

## **Technical Requirements**

### **Section 16 – Maintenance of Traffic**

#### **MAINTENANCE OF TRAFFIC**

The Contractor shall conduct all Work necessary to meet the requirements associated with Maintenance of Traffic (MOT), including provisions for the safe and efficient movement of people, goods, and services through and around the Project while minimizing impacts to local residents and business and commuters.

#### **Administrative Requirements**

##### ***Traffic Operations***

##### ***Maintenance of Traffic Task Force***

Not Applicable

##### ***Transportation Management Plan (TMP)***

The Contractor shall prepare a TMP that defines the strategic plan for transportation management on the Project. The TMP shall address major aspects of the Work for individual construction areas, phases, and stages. The Contractor shall use the TMP as a planning and policy guide to develop and execute the project MOT program.

These major aspects shall include, but are not limited to:

1. An overview and description of the proposed construction, subdivided as applicable, into the following components:

Area: A specific grouping of Work along the Project defined by the Contractor that creates segments of the Project for the purpose of planning and executing the Work.

A. Phase: A specific sequence of the construction Work in an area during which a major traffic movement is undertaken (e.g., a detour) and left in place until the Work is complete and traffic is redirected to another location. This shall require development of a specific Traffic Control Plan (TCP). In some cases, multiple TCPs may be necessary.

B. Stage: A subdivision of Work within a phase that combines similar components of Work to maintain efficiency.

2. A detailed approach to the development of TCPs and MHTs on the Project
3. A list of known or potential lane closures, including the following information

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- A. Description of traffic shift
- B. Number of shifts expected
- C. Duration of anticipated traffic shifts
4. An approach to Travel Demand Management (TDM) strategies
5. An approach to the use of Intelligent Transportation System/Variable Message Sign (ITS/VMS) boards, including coordination with Eisenhower Tunnel/CDOT Traffic Operations Center (CTMC), and the Contractor's representative.
6. The Contractor's plan for coordinating the TMP Activities with those Activities required under Book 2, Section 4 - Public Information.
  - A. A checklist identifying specific items that shall be provided both to the Contractor's Public Information Officer and the CDOT Public Information Officer every Thursday by 10:30 a.m. for public information data collection and management activities on the Project. The checklist shall provide the inclusion of supporting information relevant to coping messages and public awareness and shall be included in the Public Information Plan (PIP) required in Book 2, Section 4.
8. Additional Elements
  - A. An approach to coordination and cooperation with construction being performed by projects adjacent to the Project limits.
  - B. An approach to traffic access management, including restrictions, bicycles, pedestrians, and potential impacts to handicapped mobility.
  - C. Relevant portions of the Incident Management Plan (IMP), described below.
  - D. An approach to special event coordination.
9. Typical section requirements
10. Emergency requirements
  - A. Emergency access
  - B. Courtesy patrol
11. Temporary closure scenarios
  - A. Location
  - B. Time and Duration

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#### 12. Access

- A. Pedestrian/bike
- C. Work Site (area)
- C. Bus/Transit

#### 13. Construction Zone Temporary Speed Reduction

Temporary speed reduction, if warranted, must be authorized by a Form 568 approved by the R3 Traffic Engineer. Temporary speed reduction may be authorized during the construction phasing of the I-70 Wall Repairs when the following conditions exist:

- A. Restricted shoulder widths and TCD placement within 2' of the travel way
- B. Lane closures adjacent to live traffic
- C. Traffic phasing where corridor geometrics restrict design speed to less than posted speed
- D. Other safety concerns as documented by Contractor's Engineer

#### 14. MHT Requirements

The Contractor shall use barriers to positively separate traveled lanes and work zones in areas where work requires a closure of a lane for longer than a single working day. All work zone traffic control devices, barriers and crash cushions/impact attenuators shall meet NCHRP 350 Test Level 3 requirements.

The TMP shall be submitted to CDOT for Acceptance at least 30 Days prior to construction. No Work that impacts traffic shall commence until the TMP is Accepted.

#### ***Coordination with CDOT Traffic Management Center (CTMC)***

Portable VMS boards shall be furnished and used to display project related information in addition to the stationary VMS boards. These boards shall be placed along the project and in advance of the project to alert roadway users of construction activities.

