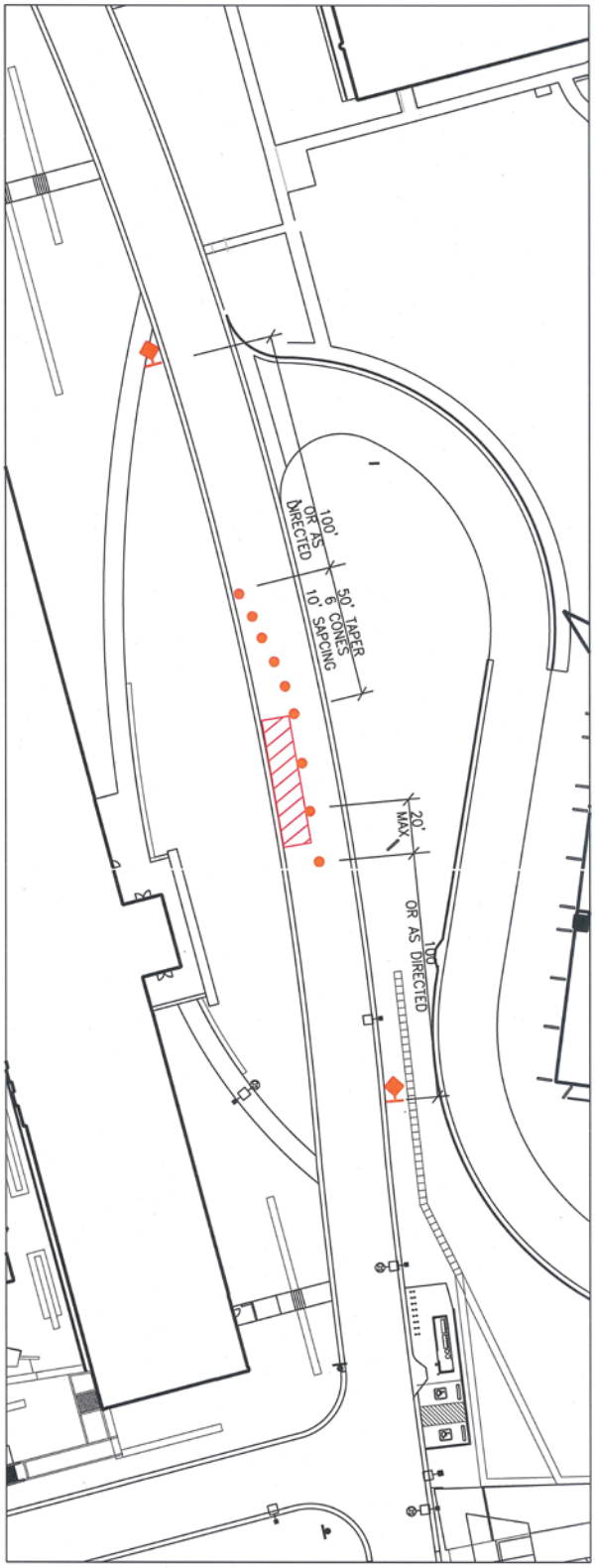
Appendix B


HIGH VOLUME ROADWAY
LOW VOLUME ROADWAY
STM ROADWAY DESIGNATION PLAN

Appendix C


LEGEND
— MIN 18" HIGH ORANGE CONE MAX 20 FOOT SPACING
— WORK ZONE
— ROAD WORK AHEAD SIGN (36"X36") WITH PORTABLE BASE
100' OR AS DIRECTED
50' TAPER 6 CONES 10' SPACING
20' MAX
100' OR AS DIRECTED
RSF
NOTES:
1. WORK ACTIVITY DURING DAYLIGHT HOURS ONLY AND TTC DEVICES TO BE REMOVED FROM ROADWAY DAILY
2. WORK ZONE MAY NOT EXCEED HALF WIDTH OF ROADWAY
3. CONES SPACED 20 FEET MAX PARALLEL TO WORK ZONE
4. TAPER TO CONTAIN SIX CONES EVENLY SPACED OVER 50 FEET AT 10' ON CENTER
5. CONES MUST BE ORANGE AND MIN 18" HIGH (REFLECTIVE BAND OPTIONAL)
6. THIS IS A TYPICAL APPLICATION PLAN AND IS TO BE ADJUSTED IN COORDINATION WITH TRAFFIC SAFETY AHJ FOR ACTUAL WORK ZONE SIZE AND LOCATION
7. FLAGGERS MAY BE REQUIRED BY TRAFFIC SAFETY AHJ WHEN DEEMED NECESSARY BASED ON CONDITIONS
STM CAMPUS
EAST LOOP ROAD
LOW VOLUME ROADWAY
TYPICAL APPLICATION #1
SCALE: 1" = 40'
40' 0' 40' 80'
N
APPROVED:
DATE: 3/27/2015

