Special Provisions

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SPECIAL PROVISIONS

1. Administrative.

a. General.

Perform the work under this construction contract for Project 4992-03-71, Racine Street Bridge, C of Menasha, Fox River Bridge & Approaches, Local Street, Winnebago County, Wisconsin as the plans show and execute the work as specified in the State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, 2020 Edition, as published by the department, and these special provisions.

If all or a portion of the plans and special provisions are developed in the SI metric system and the schedule of prices is developed in the US standard measure system, the department will pay for the work as bid in the US standard system.

100-005 (20191121)

b. Scope of Work.

The work under this contract shall consist of grading, base aggregate dense, select crushed material, concrete pavement, curb & gutter, sidewalk, storm sewer, removal of structure B-70-001, construction of structures B-70-324, R-70-159, R-70-160, R-70-161, and S-70-383, pavement marking, permanent signing, traffic signals, traffic control, restoration and all incidental items necessary to complete the work as shown on the plans and included in the proposal and contract.

104-005 (20090901)

c. Definitions and Acronyms.

A number of acronyms are used in the special provisions. The following list includes most acronyms used:

A Ampere

ANSI American National Standards Institute

AMTFT Active Matrix Thin Film Transistor

ASTM American Society for Testing and Materials

AWG American Wire Gauge

BNC Bayonet Nut Coupling

CCTV Closed-circuit Television

CMU Concrete Masonry Unit

Gb Gigabyte

GFCI Ground Fault Circuit Interface

dB Decibel

dpi Dots Per Inch

DVI Digital Visual Interface

EMT Electrical Metallic Tubing

HMI Human Machine Interface (Touchscreen)

HPU Hydraulic Power Unit

Hz Hertz

I/O Input/Output

ICEA Insulated Cable Engineers Association

IEEE Institute of Electrical and Electronics Engineers

kip 1,000 pound (force)
ksi Kips per Square Inch
LCD Liquid Crystal Display
LED Light Emitting Diode
LS Limit Switch or Lump Sum (with regard to Payment)
kV Kilovolt
kVA Kilovolt-ampere
Mb Megabyte
MCC Motor Control Center
mil thousandth of an inch (length)
NEC National Electric Code
NEMA National Electrical Manufacturers Association
NFPA National Fire Protection Association
MPH Miles per Hour
MTS Manual Transfer Switch
NTSC National Television System Committee
o.c. On Center
pcf Pounds per Cubic Foot
PLC Programmable Logic Controller
PVC Poly Vinyl Chloride
PA Public Address System
PRGS PVC Coated Rigid Galvanized Steel
psf Pounds per Square Foot
psi Pounds per Square Inch
rpm Revolutions per Minute
SCADA Supervisory Control and Data Acquisition
SCTC Submarine Cable Termination Cabinets
SXGA Super Extended Graphics Array
UL Underwriters Laboratory
UPS Uninterruptible Power Supply
V Volt
VAC Volts of Alternating Current
VDC Volts of Direct Current
VGA Video Graphics Array
VRMS Root Mean Squared Voltage
VSD Variable Speed Drive

Other acronyms can be found within the text of the special provisions and on the plans.

2. Prosecution and Progress.

a. Prosecution and Progress

Begin work within ten calendar days after the engineer issues a written notice to do so.

Provide the start date to the engineer in writing within a month after executing the contract but at least 14 calendar days before the preconstruction conference. Upon approval, the engineer will issue the notice to proceed within ten calendar days before the approved start date.

To revise the start date, submit a written request to the engineer at least two weeks before the intended start date. The engineer will approve or deny that request based on the conditions cited in the request and its effect on the department's scheduled resources

Following award of the contract and two weeks prior to the preconstruction conference submit a detailed schedule of proposed operations for the completion of the work under this contract. Show controlling items in two-week increments from the start of the project to completion.

Manufacturers' warranties or guarantees on equipment, materials, or products purchased for use on the contract are to be consistent with those provided as customary trade practice, obtained by the contractor, and submitted upon partial acceptance of the contract. The contractor will assign to the department all manufacturers' warranties or guarantees on all such equipment, material, or products furnished for or installed as part of the work.

Staging

Supplemental traffic control for the project consists of three (3) stages, described as follows: Items listed below are not limited to, but only highlight construction activities, that are subject to interim completion dates, liquidated damages, or penalties. Perform work as outlined in the following stages:

Stage 1 – Fall 2020 to Fall 2021

- Begin B-70-324 bascule pier, bascule abutment, and spans 5 & 6
- Begin R-70-159 & R-70-160

Stage 2 – Fall 2021 to Summer 2022

- Continue B-70-324 and Begins spans 1 through 4
- Continue R-70-159/160 and begin R-70-161
- Do not start Stage 2 work prior to September 1, 2021 unless otherwise allowed by the engineer.

Stage 3 – Summer 2022

- Continue and complete B-70-324, R-70-159/160/161
- Begin and complete all roadway reconstructions and open all roadways to traffic. This work includes all final pavement, sidewalk, curb and gutter, pavement marking, lighting, signing, landscaping, and all finishing items.
- Do not start Stage 3 work prior to June 6, 2022 unless otherwise allowed by the engineer.

Contract Completion

This is a completion date contract. Complete all contract work to obtain substantial completion as defined in the article "Control of the Work" by September 22, 2022.

Interim Completion Date

Complete all work in Stage 3 within eighty (80) consecutive calendar days and no later than August 24, 2022. This includes all road work from the closure of Racine Street/Main Street and Racine Street/Ahnaip Street intersections to opening the Racine Street roundabouts to traffic and obtaining partial acceptance of the Racine Street bridge.

Supplement subsection 108.11 of the standard specifications as follows:

If all work required for partial acceptance as described in the article "Control of the Work" is not completed, the department will assess the contractor $6,000 in interim liquidated damages for each calendar day the contract work remains incomplete beyond eighty (80) consecutive calendar days or August 24, 2022. An entire calendar day will be charged for any period of time within a calendar day that the requirements have not been met beyond 12:01 AM.

Replace standard spec 108.10.2.2(1) with the following:

(1) The engineer will award a time extension for severe weather on calendar day and completion date contracts. Submit a request for severe weather days if the number of adverse weather days, as defined in standard spec 101.3, exceeds the anticipated number of adverse weather days tabulated below.

Total Anticipated Adverse Weather Days for Each Calendar Month	
Jan	7
Feb	7
Mar	7
April	6
May	5
June	5
July	5
Aug	5
Sept	5
Oct	6
Nov	7
Dec	7

United States Coast Guard

Coordinate with the United States Coast Guard (USCG) Cleveland, Ohio Division 30 days prior to dates where the bascule span will remain inoperable. Coordination must include contingency days in the event of weather delays. An approval letter from USCG must be received before work commences.

USCG Contact:
Blair Stanifer
Bridge Management Specialist
Bridge Administration Branch (Room 2047)
US Coast Guard
1240 East 9th Street
Cleveland, OH 44199

Additionally, the contractor will be held responsible for any and all fines placed against the department by the United States Coast Guard for not meeting waterway navigation requirements as provided in the article “Construction Over or Adjacent to Navigable Waters.”

Winter Maintenance

Snow may be plowed from the traveled roadway into the work site by the maintaining authority. The contractor is responsible for any snow removal from the work site that may be required to continue work operations.

The contractor is responsible for plowing any areas which may need to be cleared of snow or ice to accommodate changes in traffic control and to facilitate construction staging during winter months. Winnebago County or the local maintaining authority will not provide snow plowing operations in areas outside of the active traveled lanes.

Re-install or adjust any traffic control devices that may be damaged, removed, or shifted as part of normal winter maintenance operations. Clean and maintain traffic control devices as necessary or directed as a result of winter maintenance operations.

Anticipated locations of traffic control devices are shown in the plans. Review the work site with the engineer for locations where additional area may be available to maximize lane and shoulder widths over winter months to aid in winter maintenance operations and to maximize snow storage area. Adjust traffic control devices in these areas.

Snow plowing, ice removal including any road salt which may be required, maintenance and cleaning of traffic control devices, and other winter maintenance activities are incidental to other items of work under this contract.

b. **Control of the Work**

Modify Subsection 105.11 as follows:

105.11.1 Partial Acceptance

Supplement as follows:

Partial acceptance will be made only when all elements of work associated with Structure B-70-324, R-70-159/160/161, and roadway reconstruction are completed and the bridge and new roundabouts are ready for through traffic. Those completed work elements will include:

- Railing and deck surfaces installed.
- Bascule span balanced.
- All signs, gates, signals and communication equipment functional.
- All span machinery installed and finally adjusted.
- Camera system installed, adjusted and tested.
- All lighting, including navigational and decorative lights, installed.
- All electrical controls installed. Span drives must be tuned and meet the required speed/time profiles. All limit switches must be adjusted to final locations. All operator interface screens and alarms must be functioning. Programmable logic controller program must be complete without need for any further adjustments. The electrical controls must have passed a witnessed functional test.
- Operator training.
- Maintenance training.
- Structure B-70-324 is otherwise fully functional and normal movable bridge operation restored.
- All Roadway reconstruction including north and south roundabouts and all associated work completed.

Prior to partial acceptance, all bridge operations will be conducted by the contractor.

105.11.2.1.3 Substantially Complete

Supplement 105.11.2.1.3 with the following:

A 30-day “break-in” period for bridge operation (including vehicle traffic) is required prior to substantial completion. Partial acceptance of Structure B-70-324 will be required in order to initiate the “break-in” period. During the “break-in” period, the Department will operate the bridge a minimum of 5 operations every weekday for four consecutive weeks. Each day, at least one operation will use manual mode. The contractor is to be available to immediately respond to any problems that may arise during this period.

The project is substantially complete and the engineer will no longer assess contract time if the contractor has completed all contract bid items and change order work and it has been demonstrated that the bridge functions without problems or defects under repeated use (“break-in” period) while being open to traffic. Adjustments, repairs, operating problems, reporting problems, defective equipment or incomplete final documentation will delay substantial completion. Problems deemed by the engineer to be significant, that limit the ability of the department to operate the bridge during the “break-in” period, will require that a new 30 day “break-in” period to be initiated.

Substantial completion will initiate the 12-month warranty period for the operation of the bridge that includes a warranty for all materials, manufactured or fabricated components, workmanship and control system programs provided under this contract. The warranty period extends for a period of 12-months after the date of substantial completion and extends if the contractor fails to perform to the response time requirements of the warranty.

105.11.2.3 Final Acceptance

Supplement as follows:

The project will not be accepted as final and progress payment retainage will not be reduced until successful completion of the 12-month warranty period.

Warranty

If any of the bridge systems or components provided or modified as a part of the contract fall out of adjustment or fail to function satisfactorily during the warranty period, take prompt action to replace or repair the work. If normal manufacturer's warranties have expired, it remains the contractor's responsibility to repair or replace defective components. Provide the department with any guarantees greater than 12 months that were included with manufactured items procured for this contract.

Respond, and coordinate resolution, within four (4) hours of notification of an emergency and within 48 hours of non-emergency situations. An event will be considered an emergency if the bridge is inoperable or if a key safety feature has failed.

Modify subsection 105.11.2.1.3 of the standard specifications as follows:

The contractor will be liable for all cost incurred to the department if the bridge is non-operational during the 12-month warranty period. The contractor will be charged under administrative item 801.0104 Failure to Open Road to Traffic.

Modify subsection 105.11.2.1.3 of the standard specifications as follows:

During the warranty period subsequent to the 30-day break-in period and the contract deemed substantially complete, failure to respond and coordinate resolution within 48 hours after notification of an emergency or inadequate response or resolution to an emergency will permit the department the right to take corrective action

c. **Bridge Testing.**

Prior to final acceptance, perform bridge testing in the presence of the engineer and any other invitees to demonstrate that all of the electrical and mechanical work has been properly completed to withstand repeated bridge openings. Invitees must include a representative from the city of Menasha responsible for handling movable bridge operations. If this individual declines or does not respond to the invitation, testing must still be conducted in the presence of the engineer.

Demonstrate all safety interlocks and their associated bypass a minimum of three (3) times over the testing period.

Perform a minimum of 30 complete cycles of bridge opening and closing. Perform each cycle in the same manner, as the bridge will be normally operated by the city of Menasha after the project has been accepted. Utilize the complete safety interlocking system and operate all associated external electrical devices associated with it during each cycle.

Perform a minimum of six (6) additional cycles of bridge opening and closing using the manual system.

Perform this testing over three workdays. Perform no more than 10 test cycles in normal operation mode and no more than two (2) using the auxiliary drive system during each of the days that testing is being observed by the engineer.

Provide the department, the engineer, and the city of Menasha a minimum of 10 calendar days advance notice before commencing the first day of testing. Submit record of city invitations to the engineer.

3. Meetings

a. **Mandatory Pre-Bid Meeting**

Add the following to standard spec 102.3.1:

Prospective bidders are required to attend a mandatory pre-bid meeting at 10:00 AM Thursday, July 23, 2020 at the Wisconsin Department of Transportation, Northeast Region, located at 944 Vanderperren Way, Green Bay, WI, 54304-0080.

Contractors will be able to obtain a bidding proposal form and submit a bid on this proposal only if they have been documented as attending the mandatory pre-bid meeting.

ner-102-010 (20180212)

b. **Coordinate with Businesses**

The contractor will arrange and conduct a meeting between the contractor, the department, the city of Menasha (920-967-3610), local officials and business people to discuss the project schedule of operations including vehicular and pedestrian access during construction operations. Hold the first

meeting 14 days prior to the start of work under this contract and hold additional meetings prior to each of the other two major work stages. The contractor shall notify all parties in writing a minimum of 10 days before the meetings are held.

ner-105-005 (20180212)

4. Environmental

a. Information to Bidders, U.S. Army Corps of Engineers Section 404 Permit and 408 permit

The department has obtained a U.S. Army Corps of Engineers Section 404 permit. Comply with the requirements of the permit in addition to requirements of the special provisions. A copy of the permit is available from the regional office by contacting Bill Bertrand at (920) 360-3124.

stp-107-054 (20080901)

b. Coordination with the U.S. Army Corps of Engineers

The existing navigation cable shall remain in place at all times. Coordinate all work and schedule with the ACOE for structure B-70-324 and removal of B-70-001. Coordinate scheduling and construction of Pier 4 anchors for a new navigational cable system with the ACOE. Coordinate dredging with ACOE.

c. Information to Bidders, WPDES General Construction Storm Water Discharge Permit.

The department has obtained coverage through the Wisconsin Department of Natural Resources to discharge storm water associated with land disturbing construction activities of this contract under the Wisconsin Pollutant Discharge Elimination System General Construction Storm Water Discharge Permit (WPDES Permit No. WI-S066796-1). A certificate of permit coverage is available from the regional office by contacting Bill Bertrand at (920) 360-3124. Post the permit in a conspicuous place at the construction site.

stp-107-056 (20180628)

d. United States Coast Guard Permit

Contact the United States Coast Guard 30 days prior to when the bascule span will remain inoperable. The navigation season is defined from to.

e. Construction Over or Adjacent to Navigable Waters.

The Fox River is classified as a federal navigable waterway under standard spec 107.19.

stp-107-060 (20171130)

Fish Spawning

There shall be no instream disturbance of Fox River as a result of construction activity under or for this contract, from ice out or March 1 (whichever occurs first) to June 15 both dates inclusive, in order to avoid adverse impacts upon the spawning of fish species.

Any change to this limitation will require submitting a written request by the contractor to the engineer, subsequent review and concurrence by the Department of Natural Resources in the request, and final approval by the engineer. The approval will include all conditions to the request as mutually agreed upon by WisDOT and DNR.

0036 (20090901)

Turtles

There is potential for impacts to the state special concern Blanding's Turtle (Emydoidea blandingii). It is recommended that "j-hooks" are installed at the ends of any silt fence installed. Most importantly, any amphibians or reptiles that are found in the active work zone (which includes staging, storage, and parking areas within and adjacent to the project) shall be removed and relocated outside the active work zone. If there is an amphibian or reptile mortality, please contact Jay Schiefelbein at 920-360-3784 or at jeremiah.schiefelbein@wi.gov immediately.

Migratory Birds

Swallow and other migratory birds' nests have been observed on or under the existing bridge. All active nests (when eggs or young are present) of migratory birds are protected under the federal Migratory Bird Treaty Act.

The nesting season for swallows and other birds is usually between May 1 and August 30. Either prevent active nests from becoming established, or apply for a depredation permit from the US Fish and Wildlife Service for work that may disturb or destroy active nests. The need for a permit may be avoided by removing the existing bridge structure prior to nest occupation by birds, or clearing nests from all structures before the nests become active in early spring. As a last resort, prevent birds from nesting by installing a suitable netting device on the remaining structure prior to nesting activity. Include the cost for preventing nesting in the cost of Removing Old Structure Over Waterway with Minimal Debris.

0074 (20090901)

Northern Long-eared Bat *(Myotis septentrionalis)*

Northern Long-eared Bats (NLEB) have the potential to inhabit the project limits because they roost in trees. Roosts may not have been observed on this project, but conditions to support the species exist. The species and all active roosts are protected by the Federal Endangered Species Act. If an individual bat or active roost is encountered during construction operations, stop work and notify the engineer and the WisDOT Regional Environmental Coordinator (REC).

In accordance to the final 4(d) rule issued for the NLEB, the department has determined that the proposed activity may affect, but will not result in prohibited take of the NLEB. The activity involves tree removal, but will not occur within 0.25 miles of a known hibernacula, nor will the activity remove a known maternity roost tree or any other tree within 150 feet of a known maternity roost tree.

If additional trees need to be removed, no Clearing shall occur without prior approval from the engineer, following coordination with the WisDOT REC. Additional tree removal beyond the area originally specified will require consultation with the United States Fish and Wildlife Service (USFWS) and may require a bat presence/absence survey. Notify the engineer if additional Clearing cannot be avoided to begin coordination with the WisDOT REC. The WisDOT REC will initiate consultation with the USFWS and determine if a survey is necessary.

Submit a schedule and description of Clearing operations with the ECIP 14 days prior to any Clearing operations. The department will determine, based on schedule and scope of work, what additional erosion control measures shall be implemented prior to the start of Clearing operations, and list those additional measures in the ECIP.

f. Environmental Protection, Dewatering

Add the following to standard spec 107.18:

If dewatering is required, treat the water to remove suspended sediments by filtration, settlement or other appropriate best management practice before discharge. The means and methods proposed to be used during construction shall be submitted for approval as part of the Erosion Control Implementation Plan for dewatering at each location it is required. The submittal shall also include the details of how the intake will be managed to not cause an increase in the background level turbidity before treatment and any additional erosion controls necessary to prevent sediments from reaching the project limits or wetlands and waterways. Guidance on dewatering can be found on the Wisconsin Department of Natural Resources website located in the Storm Water Construction Technical Standards, Dewatering Code #1061, "Dewatering". This document can be found at the WisDNR website:

http://dnr.wi.gov/topic/stormwater/standards/const_standards.html

The cost of all work and materials associated with water treatment and/or dewatering is incidental to the bid items the work is associated.

ner-107-040 (20180212)

g. Erosion Control Structures.

Within three calendar days after completing the excavation for a substructure unit, place riprap or other permanent erosion control items required by the contract or deemed necessary by the engineer around the unit at a minimum to a height equivalent to the calculated water elevation resulting from a storm that occurs on the average of once every two years (Q2) as shown on the plan, or as the engineer directs.

In the event that construction activity does not disturb the existing ground below the Q2 elevation, the above timing requirements for permanent erosion control shall be waived.

stp-107-070 (20191121

h. Management of Petroleum Contaminated Groundwater, Item SPV.0120.01

A Description

This special provision describes managing petroleum contaminated groundwater.

Groundwater pumped during dewatering operations between Stations 9RNB+50 to 10RNB+50 will likely contain contaminants that require discharged of the groundwater to the sanitary sewer system.

At no cost to the contractor, the City of Menasha has granted permission to discharge Petroleum-Contaminated Groundwater to the sanitary system, provided the requirements outlined herein are met.

The contractor shall notify the engineer immediately if strong petroleum odors are observed during dewatering activities. The engineer and the contractor shall discuss continued dewatering with the City of Menasha.

If petroleum odors are observed during dewatering activities at other locations on the project, terminate dewatering activities and notify the engineer.

B (Vacant)

C Construction

Add the following to standard spec 205.3:

Make every effort to minimize the amount of silt, sand, sediment, and other deleterious substances discharged during dewatering operations. Furnish, install and maintain a sediment box for the dewatering operation before discharging water to the sanitary system.

The Neenah-Menasha Sewerage Commission has granted preliminary permission to discharge to the sanitary system provided that the following requirements are met:

> Notify engineer, Mr. Adam Alix, Menasha DPW with the city of Menasha at 920-967-3610, and Paul Much of Neenah-Menasha Regional WWTP at 920-751-4760 before the discharge of contaminated groundwater to the sanitary system.
>
> If the pumping rate is equal to or less than 70 gallons per minute (70 gpm), then groundwater may be discharged into the sanitary system. Recovered groundwater shall be discharged to the nearest sanitary sewer manhole. All questions regarding discharge locations should be directed to:
>
> Paul Much of Neenah-Menasha Regional WWTP at 920-751-4760
>
> Preliminary permit has been submitted to the City of Menasha and Neenah-Menasha Sewerage Commission. Final permit will need to be completed by the contractor.

The maximum total pumping rate discharged to the sanitary sewer shall not exceed 70 gpm.

If the dewatering rate exceeds the acceptable rate of 70 gpm (rate the sanitary sewer system can accept), contain the excess groundwater and transport to the WWTP. Contained groundwater will be released at the WWTP by plant personnel within 24 hours of being received at the plant.

D Measurement

The department will measure Management of Petroleum Contaminated Groundwater by the thousand-gallon units (MGAL) of contaminated groundwater pumped into the sanitary sewer system or discharged at the WWTP as measured on a flow meter provided by the contractor. The meter shall be accurate to within 2 percent.

E Payment

The department will pay for measured quantities at the contract unit price under the following item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0120.01	Management of Petroleum Contaminated Groundwater	MGAL

Payment is full compensation for furnishing and placing all materials for pumping water.

i. Management of Petroleum Contaminated Water, Item SPV.0105.30

A Description

This special provision describes managing petroleum contaminated water.

Conform to standard spec 205, parts of the Wisconsin Administration Code (Department of Natural Resources Environmental Investigation and Remediation of Environmental Contamination, Chapters NR 700-736), as the plans show, and in this special provision.

This work consists of pumping petroleum contaminated water from open excavations into a temporary holding tank, as necessary to complete construction. Contaminated water encountered, but not requiring removal as a standard course of construction, shall remain in-place and not be managed under this special provision.

The cost for holding tank mobilization, transportation, and contaminated water disposal will be billed directly by the environmental consultant and/or disposal facility to the department.

A.1 Notice to the Contractor

A Phase I Environmental Site Assessment (ESA) and Phase II Subsurface Investigation (SI), including testing for soil and groundwater contamination, were completed by the department for locations within this project where excavation is required. Information obtained by the department indicated that petroleum contaminated groundwater requiring special management is likely to be encountered at the following location:

1. Station 628+20 to 629+20 from slope intercept to slope intercept at a depth of approximately 6 to 12 feet below existing grade.

   Groundwater contamination with gasoline or other petroleum related products at concentrations exceeding the Enforcement Standards identified in s. NR 140.10 Wisconsin Administrative Code are likely to be encountered during excavation activities.

If petroleum odors are observed during dewatering activities at other locations on the project, terminate dewatering activities and notify the engineer.

For further information regarding investigation activities at these locations, contact Kathie VanPrice, Wisconsin Department of Transportation, Environmental Coordinator, 944 Vanderperren Way, Green Bay, Wisconsin 54324, and (920) 492-7175.

A.2 Coordination

Coordinate work under this contract with the environmental consultant retained by the department:

Consultant:	TRC Environmental Corporation
Address:	708 Heartland Trail, Suite 3000, Madison, WI 53717
Fax:	(608) 826-3941
Contact:	Dan Haak
Phone:	(608) 826-3628 (office), (608) 886-7423 (mobile)
E-mail:	DHaak@trccompanies.com

The environmental consultant will determine the location and limits of contaminated groundwater to be managed and conveyed into a temporary holding tank based on groundwater analytical results from previous field investigations, visual observations or field screening of groundwater, surface water, and precipitation that collects within the excavations.

The environmental consultant will coordinate holding tank mobilization, waste characterization sampling of accumulated water, and transportation/disposal of contaminated water.

Provide a 14 calendar day advance notice of the pre-construction conference date to the environmental consultant. At the pre-construction conference, provide a proposed schedule for all excavation activities in the area of contamination. Three (3) calendar days before commencement of excavation activities in the contaminated area, notify the project engineer and environmental consultant. Coordinate with the environmental consultant to ensure that the consultant is present before and during excavation and dewatering activities in the area of contamination.

A.3 Health and Safety Requirements

Prepare a site specific Health and Safety Plan complying with the Occupational Safety and Health Administration (OSHA) standard for Hazardous Waste Operation and Emergency Response (HAZWOPER), 29 CFR 1910.120.

All site workers taking part in remediation activities or who will have the reasonable probability of exposure of safety or health hazards associated with the hazardous material shall have completed Health and Safety training that meets OSHA requirements. A site specific Health and Safety Plan, and written verification by the contractor that workers will have completed up to date OSHA training will be submitted to the project engineer before the start of remediation work.

Develop, delineate and enforce the health and safety exclusion zones for each contaminated site location pursuant to 29 CFR 1910.120.

B (Vacant)

C Construction

Add the following to standard spec 205.3:

Pump petroleum contaminated water from open excavations into a temporary holding tank as necessary to complete construction. Contaminated water encountered, but not requiring removal as a standard course of construction, shall remain in-place and not be managed under this special provision.

Take measures to limit groundwater, surface water, and precipitation from entering and exiting excavations in the area of contamination. Such measures, which may include berming, ditching, or other means, shall be maintained until subgrade construction in the area of contamination is complete.

D Measurement

The department will measure Management of Petroleum Contaminated Water as a single complete unit of work acceptably performed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.30	Management of Petroleum Contaminated Water	LS

Payment is full compensation for controlling contaminated water and preventing non-contaminated surface water and precipitation from entering the areas of contamination; and for managing and pumping petroleum contaminated water from excavations in the area of contamination to the temporary holding tank.

ner-107-100 (20180212)

j. Health and Safety Requirements for Workers Removing Contaminated Materials

Add the following to standard spec 107.1:

Contaminated materials have been identified within the construction limits of this project. Based on sediment analytical data from investigations, contamination will be encountered during excavation, dredging, and dewatering activities.

Site workers, that have a probability of exposure to a hazardous material, will have completed Health and Safety training that meets Occupational Safety and Health Administration (OSHA) requirements. Prepare a site-specific Health and Safety Plan complying with the OSHA standard for Hazardous Waste Operation and Emergency Response (HAZWOPER), 29 CFR 1910.120. Submit the site-specific Health and Safety Plan and written documentation of up-to-date OSHA training to the engineer before the pre-construction meeting.

Develop, delineate, and enforce the health and safety procedures pursuant to 29 CFR 1910.120, 29 CFR 1926.1101, and other heath and safety regulations. Restrict access to the Contaminated Material areas to only authorized, trained, and protected personnel until such time as excavation of contamination has been completed in the respective areas.

Specify the procedure for worker decontamination and for decontamination of equipment used in excavating, dewatering, and hauling of contaminated material in the site-specific Health and Safety Plan.

ner-107-085 (20180212)

k. **Excavation, Hauling, and Disposal of Contaminated Soil (Direct Landfill), SPV.0195.02; Excavation, Hauling, and Disposal of Contaminated Soil (Bioremediation), SPV.0195.03.**

A Description

A.1 General

This special provision describes excavating, loading, hauling, and disposing of contaminated soil. Contaminated soil shall be disposed of at a WDNR-approved facility. The closest WDNR-approved facilities are:

Advanced Disposal Hickory Meadows Landfill
W3105 Schneider Road
Hilbert, WI 54129

Waste Management Valley Trail Landfill
N9101 Willard Road
Berlin, WI 54923

Perform this work in accordance with section 205 of the standard specifications and with pertinent parts of Chapters NR 700-754 of the Wisconsin Administrative Code, as supplemented herein. Per NR 718.07, a solid waste collection and transportation service-operating license is required under NR 502.06 for each vehicle used to transport contaminated soil.

A.2 Notice to the Contractor – Contaminated Soil Locations

The department completed testing for soil contamination within this project where excavation is required. Previous investigations indicate that contamination is present at the following locations:

Petroleum Contamination (Bioremediation)

- Station 1+47 NB to 2+50 NB, from reference line to limits on LT
- Station 20+37 NB to 21+05 NB, from reference line to limits on RT
- Station 18+35 NB to 19+35 NB, from reference line to limits on RT
- Station 1'B'+67 to 2'B'+15, from reference line to limits on RT

Polynuclear Aromatic Hydrocarbons and Metals Contamination (Direct Landfill)

- Station 2+50 NB to 3+00 NB between 0 to 6 ft. bgs, from reference line to northwestern side of former Banta Publishing Corporation building
- Station 8+00 NB to 8+50 NB, from limits on LT to limits on RT

Contaminated soil and/or underground storage tanks (USTs) may be encountered at other locations within the construction limits. If contaminated soil and/or USTs are encountered elsewhere on the project, terminate excavation activities in the area and notify the engineer. Contaminated soil at other locations shall be managed by the contractor under this contract. USTs will be removed by others.

For further information regarding previous investigation and remediation activities at these sites contact:

Name: Kathie VanPrice
Wisconsin DOT, Northeast Region
Address: 944 Vanderperren Way
Green Bay, WI 54304
Phone: 920-492-7175
e-mail: kathie.vanprice@dot.wi.gov

Name: Dan Haak
TRC Environmental Corporation
Address: 708 Heartland Trail, Suite 3000
Madison, WI 53717
Phone: 608-826-3628
Fax: 608-826-3941
e-mail: dhaak@trccompanies.com

A.3 Coordination

Coordinate work under this contract with the environment consultant:

Consultant: TRC Environmental Corporation
Address: 708 Heartland Trail, Suite 3000, Madison, WI 53717

Fax: 608-826-3941
Contact: Dan Haak
Phone: 608-826-3628 (office), 608-886-7423 (mobile)
e-mail: DHaak@trccompanies.com

The role of the environmental consultant will be limited to:

1. Determining the location and limits of contaminated soil to be excavated based on analytical results from previous investigations, visual observations, and field screening of soil that is excavated;

2. Identifying contaminated soils to be hauled to the disposal facility;

3. Documenting that activities associated with management of contaminated soil are in conformance with the contamination management methods for this project as specified herein; and

4. Obtaining the necessary approvals for disposal of contaminated soil from the disposal facility.

Provide at least a 14-calendar day notice of the preconstruction conference date to the environmental consultant. At the preconstruction conference, provide a schedule for all excavation activities in the areas of contamination to the environmental consultant. Also, notify the environmental consultant at least three calendar days prior to commencement of excavation activities in each of the contaminated areas.

Identify the WDNR-approved bioremediation and disposal facility that will be used for disposal of contaminated soils and provide this information to the environmental consultant no later than 30 calendar days prior to commencement of excavation activities in the contaminated areas or at the preconstruction conference, whichever comes first. The environmental consultant will be responsible for obtaining the necessary approvals for disposal of contaminated soils from the bioremediation and disposal facility.

Coordinate with the environmental consultant to ensure that the environmental consultant is present during excavation activities in the contaminated areas. Perform excavation work in each of the contaminated areas on a continuous basis until excavation work is completed. Do not pump or haul contaminated groundwater offsite without specific approval from the environmental consultant. Do not transport contaminated soil offsite without prior approval from the environmental consultant.

A.4 Protection of Groundwater Monitoring Wells

Groundwater monitoring wells may be present within the construction limits. Protect all groundwater monitoring wells to maintain their integrity. Adjust wells that do not conflict with utilities, structures, curb and gutter, etc.to be flush with the final grade. For wells that conflict with the previously mentioned items, notify the environmental consultant, and coordinate with the environmental consultant for the abandonment or adjustment of the wells by others. The environmental consultant will provide maps indicating the locations of all known monitoring wells, if requested by the contractor.

A.5 Excavation Management Plan Approval

The excavation management plan for this project has been designed to minimize the off-site disposal of contaminated material. The excavation management plan, including these special provisions, has been developed in cooperation with the WDNR. The WDNR's concurrence letter is on file at the Wisconsin Department of Transportation. For further information regarding the investigations, including waste characterization within the project limits, contact Kathie VanPrice with the Department, at (920) 492-7175.

B (Vacant)

C Construction

Supplement subsection 205.3 of the standard specification with the following:

Control operations in the contaminated areas to minimize the quantity of contaminated soil excavated.

The environmental consultant will periodically evaluate soil excavated from the contaminated areas to determine if the soil will require offsite disposal. The environmental consultant will evaluate excavated soil based on field screening results, visual observations, and analytical results from previous environmental investigations. Assist the environmental consultant in collecting soil samples for evaluation using excavation equipment. The sampling frequency shall be a maximum of one sample for every 20 cubic yards excavated.

On the basis of the results of such field-screening, the material will be designated for disposal as follows:

- Excavation Common consisting of clean soil and/or clean construction and demolition fill (such as clean soil, boulders, concrete, reinforced concrete, bituminous pavement, bricks, building stone, and unpainted or untreated wood), which under NR 500.08 are exempt materials, or
- Low-level contaminated material (PID readings less than 10 ppm and no observation of staining or petroleum odor, or based on existing analytical data) for reuse as fill within the construction limits as allowed, or
- Petroleum contaminated soil (significant petroleum odor, staining, and/or PID readings greater than 10 ppm) for off-site treatment and disposal at the WDNR-licensed bioremediation facility, or
- Contaminated soil (based on the presence of industrial fill or existing analytical data) for off-site disposal at the WDNR-licensed disposal facility, or
- Potentially contaminated for temporary stockpiling and additional characterization prior to disposal.

Directly load and haul soil designated by the environmental consultant for offsite disposal to the WDNR-approved facility. Verify that vehicles used to transport contaminated material are licensed for such activity in accordance with applicable state and federal regulations. Use loading and hauling practices that are appropriate to prevent any spills or releases of contaminated soils or residues. Prior to transport, sufficiently dewater soils so as not to contain free liquids.

When material is encountered outside the above-identified limits of known contamination that appears to have been impacted with petroleum or chemical products, or when other obvious potentially contaminated materials are encountered or material exhibits characteristics of industrial-type wastes, such as fly ash, foundry sand, and cinders, or when underground storage tanks are encountered, suspend excavation in that area and notify the engineer.

Groundwater may be present within the construction limits. Water generated during dewatering operations (if necessary) is expected to be permitted to discharge to the surface except in the contaminated areas.

Contaminated groundwater generated from dewatering activities within the contaminated areas may exceed the surface water discharge limits for petroleum compounds specified in the DNR's "General Permit to Discharge under the Wisconsin Pollutant Discharge Elimination System" for "Contaminated Groundwater from Remedial Action Operations" (WPDES Permit No. WI-0046566-5), Table 3.1.

Notify the environmental consultant prior to pumping contaminated groundwater.

The Neenah-Menasha Sewerage Commission has granted preliminary permission to discharge to the sanitary system provided that the following requirements are met:

> Notify engineer, Mr. Adam Alix, Menasha DPW with the city of Menasha at 920-967-3610, and Paul Much of Neenah-Menasha Regional WWTP at 920-751-4760 before the discharge of contaminated groundwater to the sanitary system.
>
> If the pumping rate is equal to or less than 70 gallons per minute (70 gpm), then groundwater may be discharged into the sanitary system. Recovered groundwater shall be discharged to the nearest sanitary sewer manhole. All questions regarding discharge locations should be directed to:
>
> Paul Much of Neenah-Menasha Regional WWTP at 920-751-4760
>
> Preliminary permit has been submitted to the City of Menasha and Neenah-Menasha Sewerage Commission. Final permit will need to be completed by the contractor.

In lieu of disposal of groundwater generated from the contaminated areas in the sanitary sewer to the City of Neenah-Menasha Wastewater Treatment Plant, pump contaminated water that exceeds surface water discharge limits, as determined by environmental consultant, into temporary holding tanks provided by others or an alternative discharge point as determined by the environmental consultant, as necessary to complete construction. Allow contaminated water encountered, but not requiring removal as a standard course of construction, to remain in-place and do not manage in accordance to this special provision.

The environmental consultant will coordinate approval of contaminated water hauling and disposal. Only pump contaminated groundwater if the environmental consultant is on-site.

Discharging contaminated groundwater to any location other than that approved and provided by the environmental consultant, is at the contractor's cost. If the contractor chooses alternate discharge, at the contractor's cost, obtain DNR concurrence on any dewatering plans, and provide and operate any and all treatment and discharge equipment required.

Employ construction methods and techniques in a manner that will minimize the need for dewatering, and if dewatering is required, minimize the volume of water generated. Take measures to limit groundwater, surface water, and precipitation from entering and exiting excavations in the areas of contamination. Such measures, which may include berming, ditching, or other means, shall be maintained until construction of utilities in the areas of contamination are complete.

Ensure continuous dewatering and excavation safety at all times. Provide, operate, and maintain adequate pumping equipment and drainage and disposal facilities. Notify the engineer of any dewatering activities, and obtain any permits necessary to discharge water. Provide copies of such permits to the engineer. Meet any requirements and pay any costs for obtaining and complying with such permit use. Follow all applicable legislative statues, judiciary decisions, and regulations of the State of Wisconsin.

Cost for contaminated groundwater collection and disposal is incidental to the project.

D Measurement

The department will measure Excavation, Hauling, and Disposal of Contaminated Soil in tons of contaminated soil accepted by the disposal facility as documented by weight tickets generated by the facility. Load tickets must be delivered to the engineer within 10 business days of the date on which the soil was accepted by the facility.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0195.02	Excavation, Hauling, and Disposal of Contaminated Soil (Direct Landfill)	Ton
SPV.0195.03	Excavation, Hauling, and Disposal of Contaminated Soil (Bioremediation)	Ton

Payment is full compensation for excavating, segregating, loading, hauling, and treatment via bioremediation and/or disposal of contaminated soil; tipping fees; obtaining solid waste collection and transportation service operating licenses; assisting in the collection soil samples for field evaluation; dewatering of soils prior to transport, if necessary; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

205-003 (20080902)

5. Railroad Insurance and Coordination - Wisconsin Central Ltd (CN)

A. Description

Comply with standard spec 107.17 for all work affecting Wisconsin Central Ltd (CN) property and any existing tracks.

A.1 Railroad Insurance Requirements

In addition to standard spec 107.26, provide railroad protective liability insurance coverage as specified in standard spec 107.17.3. Insurance is filed in the name of Wisconsin Central Ltd and Its Parents (CN).

Notify evidence of the required coverage, and duration to Jackie Macewicz, Manager Public Works; 3912 S. Pokegama Road, Superior, WI 54880; Telephone (715) 345-2503; E-mail: Jackie.macewicz@cn.ca.

Also send a copy to the following: Jared Kinziger, NE and NC Region Railroad Coordinator; 944 Vanderperren Way, Green Bay, WI 54304; Telephone (920) 492-7713; E-mail: jared.kinziger@dot.wi.gov.

Include the following information on the insurance document:

- Project ID: 4992-03-71
- Project Location: City of Menasha, Wisconsin

- Route Name: STH 114, Winnebago County
- Work Performed: Detour signing

#	Route Name	City/County	Crossing ID	RR Subdivision	RR Milepost
1	STH 114 @ River St.	City of Menasha	386649D	Manitowoc	1.14
2	STH 114, Tayco/3rd Int	City of Menasha	386640S	Manitowoc	1.61
3	STH 114, Washington St.	City of Menasha	179887C	Manitowoc	207.83

A.2 Train Operation

#	Passenger Train Volume	Passenger Train Speed	Freight Train Volume	Freight Train Speed	Frequency	Switch Train Comment*
1	0	0	0	10	Weekly	There are switch trains in addition to through trains
2	0	0	4	35	Daily	There are switch trains in addition to through trains
3	0	0	0	10	Weekly	There are switch trains in addition to through trains

* Switch trains are in addition to freight and passenger trains.

A.3 Names and Addresses of Railroad Representatives for Consultation and Coordination

Construction Contact

Jackie Macewicz, Manager Public Works; 3192 S. Pokegama Road, Superior, WI 54880; Telephone (715) 345-2503; E-mail jackie.macewicz@cn.ca for consultation on railroad requirements during construction.

Amend standard spec 108.4 to include the railroad in the distribution of the initial bar chart, and monthly schedule updates. The bar chart shall specifically show work involving coordination with the railroad.

Flagging Contact

Submit by US Mail a "Request for Flagging Services and Cable Location" form with prepayment to: Flagging-US, 17641 South Ashland Avenue, Homewood, IL 60430; Flagging_US@CN.CA . The form can be obtained at:

http://www.cn.ca/en/safety/employees/contractors-erailsafe/utility-installations

Requests for flagging and cable locates can take up to five business days after the railroad receives the paperwork. Reference the Wisconsin Milepost and Subdivision located in A.1. Advise Wisconsin Central Ltd (CN) that the flagging services are to be billed at the rate for a public highway project.

Cable Locate Contact

In addition to contacting Diggers Hotline, follow the procedure listed under Flagging Contact.

Wisconsin Central Ltd (CN) will only locate railroad owned facilities buried in the railroad right-of-way. The railroad does not locate any other utilities.

A.4 Work by Railroad

The railroad will perform the work described in this section, except for work described in other special provisions, and will be accomplished without cost to the contractor. None

A.5 Temporary Grade Crossing

If a temporary grade crossing is desired, submit a written request to the railroad representative named in A.3 at least 40 days prior to the time needed. Approval is subject to the discretion of the railroad. The department has made no arrangements for a temporary grade crossing.

A.6 Rail Security Awareness and Contractor Orientation

All employees of contractors who work on CN properties are required to have minimum CN Safety and Security Awareness training. This training can be obtained by registering and following the CN link through www.contractororientation.com. This training is good for a period of one year.

a. Exception: CN has exempted from this training those it classifies as "Delivery Persons". Delivery Persons include contractors such as UPS, FedEx, trucking companies, etc. who merely access the property to supply materials or equipment.

The security awareness and contractor orientation certification must be renewed for projects that will carry over beyond the one-year period. Contractor and subcontractor employees shall wear the identification badge issued by www.contractororientation.com when on railroad right-of-way. Costs associated with training and registration are incidental to other items in the contract.

If employees of contractors have a current eRailSafe badge for CN then an additional badge is not required from www.contractororientation.com.

stp-107-026 (20190717)

6. Traffic and Restrictions to Work

a. Traffic

Perform the work as described in the “Prosecution and Progress” article, as detailed in the Traffic Control plans, and as hereinafter described.

Staging

Stage 1

- Maintain river navigation during navigation season.
- Maintain two-way traffic on all roadways at all times.

Stage 2

- Maintain river navigation during navigation season
- Close Racine Street Bridge traffic and provide a vehicle, pedestrian, and bicycle detour. For vehicle detour use Ahnaip Street, Nicolet Boulevard, and STH 114 (Washington Street, Tayco Street, 3rd Street). For pedestrian detour use Ahnaip Street, Nicolet Boulevard, STH 114 (Washington Street and Tayco Street), Main Street, Milwaukee Street, and 1st Street. For bicycle detour use 1st Street, Nicolet Boulevard, STH 114 (Washington Street and Tayco Street), and 1st Street.
- Maintain two-way traffic north of the Fox River on Main Street and Racine Street
- Maintain two-way traffic south of the Fox River on Ahnaip Street, Keyes Street, and Naymut Street/Riverway

Stage 3

- Maintain river navigation during navigation season
- Close Racine Street Bridge traffic and provide a vehicle, pedestrian, and bicycle detour. For vehicle detour use Ahnaip Street, Nicolet Boulevard, and STH 114 (Washington Street, Tayco Street, 3rd Street). For pedestrian detour use Ahnaip Street, Nicolet Boulevard, STH 114 (Washington Street and Tayco Street), Main Street, Milwaukee Street, and 1st Street. For bicycle detour use 1st Street, Nicolet Boulevard, STH 114 (Washington Street and Tayco Street), and 1st Street.
- Close the intersections of Main Street and Broad Street with Racine Street north of the Fox River.

- Close the intersections of Ahnaip Street, Keyes Street, and Naymut Street/Riverway to the south of the Fox River.
- Maintain pedestrian traffic, through the closed intersections, at all times during construction. Utilize temporary surfaces, ramps, and fencing for pedestrian accommodations. Maintain pedestrian detour route as noted above.

Driveways

Driveways and/or sidewalks within the project may be closed for the minimum amount of time to place and cure concrete necessary to construct the new access. Maintain one driveway to the property at 87 Racine Street at all times; driveway construction cannot be completed concurrently. Temporary access during construction must be maintained to the peninsula at all times. Maintain access from Ahnaip Street, across the Curtis Reed Plaza bridge, and onto the peninsula for City and Army Corps of Engineers maintenance and dam access. Sidewalk access to front entrance at 84 Racine Street must be maintained or temporary walkway provided. Provide the affected property owners of the driveways and/or walkways a 48-hour minimum notice for impending work/closure. Allow emergency vehicles access through the construction zone at all times.

Wisconsin Lane Closure System Advance Notification

Provide the following advance notification to the engineer for incorporation into the Wisconsin Lane Closure System (LCS).

TABLE 108-1 CLOSURE TYPE AND REQUIRED MINIMUM ADVANCE NOTIFICATION

Closure type with height, weight, or width restrictions (available width, all lanes in one direction < 16')	**MINIMUM NOTIFICATION**
Lane and shoulder closures	7 calendar days
Full roadway closures	7 calendar days
Ramp closures	7 calendar days
Detours	7 calendar days
Closure type without height, weight, or width restrictions (available width, all lanes in one direction ≥16')	**MINIMUM NOTIFICATION**
Lane and shoulder closures	3 business days
Ramp closures	3 business days
Modifying all closure types	3 business days

Discuss LCS completion dates and provide changes in the schedule to the engineer at weekly project meetings in order to manage closures nearing their completion date.

Parking and storage areas for construction vehicles, equipment, and materials must be approved by the engineer. Submit proposed location(s) and proposed hauling route(s) to the engineer and city of Menasha two (2) weeks prior to start of construction.

b. Public Convenience and Safety

Revise standard spec 107.8(6) as follows:

Check for and comply with local ordinances governing the hours of operation of construction equipment. Do not operate motorized construction equipment from 10:00 PM until the following 7:00 AM, unless prior written approval is obtained from the engineer.

stp-107-001 (20060512)

c. Holiday and Other Work Restrictions

Do not perform work on, nor haul materials of any kind along or across any portion of the roadway carrying Racine Street traffic. Clear the traveled way and shoulders of such portions of the highway of equipment, barricades, signs, lights, and any other material that might impede the free flow of traffic during the following holiday periods in Stage 1:

- From noon Wednesday, November 25, 2020 to 6:00 AM Monday, November 30, 2020, for Thanksgiving;

- From noon Wednesday, December 23, 2020 to 6:00 AM Monday, December 28, 2020, for Christmas;
- From noon Wednesday, December 30, 2020 to 6:00 AM Monday, January 4, 2021, for New Years;
- From noon Friday, May 28, 2021 to 6:00 AM Tuesday, June 1, 2021, for Memorial Day.
- From noon Thursday, July 1, 2021 to 6:00 AM Monday, July 5, 2021, for Independence Day.
- From noon Friday, September 3, 2021 to 6:00 AM Tuesday, September 7, 2021, for Labor Day.