In addition to the Portable VMS boards, use of the existing overhead VMS boards may be used to supplement information on the portable boards. Routine requests for use of the existing VMS boards shall be submitted to CDOT by 10:30 a.m. on Thursday of the week prior to when the VMS boards will be needed (Monday through Sunday of the following week). Requests for routine use of the VMS will be reviewed by noon Friday of

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the same week of the submittal. The Contractor shall coordinate directly with the Eisenhower Tunnel/CTMC following review by CDOT.

For after-hours operations only, the Contractor shall coordinate directly with the Eisenhower Tunnel/CDOT Traffic Management Center (CTMC). The Eisenhower Tunnel/CTMC is available to the Contractor to modify VMS messages 24 hours a day, 7 days a week.

The Contractor shall coordinate with CDOT and the Eisenhower Tunnel/CTMC for emergencies in accordance with the Accepted Incident Management Plan.

#### ***Incident Management Plan***

The Contractor shall develop a detailed Incident Management Plan (IMP) as a companion to the TMP to manage traffic incidents and emergency operations on the project Site.

The IMP shall, comply with the CDOT *Guidelines for Developing Traffic Incident Management Plans for Work Zones*.

At a minimum, the IMP shall include the following components:

1. Coordination with the Public Information Plan (PIP)
2. Incident detection and identification
3. Incident response
4. Incident site management
5. Incident clearance
6. Dissemination of traveler information regarding incidents
7. Emergency services notification, including local area Police Departments, the Colorado State Patrol (CSP), local area fire departments, ambulance services, and any other emergency response providers.
8. Notification of local school districts about possible impacts to school bus routes, student drop-offs, and/or pedestrian facilities.
9. Geographic and other special constraints.
10. Available resources
11. Operational procedures

The IMP shall be submitted to CDOT for Acceptance at least 30 Days prior to construction. No Work that impacts traffic shall commence until the IMP is Accepted.

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#### ***Business and Private Access***

Not Applicable

#### ***Maintenance of Traffic Variance Process***

The Contractor may request a MOT variance for any lane closure, detour, or other restriction beyond the specified limits defined herein. The following information shall be included in each MOT variance request:

1. Summary of the variance request
2. Justification for the variance request, including a list of the criteria that cannot be met and the reasons for not being able to meet the criteria
3. Public notification methods and schedule
4. List of affected emergency services and the schedule for notification
5. List of affected agencies or private owners and the method(s) and schedule for notification
6. Description of additional public information surveys to be performed, if required
7. List of any potential safety hazards to which the public may be exposed
8. Proposed revisions to the Accepted TCP or current MHT
9. Proposed duration of lane closure, detour, or phasing change for which a variance is requested

The Contractor shall allow CDOT a minimum of 14 Days for review and Approval of any MOT variance requests.

#### ***Contractor Response Time***

The Contractor shall have at least one employee on call, via cellular phone, that can respond to an incident within 30 minutes. Upon arrival at the incident site, that employee shall assess the situation and immediately notify the appropriate personnel to implement the IMP. Upon notification of the incident, the Contractor shall immediately undertake actions necessary to restore traffic operations to the maximum extent practicable.

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#### ***Special Events***

The Contractor shall coordinate with CDOT and all other local agencies, along with the Public Information Officer as specified in Book 2 Section 4 to develop a list and schedule of special events. The Contractor shall update the list as events are identified or scheduled. Work along the Vail Pass Bike Path shall be coordinated to not conflict events including Ride the Rockies, Courage Classic, Copper Triangle, Triple Bypass, as well as any others scheduled to use the path.

The Contractor shall identify and implement necessary changes in Work progress to accommodate traffic to and from special events. No lane closures shall be permitted on the day of the event unless Approved by CDOT.

#### ***Coordination with Adjacent Projects***

The Contractor shall coordinate with CDOT Maintenance, and their construction contractors to coordinate construction traffic and detour impacts and minimize simultaneous closures or impacts to adjacent or alternate routes.

### **Design Requirements**

The Contractor's Professional Engineer in responsible charge of the MOT design shall prepare, Review, and Approve: field design changes; Released for Construction documents; and TCP and MHT plans.

#### ***Traffic Control Plans (TCP)***

The Contractor shall prepare a TCP to control traffic on the Project. The TCP shall conform to the requirements specified herein and *the CDOT Standard Specifications for Road and Bridge Construction* and the most current version of the MUTCD. The TCP shall generally describe all lane and shoulder configurations, including widths, traffic control signing, pavement markings, traffic control devices, construction access, construction parking, emergency access, work areas, and pedestrian/bicycle requirements necessary for each construction phase.