Appendix D



LEGEND

— MIN 18" HIGH ORANGE CONE MAX 20 FOOT SPACING

— WORK ZONE

— ROAD WORK AHEAD SIGN (36"X36") WITH PORTABLE BASE

STM CAMPUS
NORTH LOOP ROAD
LOW VOLUME ROADWAY
TYPICAL APPLICATION #2

SCALE: 1" = 40'

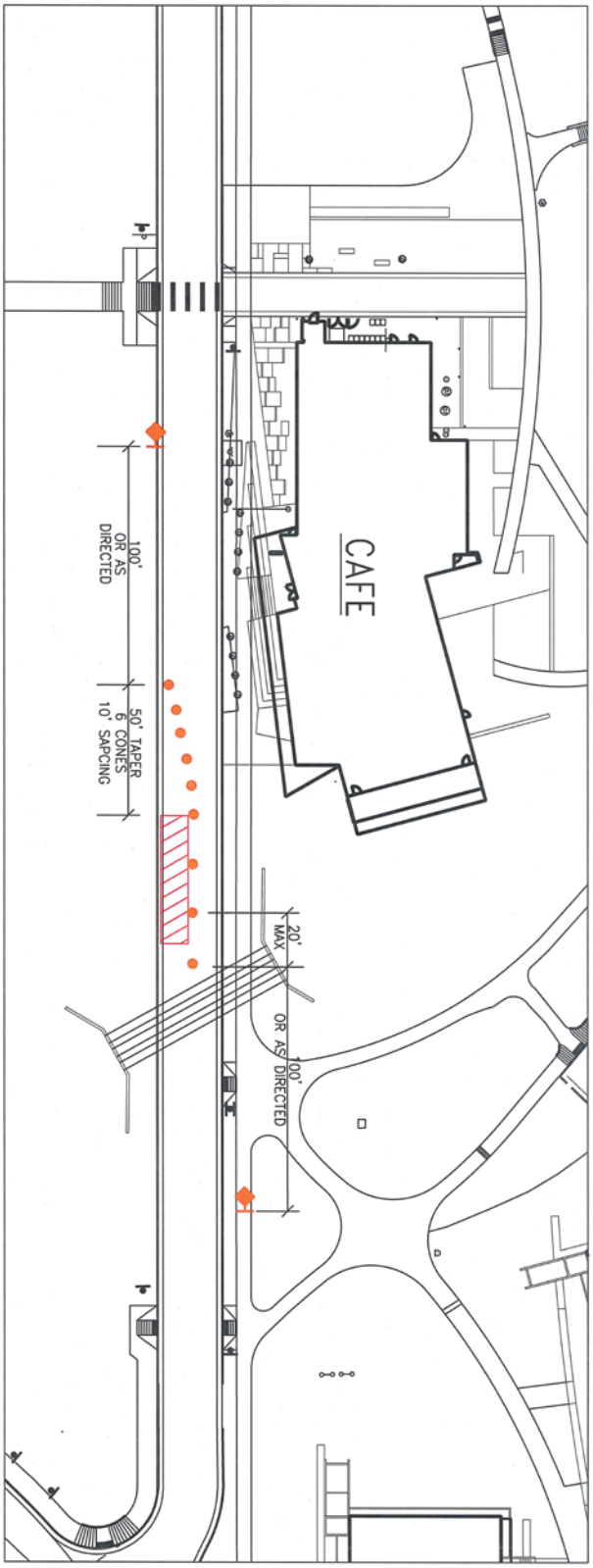
40' 0' 40' 80'