Do not perform work on, nor haul materials of any kind along or across any portion of the roadway carrying Racine Street traffic north and south of the Fox River Bridge closure. Clear the traveled way of equipment, barricades, signs, lights, and any other material that do not pertain to the bridge closure and might impede the free flow of traffic during the following holiday periods in Stage 2:

- From noon Wednesday, November 24, 2021 to 6:00 AM Monday, November 29, 2021, for Thanksgiving;
- From noon Thursday, December 23, 2021 to 6:00 AM Monday, December 27, 2021, for Christmas;
- From noon Thursday, December 20, 2021 to 6:00 AM Monday, January 3, 2022, for New Years;
- From noon Friday, May 27, 2022 to 6:00 AM Tuesday, May 30, 2022, for Memorial Day.

Do not perform work during following holiday periods during Stage 3:

- From noon Friday, July 1, 2022 to 6:00 AM Tuesday, July 5, 2022, for Independence Day.
- From noon Friday, September 2, 2022 to 6:00 AM Tuesday, September 6, 2022, for Labor Day.
- From noon Wednesday, November 23, 2022 to 6:00 AM Monday, November 28, 2022, for Thanksgiving;

stp-107-005 (20181119)

d. **Traffic Control**

Perform this work conforming to standard spec 643, and as the plans show, or as the engineer approves, except as follows.

Submit to engineer for approval a detailed traffic control plan for any changes to the proposed traffic control detail as the plans show. Submit this plan ten (10) days before the preconstruction conference.

The turning of traffic control devices when not in use to obscure the message will not be allowed under this contract.

Obtain prior approval from the engineer for the location of egress and ingress for construction vehicles to prosecute the work.

Conduct operations in such a manner that causes the least interference and inconvenience to the free flow of vehicles on the roadways. This includes the following:

Do not park or store any vehicle, piece of equipment, or construction materials on the right of way, unless otherwise specified in the traffic control article or without approval of the engineer.

All construction vehicles and equipment entering or leaving live traffic lanes shall yield to through traffic.

Equip all vehicles and equipment entering or leaving the live traffic lanes with a hazard identification beam (flashing yellow signal) capable of being visible on a sunny day when viewed without the sun directly on or behind the device from a distance of 1000 feet. Activate the beam when merging into or exiting a live traffic lane.

Do not disturb, remove or obliterate any traffic control signs, advisory signs, shoulder delineators or beam guard in place along the traveled roadways without the approval of the engineer. Immediately repair or replace any damage done to the above during the construction operations at contractor expense.

The traffic requirements are subject to change at the direction of the engineer in the event of an emergency.

Contact the City of Menasha 14 days prior to each stage for traffic signal timing adjustments at the Main Street and 1st Street intersections along Racine Street.

Contact:

City of Menasha Engineering Department
100 Main Street, Suite 200, Menasha, WI 54952
Phone: (920) 967-3610

ner-643-065 (20190410)

e. **Temporary Work Zone Clear Zone Working Restrictions.**

Park equipment and store materials, including stockpiles, a minimum of 8-feet from the edge of the traveled way unless protected by concrete barrier temporary precast.

If the contractor is unsure whether an individual work operation will meet the safety requirements for working within the clear zone, review the proposed work operation with the engineer before proceeding with the work.

ner-104-005 (20181017)

f. **Portable Changeable Message Signs - Message Prior Approval**

After coordinating with department construction field staff, notify the Northeast Region Traffic Section at 920-366-8033 (secondary contact number is 920-360-3107) 3 business days before deploying or changing a message on a PCMS to obtain approval of the proposed message. The Northeast Region Traffic Unit will review the proposed message and either approve the message or make necessary changes.

PCMS boards must be deployed 7 days before the closure of Racine Street.

ner-643-035 (20171213)

7. Utilities

a. **Utilities**

This contract does not come under the provision of Administrative Rule Trans 220.
107-065 (20080501)

There are underground and overhead utility facilities located within the project limits. Coordinate construction activities with a call to Diggers Hotline or a direct call to the utilities that have facilities in the area located as required per statutes. Use caution to ensure the integrity of the underground facilities and shall maintain OSHA code clearances from overhead facilities at all times.

AT&T Wisconsin (Communication Line) has overhead and underground facilities throughout the project area that will be required to be adjusted, relocated or replaced in order to avoid conflicts with the proposed work. AT&T intends to complete this work between Fall of 2021 to Summer of 2022.

Along westbound Keyes Street at Station 11+10'KWB' 18 feet left, the existing aerial cable will be removed and relocated and at Station 11+22'KWB' 18 feet left, a new duct will be bored west across River Way.

Along northbound Naymut Street/River Way at Station 0+62'N' 24 feet left and at Station 2+39'N' 16.5 feet left, the existing aerial cables will be removed and relocated.

Along Broad Street at Station 0+92'B' 23-30 feet right, ducts will need to be adjusted and at station 0+92'B' 38 feet right, new duct will be placed. At Station 1+72'B' 24 feet right, the contractor is to be made aware of the existing manhole that will be approximately 8 inches up into the proposed road cut. At Station 1+72'B' 24 feet right, new duct will be placed from the existing manhole at this location northeast across Broad Street.

Along southbound Racine Street at Station 3+00'SB' 62 feet right, the aerial cables are to be abandoned and can be removed if necessary. At Station 3+03'SB' 65 feet right, cable from existing handhole is to be abandoned and can be removed if necessary. At Station 15+19.5'SB' 7 feet left, and Station 16+03'SB' 7 feet right, ducts will need to be adjusted. At Station 17+46'SB' 26 feet right, a new manhole will be placed with six new ducts running from it. At station 17+66'SB' 14 feet right, 2 existing tile ducts will be exposed, replaced with a split duct, lowered and concrete encased. There are 2 transite ducts at this location believed to be vacant that can be removed.

Along eastbound Main Street at Station 2+32'MEB' 14 feet right, the buried fiber optic cable will be adjusted. At Station 2+44'MEB' 11 feet left, AT&T ducts conflict with the proposed storm pipe and the storm pipe is planned to be lowered. At Station 2+63'MEB' 0.5 feet right, the existing manhole will be removed and replaced with a new manhole and 2 vacant ducts will be abandoned and can be removed if necessary. A buried fiber option cable and ducts also exist at this location currently. At Station 3+26'MEB' 11 feet left, the ducts will be adjusted to avoid conflict with a proposed light pole.

CenturyLink (Communication Line) has underground facilities within the project limits. At Station 18+86'NB' 18 feet right, the existing handhole will be relocated. Fiber optic facilities are located at/near Stations 17+79'SB' 40 feet left, and 18+35'SB' 34 feet left, as well as at catch basins 15.4 and 15.7, and manhole 5-J, where new storm sewer is being placed. CenturyLink will work with the contractor to make any necessary adjustments. CenturyLink intends to complete this work starting in Spring of 2021.

Charter Communications (Communication Line) has underground and overhead facilities within the project limits. Overhead relocations are dependent on Menasha Electric pole relocations. New fiber at/near Station 17+38'SB' 4 feet left, will be crossed by the proposed storm sewer. Charter intends to complete this work starting in Spring of 2021.

City of Menasha (Sanitary Sewer) has underground facilities within the project limits. The City plans to remove and replace two existing sanitary manholes at Station 3+00 along with approximately 30 feet of sanitary sewer pipe. The City intends to complete this work starting in Spring/Summer of 2022.

Menasha Electric and Water Utilities (Electric) has underground and overhead services throughout the project limits.

There are several existing facilities along Ahnaip Street serving the Banta Building; the exact extent of reconfiguration of these facilities is dependent on the changes to the building. Existing light poles near the intersection of Ahnaip Street and Racine Street will be removed.

At Station 0+50'N' on the west side of Naymut Street, the existing single-phase pole with streetlight attachment is not in direct conflict but may be moved south to accommodate other changes.

At Station 1+40'N' on the east side of Naymut Street, the existing stub pole with streetlight attachment is not in direct conflict with the DOT project but may be moved south to provide more separation to the proposed sidewalk. The light on this pole will be reinstalled at the new location.

At Station 11+15'KWB' on the north side of Keyes Street, the existing three-phase pole is close to the curb ramp and will be moved east.

At Station 2+30'N' on the west side of River Way, the existing three-phase pole is not in direct conflict but may be moved north to accommodate other changes.

At Station 10+20'KEB' on the south side of Keyes Street, the existing light pole with service to Doty Island sign is in conflict with the proposed sidewalk. This pole will be removed, and the service will be fed from the west. The light on this pole will be removed and not reinstalled.

At Station 10+40'KWB' on the north side of Keyes Street, the existing steel pole is within the extents of the cut/fill zone. This pole will be removed, and the attached facilities will be reconfigured. The foundation on this pole will be removed to approximately 2' below grade. The light on this pole will be removed and not reinstalled.

At Station 5+40'RSB' on the west side of Racine Street, the existing three-phase transformer bank pole is in conflict with the proposed sidewalk. This pole will be removed, and the service will be fed from the river crossing facilities.

At Station 9+55'RNB' on the east side of Racine Street, the existing underground vault is in conflict with the proposed bridge footing. This vault will be removed.

At Station 9+90'RNB on the east side of Racine Street, the existing steel pole is in conflict with the proposed bridge. This pole will be removed, and the attached facilities will be reconfigured. The foundation on this pole will be removed until the level of bedrock (approximately 17.5' below grade).

At Station 14+60'RSB' on the east side of Racine Street, the existing steel pole is in conflict with the proposed sidewalk. This pole will be removed, and the attached facilities will be reconfigured. The foundation on this pole will be removed until the level of bedrock (approximately 16.5' below grade).

At Station 15+25'RSB' on the east side of Racine Street, the existing underground vault is in conflict with the proposed roundabout. This vault will be removed.

At Station 18+60'RNB' on the east side of Racine Street, the existing three-phase pole is in conflict with the proposed curb. This pole will be removed, and the attached facilities will be reconfigured. The light on this pole will be removed and not reinstalled.

At Station 20+10'RNB' on the east side of Racine Street, the existing three-phase pole is not in direct conflict but may be moved north to accommodate other changes.

At Station 0+05'B' on the north side of Broad Street, the existing three-phase riser pole is not in direct conflict but may be reconfigured in place.

At Station 10++'B' on the north side of Broad Street, the existing three-phase pole with switch attachment is not in direct conflict but will be moved west to accommodate other changes. The light on this pole will be removed and not reinstalled.

At Station 2+75'B' on the north side of Broad Street, the existing three-phase transformer bank pole is not in direct conflict but may be moved east to accommodate other changes.

At Station 2+80'B' on the south side of Broad Street, the existing three-phase riser pole is not in direct conflict but may be removed to accommodate other changes.

At Station 2+80'B' on the south side of Broad Street, the existing padmounted cabinets and an adjacent private enclosure are not in direct conflict but may be removed to accommodate other changes.

For the river crossing, the preferred method of construction is overhead, but the underground concept is still being investigated. This section will be updated when the method of construction is selected. Menasha Utilities (Electric) intends to complete overhead work starting in April of 2020 or underground work starting in June of 2020.

Menasha Electric and Water Utilities (Water) has underground services within the project limits. Watermain, hydrants, valves and appurtenances will be adjusted at multiple locations. Menasha Utilities intends to complete this work after the Racine Street closure, between October of 2021 and April of 2022.

At the southern roundabout, two valves will be moved, and one will be removed.

Along Ahnaip Street from Station 0+00 to Station 4+50, the watermain will be replaced. At Station 1+20 on Ahnaip Street, water service will be removed. At stations 1+60 and 3+50 on Ahnaip Street, hydrants will be moved.

At Station 5+40 on Racine Street, the valve will be removed and replaced. From Station 17+85 to Station 21+80 on Racine Street, the watermain will be relayed. The hydrant in the northwest corner of Broad Street and Racine Street will be moved.

At Station 2+30 on Riverway, the valve will be moved. Between Storm Structures 6.0 and 8.0, the watermain will be lowered at two locations.

At station 1+80 on Main Street, the hydrant will be moved. Near station 2+40 on Main Street, the valve will be replaced. At Station 2+85 on Main Street, the watermain crossing will be abandoned.

TDS Metrocom (Communication Line) has underground services that run along the east side of Racine Street from the north project limits south to Main Street, then along the south side of Main Street to the west project limits. New cable will be placed from Station 20+00'RNB' to the south along the east side of Racine Street to Station 18+70'RNB' where it will cross Racine Street to the west side right of way and then continue west along Broad Street out of the project limits. TDS intends to complete this work starting in November or December of 2019.

b. **Municipality Acceptance of Sanitary Sewer and Water Main Construction.**

Both the department, City of Menasha, and Menasha Utilities personnel will inspect construction of sanitary sewer and water main under this contract. Provide a minimum 72-hour notice prior to any work the City will be inspecting to ensure adequate coverage by staff.

stp-105-001 (20140630)

c. **Sanitary Sewer and Water Main**

All sanitary sewer work shall be completed in accordance with "Standard Specifications for Sewer and Water Construction in Wisconsin," Sixth Edition, dated December 22, 2003, including all Addendum thereto.

d. Adjusting Water Valve Boxes, Item, SPV.0060.10

A Description

This special provision describes adjusting water valve boxes to final pavement elevations the plans show.

B Materials

Utilize existing valve boxes where the required extent of adjustment allows. If additional sections are necessary, coordinate with Menasha Water and contact Steve Grenell at (920) 967-3415 to obtain required materials.

C Construction

Before completion of paving operations, adjust the water valve boxes to match the final proposed grade. Excavate and expose the existing water main valve box to the depth needed to adjust the valve box to grade, add or remove extension(s) as needed, and backfill with base aggregate material conforming to the requirements for the adjacent roadway base course construction.

Complete adjustments in such a manner to avoid any damage to the water valve boxes. Provide the Menasha Water two working days advance notice before adjusting the valve boxes to finished grade.

D Measurement

The department will measure Adjusting Water Valve Boxes as a unit of work for each valve box acceptably adjusted.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.10	Adjusting Water Valve Boxes	EACH

Payment is full compensation for adjusting each valve box; excavating as necessary to access the valve box; backfilling; repairing any damage done to the valve box during adjustment; and for adding new sections if necessary.

ner-900-015 (20190718)

e. Adjusting Sanitary Manhole Covers, Item SPV.0060.11

A Description

This special provision describes adjusting sanitary manhole covers.

B Materials

Use materials conforming to standard spec 611.2.

C Construction

Use construction methods conforming to standard spec 611.3 and as follows:

Remove and reinstall existing chimney seals, as necessary to adjust manhole cover.

D Measurement

The department will measure Adjusting Sanitary Manhole Covers as each individual unit acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.11	Adjusting Sanitary Manhole Covers	EACH

Payment is full compensation for providing all required materials, exclusive of frames, grates, or lids; and for removing, reinstalling and adjusting the covers, including removing and reinstalling the existing chimney seal.

ner-900-005 (20190718)

f. **Sanitary Sewer Pipe PVC 4-Inch, Item SPV.0090.05.**

A Description

This special provision describes providing Sanitary Sewer Pipe PVC 4-Inch for sanitary sewer service laterals as the plans show including all appurtenances. Conform to Standard Specifications for Sewer and Water Construction in Wisconsin (newest edition including all addendums), hereon referred to below as the “Standard Specification,” except as modified below.

B Materials

Sanitary Sewer Service Piping: Furnish ASTM D2665 Schedule 40 Pipe 4-Inch for sanitary sewer services. Sanitary sewer lateral fittings shall conform to ASTM F1866. Sanitary Sewer laterals shall have solvent weld joints conforming to ASTM D2672 and ASTM D2855. The solvent cement shall conform to ASM D2564.

Cleanout: Furnish 4” sanitary sewer service cleanout where called for in the plans. Furnish and install traffic rated cast iron cleanout box with cast iron lid marked “SEWER.” Set to final grade.

Tapping Saddle Tee: Furnish flexible tapping saddle tee conforming to Chapter 5.3.2 of the “Standard Specification” for cored tee connections.

Tracer Wire: Comply with Section 2.11.0 of "Standard Specifications" except as amended below: Tracer wire shall be 10-gauge CCS with 30 mil HDPE insulation for direct burial. Place tracer wire at the springline of the lateral and tape to the pipe at 5-foot intervals. Connect lateral tracer wire to the sanitary main trace wire. Terminate the tracer wire at the building in a cast iron tracer wire box set to proposed grade.

C Construction

Install in accordance with chapter 5.3.0, 5.4.0 and Section 5.6.1 "Standard Specifications".

D Measurement

The department will measure Sanitary Sewer Pipe PVC 4-Inch by the linear foot acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0090.05	Sanitary Sewer Pipe PVC 4-Inch	LF

Payment is full compensation for Sanitary Sewer Pipe PVC 4-Inch, tapping saddle, insulation, tracer wire, bends, fittings and cleanouts. Furnish necessary materials, labor, excavation, bedding, cover and backfill materials, sheathing, shoring, dewatering, testing, cleanup and all incidentals necessary to complete the work.

g. **C-901 PE Pipe 1-Inch, Item SPV.0090.06.**

A Description

This special provision describes providing C-901 PE Pipe 1-Inch for water service laterals as the plans show including all appurtenances. Conform to Standard Specifications for Sewer and Water Construction in Wisconsin (newest edition including all addendums), hereon referred to below as the “Standard Specification,” except as modified below.

B Materials

Water Service tubing: Furnish C-901 PE Pipe 1-Inch for water services conforming to Chapter 8.24.0 of the “Standard Specifications.”

Corporation Stops: Furnish Corporation Stops in accordance with AWWA C800 and ASTM B62 using compression fitting with 304 stainless steel, double stud tapping saddle in accordance with Chapter 8.30.0 of the “Standard Specifications”

Curb Stops: Furnish Curb Stops in accordance with AWWA C800 and ASTM B62 in accordance with Chapter 8.30.0 of the “Standard Specifications”.

Curb Box: Furnish Curb Box (with tracer wire connector lid) in accordance with Chapter 8.25.0 of the “Standard Specifications”.

Tracer Wire: Comply with Section 2.11.0 of "Standard Specifications" except as amended below: Tracer wire shall be 10-gauge CCS with 30 mil HDPE insulation for direct burial. Place tracer wire at the springline of the lateral and tape to the pipe at 5-foot intervals. Connect lateral tracer wire to the watermain tracer wire.

C Construction

Install in accordance with chapter 5.5.0 and Section 5.6.3 of "Standard Specifications", except as modified below.

Delete wood blocking in Section 5.5.12 and replace with solid concrete block or concrete.

Delete lead disc from Section 5.5.15.

D Measurement

The department will measure C-901 PE Pipe 1-Inch by the linear foot acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0090.06	C-901 PE Pipe 1-Inch	LF

Payment is full compensation for C-901 PE Pipe 1-Inch, including corporation stops, tapping saddles, curb stops, curb box, insulation and tracer wire. Furnish necessary materials, labor, excavation, bedding, cover and backfill materials, sheathing, shoring, dewatering, testing, disinfection, cleanup and all incidentals necessary to complete the work.

h. **Construction Staking Water Main, Item SPV.0105.38**

A Description

This special provision describes the survey required to layout and construct all water main work included in this contract, including but not limited to water main, valves, water manholes, fittings, and hydrants.

B (Vacant)

C Construction

Perform the work conforming to 3.2.1 of the Standard Specifications for Sewer and Water Construction in Wisconsin, latest edition, and as specified below.

Set and maintain construction stakes or marks as necessary to achieve the required accuracy and to support the method of operations. Locate stakes to within 0.02 feet of the true horizontal position, and to establish the grade elevation to within 0.01 feet of the true vertical position.

D Measurement

The department will measure Construction Staking Water Main as a single lump sum unit acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.38	Construction Staking Water Main	LS

Payment is full compensation for performing all survey work required to layout and construct all water main work under this contract; and for relocating and resetting damaged or missing construction stakes.

ner-650-035 (20171213)

8. Clear – Demolition - Removal

Removing concrete in the Canal

Removing concrete in the canal along the peninsula under the existing bridge shall be removed by the contractor and included in the removing pavement item.

a. Removing Old Structure Over Waterway With Minimal Debris Station 6+04, Item 203.0600.S.

Conform to standard spec 203 as modified in this special provision.

Add the following to standard spec 203:

203.3.6 Removals Over Waterways and Wetlands

203.3.6.2 Removing Old Structure Over Waterway with Minimal Debris

(1) Remove the existing structure B-70-001 over the Fox River in large sections and conforming to the contractor's approved structure removal and clean-up plan. During superstructure removal, prevent all large pieces and minimize the number of small pieces from entering the waterway or wetland. Remove all reinforcing steel, all concrete, and all other debris that falls into the waterway or wetland. The contractor may leave limited amounts of small concrete pieces scattered over the waterway floor or wetland only if the engineer allows.

(2) Submit a structure removal and clean-up plan as part of the erosion control implementation plan required under standard spec 107.20. Do not start work under the structure removal and clean-up plan without the department's written approval of the plan. Include the following information in the structure removal and clean-up plan:

- Methods and schedule to remove the structure.
- Methods to control potentially harmful environmental impacts.
- Methods for superstructure removal that prevent all large pieces and minimize the number of small pieces from entering the waterway or wetlands.
- Methods to control dust and contain slurry.
- Methods for removing piers and abutments. If blasting in water, include restrictions that regulatory agencies and the contract require.
- Methods for cleaning the waterway or wetlands.

(3) If stockpiling spoil material, place it on an upland site an adequate distance from the waterway, wetland, or any open water created by excavation. Install silt fence between the spoil pile and the waterway, wetland, or excavation site.

Add the following Removing Old Structure bid item to standard spec 203.5.1:

ITEM NUMBER	DESCRIPTION	UNIT
203.0600.S	Removing Old Structure Over Waterway With Minimal Debris Station 6+04	LS

stp-203-020 (20190618)

b. Abandoning Sewer, Item 204.0291.S

A Description

This special provision describes abandoning existing sewer by filling it with cellular concrete as the plans show and conforming to standard spec 204 and standard spec 501as modified in this special provision.

B Materials

Provide cellular concrete meeting the following specifications: 1 part cement, 1 part fly ash, 8 parts sand, or an approved equal, and water. Provide cement meeting the requirements of standard spec 501.2.1 for Type 1 Portland Cement. Provide sand meeting the requirements of standard spec 501.2.5.3 Provide water meeting the requirements of standard spec 501.2.4.

C Construction

Fill the abandoned sewer pipe with cellular concrete as the engineer directs. In the event that the sewer cannot be completely filled from existing manholes, tap the sewer where necessary and fill from these locations.

D Measurement

The department will measure Abandoning Sewer in volume by the cubic yard as specified in standard spec 109.1.3.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
204.0291.S	Abandoning Sewer	CY

Payment is full compensation for furnishing all materials and excavating and backfilling where necessary.

stp-204-050 (20080902)

c. Removing Railing, Item 204.9090.S.01.

A Description

This special provision describes removing railing conforming to standard spec 204.

B (Vacant)

C (Vacant)

D Measurement

The department will measure Removing Railing in LF acceptably completed.

E Payment

Add the following to standard spec 204.5:

ITEM NUMBER	DESCRIPTION	UNIT
204.9090.S.01	Removing Railing	LF

stp-204-025 (20150630)

d. Removing Landscaping Brick, Item 204.9090.S.02.

A Description

This special provision describes removing landscaping brick conforming to standard spec 204.

B (Vacant)

C (Vacant)

D Measurement

The department will measure Removing Landscaping Brick in LF acceptably completed.

E Payment

Add the following to standard spec 204.5:

ITEM NUMBER	DESCRIPTION	UNIT
204.9090.S.02	Removing Landscaping Brick	LF

stp-204-025 (20150630)

e. Removing Modular Block Wall, Item 204.9105.S

A. Description

This special provision describes Removing Modular Block Wall conforming to standard spec 204.

B. (Vacant)

C. (Vacant)

D. Measurement

The department will measure Removing Modular Block Wall in LS acceptable completed.

E. Payment

Add the following to standard spec 204.5

Item Number	Description	Unit

204-9105.S	Removing Modular Block Wall	LS

f. **Underwater Inspection, Item SPV.0060.12**

A. Description

This special provision describes furnishing labor, tools, equipment and materials necessary to inspect the river bottom after structure removal to confirm that all reinforcing steel has been removed.

B. (Vacant)

C. Construction

Provide audio/video equipment. Under the direction of the engineer, the diver will report characteristics of the debris remaining on the river bed. This report will consist of video documentation of the inspection.

Use a television monitor along with two-way audio communication with diver during the underwater inspection.

Record the video and audio in an engineer approved digital format for later review. Repeat inspection by the diver until all reinforcing steel is removed.

After the dive is completed, the digital recording of the inspection will become the property of the department.

D. Measurement

The department will measure Underwater Inspection as each unit per structure location acceptably completed. Multiple underwater inspections to correct deficiencies will not receive additional compensation beyond the bid price each per structure unit.

E. Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

Item Number	Description	Unit
SPV.0060.12	Underwater Inspection	Each

Payment is full compensation for providing underwater inspections of the debris.

g. **Sawing Curb Head, Item SPV.0090.12.**

A Description

This special provision describes sawing curb head as shown on the plans and as hereinafter provided.

B (Vacant)

C Construction

Saw curb head according to the applicable portions of standard spec 690. Remove leftover concrete curb head material debris according to the applicable portions of standard spec 204.

D Measurement

The department will measure Sawing Curb Head in length by the linear foot, acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0090.12	Sawing Curb Head	LF

Payment is full compensation for furnishing all sawing and sludge removal; and for disposal of leftover

9. Earthwork

a. Excavation Common

Supplement standard spec 205.4.1 (1) with the following:

The department will measure all excavation acceptably completed by computing volumes using alternate methods involving 3-dimensional measurements (surface to surface comparison).

Note that excavation for utility trenches and disposal of surplus and unsuitable material with the exception of rock is incidental to the other items of this project and will not be paid for separately.

b. Excavation and Dewatering of Dredging Material, Item SPV.0035.03

A Description

A.1 General

This special provision describes sediment dredging of the Fox River in a safe and environmentally-friendly manner. The dredging shall include all labor, materials, tools, equipment, and incidentals necessary to remove material by mechanical dredging from the bed of the Fox River to the proposed depths, elevations, and side slopes shown on the drawings, including material dewatering.

Perform this work in accordance with section 205 of the standard specifications and with pertinent parts of Chapters NR 700-754 of the Wisconsin Administrative Code, as supplemented herein. Per NR 718.07, a solid waste collection and transportation service-operating license is required under NR 502.06 for each vehicle used to transport dredging material.

A.2 Notice to the Contractor – Contaminated Sediment Locations

The department and others have completed testing for sediment contamination at locations within this project where excavation is required. Testing indicated that low-level metals and polynuclear aromatic hydrocarbons (PAHs) contaminated sediment is potentially present.

For further information regarding previous investigation and remediation activities at these sites contact:

Name:	Kathie VanPrice
	WisDOT Northeast Region
Address:	944 Vanderperren Way
	Green Bay, WI 54304
Phone:	(920) 492-7175
E-mail:	kathie.vanprice@dot.wi.gov

Name:	Dan Haak
	TRC Environmental Corporation
Address:	708 Heartland Trail, Suite 3000
	Madison, WI 53717
Phone:	(608) 826-3628
Fax:	(608) 826-3941
E-mail:	DHaak@trccompanies.com

A.3 Coordination

Coordinate work under this contract with the environmental consultant retained by the department:

Consultant:	TRC Environmental Corporation
Address:	708 Heartland Trail, Suite 3000, Madison, WI 53717
Fax:	(608) 826-3941
Contact:	Dan Haak
Phone:	(608) 826-3628 (office), (608) 886-7423 (mobile)
E-mail:	DHaak@trccompanies.com

Under this special provision, the role of the environmental consultant will be limited to:

1. Documenting that activities associated with management of dredge material is in conformance with the dredge material management methods for this project as specified herein.

Provide at least a 14-calendar day notice of the preconstruction conference date to the environmental consultant. At the preconstruction conference, provide a schedule for all dredging activities to the

environmental consultant. Also notify the environmental consultant at least three calendar days prior to commencement of dredging activities.

Coordinate with the environmental consultant to ensure that the environmental consultant can be present during dredging.

A.4 Excavation Management Plan Approval

The excavation management plan for this project has been designed to minimize risk for all parties by disposing of all dredge material at a WDNR-licensed landfill under the bid item Hauling and Disposal of Dredging Material. The excavation management plan, as described in these special provisions, has been developed in cooperation with the WDNR. The WDNR's concurrence letter is on file at the Wisconsin Department of Transportation. For further information regarding the investigations, including waste characterization within the project limits, contact Kathie VanPrice with WisDOT, at (920) 492-7175.

B (Vacant)

C Construction

Supplement subsection 205.3 of the standard specification with the following:

Dewater dredge material on barge or in designated area in accordance with WDNR-licensed landfill requirements. Dredge material may be temporarily stockpiled in the limited area designated by the environmental consultant at 59 Racine Street, Menasha, WI 54952. Provide temporary drainage and sediment control(s) such that no sediment or surface runoff (solids or liquids) can run onto neighboring properties.

Prior to transport for landfill disposal, sufficiently dewater dredge material so as not to contain free liquids, and to a level acceptable to receiving landfill. Decanted water from the river material need not be disposed of in any special way and may be deferred right back to the Fox River unless otherwise directed by the environmental consultant.

When material is encountered outside the above-identified limits of known contamination that appears to have been impacted with petroleum or chemical products, or when other obvious potentially contaminated materials are encountered or material exhibits characteristics of industrial-type wastes, such as fly ash, foundry sand, and cinders, or when underground storage tanks are encountered, suspend excavation in that area and notify the engineer.

D Measurement

The department will measure Excavation and Dewatering of Dredging Material by the CY acceptably completed.

A pre-dredge terrain surface, and post-dredge terrain surface are established by AECOM and available in LandXML format. The bid quantity has been estimated by using AutoCAD Civil3d Version 2016 by surface to surface comparison, in which volume (differential) surface is generated. The 3d volume surface is the difference between the base (pre-dredge) surface and the comparison (post-dredge) surface.

The volume of in-situ material for payment will be determined in the following manner:

Prior to dredging, Contractor shall perform a bathymetric survey of the work area, using transect spacing not greater than 20 feet. Individual soundings shall be spaced no greater than 10 feet apart along transects. This survey shall extend a minimum of 50 feet upstream and 50 feet downstream of the work area. This survey shall be referenced to NAVD88 and developed into a LandXML surface using AutoCAD Civil3d (Version 2016 or newer). Both the ascii-point survey file and LandXML surface file shall be provided to WisDOT for review and approval prior to dredging.

The required dredging is complete when 100% of the dredge area is at or below the specified dredge elevations. Maintaining control of dredge volume is paramount. No payment for over-dredging will be made. Volume of dredge material below finish grade will be at the contractor's expense and will not be paid for.

Following completion of the dredging, Contractor shall perform a post-dredge bathymetric survey of the same area covered in the pre-dredge survey, using the same transect/sounding spacing and vertical datum as the pre-dredge survey. Following this survey, the contractor shall use AutoCAD Civil3d (Version 2016 or newer) to prepare a post-dredge surface and a dredge volume surface representing the actual in-situ volume removed. The ascii survey point file, LandXML surface files, and a dredge report shall be provided to AECOM for review and approval. The dredge report shall identify the dates of pre-dredge and post-dredge surveys, the equipment used, a record of water level during each survey, and

volume calculation results depicting for-pay in-situ dredge volume removed, and not-for-pay in-situ overdredge volume removed.

The approved volume for payment is based on in-situ sediment volume, not truckload volume.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0035.03	Excavation and Dewatering of Dredging Material	CY

Payment is full compensation for excavating, segregating, loading, temporary stockpiling, and dewatering of dredging material; obtaining solid waste collection and transportation service operating licenses; assisting in the collection of sediment samples for field evaluation; dewatering of sediment prior to transport, if necessary; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

c. Excavation, Hauling, and Disposal of River Material at Substructures, Item SPV.0195.01

A Description

A.1 General

This special provision describes excavating, dewatering, hauling, and disposing of material from the Fox River at the bridge piers and north abutment at a WDNR approved landfill facility. The closest WDNR approved facility is:

Advanced Disposal Hickory Meadows Landfill
W3105 Schneider Road
Hilbert, WI 54129

Waste Management Valley Trail Landfill
N9101 Willard Road
Berlin, WI 54923

Perform this work in accordance with section 205 of the standard specifications and with pertinent parts of Chapters NR 700-754 of the Wisconsin Administrative Code, as supplemented herein. Per NR 718.07, a solid waste collection and transportation service-operating license is required under NR 502.06 for each vehicle used to transport river material.

A.2 Notice to the Contractor – Contaminated River Material Locations

The department and others have completed testing for river material contamination at locations within this project where excavation is required. Testing indicated that low-level metals and polynuclear aromatic hydrocarbons (PAHs) contaminated river material is potentially present.

For further information regarding previous investigation and remediation activities at these sites contact:

Name: Kathie VanPrice
WisDOT Northeast Region
Address: 944 Vanderperren Way
Green Bay, WI 54304
Phone: (920) 492-7175
E-mail: kathie.vanprice@dot.wi.gov

Name: Dan Haak
TRC Environmental Corporation
Address: 708 Heartland Trail, Suite 3000
Madison, WI 53717
Phone: (608) 826-3628
Fax: (608) 826-3941
E-mail: DHaak@trccompanies.com

A.3 Coordination

Coordinate work under this contract with the environmental consultant retained by the department:

Consultant: TRC Environmental Corporation
Address: 708 Heartland Trail, Suite 3000, Madison, WI 53717
Fax: (608) 826-3941

Contact: Dan Haak
Phone: (608) 826-3628 (office), (608) 886-7423 (mobile)
E-mail: DHaak@trccompanies.com

The role of the environmental consultant will be limited to:

1. Documenting that activities associated with management of excavated river material are in conformance with the river material management methods for this project as specified herein; and

2. Obtaining the necessary approvals for disposal of river material from the landfill facility.

Provide at least a 14-calendar day notice of the preconstruction conference date to the environmental consultant. At the preconstruction conference, provide a schedule for all excavation activities in the areas of the Fox River to the environmental consultant. Also notify the environmental consultant at least three calendar days prior to commencement of excavation activities in the Fox River.

Identify the WDNR approved landfill facility that will be used for disposal of excavated river material and provide this information to the environmental consultant no later than 30 calendar days prior to commencement of excavation activities in the Fox River or at the preconstruction conference, whichever comes first. The environmental consultant will be responsible for obtaining the necessary approvals for disposal of excavated river material at the landfill facility. The environmental consultant will be responsible for obtaining the necessary approvals for disposal of excavated river material from the landfill facility.

Coordinate with the environmental consultant to ensure that the environmental consultant has the opportunity to be present during excavation activities in the Fox River. Perform excavation work for each of the bridge pier and north abutment areas on a continuous basis until excavation work is completed. Do not transport excavated river material offsite without prior approval from the environmental consultant.

A.4 Excavation Management Plan Approval

The excavation management plan for this project has been designed to minimize risk for all parties by disposing of all excavated river material at a WDNR-licensed landfill. The excavation management plan, as described in these special provisions, has been developed in cooperation with the WDNR. The WDNR's concurrence letter is on file at the Wisconsin Department of Transportation. For further information regarding the investigations, including waste characterization within the project limits, contact Kathie VanPrice with WisDOT, at (920) 492-7175.

B (Vacant)

C Construction

Supplement subsection 205.3 of the standard specification with the following:

Dewater excavated river material on barge or in designated area in accordance with WDNR-licensed landfill requirements. Excavated river material may be temporarily stockpiled in the limited area designated by the environmental consultant at 59 Racine Street, Menasha, WI 54952. Provide temporary drainage and sediment control(s) such that no sediment or surface runoff (solids or liquids) can run onto neighboring properties.

Prior to transport for landfill disposal, sufficiently dewater excavated river material so as not to contain free liquids, and to a level acceptable to receiving landfill. Decanted water from the river material need not be disposed of in any special way and may be deferred right back to the Fox River unless otherwise directed by the environmental consultant.

Directly load and haul dewatered river material to the WDNR approved landfill facility. Verify that vehicles used to transport excavated river material are licensed for such activity in accordance with applicable state and federal regulations. Use loading and hauling practices that are appropriate to prevent any spills or releases of river materials.

When material is encountered outside the above-identified limits of known contamination that appears to have been impacted with petroleum or chemical products, or when other obvious potentially contaminated materials are encountered or material exhibits characteristics of industrial-type wastes, such as fly ash, foundry sand, and cinders, or when underground storage tanks are encountered, suspend excavation in that area and notify the engineer.

D Measurement

The department will measure Excavation, Hauling, and Disposal of River Material at Substructures in tons of excavated river material accepted by the landfill facility as documented by weight tickets generated by the landfill facility. Weight tickets must be delivered to the engineer within 10 business days of the date on which the river material was accepted by the landfill facility.

No payment will be made for tonnage pertaining to material removed beyond the required vertical and horizontal limits of excavation for the bridge piers and north abutment shown on the drawings. To impose this limitation of qualifying tonnage, the maximum amount of tons to be paid for Excavation, Hauling, and Disposal of River Material at Substructures is determined by the lesser of:

- Actual tonnage of excavated river material per plan limits, as determined by sum of Engineer-validated landfill weight tickets, or
- The product of multiplying the Cubic Yards of excavated material per plan limits by a factor of 1.75 Tons per Cubic Yard

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0195.01	Excavation, Hauling, and Disposal of River Material at Substructures	Ton

Payment is full compensation for excavating, segregating, loading, temporary stockpiling, dewatering, hauling, and disposal of excavated river material; obtaining solid waste collection and transportation service operating licenses; dewatering of excavated river material prior to transport, if necessary; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

d. Hauling and Disposal of Dredging Material, Item SPV.0195.04

A Description

A.1 General

This special provision describes hauling and disposing of dredge material at a WDNR approved landfill facility. The closest WDNR approved facility is:

Advanced Disposal Hickory Meadows Landfill
W3105 Schneider Road
Hilbert, WI 54129

Waste Management Valley Trail Landfill
N9101 Willard Road
Berlin, WI 54923

Perform this work in accordance with section 205 of the standard specifications and with pertinent parts of Chapters NR 700-754 of the Wisconsin Administrative Code, as supplemented herein. Per NR 718.07, a solid waste collection and transportation service-operating license is required under NR 502.06 for each vehicle used to transport dredging material.

A.2 Notice to the Contractor – Contaminated Sediment Locations

The department and others have completed testing for sediment contamination for locations within this project where excavation is required. Testing indicated that low-level metals and polynuclear aromatic hydrocarbons (PAHs) contaminated sediment is potentially present.

For further information regarding previous investigation and remediation activities at these sites contact:

Name: Kathie VanPrice
WisDOT Northeast Region
Address: 944 Vanderperren Way
Green Bay, WI 54304
Phone: (920) 492-7175
E-mail: kathie.vanprice@dot.wi.gov

Name: Dan Haak
TRC Environmental Corporation
Address: 708 Heartland Trail, Suite 3000
Madison, WI 53717
Phone: (608) 826-3628
Fax: (608) 826-3941

E-mail: DHaak@trccompanies.com

A.3 Coordination

Coordinate work under this contract with the environmental consultant retained by the department:

Consultant: TRC Environmental Corporation
Address: 708 Heartland Trail, Suite 3000, Madison, WI 53717
Fax: (608) 826-3941
Contact: Dan Haak
Phone: (608) 826-3628 (office), (608) 886-7423 (mobile)
E-mail: DHaak@trccompanies.com

Under this special provision, the role of the environmental consultant will be limited to:

1. Documenting that activities associated with management of dredge material is in conformance with the dredge material management methods for this project as specified herein; and

2. Obtaining the necessary approvals for disposal of dredge material from the landfill facility.

Identify the WDNR approved landfill facility that will be used for disposal of dredge material and provide this information to the environmental consultant no later than 30 calendar days prior to commencement of dredging activities or at the preconstruction conference, whichever comes first. The environmental consultant will be responsible for obtaining the necessary approvals for disposal of dredge material at the landfill facility.

Do not transport dredge material offsite without prior approval from the environmental consultant.

A.4 Excavation Management Plan Approval

The excavation management plan for this project has been designed to minimize risk for all parties by disposing of all dredge material at a WDNR-licensed landfill. The excavation management plan, as described in these special provisions, has been developed in cooperation with the WDNR. The WDNR's concurrence letter is on file at the Wisconsin Department of Transportation. For further information regarding the investigations, including waste characterization within the project limits, contact Kathie VanPrice with WisDOT, at (920) 492-7175.

B (Vacant)

C Construction

Supplement subsection 205.3 of the standard specification with the following:

Directly load and haul dewatered dredge material to the WDNR approved landfill facility. Verify that vehicles used to transport dredge sediment are licensed for such activity in accordance with applicable state and federal regulations. Use loading and hauling practices that are appropriate to prevent any spills or releases of dredge material.

D Measurement

The department will measure Hauling and Disposal of Dredging Material in tons of dredging material accepted by the landfill facility as documented by weight tickets generated by the landfill facility. Weight tickets must be delivered to the engineer within 10 business days of the date on which the sediment was accepted by the landfill facility.

No payment will be made for tonnage pertaining to material removed beyond the required vertical and horizontal limits of dredging shown on the drawings. To impose this limitation of qualifying tonnage, the maximum amount of tons to be paid for Hauling and Disposal of Dredging Material is determined by the lesser of:

- Actual tonnage of dredging material per plan limits, as determined by sum of Engineer-validated landfill weight tickets, or
- The product of multiplying the Cubic Yards of dredging material per plan limits by a factor of 1.75 Tons per Cubic Yard

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0195.04	Hauling and Disposal of Dredging Material	Ton

Payment is full compensation for hauling and disposal of dredge material at WDNR licensed landfill including any tipping fees; obtaining solid waste collection and transportation service operating licenses; assisting in the collection of sediment samples for field evaluation, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

10. Bases, Subbases, and Pavements

a. Protection of Concrete

Add to standard spec 415.3.14:

The contractor shall provide for a minimum of one concrete finisher to remain on the project site after final finishing of all concrete surfaces until the concrete has hardened sufficiently to resist surface scarring caused by footprints, handprints, or any other type of imprint, malicious or otherwise. The finisher shall actively and continuously patrol on foot the newly placed concrete and repair any damage to the surface that might be sustained as described above.

The cost for providing the finisher(s), the necessary equipment, and materials is incidental to the contract.

ner-415-015 (20180326)

b. Coloring Concrete Custom, Item 405.0200.

This special provision describes coloring concrete dark grey for incorporation full-depth in work constructed under other contract bid items. Conform to standard spec 405 as modified in this special provision.

Replace standard spec 405.2.1.1(1) with the following:

(1) Integrally color concrete using non-fading pigments conforming to ASTM C979.

- For dark grey: use synthetic Butterfield Color, Uni-Mix Integral U28 Charcoal at a loading of 1 bag per cubic yard of concrete material in the mix. Match the concrete color in reasonably close conformance with dark grey color, which is similar to Federal Standard 595 - FS AMS-STD 26008.

Replace standard spec 405.2.1.1(3) with the following:

(3) Color acceptance is based on comparison to existing colored concrete on Main Street included in the 2018 city of Menasha terrace construction.

stp-405-020 (20190618)

c. Concrete Pavement Joint Layout, Item 415.5110.S.

A Description

This special provision describes providing a concrete pavement or concrete base joint layout design for intersections and marking the location of joints in the field

B (Vacant)

C Construction

Plan and locate all points necessary to establish the horizontal position of the transverse and longitudinal joints in the concrete to prevent uncontrolled cracking. Submit a joint layout design to the engineer at least 7 calendar days before paving each intersection. Do not lay out joints until the engineer has reviewed the joint layout design. Mark the location of concrete joints in the field. Follow the plan details for joints in concrete making adjustments as required to fit field conditions.

D Measurement

The department will measure Concrete Pavement Joint Layout as a single lump sum unit for all joint layout designs and marking acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
415.5110.S	Concrete Pavement Joint Layout	LS

Payment is full compensation for providing the intersection joint layout designs and marking all joints in the field.

The department will adjust pay for crack repairs as specified in standard spec 415.5.3.

stp-415-020 (20170615)

d. Concrete Curb & Gutter 30-Inch HES Type A, Item SPV.0090.07

A Description

This special provision describes providing concrete curb and gutter HES with reinforcement. Conform to standard spec 601 for concrete curb and gutter.

B Materials

Furnish materials conforming to standard spec 601.2 except for concrete as specified in standard spec 416.2.

C Construction

All construction methods shall conform to standard spec 601.3.

D Measurement

The department will measure Concrete Curb and Gutter 30-Inch HES Type A by the linear foot acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0090.07	Concrete Curb and Gutter 30-Inch HES Type A	LF

The department will pay for Concrete Curb and Gutter 30-Inch HES Type A as specified in standard spec 601.5.

ner-601-005 (20190718)

11. Bridge

a. Notice to Contractor, Notification of Demolition and/or Renovation No Asbestos Found.

John Roelke, License Number All-119523, inspected Structure B-70-001 for asbestos on August 4, 2016. No regulated Asbestos Containing Material (RACM) was found on this structure. A copy of the inspection report is available from: Bill Bertrand at (920) 360-3124.

In accordance with NR447 and DHS159 , ensure that DNR or DHS receives a completed Notification of Demolition and/or Renovation (DNR Form 4500-113 (R 4/11), or subsequent revision) via U.S. mail, hand-delivery, or using the online notification system at least 10 working days before beginning any construction or demolition. Pay all associated fees. Provide a copy of the completed 4500-113 form to Bill Bertrand at (920) 360-3124. and DOT BTS-ESS attn: Hazardous Materials Specialist PO Box 7965, Madison, WI. 53707-7965. In addition, comply with all local or municipal asbestos requirements.

Use the following information to complete WisDNR form 4500-113:

- Site Name: Structure B-70-001, Racine Street over Fox River
- Site Address: Fox River Bridge & Approaches
- Ownership Information: WisDOT Northeast Region, 944 Vanderperren Way, Green Bay, WI 54304
- Contact: Enter Regional construction project engineer's name
- Phone: Enter Regional construction project engineer's phone
- Age: 68 years old. This structure was constructed in 1952
- Area: 30,638 SF of deck

Insert the following paragraph in Section 6.g.:

- If asbestos not previously identified is found or previously non-friable asbestos becomes crumbled, pulverized, or reduced to a powder, stop work immediately, notify the engineer, and the engineer will notify the department's Bureau of Technical Services at 608-266-1476 for an emergency response as specified in standard spec 107.24. Keep material wet until it is abated or until it is determined to be non-asbestos containing material.

stp-107-125 (20120615)

b. General Requirements for Blasting.