The TCPs shall be submitted to CDOT for Acceptance 14 Days prior to implementation of the particular TCP.

Any major revision to the TCP, as determined by CDOT, shall require submission of a new TCP for Acceptance.

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### ***Method of Handling Traffic (MHT)***

The Contractor shall prepare MHTs in accordance with the Project Special Provisions included in this Section 16.

### ***Design Vehicle***

Not Applicable

### ***Design Speed and Posted Speed***

Minimum design and posted speeds for Work zones shall conform to Table 16.2.

| <b>Table 16.2<br/>DESIGN AND POSTED SPEEDS FOR WORK ZONES</b> |                                      |
|---|--------------------------------------|
| <b><u>Location</u></b>  | <b><u>Posted Speed<br/>(mph)</u></b> |
| <u>I-70 Mainline</u>  | <u>65</u>                            |
| <u>US 6/US 24</u>   | <u>35</u>                            |

***\* The Contractor shall provide existing design and posted speed whenever it can be reasonably maintained on the local system.***

Speed Limits shall not be lowered below 55 mph on I-70 without prior approval from the Region Traffic Engineer. Speed limits on US 6/US 24 shall not be lowered below 25 mph unless approved by the Region Traffic Engineer.

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#### **Minimum Lane Requirements**

##### ***Lane Restrictions***

Before any travel lanes or shoulders are closed, the Contractor shall submit an appropriate MHT or TCP to CDOT for Acceptance. The MHT/TCP shall be developed in accordance with latest CDOT Region 3 Lane Closure Strategies. Any deviation from the CDOT Region 3 Lane Closure Strategy shall be previously approved by CDOT.

Lane restrictions must be submitted to CDOT by the Contractor by Thursday 10:30 a.m. of the week in advance of the work (for work Sunday through Saturday), unless required by construction emergencies or other reasonably unforeseen events.

Minimum lane widths for travel lanes on I-70 and US 6 shall be 12 feet. Minimum outside shoulder widths on I-70 are allowed to the minimum shoulder width of 2 feet. Inside shoulder widths shall be a minimum of 2 feet.

##### ***Ramps, Collector-distributor and Frontage Roads***

Minimum lane widths on US 6 shall be 11 feet. Minimum shoulder width is 2 feet.

A minimum of one reversible flagger-controlled lane shall be maintained at all times on at work locations along US 6/US 24.

##### ***Queue Lengths During Construction***

The Contractor shall monitor queue lengths on all roads within the Project limits whenever a lane closure is in effect. The Contractor shall adjust the traffic control devices, including advance signing; to provide advance warning to motorists, of stopped traffic.



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***Working Time Violations Incidents (WTVI)***

If there is a violation of the working time limitations for traffic control as allowed for in this Section 16, a written notice to stop Work will be imposed on the Contractor at the start of the next Working Day. Work shall not resume until the Contractor assures CDOT, in writing, that there will not be a reoccurrence of the working time violation. If more violations take place, CDOT will notify the Contractor in writing that there will be a price reduction charge for each WTVI. This WTVI price reduction charge shall be reflected on the Contractor's monthly invoice. This price reduction will not be considered a penalty but will be a price reduction for failure to perform traffic control in compliance with the Contract.

A WTVI is any violation up to 30 minutes in duration. Each 30 minutes or increment thereof will be considered as a WTVI. A price reduction will be assessed for each successive or cumulative 30-minute period in violation of the working time limitations, as determined by CDOT. A 15-minute grace period will be allowed at the beginning of the second WTVI on the Project before the price reduction is applied. This 15-minute grace period applies only to the second WTVI.

The number of incident charges will be accumulative throughout the duration of the Contract.

**Price Reduction Schedule**

| <b>Incident</b> | <b>Incident Rate</b> | <b>Total Price Reduction</b> |
|-----------------|----------------------|------------------------------|
| 1 <sup>st</sup> | Notice to Stop Work  | -----                        |
| 2 <sup>nd</sup> | \$150                | \$150                        |
| 3 <sup>rd</sup> | \$300                | \$450                        |
| 4 <sup>th</sup> | \$600                | \$1,050                      |
| 5 <sup>th</sup> | \$1,200              | \$2,250                      |
| 6 <sup>th</sup> | \$1,200              | \$3,450                      |
| Etc.            | \$1,200              | \$4,650                      |
|                 | Etc.                 | Etc.                         |

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#### ***Trail and Pedestrian Impacts***

The existing trail system shall be maintained at all times. See Section 5 – Environmental for trail system requirements.

