

## **14.0 SIGNING, PAVEMENT MARKING, SIGNALIZATION, LIGHTING, AND INTELLIGENT TRANSPORTATION SYSTEMS**

The Contractor shall provide permanent signing, pavement marking, traffic signalization, and lighting on 120<sup>th</sup> Avenue Connection, Wadsworth Boulevard, Wadsworth Place, 118<sup>th</sup> Avenue, Commerce Street, and other roads affected by the Project. Intelligent Transportation Systems (ITS) conduits shall be provided on the 120<sup>th</sup> Avenue Connection within the Phase 1 project limits.

The Contractor shall be responsible for the existing permanent signing, pavement marking, traffic signalization, lighting, and ITS elements within the limits of the Project and comply with the requirements of this Section.

### **14.1 Design Requirements**

The Contractor shall prepare signing, pavement marking and traffic signal designs and plans for all areas on the Project. These plans shall be a component of all Released for Construction Documents where any signing, pavement marking or traffic signal component is required for the Work.

The Contractor shall provide permanent signing, pavement marking, delineation, and other traffic control devices that facilitate safe flow of traffic through the completed Project elements and that accommodates future phases of the project (Phase 2 and any Options (Phase 3) not included in the Basic Configuration).

The Contractor shall prepare lighting and electrical designs and plans for all areas on the Project. The Contractor shall coordinate with the electrical utility company to determine electric power requirements for the Project and to develop the Project lighting design and construction requirements.

#### **14.1.1 Permanent Signing**

##### **14.1.1.1 Signing Design**

The Contractor shall prepare signing designs and plans for all areas on the Project. These plans shall include, all necessary guide, warning, supplemental, and regulatory signs, and additions, removals or modifications to existing signs and appurtenances. Plans shall also include a preliminary layout of signs which will be required for future phases of the project and that may affect placement and configuration of signs placed as a part of the Basic Configuration.

Signing design shall comply with the requirements of the MUTCD, Manual of Uniform Traffic Control Devices. The requirements of the MUTCD shall include both the standard requirements and the guidance recommendations of the manual.

The design and plans shall address modifications to permanent signing outside the Project that is rendered inaccurate, ineffective, confusing or unnecessary by the Project. Signing plans shall provide layouts showing the locations of ground-mounted and overhead signs, special sign details, and structural and foundation requirements.

The Contractor shall submit plans for all Class III and major overhead signs to CDOT for Approval. These plans shall identify the location and message content for each sign. The Contractor shall submit sign layout for all special signs of any size to CDOT for Approval. Existing major overhead sign structures shall be relocated as necessary to comply with the geometric requirements of the Basic Configuration.

Permanent signage on bridges shall not be hung from or be attached to the face of bridge superstructures.

Illuminated signs identifying local streets shall be required for all permanent traffic signals, and are subject to the approval of the City and County of Broomfield.

The Contractor shall provide appropriate signage to guide local traffic through the altered system. These signs will be subject to the approval of the City and County of Broomfield.

#### **14.1.1.2 Materials**

The Contractor shall use tubular steel posts for all Class I and Class II ground signs. Wood posts for mounting ground signs shall not be used. All delineators shall have metal posts.

All ground signs shall include breakaway devices.

Retroreflective sheeting shall be provided for all sign panels in accordance with Book 2, Section 19.

The Contractor will be allowed to reuse any of the sign structures, ground signs and their components that comply with the requirements of this Section.

### **14.1.2 Permanent Pavement Marking**

#### **14.1.2.1 Pavement Marking Design**

The Contractor shall prepare pavement marking designs and plans for roads on the Project. These plans shall include, all striping required for center lines, edge lines, lane lines, gore areas, lane drops, merging lanes, transition lanes, bike lanes, arrows, legends, symbols, object markings, delineation, and other striping, as well as any modifications to permanent pavement markings required for transitions to existing pavement markings.

Pavement marking design shall comply with the requirements of the MUTCD, Manual of Uniform Traffic Control Devices. The requirements of the MUTCD shall include both the standard requirements and the guidance recommendations of the manual.

#### **14.1.2.2 Materials**

Pavement markings shall conform to the requirements specified herein and the CDOT Standard Specifications, M&S Standards, the MUTCD, and the Broomfield Standard Specifications.

The Contractor shall use the following pavement-marking materials at the specified locations:

Location	Pavement Marking Type
Edge lines and Channelization lines	Epoxy Pavement Marking
Skip lines on PCCP	Thermoplastic Pavement Marking Type II (contrast)
Skip lines on HMA	Thermoplastic Pavement Marking Type I
Words/symbols/Cross Walks/Stop lines	Thermoplastic Pavement Marking Type III

**14.1.3 Temporary and Permanent Traffic Signalization**

Traffic signal improvements are required at the intersection of Wadsworth Parkway and 120<sup>th</sup> Avenue Connection. Portions of the existing signal installation that satisfy the system requirements of the Project may be reused or left in place.