This special provision describes requirements for blasting for removal of existing substructures. Blasting methods will not be allowed for removal of material, including bedrock, under new substructure foundations.

Add the following to standard spec 205.3.7:

Perform all blasting in compliance with the Wisconsin Administrative Code Department of Safety and Professional Services SPS 307.43.

Blasting Plan Submittal

Not less than two weeks before commencing blasting operations, or at any time when changes to the drilling and blasting methods are proposed, submit a Blasting Plan to the engineer for review. The blasting plan shall contain full details of the drilling and blasting patterns and controls proposed for both the controlled and production blasting. Include the following minimum information in the blasting plan:

1. Station limits of proposed shot.
2. Plan and section views of proposed drill pattern including free face, burden, blasthole spacing, blasthole diameters, blasthole angles, lift height, and subdrill depth.
3. Loading diagram showing type and amount of explosives, primers, initiators, and location and depth of stemming.
4. Initiation sequence of blastholes including delay times and delay system.
5. Manufacturer's data sheets for all explosives, primers, and initiators to be employed.

The blasting plan submittal is for quality control and record keeping purposes. Review of the blasting plan by the engineer does not relieve the contractor of responsibility for the accuracy and adequacy of the plan when implemented in the field.

Safety

Immediately notify the engineer of any incidents of fly rock, damage to any personal property, or existing roadway that is open to traffic, and any violations of the Wisconsin Administrative Code Department of Safety and Professional Services SPS 307.43. Failure to do so shall be considered a safety violation under standard spec 107 and all work on the project may be stopped under standard spec 105.1(1).

Notify the engineer of the station, location, and 'size' of all blasts at least one hour before the blast.

Observe the entire blast area for a minimum of five minutes following a blast to guard against rock or debris fall before commencing work in the area.

The engineer has the authority to prohibit or halt the contractor's blasting operations if it is apparent that through the methods being employed, the required slopes are not being obtained in a stable condition, the safety and convenience of the traveling public is being jeopardized, or vibration levels above the allowable levels occur.

Condition Surveys

Conduct and document pre-blast and post-blast surveys of any nearby buildings or structures as required by the scaled-distance equation specified in the Wisconsin Administrative Code Department of Safety and Professional Services SPS 307.43. Make right of entry arrangements with the property owners for these condition surveys. Before any blasting, make the pre-blast survey records available to the engineer for review. After completion of blasting operations, perform a post-blast survey and make these records available to the engineer for review. The contractor shall be responsible for any damage resulting from blasting.

These condition surveys shall consist of visually inspecting and recording all existing defects in the structures before and after blasting operations. Photographs and/or videotape may be used to assist in documentation. Submit a written report to the department detailing the visual and photographic

investigation of potentially affected structures. This report will include copies of the pre-blast and post-blast surveys and discuss any discrepancies and findings of these surveys.

If at any time during the progress of the work, the methods of drilling and blasting do not produce the desired result of a uniform slope and shear face, within the tolerances specified, drill, blast, and excavate in short sections, not exceeding 100 feet in length, until a technique is arrived at that will produce the desired results. Extra cost resulting from this requirement shall be borne by the contractor.

Vibration Control and Monitoring

All vibration control and monitoring shall comply with Wisconsin Administrative Code Department of Safety and Professional Services SPS 307.43, Instrumentation and SPS 307.44, Control of Adverse Effects.

Whenever there is a potential for vibration damage to adjacent buildings, structures, or utilities, monitor each blast with an approved seismograph located, as approved, between the blast area and the closest structure subject to blast damage, and as close as practical to the subject structure. Peak particle velocity shall not be allowed to exceed the safe limits of the nearest structure subject to vibration damage.

A vibration specialist, approved by the engineer, shall perform vibration monitoring. The vibration specialist shall monitor vibration levels according to the Wisconsin Administrative Code Department of Safety and Professional Services SPS 307.43, and interpret the seismograph records to ensure that the seismograph data shall be effectively utilized in the control of the blasting operations with respect to the existing structures and utilities.

According to the Wisconsin Administrative Code Department of Safety and Professional Services SPS 307.43 consult with the owner of any structure or utility not listed in SPS 307.43 to establish maximum allowable limits on ground vibrations. In no case shall these vibration limits exceed the following criteria:

Structure Type	Maximum Peak Particle Velocity (inches/second)
Reinforced Concrete, Structures, Unoccupied	4.0
Steel Structures, Unoccupied	4.0
Buried Utilities	2.0
Wells and Aquifers	2.0
Green Concrete (Less than 7 days)	1.0

Furnish data recorded for each shot to the engineer before the next blast; the data shall include the following:

1. Identification of vibration monitoring instrument used.
2. Name of qualified observer and interpreter.
3. Distance and direction of recording station from blast area.
4. Type of ground at recording station and material on which the instrument is sitting.
5. Peak particle velocity and principal frequency in each component.
6. A dated and signed copy of records of seismograph readings.
7. A comparison of measured seismograph readings to maximum allowable readings identified in the Wisconsin Administrative Code Department of Safety and Professional Services SPS 307.43 or as specified in this special provision.

If the recorded vibration data exceeds the allowable levels established in the Wisconsin Administrative Code Department of Safety and Professional Services SPS 307.43 or as specified in this special provision, immediately halt blasting operations. Submit a revised blasting plan to the engineer and do not resume blasting operations until the engineer approves the revised plan.

All costs associated with the work described herein shall be considered included in the bid item Excavation Rock.

stp-205-050 (20141107)

c. **Underwater Foundation Inspection South Abutment, Item 206.1050.S.01; Underwater Foundation Inspection Pier 1, Item 206.1050.S.02; Underwater Foundation Inspection Pier 3, Item 206.1050.S.03; Underwater Foundation Inspection Pier 4, Item 206.1050.S.04.**

A Description

This special provision describes providing underwater inspections of the substructure foundations conforming to standard spec 206.3.12.

B (Vacant)

C Construction

Provide a diver who, under the direction of the engineer, will report the characteristics, cleanliness and quality of the excavated rock surface below the seal or footing to ensure that the foundation has been properly prepared as specified in standard spec 206.3.8.

Provide a video monitor and video camera, along with two-way audio communications with the diver during the inspection and record the video and audio.

Correct any deficiencies in the preparation of the seal or footing foundation and repeat the inspections until all deficiencies are corrected.

Place the seal or footing concrete within 24 hours after all deficiencies are corrected or as the engineer directs.

D Measurement

The department will measure Underwater Foundation Inspection (Location) once for each individual unit, acceptably completed. The entire pier or abutment substructure location is considered a unit. Multiple underwater inspections at the same substructure location to correct foundation preparation deficiencies will not be measured.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
206.1050.S.01	Underwater Foundation Inspection South Abutment	EACH
206.1050.S.02	Underwater Foundation Inspection Pier 1	EACH
206.1050.S.03	Underwater Foundation Inspection Pier 3	EACH
206.1050.S.04	Underwater Foundation Inspection Pier 4	EACH

Payment is full compensation for all diving inspections and reporting; and for supplying video and two-way audio communications equipment and electronic video and audio files.

stp-206-050 (20190618)

d. **Course Aggregate Size No. 2 Crushed Stone, Item SPV.0195.05.**

A Description

This special provision describes furnishing and placing coarse aggregate backfill as the plans show.

B Materials

Provide clean concrete aggregate graded in accordance with the requirements as specified under standard spec 501.2.5.4.5. The soundness and wear requirements are deleted from this material.

C Construction

Construct the coarse aggregates in accordance with standard spec 209.3.

D Measurement

For measurement of Course Aggregate Size No. 2 Crushed Stone by the ton, the department will determine weight based on contractor-provided tickets submitted daily. Submit tickets as specified in 109.1.4.2. For material with more than 7 percent moisture, the department will reduce the ticket weight by the weight of water exceeding 7 percent. The department will determine moisture content as a percent of dry weight.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPC.0195.05	Course Aggregate Size No. 2 Crushed Stone	TON

Payment is full compensation for furnishing and installing the aggregate.

e. Ice Hot Weather Concreting, Item 501.1000.S.

Conform to standard spec 501.3.8.2 except the department will pay for ice at the contract unit price under the Ice Hot Weather Concreting bid item. This special provision only applies to work done under the following contract bid items:

Concrete Masonry Bridges
Concrete Masonry Bridges HES
Concrete Masonry Culverts
Concrete Masonry Culverts HES
High Performance Concrete (HPC) Masonry Structures
Concrete Masonry Retaining Walls
Concrete Masonry Retaining Walls HES
Concrete Masonry Endwalls
Concrete Masonry Overlay Decks

Replace standard spec 501.4 and 501.5 with the following:

501.4 Measurement

(1) The department will measure Ice Hot Weather Concreting by the pound acceptably completed, measured only if the conditions prescribed in standard spec 501.3.8.2 are met.

501.5 Payment

(1) The department will pay for the measured quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
501.1000.S	Ice Hot Weather Concreting	LB

(2) Payment for Ice Hot Weather Concreting is full compensation for ice used to cool concrete placed in hot weather as specified in standard spec 501.3.8.2.

(3) The department will not pay directly for the concrete specified under this section. Concrete is incidental to the various bid items using it. Payment under those bid items includes providing all materials, including aggregates and associated aggregate source testing, cement, fly ash, slag, and admixtures; for preparing, transporting, storing, protecting and curing concrete; and for contractor requirements related to testing specified in standard spec 501.3.10.

(4) If required to remove and replace any concrete damaged by lack of proper protection. Perform this work at no expense to the department.

stp-501-010 (20151210)

f. Underwater Substructure Inspection B-70-324, Item 502.9000.S.

A Description

This special provision describes providing underwater inspections of the substructure seal(s), footing(s) or shaft(s).

B (Vacant)

C Construction

After placement of Concrete Masonry Bridges or Concrete Masonry Seal for the substructure and as soon as practicable after removal of the forms, provide a diver who, under the direction of the engineer, will report the characteristics and quality of the concrete placed below water level to ensure that the concrete masonry has been properly formed and placed.

Provide a video monitor and video camera, along with two-way audio communications with the diver during the inspection and record the video and audio.

Correct all deficiencies in the concrete and repeat the inspections until all deficiencies are corrected.

D Measurement

The department will measure Underwater Substructure Inspection B-70-324 once for each individual unit, acceptably completed. The entire pier or abutment substructure location is considered a unit. Multiple underwater inspections at the same substructure location to correct concrete deficiencies will not be measured.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT

Payment is full compensation for all diving inspections and reporting; and for supplying video and two-way audio communications equipment and recorded electronic video and audio files. Payment for correcting deficiencies in the placed concrete will be included at no extra cost to the project.

stp-502-090 (20190618)

g. Bar Steel Reinforcement HS Stainless Structures, Item 505.0800.S.

A Description

This special provision describes furnishing and placing stainless steel reinforcing bars and associated stainless steel bar couplers.

Conform to standard spec 505 as modified in this special provision.

B Materials

B.1 General

Furnish stainless steel reinforcing bars conforming to ASTM A955 and to one of the following Unified Numbering System (UNS) designations: S31653, S31803, S32205, or S32304. Supply grade 60 bars, all of the same UNS designation. Conform to the chemical composition specified for the given UNS designation in ASTM A276 table 1.

Supply bars that are free of dirt, mill scale, oil, and debris by pickling to a bright or uniform light finish. The department may reject bars displaying rust/oxidation, questionable blemishes, or lack of a bright or uniform pickled surface.

Furnish chairs or continuous supports made of stainless steel or recycled plastic to support high-strength stainless bar steel reinforcement subject to the plastic chair restriction stated in standard spec 505.3.4(1).

Furnish couplers made from one of the UNS alloys allowed for bar steel.

Furnish tie wire made from one of the UNS alloys allowed for bar steel or from an engineer-approved plastic or nonmetallic material. Ensure that stainless steel tie wire is dead soft annealed.

B.2 Fabrication

Before fabrication, supply test results from an independent testing agency certifying that the reinforcement meets the requirements of Annex A1 of ASTM A955.

Bend bars conforming to standard spec 505.3.2 and according to ASTM A955. Bend and cut bars using equipment thoroughly cleaned or otherwise modified to prevent contamination from carbon steel or other contaminants. Use tools dedicated solely to working with stainless steel.

B.3 Control of Material

Identify reinforcement bars delivered to the project site with tags bearing the identification symbols used in the plans. Include the UNS designation, heat treat condition, heat number, grade corresponding to minimum yield strength level, and sufficient documentation to track each bar bundle to a mill test report.

Provide samples for department testing and acceptance according to CMM 8-50 Exhibit 1 requirements for concrete masonry reinforcement for uncoated bar steel.

Provide mill test reports for the project that do the following:

1. Verify that sampling and testing procedures and test results conform to ASTM A955, ASTM A276 table 1, and these contract requirements.
2. Include a chemical analysis with the UNS designation, heat lot identification, and the source of the metal.
3. Include tensile strength, yield strength, and elongation tests results conforming to ASTM A955 for each size furnished.
4. Certify that the bars have been pickled to a bright or uniform light finish.

C Construction

C.1 General

Ship, handle, store, and place the stainless steel reinforcing as follows:

1. Separate from regular reinforcement during shipping. Pad points of contact with steel chains or banding, or secure with non-metallic straps.

2. Store on wooden cribbing separated from regular reinforcement. Cover with tarpaulins if stored outside.
3. Handle with non-metallic slings.
4. Do not flame cut or weld. Protect from contamination when cutting, grinding, or welding other steel products above or near the stainless steel during construction.
5. Place on plastic or stainless steel bar chairs. If placing stainless steel chairs on steel beams, use chairs with plastic-coated feet.
6. Tie with stainless steel wire or an engineer-approved plastic or nonmetallic material.

Do not tie stainless steel reinforcing bars to, or allow contact with, uncoated reinforcing bars or galvanized steel. Maintain at least 1 inch clearance between stainless steel bars or dowels and uncoated or galvanized steel. Where 1 inch clearance is not possible, sleeve bars with a continuous polyethylene or nylon tube at least 1/8 inch thick extending at least 1 inch in each direction and bind with nylon or polypropylene cable ties. Sleeves are not required between stainless steel bars and shear studs. Stainless steel bars can be in direct contact with undamaged epoxy-coated bars.

Cut flush with the top flange or remove uncoated fasteners, anchors, lifting loops, or other protrusions into a bridge deck before casting the deck on prestressed concrete beams.

C.2 Splices

Splice as the plans show. Provide stainless steel couplers conforming to the minimum capacity, certification, proof testing, and written approval requirements of standard spec 550.3.3.4. The contractor may substitute stainless steel couplers for lap slices the plans show if the engineer approves in writing.

If increasing or altering the number or type of bar splices the plans show, provide revised plan sheets to the engineer showing the reinforcement layout, type, length, and location of revised bar splices and revised bar lengths. Obtain engineer approval for the location of new lap splices or substitution of mechanical bar couplers before fabrication. Ensure that new lap splices are at least as long as those the plans show.

D Measurement

The department will measure Bar Steel Reinforcement HS Stainless Structures by the pound acceptably completed, computed from the nominal weights of corresponding sizes for carbon steel deformed bars in AASHTO M31 regardless of stainless steel alloy provided. The department will not measure extra material used if the contractor alters the reinforcement layout as allowed under C.2, extra material for splices or couplers the plans do not show, or the weight of devices used to support or fasten the steel in position.

The department will measure the Bar Couplers Stainless bid items as each individual coupler acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
505.0800.S	Bar Steel Reinforcement HS Stainless Structures	LB

Payment for Bar Steel Reinforcement HS Stainless Structures is full compensation for furnishing and placing stainless steel reinforcing bars, including supports. Where the plans specify bar couplers, the department will pay for the length of bars as detailed with no deduction or increase for installation of the coupler.

Payment for the Bar Couplers Stainless bid items is full compensation for providing couplers; including bar steel that is part of the coupler and not detailed in the plan; for threading reinforcing bars; for installing and coating the splice; and for supplying and testing 3 couplers.

stp-505-005 (20190618)

h. Counterweight Concrete, Item SPV.0035.01.

A Description

This special provision describes performing all work related to the construction of the concrete counterweight for the bascule leaf.

B Materials

B.1 Concrete

Construct counterweight using Grade A concrete. Perform the work in accordance with applicable provisions of section 501 of the standard specifications, except air-entrainment will not be required for counterweight concrete.

For design purposes in developing the size of the counterweight shown on the plans, the unit weight of non-air-entrained counterweight concrete was assumed to be 149 pounds per cubic foot. Select appropriate materials for the concrete mix to achieve this unit weight. Modify the proposed size and/or configuration of the counterweight and counterweight pockets as necessary to account for any planned or unplanned deviations from that target unit weight.

C Construction

C.1 General

Construct and configure the counterweight as shown on the plans except as specified below under "Balancing Calculations".

Determine the final weight, outline and precise horizontal and vertical location of the center of gravity of counterweight. During final adjustment provide a "slight" over-balance on the channel side of the bascule leaf as specified below under "Balancing".

Assume full responsibility for the correctness of final detailing and construction of the counterweight, so that when completed, the bridge will be in proper balance.

The counterweight framing is not designed to support the wet concrete. Construct the counterweight using proper forms and supports. Whenever there is a lapse of time between the placing of successive layers of concrete, provide 5/8-inch diameter dowels, not less than three (3) feet long at 24-inch centers and embedded 18 inches into the fresh concrete for the purpose of tying the next succeeding layer to that just poured. In addition, roughen and clean the surface for the next pour and coat it with cement mortar immediately before placing additional concrete thereon.

Submit for review the method of supporting the counterweight forms. Such review does not, however, relieve the contractor of any responsibility in connection with the construction of the counterweight.

C.2 Test Blocks

In order to make a close determination of the average unit weight of the concrete that will be used to construct the counterweight, make at least four sets of test blocks, with no less than six blocks in each set. Each block will measure at least 8 inches by 8 inches by 12 inches and all blocks will be the same size. The forms for the test blocks will be rigid and impervious. The concrete used for the test blocks will contain the same materials and air content as the concrete that will be used in the counterweight. After the concrete is poured into the forms, vibrate it to the same extent that the counterweight concrete will be vibrated. After vibrating, strike off the tops prior to initial set. Cure the test blocks in their forms for two days with the tops uncovered. During this time, store the blocks under shelter in the open air. Do not sprinkle water on them for purpose of curing. After two days, remove the forms and weigh the blocks. Use a scale having an accuracy of 0.01 pound to weigh the blocks. Accurately measure all three dimensions and record the weights of the individual blocks, the calculated unit weight of the individual blocks, and the calculated average unit weight of the set of blocks to the nearest 0.01 pcf. Recalibrate the scale by weighing a reference object prior to each time a set of blocks is weighed.

Make the first set of test blocks at least 75 days prior to final detailing of the proposed counterweight and completing the center of gravity calculations for the bascule leaf with counterweight.

Make the second set of test blocks approximately 15 days after the first set is made. If the average unit weight of the second set of blocks differs from the average unit weight of the first set by more than 1.0 pound per cubic foot, cast additional sets of test blocks until consistent unit weights are obtained.

Make an additional set of test blocks approximately seven days prior to pouring the counterweight. If the average unit weight of these test blocks differs from the average unit weight of the previous sets by more than 1.5 pcf, notify the engineer of the steps intended to be taken to ensure the proper balance of the completed bridge. The engineer's approval of these steps will be required prior to pouring the counterweight concrete.

Cast a set of test blocks with the concrete actually used in each pour of the counterweight. If the average unit weight of any of these sets differs from the average unit weight required by more than 1.5 pcf, notify the engineer of the steps intended to be taken to ensure the proper balance of the completed bridge. The engineer's approval of these steps will be required prior to pouring any additional portions of the counterweight concrete.

C.3 Balancing Calculations

Prepare complete center of gravity calculations for the entire bascule leaf including its counterweight using weights and centers of gravity based on approved shop details for all components of the bascule leaf. Prepare these calculations by grouping material and computing subtotals only as directed by the engineer. Balance calculations not prepared by grouping material, as directed by the engineer, will be rejected. No construction will proceed on the counterweight until the contractor's balance calculations, and counterweight drawings with final dimensions and details have been reviewed by the engineer. This review will not relieve the contractor of the sole responsibility to provide acceptably balanced bascule leaf.

Adjustments for balancing of the leaf can be accomplished by varying any combination of the following:

- The size and shape of the concrete counterweight. If the size of the counterweight is increased, it must be made in areas that will not critically reduce clearances to any adjacent fixed elements of the structure.
- The size, shape and location of voids in the counterweight for placement of adjustment blocks.
- The number of voids within the counterweight.

Prepare final balancing calculations based on the requirement that after completion of construction, the adjustment blocks installed in the adjustment pockets will constitute, at a minimum, 3.5 percent of the total weight of the counterweight. The number of adjustment blocks shown on the plans reflects a weight that is approximately 3.5 percent of the total design weight of the counterweight. Provide adjustment blocks distributed in the upper and lower pockets in proportion to what is shown on the plans and of approximately the total quantity shown on the plans.

C.4 Concrete Adjustment Blocks

Make counterweight balancing adjustment blocks of the same size as shown in the plans.

Place the adjustment blocks in the pockets as shown on the final contractor prepared balancing drawings or as directed by the engineer. Provide the number of additional blocks shown on plans neatly stacked at the track level of the bascule pier and bascule abutment as directed by the engineer.

C.5 Balancing

Check initial balance of the bascule leaf by opening and closing the leaf repeatedly under power while checking and recording the amperage. For initial balancing, adjustment blocks will be added, removed or rearranged until the amperage readings for opening and closing are approximately the same.

Place the first row of adjustment blocks in any pocket tight and neatly against the back of the pocket, and each subsequent row tight against the previous row.

Prior to placement of blocks into balance pockets for final balancing, remove any debris from the adjustment pockets; only adjustment blocks will be permitted in the pockets.

Measure the balance of each leaf of the movable span using the dynamic strain gauging technique. Furnish and install all equipment, materials, instruments, and labor necessary to determine the imbalance by dynamic strain gauging.

Employ the services of an established testing company experienced in dynamic strain gauge measurement of movable bridge balance, subject to approval of the engineer. To demonstrate such experience, identify a minimum of six movable bridges, including at least three bascule bridges, for which the company has provided complete and satisfactory dynamic strain gauge measurements and reporting. Make the measurements under the immediate direction of a Professional Engineer registered in the State of Wisconsin who has had hands-on-experience measuring movable span balance by the dynamic strain gauge procedure.

Furnish and install the required strain gauges, all cabling and transmission equipment, data acquisition equipment and strip chart recorders, and produce fully documented reports detailing the results of the measurements.

The following applies to the approved testing company: Submit the following items to the engineer for approval:

1. Description of experimental procedure including type and method of installation of strain gauge rosettes, method of transmission of low level signals, data acquisition equipment and/or strip chart recorders.

2. Layout of span drive machinery showing proposed location of strain gauges, amplifiers, cable or radio links, data acquisition equipment and all associated cabling.

3. Details of method of transmission of signals from shafting to data acquisition units.

4. Elementary wiring diagrams of interconnection of strain gauges, amplifiers, data acquisition equipment, and strip chart recorders.

5. Sample computations of shaft torque from measured strains, span imbalance, curve fitting and basis for friction correction.

Affix two foil resistance strain gauge rosettes to each of the main pinion shafts, in accordance with the strain gauge manufacturer's installation instructions. Use 2-arm 90-degree rosettes mounted such that the grids are oriented at 45 degrees with the shaft axis and the two rosettes are affixed "back-to-back", spaced 180 degrees apart circumferentially. Connect the gauges such that any bending strains in the shafts will be canceled and torsional shearing strains will be measured on each pinion shaft. Sufficiently clean the areas of the shafts where the gauges are to be mounted to remove all contaminants. On each shaft, mount two rosettes at 180 degrees from each other. Connect the two gauges such that any direct shear forces in the shafts are neglected and true torsional shear is measured.

Connect the strain gauge leads on each shaft to a four-arm amplifier. Transmit signals from the gauges to the data acquisition equipment either through cable links or amplified and then through wireless transmitters.

Connect output leads from each channel of the amplifiers to either a computer-based data logger provided with a two-channel strain gauge module streaming the amplified data to disk at a minimum1-kHz sample rate, or a five-channel minimum strip chart recorder with at least 250 mm wide chart paper. Provide an inclinometer to provide continuous leaf angle to either the data logging equipment or the strip chart recorder. Utilize step-wise adjustable chart speed and include a setting of at least 250 mm per minute. Use a recorder that is capable of recording data from at least 4 channels if it is equipped with a dedicated event marker or 5 channels if a channel is used to record events.

Record the strains in both shafts simultaneously versus span opening angle during opening and closing to a suitable scale. Record the readings for all shafts at the same strain scale and the chart speed, if a strip chart recorder is used. Make at least 3 opening/closing runs, when the wind speed is less than 5 miles/hour and the bridge deck is visibly dry. Release wind-up torque in the operating machinery prior to each run as verified by space between the faces of the engaged teeth of main pinion and gears.

Numerically convert the strains induced in the shafts to torque by applying fundamental stress-strain relationship calculations for each strain plot for both opening and closing. Use this data to give leaf imbalance versus opening angle, corrected for friction, at each pinion. Prepare plots of total span imbalance.

Submit a report documenting the results of the initial strain gauge measurements to the engineer. Separate reports are required for each leaf. Include the following in the reports:

1. Description of experimental procedure and equipment used.

2. Span drive diagram showing location at which strain gauges were attached and all applicable gear ratios.

3. Photocopies of a sample original strip chart for one complete run of each of the three sets in the case of strip chart recordings or data and chart files in Excel format if recorded by a data logger. Annotate with strain scales, angle of opening, significant ordinates, etc.

4. Description of relationships and sample calculations for obtaining shaft torque from strains, span imbalance from shaft torque, curve fitting and basis for friction correction.

5. Plots of the following parameters versus degree of opening during each opening/closing run and fitted balance curves corrected for friction:

Total imbalance in foot-pounds for span.

Frictional moment in foot-pounds for span.

6. Tabulation of imbalance moment at seated position for each leaf/run including the average value for each leaf.

7. The location of the leaf center of gravity.

After balance block adjustment, submit the final balance report, similar to the initial report, to the engineer. Include an introductory section giving the name of the bridge, the date of the measurements, weather conditions during measurements and any other information requested by the engineer.

Provide five (5) working days of advance notice for final balance of the bascule leaf. For final balance of the bascule leaves, add, remove or rearrange adjustment blocks as necessary to make the leaves "slightly" leaf-heavy; that is, when no outside forces are acting on the leaf, it should tend to slowly drift to the closed position. The "slightly leaf heavy" condition is defined as:

a. A downward reaction at the tip of each bascule girder when in the closed position of no less than 1,000 pounds and no greater than 2,000 pounds

b. and the center of gravity with the span fully seated is located towards the channel at an angle no greater than 20 degrees above or below the horizontal line passing through the pinion.

The final balance will be checked in the nearly closed and nearly open positions as follows: With the leaf stationary, place the drive in a "freewheeling" mode with the brakes released. The leaf should begin to drift closed. Record the time that it takes from the moment that the brakes are released until the leaf has drifted 1.0 degree. If the leaf drifts more than 1.0 degree in 10 seconds, place additional adjustment blocks in the pockets as necessary. If the leaf drifts less than 1.0 degree in 60 seconds, remove adjustment blocks from the pockets as necessary.

Final balancing will be subject to the approval of the engineer and all necessary adjustment and materials which may be required will be considered as part of the work and expense of the contractor.

C.6 Acceptance

The balance of the bascule leaf will be considered unacceptable if any of the following conditions occur:

- After final balancing, the total weight of adjustment blocks in the pockets constitutes less than 1 percent of the total weight of the counterweight.
- After final balancing, the total weight of adjustment blocks in the pockets constitutes more than 6 percent of the total weight of the counterweight.
- After final balancing, the bascule leaf is "slightly leaf heavy" as defined above.

D Measurement

The department will measure Counterweight Concrete by the cubic yard of counterweight concrete acceptably constructed based on the proposed dimensions for the counterweight in the approved balancing calculations plus the volume of adjustment blocks approved and actually constructed.

E Payment

The department will pay for the measured quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0035.01	Counterweight Concrete	CY

Payment is full compensation for performing all the work required to place the bascule leaf in a condition of balance that conforms to the above stated requirements. The cost of preparing approved balancing calculations is included in the bid item Structural Steel Bridge.

i. Concrete Masonry Bridges Lightweight, Item SPV.0035.02.

A Description

This special provision describes furnishing and placing lightweight concrete masonry for the movable bridge deck conforming to standard spec 502.

B Materials

This work requires that the open-grid deck be filled with lightweight concrete masonry having a unit weight of 115 pounds per cubic foot. The lightweight concrete shall have a minimum compressive strength of 4,000 psi at 28 days. The contractor is responsible for the lightweight concrete mix design.

Submit the concrete mix design, including all required test data, to the engineer for approval.

B.1 Lightweight Coarse Aggregate

Lightweight coarse aggregate shall conform to AASHTO M195. When tested in accordance with AASHTO M104 using magnesium sulfate, the loss of lightweight aggregate in 5 cycles of the accelerated soundness test shall not exceed 8 percent. The drying shrinkage of concrete specimens prepared and tested conforming to section 8.4 of AASHTO M195, shall not exceed 0.07 percent. The resistance to degradation of the coarse aggregate, when tested conforming to AASHTO T96, shall not exceed a loss of 50% in 500 cycles.

The lightweight aggregate producer shall furnish test reports from an independent testing laboratory certifying that concrete made from the aggregate and containing approximately 6 percent air content shall have a minimum durability factor of 85 percent when tested conforming to AASHTO T161.

B.2 Composition of Concrete

Determine the proportions of cement, supplementary cementitious materials, fine aggregate, lightweight coarse aggregate and water and submit with the test result data to the engineer for approval. The unit weight of freshly mixed lightweight concrete measured conforming to AASHTO T121 shall not be greater than 116 and no less than 114 pounds per cubic foot. The water/cementitious materials ratio of the mix shall not exceed 0.40. Use a polycarboxylate high range water reducing admixture to achieve the workability required for placement of the concrete. The minimum cementitious materials content is 565 pounds per cubic yard. The mixture at the point of placement shall have a slump of 5” +/- 1” and air content of 7% +/-1%. The concrete shall have a minimum compressive strength of 4000 psi at an age of 28 days.

Use supplementary cementitious materials as needed to achieve low concrete permeability concrete that meets the testing requirements specified below. Fly ash, if used, shall conform to AASHTO M295, and may be used as a partial replacement for cement up to 30% on a 1:1 ratio by weight. Ground granulated blast furnace slag, if used, shall conform to AASHTO M302 and may be used as a partial replacement for cement up to 30% on a 1:1 ratio by weight. Silica Fume, if used, shall conform to AASHTO M 307 and may be used as a partial replacement for cement up to 10% on a 1:1 ratio by weight. The combined weight of all supplementary cementitious materials used in the mix shall be limited so that portland cement constitutes a minimum of 60% by weight of the total cementitious material.

Measure concrete permeability conforming to AASHTO T277 (Rapid Chloride Permeability Test). Permeability samples for T277 testing must be stripped of their molds and wet cured to an age of 7 days in a standard moist room or water tank. After 7 days, submerge the samples in water heated to 100°F until an age of 28 days. Upon completion of the curing process, obtain one sample from each cylinder and test conforming to AASHTO T277. The permeability test result shall not exceed 1500 coulombs.

C Construction

In order to make a close determination of the average unit weight of the concrete that will be used in the deck, make at least four sets of test blocks, with no less than six blocks in each set. Each block will measure at least 8 inches by 8 inches by 12 inches and all blocks will be the same size. The forms for the test blocks will be rigid and impervious. The concrete used for the test blocks will contain the same materials and air content as the concrete that will be used in the deck. After the concrete is poured into the forms, vibrate it to the same extent that the deck concrete will be vibrated. After vibrating, strike off the tops prior to initial set. Cure the test blocks in their forms for two days with the tops uncovered. During this time, store the blocks under shelter in the open air. Do not sprinkle water on them for purpose of curing. After two days, remove the forms and weigh the blocks. Use a scale having an accuracy of 0.01 pound to weigh the blocks. Accurately measure all three dimensions and record the weights of the individual blocks, the calculated unit weight of the individual blocks, and the calculated average unit weight of the set of blocks to the nearest 0.01 pcf. Recalibrate the scale by weighing a reference object prior to each time a set of blocks is weighed.

To prove the design meets the given criteria, provide the engineer with the mix design and all required test results at least 4 days prior to making the first set of test blocks.

Make the first set of test blocks at least 75 days prior to final detailing of the proposed counterweight and completing the center of gravity calculations for the bascule leaf with deck and counterweight.

Make the second set of test blocks approximately 15 days after the first set is made. If the average unit weight of the second set of blocks differs from the average unit weight of the first set by more than 1.0 pound per cubic foot, cast additional sets of test blocks until consistent unit weights are obtained.

Make an additional set of test blocks approximately seven days prior to pouring the deck. If the average unit weight of these test blocks differs from the average unit weight of the previous sets by more than 1.5 pcf, notify the engineer of the steps intended to be taken to ensure the proper balance of the completed

bridge. The engineer's approval of these steps will be required prior to pouring the counterweight concrete.

Cast a set of test blocks with the concrete actually used in each pour of the deck. If the average unit weight of any of these sets differs from the average unit weight required by more than 1.5 pcf, notify the engineer of the steps intended to be taken to ensure the proper balance of the completed bridge. The engineer's approval of these steps will be required prior to pouring any additional portions of the deck concrete.

Stockpile all lightweight aggregate at the central batching plant for not less than 24 hours prior to use in the batches. Pre-wet the lightweight aggregate stockpiles using a sprinkler system as recommended by the lightweight aggregate manufacturer. At the end of the wetting period, allow the stockpiles to drain for a period of 12-15 hours immediately prior to use. Protect the stockpiles to prevent excessive evaporation of moisture after wetting.

Monitor air content using the volumetric method, conforming to AASHTO T196.

Delay the pour if the temperature within 48 hours following the proposed pour is predicted to fall below 40°F (5°C).

Give the concrete a continuous wet cure for a period of 7 days.

D Measurement

The department will measure Concrete Masonry Bridges Lightweight by the cubic yard acceptably completed, conforming to standard spec 502.4.2.

E Payment

The department will pay for the measured quantity at the contract unit price under the following bid item:

ITEM NUMBER DESCRIPTION UNIT

SPV.0035.02 Concrete Masonry Bridges Lightweight CY

Payment for Concrete Masonry Bridges Lightweight is full compensation for furnishing test blocks, furnishing and placing concrete, monitoring, and curing.

j. Clearance Gauge, Item SPV.0060.01

A Description

This special provision describes cleaning the end of the bascule pier and bascule abutment and painting a clearance gauge on each. This work shall be in accordance with the plans, as directed by the engineer, and as hereinafter provided.

B Materials

Use paint that is formulated to be used on concrete in exterior weather conditions. Provide product data to the engineer.

C Construction

To clean the area to be painted, give it a light sand blast.

D Measurement

The department will measure Clearance Gauge as each individual clearance gauge acceptably completed.

E Payment

The department will pay for the measured quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.01	Clearance Gauge	Each

Payment is full compensation for cleaning the pier and abutment areas and painting the clearance gauge; and for furnishing all labor, tools, equipment, materials, and incidentals necessary to complete the contract work.

k. **Decorative Pedestal Masonry, Item SPV.0060.09.**

A DESCRIPTION

Furnish all labor, material and tools required for the satisfactory completion of the precast pedestal cap and thin brick facing at the Racine Street Bridge piers and retaining wall in accordance with the drawings and as set forth in these specifications.

Included are the following:

1. Precast Stone pedestal caps.
2. Thin brick pier facing.

B MATERIALS

B.1 Cast Stone Pier Caps

B.1.1 Submittals

Make all submittals in accordance with Sections 105 and 106 of the Standard Specifications.

For cast-stone units, submit manufacturer test reports for concrete mix based on testing according to ASTM C 1364 and including test for compressive strength, water-absorption and resistance to freezing and thawing.

Submit shop drawings showing fabrication and installation details for cast-stone units. Include dimensions, details of reinforcement and anchorages, and indication of finished faces.

Submit 12 by 12 inches by 2 inch samples for color and texture of cast stone required.

B.1.2 Quality Assurance

Fabricator Qualifications: PCI-certified plant for Group A, Category AT that assumes responsibility for engineering precast stone units with a minimum of 5 years successful experience in manufacturing precast stone units similar to those required. Submit documentation stating that the fabricator meets these qualifications.

Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."

B.1.3 Performance Requirements

Delegated Design: Engage a qualified professional engineer to design precast stone units.

Design Standards: Comply with ACI 318 and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast stone units indicated.

B.1.4 Materials

Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed, ASTM A 775/A 775M, epoxy-coated, with less than 2 percent damaged coating in each 12-inch bar length.

Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.

Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet epoxy coated or galvanized.

Portland Cement: ASTM C 150/C 150M; Type I, or III.

> For surfaces exposed to view in finished structure, use gray or white, as required for selected color, of same type, brand, and source throughout production.

Metakaolin: ASTM C 618, Class N.

Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33/C 33M, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for the project.

Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.

Gradation: To match approved sample.

Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand compatible with coarse aggregate; to match approved finish sample.

Coloring Admixture: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures, temperature stable, nonfading, and alkali resistant.

Water: Potable; complying with chemical limits in PCI MNL 130.

Polymer-Curing Admixture: Acrylic thermoplastic copolymer dispersion complying with PCI MNL 130.

Air-Entraining Admixture: ASTM C 260/C 260M, containing not more than 0.1 percent chloride ions.

Chemical Admixtures: ASTM C 494/C 494M, containing not more than 0.1 percent chloride ions.

Sealer: Colorless, pure acrylic water-repellent penetrating sealer which maintains natural look of concrete surface with no glaze or gloss, darkening or color change.

B.1.5 Concrete Mixes

Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

Compressive Strength (28 Days): 5000 psi minimum.

Water Absorption: 6 percent by weight or 14 percent by volume, tested according to ASTM C 642, except for boiling requirement.

Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.

B.1.6 Fabrication General

Cast-in recesses for stainless steel pins and other anchorage hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position recesses for attachment to pins where they do not affect position of main reinforcement or concrete placement.

Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.

Reinforce precast stone units to resist handling, transportation, and erection stresses and specified in-place loads.

Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

Place face mixture to a minimum thickness after consolidation of the greater of 1 inch or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover required.

Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.

Place backup concrete mixture to ensure bond with face-mixture concrete.

Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 117.

Comply with PCI MNL 117 for hot- and cold-weather concrete placement.

Identify pickup points of precast concrete units and orientation in structure with permanent markings.

Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Engineer's approval.

Tolerances: Fabricate precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

B.1.7 Cast Stone Units

Cast-Stone Units: Comply with ASTM C 1364. Units shall be manufactured using the vibrant dry tamp or wet-cast method. Units shall be resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.

Fabricate units with sharp edges and accurately reproduced details with indicated texture on all exposed surfaces unless otherwise indicated. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated. Provide drips on projecting elements unless otherwise indicated.

Cure Units as Follows:

Cure units in enclosed, moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F (38 deg C) for 12 hours or 70 deg F (21 deg C) for 16 hours.

Keep units damp and continue curing no fewer than seven days at mean daily temperature of 50 deg F (10 deg C) or above.

Acid etch units after curing to remove cement film from surfaces to be exposed to view.

B.1.8 Finishes

Exposed faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints, shall be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast stone units to match approved sample and as follows:

Color: Limestone to match cast stone on bridge house.

Finish unexposed surfaces of architectural precast stone units with as cast finish.

Apply sealer to exposed surfaces.

B.1.9 Mortar

Comply with requirements in Section B.1 "Masonry Veneer" for mortar mixes.

For setting mortar, use Type S unless otherwise recommended by manufacturer.

For pointing mortar, use Type N unless otherwise recommended by manufacturer.

B.1.10 Accessories

Furnish loose hardware items including stainless steel pins and other hardware shapes for securing precast stone units to supporting construction.

Anchors: Type and size indicated, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.

Dowels: 1/2-inch diameter round bars, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.

B.2 Masonry Thin Brick

B.2.1 Submittals

Submit Thin Brick Product Data and Samples for Verification of color and size.

Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6. Do not use units with defects. Provide shapes with exposed surfaces matching finish and color of bridge house masonry brick and exposed faces of adjacent units. Provide L configured finished corner units.

B.2.2 Clay Thin Brick: Facing brick complying with ASTM C 216.

Basis of Design: Bridge Pier brick – Interstate Brick Monterey L-4 Thin Brick & Corner

Grade Exterior

Type SW-TBS

Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested according to ASTM C 67.

Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."

Size (Actual Dimensions): 9/16 inches wide by 2-1/4 inches high by 7-5/8 inches long.

B.2.3 Installation Materials

Latex-Portland cement mortar – ANSI A118.4 Bonding Mortar: Type S

Grout Mortar – ANSI A118.6 or A118.7 Type N

B.2.4 Masonry Cleaners

Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

B.2.5 Mortar Mixes

General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated. Do not use calcium chloride in mortar or grout. Use portland cement-lime mortar unless manufacturer recommends otherwise.

Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to project site.

Mortar for Thin Masonry: Comply with ASTM C 270, Proportion Specification. Use Type S for bonding mortar and Type N mortar grout unless another type is recommended for thin brick by the manufacturer.

B.3 Masonry Pier Accessories

B.3.1 Submittals

Product Data: For each type of product.

B.3.2 Materials

Flashing: 18 gage stainless steel; ASTM A167, Type 304, soft temper; smooth finish. Provide a mill certification for this material.

Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

Sealant: Urethane, S, NS, 25, NT: Single-component, non-sag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

Manufacturers: Tremco Dymonic or Vulkem 116.

C. CONSTRUCTION

C.1 PEDESTAL CAP AND THIN BRICK FACING

C.1.1 Coordination

Coordinate and prepare shop drawings with pier light pole mounting assembly requirements and bolt pattern accommodating sound structural attachment and smooth installation.

C1.2 Field Conditions

Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not install on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

C.1.3 Installation, General

Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested according to ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

Tolerances for Lines and Levels:

For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.

For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet or 1/2 inch maximum.

For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2 inch maximum.

For conspicuous vertical lines, such as external corners do not vary from plumb by more than 1/8 inch maximum.

For lines and surfaces, do not vary from straight by more than 1/8 inch maximum.

Tolerances for Joints:

For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch maximum.

For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch maximum.

C.1.4 Preparation for Applying Pedestal Thin Brick

Clean and remove all bond breaking materials, oil, wax, etc. from surface to receive thin brick. If the bond breakers are not completely removed from the concrete substrate, the thin brick will not properly adhere to the concrete walls.

Concrete should be bush-hammered or heavily sandblasted.

Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of returns, and offsets. Use special L shaped units at outside corners and avoid using less-than-half-size units. Pattern: running bond.

C.1.5 Thin Brick Application

Substrate may need to be moistened to prevent desiccation of the bonding mortar.

Apply thin brick to substrate using Type S bonding mortar using a ¼” notched trowel. Do not trowel an area larger than can be completed in 10 minutes.

Blend from multiple cartons to create a uniform distribution of color.

Back Butter (coat) the back side of the thin brick and press into place. Allow to dry a min of 24 hours.

Grout all joints to receive mortar with Type N Portland cement mortar.

Tool joint when mortar is thumb print hard.

C.1.6 Anchored Cast Stone Pier Caps

Anchor cast stone pier caps to concrete piers with stainless steel pins to comply with the following requirements:

Embed pins 4” into drilled or cast holes in concrete structural piers with mortar or epoxy as indicated. Use two pins per cap and locate with spacing as indicated.

Set cast stone pier caps with 1.5” overhang all around onto fresh bed of mortar over flashing described below.

Embed stainless steel pins 1.5” into ¾” drilled or cast holes at underside of cast stone as it is set.

C.1.7 Stainless Steel Flashing

General: Install embedded flashing under precast stone cap as indicated.

Install flashing as follows unless otherwise indicated:

Prepare substrate surfaces so they are smooth and free from projections that could puncture flashing. Place one-piece flashing on slightly sloping bed of mortar and cover with mortar.

Before covering with mortar, seal steel pin penetrations and where indicated light fixture mounting bolt penetrations in flashing with sealant.

Install flashing with drip edges beneath cast stone cap at exterior faces of pier.

C.1.8 Cleaning

Clean brick using appropriate cleaning methods. Use low pressure cleaning method.

In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar / grout fins and smears before tooling joints.

Final Cleaning: After mortar / grout is thoroughly set and cured, clean exposed masonry as follows:

Test cleaning methods on sample lower wall section to insure cleaner is not detrimental to finished product.

Protect adjacent precast stone and non-masonry surfaces from contact with cleaner.

Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.

Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.

Clean masonry with a proprietary cleaner applied according to manufacturer's written instructions.

D. Method of Measurement

The department will measure completed pedestal precast cap and thin brick finishes, constructed in accordance to the contract and accepted, each as single complete units of work.

E. Basis of Payment

The department will pay for the measured quantity at the contract price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.09	Decorative Pedestal Masonry	EACH

Payment is full compensation for all materials, labor and incidentals for decorative pedestal caps and brick facing, including precast concrete cap, foam thin brick applied with mortar in accordance with the drawings and as set forth in these specifications.

l. Structural Steel Bridge, Item SPV.0085.01.

A Description

This special provision describes furnishing, fabricating, and erecting all structural steel associated with the bascule span of the bridge as shown on the plans and specified herein. Perform all work for this item in accordance with all applicable requirements of the standard specifications except as modified herein or as shown on the plans.

This work includes, but is not limited to, the following items:

- All steel members of the movable leaf including but not limited to the bascule girders, floor beams, roadway stringers, lateral bracing, sidewalk stringers, sidewalk bracing and sidewalk supporting cantilevered brackets.
- Counterweight supporting trusses, cross framing system and end form plates.
- Machinery floor framing, machinery room floor plates, machinery room enclosure framing and bolts attaching machinery supports to machinery floor framing.
- Slip resistant steel plate for bascule sidewalks.
- Front and rear breaks in roadway including moving portions attached to the bascule leaf and non-moving portions attached to the adjacent fixed span and substructures.

- Front and rear breaks of sidewalks including moving portions attached to the bascule leaf and non-moving portions attached to the adjacent fixed span and substructures.
- Longitudinal breaks in sidewalks including the portions attached to the bascule leaf and attached to the bascule pier and bascule abutment.
- Angles with anchors embedded in edges of bascule roadway slabs.
- Steel roadway barrier system and associated connections along inboard face of bascule girders
- Rack support frame systems
- Track girder
- Grillages systems under rear locks.
- Anchor bolts for column bases of rack support frames
- Anchor bolts for attachment of track girder to bascule pier and bascule abutment
- Machinery room access ladders and hardware.
- All shop and field welded stud connectors attached to steel, unless otherwise noted.
- All shop installed and field installed fasteners for steel.
- Any other shop and field fasteners for connection of other items to the above structural steel except for the items furnished as a part of the bid item Mechanical Work Bascule Span and as otherwise shown or noted on the plans or in the special provisions.
- Furnishing, installing and final tensioning of bolts connecting tread forgings to bottom flanges of bascule girders, and those connecting track forgings to top flanges of track girders.
- Any other fabricated steel shown on the plans but not specifically listed above, except those specifically included with another bid item.