The contractor shall implement one of the following alternatives on the Vail Pass Recreation Trail in the vicinity of the Project:

1. The trail shall not be closed during daytime hours once it is open for the season. Any daytime work shall be completed prior to the trail opening for the summer.
2. Trail closures shall be allowed from 8:00 p.m. to 5:00 a.m. any day of the week. The trail must remain fully open during all other times.

#### ***Emergency Pullouts***

#### **Section deleted**

#### ***Courtesy Patrols***

#### **Section deleted**

### **Construction Requirements**

The Contractor shall provide installation, maintenance, and removal of all temporary traffic control devices.

#### ***Temporary Traffic Control Devices***

#### ***Construction Signing***

Construction signing within the Project limits shall comply with CDOT *Standard Specifications*, the MUTCD and all other applicable standards set forth herein. Construction signing and construction signing maintenance shall be the responsibility of the Contractor.

Wood signposts conforming to CDOT *Standard Specifications* will be allowed for installation of temporary signs.

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### ***Temporary Traffic Signals***

#### **Section deleted**

### ***Temporary Marking Paint and Signs***

The Contractor shall furnish, apply and remove temporary pavement marking paint in accordance with CDOT *Standard Specifications*. Temporary paint striping shall meet the conformity of lines (including no overspray), dimensions, patterns, locations and details established in the Contractor's TCP and MHT.

1. Temporary pavement paint striping shall be re-striped once a month, or as required to maintain safe traffic operations.
2. Epoxy-based paint shall not be allowed for temporary striping. Pavement Marking with Low Temperature Acrylic paints and High Build Acrylic Paint shall be used as approved by CDOT.
3. Hydro blasting, or other methods that do not result in scaring of permanent pavements shall be used for removal of temporary striping.

### ***Glare Screens***

#### **Section deleted**

### ***Maintenance of Temporary Traffic Control Devices***

The Contractor shall be responsible for the maintenance of all temporary traffic control devices within the Project limits, including the local street system.

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#### Deliverables

| The Contractor shall submit the following to CDOT for review, Approval, and/or Acceptance:              | Deliverable review, Acceptance, or Approval | Schedule  |
|---|---|---|
| Transportation Management Plan (TMP)  | Acceptance                                  | 30 Days prior to Construction   |
| Requests to CDOT CTMC and Local Agencies for modifications to traffic signals, timing, and VMS messages | Review                                      | 14 Days prior to the requested date for modifications                       |
| Incident Management Plan (IMP)  | Acceptance                                  | 30 Days prior to Construction   |
| Traffic Control Plan (TCP)  | Acceptance                                  | At least 14 Days prior to implementation of the TCP                         |
| Method of Handling Traffic (MHT)  | Acceptance                                  | At least 2 Days prior to implementation of the MHT requiring a lane closure |

All deliverables shall also conform to the requirements of Book 2, Section 3, and Quality Management.

#### Project Special Provisions

***The following specifications modify and take precedence over the Standard Specifications.***

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#### **REVISION OF SECTION 630**

#### **IMPACT ATTENUATOR (TEMPORARY)**

Section 630 of the Standard Specifications is hereby revised for this project to include the following:

#### **DESCRIPTION**

This work consists of furnishing, installing, certifying, moving, repairing, maintaining, and removing temporary impact attenuators in accordance with these specifications and in conformity with the lines and details shown on the plans or established.

#### **MATERIALS**

Each impact attenuator shall be selected from the Crash Cushion and End Treatment Application Chart as listed in the *Safety Selection Guide* on the CDOT Design and Construction Project Support web site. Impact attenuators shall conform to the requirements of the manufacturer and be capable of bi-directional shielding of the objects detailed and located on the plans. Sand Barrel Arrays will not be permitted in narrow median locations as designated in the plans. Filler materials shall be treated according to the manufacturer's recommendations to prevent freezing to a temperature of -50 °F.