APPROVED: Brad Yeaman

DATE: 3/27/2015

NOTES:
1. WORK ACTIVITY DURING DAYLIGHT HOURS ONLY AND TTC DEVICES TO BE REMOVED FROM ROADWAY DAILY
2. WORK ZONE MAY NOT EXCEED HALF WIDTH OF ROADWAY
3. CONES SPACED 20 FEET MAX PARALLEL TO WORK ZONE
4. TAPER TO CONTAIN SIX CONES EVENLY SPACED OVER 50 FEET AT 10' ON CENTER
5. CONES MUST BE ORANGE AND MIN 18" HIGH (REFLECTIVE BAND OPTIONAL)
6. THIS IS A TYPICAL APPLICATION PLAN AND IS TO BE ADJUSTED IN COORDINATION WITH TRAFFIC SAFETY AHJ FOR ACTUAL WORK ZONE SIZE AND LOCATION
7. FLAGGERS MAY BE REQUIRED BY TRAFFIC SAFETY AHJ WHEN DEEMED NECESSARY BASED ON CONDITIONS

Appendix E



NOTES:
1. WORK ACTIVITY DURING DAYLIGHT HOURS ONLY AND TTC DEVICES TO BE REMOVED FROM ROADWAY DAILY
2. WORK ZONE MAY NOT EXCEED HALF WIDTH OF ROADWAY
3. CONES SPACED 20 FEET MAX PARALLEL TO WORK ZONE
4. TAPER TO CONTAIN SIX CONES EVENLY SPACED OVER 50 FEET AT 10' ON CENTER
5. CONES MUST BE ORANGE AND MIN 18" HIGH
6. (REFLECTIVE BAND OPTIONAL)
7. THIS IS A TYPICAL APPLICATION PLAN AND IS TO BE ADJUSTED IN COORDINATION WITH TRAFFIC SAFETY AHJ FOR ACTUAL WORK ZONE SIZE AND LOCATION
FLAGGERS MAY BE REQUIRED BY TRAFFIC SAFETY AHJ WHEN DEEMED NECESSARY BASED ON CONDITIONS