B Materials

B.1 General

Furnish steel conforming to AASHTO M 270 grade 50 unless otherwise noted on the plans.

Order all plate from the mill that is to be bent during fabrication such that the bend line will be oriented perpendicular to the direction of rolling.

B.1.1 Fracture Control Plan

The AASHTO/AWS Fracture Control Plan (FCP) for Non-redundant Members, (Bridge Welding Code D1.5) shall be followed and shall constitute the Fracture Control Plan for this project, except as modified herein.

All non-redundant fracture critical material, noted (FCM) on the plans shall adhere to all requirements of the Fracture Control Plan.

The first sentence of the second paragraph of Subsection 8.2 of the Guide Specifications is amended as follows:

The Charpy test requirements for weld metal connecting AASHTO M270 (ASTM A709) Grades 36, and 50 steels to be 35 ft-lb (47.5 Nm) at -30 °F (-34.4 °C).

Base metal Charpy V-Notch requirements for fracture critical members are as follows:

MATERIAL: AASHTO M270 (ASTM A709)

GRADES	THICKNESS, INCHES	REQUIREMENTS
50*F Up to 4”	Mechanically Fastened	25 ft-lb @ -30 °F
50*F Up to 2”	Welded	25 ft-lb @ -30 °F
50*F Over 2” to 4” incl.	Welded	30 ft-lb @ -30 °F

F- Designates “Fracture Critical” (Zone number is omitted because this specification exceeds Zone 3)

Conduct the CVN-impact testing “P” plate frequency testing in accordance with AASHTO T-243 (ASTM A673). Conduct Charpy impact tests on each plate at each end. Code the Charpy test pieces with respect

to heat/plate number and record that code on the mill-test report of the steel supplier with the test result. If requested by the Engineer, package and forward the broken pieces from each test (three specimens, six halves) to the Quality Assurance organization of the State.

* Reduce acceptability temperature for the CVN value by 15 °F for each increment of 10 ksi above 65 ksi, if the yield strength of the material exceeds 65 ksi. The yield strength is the value given in the certified “Mill Test Report”.

** Reduce acceptability temperature for the CVN value by 15 °F for each increment of 10 ksi above 85 ksi, if the yield strength of the material exceeds 85 ksi. The yield strength is the value given in the certified “Mill Test Report”.

B.1.2 Bolts and Anchors

Subsection 506.2.5.1 of the standard specifications is amended as follows:

Where bolt diameters less than ½ inch or greater than 1½ inches are called for on the plans, use ASTM A449, Type I bolts except where another type of bolt is specifically called for.

Provide only high strength bolts that meet FHWA requirements for rotational tests.

B.1.3 Slip Resistant Steel Plate

Furnish slip resistant steel plate of the size, shape, and thickness shown on the plans for the sidewalk on bascule span conforming to ASTM A709 Grade 50. Provide a surface with a static coefficient of friction of 0.50 minimum in both dry and wet conditions. Do not provide additional joints or splices not shown on the plans without prior written approval of the engineer. Cover surface of the steel plate with a Martensitic alloy having a hardness of at least 55 on the Rockwell “C” scale. Use plasma stream deposition to assure maximum adhesion to the substrate. Provide surface bond strength for the coating no less than 4,000 psi. Hot-dip galvanize, the slip resistant steel plate after fabrication, drilling of all holes for bolted connections, and application of the slip resistant coating.

B.1.4 Submittals

Prepare and submit complete steel shop detail drawings and steel erection drawings.

Prepare and submit span balancing calculations along with counterweight shop drawings as part of the shop drawings. See article “Counterweight Concrete” for the balancing calculation format and associated requirements. Prepared span balance calculations based on actual weights of all proposed elements to be furnished for the construction of the movable bascule leaf.

B.2 Galvanizing

B.2.1 General

Hot-dip galvanize the following items, including all appurtenant parts in accordance with ASTM A123 or A153 as applicable.

- Longitudinal steel beams supporting the open steel roadway grid of the bascule span and their associated end connection angles and plates
- Center break weldment and rear break weldment
- Steel traffic barrier
- Stringers along lines “a” and “g”
- Fascia sidewalk stringer
- Intermediate sidewalk bracket between exterior stringer and bascule girder
- Ends of floor beams and ends of lateral bracing members within 5’-0” of the bascule girders and all associated end connection angles and plates
- Slip resistant steel plate for the sidewalks
- Front sidewalk breaks
- Longitudinal sidewalk breaks
- Angles embedded in the roadway slab on the bascule leaf
- Access ladders and all associated safety related components and attachment hardware.

- All bolts, unless noted otherwise on the plans
- All anchor bolts — from the exposed end to a point 3 inches below the surface of the concrete, unless noted otherwise on the plans
- Steel stairways located in bascule pier and bascule abutment
- Any other items designated on the plans to be galvanized

B.2.2 Bolts and Nuts

Tap galvanized nuts oversize in accordance with ASTM A563 and all other applicable ASTM standards. Supplementary Requirement S1, Lubricant and Test for Coated Nuts will apply.

Assemble and ship from a single manufacturer all bolts and nuts. The manufacturer is responsible for all mill tests and other reports and will perform the rotational tests and certification.

Perform rotational capacity tests in accordance with FHWA requirements.

B.2.3 Repair of Damaged Galvanized Coating

Repair any galvanized areas that are damaged by abrasion and other causes in accordance with ASTM A780, using either the Zinc-Based Solders or the Zinc-Rich Paints type of materials. Follow the requirements of Annexes A1, Repair Using Zinc-Based Alloys, and/or A2, Repair Using Zinc-Rich Paints.

Alternatively, repair damaged areas as specified in subsection 635.3.4 of the standard specifications.

B.3 Painting

Clean and paint all structural steel, except as specified in section B.8.1 of this special provision, and miscellaneous metals in accordance with section 517 of the standard specifications using the Epoxy System, unless otherwise noted.

Paint all metal elements of the bridge in accordance with 506.3.32.

The color of the epoxy intermediate coat will be white.

Provide a urethane finish coat with gray color. Prepare test panels as described under the article "Painting Epoxy System B-70-324" and coordinate with the engineer for confirmation of the paint color from the engineer from the City of Menasha. Include color number for finish coat in shop drawings for structural steel.

Supply the engineer with the product data sheets before any coating is applied. The product data sheets will indicate the mixing and thinning directions, the recommended spray nozzles and pressures, the minimum drying time for shop applied coats, and the recommended procedures for coating galvanized bolts, nuts, and washers.

Blast clean and paint with a 1 mil (minimum dry film thickness) coating of zinc rich primer portions of structural steel which will be embedded in concrete, unless noted otherwise.

Do not perform abrasive blasting within the machinery rooms after the installation of any machinery.

Paint galvanized stringers, lateral bracing, and all associated gusset plates, connection angles, and connection plates. Provide a wash coat and a tie coat appropriate for painting of galvanized surfaces before painting these members with the same paint system as the rest of the bridge

B.4 Welding

Perform welding in conformance to the requirements of subsection 506.3 of the standard specifications supplemented by the following:

Perform all welding and non-destructive testing for redundant and non-redundant main members and secondary members in conformance to the current edition of the AASHTO Bridge Welding Specifications, D1.5 and the details shown on the plans. Perform all welding by the electric arc process. Use full penetration welds for all butt and groove welds. The symbols on these plans indicate only the general type of weld required. Submit to the engineer for approval, the proposed weld geometry to be used in fabrication. Include machining or grinding required to maintain 2½ to 1 transitions. If a fillet weld size is not shown on the plans, size the weld in accordance with WisDOT requirements for minimum weld size based on material thickness.

B.5 Fabrication

B.5.1 Rolling Portion of the Bascule Girders

Bend flange plates of the heel portions of the bascule girders which support the tread forgings as shown on the plans. When plates are ordered from the mill, order widths and lengths of plates such that the bending is performed perpendicular to the direction that the plate was rolled. Prior to bending, heat the area of the plate that is to be bent to no less than 1,100 °F and no more than 1,250 °F. Notify the engineer so that he or she may be present during the bending of these plates.

Accurately weld the flange plates, at the heel portions of the bascule girders, which support the tread forgings, to the web plates so that not less than the designated thickness of metal will remain after machining the flange. Assure flange plates are square with the web plates. Order flange plates with extra thickness to allow for finishing and tolerances. The pay weight will be based on the thickness shown on the plans.

Weld the stiffener plates to the web and flange plates before the flange plates are machine finished. Finish the flange plates to provide a true and uniform bearing for the tread forgings.

Fabricate as a minimum, the heel portion of the bascule girder into a subassembly prior to boring the hole in the girder web for the pinion shaft bearing, prior to machining the curved surface of the bottom flange of the bascule girder to which the tread forging attaches, and prior to machining the curved rolling surface of the tread forging. Include in the heel subassembly the web plate, the curved bottom flange plate and all radial stiffeners attached to the web. After all welding of this subassembly is complete, precisely locate the center of roll and bore the hole for the bearing. Final-machine the curved rolling surface of the tread forgings after permanently attaching to the bascule girder bottom flange.

B.5.2 Rack Supports

Machine the bottom flanges of the girders supporting the rack castings for the full length of the attached rack castings to provide a true plane for attaching the castings. Straighten the girders first if necessary so that machining of the bottom flange does not remove more than 1/8 inch of material

B.6 Shims

Wherever shims are specified on the plans, the nominal, or theoretical, thickness "t" is indicated. Furnish shim pack thicknesses equal to 2 times the nominal thickness, of the following material thicknesses: t, t/2, t/4, t/8, t/16, etc., unless noted otherwise on the plans.

For machinery bases and structural parts that have machined surfaces, furnish the shim pack thicknesses in increments of 1/32 inch, unless otherwise noted on the plans. Use 1/16-inch increments for structural steel connections for parts not having machined surfaces.

B.7 Finishing

Machine finish any welded assembly only after all welding is complete.

Anywhere the terms "Fin", "Finish", "Finished", or "Machined" or the finish symbol (√) appear on the plans, it means that the surface must be machine finished; hand grinding will not be permitted.

B.8 Shop Assembly

In addition to the shop assembly of components required by the standard specifications and as shown or noted on the plans, provide shop assembly as described below, including items furnished under other bid items where appropriate.

B.8.1 Assembly of the Tread Forgings to the Bascule Girders

After final machining of the portion of bottom flanges of the bascule girders to which tread forgings are attached, blast clean the faying surface of the girder flanges and tread forgings. Perform blast cleaning of this surface in accordance with SSPC-SP10/NACE No. 2, Near-White Blast Cleaning.

Provide a minimum blast profile to this surface of three (3) mils. Employ blasting equipment and necessary blasting materials that will ensure achieving this minimum blast profile. In the presence of a representative of the engineer or the representative he or she designates, measure and document this surface profile in accordance with NACE standard RPO287 “Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using a Replica Tape” and provide documentation thereof. Provide the engineer a minimum of two weeks’ written notice prior to measuring the blasted surface profile.

Do not prime paint the final blast cleaned faying surfaces of the tread forgings and mating surface of girder bottom flange. Immediately after completing of surface preparations and verification of achieving the three (3) mil roughness, attach tread forgings to bascule girder flanges. Take all precautions necessary to assure

that no corrosion develops on final blast cleaning faying surfaces before mounting and final bolting of tread forgings to girder flanges.

See Section C.4 “Attachment of Tread Forgings to Bascule Girder Flanges” of Article “Steel Treads and Tracks” regarding specific requirements for installation and final tensioning of bolts between tread forgings and bottom flanges of bascule girders.

Perform final finishing of the outside radius of the tread forgings after they are final-bolted to the bascule girders. Final finishing shall bring the tread surfaces to the specified radius, and within the tolerance shown on the plans.

B.8.2 Bascule Leaves

Shop assemble the bascule leaves completely including the bascule girders with tread forgings permanently bolted, floor beams, vertical and horizontal truss members, counterweight end form plates, machinery room floor framing and machinery room floor plates.

Maintain a center to center distance between the bascule girders of the assembled bascule leaf as measured between longitudinal scribe lines on the attached tread forgings within 1/32 inch of the dimension shown on the plans for all locations along the length of roll. Provide the engineer a minimum of two weeks’ written notice to witness the verification of this dimension.

For each bascule girder, assure that the centerline of bore for the pinion shaft bearing is located within 0.010 inch of the theoretical center of roll shown on the plans. Assure that the radius of roll after final machining of the rolling surface of the tread forging is within 1/16 inch of the theoretical radius shown on the plans.

B.8.3 Rack Segments and Rack Support Frames

Attach the rack segments to the rack support girders in the shop with turned bolts. Drill holes in the rack girders from the solid with rack segments attached.

Shop-assemble the rack support girder, columns, diagonal and horizontal strut as units. Sub-drill and ream all holes for field bolts to the sizes shown on the plans. Prior to reaming, hold the assembled pieces in their exact position by using temporary undersized bolts. Maintain all work points and work lines to within 1/32 inch of their absolute theoretical locations during this assembly.

Scribe the centerlines of the columns, in both directions, on the top and sides of the column cap plates. Scribe matching lines on the bottom flanges of the girders.

B.9 Numerical Roll Through Procedure

Perform a numerical roll-through test for each of the fully assembled heel portions of the bascule girders with tread forgings permanently attached to assure acceptable mating of track forgings with corresponding tread forgings. Perform the procedure only in the presence of the engineer or designated representative. Provide the engineer a minimum of two weeks advanced notice of when this procedure will be performed for each of the four bascule girders to enable him to witness it.

The roll-through procedure shall provide proof and assurance of the following:

1. The longitudinal centerlines scribed on the final-machined tread forgings when attached to the bascule girders will precisely correspond to the longitudinal centerlines scribed on the final-machined track forgings when permanently erected in the field.
2. The transverse lines at the first and last positions of roll scribed on the final-machined tread forgings when attached to the bascule girders will precisely correspond to the transverse line scribed on the final-machined track forging when permanently set in the field.
3. All track forging pintles will precisely mate with corresponding tread forging receiving pockets without interference and without the space between any pintles and mating receiving pockets exceeding the maximum shown on the plans.

Prepare and submit complete details of the proposed numerical roll-through procedure for review and approval by the engineer. Following is an outline of a recommended form for the procedure:

1. After final machining of the tread forging when permanently attached to the bascule girder, place a permanent longitudinal scribe line on the tread forging. Assure this scribe line corresponds to the precise centerline of the bascule girder web. Provide details on how this will be achieved.

2. For the first position of roll, project the center of bore in the bascule girder web for the pinion shaft bearing down to the attached tread forging. Place a permanent transverse scribe line for this position onto the rolling face of the tread forging. Extend this line onto the vertical surfaces of the edge of the plate for future use during field erection.

3. For each machined receiving pocket of the tread forgings, precisely measure and record the distance from the inside edge of the pocket to the scribed longitudinal centerline. Precisely measure and record the distance from the transversely scribed line for the first position to the front and back edges of each pocket.

4. For the mating track forging, make a temporary transverse reference line near the first position of roll. Also make a temporary longitudinal reference line near the centerline of the plate.

5. For each pintle of the track forging, precisely measure and record the distance from the inside edge of the pintle to the temporary longitudinal reference line. Similarly, precisely measure and record the distance from the front and back edges of each pintle to the temporary transverse reference line at the rolling surface.

6. Correlate the measurements from Step 3 for the inside edges of each tread forging pocket with the measurements from Step 5 for the inside edge of each track forging pintle to determine the optimum location to place a permanent longitudinal scribe line for the track forging. The optimum location will minimize the potential for interference between the inside edges of tread forging pockets and the inside edge of track forging pintles. Perform any supplemental machining of inside faces of track forging pintles required to assure a 0.02-inch minimum clearance is provided between inside edges of all tread forging pockets and inside edges of corresponding track forging pintles. Place permanent longitudinal scribe line on track forging. Extend scribe line onto vertical faces at front and back of tread forging.

7. Correlate the measurements from Step 3 for the front and back edges of each tread forging pocket with the measurements from Step 5 for the front and back edges of each track forging pintle to determine the optimum location to place a permanent transverse scribe line representing the first position of roll for the track forging. The optimum location will minimize the potential for interference between the front and back edges of the tread forging pockets and the front and back edges of track forging pintles. Provide any supplemental machining of front and back faces of track forging pintles required to assure a 0.02-inch minimum clearance is provided between front and back edges of all tread forging pockets with front and back edges of all track forging pintles. Place permanent transverse scribe lines for first and last position of roll on track forging. Extend scribe line onto vertical edge of tread forging.

C Construction

C.1 General

Erect the bascule leaf in such a manner that navigation on the waterway is maintained as specified in the section “Construction Over or Adjacent to Navigable Waters”.

Coordinate with waterway users and secure permission from the U.S. Coast Guard to limit or obstruct to navigation for any periods of time that may be needed to accomplish items of work requiring a bascule leaf to be in the closed position—such as pouring of concrete for the roadway deck over the steel grid, machinery rooms and counterweight pits.

During periods when the bascule leaf is unbalanced, provide adequate supports, shoring, and/or falsework to support the unbalanced loads and maintain the leaf securely in its intended position. Secure the services of an engineer, registered in Wisconsin, to design these supports to carry the entire unbalanced loads plus all additional loads resulting from wind forces, temporary erection forces, accumulations of snow, ice, dirt, etc. Submit proposed methods, sealed by the contractor's engineer, to the engineer for review. Any review by the engineer will not relieve the contractor of full responsibility to ensure that the unbalanced bascule leaf is adequately maintained in a safe manner.

Submit proposed construction methods and sequences required to move leaf while in an unbalanced condition for approval of the engineer. Submit full procedures that will be used to assure full control of the leaf is maintained.

C.2 Track Forgings

Carefully and accurately position the track forgings on track girder. Set the tops of the track forgings at the exact elevation shown on the plans and such that they will be perfectly level and all in the same horizontal plane. Provide competent personnel and all survey and other measuring equipment to assure accurate positioning of tread forgings.

C.2.1 Erection Tolerances for Track Forgings

Set track forgings within the following tolerance:

- The elevation of the rolling surface at each end of each track forging: within 1/32 inch of the elevation shown on the plans.
- The distance between the longitudinal centerline of each track forging at both the first and last position of roll: within 1/32 inch of the dimension measured in the shop between the longitudinal lines on the tread forgings after permanent attachment to the fully assembled heel portion of the bascule leaf.
- The location of the transverse scribe line for the first position of roll for each track forging: within 1/32 inch.

Provide all tools, equipment, and means necessary to assure track forgings do not shift after being positioned until encasing concrete around the track girder is poured and cured. Failure to permanently position and orient track forgings within these required tolerances will result in rejection of track forgings.

C.3 Rolling Portions of Bascule Girders

The central planes of rotation of the rolling tread forgings must coincide with the vertical planes through the centerlines of their respective track forgings for all positions of the bascule leaf. Special care must be taken to maintain each rolling tread forging in the same vertical plane during the erection of the bridge and the construction of the counterweight.

See Section C.4 “Attachment of Tread Forgings to Bascule Girder Flanges” of Article “Steel Treads, Tracks & Centerlocks” for additional requirements for installation, snug tightening and final tensioning of bolts connecting tread forgings to bascule girder bottom flanges.

Assure the centers of roll for both bascule girders is maintained precisely in the same position relative to one another throughout erection of the bascule superstructure and during forming and pouring of the concrete counterweight so that no warp in the structure exists at completion.

During erection of the bascule leaf and immediately prior to pouring the concrete counterweight, ensure that the distance from centerline of each bascule girder to the centerline of roadway does not deviate by more than 1/16 inch from the theoretical value shown on the plans at reference line “B” nor more than 1/16 inch at reference line “6”.

C.4 Shoring

Use adequate blocking, shoring, or struts to support the bascule girders and the counterweight during erection in order to accurately and satisfactorily erect the bridge. Assure each of the bascule girders cannot roll in either direction during forming, placement and curing of the concrete counterweight.

C.5 Rack Supports

Accurately align the rack support frame members including the bottom strut and diagonal brace before embedding the lower portion in concrete. Locate the tops of the columns within 1/16 inch of their theoretical locations in any direction. Erect the rack support girders with the pitch line of the attached rack castings at the proper elevation and horizontal alignment. Both ends of each rack must be within 1/32 inch of their theoretical locations in all directions. Assure the rack and pinion pitch lines are vertically aligned throughout the entire length of roll. Adjust and/or shim as required.

Assure the longitudinal centerline of the rack castings are aligned with the associated pinion centerline for all position of roll.

After final adjustment, fully tighten all bolts connecting the rack support girders to the columns.

C.6 Clearances

The first time the bascule leaf is slowly moved, check for minimal clearance or possible interference at all critical locations between the fixed and movable parts of the structure.

C.7 Vertical and Horizontal Alignment of Girders and Breaks

Align the bascule girders and front and rear breaks in the roadway as follows and in the order shown:

1. Lower both leaves to the nearly closed position to ascertain the relative alignment of the leaves
2. Align the bascule girders laterally at the center of span so that the jaw portions of the centerlocks are precisely centered horizontally with respect to the mating diaphragm portions. Prior to final bolting the steel grid deck in place in panel 3-4, drill holes for lateral bracing in panel 3-4 as shown on the plans. Install bolts and fully tighten
3. Adjust the shims at the centerlock jaw plates such that when lowering the leaves, both diaphragm castings strike their respective jaw plate at precisely the same position of the bascule leaf
4. Adjust the shims at for the uplift supports so that when both leaves are in the fully closed position the strike plates at all four uplift supports rest fully and firmly on the uplift bearing plates
5. Adjust the shims at the rear locks so that when the rear lock is driven, the "clearance" between each rear lock and associated bascule girder strike plate is +0.000" and -0.015"
6. After the above adjustments have been made, align the mating sections of roadway center and rear break plates so their teeth align properly

C.8 Floor Beams on Bascule Span

Assure the floor beams and stringers on the bascule span are fabricated and erected to be at the correct distance below the top of floor as shown on the plans. Assure the positions of these members will enable the roadway steel grid, which will be supported on them, to be at the proper elevation at all points.

C.9 Front and Rear Breaks in Roadway

Ensure that the front and rear roadway break plates are adjusted to be parallel and at the same elevation as the surface of the concrete deck. Ensure the mating elements of the finger plate teeth of the roadway front and rear break are in proper alignment with respect to one another, as shown on the plans.

Do not connect the sections of the adjacent roadway floor grid at the center break to the stringers until the center break sections have been set to proper alignment and the centerlocks are precisely aligned both vertically and horizontally.

Do not connect the roadway floor grid sections at “Floor Beam Truss 1” to the stringers until after the grid sections have been set to their proper alignment.

Coordinate the work at the roadway rear break so that proper alignment, clearance and meshing of teeth will be maintained during construction of the adjacent concrete deck.

C.10 Metal Work Set in Concrete

Place and maintain all metal work to be set or embedded in concrete with care to ensure exact alignment elevation. Where grout is shown on the plans, adjust and support the metal parts by means of leveling bolts. Provide an approved self-leveling, high strength non-shrink and non-staining grout. The furnishing and placing of grout will be considered incidental to the work of this bid item and others and no separate payment will be made for it.

D Measurement

The department will measure Structural Steel Bridge by the pound acceptably completed.

E Payment

The department will pay for the measured quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0085.01	Structural Steel Bridge	LB

Payment is full compensation for furnishing, fabricating, transporting and delivering, erecting, and painting all structural steel and furnishing all labor, tools, equipment and incidentals necessary to complete the work.

The preparation of shop drawings, preparation of bascule leaf balancing calculations and associated drawings are included in this bid item.

Furnishing and installing shop welded shear connectors to structural steel is included in this bid item and no separate payment will be made for them. These connectors include, but are not limited to, angles, plates for roadway and sidewalk rear breaks, bascule girder web plates, counterweight end form plates, counterweight pocket cover connection angles, steel barrier end plate anchors.

Furnishing, installing and final tensioning of bolts connecting tread forgings to bascule girder flanges is included as part of this work.

7/8” diameter 4-inch long shear connectors field welded to the structural steel will be paid for separately. These connectors include those which are embedded in the roadway deck, including only those welded to the tops of the rack frames, floor beam truss 1, and roadway stringers.

The shop assembly and/or field erection of associated materials furnished under other bid items as specified herein is also included to this bid item and includes field setting of track forgings and attachment of tread forgings.

All costs for items associated with placing the bascule span in proper structural operating condition configuration, alignment, and balance is also considered included in this bid item.

m. **Steel Treads, Tracks, & Centerlocks, Item SPV.0085.02.**

A Description

This work consists of providing all labor, materials, tools and equipment necessary to detail, furnish, fabricate, machine, and deliver steel tread forgings that will be attached to the bottom flange of the bascule girders and mating steel track forgings that will be mounted on the bascule pier and bascule abutment as shown on the plans and specified herein.

This special provision also describes furnishing and machining of center lock diaphragm castings that will be attached to the tips of the south leaf bascule girders.

This work includes all transportation of parts that may be required between the forge, machine shop, steel fabricator and project site.

B Materials

B.1 Forgings

Provide steel forgings for treads and tracks with the yield and tensile strength and toughness shown on the plans. Provide steel forgings for treads and tracks conforming to ASTM A668 of the Class and strength specified on the plans, and conforming to the general requirements of ASTM A788.

Perform each of the following for each forging:

- Magnetic Particle examination per ASTM A275 and ASTM E 709, or Liquid Penetrant examination per ASTM E 165. Acceptance criteria of ASTM A 788 Supplementary Requirements S18 and S19 shall apply
- Ultrasonic examination per ASTM A 388 or ASTM E 2375. Acceptance criteria of ASTM A 788 Supplementary Requirement S20, Level BR and Level S shall apply.

B.2 Castings

Provide material for all castings conforming to AASHTO M 192, Class 90, and ASTM A148M Grade 620-415. Supplementary requirements SI, Magnetic Particle Examination apply to this work.

Provide material meeting Charpy Impact requirements of 15 ft-lb at –50 degrees Fahrenheit.

C Construction

Perform all work in accordance with the details shown on the plans. Prepare and submit complete shop drawings for each tread forging, track forging, and diaphragm casting. Prepare and submit procedure for repairs to castings for minor defects in forgings or castings.

Provide ample thickness of material so that after finishing, the thickness of metal at every point will not be less than shown on the plans.

Manufacture castings that provide neat finish patterns and appearance. Manufacture castings that will provide rounded edges and fillets to unfinished edges and inside corners. Construct the allowance for draft to be as small as is practicable.

C.1 Identification Marking

Construct a distinctive identification mark on each forging and casting that will permanently and clearly show on each part and insure traceability to test report data after forgings have been final machined, painted, attached to bascule girders and erected on site. Locate these marks within two (2) inches of the rolling surfaces of the track and tread forgings. Locate these marks for each forging on the outboard side of the

tracks and treads at their ends that will be nearest the navigation channel. For each track and tread forging associated with the south bascule leaf, include the letter “S” in the mark. For each track and tread forging associated with the north bascule leaf, include the letter “N” in the mark. For each track forging, tread forging and centerlock diaphragm casting associated with a west bascule girder, also include the letter “W” in the mark. For each forging or casting associated with an east bascule girder, also include the letter “E” in the mark.

C.2 Machining, Scribing and Punch Marking

Machine each track and tread forging to the dimensions shown on the plans. Perform machining such that surfaces do not deviate from theoretical plan dimensions by more than tolerances shown on the plans. Machine final rolling surface of treads after they are permanently attached to the bottom flange of the bascule girder. Scribe a longitudinal centerline on each track and tread forging. Provide punch marks of the first and last positions of roll on the track and tread. Provide scribe lines through the punch marks at right angles to the centerlines that extend fully to each face and that continue for a minimum of one (1) inch onto the vertical side faces. Assure that all punch marks and scribe lines are clearly visible after the rolling surfaces of the tracks and treads are provided a clear coating, as described below, and delivered to the site.

See article “Structural Steel Bridge” for additional requirements for establishing precise location of centerlines and first and last positions of roll on tracks and treads through the mandatory numerical roll-through procedure.

Accurately finish the center lock castings as shown on the plans. Coordinate with fabricator of the centerlock jaw assemblies to assure that the vertical distance between each set of jaw wear plates is no less than 0.005 inches and no more than 0.050 inches greater than the associated dimension of each mating diaphragm casting.

C.3 Faying Surface Preparation of Tread and Track Forgings

After final machining of each tread and track forging, blast clean its faying surface which mates and is attached to the final machined surfaces the bascule girder or track girder. Perform blast cleaning of this bolted faying surface in accordance with SSPC-SP10/NACE No. 2, Near White Blast Cleaning.

Provide a minimum blast profile to this surface of 3 mils. In the presence of a representative of the engineer, measure and document this surface profile in accordance with NACE standard RPO287 “Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using a Replica Tape” and provide documentation thereof including the replica tapes used for verification of the minimum required profile for each tread and track forging. Provide the engineer a minimum of two weeks’ written notice prior to measuring the roughness of this blasted surface profile to allow witnessing of it.

Assure this same surface preparation and verification of achieving a three (3) mil blast profile is performed on the mating final machined faying surface of the bascule girder bottom flange and track girder top flange.

Do not prime paint the final blast cleaned faying surfaces of the tread forgings and mating surface of girder bottom flange or the track forging and mating surface of track girder top flange. Immediately after completion of surface preparations, attach the forgings to the flanges. Take all precautions necessary to assure that no corrosion develops on final blast cleaning faying surfaces before mounting and final bolting of the forgings to the flanges.

C.4 Attachment of Tread Forgings to Bascule Girder Flanges and Track Forgings to Track Girder Flanges

Install all bolts shown in the plans between each forging and flange and fully snug tighten all bolts before final tensioning. Only final tension bolts in the presence of the engineer. Provide a minimum of 2 weeks’ written notice to the engineer in advance of final tightening to allow witnessing of snug tight condition of all bolts and of final tensioning. Final tension bolts in accordance with the requirements of Section 506.3 of The Standard Specifications for Highway and Structure Construction, except provide 2/3 turn of nut rotation from the fully snug condition. Assure the minimum bolt tension of 104,000 pounds specified in Table 506-1 of the Wisconsin Department of Transportation Standard Specifications is achieved for all bolts after they have been final tensioned.

C.5 Cleaning and Painting

Paint the machined rolling surfaces of the treads and the mating surface of the tracks with clear lacquer after completion of all machining and placement of all alignment scribe lines and before placing outside or transporting. Assure that all scribe lines and punch marks remain visible for field erection after providing of the clear lacquer coating.

Except for the rolling surfaces of treads and tracks and the connection faying surfaces of treads, paint all remaining surfaces of treads and tracks' plates in accordance with section 517 of the standard specifications with a three coat paint system.

C.3 Erection

See article "Structural Steel Bridge" for track erection requirements.

C.4 Quality of Forgings

Provide adequate stock to allow removal of test coupons from each forging. Coupons shall be of sufficient size to allow for all necessary testing. Remove integral coupons only in the presence of the engineer or his or her representative. Remove integral coupons only after all heat treatment processes have been completed. Provide the engineer a minimum of two weeks' written notice prior to removal of coupons.

Provide the engineer a minimum of two weeks' written notice prior to performing testing to allow for the engineer or his or her representative to witness. Provide test reports within two weeks. Send test reports to the engineer within 10 days after testing is performed. Transport components from the forge only after testing has been completed, all test reports have been received by the engineer, and have been approved for shipping.

Where forgings are finished, assure the thickness of the metal remaining after finishing is not less than that shown on the plans.

C.5 Quality of Castings

Neatly cast unfinished edges of bases, ribs and similar casting elements with rounded corners. Cast inside corners with a radius of one inch minimum. Clean castings and all fins or other irregularities removed so that they will have clean, smooth surfaces suitable for this class of work. Finish bosses to correct plane. Finish contact surfaces of castings which are to be attached to structural steel.

Cast one coupon integrally with each casting. Cast coupons of sufficient size to allow for all necessary testing. Castings with coupons insufficient in size, shape, or quality will be rejected. Castings with flame cut edge coupons will be rejected. Remove integral coupons only in the presence of the engineer or his representative. Remove integral coupons only after all heat treatment processes have been completed for the castings to which they are attached. Provide the engineer a minimum of two weeks notice prior removal of coupons. Castings with coupons removed without witness by the engineer or his representative will be rejected.

Provide the engineer opportunity to witness all material testing, including magnetic particle or Magnaflux examination of castings and tensile testing and Charpy impact testing of samples manufactured from integral coupons. Provide the engineer a minimum of two weeks notice prior to performing any testing to allow witnessing of all testing by him or his representative. Send elementary reports within two weeks. Send test reports to the engineer within 10 days after any test is performed. Transport castings from the foundry only after testing has been completed, all test reports have been received by the engineer, and he has approved them for shipping.

Castings having defects deemed significant by the engineer will be rejected. Recast any rejected casting. Any casting may be rejected either before or after finishing. Limited welding repairs of minor defects will be permitted. After submittal of details and procedures for making of repairs, allow two weeks for review by the engineer.

Where castings are finished, assure the thickness of the metal remaining after finishing is not less than that shown on the plans.

D Measurement

The department will measure Steel Treads, Tracks, & Centerlocks by the pound based on the final-machined dimensions shown on the plans.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0085.02	Steel Treads, Tracks, & Centerlocks	LB

Payment is full compensation for furnishing all materials and providing all labor, tools, equipment, machining, transportation, and incidentals necessary to complete the contract work.

n. **Structural Steel Operator House, Item SPV.0085.03.**

A Description

This special provision describes furnishing, fabricating, and erecting all structural steel associated with the operator house of the bridge as shown on the plans and specified herein. Perform all work for this item in accordance with all applicable requirements of the standard specifications except as modified herein or as shown on the plans.

This work includes, but is not limited to, the following items:

- All steel members for the bridge operator room framing system including columns, cross members, plates, and angles.
- Base plate grouting.
- All shop and field welded threaded stud connectors attached to steel.
- All shop and field welding required for the connection of steel framing members.
- Any other fabricated steel shown on the plans but not specifically listed above, except those specifically included with another bid item.
- Shop-applied 3-coat epoxy paint system and field touch up of paint.

B Materials

B.1 General

Furnish steel conforming to ASTM A500 Grade C unless otherwise noted on the plans.

Order all plate from the mill that is to be bent during fabrication such that the bend line will be oriented perpendicular to the direction of rolling.

B.2 Submittals

Prepare and submit complete steel shop detail drawings and steel erection drawings.

B.3 Painting

Clean and paint all structural steel in accordance with section 517 of the standard specifications using the Epoxy System, unless otherwise noted.

Paint all metal elements of the bridge in accordance with 506.3.32.

The color of the epoxy intermediate coat will be white.

Provide a urethane finish coat with black color. Include color number for finish coat in shop drawings for structural steel.

Supply the engineer with the product data sheets before any coating is applied. The product data sheets will indicate the mixing and thinning directions, the recommended spray nozzles and pressures, the minimum drying time for shop applied coats, and the recommended procedures for coating galvanized bolts, nuts, and washers.

Blast clean and paint with a 1 mil (minimum dry film thickness) coating of zinc rich primer portions of structural steel which will be embedded in concrete, unless noted otherwise.

B.4 Welding

Perform welding in conformance to the requirements of subsection 506.3 of the standard specifications supplemented by the following:

Perform all welding and non-destructive testing for redundant and non-redundant main members and secondary members in conformance to the current edition of the AASHTO Bridge Welding Specifications, D1.5 and the details shown on the plans. Perform all welding by the electric arc process. Use full penetration welds for all butt and groove welds. The symbols on these plans indicate only the general type of weld required. Submit to the engineer for approval, the proposed weld geometry to be used in fabrication. Include machining or grinding required to maintain 2½ to 1 transitions. If a fillet weld size is not shown on the plans, size the weld in accordance with WisDOT requirements for minimum weld size based on material thickness.

C Construction

C.1 Metal Work Set in Concrete

Place and maintain all metal work to be set or embedded in concrete with care to ensure exact alignment elevation. Where grout is shown on the plans, adjust and support the metal parts by means of leveling bolts. Provide an approved self-leveling, high strength non-shrink and non-staining grout. The furnishing and placing of grout will be considered incidental to the work of this bid item and others and no separate payment will be made for it.

D Measurement

The department will measure Structural Steel Operator House by the pound acceptably completed.

E Payment

The department will pay for the measured quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0085.03	Structural Steel Operator House	LB

Payment is full compensation for furnishing, fabricating, transporting and delivering, erecting, and painting all operator house structural steel and furnishing all labor, tools, equipment and incidentals necessary to complete the work.

The preparation of shop drawings is included in this bid item.

o. **Railing Aluminum Special B-70-324, Item SPV.0090.01; Railing Aluminum Special R-70-159, Item SPV.0090.02; Railing Aluminum Special R-70-160, Item SPV.0090.03; Railing Aluminum Special R-70-161, Item SPV.0090.04**

A Description

This special provision describes furnishing labor, tools, equipment and materials necessary to provide and mount Railing Aluminum Special on the structures B-70-324, R-70-159, R-70-160 and R-70-161.

B Materials

Furnish all material for extruded shapes conforming to the requirements of ASTM Designation: B 221, Alloy 6061-T6 and to the requirements of Section 513 of the Standard Specification.

Provide anchor bolts, nuts, and washers of the size called for on the plans. Provide bolts material that conform to the requirements of ASTM A276 and be of any type in the 300 series having a minimum yield strength of 40,000 pounds per square inch and a minimum elongation in two inches of 15 percent. Provide nuts that conform to the requirements of ASTM A194, Grade 8, 8C, 8T, or 8F and conform to ANS finished hexagon ANSI Specification B 18.2.2. Provide washers material that conform to the requirements of ASTM A240, Type 302, 304, 304L, 305, or 309S. Threads to conform to the Standards of Class 2A or 2B.

Provide all material sizes as shown on the plans.

B.1 General

Submit complete shop detail drawings, anchor bolt setting plans, catalog data, and erection drawings as provided in Subsection 506.3.2 of the Standard Specifications, in the Article "Contractor Responsibility", Subsection "Submittals", and as specified herein.

C Construction

Conform construction of the railing to the requirements of Subsection 513.3 of the Standard Specifications and the Plans.

Fabricate sections of railing to the sizes shown on the plans, or required by the as-built anchor bolt setting plans; no field welding will be permitted.

Provide an elastomeric bearing pad where aluminum would come in contact with concrete or steel. Provide 1/8” thick elastomeric pad.

After fabrication, anodized all posts, railings, and appurtenant parts with Statuary Bronze color (or other color if specified by the Engineer).

Anchor bolts may be either embedded anchor bolts or concrete masonry anchors, conforming to the requirements of Section 502.2.12 and Section 502.3.14 of the Standard Specifications. Mechanical anchors will not be allowed.

If the Contractor elects to use embedded anchor bolts, obtain from the fabricator of the aluminum railing anchor bolt setting plans. Set each group of anchor bolts (for a single post) together using a single template. Mark worklines on the templates to facilitate the accurate placement of the anchor bolt groups to the precise dimensions of the anchor bolt setting plans. Verify the exact location of each anchor bolt after the concrete is poured and cured. If necessary, revise the anchor bolt setting plans to show the as-built condition and take appropriate measures with the fabricator of the aluminum railing to assure that the railing and anchor bolts fit properly.

D Measurement

The department will measure Railing Aluminum Special (Location) as a linear foot unit for work acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0090.01	Railing Aluminum Special B-70-324	LF
SPV.0090.02	Railing Aluminum Special R-70-159	LF
SPV.0090.03	Railing Aluminum Special R-70-160	LF
SPV.0090.04	Railing Aluminum Special R-70-161	LF

Payment is full compensation for furnishing and installing Railing Aluminum Special on structures B-70-324, R-70-159, R-70-160 and R-70-161, including all labor, tools, equipment and incidentals necessary to complete the contract work.

p. Waterproofing Bascule Pier and Bascule Abutment, Item SPV.0105.01.

A Description

This special provision describes furnishing and installing a commercial industrial membrane waterproofing system on the entire exterior surfaces of the bascule pier and bascule abutment from the top of footing to elevation 748.0.

B Materials

B.1 General

Furnish a liquid applied, two-component, high solids, elastomeric asphalt modified urethane coating that forms a seamless, abrasion resistant, and elastomeric waterproof membrane able to bridge cracks and joints. Provide a membrane that is impervious to water. Furnish a coating system that meets the following requirements:

- Elastomeric Waterproofing, ASTM C836 and C957: Exceeds all criteria.
- Solids by volume: 88 percent.
- Volatile Organic Compounds (VOC): 0.76 pounds per gallon (92 g/L).
- Mullen Burst Strength, ASTM D751, 50 mils in CIM Scrim: 150 psi.
- Tear Strength, ASTM D624, Die C: 150 pounds per inch.
- Tensile Strength, ASTM D412, 100-mil sheet: 900 psi.
- Extension to Break, ASTM D412: 400 percent.
- Recovery from 100 Percent Extension:
    - After 5-minutes: 98 percent.
    - After 24-hours: 100 percent.
- Coating Performance, Crack Bridging:
    - 10 Cycles at minus 15 degrees F (minus 26 degrees C): Greater than 1/8 inch.
    - After Heat Aging: Greater than ¼ inch.
- Coating Performance, Weathering, ASTM D822: 5000 hours: no cracking.
- Softening Point, ASTM D36: Greater than 325 degrees F (160 degrees C).
- Deflection Temperature, ASTM D648: below minus 60 degrees (minus 50 degrees C).

- Service Temperature: minus 60 degrees F to 220 degrees F (minus 50 degrees C to 105 degrees C).
- Hardness, ASTM D2240, Shore A, 77 degrees F (25 degrees C): 60.
- Permeability to Water Vapor, ASTM E96, Method E, 100 degrees F (38 degrees C), 100-mil sheet: 0.03 perms.
- Abrasion Resistance, Weight Loss, ASTM D4060: 1.2 mg.
- Adhesion to Concrete, Dry, Elcometer: 350 psi.
- Color: Black.

B.2 Submittals

Submit manufacturer's product data, including surface preparation, application, and curing. Submit for approval by the engineer 3-inch by 1-inch samples of cured fluid-applied waterproofing, 60 mils thick, and the reinforcing fabric and joint cover sheet. Submit a list of completed project references. Submit for applicator's supervisor a certificate indicating completion of manufacture's contractor training program. Submit manufacturer's standard warranty. The applicator must be experienced in the application of the specified fluid-applied waterproofing for a minimum of 2 years on projects of similar size and complexity. Provide a list of completed projects including project name and location, name of engineer, name of coating manufacturer, and approximate quantity of coating applied.

C Construction

C.1 General

Waterproof the exterior surface of the bascule pier and bascule abutment, including the portion beneath the operator's house, from the top of footing to the top of the recessed horizontal groove at elevation 748.00 around all sides of the bascule pier and bascule abutment. Extend the waterproofing at the base of the walls onto the top of the footing for a distance of 12 inches from the joint between exterior face of the wall and the footing.

Prior to application of the waterproofing system to the entire exterior surface of the walls, pretreat all shrinkage and non-moving structural cracks under 1/16-inch in width with a minimum of 60 wet mils. Extend a minimum of three (3) inches to either side of the crack.

Rout or saw cut all cracks 1/16 inch to ¼ inch in width to a minimum size of ¼ inch wide by ½ inch in depth. Insert joint backing to allow a recess of approximately 1/8 inch to ¼ inch. Place backer rod into the recess. Extend a 60 wet mil thickness a minimum of three (3) inches to either side of the crack.

Prior to application of the waterproofing, apply a primer at the rate of 200-250 square feet per gallon.

After application of the waterproofing membrane is complete, flood the cofferdam and make visual observations for a period of three days, observing any indication of seepage or leakage.

If any indication of seepage or leakage appears, dewater the cofferdam and apply additional waterproofing membrane overlapping 18 inches on each side of the seepage leakage area. Re-flood the cofferdam and again make visual observations for a period of three days, observing for any further indications of seepage or leakage and correct for them if they appear.

C.2 Delivery, Storage and Handling

Follow the manufacturer's instructions for delivery, storage and handling.

C.3 Inspection

Inspect substrate and adjacent areas where fluid-applied waterproofing will be applied. Notify the engineer of conditions that would adversely affect the application or subsequent utilization of the fluid-applied waterproofing. Do not proceed with application until unsatisfactory conditions are corrected.

C.4 Protection

Protect adjacent work and surrounding areas from contact with fluid-applied waterproofing.

C.5 Preparation

C.5.1 General

Prepare surface in accordance with manufacturer's instructions.

Provide clean, dry, and structurally sound concrete surface.

Ensure concrete has a minimum compressive strength of 3,500 psi, is dry, and is free of release agents and curing compounds before application of fluid-applied waterproofing.

Remove surface laitance and expose the underlying aggregate consistent with ICRI CSP 4 to 6 in accordance with ICRI 03732.

Prepare concrete surface to receive fluid-applied waterproofing by abrasive blasting.

Remove dirt, soil, grease, oil, paint, coatings, form release agents, curing compounds, laitance, loose material, unsound concrete, and other foreign materials that would inhibit performance of fluid-applied waterproofing in accordance with ASTM D4258 and by abrasive blasting.

Obtain a firm, sound concrete surface in which bug holes are fully opened or repaired.

Remove sharp concrete edges and projections.

Expose aggregate to obtain a profile of ICRI CSP 4 to 6 in accordance with ICRI 03732.

Repair concrete surface to be free of holes. Fully open bug holes before repair. Repair defects in the concrete surface, such as bug holes, air pockets, and honeycomb by filling and smoothing off with patching material, epoxy patching compound, or grout. Abrasive blast repaired surfaces.

Ensure substrate is clean and dry in accordance with manufacturer's instructions. Remove surface laitance from concrete surface to expose aggregate to obtain a profile of ICRI CSP 4 to 6 in accordance with ICRI 03732.

Repair cracks in concrete surface with material suitable for type and width of crack, compatible with substrate and fluid-applied waterproofing, and approved by the engineer.

C.5.2 Moisture Tests

Do not apply primer or fluid-applied waterproofing to concrete surface unless two or more of the following moisture tests confirm appropriate moisture levels for properly prepared substrates

- Plastic Sheet Method (ASTM D4263): Pass/Fail
- Relative Humidity Test: Less than 75 percent relative humidity at 70 degrees F
- Calcium Chloride Test: Less than 5 pounds per 1,000 square feet per 24 hours
- Radio Frequency Test: Less than 5 percent moisture

C.6 Application

C.6.1 General

Apply primer to concrete surface a minimum of 5 mils wet thickness as required per manufacturer direction. A uniform coating free of holidays or pinholes is necessary to minimize outgassing effects curing the application of the fluid-applied waterproofing to porous surfaces such as concrete. Surfaces may require additional coats to obtain a pinhole free finish.

Allow primer to cure in accordance with manufacturer's instructions before top coating with the fluid-applied waterproofing.

Apply fluid-applied waterproofing in accordance with manufacturer's instructions.

Keep material containers tightly closed until ready for use.

Keep equipment, air supplies, and application surfaces dry.