If the posted speed limits of the construction zone are 45 miles per hour or less, the impact attenuator shall comply with the crash test requirements contained in NCHRP Report 350 (only applicable for impact attenuators developed prior to 2011) or MASH (acceptable for all impact attenuators), TL-2. For posted speed limits in the construction zone greater than 45 miles per hour, the attenuator shall meet the requirements of TL-3.

#### **CONSTRUCTION REQUIREMENTS**

If sand barrel arrays are used, the Contractor shall paint, with white epoxy paint, an outline and the weight of each barrel on the pavement prior to final placement. All numbers shall be a minimum of 6 inches high. Barrel type shall be one of those listed in the *Safety Selection Guide*.

The site shall be prepared to receive the impact attenuator by filling, excavating, smoothing, constructing the paved foundation pad, installing approved transition and anchoring, and all other work necessary for the proper installation of the attenuator.

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#### **REVISION OF SECTION 630 IMPACT ATTENUATOR (TEMPORARY)**

The impact attenuator shall be fabricated and installed in accordance with the manufacturer's recommendations. The Contractor shall provide a copy of the manufacturer's installation instructions and parts list to the Engineer prior to installation of the device.

Each installation shall be supervised and certified as correct upon completion by a representative of the device manufacturer or by an employee of the Contractor who is a certified installer. The certified installer shall have completed device training and shall be registered with the manufacturer as a certified installer. The Contractor shall submit all appropriate documentation to validate that the certified installer has completed device training and has been registered with the manufacturer as a certified installer.

#### **METHOD OF MEASUREMENT**

Impact Attenuator (Temporary) will be measured by the number of attenuators shown on the plans, installed, certified, and accepted; or the actual number of authorized 24-hour periods that the attenuator is used.

**END OF SECTION REVISION**

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#### **REVISION OF SECTION 630**

#### **IMPACT ATTENUATOR (TRUCK MOUNTED ATTENUATOR) (TEMPORARY)**

Section 630 of the Standard Specifications is hereby revised for this project to include the following:

#### **DESCRIPTION**

This work shall consist of furnishing, operating, and maintaining a truck with an attached impact attenuator.

#### **MATERIALS**

The Contractor shall supply a vehicle with a truck mounted attenuator approved by the FHWA to meet NCHRP 350 criteria for level TL-3 collisions. The attenuator shall be mounted to a suitable truck in a manner meeting the Manufacturer's specifications. The truck shall be furnished with a roof mounted Advance Warning Flashing or Sequencing Arrow Panel (B Type). The truck shall be used when setting up or taking down the work zone and shall be parked in the activity area protecting the construction work while work is being performed, unless otherwise directed.

#### **CONSTRUCTION REQUIREMENTS**

Maintenance, storage, operation, and all repairs of truck mounted attenuator and associated vehicle shall be the responsibility of the Contractor.

#### **METHOD OF MEASUREMENT**

Impact Attenuator (Truck Mounted Attenuator) (Temporary) will be measured by the number of attenuators shown on the plans, installed, certified, and accepted; or the actual number of authorized 24-hour periods that the attenuator is used.

#### **END OF SECTION REVISION**

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#### REVISION OF SECTION 630 PORTABLE MESSAGE SIGN PANEL

Section 630 of the Standard Specifications is hereby revised for this project as follows:

Subsection 630.01 shall include the following:

This work includes furnishing, operating, and maintaining a portable message sign panel.

Add subsection 630.031 immediately following subsection 630.03 as follows:

**630.031 Portable Message Sign Panel.** Portable message sign panel shall be furnished as a device fully self-contained on a portable trailer, capable of being licensed for normal highway travel, and shall include leveling and stabilization jacks. The panel shall display a minimum of three - eight character lines. The panel shall be a dot-matrix type with an LED legend on a flat black background. LED signs shall have a pre-default message that activates before a power failure. The sign shall be solar powered with independent back-up battery power. The sign shall be capable of 360 degrees rotation and shall be able to be elevated to a height of at least five feet above the ground measured at the bottom of the sign. The sign shall be visible from one-half mile under both day and night conditions. The message shall be legible from a minimum of 750 feet. The sign shall automatically adjust its light source to meet the legibility requirements during the hours of darkness. The sign enclosure shall be weather tight and provide a clear polycarbonate front cover.