Electrical conduit shall be installed along the 120<sup>th</sup> Ave Connection for connection of future signals. Contractor shall install 2 - 2” conduits on the south side of the roadway and through both structures. These 2-2” Conduits shall be installed at a 4-foot depth. These 2 -2” conduits shall not be used for signal or street lighting but shall be left vacant for future ITS fiber installation by CDOT. These conduits shall contain tracer wire a pull tape per the Specification. Pull boxes (24”x36”x24”) shall be placed at 500’ spacing, at future ramp terminals for the proposed interchange, and at intersection of 120<sup>th</sup> Avenue Connection and Wadsworth Boulevard. Pull boxes shall also be used for interconnection of both structures. Fiber Optic Marker Post shall be installed per the Location Marker Standard. CDOT ITS Standards and Specifications for Conduit, Pull boxes and Markers can be found at <http://www.dot.state.co.us/DesignSupport/ITS/Index.htm>

The Contractor shall prepare traffic signal plans for the 120<sup>th</sup> Avenue Connection and Wadsworth Parkway (SH-121) intersection. These plans shall include, existing and proposed intersection plan details, traffic signal pole locations, mast arm and signal head locations, descriptions and directions, pedestrian button and signal locations, descriptions and directions, approach striping and marking locations and types, cabinet and power source locations, conduit and pull boxes, detection systems and locations, and all other plan and component details for complete traffic signal installation. The Contractor shall also prepare preliminary traffic signal plans at the 120<sup>th</sup> Avenue Connection and Wadsworth Boulevard intersection in accordance with the requirements above for the purpose of demonstrating coordination of the improvements constructed under the Basic Configuration with future needs of the Project once Phase 2 is constructed.

All temporary and permanent traffic signals shall be designed and constructed in conformance with CDOT Specifications and shall be subject to Approval of CDOT. Permanent traffic signal equipment shall match existing equipment in appearance.

Illuminated street signs are required for all permanent traffic signals.

Permanent traffic signalization appurtenances will not be allowed to hang from, or be attached to the face of bridge superstructures.

#### **14.1.4 Permanent Lighting**

##### **14.1.4.1 Lighting Design**

The Contractor shall prepare lighting designs and plans for all permanent roadways on the Project. The plans shall address both temporary and permanent Work and shall include existing topography, right-of-way, utilities and drainage facilities, structures, and all other existing and proposed facilities. The plans shall include location and orientation of standards and fixtures, wiring, conduits, pedestals, power sources, and all other lighting components required to construct the lighting on the Project.

All permanent lighting shall be designed and constructed in compliance with City and County of Broomfield Standard Specifications. Lighting designs and plans shall be subject to Approval of CDOT and the City and County of Broomfield.

Roadway lighting shall be provided from the outside edges of the roadways, unless otherwise Approved by CDOT.

The Contractor shall submit to Broomfield and CDOT for Acceptance lighting calculations showing the design meets the performance criteria for roadway design to include average, maximum, minimum foot-candles, and average to minimum, and maximum to minimum illuminance on the horizontal roadway plane. In addition, the Contractor shall submit voltage-drop calculations for each circuit.

All permanent lighting at intersections and local streets shall be at locations and spacing as approved by the City and County of Broomfield.

Lighting on and underneath all bridge structures shall comply with the design criteria for average and minimum illuminance for the roadway. Roadway and pedestrian lighting on bridge structures shall comply with the requirements of the Aesthetic Treatment Concepts. Lighting design and construction shall also include additional conduit and pull boxes within the bridge structure over US-36 for future use to provide illumination to the ultimate configuration of US-36 and ramps beneath the bridge.

#### **14.1.5 Intelligent Transportation System**

CDOT ITS Branch is responsible for the design and operation of all existing ITS equipment within the Project limits. Modification of ITS facilities shall be subject to Approval of CDOT

Existing conduit or equipment affected by the Work shall be relocated. Location, design, details and the schedule of relocation of the equipment shall be subject to the Approval of CDOT ITS at 303-512-5805. Existing equipment includes the Wadsworth Parkway mainline conduit/fiber optic cable, a mesh router at the US 36 Bridge, and miscellaneous equipment on US 36 mainline.

### **14.2 Construction Requirements**

#### **14.2.1 Permanent Signing**

The Contractor shall remove and dispose of the existing sign structures, ground-mounted signs and delineators within the Project area that do not meet the requirements of this Section. They shall become the property of the Contractor.

## **14.2.2 Permanent Pavement Marking**

New PCCP shall be sandblasted prior to placement of any primer or pavement-marking material.

## **14.2.3 Permanent Traffic Signalization**

### **14.2.3.1 Contractor Requirements**

The Contractor shall purchase and deliver controller cabinets to CDOT.

All existing signalization equipment at the intersection of Wadsworth Parkway and 120<sup>th</sup> Avenue is the property of CDOT. Contractor shall deliver in good condition, all equipment removed from intersection, to the traffic yard at 2000 South Holly Street Denver, Colorado 80222.

### **14.2.3.2 Operational**

CDOT will equip the controller cabinets with all the necessary software to operate the permanent traffic signals.

CDOT will time the permanent traffic signals during the initial startup.

## **14.2.4 Permanent Lighting**

The Contractor shall remove and dispose of the existing lighting that does not meet the requirements of this section. It shall become the property of the Contractor. The Contractor may reuse any of the existing light standards that meet the requirements set forth in this Section. Permanent lighting within the limits of the Basic Configuration shall comply with the Architectural Requirements, if applicable.

## **14.2.5 Intelligent Transportation System**

If necessary because of the Work, the Contractor shall relocate existing equipment according to the design standards and specifications of CDOT ITS Branch

The Contractor shall keep all the existing equipment operational at all times during the Project.

## **14.3 Deliverables**

At a minimum, the Contractor shall submit the following to CDOT for review, Approval and/or Acceptance:

<b>Deliverable</b>	<b>Acceptance or Approval</b>	<b>Schedule</b>
Class III and major overhead sign plans	Approval	prior to issuance of Released-for-Construction documents
lighting design calculations	Acceptance	prior to issuance of the Released-for-Construction documents