Mix and apply when fluid-applied waterproofing is above 60 °F (15 °C).

Do not use adulterants, thinners, or cutback solutions.

Blend and mix 2-component materials in accordance with manufacturer's instructions. Do not hand-mix components.

Maintain air supply for material spray application free of oil and water in accordance with ASTM D4285.

Apply fluid-applied waterproofing directly to a clean and dry surface or to reinforcing fabric.

Apply a 6- to 12-inch wide strip of joint cover sheet over cracks larger than 1/8-inch wide, all joints, and edges. Adhere center joint cover sheet over all joints by applying a tack coat of the fluid-applied waterproofing.

Apply sufficient fluid-applied waterproofing to achieve 60-80 wet-mil film thickness.

C.6.2 Joint Lines

Prepare for joint lines should rain or other conditions require work stoppage or extended delay.

Install joint lines clean and straight. Install overlap 6 inches minimum to ensure an impervious joint.

Severely abrade with wire brush or sandpaper and apply bonding agent to all areas where the fluid-applied waterproofing has cured beyond its recoat window.

C.6.3 Recoating

Recoat the fluid-applied waterproofing system within the recoat window to obtain maximum interlayer adhesion to build specific thickness.

C.6.4 Immersion Service

Minimize areas to be recoated outside the recoat window, except at joint lines.

C.6.5 Non-Immersion Service

Severely abrade with wire brush or surface grinder, apply bonding agent, and recoat, if fluid-applied waterproofing has cured more than the recoat window. Acceptable adhesion can only be achieved through aggressive abrading.

C.7 Curing

Cure fluid-applied waterproofing in accordance with manufacturer's instructions.

Allow sufficient time for solvents to evaporate from the cured fluid-applied waterproofing before placing into service.

Allow minimum solvent release time of 24-hours to 48-hours at 60 °F (15 °C) for a 60 wet mil coating thickness.

Receive approval of cured coating by engineer.

C.8 Cleaning

Remove and dispose of all temporary materials used to protect adjacent work and surrounding areas.

Immediately remove and clean fluid-applied waterproofing materials from surfaces not intended to receive the materials.

D Measurement

The department will measure Waterproofing Bascule Pier and Bascule Abutment as a single lump sum unit of work acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.01	Waterproofing Bascule Pier and Bascule Abutment	LS

Payment is full compensation for furnishing and installing the waterproofing system on the bascule pier and bascule abutment including all labor, tools, materials, equipment and incidentals necessary to complete the contract work. Payment includes the cost to de-water for correcting any seepage or leakage after application of the waterproofing system.

q. Closures and Seals, Item SPV.0105.02.

A Description

This special provision describes furnishing labor, tools, equipment and materials necessary for closures in front of the machinery room, flashing attached to the bascule girders and adjacent concrete, flashing at center break, flashing over counterweights, and seals at the longitudinal breaks in the sidewalks.

B Materials

All materials for shall be new stock, free from defects impairing strength, durability, and appearance.

B.1 Polycarbonate Structural Sheeting

Provide shatter resistant, extruded polycarbonate cellular sheet with minimum thickness of 5/8 inch. Provide sheet with UV-stabilized co-extruded outer layer and triple wall configuration with x-brace inner structure. Provide base material mass approximately 0.737 lbs per square foot. Provide sheeting with a

clear color. Provide PolyCarb 16RDC as manufactured by Gallina, USA, Polygal Titan as manufactured by Polygal Plastics Industries, Lexan Thermoclear as manufactured by General Electric Co., or an approved equal.

Provide sheeting classified as CC-1 for extent of burning per ASTM D-635 and having a smoke density rating no greater than 450 when tested according to ASTM E-84.

Provide sheeting having a light transmission rating of approximately 80 percent.

Provide extruded profiles and trim as recommended by the manufacturer to seal and neatly finish all edges.

Provide neoprene sealing washers having the following properties:

- Min. tensile strength of 2500 psi
- Elongation at rupture min. 350%
- Max. compression 35%
- Tear resistance min. 214 N/cm

B.2 Seals at Longitudinal Breaks

Furnish neoprene seal that is in accordance to the pertinent requirements of section 502 of the standard specifications.

B.3 Stainless Steel Flashing

Provide stainless steel flashing that conforms to the requirements of ASTM A240, Type 304, 2B mill finish, with a minimum 16-gauge thickness. Provide 410 stainless steel hex head concrete screws.

Provide silicone caulk at the top of the flashing for the entire length for a watertight seal between the concrete surface and the flashing system where installed at the bascule span counterweight.

C Construction

C.1 Polycarbonate Structural Sheeting

Furnish and install polycarbonate sheeting in front of the machinery room along “Floor Beam 1” as shown on the plans and as recommended by the manufacturer.

Attach the polycarbonate sheeting to the enclosure framing with ¼-inch stainless steel bolts placed at 1-foot maximum centers. Include locking nuts, double washers and a sealing washer on each bolt. Install bolts with the heads at the outside face of the enclosure. Splice panels as per manufacturer’s requirements. Fasten splices at 1 foot maximum centers. Cap exposed points of fasteners with plastic protectors.

C.2 Seals at Longitudinal Breaks

Furnish and install neoprene seals at the longitudinal sidewalk breaks as shown on the plans.

Attach the neoprene seal to the steel support member with A307 galvanized steel countersunk bolts. Install the neoprene seals to provide firm, continuous contact with the adjacent angle embedded in the sidewalk concrete. Install the neoprene seals to provide a smooth, level surface with the adjacent sidewalk within +0 inches to -1/8 inches along the entire length.

C.3 Stainless Steel Flashing

Install the flashing as required to close all gaps between the movable structure and bascule pier/abutment to a maximum opening of 3/4 inch. Attach the stainless steel flashing to the bascule girder stiffener plate only as shown on the plans with ¼-inch stainless steel bolts and nuts with double washers placed at 1 foot maximum centers. Attach the stainless steel flashing to the bascule pier/abutment concrete with ½-inch stainless steel masonry anchors placed at 6-inch maximum centers.

Install center break and counterweight flashing at the locations indicated on the plans, with minimum sheet lengths of 10 feet.

D Measurement

The department will measure closures and seals as a single lump sum unit acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT

Payment is full compensation for closures and seals; fabricating, furnishing and installing the flashing system; for furnishing and installing the caulk seal; and for furnishing all labor, tools, equipment, materials, and incidentals necessary to complete the contract work.

r. HVAC Work, Item SPV.0105.03.

A Description

A.1 Work Summary

This special provision describes the installation of the heating and ventilating (HVAC) equipment and systems.

A.2 Regulatory Requirements

1. State & Local Codes
2. Conform to all state and local code requirements.
3. Permits & Inspections
4. Obtain permits and request inspections from authority having jurisdiction and pay for all Permit fees incidental thereto.

A.3 Equipment Accessibility

Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

A.4 HVAC Installations

Coordinate HVAC equipment and materials installation with other building components. Verify all dimensions by field measurements. Arrange for chases, slots and openings in other building components to allow for HVAC installations. Install HVAC equipment to facilitate maintenance and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum interference with other installation.

A.5 Quality Assurance

Electrical characteristics for HVAC equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified, and costs associated for modifications are included as part of the contractor's work. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

A.6 Delivery, Storage & Handling

Deliver HVAC materials with appropriate protective packaging with labels in place. Deliver pipes and tube with factory-applied end caps. Maintain end caps through shipping, storage and handling to prevent pipe end damage and to prevent entrance of dirt, debris and moisture.

A.7 References

National Fire Protection Association (NFPA)

1. NFPA 54 (ANSI Z223.1) National Fuel Gas Code.
2. NFPA 255 Building Materials, Test of Surface Burning Characteristics.
3. NFPA 90A Installation of Air Conditioning and Ventilating Systems.
4. NFPA 90B Installation of Warm Air Heating and Air Conditioning Systems.

American Society for Testing & Materials (ASTM)

1. ASTM C612 Specification for Mineral Fiber Block and Board Thermal Insulation.
2. ASTM B32 Specification for Solder Metal
3. ASTM B280 Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

4. ASTM A90 Test Method for Weight of Coating on Zinc-Coated (Galvanized Iron or Steel Articles.
5. ASTM A525 Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process.
6. ASTM A527 Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process, Lock Forming Quality.
7. ASTM C553 Specification for Mineral Fiber Blanket and Felt Insulation (Industrial Type).

Underwriters Laboratories (UL)

1. UL 723 Test for Surface Burning Characteristics of Building Materials.
2. UL 181 Factory-Made Air Ducts and Connectors
3. UL 441 Standard for Gas Vents

American National Standards Institute (ANSI)

1. ANSI/ASHRAE 34 Number Designation of Refrigerants.
2. ANSI/ASME B16.22 Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
3. ANSI/ASME B31.5 Refrigeration Piping.
4. ANSI/ARI 710 Driers, Liquid-Line.
5. ANSI/ASHRAE 90A Energy Conservation in New Building Design.
6. ANSI/ASHRAE 103 Heating Seasonal Efficiency of Central Furnaces and Boilers, Methods of Testing.

Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

1. SMACNA Low Pressure Duct Construction Standards.

Air Movement and Control Association (AMCA)

1. AMCA 99 Standards Handbook
    - AMCA 210 Laboratory Methods of Testing Fans for Rating Purposes.
    - AMCA 300 Test Code for Sound Rating Air Moving Devices.
    - AMCA 301 Method of Calculating Fan Sound Ratings from Laboratory Test Data.

Air Conditioning and Refrigeration Institute (ARI)

1. ARI 201/240 Unitary Air Conditioning and Air Source Heat Pump Equipment
    - ARI 530 Positive Displacement Refrigerant Compressors, Compressor Units and Condensing Units.

A.8 Submittals

A.8.1 Equipment and Material Shop Drawings

Submit shop drawings which include equipment information and product data for equipment listed below for review:

1. Furnace, DX Coil, Condensing unit & accessories.
    - Exhaust Fan

A.8.2 Report & Manuals Submittal

Submit the Reports and Manuals requested for review:

- HVAC Testing, Adjusting and Balancing (TAB) Report.
- HVAC operating and maintenance manual including warranty documentation.

B Materials

B.1 Basic HVAC System Materials & Methods.

B.1.1 Pipe, Tube, and Fittings – General

Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

B.1.2 Joining Materials – General

Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

B.1.3 Pipe Penetrations – General

Provide steel pipe sleeves with minimum wall thickness of 1/4 inch for pipes passing through beams and walls of concrete, brick, tile, or masonry, and 22 gage galvanized iron sleeves for pipes passing through other parts of construction. Provide steel pipe for all sleeves penetrating floors. Furnish each sleeve having inside diameter 1 inch larger than outside diameter of un-insulated and insulated pipe, unless wall or floor is a fire wall or barrier, in which case, only the pipe shall penetrate.

For pipes passing through floors, walls, and ceilings provide chrome-plated brass escutcheons having outside diameter to cover sleeved openings and inside diameter to fit pipe.

B.1.3.1 Non-rated surfaces

Stamped steel, chrome plated, hinged, split ring escutcheons or floor-ceiling plates for covering openings in occupied spaces.

In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated pipe and the cored opening or a water stop type wall sleeve.

At interior partitions where pipe penetrations are sealed, use Tremco Dymonic, Sika Corp. Sikaflex 1a, Sonneborn Sonolastic NPI, or Mameco Vulken 116 urethane caulk to affect the seal. Use galvanized sheet metal sleeves in hollow wall penetrations.

B.1.4 Duct Penetrations - General

Non-rated surfaces. Fiberglass insulation fill at voids with galvanized steel sheet metal bank-off on both sides of duct penetration through walls and ceiling structures. Use fire resistant sealant for sealing and soundproofing.

B.2 Identification and Painting for HVAC Systems

B.2.1 Materials – Identification Systems

Color: Unless specified otherwise, conform with ANSI/ASME A13.1.

Snap On Plastic Pipe Markers: Manufacturer's standard preprinted, semi rigid snap on, color coded pipe markers, conforming to ASME A13.1

Plastic Duct Markers: Manufacturer's standard laminated plastic, color coded duct markers. Conform to following color code:

1. Yellow/Green: Supply air.
2. Blue: Exhaust, outside, return, and mixed air.

Plastic Equipment Markers: Laminated plastic, color coded equipment markers: Conform to following color code:

1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Yellow/Green: Combination cooling and heating equipment and components.

Nomenclature: Include following, matching terminology on schedules as closely as possible:

1. Name and plan ID number.
2. Equipment service.
3. Size: Approximately 2½ by 4 inches (65 by 100 mm) for control devices, dampers, and valves; and 4½ by 6 inches (115 by 150 mm) for equipment.

Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, letter, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.

B.2.2 Materials – Paint Systems

Acceptable Manufacturers

1. Tnemec.
2. Carbolene.
3. Or approved equal.

Painting Systems

Application on metal piping and pipe and equipment supports:

Non-submerged, normal conditions, indoors.

Generic Type: Polyamidoamine epoxy.

Finish Coat: Tnemec Series 69.

Interior: Two coats Series 69.

Exterior: One coat Series 69, one coat Series 74.

Primer Coat: Self priming.

Minimum Dry Mil Thickness: 5 to 8 mil.

Surface Preparation: Hand tool clean.

B.3 HVAC Ductwork Insulation

B.3.1 Manufacturers

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Glass Fiber:

1. Knauf Fiber Glass
2. Manville
3. Owens Corning Fiberglass Corporation

B.3.2 Materials

Type A: Flexible Glass Fiber: ASTM C553 Type 1; "k" value of 0.29 at 75°F; foil scrim kraft facing with 0.02 perm rating.

Type B: Board: ASTM C 612, Class 2, semi-rigid jacketed board "k" value of 0.23 @ 75°F; FSK facing with 0.02 perm rating.

Adhesives: Waterproof fire-retardant type produced under the UL classification and follow-up service.

Lagging Adhesive: Fire resistive to NFPA 255 or UL 723.

Impale Anchors: Galvanized steel, 12 gage, self-adhesive pad.

Joint Tape: Glass fiber cloth, FSK backing.

B.4 Refrigerant Piping and Specialties

B.4.1 Piping

Copper Tubing: ASTM B280, Type ACR hard drawn or annealed.

Fittings: ANSI/ASME B16.22 wrought copper.

Joints: ANSI/ASTM B32, solder Grade 95TA or ANSI/AWS A5.8 BCup silver braze.

Factory precharged linesets are acceptable.

B.4.2 Refrigerant

Refrigerant: R-410A.

B.4.3 Moisture and Liquid Indicators

Indicators: Single or Double port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; suitable for system working pressure and temperature.

B.4.4 Refrigerant Piping Insulation

Flexible, close-cell elastomeric pipe insulation conforming to ASTM C534 Grade 1, Type I: AP Armaflex with appropriate adhesive; Armaflex 520.

B.5 Ductwork

B.5.1 Materials

Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts, stainless steel where installed on stainless steel ducts.

General: Non-combustible or conforming to requirements for Class 1 air duct materials, or UL 181.

Steel Ducts: ASTM A525 or ASTM A527 galvanized steel sheet, lock-forming quality, having zinc coating of 1.25 oz per sq ft for each side in conformance with ASTM A90.

Flexible Ducts: Interlocking spiral of galvanized steel or aluminum construction or fabric supported by helically wound spring steel wire or flat steel bands; rated to 2 inches WG positive and 1.5 inches WG negative for low pressure ducts.

Fasteners: Rivets, bolts, or sheet metal screws. Use stainless steel fasteners on stainless steel ducts.

Sealant: Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.

Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

Hanger Rod: Steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

B.5.2 Sealant Materials

Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.

Joint and Seam Tape: 2 inches wide; glass-fiber-reinforced fabric.

Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.

Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.

Solvent-Based Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant formulated with a minimum of 75 percent solids.

Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

B.5.3 Hangers & Supports

Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.

Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
Hanger Materials: Galvanized sheet steel or threaded steel rod.

Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.

Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.

Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

B.5.4 Rectangular Duct Fabrication

Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.

Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.

Manufacturers:

1. Ductmate Industries, Inc.
2. Nexus Inc.
3. Ward Industries, Inc.

Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.

Manufacturers:

1. Ductmate Industries, Inc.
2. Lockformer.

B.5.5 Round Duct and Fitting Fabrication

Diameter as applied to flat-oval ducts in this Article is the diameter of a round duct with a circumference equal to the perimeter of a given size of flat-oval duct.

Round, Spiral Lock -Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

Duct Joints: Ducts up to 48 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.

90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.

Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

Fabricate elbows using die-formed, gored, pleated, or mitered construction. Unless elbow construction type is indicated, fabricate elbows as follows:

1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg:
3. Ducts 3 to 36 Inches in Diameter: 0.034 inch.

4. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.
5. Round Elbows 8 Inches and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
6. Round Elbows 9 through 14 Inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
7. Round Elbows Larger Than 14 Inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
8. Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040-inch thick with 2-piece welded construction.
9. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.

B.5.6 Ductwork General

Construct Ts, bends, and elbows with radius of not less than 1-½ times width of duct on centerline. Where not possible and where rectangular elbows are used, provide turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

Elbows and transformation pieces, etc., shall be one to two gauges heavier, depending on size. Ratio of width individual air passages to total width of elbow shall be one (1) to five (5).

Longitudinal joints in horizontal runs or in risers shall be made with grooved seams. In elbows and transformation pieces, they shall be made with Pittsburgh corner seams or double corner seams.

Bracing shall be galvanized steel or stainless-steel angles as applicable and conform to SMACMA recommendations and standards.

All ductwork shall be constructed in accordance with SMACNA and ASHRAE Specifications Standards and in accordance with state and local code requirements. Ductwork to be sealed in accordance with SMACNA seal Class B.

Provide fire resistant neoprene or other approved flexible connections on the entering and leaving side of all air handling units, etc., and at the collection boxes of all roof fans, etc., or as shown on plans, equal to Ventfabric "Ventglas". Attach with metal collar frames to prevent air leakage.

Provide flexible connection for ducts of dissimilar metals to prevent galvanic action.

Use double nuts and lock washers on threaded rod supports.

B.6 Ductwork Accessories

B.6.1 Sheet Metal Materials

Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.

Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G60 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

B.6.2 Flexible Connectors

Manufacturers:

1. Ductmate Industries, Inc.
2. Duro Dyne Corp.

3. Ventfabrics, Inc.

General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Select metal compatible with ducts.

Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

Minimum Weight: 26 oz./sq. yd.

Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.

Service Temperature: Minus 40 to plus 200 deg F.

B.6.3 Duct Accessory Hardware

Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct insulation thickness.

Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

B.7 Ceiling Exhaust Fans

Centrifugal Fan Unit: Direct driven, with steel housing, resilient mounted motor, gravity backdraft damper in discharge.

Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor.

Grille: As required, molded aluminum with baked white enamel finish.

Accessories: Provide with Wall Cap and backdraft damper.

Provide cabinet and ceiling exhaust fans with capacities and accessories as indicated and scheduled on drawings.

Acceptable manufacturers to be: Greenheck, Cook or Penn.

B.8 Forced Air Furnaces and Evaporator Coils

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carrier
2. Trane

B.8.1 Manufactured Units

Configuration: Upflow, type as shown on drawings with gas burner and direct expansion refrigeration. Single or two-stage as scheduled on drawings.

Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heat exchanger, burner or heater, controls, air filter, refrigerant cooling coil and outdoor package containing compressor, condenser coil and condenser fan

Refrigerant: Puron (R-410A).

Construction and Ratings: In accordance with ARI 210/240. Testing: ASHRAE 14.

Performance Ratings: Energy Efficiency Rating (EER) not less than requirements of ANSI/ASHRAE 90A; seasonal efficiency to ANSI/ASHRAE 103. Provide units with meet or exceed the requirement of those scheduled on the drawings.

Heating Capacity and Staging: As scheduled on plans.

Air Handling: As scheduled on plans.

Cooling Capacity and Staging: As scheduled on plans.

B.8.2 Fabrication

Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors, glass fiber insulation and reflective liner.

Heat Exchanger:

Primary: 3-pass 20-gauge corrosion resistant aluminized steel of fold and crimp sectional design which operates under negative pressure

Secondary: Flow-through design having an interior laminate coating of polypropylene for corrosion resistance with fold and crip design which operates under negative pressure

Power vent fan, single or 2 speed as applicable.

Supply Fan: Centrifugal type rubber mounted with direct drive.

Motor: ANSI/NEMA MG 1; 1750 rpm rubber isolated hinge mounted, 4 speed.

Air Filters: Two-inch thick glass fiber – Merv 8, disposable type arranged for easy replacement.

B.8.3 Burner

Gas Burner- Sealed combustion type with power vent fan, slow-opening dual rate gas valve, electric switch gas shut-off; flame proving sensor, hot surface igniter, pressure switch assembly; flame rollout switch, drain tubing and condensate trap, blower and inducer assembly, 40va transformer for thermostat power. Suitable for use with LP gas.

Burner Operating Controls:

High Limit Control: Fixed stop at maximum permissible setting, de energizes burner on excessive bonnet temperature and re-energizes when temperature drops to lower safe value.

Control Supply Fan: Bonnet temperatures and independent of burner controls, manual switch for continuous fan operation.

Single or two stage control as Scheduled

B.8.4 Evaporator Coil

Coil and Coil Casing: Copper tube aluminum fin assembly, galvanized drain pan, drain connection, refrigerant piping connections and factory installed thermostatic expansion valve, fully insulated cabinet.

B.8.5 Electronic Programmable Room Heating/Cooling Thermostat

Field-installed programmable, manual staged auto-changeover electronic digital thermostat. The thermostat shall offer three heating and two cooling stages with temperature control. An OFF-HEAT Auto-Cool Emerg system switch, OFF-AUTO fan switch and indicating LED's shall be provided along with 7-day programming.

The thermostat must also be programmable for Occupied/Unoccupied status. During Occupied, the supply fan shall remain on and the unit to cycle heating cooling as required to maintain space setpoint. During Unoccupied cycle, the supply fan is to cycle on with heating/cooling operation in order to maintain setback temperature.

Thermostat is also to provide auxiliary contact to engage auxiliary fans (heat recovery) whenever the thermostat is in Occupied mode. During unoccupied mode, the auxiliary fan signal should be off.

Provide Honeywell T7351 Programmable thermostat or equivalent.

B.9 Air Cooled Condensing Units

B.9.1 Manufacturers

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Carrier Corporation; Carrier Air Conditioning Div.

Trane Co. (The); Worldwide Applied Systems Group.

B.9.2 General - Split System Cooling

Fully charged from the factory for matched indoor section and up to 15 feet of piping. Unit designed to operate at outdoor ambient temperatures as high as 115ºF.

A.R.I certified.

UL listed.

Exterior must be designed for outdoor application.

Description: Factory assembled and tested; consisting of casing, conden-ser coils, condenser fans and motors, and unit controls.

Refrigerant: R-410A

B.9.3 Split System Cooling Unit Casing

Unit casing constructed of heavy gauge, galvanized steel and painted with a weather-resistant powder paint.

Corrosion and weatherproof CMBP-G30 Duratuff base.

B.9.4 Split System Cooling Compressor

Compressor to have internal over temperature and pressure protector, total dipped hermetic motor and thermostatically controlled sump heater.

Also include roto-lock suction and discharge refrigeration connections, centrifugal oil pump, and low vibration and noise.

Compressor to have a 5-year limited warranty.

B.9.5 Split System Cooling Condenser Coil & Fans

The Fin coil is continuously wrapped, corrosion resistant, all copper tubes & aluminum fins with minimum brazed joints. The coil is 3/8" O.D. seam-less copper or aluminum glued to a continuous fin.

Condensing Fans and Drives: Propeller fans with aluminum or galvanized-steel fan blades, for vertical air discharge; directly driven with permanently lubricated ball-bearing motors with integral current- and thermal-overload protection.

Coils are lab tested to withstand 2,000 pounds of pressure per square inch. Coil to be protected on all four sides by louvered panels.

Coil to have a 1-year warranty.

B.9.6 Split System Cooling Refrigerant Controls

Operating and Safety Controls: Include condenser fan motor thermal and overload cutouts; 115-V control transformer, if required; magnetic contactors for condenser fan motors and a non-fused factory-mounted and -wired disconnect switch for single external electrical power connection.

High- and low-pressure protection to be inherent to the compressor.

Provide a factory installed liquid line drier.

B.9.7 Cooling Low Ambient & Frost Control

Provide unit with cooling capability to 55 deg. F, plus the addition of an evaporator defrost control to permit operation to 40 deg. F.

B.10 Natural Gas Systems

B.10.1 Materials and Products

General: Provide piping materials and factory fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with NFPA 54 where applicable, base pressure rating on natural gas piping system maximum design pressures. Provide sizes and types matching piping and equipment connections; provide fittings of materials that match pipe materials used in natural gas systems.

B.10.2 Basic Pipes and Pipe Fittings

Building Distribution Piping: Pipe Size 2 inches and Smaller:

Black steel pipe; Schedule 40, malleable iron threaded fittings.

304 Stainless Steel Pipe; Schedule 40S, stainless steel threaded fittings.

Pipe Size 2½ inches and Larger: Black steel pipe: Schedule 40; wrought steel butt-welding fittings.

Gas Piping (Underground) – Underground piping from utility main to the Gas Meter shall be by the local gas utility. Piping from the meter into the Structure shall be considered building distribution piping.

B.10.3 Special Valves

General: Special valves required for natural gas systems include the following types:

Gas Cocks:

Gas Cocks 2 inches and Smaller: 150 psi non-shock WOG, bronze straightway cock, flat or square head, threaded ends.

Gas Cocks 2½ inches and Larger: 125 psi non-shock WOG, iron body bronze mounted, straightway cock, square head, flanged ends.

Pressure Regulators: Step down pressure regulator, lock-up type staging type, reduction & capacity as required.

Manufacturer: Subject to compliance with requirements, provide gas cocks of one of the following:

NIBCO, Inc.

DeZurik Corporation

Jenkins Bros.

Lunkenheimer Company

Rockwell International, Flow Control Division

Stockham Valves and Fittings

Walworth Company

C Construction

C.1 Piping Systems – Common Requirements

Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

Install piping free of sags and bends.

Install piping to allow application of insulation.

Select system components with pressure rating equal to or greater than system operating pressure.

Sleeves are required for core-drilled holes.

Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

Cut sleeves to length for mounting flush with both surfaces.

Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

Install sleeves in new walls and slabs as new walls and slabs are constructed.

Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

Steel Pipe Sleeves: For pipes smaller than NPS 6.

Verify final equipment locations for roughing-in.

C.1.1 Piping Joint Construction

Join pipe and fittings according to the following requirements.

Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

C.1.2 Equipment Installation – Common Requirements.

Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

Install equipment to allow right of way for piping installed at required slope.

C.1.3 Painting

Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

C.2 Identification & Painting - General

Where more than one type of mechanical identification is specified for listed application, selection is installer's option, but provide single selection for each product category.

Degrease and clean surfaces to receive adhesive for identification materials.

C.2.1 HVAC Systems - Labeling and Identifying

Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

Plastic markers: Install on pipe insulation segment where required for hot non-insulated pipes.

Locate pipe markers wherever piping is exposed in finished spaces, equipment rooms, accessible maintenance spaces (shafts, tunnels, plenums), and exposed exterior locations as follows:

1. Near each valve and control device.
2. Near each branch, excluding short take offs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.
3. Near locations where pipes pass through walls, floors, ceilings, or enter inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at a maximum of 50-foot (15 m) intervals along each run. Reduce intervals to 25 feet (7.5 m) in congested areas of piping and equipment.
7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

Equipment: Install engraved plastic laminate sign or equipment marker on or near each major item of mechanical equipment. Do not label equipment such as cabinet heaters and ceiling fans in occupied spaces.

Lettering Size: Minimum ¼ inch (6 mm) high lettering for name of unit where viewing distance is less than 2 feet (0.6 m), ½ inch (13 mm) high for distances up to 6 feet (1.8 m), and proportionately larger lettering for greater distances. Provide secondary lettering 1/2 to ¾ of size of principal lettering.

Text of Signs: Provide text to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to name of identified unit.
Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with duct markers; or provide stenciled signs and arrows, showing duct system service and direction of flow.

Location: In each space where ducts are exposed or concealed by removable ceiling system, locate signs near points where ducts enter into space and at maximum intervals of 50 feet (15 m).
Adjusting: Relocate identifying devices, which become visually blocked by work of this Division or other Divisions.

C.2.2 Painting

Color Coding and Labeling of Piping and Equipment - The following color code shall be applied for all new piping installed as part of this project exposed to view:

1. Natural gas piping (interior) – yellow; (exterior) - grey
2. Exposed HVAC mechanical equipment hangers and supports: grey.

Protection of Finished Work and Equipment:

1. Protect with tarpaulin or drop cloth all floors, walls, glass, finished painted work, and equipment from paint spatter or other damage that might result from this Work.
2. Promptly remove all oil, paint, and solvent waste rags from the site and legally dispose of them. Do not burn waste materials.
3. Paint, varnish, and mixing cans shall not be placed on bare floors.
4. Dirty, oily, and dusty cover shall not be used.
5. No stains or spots shall remain after completion of painting. Remove hardware accessories, light fixtures, and similar items before painting.
6. Replace above items after finish coat is applied.
7. Masking may be utilized in lieu of removal of items.

Application:

1. Application may be by brushing or rolling. Method used shall be one as approved by material manufacturer for any one particular product.
2. Brushing: Brush in one direction then smooth at right angles to original brushing to produce a uniform thickness of coating.
3. Thickness of Coating: Where number of coats is indicated, it is intended to show the normal practice to obtain the proper dry mil thickness.
4. The dry mil film thickness must be provided in all cases even though it may require additional coatings to that specified. Contractor must provide adequate ventilation at all times.

Ventilation shall be adequate to remove fumes, preventing injury to workmen, or possibility of accumulating volatile gases.

C.3 HVAC Ductwork Insulation

C.3.1 Preparation

Surface Preparation

Clean, dry, and remove foreign materials such as rust, scale, and dirt.

Mix insulating cements with clean potable water. Mix insulating cements contacting stainless steel surfaces with demineralized water.

C.3.2 Installation

Refer to schedules at the end of this section for materials, forms, jackets, and thicknesses required for each ductwork system.

Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation or jacket in either the wet or dry state.

Install vapor barriers on insulated ducts having surface operating temperatures below 60°F.

Install insulation, accessories and finishes in accordance with the latest edition of MCIA National Commercial and Industrial Insulation Standards and manufacturer's installation instructions. Exceptions to these standards will be accepted where specifically modified in these specifications or where prior written approval has been obtained from the Engineer.

Install insulation with smooth, straight, and even surfaces.

Seal joints and seams to maintain vapor barrier on insulation requiring a vapor barrier.

Seal penetrations for hangers, supports, anchors, and other projections in insulation requiring a vapor barrier.

Seal Ends

Except for flexible elastomeric insulation, taper ends at 45 deg angle and seal with lagging adhesive. Cut ends of flexible elastomeric cellular insulation square and seal with adhesive.

Apply adhesives and coatings at manufacturer's recommended coverage per gallon rate.

Keep insulation materials dry during application and finishing.

Items Not Insulated: Unless otherwise indicated do not apply insulation to the following systems, materials, and equipment:

Factory insulated flexible ducts.

Flexible connectors.

Testing laboratory labels and stamps.

Access panels and doors in air distribution systems.

Install block and board insulation as follows:

Speed Washers Attachment: Secure insulation tight and smooth with speed washers and welded pins. Space anchor pins 18 inches apart each way and 3 inches from insulation joints. Apply vapor barrier tape to seal insulation in contact, open joints, breaks, punctures, and voids in insulation.

Blanket Insulation: Install tight and smooth. Secure to ducts having long sides or diameters as follows:

1. Smaller than 24 Inches: Bonding adhesive applied in 6-inch wide transverse strips on 12-inch centers.
2. Overlap joints 3 inches.
3. Seal joints, breaks, and punctures with vapor barrier tape.
4. At test plugs, provide removable insulation plugs.
5. Insulate around damper operators so as to maintain full operating range of operator.

C.3.3 Ductwork Insulation Schedule

First 6’ of exhaust duct and outside air duct from building envelop Penetration.

1. Material: Glass fiber board round or rectangular as required.
2. Thickness 1/1/2”
3. Jacket: Provide with factory FSK jacket.

Supply air duct concealed above Toilet Room Ceiling:

4. Material: Glass fiber board round or rectangular as required.
5. Thickness: 1/1/2”
6. Jacket: Provide with factory FSK jacket.

C.4 Refrigeration Piping & Specialties Installation

C.4.1 Preparation

Ream pipe and tube ends. Remove burrs.

Remove scale and dirt on inside and outside before assembly.

Prepare piping connections to equipment with flanges or unions.

C.4.2 Installation

Install refrigeration specialties in accordance with manufacturer's instructions.

Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

Install piping to conserve building space and not interfere with use of space.

Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

Provide non-conducting dielectric connections when joining dissimilar metals.

Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

Provide clearance for installation of insulation and access fittings.

Provide access to concealed fittings.

Where pipe support members are welded to structural building frame, brush clean and apply one coat of zinc rich primer to welding.

Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting.

Insulate piping per insulation manufacturers recommendations. All insulation exposed to sunlight or installed outdoors shall be protected with two coats of WB Armaflex Finish or weather resistant coating.

Fully charge completed system with refrigerant after testing.

Provide refrigerant charging valve connections in liquid line between receiver shut off valve and expansion valve.

C.4.3 Field Quality Control

Test refrigeration system in accordance with ANSI/ASME B31.5.

Pressure test system with dry nitrogen to 200 psig. Perform final tests at 27 inches vacuum and 200 psig using halide torch electronic leak detector. Test to no leakage.

C.5 Ductwork Installation

Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

Suspended horizontal ductwork shall be securely and rigidly anchored and supported from the building structure by means of rod-angle iron or strap iron hangers. Rod hangers shall be threaded at both ends and equipped with nuts and washers. Angle and strap hangers shall be attached to ducts by means of welds or sheet metal screws or by rivets. They shall be attached to suitable roof or ceiling structures through formed angles, by anchor screws and heavy, wide washers. If attached to floor slab, the bearing quality of slab material shall be checked and found capable of supporting weight of duct.

Vertical dust risers shall be rigidly supported as they pass through floors, ceilings or roofs by angle iron spanning the opening and firmly and securely attached to the building walls or columns. All ductwork shall be so installed as to be free from vibration under all normal operating conditions. Where required, suitable sound attenuators shall be incorporated with the anchors and/or supports. Finish openings in floors, walls and ceilings with 22-gauge sheet metal closures to give a neat appearance.

Where ducts pass through walls or floors, provide a suitable sheet metal angle around the periphery of the duct. Where ducts pass through exterior building construction, provide a suitable flashing and counterflashing to make a weathertight installation.

Where external insulated ducts pass through walls, floors or ceilings, suitable size openings shall be made to allow for the insulation through the opening. The insulation shall not be stopped on each side of the opening.

Connect diffusers to low pressure ducts with 5 feet maximum length of flexible duct. Hold in place with strap or clamp.

C.5.1 Field Quality Control

Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual". Provide evidence of compliance upon request.

Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.

Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.

Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round and flat-oval ducts, Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to 2-inch wg (both positive and negative pressures), and Leakage Class 6 for pressure classes from 2- to 10-inch wg.

Remake leaking joints and retest until leakage is equal to or less than maximum allowable.

C.5.2 Adjusting and Cleaning

Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment, which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.

C.6 Application and Installation of Ductwork Accessories

Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts

Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized ducts

Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.

Install duct test holes where indicated and required for testing and balancing purposes.

C.6.1 Adjusting

Adjust duct accessories for proper settings.

Final positioning of manual-volume dampers is specified in “Testing, Adjusting, and Balancing” work description.

C.7 Ceiling Exhaust Fan Installation

Install in accordance with manufacturer's instructions.

Coordinate all wall openings required with general contractor.

Support fan and fan housings utilizing neoprene isolators at all hanging points. Coordinate supports and support anchoring placement with general contractor.

Coordinate electrical requirements. Final electrical connections shall conform to Project Electrical requirements. Properly ground equipment. Coordinate the mounting and power wiring of fans with manufacturer’s recommendations.

C.8 Forced Air Furnace and Evaporator Coil Unit installation

C.8.1 General

Coordinate furnace, cased cooling coil with air cooled condensing unit. All equipment shall be matched to work together and be of the same manufacturer.

Verify pressure of natural gas to furnace. Install stepdown regulator if required.

C.8.2 Examination

Verify that floors are ready for installation of units and openings are as indicated on shop drawings.

Verify that proper power supply is available for furnace and condenser package.

Verify that proper fuel supply is available for connection.

C.8.4 Installation

Install in accordance with manufacturer's instructions.

Install venting and combustion air per the furnace manufacturer’s instructions. Utilize listed Polypropylene piping material for furnace vent.

Install refrigerant lines from indoor equipment to outdoor condensing units. Insulate as required and recommended by manufacturer. Refrigerant lines are to be insulated.

Install condensate drain lines from Furnace and DX Coil to Condensate Pump. as shown on plans. Pipe condensate utilizing Schedule 40 PVC drain piping.

Install interconnecting control wiring between thermostat, furnace and air-cooled condensing unit.

Install to NFPA 90A and ANSI/NFPA 90B.

Install gas fired furnaces to ANSI Z223.1 (NFPA 54).

Provide vent connections to ANSI/NFPA 211.

C.9 Air-Cooled Condensing Unit installation

C.9.1 Examination

Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of air-cooled condensers.

Examine roughing-in for refrigerant piping systems to verify actual locations of piping connections before equipment installation.

Proceed with installation only after unsatisfactory conditions have been corrected.

C.9.2 Installation

Install unit(s) level and plumb, firmly anchored in locations indicated; maintain manufacturer's recommended clearances.

Install air-cooled condensers on concrete base.

Maintain manufacturer's recommended clearances for service and maintenance.

Loose Components: Install electrical components, devices, and accessories that are not factory mounted.

C.9.3 Connections

Piping installation requirements are specified herein. Drawings indicate general arrangement of piping, fittings, and specialties.

Install piping adjacent to machine to allow service and maintenance.

Refrigerant Piping: Connect piping to unit with pressure relief, service valve, filter-dryer, and moisture indicator on each refrigerant-circuit liquid line.

Ground equipment according to electrical requirements of this project.

Connect wiring according to electrical requirements of this project.

C.9.4 Field Quality Control

Perform the following field tests and inspections and prepare test reports:

Perform electrical test and visual and mechanical inspection.

Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Complete manufacturer's starting checklist.

Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

Verify proper airflow over coils.

Remove and replace malfunctioning air-cooled condensers and retest as specified above.

C.9.5 Startup Service

Complete installation and startup checks according to manufacturer's written instructions and perform the following:

Inspect for physical damage to unit casing.

Verify that access doors move freely and are weathertight.

Clean units and inspect for construction debris.

Verify that all bolts and screws are tight.

Verify that controls are connected and operational.

Lubricate bearings on fans.

Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.

Start unit according to manufacturer's written instructions and complete manufacturer's startup checklist.

Verify proper operation of capacity control device.

After startup and performance test, lubricate bearings.

C.10 Natural Gas System Installation

C.10.1 Summary

Extent of work is limited to piping and accessories as required to extend natural gas line from meter to gas fired equipment as indicated on drawings and schedules as required by this section.

Contractor to verify gas pressure available with local natural gas utility and to provide piping system including gas pressure step down regulators as may be needed.

C10.2 Installation of Natural Gas Piping

Use sealants on metal gas piping threads that are chemically resistant to natural gas. Use sealants sparingly and apply to only male threads of metal joints.

Remove cutting and threading burrs before assembling piping.

Do not install defective piping or fittings. Do not use pipe with threads that are chipped, stripped or damage

Plug each gas outlet, including valves, with threaded plug or cap immediately after installation and retain until continuing piping, or equipment connections are completed.

Install drip legs in gas piping where indicated, and where required by code or regulation.

Install "tee" fittings with bottom outlet plugged or capped, at bottom of pipe risers.

Install piping with 1/64 inch per foot downward slope in direction of flow.

Install piping parallel to other piping, but maintain minimum of 12-inch clearance between gas piping and steam or hydronic piping above 200 deg F.

Install gas pressure regulator at equipment. Size for pressure leaving meter, required pressure at equipment and required flow. Vent per code to atmosphere. NOTE: Coordinate gas pressures provided and placement of step-down regulators where they may be required.

All pipe supports to be spaced a maximum of 5 feet.

C.10.3 Natural Gas Service

General: Coordinate with local gas utility company the connection of new loads to the existing natural gas service.

Coordinate available gas pressure and gas load the new service.

Coordinate with the utility the location of the new gas service.

Consult with utility as to extent of its work, costs, and fees associated with any service

size increases or modifications. Pay such costs and fees.

Verify pressure leaving the meter. Gas piping distribution system was sized based on the indicated pressure leaving the meter or at the building structure as shown on the plans. If needed modify the gas pipe size based on actual pressures being provided.

Provide step down gas regulators as required at each structure and as may be needed at each natural gas burning device/equipment.

C.10.4 Installation of Natural Gas Piping Specialties

Do not conceal any gas piping or specialties.

C.10.5 Installation of Valves

Gas Cocks: Provide at connection to gas train for each gas fired equipment item and on risers and branches where indicated.

Locate gas cocks where easily accessible, and where they will be protected from possible injury.

C.10.6 Equipment Connections

General: Connect gas piping to each gas fired equipment item with drip leg and shutoff gas cock.

Comply with equipment manufacturer's instructions.

Install any required step-down pressure regulators that may be required based on gas pressures supplied from gas meter to gas pressure requirements of equipment. Pipe any regulator vents to outside of building away from any O.A. intakes.

C.10.7 Field Quality Control

Piping Tests: Inspect, test, and purge natural gas systems in accordance with NFPA 54.

C.10.8 Adjusting, Cleaning & Painting

Cleaning and Inspecting: Clean and inspect natural gas systems. Paint gas piping per this SPV, paragraph C.2.2.

C.11 HVAC Testing & Balancing

This Section includes TAB to produce design objectives for the following:

1. Furnace & supply air & return air duct distribution system
2. Exhaust fans
3. HVAC equipment quantitative-performance settings.
4. Test & Verify that automatic control devices function properly and that interlocks work.

Reporting results of activities and procedures specified in this Section.

C.11.1 TAB Submittals

Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

D Measurement

The department will measure HVAC Work, completed in accordance to the contract and accepted, as a single completed unit of work.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.03	HVAC Work	LS

s. **Operator House Miscellaneous, Item SPV.0105.04.**

A Description

Furnish all labor, material and tools required for the satisfactory construction completion of the Racine Street bridge operator house in accordance with the plans and as described in these specifications.

This work includes but is not limited to the following:

1. Concrete Masonry Units
2. Metal Stair Nosing
3. Rough Carpentry
4. Shop-Fabricated Wood Trusses
5. Thermal Insulation
6. Fluid Applied Air Barrier
7. Standing Seam Metal Roof Panels

8. Joint Sealants
9. Aluminum Storefront
10. Aluminum Windows
11. Steel Doors and Frames
12. Door Hardware
13. Glazing
14. Non-Structural Metal Framing
15. Gypsum Board
16. Ceramic Tile
17. Acoustical Panel Ceiling
18. Resilient Base
19. Epoxy Flooring
20. Painting
21. Toilet Accessories
22. Fire Extinguishers
23. Roller Shades
24. Furniture

Related Articles:

"Cast-In-Place Concrete" for bridge operator house superstructure specified in Standard Specification Section 501 Concrete and Section 502 Concrete Bridges.

"Structural Steel" for bridge operator house steel framing specified in Special Provision Section: Structural Steel Operator House.

"Metal Fabrications" for galvanized steel lintels for brick and stone support specified in Special Provision Section: Operator House Masonry

"Brick Masonry Veneer" for bridge operator house façade facing specified in Special Provision Section: Operator House Masonry.

"Cast Stone Masonry Veneer" for bridge operator house façade facing specified in Special Provision Section: Operator House Masonry.

"Painted Pipe and Tube Railings" for all bridge operator house handrails and guard rails specified in Special Provision Section: Steel Stairs, Platforms and Railings.

B Materials

B.0 General

Provide all products and workmanship of the highest commercial or industrial quality available. Lesser quality products, such as "economy" grade, will not be acceptable. The engineer will reject any product or work that is inferior in his judgment.

Interpret specific reference in these specifications to any article, device, product, material, fixture, form or type of construction, etc., by name, make or catalog number as establishing a standard of quality. Do not construe specific references as limiting competition. Use any article, device, product or material, fixtures, form, or type of construction, which in the judgment of the engineer is equal to that named in the special provisions or shown on the plans.

B.1 CONCRETE MASONRY UNITS

Provide concrete unit masonry as shown and as specified.

Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

B.1.1 Submittals

Product Data: For each type of product indicated.

Mix Designs: For mortar and grout. Include description of type and proportions of ingredients.

B.1.2 Project Conditions

Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

B.1.3 Materials

Concrete Masonry Units (CMUs): ASTM C 90.

Density Classification: Normal weight.

Masonry Lintels: Built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured.

Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction.

Hydrated Lime: ASTM C 207, Type S.

Aggregate for Mortar: ASTM C 144.

Aggregate for Grout: ASTM C 404.

Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 deformed bars.

Masonry Joint Reinforcement: ASTM A 951/A 951M, hot-dip galvanized, carbon steel, either ladder or truss type with single pair of side rods.

Wire Size: 0.148-inch diameter.

Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.

Ties and Anchors Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.

Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.

Anchors for Connecting to Concrete: Corrugated Metal Ties consisting of metal strips not less than 1-1/4 inch wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from 0.075 inch thick, steel sheet, galvanized after fabrication with 1-1/2 inch 90 degree bend with 9/32 inch diameter hole for fastening to concrete and sized to extend to within 4 inches into masonry.

Partition Top Anchors: 0.105 inch thick metal plate with 3/8 inch diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

Compressible Filler: Pre-molded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; formulated from neoprene or urethane.

B.1.4 Mortar and Grout Mixes

Mortar: Comply with ASTM C 270, Type N, Proportion Specification.

Grout: Comply with ASTM C 476.

B.2 Metal Stair Nosing

B.2.1 Nosings for Concrete Stairs

Furnish and install abrasive cast iron nosings at all concrete stair treads within the operator house, bascule abutment, and bascule pier. Provide nosings having a surface of silicon carbide abrasive, a minimum of 2-1/4 ounces per square foot to a minimum depth of 1/32 of an inch, and a cross-hatched pattern. Provide all nosings 5/16" thick, 3" wide, and full width of stair.

Provide all castings of uniform quality, free from blow holes, shrinkage defects, swells, cracks, or other defects. Nosings must be true to pattern. Casting material shall be of high quality iron. Castings must be free of fins, burrs and slag. Provide castings with one coat of black paint.

B.3 Rough Carpentry

Provide rough carpentry work as shown and as specified. Rough carpentry includes:

Roof framing with dimension lumber and plywood.

Wood blocking

B.3.1 General

Wood products shall be factory-marked to identify type, grade, inspection agency, producing mill and other qualities as specified.

Obtain measurements and verify dimensions shown before proceeding with carpentry work.