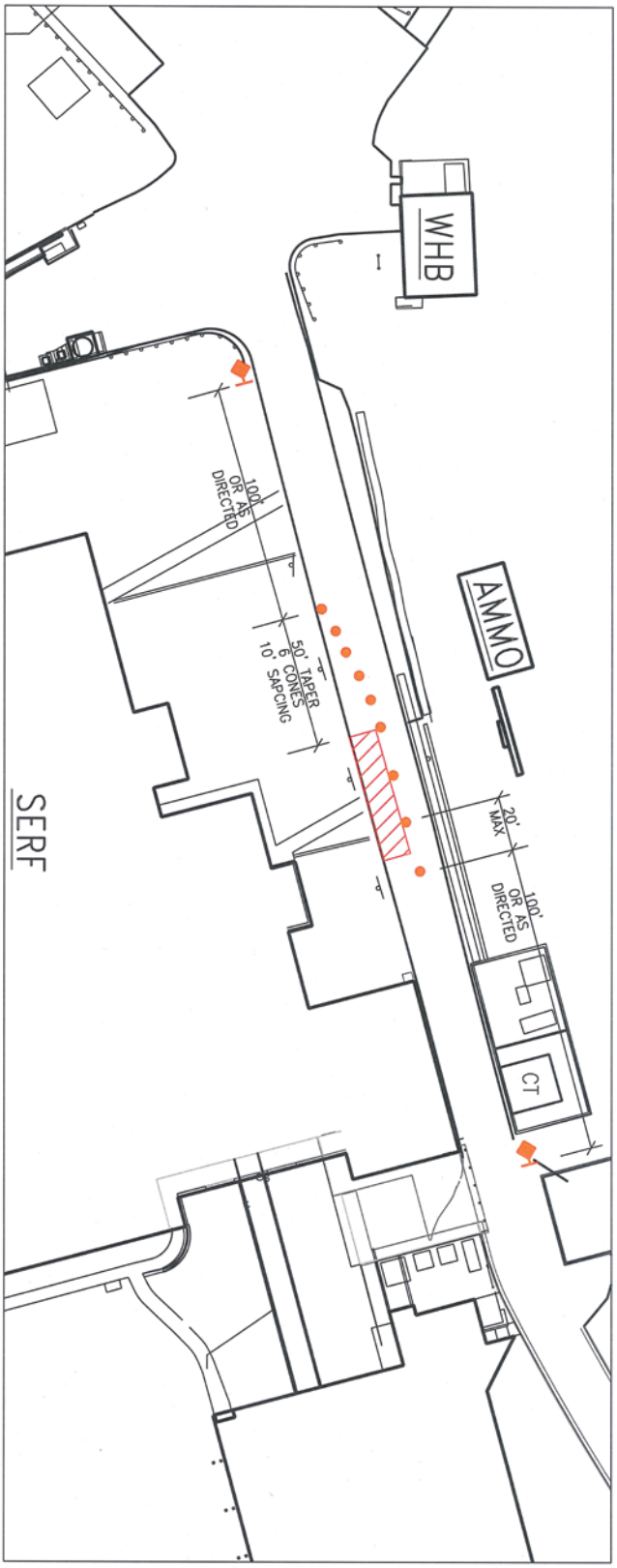
STM CAMPUS
DENVER WEST PARKWAY
LOW VOLUME ROAD SECTION
TYPICAL APPLICATION #3

LEGEND
— MIN 18" HIGH ORANGE CONE MAX 20 FOOT SPACING
— WORK ZONE
— ROAD WORK AHEAD SIGN (36"X36") WITH PORTABLE BASE

SCALE: 1" = 40'
40' 0' 40' 80'

APPROVED:
DATE: 3/27/2015

Appendix F



NOTES:
1. WORK ACTIVITY DURING DAYLIGHT HOURS ONLY AND TTC DEVICES TO BE REMOVED FROM ROADWAY DAILY
2. WORK ZONE MAY NOT EXCEED HALF WIDTH OF ROADWAY
3. CONES SPACED 20 FEET MAX PARALLEL TO WORK ZONE
4. TAPER TO CONTAIN SIX CONES EVENLY SPACED OVER 50 FEET AT 10' ON CENTER
5. CONES MUST BE ORANGE AND MIN 18" HIGH (REFLECTIVE BAND OPTIONAL)
6. THIS IS A TYPICAL APPLICATION PLAN AND IS TO BE ADJUSTED IN COORDINATION WITH TRAFFIC SAFETY AHJ FOR ACTUAL WORK ZONE SIZE AND LOCATION
7. FLAGGERS MAY BE REQUIRED BY TRAFFIC SAFETY AHJ WHEN DEEMED NECESSARY BASED ON CONDITIONS