Solar powered message signs shall be capable of operating continuously for 10 days without any sun. All instrumentation and controls shall be contained in a lockable enclosure. The sign shall be capable of changing and displaying sign messages and other sign features such as flash rates, moving arrows, etc.

Each sign shall also conform to the following:

- (1) In addition to the onboard solar power operation with battery back-up, each sign shall be capable of operating on a hard wire, 100-110 VAC, external power source.
- (2) All electrical wiring, including connectors and switch controls necessary to enable all required sign functions shall be provided with each sign.
- (3) Each sign shall be furnished with an operating and parts manual, wiring diagrams, and trouble-shooting guide.
- (4) The portable message sign shall be capable of maintaining all required operations under Colorado mountain-winter weather conditions.
- (5) Each sign shall be furnished with an attached license plate and mounting bracket.
- (6) Each sign shall be wired with a 7-prong male electric plug for the brake light wiring system.



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#### **REVISION OF SECTION 630 PORTABLE MESSAGE SIGN PANEL**

Subsection 630.13 shall include the following:

The portable message sign panel shall be on the project site at least 7 working days prior to the start of active roadway construction. Maintenance, storage, operation, relocation to different sites during the project, and all repairs of portable message sign panels shall be the responsibility of the Contractor.

**END OF SECTION REVISION**

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#### ADDED SECTION 632

#### NIGHT WORK LIGHTING

Section 632 Night Work Lighting is added to the Standard Specifications for this project as follows:

#### DESCRIPTION

**632.01** This work consists of furnishing, installing, operating, maintaining, moving, adjusting, and removing lighting to illuminate construction work spaces for night work. Night work will be defined as work performed between 30 minutes before sunset and 30 minutes after sunrise.

#### MATERIALS AND EQUIPMENT

**632.02** The Contractor shall provide lighting for night work in the activity area work space where construction equipment, workers on foot, or both are present. The work space is that portion of the roadway closed to road users, or outside of the roadway, set aside for workers, equipment and materials performing contract work. the work space may be stationary or may move as the work progresses.

Illumination may be accomplished by using a combination of portable lights, floodlights, equipment mounted lights, or other lighting methods that will provide the required minimum lighting intensity. Light fixtures that are mounted on the construction equipment shall have a secure connection to minimize vibration and ensure that the view of the equipment operator is not obstructed. Portable lights shall be aimed either generally parallel or perpendicular to the roadway, aimed downward towards the work to avoid glare to oncoming drivers.

In the event of any failure of the lighting system, the construction operation shall be discontinued until the required level of illumination is restored. Delays due to insufficient lighting levels are the responsibility of the Contractor. Existing street and highway lighting shall not eliminate the need for the Contractor to provide work area lighting. Vehicle headlights shall not be permitted as the sole means of illumination while working.

Portable Generators/Inverter Generator. The Contractor shall provide portable generator(s)/inverter generator(s) as needed to power the added equipment mounted lights on motorized equipment if the existing power supply on the equipment is insufficient to power the added lights. Fuel tank capacity and availability of fuel on site shall be sufficient to permit uninterrupted operation throughout the planned shift. All power sources shall be equipped with a Ground-Fault Circuit Interrupter. The portable generators/inverter generators shall be placed or temporarily mounted on the equipment without obstructing access onto the equipment or the view of the operator.

**632.03 Light Meter.** The Contractor shall furnish a light meter for use by the Engineer. The meter shall have a digital display calibrated to **National Institute of Standards and Technology** (NIST) standards, shall be cosine and color corrected with an accuracy of +/- 5 percent. The light meter will remain the property of the Contractor after final acceptance.

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#### ADDED SECTION 632 NIGHT WORK LIGHTING