Keep carpentry materials dry during delivery. Store lumber and plywood in stacks with provisions for air circulation within stacks. Protect bottom of stacks against contact with damp or wet surfaces. Protect exposed materials against weather. Do not store dressed or treated lumber or plywood outdoors.

B.3.2 Lumber

Lumber shall comply with U.S. Product Standard PS-20 for American Softwood Lumber, U.S. Dept of Commerce, and with rules of applicable manufacturer's association or authorized inspection bureau under which each species of lumber is produced.

Nominal sizes shown and specified refer to undressed lumber dimensions. Dress lumber four sides (S4S), unless otherwise shown or specified, and work to shapes and patterns shown. Detailed dimensions show actual sizes required.

Framing and miscellaneous lumber: Construction or No. 2 grade.

Species:

Hem-fir (north); NLGA.

Southern pine; SPIB.

Douglas fir-larch; WCLIB or WWPA.

Maintain 19% maximum moisture content for all pieces of construction lumber. Mark Lumber "DRY."

B.3.3 Plywood

Plywood shall comply with U.S. Product Standard PS-1 for Construction and Industrial Plywood, U.S. Dept. of Commerce, except as otherwise specified.

Plywood shall be exterior-type plywood, APA Grade CDX, in thickness indicated.

B.3.4 Fasteners

Provide fasteners, anchors, etc., for proper assembly and erection. Fasteners shall be of size to rigidly secure members in place.

B.3.5 Metal Framing Anchors

Products: Subject to compliance with requirements, provide either the basis-of-design products indicated on drawings or comparable products by one of the following:

Alpine Engineered Products, Inc.

Cleveland Steel Specialty Co.

Harlen Metal Products, Inc.

KC Metals Products, Inc.

Simpson Strong-Tie Co., Inc.

Southeastern Metals Manufacturing Co., Inc.

USP Structural Connectors.

Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of basis-of-design products. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

B.4 Shop-Fabricated Wood Trusses

B.4.1 Reference Standards

TPI 1 – National Design Standard for Metal-Plate-Connected Wood Truss Construction; 2014.

TPI BCSI 1 – Building Component Safety Information Booklet: The Guide to Good Practice for Handling, Installing & Bracing of Metal Plate Connected Wood Trusses; 2015.

TPI DSB-89 – Recommended Design Specification for Temporary Bracing of Metal Plate connected wood trusses; 1989.

B.4.2 Submittals:

Product Data: Manufacturer's data sheets on plate connectors, bearing plates, and metal bracing components.

Shop Drawings: Show truss configurations, sizes, spacing, size and type of plate connectors, cambers, framed openings, bearing and anchor details, and bridging and bracing.

Include identification of engineering software used for design.

Provide shop drawings stamped or sealed by design engineer.

B.4.3 Quality Assurance

Designer Qualifications: Perform design by or under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Wisconsin.

Fabricator Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of metal plated connected wood truss fabrication experience.

B4.4 Delivery Storage and Handling

Handle and erect trusses in accordance with TPI BCSI 1.

Store trusses in vertical position resting on bearing ends.

B4.5 Trusses

Wood Trusses: Designed and fabricated in accordance with TPI 1 and TPI DSB-89 to achieve structural requirements indicated.

Structural Design: Comply with applicable code for structural loading criteria.

Roof Deflection: 1/240, maximum.

B4.6 Materials

Lumber: Moisture Content: Between 7 and 9 percent.

Steel Connectors: Hot-dipped galvanized steel sheet, ASTM A653/A653M Structural Steel (SS) Grade 33/230, with G90/Z275 coating; die stamped with integral teeth.

Truss Bridging: Type, size and spacing recommended by truss manufacturer.

B.4.7 Accessories

Wood Blocking, Bridging, Plates, and Miscellaneous Framing: Softwood lumber, any species, construction grade, 19 percent maximum and 7 percent minimum moisture content.

Fasteners: Electrogalvanized steel, type to suit application.

Bearing Plates: Electrogalvanized steel.

B.5 Thermal Insulation

Provide either glass fiber blanket insulation or loose-fill insulation in framing of bridge operator house roof as shown and as specified.

Rigid and semi-rigid board insulation at cavity wall construction and perimeter foundation wall.

B.5.1 Submittals

Manufacturer’s product data for each type of product indicated.

B.5.2 Materials

Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

Glass-Fiber Loose-Fill Insulation: ASTM C 764, Type I for pneumatic application or Type II for poured application; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.

Extruded Polystyrene Insulation for furred interior walls: ASTM C578, Types IV and VI; cellular type, conforming to the following:

Board Density: 1.6 lb/cu ft minimum.

Board Size: 96 x 16 minimum.

Board Thickness: 2 inches, unless otherwise indicated on Drawings.

Thermal Resistance: R of 5.0 per inch.

Water Absorption: In accordance with ASTM D2842 0.3 percent by volume maximum.

Compressive Strength: Below grade and foundation applications: Type VI; Minimum 40 psi.

Board Edges: Square edges.

Flame/Smoke Properties: In accordance with ASTM E84, labeled by agency acceptable to authorities having jurisdictions.

Flame Spread: 5.

Smoke Developed: 165.

Polyisocyanurate (ISO) Board Insulation for Masonry Cavity Wall: Rigid cellular foam, complying with ASTM C1289. Type II:

Class 1 - Faced with glass fiber reinforced cellulosic felt facers on both major surfaces of core foam.

Compressive Strength: Classes 1-2-3, Grade 1 - 16 psi (110 kPa), minimum.

Thermal Resistance, R-value: At 1-1/2 inch thick; Class 1, Grades 1-2-3 - 8.4 (1.48) at 75 degrees F

Eave Baffles: Flame-retardant PVC panels fastened to the wall top plate and underside of roof deck at eaves to prevent attic insulation from blocking air circulation channels between eave soffits and attic vents. Install between each truss/rafter.

Polyethylene Vapor Retarders: ASTM D 4397, 10 mils thick, with maximum permeance rating of 0.13 perm.

Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

Adhesive: Gun grade, mastic type, compatible with insulation and substrate, and as recommended by manufacturer.

B.6 Fluid Applied Air Barrier

B.6.1 Submittals

Submit Product Data: For each type of product. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.

Submit Shop Drawings: For air-barrier assemblies. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction. Include details of interfaces with other materials that form part of air barrier.

B.6.2 Quality Assurance

Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

B.6.3 Field Conditions

Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.

Protect substrates from environmental conditions that affect air-barrier performance.

Do not apply air barrier to a damp or wet substrate or during snow, sleet, hail, rain, fog, or mist.

B.6.4 Performance Requirements

General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 283, ASTM E 783 or ASTM E 2357.

B.6.5 Materials

Fluid-Applied, Synthetic Polymer, Vapor-Retarding Membrane Air Barrier.

Products: Subject to compliance with requirements, provide one of the following:

Grace Construction Products; W.R. Grace & Co. - Conn.; Perm-A-Barrier Liquid.

Henry Company; Air-Bloc 32.

Rubber Polymer Corporation, Inc.; Rub-R-Wall Airtight.

Physical and Performance Properties:

Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.

Vapor Permeance: Maximum 0.1 perm; ASTM E 96/E 96M.

Ultimate Elongation: Minimum 500 percent; ASTM D 412, Die C.

B.6.6 Accessory Materials

Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier material:

Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.

Butyl Strip: Vapor retarding, 30 to 40 mils thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive with release liner backing.

Joint Reinforcing Strip: Air-barrier manufacturer's glass-fiber-mesh tape.

Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

Adhesive and Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.

Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0187 inch thick, and Series 300 stainless-steel fasteners.

Sprayed Polyurethane Foam Sealant: One- or two-component, foamed-in-place, polyurethane foam sealant, 1.5- to 2.0-lb/cu. ft density; flame-spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

Elastomeric Flashing Sheet: ASTM D 2000, minimum 50- to 65-mil-thick, cured sheet neoprene with manufacturer-recommended contact adhesives and lap sealant with stainless-steel termination bars and fasteners.

Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 079200 "Joint Sealants."

Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.

B.7 Standing Seam Metal Panel Roof System

B.7.1 Description

System includes:

Roof Panels

Roof Louvers and Vents

Gutters and Downspouts

Soffit panels.

Snow Guards

B.7.2 Submittals

Submittals

Product Data: For each type of product indicated.

Shop Drawings:

Include plans, elevations, sections, and attachment details.

Detail fabrication and installation layouts, expansion joint locations, fixed points, and keyed details. Distinguish between shop- and field-assembled work.

Include details for forming, including seams and dimensions.

Include details for joining and securing, including layout and spacing of fasteners, cleats, and other attachments.

Include pattern of seams to match contract drawings.

Include details of termination points and assemblies.

Include details of expansion joints, including showing direction of expansion and contraction from fixed points.

Include details of penetrations.

Include details of edge conditions.

Include details of special conditions.

Include details of connections to adjoining work.

Samples: For each exposed product, minimum two 3 inches x 5 inches.

B.7.3 Quality Assurance.

Sheet Metal Fabricator Qualifications: Fabricated a minimum of 250,000 square feet of metal roofing and wall panel systems of similar type to that specified that have a record of successful in-service performance.

Installer Qualification: An entity that employs installers and supervisors who are trained and approved by manufacturer.

Delivery Storage and Handling:

Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed.

Do not store sheet metal materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal materials away from uncured concrete and masonry.

Retain and protect strippable protective covering on sheet metal from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal installation.

B.7.4 Performance Requirements

General Performance: Sheet metal roofing system including, but not limited to, metal panels, cleats, anchors and fasteners, sheet metal flashing integral with sheet metal panels, fascia panels, copings, trim, underlayment, and accessories, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, or installation, or due to other defects in construction. Sheet metal roofing shall remain watertight.

Single Source Responsibility: Provide components and materials specified in this section from a single manufacturer.

Sheet Metal Roofing Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or indicated on drawings.

Conform to dimensions and profiles shown unless more stringent requirements are indicated.

Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance rating: UL 90.

Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.

Temperature Change: 130 deg F, ambient; 200 deg F, material surfaces.

B.7.5 Standing-Seam Metal Roof Panels

General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.

Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and a flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Berridge Manufacturing Company.

CENTRIA Architectural Systems.

Firestone Metal Products, LLC.

Petersen Aluminum Corporation.

Kynar Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

Nominal Thickness: 0.028 inch (24 gage).

Exterior Finish: Series E: Standard Kynar 500

Color: Match Citadel Architectural Products “Statuary Bronze”

B.7.6 Underlayment

Self-Adhering, Self-Healing, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.

Products: Subject to compliance with requirements, available products that may be incorporated into the work include, but are not limited to, the following:

Henry Company; Blueskin PE 200HT basis of design per manufacturer's written assembly recommendations.

Carlisle Residential, a division of Carlisle Construction Materials; WIP 300HT.

Grace Construction Products, a unit of W. R. Grace & Co.-Conn.; Ultra.

Protecto Wrap Company; Protecto Jiffy Seal Ice & Water Guard HT.

SDP Advanced Polymer Products Inc; Palisade SA-HT.

Thermal Stability: ASTM D 1970; stable after testing at 240 deg F or higher.

Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F or lower.

Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

B.7.7 Miscellaneous Materials

Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete roofing system and as recommended by primary sheet metal manufacturer unless otherwise indicated.

Miscellaneous Metal Components: ASTM C 645; cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B.7.7.1 Panel Accessories:

Provide components required for a complete, weathertight panel system including trim, fasciae, soffits, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels.

Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.

Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, valleys, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

B.7.7.2 Panel Fasteners:

Self-tapping screws designed to withstand design loads:

Wood screws, annular-threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

Exposed Fasteners: Heads matching color of sheet metal roofing using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of panels.

Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed; with hex-washer head.

Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

Fasteners for Steel Sheet: passivated Series 300 stainless steel.

B.7.7.3 Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

B.7.7.4 Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal roofing and remain watertight.

B.7.7.5 Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

B.7.8 Roof Accessories

B.7.8.1 Cleats: Provide intermittent and continuous attachment devices for mechanically seaming into joints and formed from same material as sheet, inter-lockable with sheet.

B.7.8.2 Gutters and Downspout Components:

Gutters: Rectangular/Box "A" SMACNA style profile.

Downspouts: Rectangular profile, with seams facing away from building.

Components fabricated from pre-finished galvanized steel, ASTM A755; structural steel sheet, G90 zinc coating; 24 gage.

Finish: coating matching roof panels.

Anchorage Devices: per SMACNA requirements.

Supports: Bracket straps.

Accessories: Downspout outlets and headers profiled to suit gutters and downspouts.

B.7.8.3 Flashing and Trim: Formed from same material and with same finish as sheet metal roofing, minimum 0.018 inch thick.

B.7.8.4 Soffit Vents: Rectangular aluminum louvers with grilled faces and insect screening.

Size: See drawings.

Finish: Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

Nominal Thickness: 0.028 inch (24 gage).

Exterior Finish: Series E: Standard Kynar 500

Color: Match Citadel Architectural Products “Statuary Bronze”

B.7.8.5 Roof Vent: Fixed, Extruded-Aluminum Louvers

Submittals

Product Data: For each type of product.

Samples: For each type of metal finish required.

Louvers:

Horizontal, Drainable-Blade Louver

Louver Depth: 4 inches.

Frame and Blade Nominal Thickness: Not less than 0.080 inch for blades and 0.080 inch for frames.

Mullion Type: Exposed.

Louver Performance Ratings:

Free Area: Not less than 1.0 sq. ft. for pyramidal louver with sides matching angles of roof ridges from horizontal.

Louver Screening for Aluminum Louvers:

Bird Screening: Aluminum, 1/2-inch square mesh, 0.063-inch wire.

Materials

Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5, T-52, or T6.

Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

Fasteners: Use types and sizes to suit unit installation conditions.

Use Phillips flat-head tamper-resistant screws for exposed fasteners unless otherwise indicated.

For color-finished louvers, use fasteners with heads that match color of louvers.

Fabrication

Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

Join frame members to each other and to fixed louver blades with fillet welds concealed from view, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

Aluminum Finishes:

Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

Nominal Thickness: 0.028 inch (24 gage).

Exterior Finish: Series E: Standard Kynar 500

Color: Match Citadel Architectural Products “Statuary Bronze”

B.7.8.6 Snow Guards: Rail-type, seam-mounted snow guards. Provide snow guards that withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

Description: Snow guard rails fabricated from metal pipes, bars, or extrusions, anchored to brackets and equipped with one rail with color-matching inserts of material and finish used for metal roofing.

B.7.9 Fabrication

B.7.9.1 General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

Fabricate sheet metal roofing to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions (panel width and seam height), geometry, metal thickness, and other characteristics of installation. Fabricate sheet metal roofing and accessories in shop to greatest extent possible.

B.7.9.2 Double Lock Standing-Seam Roof: Form standing-seam panels with finished seam height of 1 inch.

Installation method: Solid deck with concealed clip fasteners and mechanically seamed panel joints.

B.7.9.3 Flat-Seam Soffit Panels: Form flat-seam panels from metal sheets with 1/2-inch notched and folded edges.

B.7.9.4 Fascia: Fabricate in minimum 96-inch long. Fabricate joint plates of same thickness as fascia, 24 oz./sq. ft.

Form exposed sheet metal work to fit substrates with little oil canning; free of buckling and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.

Form and fabricate sheets, seams, strips, cleats, edge treatments, integral flashings, and other components of metal panels to profiles, patterns, and drainage arrangements indicated on drawings and as required for leakproof construction.

B.7.10 Sheet Metal Accessories: Fabricate flashings and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item required. Obtain field measurements for accurate fit before shop fabrication.

Seams: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder. Following soldering, remove flux, wipe and wash solder joints clean.

Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.

Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

B.7.10.1 Gutters: Fabricate to cross section required, with riveted and soldered joints, complete with end pieces, and other special accessories as required. Fabricate in minimum 96-inch-long sections. Fabricate expansion joints and accessories from same metal as gutters unless otherwise indicated.

B.7.10.2 Downspouts: Fabricate round downspouts to dimensions indicated, complete with mitered elbows and solder watertight. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows. Solder all horizontal and vertical seams.

B.8 Joint Sealants

Provide joint sealants as shown and as specified.

B.8.1 Submittals

Product Data: For each joint-sealant product indicated.

Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

Samples for Verification: For each type and color of joint sealant required. Install joint sealants in 1/2-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

B.8.2 Quality Assurance

Obtain elastomeric materials from manufacturers who will, if requested, send a qualified technical representative to advise installer of proper procedures and precautions for use of materials.
Employ only skilled, experienced tradesmen for sealant application.

B.8.3 Materials

Compatibility: Provide joint sealants, joint fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by testing and field experience.

Colors: Provide colors of exposed joint sealants as selected by Architect from Manufacturer's standard range

Interior Sealants: One-part, siliconzied acrylic latex sealant, ASTM C 834, paintable.

Products:

Pecora AC-20 Latex Sealant

Tremco Tremflex #834 Siliconzied Acrylic Latex Sealant

Exterior Sealants: Medium Modulus (+/-50%) Structural Silicone Sealant: One-part, neutral cure; ASTM C 920, Type S, Grade NS, Class 50, Use NT, G, A, M, O.

Products:

Dow Corning 795 Silicone Building Sealant

GE SilPruf SCS2000

Pecora 895 Silicone Sealant

Tremco Spectrem 2 or Spectrem 3

Backer Rod: ASTM C 1330 cylindrical sealant backings of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

Cleaners and Primers: Provide joint cleaners and substrate primers recommended by sealant manufacturer for applications indicated.

B.9 Aluminum Storefront

B.9.1 Submittals

Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners[<>], glass and infill, door hardware, and internal drainage details

Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required. Include design engineer's stamp or seal on shop drawings for attachments and anchors.

Samples: Submit two samples 4" by 4" inches in size illustrating finished aluminum surface, glass, infill panels, glazing materials.

B.9.2 Delivery Storage and Handling

Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

B.9.3 Field Conditions

Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

B.9.4 Warranty

Correct defective Work within a five year period after Date of Substantial Completion.

Provide five-year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

Provide five-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

B.9.5 Products

B.9.5.1 Basis of Design: EFCO Series 960 Wall, a Pella Company:

www.efcocorp.com/#sle.

Framing for Insulating Glazing

Front-Set Style, Thermally-Broken Storefront

Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:

Kawneer North America: www.kawneer.com

YKK AP America Inc.: www.ykkap.com/#sle

B.9.5.2 Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.

Glazing Rabbet: For 1 inch (25 mm) insulating glazing.

Finish: Class I color anodized. Factory finish all surfaces that will be exposed in completed assemblies.

Finish Color: Dark bronze.

Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.

Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.

System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.

Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.

Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.

B.9.5.3 Performance Requirements

Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load. Design Wind Loads: Comply with requirements of ASCE 7.

Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.

Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf (390 Pa).

Air Leakage Laboratory Test: Maximum of 0.06 cu ft/min sq ft (0.3 L/sec sq m) of wall area, when tested in accordance with ASTM E283 at 6.27 psf (300 Pa) pressure differential across assembly.

Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.

B.9.5.4 Components

Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.

Glazing Stops: Flush.

Cross-Section: As indicated on drawings.

Glazing: As specified in Section B.12

Operable Sash: Aluminum [projecting out awning]; finished to match storefront; turn handle latch with manufacturer's standard insect screen.

B.9.5.5 Materials

Extruded Aluminum: ASTM B221 (ASTM B221M).

Sheet Aluminum: ASTM B209 (ASTM B209M).

Fasteners: Stainless steel.

Exposed Flashings: Aluminum sheet, 20 gage, 0.032 inch (0.81 mm) minimum thickness; finish to match framing members.

Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

B.9.5.6 Finishes

Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils (0.018 mm) thick.

Color: Dark bronze.

B.10 Aluminum Windows

Provide hollow aluminum windows as indicated on drawings and as specified herein

Related sections:

"Sealants" for sealants used during installation of aluminum windows.

"Glazing" for installation of glass in aluminum windows.

B.10.1 Submittals

Product data: Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.

Product Test Reports: For aluminum windows, for tests performed by a qualified testing agency, showing that window units comply with performance requirements indicated.

Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

Samples: Exposed Finishes: 2 by 4 inches.

B.10.2 Quality Assurance

Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

Field Conditions: Verify actual locations of structural supports and dimensions of openings for aluminum windows by field measurements before fabrication and indicate measurements on Shop Drawings.

B.10.3 Warranty

Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

Failures include, but are not limited to, the following:

Failure to meet performance requirements.

Structural failures including excessive deflection, water leakage, condensation, and air infiltration.

Faulty operation of movable sash and hardware.

Deterioration of materials and finishes beyond normal weathering.

Failure of insulating glass.

Warranty Period: 10 years from date of Substantial Completion.

B.10.4 Manufacturers

Basis-of-Design Product: Subject to compliance with requirements, provide Series 670 Double Hung Windows by EFCO a Pella Company: www.efcocorp.com/#sle. or a comparable product by one of the following:

TRACO
Wausau Window and Wall Systems.
YKK AP America, Inc.

B.10.5 Performance Requirements

Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

Minimum Performance Class: AW.
Minimum Performance Grade: 60.

Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.42 Btu/sq. ft. x h x deg F.

Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a minimum CRF (frame) of 47.

Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

Temperature Change: 140 deg F, ambient; 210 deg F material surfaces.

B.10.6 Materials

Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength, not less than 16,000-psi minimum yield strength, and not less than 0.125-inch thickness at any location for the main frame and sash members.

Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be non-corrosive and compatible with aluminum window members, trim, hardware, anchors, and other components. Cadmium-plated steel fasteners are not permitted.

Reinforcement: Where fasteners screw-anchor into aluminum less than 0.125 inch thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, non-corrosive, pressed-in, splined grommet nuts.

Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

Anchors, Clips, and Accessories: Aluminum, Type 304 stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions, providing sufficient strength to withstand design pressure indicated. Cadmium-plated steel anchors, clips, and accessories are not permitted.

Reinforcing Members: Aluminum, Type 304 stainless steel, nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions, providing sufficient strength to withstand design pressure indicated. Cadmium-plated steel reinforcing members are not permitted.

Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action, and completely concealed when aluminum window is closed.

Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA 101/I.S.2.

Sealants: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

B.10.7 Hardware

Provide manufacturer's standard hardware fabricated from aluminum or Type 304 stainless steel designed to smoothly operate, tightly close, and securely lock aluminum windows and sized to accommodate sash or ventilator weight and dimensions. Cadmium-plated hardware is not permitted. Do not use aluminum in frictional contact with other metals. Where exposed, provide extruded, cast, or wrought aluminum, die-cast zinc with special coating finish or nonmagnetic stainless steel.

Operation Function: Ventilators securely close at sash frames without using additional manually controlled locking devices.

Hung Window Hardware:

Counterbalancing Mechanism: AAMA 902.

Locks and Latches: Operated from the inside only.

Tilt Latch: Releasing latch allows sash to pivot about horizontal axis.

B.10.8 Insect Screens

Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Provide for each operable exterior sash or ventilator.

Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints, concealed fasteners and removable PVC spline/anchor concealing edge of frame.

Finish: Match aluminum window members.

Aluminum Wire Fabric: 18-by-16 mesh of 0.011-inch-diameter, coated aluminum wire.

Wire-Fabric Finish: Charcoal gray.

B.10.9 Fabrication

Fabricate aluminum windows, in sizes indicated, that comply with AAMA/WDMA 101/I.S.2 for performance class and performance grade indicated. Include a complete system for assembling components and anchoring windows.

Fabricate aluminum windows that are re-glazable from inside of unit without dismantling sash or ventilator framing.

Provide thermal-break construction that has been in use for not less than five years and has been tested to demonstrate resistance to thermal conductance and condensation and to show adequate strength and security of glass retention.

Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.

Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

Sub-frames: Provide sub-frames with anchors for window units as shown, of profile and dimensions indicated but not less than 0.062-inch-thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners. Finish to match window units. Provide sub-frames capable of withstanding design loads of window units.

B.10.10 Aluminum Finish

Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

Color: Match storefront color.

Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.

Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

B.11 Steel Doors and Frames

Provide hollow metal doors and frames as indicated on drawings and as specified herein related sections:

“Door Hardware” for installation accessories.

“Painting” for field finishing of steel doors and frames.

B.11.1 Definitions

Minimum Thickness: Minimum thickness of base metal without coatings.

B.11.2 Submittals

Product Data: Include construction details, material descriptions, core descriptions, and finishes.

Shop Drawings:

Details of doors, including vertical and horizontal edge details and metal thicknesses.

Frame details, including dimensioned profiles and metal thicknesses.

Locations of reinforcement and preparations for hardware.

Details of anchorages.

B.11.3 Delivery, Storage, and Handling

Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and project-site storage. Use vented plastic.

Deliver frame with two removable spreader bars across bottom of frames tack welded to jambs.

Store hollow metal work under cover at project site.

B.11.4 Field Measurements

Verify actual dimensions of openings by field measurements before fabrication.

B.11.5 Manufacturers

Subject to compliance with requirements, provide products by one of the following:

Amweld Building Products, LLC.

Ceco Door Products; an Assa Abloy Group company.

Curries Company; an Assa Abloy Group company.

Kewanee Corporation (The).

LaForce.

Steelcraft; an Ingersoll-Rand company.

B.11.6 Materials

Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 (ZF120) metallic coating.

Inserts, Bolts, and Fasteners: Hot-dip zinc-coated according to ASTM A 153/A 153M.

Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20.

Shop Primer: Manufacturer's standard, fast-curing, lead-free and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

B.11.7 Hollow Metal Doors

Comply with ANSI A250.8, except as modified below.

Design: Flush panel.

Thickness: 1-3/4 inches

Face Sheets: Fabricated from metallic-coated steel sheet. Comply with requirements indicated below by reference to ANSI A250.8 for level and model and ANSI A250.4 for physical-performance level:

Level 3 and Physical Performance Level A (Extra Heavy Duty, 0.053 inch thick (16 gauge) face sheets), Model 1 (Full Flush).

Core: Polyurethane; provide doors fabricated with thermal-resistance value (R-value) of not less than 14.5 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.

B.11.8 Hollow Metal Frames

Comply with ANSI A250.8 and with details indicated for type and profile.

Fabricate from 0.067 inch thick (14 gauge) metallic-coated steel sheet, with mitered or coped and full profile welded corners with seamless face joints.

Form door stops integral with frames, minimum 5/8 inch high.

B.11.9 Hardware Reinforcement

Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets and door frames.

Hinges: Minimum 0.123 inch (10 gauge), thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.

Lock Face, Closers and Other Surface-Mounted Hardware:

Minimum 0.067 inch thick (14 gauge).

Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

B.11.10 Frame Anchors

Jamb Anchors:

For Masonry: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.

For In-Place Concrete: Minimum 3/8 inch diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

Floor Anchors: Clip-type anchors, with two holes to receive fasteners, formed from same material as frames, not less than 0.042 inch thick (18 gage).

B.11.11 Fabrication

Fabricate hollow metal work rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal.

Fabricate hollow metal work to tolerances indicated in SDI 117.

Doors: Provide weep-hole openings in bottom of doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

Provide countersunk, flat-head or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

Weld floor anchors to bottom of jambs with at least four spot welds per anchor.

Locate jamb anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the templates furnished as specified in "Door Hardware" paragraph.

Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

B.11.12 Finishes

Surface Preparation: Comply with ASTM D6386 preparation for painting of galvanized steel. Clean surfaces with non-petroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

Priming: Apply shop primer immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils. Prime all surfaces of door and frame including inside of frame and bottom of door.

Steel doors and frames shall be finished with 2 coat paint system as specified in Section 517 Painting Epoxy System. Colors as selected by Architect and approved by the State.

B.12 Door Hardware

Provide door hardware for new FRP doors and aluminum frames for the bridge operator house as specified herein.

Package and label each hardware item separately with all screws, bolts and accessories required for a complete installation.

B.12.1 Submittals

Product Data: Catalog cuts and descriptive data of each product indicated.

Shop Drawings: Wiring diagrams for electrified door hardware.

Templates: Furnish hardware templates to doors and frames manufacturer as required for fabrication.

B.12.2 Quality Assurance

Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

Review methods and procedures related to electrified door hardware including, but not limited to, the following:

Inspect and discuss preparatory work performed by other trades.

Inspect and discuss electrical roughing-in for electrified door hardware.

Accessibility Requirements: Comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.

Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.

Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

B.12.3 Hinges

Continuous Hinges: BHMA A156.26; extruded-aluminum, pinless, geared hinge leaves; joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

Minimum 0.120 inch thick hinge leaves with minimum overall width of 4 inches; fabricated 1 inch less in length than door height to accommodate full width surface sweeps, and to template screw locations; with components finished after milling and drilling are complete.

Manufacturers:

Select Products Limited

Bommer Industries, Inc.

Hager Companies

McKinney Products Company; an ASSA ABLOY Group company

B.12.4 Locksets

Cylindical Locks: BHMA A156.2; Grade 1, Series 4000.

Manufacturers:

Dorma, LR design.

Schlage, Longitude design.

Sargent, LL Design.

Lock Throw: 3/4 inch.

Backset: 2-3/4 inches.

Function: Storeroom.

Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

Construction Cylinders: Standard Lock Cylinders, BHMA A156.5; Grade 1; with interchangeable cores; face finished to match lockset.

Number of Pins: 6.

Permanent Cores: Schlage Primus cylinders provided by Owner and exchanged for construction cylinders following Substantial Completion.

B.12.5 Electric Strikes

BHMA A156.31; Grade 1.

Provide power supply by same manufacturer as electric strike.

Manufacturers:

Dorma Architectural Hardware; Member of The DORMA Group North America.

Adams Rite Manufacturing Co.; an Assa Abloy Group company.

Security Door Controls.

Von Duprin; an Ingersoll-Rand company.

B.12.6 Door Closers

BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

Manufacturer: LCN Closers; an Ingersoll-Rand company.

B.12.7 Overhead Stops

BHMA A156.8.

Manufacturers:

Architectural Builders Hardware Mfg., Inc.

Glynn-Johnson; an Ingersoll-Rand company.

Rockwood Manufacturing Company.

B.12.8 Kick Plates

Fabricate not more than 1-1/2 inches less than door width on stop side and 30” height.

Base metal: Stainless steel, 0.050" (U.S. 18 gauge).

Manufacturers:

Trimco

ABH (Architectural Builders Hardware Mfg., Inc.)

CHMI (Custom Hardware Manufacturing, Inc.)

Rockwood Manufacturing Co.

B.12.9 Weather-Stripping

BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

Manufacturers:

National Guard Products.

Pemko Manufacturing Co.; an ASSA ABLOY Group company.

Reese Enterprises, Inc.

Zero International

B.12.10 Thresholds

BHMA A156.21; fabricated to full width of openings indicated.

Manufacturers:

National Guard Products.

Pemko Manufacturing Co.; an ASSA ABLOY Group company.

Reese Enterprises, Inc.

Zero International

B.12.11 Finishes

Provide finishes complying with BHMA A156.18.

Bronze or bronze anodized except as otherwise indicated.

Interior Door closers: Bronze painted or powder-coated.

B.13 Glazing

Insulating laminated glass units for aluminum windows, as indicated on Drawings and as specified herein.

B.13.1 Submittals

Product Data: For each glass product and glazing material indicated.’

Samples: For glass specified, 12 inches square.

B.13.2 Quality Assurance

Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."

IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B.13.3 Warranty

Manufacturer's warranty, agreeing to repair or replace work which exhibits defects in materials or workmanship. “Defects" is defined to include, but not limited to, leakage of water, abnormal aging or deterioration, failure of hermetic seals, edge separation or delamination of laminated glass, and failure to perform as required. Include requirement for removal and replacement of covering and connected adjacent work.

Warranty Period: Ten years from date of Substantial Completion.

B.13.4 Manufacturers

Subject to compliance with requirements, provide products of one of the following:

Guardian Industries Corp.

Oldcastle Glass, Inc.

Pilkington North America

PPG Industries, Inc.

Viracon, Inc.

B.13.5 Glass

Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.

Overall Unit Thickness: 1 inch.

Outdoor Lite: Laminated glass with two plies of 5 mm (3/16 inch).fully tempered float glass.

Indoor Lite: 6 mm (1/4 inch) thick fully tempered float glass

Sealing System: Dual seal.

Spacer: Thermally improved warm edge type, fabricated from aluminum or steel with a polymer bridge, or extruded polymer.

Thickness: 3/8 inch

Interspace Content: Air.

Low-E Coating: Pyrolytic or sputtered on fourth and fifth surfaces.

Visible Light Transmittance: 43 percent minimum.

Winter Nighttime U-Factor: 0.28 maximum.

Summer Daytime U-Factor: 0.26 maximum.

Solar Heat Gain Coefficient: 0.31 maximum.

Fully Tempered Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear), kind Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written recommendations.

Interlayer Thickness: 0.060 inch.

Interlayer Color: Clear.

B13.6 Installation Materials

Compression Gaskets: Extruded or molded, closed-cell, integral-skinned EPDM gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.

Glazing Tapes: AAMA 806.3, preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800.

B.13.7 Miscellaneous Materials

Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

Cleaners, Primers, and Sealers: Types recommended by sealant or gasket

Manufacturer.

Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

B.14 Non-Structural Metal Framing

B14.1 Submittals

Product Data: For each type of product.

B14.2 Products

Framing Members, General: Comply with ASTM C 754 for conditions indicated.

Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.

Protective Coating: Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.

Studs and Tracks: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners.

Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

MarinoWARE

MBA Building Supplies

MRI Steel Framing, LLC

Telling Industries

Minimum Base-Metal Thickness: 0.033 inch (20 gage).

Depth: As indicated on Drawings.Slip-Type Head Joints: Provide the following:

Single Long-Leg Runner System: ASTM C 645 top runner with 2 inch deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.

Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

ClarkDietrich Building Systems

MBA Building Supplies

Steel Network, Inc. (The)

Telling Industries

Z-Shaped, Rigid Furring Channels: ASTM C 645.

Minimum Base-Metal Thickness: 0.033 inch.

Depth: As indicated on Drawings.

B14.3 Auxiliary Materials

General: Provide auxiliary materials that comply with referenced installation standards.

Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

Isolation Strip at Exterior Walls: Provide the following:

Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

B.15 Gypsum Board

Submit Product Data or each type of product specified.

B15.1 General:

Obtain gypsum wall board products, including joint reinforcing tape, and embedding material, from single manufacturer.

Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

B15.2 Interior Gypsum Board

Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.

Core: 5/8 inch with long edges tapered.

Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

B15.3 Tile Backing Panels

Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.

Thickness: 5/8 inch

Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

B15.4 Trim Accessories

Interior Trim: ASTM C 1047.in shapes, (cornerbead, L bead, U bead, etc.) as required.

Material: Galvanized or aluminum-coated steel sheet.

B15.5 Joint Treatment Materials

General: Comply with ASTM C 475/C 475M.

Joint Tape:

Interior Gypsum Board Joint Tape: Paper.

Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.

Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.

Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

Fill Coat: For second coat, use setting-type, sandable topping compound.

Finish Coat: For third coat, use setting-type, sandable topping compound.

Joint Compound for Glass-Mat, Water-Resistant Backing Board: As recommended by backer unit manufacturer.

B15.6 Auxiliary Materials

General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

Steel Drill Screws: ASTM C 1002 unless otherwise indicated.

Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

B.16 Glazed Ceramic Tiles

B.16.1 Submittals

Product Data: For each type of product.

Samples for Verification: Full-size units of each type and composition of tile and for each color and finish required.

Attic Stock: Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents:

Tile and Trim Units: Furnish quantity used to cover 5'x5' area for each type, composition, color, pattern, and size indicated.

Grout: Furnish quantity of grout used to cover 5'x5' area for each type, composition, and color indicated.

B.16.2 Delivery Storage and Handling

Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

Store liquid materials in unopened containers and protected from freezing.

Field Conditions

Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

B.16.3 Products

B.16.3.1 General:

Source Limitations for Tile: Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

Source Limitations for Setting and Grouting Materials: Obtain setting and grouting materials, from single manufacturer.

ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

Provide tile complying with Standard grade requirements.

ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

B.16.3.2 Tile:

Basis of Design: Bridge House Wall Tile – Daltile: Annapolis

Type: Glazed Matte

Pattern: Subway

Color: Sail Matte AP10

Size (Actual Dimensions): 6 inches high by 16 inches long.

Basis of Design: Bridge House Floor Tile – Daltile: Chord

Type: Colorbody Porcelain

Pattern: Grid

Color: Canon Gray CH22

Size (Actual Dimensions): 24 inches wide by 48 inches long.

B.16.3.3 Setting Materials

Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15.

For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.15.

Grout Materials

High-Performance Tile Grout: ANSI A118.7, sanded.

B.16.3.4 Miscellaneous Materials

Corner Vertical Trim: 12” Jolly by Daltile to match tile color.

Window sill corner: Schluter-Rondec-Step in color coated aluminum to match tile or window color.

Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

B.16.4 Mixing Mortars and Grout

Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

Add materials, water, and additives in accurate proportions.

Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

B.17 Acoustical Panel Ceiling

B.17.1 Field Conditions

Deliver acoustical panels, suspension-system components, and accessories to project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for project when occupied for its intended use.

B.17.2 Manufacturers

Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from a single source from a single manufacturer.

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

Armstrong World Industries, Inc.

CertainTeed Corporation

Chicago Metallic Corporation

United States Gypsum Company

B.17.2 Performance Requirements

Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

Flame-Spread Index: Class A according to ASTM E 1264.

Smoke-Developed Index: 50 or less.

B.17.3 Acoustical Panels

Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264. Color: White. Edge/Joint Detail: Reveal sized to fit flange of exposed suspension-system members. Thickness: 5/8 inch. Modular Size: 24 by 96 inches.

B.17.4 Metal Suspension System

Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.

Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 9/16-inch-wide metal caps on flanges.

Structural Classification: Intermediate-duty system.

End Condition of Cross Runners: butt-edge type.

Face Design: Flat, flush.

Cap Material: Aluminum.

Cap Finish: Painted white.

B.17.5 Accessories

B.17.5.1 Attachment Devices:

Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

Anchors: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488/E 488M or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

Type: Post-installed bonded anchors.

Corrosion Protection: Carbon-steel components zinc plated according to ASTM B 633, Class SC 1 (mild) service condition.

Wire Hangers, Braces, and Ties: Provide wires as follows:

Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

B.17.5.2 Window Shade Pocket

Provide window shade pockets consisting of roll-formed, aluminum with profile as shown on the plans. Match the finish on the aluminum window shade pocket to the ceiling color.

B.17.5.3 Molding and Trim

Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners.

Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.

Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils. Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

B.18 Resilient Base

Rubber cove base as indicated on the Drawings and as specified herein

B.18.1 Submittals

Product Data: For each type of product indicated.

Samples: For each exposed product and for color and texture specified, not less than 12 inches long.

B.18.2 Materials

Rubber Wall Base: ASTM F 1861, Type TP (rubber, thermoplastic).

Group: I (solid, homogeneous).

Style B, Cove.

Manufacturers: Subject to compliance with requirements, provide products by the following:

Johnsonite; A Tarkett Company.

Mondo Rubber International, Inc.

Nora Systems, Inc.

Roppe Corporation, USA.

Thickness: 0.125 inch.

Height: 4 inches.

Lengths: Coils in manufacturer's standard length.

Outside Corners: Preformed.

Inside Corners: Job formed.

Colors: As selected by Architect from full range of industry colors.

Adhesives: Water-resistant type recommended by resilient base manufacturer for resilient products and substrate conditions indicated.

Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement based formulation provided or approved by resilient product manufacture for applications indicated.

B.19 Epoxy Flooring

Surface preparation and the application of epoxy flooring systems as shown and as specified.

Section includes installation of trowel or fluid applied epoxy flooring system with integral colored quartz chips and non-slip finish where indicated.

B.19.1 Definitions

ASTM C579 - Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings and Polymer Concretes.

ASTM D695 – Standard Test Method for Compressive Properties of Rigid Plastics.

B.19.2 Submittals

Product Data: Submit data on specified products, describing physical and performance characteristics; sizes, patterns and full range of colors available for selection.

Samples: Submit two samples 4 x 4 inch in size illustrating color, chip size and variation, matrix color, and texture.

Manufacturer's Certificate: Certify products meet or exceed specified requirements.

Manufacturer's Installation Instructions: Submit special procedures, and perimeter conditions requiring special attention.

Closeout: Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

B.19.3 Warranty

Warranty: Include coverage for delamination of floor and base materials from substrate and degradation of surface finish for a period of five years.

B.19.4 Manufacturer's

Bond Blend Industrial Flooring; E300 Epoxy Slurry System; locally distributed by Creative Maintenance Solutions, Inc.

BASF/Selby; Selbatwede 41 System; locally distributed by Masse's Inc

Dex-O-Tex; Decor-Flor; locally distributed by Masse's Inc.

B.19.5 Components

Epoxy Flooring: Thermosetting two-component epoxy resin binder, colored with select quartz aggregate for slip-resistant finish, complying with the following:

Total flooring thickness: 1/8 inch thick minimum.

Aggregate: Small quartz chips and ceramic granules, multiple colors as selected by Owner from manufacturer's standard colors.

Top Coat: Thermosetting single component epoxy or urethane, clear.

Compressive Strength:

System: ASTM C579; 10,000 psi.

Resin: ASTM D695; 12,000 psi.

Fire Resistance: Weight loss not to exceed limit for non-combustibility, in accordance with ASTM D1360.

Color & Texture: To be selected by Architect from manufacturer's standard colors and textures for non-slip finish.

B.19.6 Accessories

Control Joints: Extruded mill finished aluminum; 1/8 inch wide neoprene filler strip between side strips, height to match flooring thickness, with anchoring features suitable for substrates.

Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.

B.20 Painting

Prepare surfaces, paint bridge house interior concrete walls, unless tiled, and ceilings; also interior metal railings and steel door frame.

B.20.1 Definitions

Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523,

B.20.2 Submittals

Product Data: For each type of product. Include preparation requirements and application instructions.

Samples: For each type of paint system and each color and gloss of topcoat.

Product List: For each product indicated. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

B.20.3 Paint

MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

Material Compatibility: For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

Primers: As recommended in writing by topcoat manufacturer for each substrate encountered.

Paint for Walls and Ceiling: Latex, Interior, High Performance Architectural, (Gloss Level 3): MPI #139.

Paint for Interior Metal: MPI #163, Light Industrial Coating, exterior, water based, semi-gloss (Gloss Level 5).

Colors: As selected by Architect from manufacturer's full range.

Paint for Exterior Metal: Per bridge steel epoxy paint system.

Colors: As selected by Architect from manufacturer's full range.

B21 Toilet Accessories

B21.1 Submittals

Product Data: For each type of product indicated. Include the following:

Construction details and dimensions.

Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

Material and finish descriptions.

Features that will be included for Project.

Manufacturer's warranty.

Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

B21.2 Materials

Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.

Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60hot-dip zinc coating.

Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

B21.3 Manufacturers

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

American Specialties, Inc.

Bobrick Washroom Equipment, Inc.

Bradley Corporation

B21.4 Washroom Accessories

Toilet Tissue Dispenser: Combination unit with double-roll toilet tissue dispenser and removable sanitary-napkin waste receptacle with self-closing, disposal-opening cover.

Basis-of-Design Product: Bradley Model 5942-10.

Mounting: Semi-recessed. Designed for nominal 4 inch wall depth.

Toilet Tissue Dispenser Capacity: 4 1/2 or 5 inch diameter tissue rolls.

Toilet Tissue Dispenser Operation: Non-controlled delivery with theft-resistant spindles.

Material and Finish: Stainless steel, No. 4 finish (satin).

Lockset: Tumbler type.

Towel Dispenser/Waste Receptacle: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.

Basis-of-Design Product: Bradley Model 237-10.

Mounting: Semi-recessed. Designed for nominal 4 inch wall depth.

Minimum Towel-Dispenser Capacity: 600 C-fold or 800 multifold paper towels.

Minimum Waste-Receptacle Capacity: 12 gal..

Material and Finish: Stainless steel, No. 4 finish (satin).

Liner: Reusable, vinyl waste-receptacle liner.

Lockset: Tumbler type for towel-dispenser compartment.

Liquid-Soap Dispenser: Designed for dispensing soap in liquid or lotion form.

Basis-of-Design Product: Bradley Model 646.

Mounting: Vertically oriented, recessed.

Capacity: 40 oz.

Soap Vessel Liner: Low density polyethylene.

Soap Valve: Chrome-plated brass with ABS mechanism. Requires less than 5 lbs. of force to dispense soap.

Lockset: Tumbler type.

Refill Indicator: Window type.

Grab Bar:

Basis-of-Design Product: Bradley Model 837 Series.

Mounting: Flanges with exposed fasteners.

Material: Stainless steel, 0.05 inch thick.

Finish: Smooth, No. 4 finish (satin).

Outside Diameter: 1-1/4 inches.

Configuration and Length: As indicated on Drawings.

Mirror Unit:

Basis-of-Design Product: Bradley Model 7805 Series.

Frame: Stainless-steel angle, 0.05 inch thick.

Corners: Welded and ground smooth.

Integral Shelf: 5 inches deep.

Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.

One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.

Size: As indicated on Drawings.

B.21.5 Custodial Accessories

Mop and Broom Holder: Unit with shelf, hooks, holders, and rod suspended beneath shelf.

Basis-of-Design Product: Bradley Model 9984.

Length: 36 inches.

Hooks: Three.

Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.

Material and Finish: Stainless steel, No.4 finish (satin).

Shelf: Not less than nominal 0.05 inch thick stainless steel.

Rod: Approximately 1/4 inch diameter stainless steel.

B.21.6 Fabrication

General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of three keys to owner's representative.

B.22 Fire Extinguishers

Furnish and install six fire extinguishers in positions designated by the engineer.

Provide extinguishers with an all epoxy coated steel cylinder with an easy to operate, rugged metal trigger valve assembly, a highly visible recessed pressure indicating gauge, a siphon hose, and an appropriate mounting bracket. The extinguishers must be charged with Halon and have an Underwriters Laboratories (UL) rating of 4A-80 B:C. Provide extinguishers having a nominal capacity of 20 pounds of free flowing dry chemical, and a discharge time of approximately 20 seconds. The container of the extinguisher shall be manufactured in accordance with I.C.C. specification 48A250. The instruction plate must clearly show the UL and FM approval and have a 60 B C minimum rating.

B.23 Roller Shades

Equip the windows in the operator room with dual window shades. The outer shade (mounted nearest the glass) shall be a light filtering shade and the inner shade shall be a room darkening shade. Equip the windows at the entry level with room darkening shades only. Furnish seamless shades of a high quality commercial grade acceptable to the engineer.

Furnish bottom weights of aluminum, 1-inch x 1/8 inch x width of shade, enclosed in a fabric hem pocket. Furnish 1 3/8 inch OD steel roller tubes, lock-seamed and coated with a protective enamel finish.

Provide a clutch of high strength fiberglass reinforced polyester with high carbon steel springs to transmit motion from driving to driven members of the clutch mechanism. Provide a crash proof clutch mechanism that prevents slippage and raises and lowers smoothly to any desired height. Provide a clutch that operates bi-directionally with the use of an endless beaded chain and that never needs adjustment. Provide an idler made of high strength fiberglass reinforced polyester consisting of an outside sleeve and center shaft. The sleeve shall provide a bearing surface for the roller tube and must rotate freely on the center shaft, providing smooth, quiet, and long wearing operation. The control loop shall be an endless plated steel ball chain or plastic bead chain with a plastic connector.