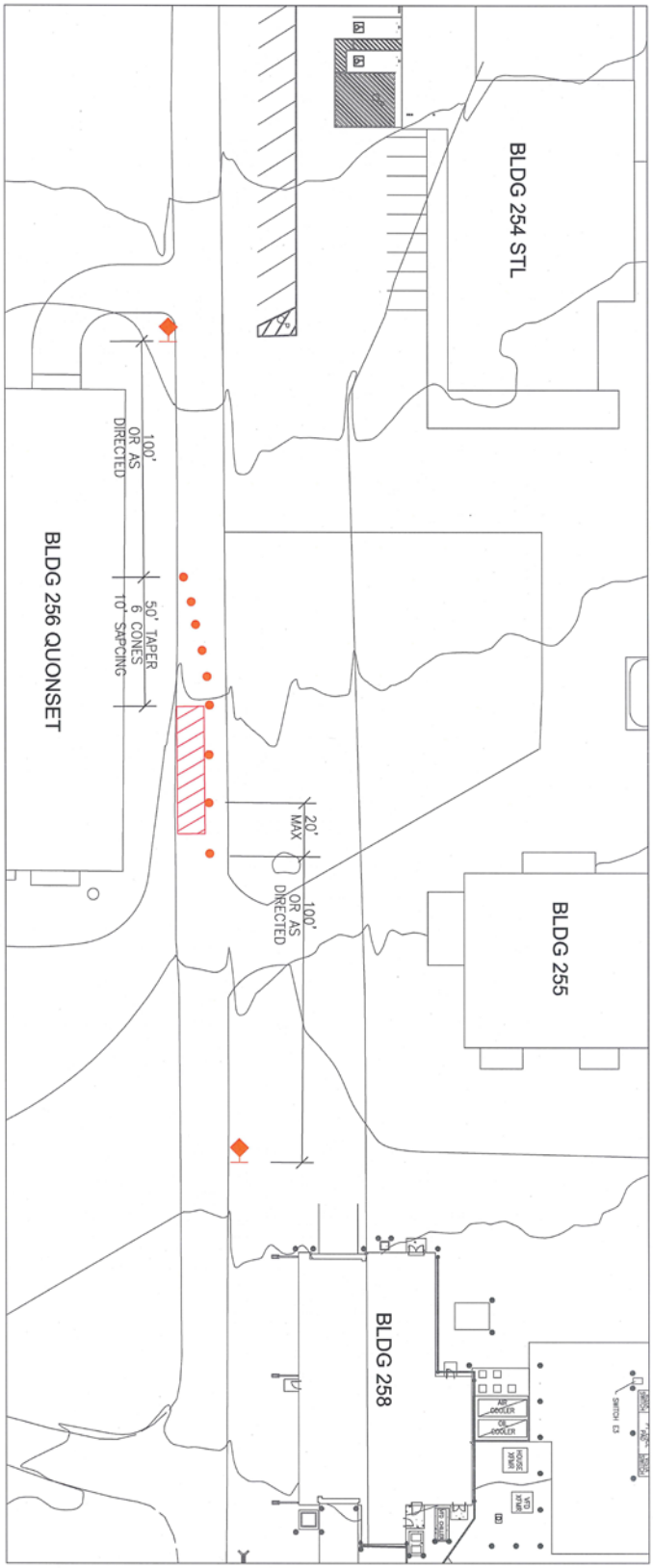
STM CAMPUS
SERVICE ACCESS ROADWAY
LOW VOLUME ROAD SECTION
TYPICAL APPLICATION #4

LEGEND
— MIN 18" HIGH ORANGE CONE MAX 20 FOOT SPACING
— WORK ZONE
— ROAD WORK AHEAD SIGN (36"X36") WITH PORTABLE BASE

SCALE: 1" = 40'
40' 0' 40' 80'

APPROVED:
DATE: 3/27/2015

Appendix G



NOTES:
1. WORK ACTIVITY DURING DAYLIGHT HOURS ONLY AND TTC DEVICES TO BE REMOVED FROM ROADWAY DAILY
2. WORK ZONE MAY NOT EXCEED HALF WIDTH OF ROADWAY
3. CONES SPACED 20 FEET MAX PARALLEL TO WORK ZONE
4. TAPER TO CONTAIN SIX CONES EVENLY SPACED OVER 50 FEET AT 10' ON CENTER
5. CONES MUST BE ORANGE AND MIN 18" HIGH (REFLECTIVE BAND OPTIONAL)
6. THIS IS A TYPICAL APPLICATION PLAN AND IS TO BE ADJUSTED IN COORDINATION WITH TRAFFIC SAFETY AHJ FOR ACTUAL WORK ZONE SIZE AND LOCATION
7. FLAGGERS MAY BE REQUIRED BY TRAFFIC SAFETY AHJ WHEN DEEMED NECESSARY BASED ON CONDITIONS

NWTC CAMPUS
ALL INTERNAL ROADWAYS
LOW VOLUME ROAD SECTION
TYPICAL APPLICATION #5

LEGEND
— MIN 18" HIGH ORANGE CONE MAX 20 FOOT SPACING
— WORK ZONE
— ROAD WORK AHEAD SIGN (36"X36") WITH PORTABLE BASE

SCALE: 1" = 40'
40' 0' 40' 80'

APPROVED:
DATE: 3/27/2015

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