##### CONSTRUCTION REQUIREMENTS

**632.04** Lighting for night work shall include:

- (1) Minimum lighting intensity of 5 foot candles for work space illumination.
- (2) Illuminate the stationary work space as stated in (1) above where construction equipment, workers on foot or both are present.
- (3) Light sources shall be positioned not to interfere with or impede traffic in any direction and not cause glare for motorists or onto adjacent properties whenever possible. The Contractor shall make adjustments, use visors or shields, or both to minimize glare.
- (4) Illumination for mobile operations within a closed travel lane with traffic control devices will be defined as 25 feet in front of and behind and 5 feet to each side of each piece of moving equipment.
- (5) Workers performing materials testing for either mobile or stationary operations shall have their work space illuminated as stated in (1) above. For concrete operations at night, the Contractor shall illuminate the designated concrete truck washout location including the access and the wash out site.
- (6) Workers on foot, performing work within a moving work space (i.e. striping layout/installation, surveying, etc.) shall wear ANSI approved high visibility apparel and headwear for Class 3 risk exposure including vest, Class E pants or leg gaiters, and reflective tape on hard hats.
- (7) Portable light towers and lights mounted on stands shall be sturdy and free-standing without the aid of guy wires or bracing. Minimum illumination levels as stated in (1) above shall be maintained at a distance of 5 feet on all sides of stationary equipment with either equipment mounted or free standing lights.
- (8) The Contractor shall ensure that all pieces of equipment have operating lights to illuminate operator's controls, backhoe and loader buckets, and illuminate the equipment reach limits around rotating equipment. (i.e. the paving machine shall have illumination for the hopper, auger, and screed areas.)
- (9) The TCS vehicle shall have the rear of the truck illuminated while installing, maintaining, and removing traffic control devices unless sufficient lighting levels exist with stationary lights.
- (10) The Contractor shall maintain a uniformity ratio no greater than 5:1 over the work space. Uniformity ratio is the ratio of average to minimum horizontal illuminance within the work space. The uniformity ratio shall be determined by dividing the average of all light meter measurements by the light meter measurement at the darkest spot within the illuminated area. The limits for checking the uniformity ratio for moving operations within the closed travel lanes will be limited to the 25 feet in front of and behind and 5 feet to each side of each piece of moving equipment.

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#### ADDED SECTION 632 NIGHT WORK LIGHTING

**632.05 Night Work Lighting Plan.** The Contractor shall submit a lighting plan to the Engineer for review signed by the Contractor's competent person three days in advance of the Preconstruction Conference. The lighting plan shall appropriately describe the work and include the following:

- (1) Layout drawing and supplemental narrative showing light locations, equipment mounted lights, and configuration including both typical spacing and lateral placement for each work activity
- (2) Tabulation of lights for those lights that are included within the Night Work Lighting pay item. Lights included in the tabulation such as tower lights, lights mounted on stands and lighting mounted to mobile equipment (not original equipment lights) but those additional equipment mounted lights or portable lights that provide the 25 feet in front and behind illumination zone shall have catalog cuts giving the specific brand names, model numbers, lamp type and wattage.
- (3) Narrative description of those operations where workers will be on foot in a moving work space.
- (4) Details of hoods, visors, louvers, shields or other means to be used to minimize glare.

The plan shall be revised and updated by the Contractor as requested by the Engineer during the progress of the work to accommodate changes to the work.

**632.06 Inspection of Lighting.** Lighting inspection by the Engineer will be performed jointly with the Contractor's designated person on a drive through the project to include (1) observation of the lighting setup to evaluate glare potential for drivers and workers and (2) light meter measurements to determine minimum illumination levels. The Contractor shall make adjustments to the lighting as needed based on the Engineer's inspection. Any corrections and deficiencies needed to provide the minimum illumination levels must be made within one hour of being notified or the Engineer is required to shut down construction.

The Engineer will take light meter measurements to verify the minimum lighting levels using a light meter provided by the Contractor during the night work shift. Light meter readings will be taken within the work space where work is being performed, in a horizontal plane, light sensor part of the meter held parallel to the ground with the sensor aimed upward, 3 feet above the pavement or ground surface. Meter readings will be taken at the source at 5 foot intervals out to the illuminated work space perimeter. These measurements will be documented and filed in the project records.

## **Section 16 – Maintenance of Traffic**

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### **ADDED SECTION 632 NIGHT WORK LIGHTING**

**632.07 Lighting for Flagger Stations.** For nighttime flagging, flagger stations shall be illuminated by an overhead light source providing a minimum lighting intensity level of 5 foot candles measured 1 foot out from the flagger's chest. The flagger station light shall illuminate the station area with a radius of at least the width of the lane plus 5 feet, and be centered on the flagger in the initial flagging position. The size of the illuminated area shall be increased to account for flagger movements required to control traffic. The flagger station light shall be a minimum of 10 feet above the pavement and be capable of being shielded through the use of visors, hoods, louvers, or screens as needed to minimize glare to approaching traffic and spilling over onto adjacent properties.

**END OF SECTION**