Provide installation brackets of at least 1/16 inch thick steel with black baked enamel finish. Brackets must accommodate overhead, side, or face mounting with the clutch at either end of roller tube.

B.23.1 Light Filtering Shades

Furnish light filtering shades made of 3.5 mil minimum Mylar fabric with a sputtered metalized surface. The sputtered metalized surface shall be charcoal/silver-CS69 with the following characteristics:

Percent solar energy transmission:	15 ±
Percent solar energy absorption:	35 ±
Percent solar energy reflectance:	50 ±
Percent UV transmission:	2 ±
Percent visible light transmission:	12 ±

B.23.2 Room Darkening Shades

Furnish room darkening shades made of fabric woven from extruded vinyl over a fiberglass or polyester core. Fabric must hang straight and flat, without buckling or distortion, and when trimmed, the fabric edge must remain straight and free of raveling. Fabric shall be closed weave to provide a room darkening capability. Fabric shall be flame retardant and shall be fade resistant to commercially accepted standards. Variations in fiber density and striations inherent in woven fabrics shall be within commercially accepted standards. Provide beige shades.

B.24 Furniture

Provide furniture of highest quality with substantial commercial construction. Replace, at no additional cost to the state, any item not meeting the approval of the engineer with an item of higher quality that does meet the approval of the engineer.

B.24.1 Desk

Provide one double pedestal style desk constructed of heavy duty steel with a total weight of approximately 250 pounds. Provide the desk with a 30" x 60" top made of plastic laminate and steel core, with stainless steel binding and enamel rim, and rounded corners. Provide the desk with height adjustable from 28-1/2"± to 30-1/2"± and leveling floor glides. Provide the desk with a back panel mounted between the two pedestals. All pedestal drawers shall be locked by the keyed center drawer. One pedestal shall contain 3-box drawers, the other pedestal one box drawer and one file drawer (file drawer to be approximately 12-1/4" wide x 11" high x 26-1/2" deep and have a compressor), both pedestals to contain a slide-out reference shelf. Provide the desk with stainless steel or chrome for all hardware and trim; and brushed chrome for drawer pulls.

B.24.2 Utility Table

Provide one metal base utility table 36” deep x 72” wide x 29” high. Table must have adjustable, non-marring, leveling floor glides. Table must have a smooth top, chrome legs, and painted apron.

B.24.3 File Cabinets

Provide one two-drawer file cabinet, 15" wide x 28" deep x 29" high. Provide a cabinet constructed of 20-gage steel for the body and 18-gage steel for the top and bottom. Each drawer shall be supported by full ball bearing plated cradle suspension with 3 cross straps, and equipped with a drawer catch, handle and opening latch. The cabinet shall have a baked enamel finish.

B.24.4 Chairs

Provide one high-back executive chair with arms and one low-back operator chair without arms, both of heavy duty commercial quality. Provide easy-to-reach pneumatic seat height control and dual action posture control for adjusting both the seat tilt and the back tilt (control levers shall be behind the mid-point of the seat). Both seats and backs must be ergonomically shaped for comfort. Provide upholstering with a long wearing nylon over a dense foam padding (both upholstery and padding must conform to CA117 for flammability retardancy). Provide both chairs with five-pedestal bases with heavy duty casters suitable for use on ceramic flooring.

B.24.5 Coat Rack

Furnish one 24" wide, free-standing metal coat rack made of heavy gage steel with a baked enamel finish with eight wooden hangers.

B.24.6 Vertical Plan File

Provide one heavy duty, single, mobile stand complete with 12 clamps, one data file extension with 12 data files. Provide a rolling stand made of steel tubing (square or round) with a baked enamel finish adjustable for both height and depth (for documents up to 36" x 48"). Provide the stand with two rear casters that roll freely and two front casters that are lockable. Provide heavy duty binder clamps with clips for pivot or drop lift filing. Provide clamps that hold documents without punching or stapling and are capable of holding from 1 to 100 sheets. Provide anodized aluminum clamps that have plastic end caps and snap-on, clear plastic windows for identification tags. Provide tee bolts and wing knobs fabricated of non-corrosive, non-seizing materials.

B.24.7 Waste Receptacle

Provide one free standing waste paper receptacle having a capacity of 5 gallons and constructed of heavy-gage steel with a baked enamel finish.

B.24.8 Clock

Provide one wall mounted office type analog clock in the operator's room. Provide a battery powered clock. The clock must be minimum 12 inches in diameter and have black arabic numbers on a white background. The clock must have a second hand.

B.24.9 Locker

Provide two, two compartment wide, double tier storage lockers, manufactured from 24-gage (minimum) steel and resting on 6-inch high legs. Compartments must be 12" wide x 18" (minimum) deep x 72" high and equipped with a shelf approximately 9" from the top, three double coat hooks or a coat rod, and three wooden hangers. Provide doors with rubber cushions and lockable tamper-proof chrome handles. A baked enamel finish is required on all surfaces.

B.24.10 Cabinet

Provide three industrial quality steel storage cabinets manufactured from extra heavy duty, 16-gage steel frame with welded construction. Two cabinets must be 48" wide x 24" deep x 78" high. The third cabinet must be 36" wide x 24" deep x 72" high. All cabinets must have four 20-gage shelves, adjustable on 2" centers. The shelves must be double reinforced at the front and rear edges. Provide reinforced doors with three-point locking mechanisms and stainless steel or chrome plated door handles with a built-in key lock. Provide cabinets with leveling glides. A baked enamel finish is required on all surfaces, inside and out.

C. Construction

C.0 General

C.0.1 Codes and Permits

Install all equipment in strict compliance with applicable laws and the latest rules and regulations of all municipal and other public agencies having jurisdiction over this work.

If any items or requirements in this special provision conflict with any of the above-mentioned rules and regulations, then the minimum requirements shall be as shown on the plans and described in these special provisions and shall be altered, as approved in advance by the engineer, to meet any additional requirements. The engineer's interpretation will govern.

Prepare and submit drawings and/or applications for approval of the state and agencies having jurisdiction to obtain any required permits and certificates and deliver a copy of the same to the engineer. The cost of any required permits is included in this bid item.

C.0.2 Submittals

Submit to the engineer for review and approval complete construction drawings, shop details, installation drawings, catalog data, manufacturer's literature, etc. Complete submittals required include, but are not limited to, all aluminum windows, mullions, architectural metals, CMU walls, hollow metal doors, door frames, door hardware, trim, concrete corbels, roofing, gutters, fiberglass grating and other pertinent items.

C.0.3 Workmanship and Finish

Secure all items to be set in concrete. Adjust these items to the satisfaction and approval of the engineer before placing concrete. Maintain position in correct alignment and at proper elevation during placing and curing of concrete. Neatly finish installation of metal work. Correct any defective work to the satisfaction of the engineer at no additional expense to the state.

C.0.4 Color Selection

Before making the color selections, the engineer must have color samples for all items requiring a color selection. Submit samples of each manufacturer's entire color line to the engineer. For each item, the engineer will make a color selection from all the color samples submitted.

C.0.5 Guarantee

For all items of work to be performed under this article, guarantee each item against defects in material and workmanship for a period equal to the standard warranty period of the manufacturer or the industry, whichever is longer. Commencement of the warranty period begins after final acceptance of the work. In the event of a legitimate claim, replace or repair the defective item, in whole or in part, as necessary, to restore the item to its original intended state.

C.1 CONCRETE MASONRY UNITS

C.1.1 Examination

Examine conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

Proceed with installation only after unsatisfactory conditions have been corrected.

C.1.2 Masonry Installation

Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

Lay out walls in advance for accurate spacing of surface bond patterns with uniform 3/8 inch joint thicknesses and for accurate location of openings. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

Bond Pattern: Lay masonry in running bond; do not use units with less than nominal 4 inch horizontal face dimensions at corners or jambs.

Fill space between steel frames and masonry solidly with mortar.

Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

Fill cores in hollow CMUs with grout 24 inches under lintels.

Install compressible filler in joint between top of walls and underside of structure above.

Fasten partition top anchors to structure above and build into top of wall. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2 inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c.

Mortar Bedding and Jointing:

Lay hollow CMUs as follows:

With face shells fully bedded in mortar and with head joints of depth equal to bed joints.

With webs fully bedded in mortar in grouted masonry, including starting course on footings.

With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness.

Masonry Joint Reinforcement: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on side of walls. Lap reinforcement a minimum of 6 inches. Space reinforcement not more than 16 inches o.c.

Provide reinforcement not more than 8 inches above wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

Anchoring Masonry to Concrete: Anchor masonry to concrete where masonry abuts concrete to comply with the following:

Anchor masonry with anchors embedded in masonry joints and attached to structure.

Space anchors not more than 24 inches o.c. vertically.

Lintels: Provide masonry lintels where shown and where openings of more than 24 inches for block-size units are shown without structural steel or other supporting lintels.

Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

C.1.3 Cleaning and Disposal

In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

Excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

C.2 Metal Stair Nosing

Place nosings for concrete stairs into fresh concrete at the time of casting stairs. Finish concrete flush with top of nosings for stairs between the entry level and MCC level. Finish concrete lower than top of nosings for stairs between the entry level and operator room to provide a flush surface with the ceramic tile. Paint nosings for concrete stairs between the entry level and operator's room to match the floor tile.

C.3 Rough Carpentry

C.3.1 General: Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

Do not splice structural members between supports unless otherwise indicated.

Plywood: Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

NES NER-272 for power-driven fasteners.

Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

C.4 Shop-Fabricated Wood Trusses

C.4.1 Examination

Verify that field measurements are as indicated.

Verify that supports and openings are ready to receive trusses.

C.4.2 Erection

Coordinate placement of bearing items.

Install trusses in accordance with manufacturer's instructions and TPI DSB-89 and TPI BCSI 1; maintain a copy of each TPI document on site until installation is complete.

Set members level and plumb, in correct position.

Make provisions for erection loads, and for sufficient temporary bracing to maintain structure plumb, and in true alignment until completion of erection and installation of permanent bracing.

Do not field cut or alter structural members without approval of Truss Engineer of Record.

Install permanent bridging and bracing.

Install headers and supports to frame openings required with lumber in accordance with Section C.3.

Coordinate placement of decking with work of this section.

C.6.4 Tolerances

Framing Members: 1/2 inch maximum, from true position.

C.5 Thermal Insulation

C.5.1 Concrete Foundation Perimeter:

Adhere 6 inch wide strip of polyethylene sheet over construction joints with double beads of adhesive each side of joint.

Tape seal joints.

Extend sheet full height of joint.

Apply adhesive in three continuous beads per board length, minimum 1/8 inch thick.

Adhere boards to foundation wall perimeter, horizontally

Place boards in a method to maximize contact bedding

Stagger end joints

Butt edges and ends tight to adjacent board and to protrusions

Cut and fit insulation tight to protrusions or interruptions to insulation plane.

Do not permit work to be damaged prior to covering insulation.

C.5.2 Cavity walls:

Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

Install boards horizontally between wall ties.

Place boards in a method to maximize contact bedding. Stagger end joints. Butt edges and ends tight to adjacent board and no protrusions.

Apply a single continuous bead of adhesive at all insulation board joints.

Do not permit work to be damaged prior to covering insulation.

C.5.3 Installation of Thermal Insulation

Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

Extend insulation to envelop entire area to be insulated. Remove projections that interfere with placement.

Glass-Fiber Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

Install blankets according to ASTM C 1320.

Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.

Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

Loose-Fill Insulation: Apply according to ASTM C 1015 and manufacturer's written instructions. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.

C.5.4 Installation of Vapor Retarders

Extend vapor retarders to extremities of areas to protect from vapor transmission. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

Seal joints in vapor retarders over framing by lapping no fewer than two studs.

Fasten vapor retarders to wood framing at all edges; at perimeter of openings; and at lap joints. Space fasteners 16 inches o.c.

Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

C.6 Fluid Applied Air Barrier

C.7 .1 Examination

Examine substrates, areas, and conditions, for compliance with requirements and other conditions affecting performance of the Work.

Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.

Verify that concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.

Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

Proceed with installation only after unsatisfactory conditions have been corrected.

C.6.2 Surface Preparation

Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.

Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

C.6.3 Joint Treatment

Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air-barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.

Prime substrate and apply a single thickness of air-barrier manufacturer's recommended preparation coat extending a minimum of 3 inches along each side of joints and cracks. Apply a double thickness of fluid air-barrier material and embed a joint reinforcing strip in preparation coat.

C.6.4 Transition Strip Installation

General: Install strips, transition strips, and accessory materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.

Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.

Install butyl strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.

Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.

Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply elastomeric flashing sheet so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.

Apply adhesive to wall, frame, and flashing sheet. Install flashing sheet and termination bars, fastened at 6 inches o.c. Apply lap sealant over exposed edges and on cavity side of flashing sheet.

Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.

Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

Seal top of through-wall flashings to air barrier with an additional 6-inch-wide, counterflashing strip.

Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

C.6.5 Fluid Applied air Barrier Installation

Apply fluid air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions. Apply fluid air-barrier material within manufacturer's recommended application temperature ranges.

Apply primer to substrates at required rate and allow it to dry.

Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.

Apply a continuous unbroken air-barrier membrane to substrates according to the following thickness. Apply air-barrier membrane in full contact around protrusions such as masonry ties.

Total dry film thickness as recommended in writing by manufacturer to meet performance requirements, but not less than 40-mil dry film thickness, applied in one or more equal coats.

Apply strip and transition strip a minimum of 1 inch onto cured air-barrier material or strip and transition strip over cured air-barrier material overlapping 3 inches onto each surface according to air-barrier manufacturer's written instructions.

Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

C.6.6 Field Quality Control

Owner will perform inspections.

Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:

Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.

Continuous structural support of air-barrier system has been provided.

Concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.

Site conditions for application temperature and dryness of substrates have been maintained.

Maximum exposure time of materials to UV deterioration has not been exceeded.

Surfaces have been primed, if applicable.

Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.

Termination mastic has been applied on cut edges.

Strips and transition strips have been firmly adhered to substrate.

Compatible materials have been used.

Transitions at changes in direction and structural support at gaps have been provided.

Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.

All penetrations have been sealed.

Air barriers will be considered defective if they do not pass inspections.

Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.

Remove and replace deficient air-barrier components for reapplication as specified above.

C.6.7 Cleaning and Protection

Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 30 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.

Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

Remove masking materials after installation.

C.7 Standing Seam Metal Panel Roof System

C.7.1 Examination

Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.

Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.

Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

Proceed with installation only after unsatisfactory conditions have been corrected.

C.7.2 Coordination

Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

C.7.3 Metal Roof System Installation

General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

Shim or otherwise plumb substrates receiving metal panels.

Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers, gutter supports, valleys and flashings that will be concealed by metal panels are installed.

Install screw fasteners in predrilled holes.

Locate and space fastenings in uniform vertical and horizontal alignment.

Install flashing and trim as metal panel work proceeds.

Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.

Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.

Provide weathertight escutcheons for pipe and conduit-penetrating panels.

Fasteners: Use stainless-steel fasteners for surfaces exposed to the exterior.

Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.

Valleys: Overlap metal valley flashing 3 inches and seal to metal roof panel.

Install clips to supports with self-tapping fasteners.

Install pressure plates at locations indicated in manufacturer's written installation instructions.

Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.

C.7.4 Accessory Installation

Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

Install components required for a complete metal panel roofing system including trim, corners, seam covers, flashings, gutters, downspouts sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.

C.7.4.1 Gutters and Downspouts

Join lengths with seams sealed and soldered waterproof. Tin edges of sheets to be soldered with solder on both sides for width not less than 1-1/2". inches. Slope gutters to downspouts. Face all downspout vertical seams away from building. Flash and seal gutters to downspouts and accessories.

C.7.4.2 Flashing and Trim

Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.

Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

C.7.4.3 Roof Vent Installation

Locate and place louvers level, plumb, and at indicated alignment with adjacent work. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection. Provide perimeter reveals and openings of uniform width for sealants and joint fillers. Seal units in place with sealant of color to match vents.

C.7.5 Cleaning and Protection

Remove temporary protective coverings and strippable films, if any, as metal roof and soffit panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

C.7.6 Snow Guards

Install snow guards according to manufacturer's written instructions.

Attachment for Standing-Seam Metal Roofing:

> Seam-Mounted, Rail-Type Snow Guards: Stainless-steel clamps attached to vertical ribs of standing-seam metal roof panels.

C.8 Joint Sealants

C.8.1 Project Conditions

Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:

> When adverse or inclement weather conditions are impending or when ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturers.
>
> When joint substrates are wet due to rain, frost, condensation or other causes.

Joint Width Conditions: Do not proceed with installation of joint sealants when joint widths are less than recommended by joint sealant manufacturer for application indicated.

Inspection: Inspect joints indicated to receive joint sealants for compliance with requirements for joint configurations, installation tolerances and other conditions affecting joint sealant performance. Submit written report listing any conditions detrimental to performance of joint sealant work. Do not allow joint sealant work to proceed until unsatisfactory conditions have been corrected. Start of installation is evidence of acceptance of substrate.

C.8.2 Preparation

Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

C.8.3 Installation

Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

Do not leave gaps between ends of sealant backings.

Do not stretch, twist, puncture, or tear sealant backings.

Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

Install sealants using proven techniques that comply with the following and at the same time backings are installed:

Place sealants so they directly contact and fully wet joint substrates.

Completely fill recesses in each joint configuration.

Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

Remove excess sealant from surfaces adjacent to joints.

Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

Clean off excess sealant or sealant smears adjacent to joints as the work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

C.9 Aluminum Storefront and Windows

C.10.1 Examination

Verify dimensions, tolerances, and method of attachment with other work.

Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

C.9.2 Installation

Install wall system in accordance with manufacturer's instructions.

Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

Provide alignment attachments and shims to permanently fasten system to building structure.

Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

Provide thermal isolation where components penetrate or disrupt building insulation.

Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

Install operating sash.

Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

C.9.3 Tolerances

Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.

Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

Adjusting

Adjust operating hardware and sash for smooth operation.

C.9.4 Cleaning

Remove protective material from pre-finished aluminum surfaces.

Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

Protecting

Protect installed products from damage until Date of Substantial Completion.

C.10 Aluminum Windows

C.10.1 Examination

Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

Verify rough opening dimensions, levelness of sill plate, and operational clearances.

Proceed with installation only after unsatisfactory conditions have been corrected.

C.10.2 Installation

Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

C.10.3 Field Quality Control

Testing Agency: City will engage a qualified testing agency to perform tests and inspections.

Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

Testing Services: Testing and inspecting of installed windows shall take place as follows:

Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.

Air-Infiltration Testing:

Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.

Allowable Air-Leakage Rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.

Water-Resistance Testing:

Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.

Allowable Water Infiltration: No water penetration.

Testing Extent: Three windows of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested after perimeter sealants have cured.

Test Reports: Prepared according to AAMA 502.

Remove and replace noncomplying windows and retest as specified above.

Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

Prepare test and inspection reports.

C.10.4 Adjusting, Cleaning and Protection

Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

Keep protective films and coverings in place until final cleaning.

Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

C.11 STEEL DOORS AND FRAMES

C11.1 Examination

Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the work.

Proceed with installation only after unsatisfactory conditions have been corrected.

C.11.2 Installation

Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

Install hollow metal frames in compliance with ANSI/SDI A250.11.

Set frames accurately in position; plumbed, aligned, and braced securely.

Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.

In-Place Concrete: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

Remove welded-in shipping spreaders.

Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

Jambs and Head: 1/8 inch plus or minus 1/16 inch.

Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.

Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of galvanizing repair paint and compatible air-drying, rust-inhibitive primer.

C.12 Door Hardware

C.12.1 Preparation

For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

Review methods and procedures related to electrified door hardware including, but not limited to, the following:

Inspect and discuss preparatory work performed by other trades.

Inspect and discuss electrical roughing-in for electrified door hardware.

C.12.2 Installation

Mounting Heights: Mount door hardware units at heights to comply ANSI/SDI A250.8. unless otherwise required to comply with governing regulations.

Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing. Do not install surface-mounted items until finishes have been completed on substrates involved.

Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.

Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene sealant.

C.12.3 Adjusting

Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

C.13 Glazing

C.13.1 Installation

Comply with combined written instructions of manufacturers of glass, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

Glaze aluminum windows in the factory. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer.

Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

Provide spacers for glass lites where length plus width is larger than 50 inches.

Provide edge blocking where needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

C.13.2 Glazing Tape:

Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

Center glass lites in openings on setting blocks and press firmly against tape.

C.13.3 Gaskets:

Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

Insert compression gasket between glass and pressure-glazing stop so it is securely in place with joints miter cut and bonded together at corners.

Install pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass.

Install gaskets so they protrude past face of glazing stops.

C.13.4 Cleaning and Protection

Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

Examine glass surfaces adjacent to exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

C.14 Non-Structural Metal Framing

C.14.1 Examination

Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

C.14.2 Installation

Installation Standard: ASTM C 754.

Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

Install supplementary framing, and blocking to support fixtures, grab bars, toilet accessories, or similar construction.

Install bracing at terminations in assemblies.

Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

Install framing system components according to spacing indicated, but not greater than spacing required by referenced installation standards for assembly types:

16 inches o.c. unless otherwise indicated.

Where studs are installed directly against exterior masonry walls at exterior walls, install isolation strip between studs and exterior wall.

Install studs so flanges within framing system point in same direction.

Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings.

Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.

Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

Install two studs at each jamb unless otherwise indicated.

Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.

Furring: Attach to concrete with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

C.15 Gypsum Board

C.15.1 Installation

Comply with ASTM C 840.

Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

Prefill open joints, rounded or beveled edges, and damaged surface areas.

Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

Level 2: Panels that are substrate for tile.

Level 4: At surfaces that will be exposed to view unless otherwise indicated.

C.15.2 Protection

Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

Remove and replace panels that are wet, moisture damaged, and mold damaged.

C.16 Glazed Ceramic Tiles

C16.1 Examination

Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within the following limits:

Moisture Emission Rate: Not greater than 3 lb per 1000 sq ft (7.1 kg per 100 sq m) per 24 hours, test in accordance with ASTM F1869.

Alkalinity (pH): Verify pH range of 5 to 9, test in accordance with ASTM F710.

C16.2 Preparation

Protect surrounding work from damage.

Vacuum clean surfaces and damp clean.

Seal substrate surface cracks with filler.

Level existing substrate surfaces to acceptable flatness tolerances.

C16.3 Installation

General:

Install tile and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.

Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints. Offset wall tile to running bond pattern to floor.

Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

Form internal angles square and external angles square.

Sound tile after setting. Replace hollow sounding units.

Keep control and expansion joints free of mortar, grout, and adhesive.

Prior to grouting, allow installation to completely cure; minimum of 48 hours.

Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

16.4 Floor Installation

Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout.

16.5 Wall Tile Installation

Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

Over interior concrete install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.

16.6 Cleaning

Clean tile and grout surfaces.

16.7 Protecting

Do not permit traffic over finished floor surface for 4 days after installation.

C.17 Acoustical Panel Ceilings

C.17.1 Examination

Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

Proceed with installation only after unsatisfactory conditions have been corrected.

C.17.2 Preparation

Measure ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated and comply with layout shown on reflected ceiling plans.

Layout openings for penetrations centered on the penetrating items.

C.17.3 Installation

Install acoustical panel ceilings according to ASTM C 636/C 636M and manufacturer's written instructions.

Suspend ceiling hangers from building's structural members and as follows:

Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.

Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system

members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.

Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.

Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.

Do not use exposed fasteners, including pop rivets, on moldings and trim.

Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.

For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.

C.17.4 Tolerances

Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.

Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

C.17.5 Cleaning

Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

C.18 Resilient Base

C.18.1 Preparation

Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

Do not install resilient products until they are the same temperature as the space where they are to be installed.

Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

C.18.2 Installation

Comply with manufacturer's written instructions for installing resilient base.

Apply resilient base to walls, pilasters, and other permanent fixtures in rooms and areas where base is required.

Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

Do not stretch resilient base during installation.

Preformed Outside Corners: Install preformed corners before installing straight pieces.

Job-Formed Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

Miter or cope corners to minimize open joints.

Comply with manufacturer's written instructions for cleaning and protecting resilient products.

C.19 Epoxy Flooring

C.19.1 Environmental Requirements

Material shall be delivered to the project site in manufacturer’s original unopened containers bearing manufacturers name, product and color.

Store materials in dry, secure area, for three days prior to installation in area of installation to achieve temperature stability.

Maintain minimum temperature in storage area of 50 degrees F.

Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

C.19.2 Examination

Verify that substrate is ready to receive work, and that subfloor surface is clean, dry, and free of substances which could affect bond.

Do not begin work until concrete substrate has cured 28 days minimum, and measured moisture content is not greater than 16 percent.

C.19.3 Preparation

Mask/cover existing adjacent surfaces or areas that require protection from flooring installation operations.

Prepare surfaces as required by manufacturer for shot blast or grind existing substrate.

Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with filler as recommended by manufacturer.

Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind remaining irregularities above surface level. Prohibit traffic until filler is cured.

Clean and vacuum substrate.

C.19.4 Joint Installation

Install strips straight and level at existing substrate control joint locations.

Clean and vacuum entire surfaces.

C.19.5 Flooring Installation

Mix all materials in strict accordance with manufacturers instructions.

Apply primer/body coat within thickness range required by manufacturer.

Broadcast selected color quartz into wet epoxy to provide non-slip finish and cure as required.

Apply clear chemical resistant epoxy top coat to achieve final finish and texture selected.

Finish to smooth level surface, following original flatness and slope.

C.19.6 Protection

Prohibit traffic on floor finish until cured; minimum 48 hours after installation.

Barricade area to protect flooring until cured.

Remove all materials from site.

C.20 Painting

C.20.1 Examination

Examine substrates and conditions for compliance with requirements affecting performance of the Work.

Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

Concrete: 12 percent.

Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

Proceed with coating application only after unsatisfactory conditions have been corrected.

Application of coating indicates acceptance of surfaces and conditions.

C.20.2 Preparation

Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

Shop-Primed Steel Substrates:

Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

Remove incompatible primers and reprime substrates with compatible primers or apply tie coat as required to produce paint systems indicated.

C.20.3 Application

Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."

Apply 1 coat primer and 2 coats finish. Apply additional coats when undercoats, stains or other conditions show through final coat of paint; paint film shall be of uniform finish, color and appearance.

Omit primer on metal surfaces which have been shop-primed and touch-up painted, unless otherwise directed by the Architect.

Paint both sides and edges of interior doors and entire exposed surface of door frames.

Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

C.20.4 Cleaning and Protection

After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Engineer, and leave in an undamaged condition.

At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

C.21 Toilet Accessories

C.21.1 Installation

Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

C.21.2 Adjusting and Cleaning

Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

Remove temporary labels and protective coatings.

Clean and polish exposed surfaces.

C.22 Fire Extinguishers

Install one fire extinguisher at each level within the operator's house, at the MCC level within the machinery access house, and in each machinery room of the bascule superstructure. Install fire extinguishers in positions designated by the engineer.

Securely fasten to structure, square and plumb, in accordance with manufacturer's instructions.

C.23 Roller Shades

Furnish and install dual window shades at all windows at the operator's house. Coordinate the window shade work with the suspended ceiling system and with the windows and window shade pockets. Furnish and install room darkening shades at all windows in the entry level. Install and finish all items in accordance with good practice.

C.24 Furniture

C.24.1 Delivery, Unpacking and Assembly

Deliver furniture to job site only after all construction activities have been completed and State is ready to occupancy the bridge house.

Delivery each piece of furniture to the proper floor as directed by Owner's onsite engineer. Unwrap and remove all packaging from the site.

Taking care not to damage any existing finished surfaces of the building assemble furniture per manufacture's written instructions.

Repair and or touch up and scrapes caused by furniture delivery, unpacking and assembly.

D Measurement

The department will measure Operator House Miscellaneous as a single lump sum unit of work acceptably completed.

E Payment

The department will pay for the measured quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.04	Operator House Miscellaneous	LS

Payment is full compensation for furnishing and installation of the miscellaneous items of work within the operator's house, painting bascule pier/abutment interior and for furnishing all labor, tools, equipment, materials, and incidentals necessary to complete the contract work.

t. Fender Rub Rails, Item SPV.0105.05.

A Description

This special provision describes furnishing labor, tools, equipment and materials necessary to provide and mount Fender Rub Rails to the channel face and around the upstream and downstream corners of the bascule pier and bascule abutment.

B Materials

Provide material for fender rub rails conforming to requirements of ASTM D-2000 of the designation code recommended by the manufacturer for location and usage. Provide fender rub rail manufactured by Uniroyal, Inc., Goodyear Tire, Lord Corp. or an approved equal.

Provide fender rub rail 6-inch diameter half round as shown on the plans.

Submit complete shop detail drawings and erection drawings as provided in Subsection 506.3.2 of the Standard Specifications, in the Article "Contractor Responsibility", Subsection "Submittals", and as specified herein.

Furnish 12 additional sections of fender rub rails measuring 5 feet – 0 inches each and stored in operator house for future maintenance.

Furnish galvanized masonry anchors conforming to the requirements of subsection 502.2.12.2 of the standard specifications and as shown on the plans.

C Construction

Attach fender rub rails to the channel face of the bascule pier and bascule abutment with galvanized connection hardware as shown on the plans.

Install galvanized masonry anchors conforming to the requirements of subsection 502.3.14.2 of the standard specifications and as shown on the plans.

Anchor bolts may be either embedded anchor bolts or concrete masonry anchors. If the contractor elects to use embedded anchor bolts, obtain from the manufacturer of the Fender Rub Rails anchor bolt setting plans. Set each group of anchor bolts (for a single piece of rub rail) together using a single template. Mark worklines on the templates to facilitate the accurate placement of the anchor bolt groups to the precise dimensions of the anchor bolt setting plans. Verify the exact location of each anchor bolt after the concrete is poured and cured. If necessary, revise the anchor bolt setting plans to show the as-built condition and take appropriate measures with the manufacturer of the Fender Rub Rails to assure that the rub rails and anchor bolts fit properly.

D Measurement

The department will measure Fender Rub Rails as a single lump sum unit acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.05	Fender Rub Rails	LS

Payment is full compensation for furnishing and installing the Fender Rub Rails on the bascule pier and bascule abutment including all materials, labor, tools, equipment and incidentals necessary to complete the contract work.

u. **Mechanical Work Bascule Span, Item SPV.0105.06.**

A Description

A.1 General

This section describes the general requirements for the detailed work to be completed for bridge machinery components and systems. Provide bridge machinery that meets the requirements of AASHTO LRFD Movable Highway Bridge Design Specifications, 2015 7th Edition with Interim Revisions through 2016, hereafter referred to as AASHTO Movable, and these contract documents. Each lift span shall be powered by an electro-mechanical span drive system driven by a single 50 hp electric motor and equipped with a separate redundant 50 hp motor.

The Bridge Machinery consists of the following machinery:

Prime Mover – 50 hp electric motor

Redundant Prime Mover – Backup 50 hp electric motor

Primary Speed Reducer – 24:1 with parallel dual input shafts and differential

Primary Speed Reducer Support Weldment

Secondary Speed Reducer – 50.6:1 triple reduction

Secondary Speed Reducer Support Weldment

Motor Brake – 10” drum type rated for 130 ft*lbf

Machinery Brake – 16” drum type rated for 1,325 ft*lbf

Couplings and Floating Shafts

Pinion Shaft Bearing ‘B’ and support weldment

Pinion Shaft

Pinion Bearing and Hub

Rack and Pinion

The cost of work in Bridge Machinery- General is included in the Bridge Machinery bid items.

A.2 Manufacturer’s Product Data

Submit manufacturer’s data and/or shop drawings for all manufactured and purchased products.

Include in the submittal, as applicable: the manufacturer’s name and trade name; descriptive literature, catalog cuts, drawings, diagrams and certified prints and lay out dimensions; catalog model number, nameplate data, size and capacity, plus commercial, federal and military specification references; and any other relevant data required to establish contract compliance.

A.3 Shop Drawings

Detail and accurately dimension all parts on the shop drawings. Show limits of accuracy and tolerance required for machining, surface finishes and allowances for fits. Provide fits and finishes as specified in accordance with ANSI B46.1 and ANSI B4.1.

Show proprietary parts in outline on the drawings. Furnish complete dimensions and data to enable a determination of the adequacy of the unit. Furnish certified dimensional prints stating the name, part and job number. Give pertinent load and speed ratings; provisions for lubricating, the method of lubrication, location and type of all lubrication, and vent fittings. If a product is modified in any way from the description submitted by its original manufacturer, provide a drawing that details the modifications and assigns a special part number to that part to avoid supply of replacement parts not similarly modified.

Provide a diagram or assembly drawing sufficient to enable disassembly and reassembly of the component. Identify and describe on the assembly drawing, or diagram, each internal part and show dimensions of principal parts; certified external dimensions; gross weight and normal operating ratings.

Provide shop bills of material, listing all parts by number and quantity. Provide the materials and specifications for each part. Where standard specifications are used, give the designating numbers.

The following abbreviations may be used:

AASHTO	American Association of State Highway Transportation Officials
ABMA	American Bearing Manufacturers Association
AGMA	American Gear Manufacturers Association
AISI	American Iron and Steel Institute
ANSI	American National Standard Institute
ASME	American Society of Mechanical Engineers
ASTM	ASTM International
AWS	American Welding Society
NEMA	National Electrical Manufacturers Association
NLGI	National Lubricating Grease Institute
OSHA	Occupational Safety and Health Act
SAE	Society of Automotive Engineers Standard
Specifications	State of Wisconsin Standard Specifications for Highway and Structure Construction, 2013 edition
SSPC	Steel Structures Painting Council

Furnish assembly and erection drawings with identifying marks and essential dimensions for locating parts and assemblies. The use of opposite hand or mirror image assembly drawings is not acceptable. It is the contractor’s responsibility to achieve satisfactory construction and operation of the machinery; approval of shop drawings by the engineer does not constitute relief from this provision.

Show subtitles describing the parts and the inspection agency on each shop drawing.

Submit shop drawings to the engineer for review and approval in accordance with article “Shop drawings and submittals”. Resubmit drawings rejected or requiring correction until they are approved. Any damages or costs that result from ordering materials or performance of any work before receiving shop drawing approval shall be the responsibility of the contractor.

A.4 Operation and Maintenance Manuals

A.4.1 General Requirements

Furnish manuals containing complete descriptive literature, catalog cuts, reduced size shop drawings and other information required for successful operation and maintenance

for the machinery systems of the bridge. Provide revisions, if required, after the start-up period by means of addenda to the manuals.

Clearly print all materials so that the submittals, drawings, catalog cuts and all other information is legible, accurate and distinct. Reduced size drawings and illustrations must be legible so that dimensions and lettering are readable. Fold all large format pages to the page size necessary for inclusion in the manuals.

Print the material on durable mediums. Use water resistant inks. Use printing methods that offer permanence and durability.

A.4.2 Contents

Neatly inscribe the following information on the manual’s cover: Title: “Operating and Maintenance Manual”; the name and location of the bridge; the contract number, date, and the names of the consulting engineer and the contractor.

Include the following in the manual:

1. Index of contents and tabbed dividers for each section.
2. A system layout showing all machinery components, including all existing components reused.
3. A detailed description of the control system and procedure for operating the bridge using the main drive motors, auxiliary drive motors and any manual means.
4. Reduced size copies (11” x 17”) of shop drawings and lubrication charts.
5. Certified parts drawings and descriptions of proprietary units.
6. A detailed description of the function of each principal component.
7. Manufacturer’s standard literature and instructions for installation, operation, lubrication, adjustment, and maintenance for each component and assembly.
8. A list of the names, addresses and telephone numbers of all subcontractors and manufacturers furnishing and installing the equipment and systems together with a record of the local representatives for the equipment and systems installed.
9. Recommended procedures and frequency for cursory and detailed inspections of the equipment.
10. Information on trouble-shooting problems that may be encountered during operation for each of the major pieces of equipment. Include things to look for, signs of irregular operation and suggested solutions.

A.4.3 Materials for Manuals

Bind the maintenance and operating materials in heavy duty, three-hole binders, of either ring or post type, as directed by the engineer. Use binders that have nickel-plated, metal hinges and a locking mechanism that permits the sheets to lie flat, such as a channel lock. Use heavy duty, stiff covers that are moisture, oil and grease resistant such as plastic or other suitable materials.

Bind all the printed material between the rigid covers of the book. Provide a book measuring approximately 9 x 12 inches. Provide included drawings in black outline on white background. Use archival quality, acid free, punched, 60 pound, loose leaf paper. Use paper pages, foldout drawings, diagrams and illustrations having three standard spaced holes, 5/16 inch minimum diameter, with plastic or cloth reinforcement.

A.4.4 Manual Submittals

Submit to the engineer for approval the arrangement of the books, proposed methods of binding, printing and reproduction and materials to be included. Two copies of sample formats and outlines of the contents

in draft form are required ninety (90) days before the earliest of: final inspection, acceptance tests or return of the span operation to the City of Menasha, Department of Public Works.

Submit two (2) copies of the complete manual in final form thirty (30) days prior to final inspection, acceptance tests or return of the span operation to the City of Menasha, Department of Public Works.

Submit five (5) copies and two (2) CDs or electronic copies of the approved manual ten

(10) days after final inspection and acceptance tests. One of the five copies shall become the property of the engineer of record; the remaining copies shall become the property of the City of Menasha, Department of Public Works. Submit two (2) copies of the manual in Adobe Acrobat format.

A.5 Operating Instructions

Provide operating instructions, approved by the engineer, for each system and principal piece of equipment for the use of operation and maintenance personnel. Post on or adjacent to the piece of equipment the printed operating instruction, including proper adjustment, operation, lubrication, safety precautions, procedures to be followed in event of equipment failure and other items of instruction recommended by the manufacturer. Use either weather-resistant materials or protect the instructions with suitable enclosures. Prepare diagrams showing the complete layout of the operating machinery. Frame the diagrams, under glass or in an approved laminated plastic, and post where directed by the engineer. Securely fasten all posted instructions and diagrams to prevent easy removal. Do not locate in the direct sunlight.

A.6 Quality Assurance

A.6.1 Standard Products

In so far as practical, use materials and equipment that are the standard, catalogued products of manufacturers regularly engaged in the production of such products; and that are the latest standard design; and that comply with the requirements of the contract documents. Provide materials and equipment that essentially duplicate units which have served satisfactorily for at least two years prior to bid opening. Where two units of the same category equipment are required in the system use products of the same manufacturer; although, components of the system need not be the products of one manufacturer.

Provide each major component with a name plate, securely affixed in a conspicuous place, with the manufacturer's name and address, the model and serial number. The nameplate of the distributing agent is not acceptable. A duplicate replacement component shall be able to be procured completely and solely from the information listed on the nameplate.

A.6.2 Manufacturer's Recommendations

Install and align all units and components as recommended by the manufacturer of that product. Furnish printed copies of those instructions and procedures to the engineer before beginning installation. Failure to furnish these instructions may be cause for rejection. Preparation of the mounting surfaces and associated components required for the installation is included in the work.

A.6.3 Codes and Standards

Furnish all machinery bid items in compliance with the applicable requirements of the latest standards and codes of, but not limited to, those organizations designated above. Where other codes and standards are designated in these special provisions they shall also apply to the work requirements of the parts and equipment with which they are associated.

A.6.4 Qualification, Personnel and Facilities

Complete all fabrication, cleaning, lubrication, testing and all other work required for bridge machinery pay items using an adequate number of experienced mechanics and service personnel who are thoroughly trained and familiar with the required methods specified for correct completion of the work.

For the installation, alignment and fastening of the bridge machinery, use an adequate number of trained and skilled millwrights having past experience in the installation of machinery on at least two (2) previous movable bridges.

Equip the mechanics, millwrights and service personnel with the necessary instruments, tools and other equipment necessary to assure the related components have been furnished within acceptable tolerances; and to make any adjustments required to attain correct installation and satisfactory operation.

A.6.5 Rules, Regulations and Ordinances

Assure that all work complies with all applicable federal, state and local rules, regulations and ordinances.

In the event of a conflict between these special provisions and the federal, state and local codes, standards, rules, regulations and ordinances the most stringent requirement applies.

A.6.6 Measurements and Verification

Dimensions given on the plans are nominal and intended for guidance only. Note any variations from nominal dimensions on the shop drawings.

A.6.7 Substitutions

The specification of a manufacturer's name and part number is for the purpose of defining quality, configuration, rating and arrangement of parts. Equivalent products of another manufacturer may be substituted for the specified item upon the written approval of the engineer. Make any changes necessary, as a result of the substitution, in related machinery, structural, and electrical parts at no additional cost to the City.

Obtain the engineer's written approval for a substitute product prior to ordering it. Acceptance of the substitute product is at the sole discretion of the engineer. The basis for acceptability of a substitute product will be a review of the descriptive material and detail submitted and evaluation of its ability to fulfill the contract requirements.

The engineer will stamp submittals for substituted materials. Resubmit rejected shop drawings showing the specified product. Rejection shall in no way result in extra cost to the City. Approval of a substitute product by the engineer does not relieve the contractor of the responsibility for proper operation, performance or functioning of that product.

Inform the engineer if departures from the contract documents are deemed necessary. Submit full details of the departures and reasons for the need, as soon as possible, to the engineer for approval. Do not proceed with any departure without written approval.

B Materials

B.1 Open Gear Lubricant

The open gear lubricant utilized must bond strongly to gear teeth to maintain a continuous film on bearing surfaces despite high loading and high load repetition, contain an EP (Extreme Pressure) additive, repel water, resist throw-off and dripping, maintain consistency over wide temperature variations, and allow for ease in application and removal. The lubricant must have an operating range of 0°F to 210°F and must be considered a heavy bodied, adhesive type open gear lubricant by its reputable lubricant manufacturer.

Some adhesive lubricants are available in a diluted form for ease of application. This type of lubricant is diluted with solvent that quickly evaporates after application leaving behind an adhesive tacky film. If such a lubricant is desired, the solvent must be non-flammable and the mixture must not pose any hazard to health. The detailed specifications for open gear lubricants that will satisfy the above requirements do vary. Use unleaded, non-diluent type, non-chlorinated open gear grease, SUS 7,000 @ 100°F viscosity, water resistant, anti-wear/extreme pressure.

B.2 Enclosed Gear Reducers

B.2.1 Reducer Design & Fabrication Requirements

The following requirements apply to all gear boxes in the Leaf Operating Machinery gear train. Provide Nuttall or Falk enclosed speed reducers, or approved equal.

The manufacturer is to submit for approval a certified print of each speed reducer showing as a minimum the following:

1. All external mounting dimensions including shaft sizes, bores, and keyways where required.
2. The ratings that will appear on the nameplate.
3. Location of all lubricant connections.
4. Lubrication recommendations.
5. Provide internal drawings showing each gearbox component with part numbers to the Department.
6. Submit shop drawings showing steel designations, AWS welding symbols, and net weld lengths.
7. Product data for all bearings.

8. Manufacturer's installation instructions.
9. Operation and Maintenance data.
10. Duplicate copies of shop results for welds and full load testing of reducer(s).

Provide primary reducers designed and fabricated based on the following criteria:

Input Horsepower = 50 HP at 1200 RPM (from either motor)

Ratio = 24:1

Service Factor = 1.5

(150%) FLT Torque Rating: 100,000 in-lb. output torque (total)

200% Testing Torque Rating required: 133,333 in-lb. without exceeding 75% of the yield strength of any component.

Maximum Operating Cycle = 10 min/hr.

Design Cycles: 12,000 per year for 50 years

Special feature: Differential assembly

Provide secondary reducers designed and fabricated based on the following criteria:

Input Horsepower = 25 HP at 50 RPM

Ratio = 50.6:1

Service Factor = 1.5

(150%) FLT Torque Rating: 2,400,000 in-lb. output torque

200% Testing Torque Rating required: 3,200,000 in-lb. without exceeding 75% of the yield strength of any component.

Maximum Operating Cycle = 10 min/hr.

Design Cycles: 12,000 per year for 50 years.

Shop/Factory Finish: Factory finish the speed reducer with 2 coats of red oxide

primer, in conformity with SSPC 15, Type 1.

Provide the reducer design calculations and drawings to the Engineer for approval before construction of the unit.

Provide primary reducers of the parallel shaft design to include a differential assembly as noted in the plans.

Provide custom secondary reducers of the parallel shaft design and diagonal /vertical shaft line as shown in the Plans. Two secondary reducers are required per bascule leaf drive system, one right-hand and one left-hand.

Coordinate reducer details with other drive system machinery.

For the manufacture and installation of the gear boxes, employ a manufacturer with at least ten years' experience in the design, fabrication, testing, installation and startup of gear boxes for movable bridge systems of comparable size and type. The Engineer may send an inspector to witness shop testing and to verify compliance of the reducer and its components, prior to shipment of the reducers to the field. Provide all gear boxes from a single manufacturer, with sizes, ratios and construction details as shown on the Plans.

Provide gear boxes that conform to the current edition of ANSI/AGMA 6013.

Provide ANSI/AGMA 2001-D04 Grade 2 material, as a minimum, for gearing and shafting. Provide results of mechanical testing of materials. Perform all inspection and testing recommended by AGMA 923-B05 to demonstrate compliance with metallurgical specifications of the selected material grade.

Provide gear boxes with the ratings shown on the Plans. Provide gear boxes that withstand an intermittent load equal to 2.75 times the rated full load torque of the driving motor(s) when referred to the input to the reducer, without any component reaching 75 percent of its yield strength. Ratios shown in the Plans are for general configuration. Final ratios shall be determined by the reducer manufacturer. Final

drive train ratio (primary and secondary ratio) shall not deviate from that shown in the Plans by greater than +/- 5%.

Provide helical or herringbone gearing, Spur gears are not acceptable. Bevel gears are required for the differential gearing and auxiliary input shaft gearing. All gears are to be through hardened steel and shall conform to the current specifications of ANSI/AGMA 2015-1, Accuracy Class A8 or better.

Provide pinions integrally cut on the pinion shafts with the material conforming to AGMA Grade 1, as a minimum. Proportion the pinions to have a root diameter larger than the diameter of the journals for the pinion shaft. The relative hardness of gears and driving pinions is to be such that the loading and testing requirements of these Specifications are met. Provide pinions with a minimum hardness of 320 Brinell. Provide gears of a minimum 265 Brinell hardness.

Use shafts made from alloy steel, heat treated and annealed as required. Provide radii at fillets in keyways. Provide keys and keyways per ANSI B 17.1 Class 2. Include key and keyway dimensions on shop drawings.

Provide anti-friction type bearings with an ABMA L-10 life of 40,000 hours at the rated speed and horsepower, and a service factor of one.

Provide housings of welded steel construction, or heavy duty cast steel, and duly stress relieved. Provide dowel pins at all parting seams for accurate gear and bearing alignment.

Provide large rugged lifting lugs for each housing section. Provide removable inspection covers on the housings to facilitate viewing of all the gearing (except differential gears) and meeting all requirements detailed herein. Extend the reducer bases sufficiently past the body of the reducers to allow for drilling and reaming of the mounting bolt holes, and for bolt installation from above the base. Provide a minimum edge distance of 1.35 times the bolt diameter, to the centerline of the mounting bolt on the mounting pad. Provide adequate thickness and width at the base to reduce the stress on mounting bolts. Provide clearances for hydraulically tensioning the reducer support anchor bolts.

Sandblast clean the inside of housings prior to assembly and protect from rusting. Equip the gear boxes with a means for filling and draining; provide shut-off valves for the drains. For observing the lubricant level in the gear box, provide both a dipstick and a sight level gauge.

In all cases where the design standards for gear boxes or the Specifications are in conflict with another, design for the more conservative standard.

Manufacture reducers in accordance with the requirements of AASHTO LRFD Movable Highway Bridge Design Specifications, and provide the following information on the nameplate:

Serial Number

Manufacturer’s name and address

Type, model and size of gear box

Gear reduction ratio

Service power rating

High speed shaft rpm

Service factor

Lubrication specification, viscosity in SSU

AGMA symbol and Gear Accuracy Class

Attach name plate at reducer manufacturer facility. Provide automatic lubrication of the gears and bearings when the unit is in operation, using a bath lubrication system. All components in the gear box, which require lubrication, shall be partially submerged in an oil bath. Use a splash lubrication system only when the configuration of gears and bearings prevent bath lubrication. Splash lubrication systems must continuously lubricate all gears and bearings properly, when the unit is in operation. Design splash lubrication systems such that equal lubrication is supplied to each internal component for both directions of operation. Oil feed troughs may be used to supply oil to bearings and gears, which are above the bath. Provide lubricant meeting viscosity and other requirements of ANSI/AGMA 9005-E02, Industrial Gear Lubrication. Do not use pressurized lubrication systems for gear boxes unless specifically approved by the Engineer or specified in the Contract Documents. When a pressurized lubrication system is required for the reducer, provide a redundant lubrication system so that both systems operate concurrently. Provide a contact for remote alarm indication in case of a lubrication system malfunction.

Provide inspection covers on reducers for inspection of all gears, bearings and other internal devices. Locate covers on the side above the oil level, if practicable, so that oil draining is not required for inspection. If covers are located below oil level, engrave on the cover “Drain oil before removing cover.” Size the access covers such that minor repairs could be made to reducers without requiring housing disassembly. Provide the inspection cover with seals that do not require replacement when access covers are opened. Provide handles on the cover.

Provide breathers that are water barrier type with an indicator to show the moisture state. Locate breathers above the maximum oil levels in all positions of the reducer during operation, and its piping entering the unit at the highest point possible. Breathers shall not be mounted in bearing caps.

Mount oil level indicators in locations that can be easily viewed by maintenance crews. Provide a graduated sight gauge. Vent the indicator back to the case. Provide sight gauges of rugged construction, and protected against breakage.

Locate oil drains, fitted with a stainless steel ball valve with a pressure-temperature rating of 200 psig and 200° F, at the lowest point possible. Provide a plug on the open end of the valve. Provide a hand-operated lever for the drain that can be locked in the closed position.

Provide two oil sampling cocks, one located at the lowest level of oil and one just below the upper oil level, in accessible positions on the reducers.

Design gear boxes to accommodate oil expansion due to churning and temperature change.

Locate grease fittings for grease lubricated bearings at readily accessible locations.

Provide internal seals between the bearing housing and the gear oil to prevent interaction between grease and oil.

Provide bearing shaft ring seals of the mechanical type, dual lip, spring-loaded oil seals that compensate for wear. For custom build boxes provide two lip seals separated by grease cavity. Both lips should be facing inward. Provide grease vent and seal cover plate for seal protection.

Reducer foundations shall extend past the body of the reducers to allow for mounting bolt hole reaming and bolts installation from above the unit

Provide shaft extensions of the arrangement, lengths, and diameters, if shown in the Plans.

Assemble hubs of gear couplings on the shafts, with a shrink fit, in the shop.

All seals covers and keepers shall be stainless steel AISI 316 or similar. All bolts, nuts and washers shall be hot dip galvanized per ASTM A153 or ASTM F2329. Nuts must meet supplemental requirement S1 and S2 per ASTM A563.

All input and output shafts shall be hard chrome plated (with an undercoat of electrodeposited nickel) from the area of a contact with seals up to the end of the shaft.

The coupling seats could be chrome plated or left uncoated per manufacturer recommendation. Surface preparation and hard chrome plating shall conform to QQC-320, Class 2E specification with an undercoat of electrodeposited nickel. Grind chrome plated shafts in the area of seal contact or where required by manufacturer. Provide final chrome thickness not less than 0.002 inches over an undercoat of electrodeposited nickel in thickness not less than 0.001 inch.

Factory-finish the gear boxes (external surfaces only) with thermal sprayed metalizing per Paints and Protective Coatings of Structural Steel of this Special Provisions. Paint for painting the interior of gear housings shall be special oil-resistant crankcase paint.

B.2.2 Speed Reducer Shop Drawings

Provide the reducer design calculations and drawings to the Engineer for approval before the fabrication of the unit.

Submit shop drawings showing interface with other equipment, and including the following:

1. main drive gear boxes with bill of materials,
2. ratios, dimensions, construction details, and AGMA ratings,
3. Installation, Operation and Maintenance Manual sheets,
4. operational experience record for model supplied,
5. product data for all components,

6. certified test data for all factory tests and As-Built Plans,
7. calculations including AGMA ratings for gear sets, bearing ratings, and shaft sizing.

Submit a certified print of each gear box drawing, showing:

1. all external mounting dimensions including shaft sizes, bores, and keyways,
2. ratings that will appear on the nameplate,
3. location of all lubricant connections,
4. lubrication recommendations,
5. section views, with part numbers for each component.

Show all steel designations, AWS welding symbols, and net weld lengths. Submit product data for all bearings.

Submit manufacturer's installation instructions, operation and maintenance data.

Submit results of weld testing, and shop full load testing of reducer(s).

B.3 Motor & Machinery Brakes

The motor brakes function to stop the bascule leaf under emergency stops and to hold the leaf stationary against wind and unbalance loads. During normal operation the span drive will stop the leaf and provide all necessary dynamic braking and control. Machinery brakes function primarily to hold the span against high wind loads. The machinery brakes also function to assist in stopping the bascule leaf under emergency stops should the motor brakes alone fail to do so. Set and adjust brake application times such that under an emergency stop in low wind conditions (equal to or less than AASHTO “Condition A”) the machinery brakes do not engage until after the motor brakes have fully set and stopped the leaf.

Provide motor and machinery brakes of mill duty quality, manufactured to AISE-NEMA Standards, and conforming to the ratings, sizes and mounting arrangements shown on the Plans. Provide drum and shoe brakes of 230/460 VAC, 3 phase, 60 Hz, spring applied, electro hydraulic thruster released type. All dimensions conform to the AISE Standards.

Provide all brakes from a single manufacturer, with a minimum of 10 years of experience supplying brakes to the movable bridge industry.

Provide stainless steel pins and clips, or other approved corrosion resistant material. Nitride all steel components for corrosion protection and resistance to wear, scuffing and fatigue prior to surface painting. Coat all items with the manufacturers’ special paint and application process required for corrosive atmospheres. Submit process documentation. Other surface processes, such as, hard chrome plating, nickel plating or hot-dipped galvanizing must be submitted and approved.

All main pivot points shall contain a bolted bushing assembly manufactured from corrosion resistant material. The outer bearing race shall be a Teflon/Dacron material for a self-lubricating surface and the inner race shall be made from nitrided steel. The use of needle type bearings or the use of pins as a pivot point is not acceptable.

Actuator: Provide a waterproof, dustproof IP65/NEMA 4 brake actuator enclosure of cast aluminum alloy, fitted with double shaft seals. Ensure the thrustor motor is of ample capacity for the intended application. Actuator design to be independent of direction of motor rotation. Ensure that the rated stalled thrust of each thrustor is not less than 135% of the thrust actually required to release the brake with the torque adjusted to the continuous rated value. Brakes are to set automatically when the thrustor motor is de-energized. Note: When the bridge is in the closed position the brake will be horizontal. When the bridge is in the full open position the brake will be a 70° angle with actuator above the brake wheel.

Use hydraulic oil specifically recommended by the thrustor manufacturer with a free operating temperature range between -10°F and +120°F.

Torque Spring: External torque spring, infinitely adjustable down to max. 40 percent of full rated torque, fully enclosed with calibrated torque indicated. Physically field verify the motor and machinery brake torque setting to be within +10% and -0% of the factory set torque. Adjust setting if needed and demonstrate conformance. See plans for minimum torque capacities/setting.

Adjustments: Provide for self-adjustment for lining wear to sense the need for adjustment every time the brake sets and make correction next time the brake releases, and resistant to externally caused vibration. Provide for auto-equalization such that when the brake releases, running shoe clearance is automatically equalized and maintained. Locate to be immune to accumulated dust and be easily serviced. Provide

adjustable time delay for setting the brake. Provide thrustor actuator with an independent internal time delay valve constructed of stainless steel, adjustable between 0 and 5 seconds for setting the brake. Provide for step-less adjustment between the minimum and maximum settings, adjustable with the brake in full service.

Manual Release: Provide a manual release lever that is self-locking in the released position. Mount the hand release attachment permanently on the brakes, arrange such that the brake is releasable manually without the use of apparatus not permanently attached to the brakes. Provide a hand release that is releasable without removing the brake cover. Ensure the mechanism latches in both the released and non-active positions, provides, at a minimum, 90% of the power release stroke, and not inhibit the working stroke of the actuator when fully retracted. Provide brakes that do not require more than 50 lbs of force to release the brake manually.

Limit Switches: Provide electro-mechanical, lever-operated, brake mounted limit switches for indication of brake released, brake set and brake manually released. Utilize three independent limit switches with two N.O./N.C. contacts per switch rated for 120 VAC. Each lever type limit switch shall provide snap action double pole, double throw, contact blocks rated 10 amps at 120 VAC with high snap-through force to minimize contact rebound. Heavy duty, oil tight, NEMA type 4X construction with sealed bodies and pig-tail leads. Provide 316 S.S. lever arms with length required for application.

Brake Enclosure: Provide brake enclosures manufactured from 14 gauge aluminum. Enclosures shall be attached to the brake support weldment, approximately ½" below the bottom of the brake, with two ¼" fasteners at each side of the enclosure. Brake enclosures shall be one piece with a hinged lid. The lid shall be fitted with a lanyard to prevent over-travel of the hinges when the lid is in the open position. The lid is to be configured with the handle of the lid on the actuator side of the brake and the hinge located on the opposite side. The lid shall be configured with a locking device to keep the lid closed when not in use.

The brake enclosures shall be supplied with one slotted hole for the brake release handle. The shaft slot shall be left blank and fabricated at the time of installation.

Shoes: Provide self-centering brake shoes that are easily replaced from either side of the brake frame without disassembling the top brake connecting rod or pull rod, and without disturbing the torque adjustments.

Provide brake shoes that are worn into the brake drum provided with the brake.

Brake Wheels: Supply brake wheels manufactured from ASTM A276 Type 316 Stainless Steel. Machine bore and keyway to obtain the specified fits with mating shaft. Mount the brake wheels to the shafts with an FN2 fit. Mount motor brakes on the input shaft extensions of the primary reducer, and the machinery brakes on the input shaft of the secondary reducers, unless otherwise indicated on Plans. Do not use brake wheel couplings. Check, document and submit "run-out" measurements for all brake wheels. Dynamically balance all brake wheels 16 inch diameter and larger.

Nameplates: Provide each piece of mechanical equipment and apparatus with permanent, stainless steel nameplate on which is engraved the name of the Manufacturer, the catalog or model number, push capacity of the actuator, stroke of the actuator, volts, phase, HZ watts, and the braking torque with lettering a minimum of 0.125 inch high and 0.015 inch deep. Nameplates on all proprietary elements must be readable, clean, and free of all paint before acceptance of the machinery.

B.3.1 Shaft Journals

Turn journal bearing areas on shafts and pins and polish with no trace of tool marks or scratches on the journal surface, and no step between the journal surface and fillet. Provide running fits between journals and bearings, in accordance with ANSI Class RC6.

B.4 Open Gears

Provide spur gears with 20-degree full-depth involute teeth, cut in accordance with ANSI/AGMA 201.02, unless otherwise specified or shown in the Plans. Cut gears from solid rims or blanks. Machine-finish the outside diameters, and the sides, of all pinions and racks. Accurately scribe pitch lines to a depth of 0.031 inch on both sides with a V-pointed tool. Provide 0.01-inch tip relief on both sides of each tooth and round the top edges of all teeth to a 1/32-inch radius. The working surfaces of all gear teeth shall be true to the proper outline, accurately spaced on the true pitch circle, smooth, and free from cutter ridges, with an arithmetic average roughness height (Ra) of 125 micro-inches or finer, unless otherwise shown in Plans.

Remove cutter burrs from all edges of the teeth. Except as otherwise provided herein or on the Plans, cut all open gearing to meet the requirements of ANSI/AGMA 2015-1-A01, Accuracy Grade A10 or better.

State the AGMA accuracy grade on the shop drawings. Furnish racks and pinions with all other requirements as shown in the Plans.

B.5 Racks

Fabricate the racks from ASTM A668 Class J forgings. Furnish racks with a circular pitch, number of teeth and other parameters as indicated in the Plans. Machine cut 20 degree involute teeth with 0.01-inch tip relief on both sides of each tooth and round the top edges of all teeth to a 1/32-inch radius. Remove all cutter burrs from all edges of all teeth. Except as otherwise provided herein or on the Plans, cut all open gearing to meet the requirements of ANSI/AGMA 2015-1-A01, Accuracy Grade A10 or better. Inscribe a "V" shaped with a 60 degree included angle and a depth of 0.031-inch pitch line on both ends of all rack teeth.

Ultrasonically examine the forged of the racks in accordance with ASTM A388 prior to welding unexplained indications. Loss of back reflection, using the straight beam method will be cause for rejection. Replace any rejected forging at no cost to the Department.

Assemble the racks to the bascule girder in the field. Holes may be sub drilled (1/16-inch under nominal diameter) in the shop prior to assembly with the bascule girder. Once the rack has been located and aligned on the bascule girder as shown on the Plans, drill the holes in the bascule girder and ream for turned bolts using the holes in the rack as a template.

B.6 Shafts

Provide forged shafts, including those having integral flanges or pinions, homogeneous and reduced to size from a single bloom or ingot at no less than red heat. Ensure the blooms or ingots have a cross sectional area at least three times that required after finishing and that the finished product is free of injurious flaws such as seams, pipes, or cracks. Report hot rolling reduction ratio. Provide forged shafts over 8 inches in diameter with a hole bored lengthwise through the center, about 1/5 the diameter of the shaft.

Test shafting materials for mechanical properties and furnish certificates to the City. Evaluate mechanical properties in accordance with the test methods and definitions of ASTM A 370. Ensure that finished shafts are free of camber and will run without vibration, noise or chatter at all speeds up to and including 120 percent of design speed. Provide all shafts and pins with accurate finishes. Ensure they are round, true, smooth and straight, and have round fillets and shoulders. Provide ample radii at fillets. Blend in all fillets and shoulders smoothly to the adjacent surfaces, without tool marks or scratches. Unless otherwise required herein or on the Plans to have a finer finish, ensure the surfaces have a maximum ANSI roughness average of 16 micro-inches.

Furnish shafts conforming to tolerances in ASTM A29, unless otherwise indicated. Ensure that straightness tolerances for turned, ground and polished shafting do not exceed 0.002 inch per foot for shafts, up to and including 1 1/2 inch in diameter, and 0.003 inch per foot for shafts over 1 1/2 inch in diameter. At any measuring position when the part is rotated 360 degrees about the datum axis, with the indicator fixed in a position normal to the true geometric shape, the circular runout tolerance of shafts shall not exceed 0.020 inch FIM (Full Indicator Movement), and pins not exceed 0.004 inch FIM. Unless otherwise required 107 of 257

herein or in the Plans to have a finer finish, the non-mated surfaces shall have maximum roughness of 125 micro inches.

Provide each end of all shafts, when finished to the required lengths, with a 60 degree lathe center, with clearance hole, at the exact center of the shaft. Prepare the ends of shafts that are bored with an inspection hole for the attachment of a centering device equivalent to the lathe center. Furnish all such devices as part of the work.

Rolled material is acceptable for shafting and pins up to 4 inches in diameter. Test all cold-finished shafting for its mechanical properties and furnish a test certificate to the Engineer. Ensure that cold-finished shafts are free from camber and run without vibration, noise, or chatter at all speeds up to and including 120 percent of design speed. Ensure all hubs mounted on the ends of cold-finished shafts have the fit specified herein or on the Plans. To obtain the required fit between hub and shaft, furnish the cold-finished shaft 0.060 inch larger than the nominal diameter specified and turn the ends to the required dimension for the hub. Furnishing any cold-finished shaft of one diameter end to end is permitted provided the shaft has tolerances selected from the normal manufacturing range to provide the specified fit. Show the selected tolerances on the shop drawings.

Accurately machine and polish all journal-bearing areas on shafts and pins, with no trace of tool marks or scratches, or steps on the journal surface and the adjoining shoulder fillets. Burnishing of the shaft journal

areas and adjoining shoulder fillets to a mirror finish is acceptable in lieu of polishing, provided that burnishing is done with a Stellite roller or equal. Provide and install journals and bearings to an ANSI RC6 running fit unless otherwise noted in the Plans.

B.7 Motor Couplings

Flexible couplings shall be grid-type, self-aligning, fully flexible, torsionally flexible couplings intended to connect electric motors to machinery components. Grid-type couplings shall have steel hubs, alloy steel grids, and steel or aluminum covers. Bolts in the covers shall be shrouded. Motor couplings shall meet the requirements of Sub-article 6.7.9.3 of the AASHTO Movable Specifications. Couplings shall be a standard product of an established Manufacturer. Provision shall be made for introducing lubricant to all contact surfaces.

B.8 Flexible Couplings

Finish boring and cutting of keyways in couplings shall be done by the coupling Manufacturer or the Manufacturer's designee to limits specified on the Shop Drawings. Ship finished couplings to the proper location for installation on shafts by the Manufacturer of the connected component. Install coupling halves on reducer shafts and other shafts as per the coupling Manufacturer's installation instructions. Coupling-shaft fits shall conform to H7/s6 (FN2) fit, unless otherwise noted in the Contract Documents. Manufacturer recommended coupling alignment tolerances apply. Flexible couplings shall meet the requirements of Sub-article 6.7.9.3 of the AASHTO Movable Specifications. Couplings shall be a standard product of an established Manufacturer. Provision shall be made for introducing lubricant to all contact surfaces.

B.9 Steel Castings

Provide steel castings that are true to pattern in form and dimensions, free from pouring faults, sponginess, cracks, blow holes, and other defects. Sandblast or otherwise effectively clean castings of scale and sand, to present a smooth, clean, and uniform surface. Finish all edges of castings with rounded corners and provide ample fillets on all inside angles. Provide adequate material allowance for all surfaces requiring finish for machining to finish dimensions. Finish all surfaces of castings in contact with other metal to 125 micro-inches as measured under ANSI B46.1, unless a finer finish is specified by the plans. Where castings are machined, the thickness of the metal after finishing shall not be less than the thickness shown on the plans. Provide machined bosses to give proper seats for bolt heads and nuts.

Blow holes appearing upon finished castings shall not have a depth injuriously affecting the strength of the casting. Weld minor defects, which do not impair the strength, by an approved process, with the approval of the engineer, and inspect by magnetic particle examination.

Perform visual surface examinations per ASTM A802 criteria for Level II and requirements of MSS SP-55 for every steel casting. Perform liquid-penetrant exams in accordance with ASTM E165, or magnetic particle examination in accordance with ASTM E709 on every casting to detect surface and near-surface flaws. Perform ultrasonic inspection on every casting in accordance with ASTM A609 that meets the requirements of Level 2 (Procedure A) or Level 3 (Procedure B) for castings with cross sections in both directions thicker than 4 1/2 inches. Meet the requirements of Level 1 (Procedure A) or Level 1 (Procedure B) for thinner castings.

Reject steel castings that do not meet all of the above examination criteria. Reject castings that have been welded without the engineer's approval. Reject steel castings that do not have adequate thickness to "clean up" during machining.

Retain and deliver all patterns, not including wire rope sheaves and wire rope fittings, to the engineer. Make all patterns for castings neat, strong and durable of thoroughly seasoned, first-class pattern lumber. Proportion the pattern to suit the shrinkage of the particular metal to be cast from them and allow adequate thickness for tool finish mating with other components. Round the outstanding unfinished edges of all ribs, bases, etc., to a radius of one-fourth the thickness of the ribs, bases, etc., and fit inside corners with wood or leather fillets with a radius of at least one-half the thickness of the thinnest member forming the corner.

Provide all patterns with lifting and rapping plates, set flush with their surfaces. Provide a metal plate bearing the letters "RACINE ST. BRIDGE" in sharp gothic style, at least three-fourths inch high in each pattern outside of the casting region.

Stain patterns black on surfaces unfinished on castings, red on surfaces tool finished, and yellow or clear shellac on core points. Varnish the patterns before use with first-class pattern shellac, and repair after final use. Clean and varnish again before delivery to the engineer.

All patterns shall be subject to inspection and approval by the engineer before castings are made from them and again on final delivery to the engineer.

B.10 Steel Forgings

Use annealed forgings where possible. Reduce to size all forged shafts from a single bloom or ingot until perfect homogeneity is secured. For all forged shafts provide a bloom or ingot cross-sectional area of at least three times that required after finishing. Forge material only at temperature greater than or equal to a red-heat. Provide forged rounds for shafts that are true, straight, and free from all injurious flaws, seams, or cracks. Prior to heat treatment, bore a hole lengthwise through the forging for shafts with a finish diameter greater than eight inches. Provide forgings with adequate material allowance for machining to finish dimensions. Reject all shafts with areas that do not clean up after machining. Inspect forgings with ultrasonic evaluation per the conditions of ASTM A668 supplement requirement S7 and Practice A388. Submit all test results to the engineer. For forgings that are to be welded to plate steel, ensure that the forgings meet the requirements of ASTM A668 supplement requirement S4 for low carbon content.

B.11 Fasteners

B.11.1 General

Sub-drill all holes for connecting machinery parts to the supporting steel at least 1/32 inch smaller in diameter than the finish diameter, unless otherwise specified. Line ream at assembly with the mating part for proper fit after the parts are correctly aligned.

Furnish positive locks for all nuts. Provide double nuts for all connections requiring occasional opening or adjustment. For connections with single nuts, provide lock washers made of tempered steel and conforming to the SAE regular dimensions. Provide lock washers of material that meets the SAE tests for temper and toughness.

Use beveled washers where bearing faces have a slope of more than 1:20 with respect to a plane normal to the bolt axis.

Provide fasteners manufactured in the United States correctly marked on top of the head with identification of the property, class and source.

Clean all contacting surfaces of machinery elements and structural steel to be bolted together in accordance with the standard specifications before bolting.

Provide bolts, nuts, and cap screws that conform to the coarse thread series and have a Class 2 tolerance for bolts and nuts or Class 2A tolerance for bolts and Class 2B tolerance for nuts in accordance with the ANSI B1.1, "Unified Screw Threads."

All bolt heads and nuts shall bear on seats square with the axis of the bolt. On castings, except where recessed, furnish finished bosses or spot-faced seats. Provide square bolt heads for recesses in castings. Spot face all bolt holes through unfinished surfaces for the head and nut, square with the axis of the bolts.

B.11.2 Turned Bolts (Machinery to Machinery Supports)

Use turned bolts for all connections of machinery to supports. Provide turned bolts that conform to the requirements of ASTM Specifications F3125 Gr. A325. Provide nuts, and hardened washers that conform to the requirements of ASTM Specifications A563, and F436, respectively. Turn the diameter of the shank such that it is 1/16-inch larger than the diameter of the threads. Supply a surface finish of 63 micro-inches as measured under ANSI B46.1. Use hexagonal heads and nuts in accordance with the heavy series specified in ANSI B18.2.1. Use two nuts or one nut and a lock-washer on turned bolts. Lock washers will only be permitted if approved by the Engineer. Carefully ream holes for turned bolts in mating structure to provide for an ANSI B4.1 LC6 fit with the body of the bolt.

B.11.3 High Strength Bolts (Machinery Supports to Steel Structure)

Use high strength bolts for connections of supports to steel bridge structure. Provide bolts, nuts, and hardened washers that conform to the requirements of ASTM Specifications F3125 Gr. A449, A563, and F436, respectively. Drill holes for bolts 1/32 inch larger than the diameter of the bolt. All high strength bolts, nuts, and washers shall be zinc coated with a Class 50 mechanically deposited zinc coating in accordance with the requirements of ASTM B695.

B.11.4 Anchor Bolts (Machinery Supports to Concrete Structure)

Use embedded stainless steel bolts that conform to ASTM F593 for connecting machinery supports to concrete structures. Use stainless steel nuts that conform to the requirements of ASTM F594, and stainless steel washers. Use double nuts on all anchor bolt connections.

B.11.5 Socket Head Screws

Where socket-head cap screws are used, provide screws that conform to ANSI B18.3, made of cadmium-plated heat-treated alloy steel, and furnished with a self-locking nylon pellet embedded in the threaded section. Provide set screws of the headless, safety type; threads of the coarse thread series; and cut points. Do not use set screws to transmit torque nor as the fastening or stop for any equipment that contributes to the stability or operation of the bridge.

B.12 Keys and Keyways

Provide square and rectangular keys and keyways that meet ANSI B.17.1, except where specified herein. Provide closed-end, milled keyways in the shaft to hold all keys in place. Provide clearance between keyways and bearings. Where one key is used, provide a key with an ANSI B4.1 LC4 fit with the keyway. Where two keys are used locate them 120 degrees apart and provide an ANSI B17.1 Class 2 fit between keys and keyways. Finish keys and keyways to a roughness value of 63 micro-inches as measured under ANSI B46.1.

Furnish keys that are machined from carbon steel forgings, ASTM A668, Class D, unless otherwise specified in the contract documents.

B.13 Bearings and Bushings

Select anti-friction bearings to provide for an ABMA rated L-10 life of 40,000 hours. Use pillow block bearings, adapter mounted, self-aligning, fixed or expansion versions as required. Use cast steel housings capable of withstanding the design loads in any direction, including radial up-lift. Cast the mounting bases without bolt holes. Mounting holes may be sub-drilled in the shop and then final drilled and reamed with the supporting structures, after alignment in the field. Provide units that are grease lubricated and have provision for re-lubrication through fittings in the housings. Provide triple lip shaft seals, mounted in the housings, capable of retaining the lubricant and preventing the entry of water and foreign materials.

For sleeve bearings, provide cast bronze that meet the requirements of castings above. Finish machine the outside diameters of the bushings to provide an ANSI Class LC-1 fit with their associated housing bores, unless specified otherwise in the Plans or herein. Provide sufficient stock in the bushing inside diameter to permit final machining of the bore after assembly in their housings with the full liners in place. Polish bushing bores to a surface texture of 16 microinches in accordance with ANSI B46.1 and provide an ANSI B4.1 RC6 fit between bushing and shaft. Provide grease grooves that have smooth edges that blend smoothly in the bearing surface. Provide entry holes for the grease fittings that intersect and lie completely within the grooves. Provide machine cut grease grooves.

Provide bushing of ASTM B 22 Copper Alloy, and liner of ASTM B 36 Copper Alloy.

Provide bushings on machinery shafts of the split type, mounted to the base and the cap. Provide an ANSI B4.1 Class LC1 locational clearance fit between the bushing outside diameter and housing. Provide the same fit between flanges and the end faces of the base and cap of double flanged bushings. Fit bores with shaft journals to achieve an ANSI B4.1 Class RC6 running fit. Turn bushings with a 1/4 inch gap between the bushing halves to suit the liner thickness. Include in each liner pack, one each of 1/8 inch, 1/16 inch and 1/32 inch thickness, and the rest in 0.003 inch laminations. Cut liners to fit shoulder fillets and to be square with bushing flanges, with bolt holes drilled through them. Provide bushings with spiral grease grooves such that the grooves intersect at the center of each bushing half. Provide all grease lubricated bronze bushings 8 inch in diameter or less with grease grooves cut in a spiral pattern for the full length of half the bearing, unless otherwise shown on the Plans. Machine cut all grease grooves smooth with edges that blend smoothly into the bearing surface. Provide grooves 3/8 inch wide at the bearing surface, and rounded to a 3/16 inch radius at the corners, unless otherwise shown on the Plans.

B.14 Shims

Provide stainless steel shims required for leveling and alignment conforming to ASTM A240, Type 304, sub-drilled for all bolts that pass through and trimmed to the dimensions of the assembled unit. Final drill and ream the shims at assembly with the components and structures. Provide shim packs capable for adjustment from 0 inches to twice the nominal shim pack dimension. Provide sufficient thicknesses to permit 1/64 inch variations of the shim allowance plus one full allowance shim. Corrosion resistant precision thickness shims shall be supplied at no additional cost to the City if for any reason the tolerance

on the plans cannot be achieved with shim increments of 1/64 inch thickness. Shims with slots or slotted holes will not be permitted.

B.15 Welding

Ensure that welding required or designated in the Contract Documents conforms to the American Welding Society (AWS) Specifications. Inspect all weldments utilizing Ultrasonic Testing or Radiographical Testing as per ASTM E164 and AWS D1.1. Stress relieve all shop welds. Submit shop drawings that include procedures for field structural welding with inspection requirements stipulated in the Contract Documents for approval by the Engineer prior to start of welding. Do not machine components until after welding and stress relieving.

Include a certified copy of a test report showing the chemical composition of the specific steel piece(s) to be welded in any welding procedure involving attachment to existing steelwork. Consider this chemical composition in the welding procedure.

Ensure all welding required or designated in the Contract Documents conforms to the appropriate AASHTO and American Welding Society (AWS) Specifications for the material being welded.

Perform welding of steel in accordance with the ANSI/AASHTO/AWS D1.5 Bridge Welding Code.

Groove welds to be complete joint penetration groove welds (CJP). Ensure the fitting up and welding procedure is such that distortion of the work will be a minimum. If necessary to obtain this result, use suitable welding fixtures. Unless otherwise specifically stated, stress relieving is required for welded machinery parts prior to final machining.

Inspect all weldments utilizing non-destructive tests (i.e., via dye penetrant checks supported by Ultrasonic Testing or Radiographical Testing as required by the AASHTO/AWS D1.5 Bridge Welding Code or the Contract Documents.

Submit, in shop drawing form (i.e., with inspection requirements stipulated in the General Notes of the Drawing), procedures for structural welding to be permitted in the field, for approval by the Engineer, before welding is begun.

Do not paint welded components until welds are inspected and approved.

Clip Stiffeners as necessary to avoid overlap or clear fillet welds by a minimum of ¼". Break all sharp edges. Where CJP is not required, mill all vertical plates to bear on horizontal plates prior to welding.

Galvanize all weldments supporting machinery using the hot dip process per ASTM A-123. Galvanize after welding, stress relief and machining. Mask Surfaces machined to contact machinery bases (connection to structural beams and concrete/grout to remain galvanized). Re-machine as necessary to remove excess galvanizing and correct flatness of any surfaces that distort during galvanizing. After installation, hand tool clean exposed surfaces of galvanized weldments and apply a coating per this specification.

B.16 Machinery Base Supports and Brackets

Provide machinery base supports that are constructed of welded steel plate. Select plates of proper thickness to allow for final machining. Indicate initial and final machined thicknesses on shop drawings.

Mill top and bottom surfaces of all machinery base supports after fabrication to provide a uniform surface. All surfaces requiring milling shall have adequate material allowance for milling to the minimum finish dimensions as required by AASHTO Movable or as shown on the Plans.

Hot-dip galvanize and paint with the approved two-coat paint system all machinery supports and brackets after fabrication.

Weldments for machinery base supports including all brackets shall be neat and free from any defects including weld spatter or porosity. Remove all exposed sharp corners and edges. Mounting surfaces of the machinery base supports shall be straight and flat such that full contact with the equipment being supported or retained is obtained.

Examine all fillet welds and partial penetration groove welds by the magnetic-particle method in accordance with the requirements of Section 6 of AASHTO/AWS D1.5. Examine all complete joint penetration groove welds in butt joints by radiographic testing. Examine all complete penetration groove welds in T-joints and corner joints by ultrasonic testing.

All complete joint penetration welds shall be tested in accordance with the requirements of Section 6 of AASHTO/AWS D1.5 for each size and type weld. Inspection and testing of welds and basis of acceptance shall be in accordance with the requirements of Section 6 of AASHTO/AWS D1.5.

B.17 Machinery Guards

Provide machinery guards for all moving parts readily accessible to personnel, including but not limited to the following:

1. Couplings (Drive Machinery)
2. Unused shaft extensions
3. Shafts at platform and roadway level
4. Brakes
5. Instrument drives and limit switches

Design and fabricate machinery guards in accordance with ANSI B15.1. Machinery guards are not required for the rack segments and pinions, unless shown on the Plans.

Fabricate guards from expanded or sheet metal and structural shapes to withstand a load of 350 pounds applied vertically without any permanent deformations. Provide finger tightened fasteners, hinged covers, and other features to enable removal by one person and for easy access toward maintenance and inspection. If a guard cannot be removed by a single person due to size and weight, removable access ports shall be incorporated at all critical inspection locations. Bolt the guards to the machinery supports, adjacent structural steel or supporting concrete. The machinery guards are not shown on the Plans. Provide complete details of all machinery guards on shop drawings.

Unless otherwise indicated or specified, provide machinery guards of AISI Type 316 stainless steel, minimum 12 gauge. Removal of the guard shall not require disassembly of any machinery component.

Locate removable covers such that access to lubrication fittings is not blocked. If this is not possible due to the location of the fitting, mount a remote lubrication fitting on the cover or other easily accessible location and route a flexible stainless steel line to the lubrication fitting. Phenolic nameplates shall be provided on these covers with lubrication instructions.

Machinery guarding sheet metal shall be stainless steel construction. Structural shape supports shall be either stainless steel or aluminum.

B.18 Non-Shrink Epoxy Leveling Grout

Use a Non-Shrink Epoxy Leveling Grout where required for chocking, leveling and supporting equipment. Use a Non-Shrink Epoxy Leveling Grout that is a two component, pourable, epoxy-based grouting compound manufactured for use in severe applications. Use Non-Shrink Epoxy Leveling Grout manufactured for use in a thickness range shown in the Plans or detailed in approved shop drawings for each application.

Use Non-Shrink Epoxy Leveling Grout having the following minimum properties:

Minimum Compressive Strength: 19,000 PSI

Maximum Linear Shrinkage: 0.0002 in/in

Minimum Tensile Strength: 4,970 PSI

Fire Resistance: Self Extinguishing

Store, mix, place, and finish Epoxy Leveling Grout in strict accordance with the Manufacturer’s recommendations.

B.19 Lubrication

B.19.1 General

Standardization of the lubrication for the mechanical and electrical systems is required. Coordinate with all the system suppliers to ensure that the type of lubricant supplied shall be kept to as few as possible.

B.19.2 Lubrication Fittings

Provide standard grease fittings for a pressure system of lubrication for all bearings and surfaces requiring external lubrication. Do not use more than two sizes of fittings. Use the large size wherever possible and use the smaller size for motor bearings and other small devices. Provide pressure fittings rated at a minimum 10,000 psi. Provide fittings with a steel check valve that will receive grease and close against backpressure.

Locate the fittings to conveniently facilitate lubrication. Connect the lubrication ports to central stations using ¼ inch stainless steel, seamless pipe with stainless steel fittings. Use pipe extensions that are as short as possible and securely supported.

Upon completion of fabrication plug all grease fitting locations until the components are installed and regular lubrication is started. Immediately after erection and prior to operation lubricate all rotating and sliding parts.

Provide removable hinged or bolted covers in order to access lubrication fittings and other routine maintenance devices that might be covered by machinery guards.

B.19.3 Enclosed Gear Reducer Lubrication

Provide Purus 220, or approved equal, synthetic lubricant for wider applicable viscosity range in varying temperatures. Lubricant shall meet the requirements of AGMA Standard 9005 “Lubrication of Industrial Gear Drives.” Provide lubricants manufactured by a reputable and knowledgeable supplier of lubrication and as recommended by the reducer manufacturer. The lubricant shall contain oxidation inhibitors, rust inhibitors, anti-foaming agents, and anti-wear additives. Follow recommendations of both the reducer manufacturer and the lubricant manufacturer with respect to maintenance of the lubricant, method of application, and relubrication intervals.

B.19.4 Open Gear Lubrication

Provide open gear lubricant that bonds strongly to gear teeth to maintain a continuous film on bearing surfaces despite high loading and high load repetition, contains an Extreme Pressure (EP) additive, repels water, resists throw-off and dripping, maintains consistency over wide temperature variations, and allows for ease in application and removal. Provide lubricant that has an operating range of 0 to 210°F and is considered a heavy bodied, adhesive type open gear lubricant by its reputable lubricant manufacturer. (Note: Some adhesive lubricants are available in a diluted form for ease of application. This type of lubricant is diluted with solvent that quickly evaporates after application leaving behind an adhesive tacky film. If such a lubricant is desired, the solvent must be non-flammable and the mixture must not pose any hazard to health). Provide a lubricant that meets the following requirements: Unleaded, non-diluent type, non-chlorinated open gear grease, SUS 7,000 at 100°F viscosity, water resistant, anti-wear/extreme pressure.

B.19.5 Bearing & Coupling Lubrication

Roller Bearings: Provide roller bearing lubricant, the maintenance of the lubricant, method of application, and re-lubrication intervals as recommended or approved by the manufacturer.

Sleeve Bearings: Provide lubricant approved for use in sleeve bearings by the lubricant manufacturer. Recommended Lubricant: NLGI No. 2 grease with rust and oxidation inhibiting additives, 280 Worked Penetration at 77°F, 340°F (or higher) ASTM D2265 Drop Point, SUS 900 at 100°F, water resistant, anti-wear/extreme pressure.

Couplings: Provide coupling lubricant and its maintenance as approved for use in gear couplings by the manufacturer.

Proprietary units: Provide lubricants approved by the manufacturer. Other units: Provide the lubricants specified in the latest edition of the Bridge Maintenance Manual.

B.19.6 Bulk Lubrication & Storage

Furnish the bridge with an appropriate amount of proper lubricant. Store the lubricant in steel containers at room temperature. Store, at the site, the following amounts of additional lubricant (turn over to the Department any unused lubricant):

- Gear Reducer Oil - 10% of the total reducer fill volume
- Open Gear Grease - 100 pounds
- Bearing Grease - 100 pounds
- Grid Coupling Lubricant - 25 pounds
- Gear Coupling Lubricant - 50 pounds

Keep the lubricant for each type of machinery component separately in clearly marked containers. Take all measures necessary to prevent lubricant contamination.

B.19.7 Remote Greasing Stations

Provide remote greasing stations for any lubrication fittings which are not easily accessible from the primary walking area, that are ergonomically accessed, or for any machinery component which would require any other method of access other than standing. Maintenance personnel shall not have to kneel, crawl, or dis-assemble any component in order to apply grease. For areas where traffic poses a danger to personnel, remote greasing station shall be accessible from the sidewalk. Exception shall be made for kneeling access on the sidewalk or bridge span deck only. No machinery guards or machinery shall need be removed in order to access the remote greasing station.

Mount all lubrication fittings for the remote greasing station on a single piece of stainless steel plate and provide flexible stainless steel hosing and piping between the remote greasing station and the machinery component. Size hosing and plumbing such that a normal amount of pressure is required at the remote greasing station in order to pump grease to the component. The required pressure to pump grease will be checked during functional checkout and subject to Engineer's discretion. Since the system is new, there shall be no discernable difference between the amount of pressure required at the remote greasing station and if the grease were being pumped directly into the component.

Where required, provide Type 316 stainless steel tube with Type 316 stainless steel fittings for lubrication tubing. Use Type 316 stainless steel hardware to secure lubrication tubing and fittings. Introduced grease directly into the grease grooves for distribution. Extend tubing from the bearings to convenient lubrication stations but keep lines as short as practical. In such cases, securely support and locate the tubing to protect it from damage and prohibit vibration during application of live load.

Supply one grease gun for each type fitting. Immediately after the completion of fabrication, plug all grease fittings until components are installed and regular lubrication is started.

B.19.8 Lubrication Charts

Furnish three (3) copies on laminated sheet or mylar full size (22 inches by 34 inches) as well as reduced 1/2 sized for inclusion in the operating and maintenance manuals. The lubrication chart shall show the location of all lubrication fittings and other points of lubrication for the new and existing mechanical and electrical equipment, which will require lubrication of any kind. The chart shall show the kind of lubricant to be used at each point and the frequency of lubrication. A full size print of the chart shall be framed under Lexan in a neat wooden frame with backing and shall be placed as directed by the engineer within the control house.

Submit the lubrication chart to the engineer for review and approval as a working drawing in accordance with this Special Provision. Final lubrication chart shall not be made until the chart has been approved by the engineer.

B.20 Spare Parts

Provide the following spare parts and tools to the Department, along with all spare parts required in this Technical Special Provision.

a. Two wrenches, drop forged steel, for each sized fastener.

b. One complete shim pack for each component.

c. Complete sets of seals for each type of antifriction bearing.

d. See additional requirements for spare parts in each specific section.

e. Two permanent storage cabinets. Provide heavy-duty storage cabinets of minimum 36 x 24 x 78 inch size steel frame with 16 gage minimum thickness and 22 gage minimum thickness sides, doors and shelves. Provide cabinets with inside surfaces of gear cases a minimum of four shelves, hinged doors and locking handle or heavy-duty padlocks and hasps. Install one cabinet in each bascule pier/abutment at a location determined by the engineer. Submit a list of all bolt, screw, and nut sizes to the Engineer along with the name, size, type, and manufacturer of the wrenches to be provided for review. Provide in each set, a wrench for each size and type of bolt, screw, or nut including any special hardware required as part of the Contract. Do not provide adjustable wrenches which fit more than one size bolt, screw, nut, or other item of hardware.

Deliver all spare parts, tools and supplies, including those required by other Articles to the maintenance office that oversees the maintenance of the machinery. Spare parts and tools are considered incidental to the component to which they apply.

B.21 Tools

Provide one set of wrenches suitable for machinery maintenance and to fit all nuts and bolt heads in the machinery installation. In addition, furnish a full set of flat head and Phillips head screwdrivers that will fit all machinery and furnish an assortment of punches, files, chisels, and a ball peen hammer.

Provide a cabinet made of galvanized steel of sufficient size to store the tools, lubricants, and grease guns. Provide a cabinet that is lockable with a padlock. Place the cabinet in a location designated by the engineer.

C Construction

C.1 Shop Fabrication

Give the City or its representative no less than ten (10) working days' notice before beginning work at foundries, forge and machine shops so that inspections and tests may be arranged. Provide the City with the names and locations of casting, forging and machining suppliers; and other suppliers; and furnish copies of orders that have been placed, prior to the start of any work.

Allow the inspector, designated by the engineer, free access and facilities for inspection of materials and workmanship in foundries, forge and machine shops. Such inspections are to facilitate work and avoid errors, but it is understood the contractor is not relieved of the obligation of assuring compliance with the plans and specifications or the necessity of replacing defective materials and workmanship. Any work performed while free access has been refused will be automatically rejected.

The inspector shall have full authority to reject materials or workmanship which does not fulfill the requirements of these special provisions.

Perform all testing and furnish test specimens, certified copies of chemical and physical tests and certificates of compliance to the engineer without additional charge. Initial acceptance of material and finished parts and assemblies will not preclude subsequent rejection if found deficient. Correction of the deficiencies and/or replacement of materials shall be the responsibility of the contractor. Any materials, components or assemblies rejected after receipt at the bridge site shall be removed and replaced without additional cost to the City.

C.2 Shop Inspection and Testing

Completely assemble all machinery components to assure they fit as required. Perform critical measurements to confirm conformance with the shop detail and assembly drawings.

C.2.1 Shop Testing and Inspection of Speed Reducers

Ensure the following information is provided:

1. NDT documentation for ultrasonic or radiographic testing all welds for all gearing components,
2. test reports for materials used in the manufacture of the gears and pinions,
3. heat treatment documentation for through hardening of the gears and pinions,
4. hardness quality control documentation,
5. lead, profile, spacing, and run-out measurements for gears and pinions,
6. summary computer printout of calculations for all gear/pinion sets,
7. specific design criteria for the gear box; i.e., material requirements on the housing, gears, pinions, shafts, bearings, seals, lubrication, factory finish, etc.

Provide two weeks' notice to the Engineer on the reducer testing schedule.

Secure the reducer to rigidly fix its position during all testing.

Provide temporary couplings for the reducer testing that are capable of operation at reducer test torque. Secure couplings to shafts using temporary keys and at least an FN1 shrink fit. These tests shall be run with the reducer filled to the dip-stick marked with new oil of the viscosity the manufacturer recommends on her/his lubrication chart for normal operation.

After testing and before field installation, drain and replace with new oil.

Immediately before the start of the test, and at half-hour intervals thereafter, the following measurements shall be made and recorded and the records shall be submitted with the Certificate of Compliance:

1. Temperature of ambient air.
2. Temperature of oil near bottom of crankcase.

3. Surface temperature of each shaft extension adjacent to shaft seal.
4. Sound levels at points above and at 3 feet distant from the unit. Record maximum sound level after measuring all around the reducer.
5. The temperature of the oil near bottom of crankcase shall not rise more than 40 degrees F from ambient during this test and no shaft shall experience a temperature rise of more than 60 degrees F from the ambient. The enclosed reducer manufacturer shall specify maximum test temperatures for specific points of the reducer and also criteria for rejection. The temperatures during tests shall not rise above what is specified by the manufacturer.

The noise level of the reducer shall not exceed 90db with the microphone held 3 feet from any point of the reducer housing.

During testing each speed reducer shall be checked for unusual noise (thumping or any non-uniformity), excessive bearing clearance, and any other unusual operating characteristics. The units shall operate smoothly, and without excessive vibration or temperature rise. All malfunctions shall be recorded and corrected, and the units retested if necessary before release from the manufacturer's shop. After the unit has passed the test, a Certificate of Compliance shall be submitted by the Contractor to the Engineer.

The proper operation of the lubricating system shall be demonstrated during the shop test.

Before the load test, demonstrate all initial gear contact by applying yellow compound to the gear teeth and hand rotating the input shaft. After the load test, demonstrate contact of all teeth through application of Prussian blue or red. Provide documentation of the teeth contact In addition to the test specified above, the proper distribution of load on the gear teeth shall be demonstrated by the tooth contact tape applied to each gear and these tapes shall be preserved in the records to be submitted with the Certificate of Compliance.

No Load Spin Test

After assembly of the reducer, conduct a no load spin test at 115 percent of rated speed for one hour in each direction. All reducer testing is to be performed at one location. Block out noise coming from other equipment of the test stand with sound shields if the sound level readings taken at 2 ft. from the test equipment surface exceeds 80 dBA.

Sound level readings, taken at 3 feet from the reducer surface, shall not exceed 85 dB with the unit running at 115 percent of the rated speed. Closely monitor the reducer during the spin test for oil leaks, excessive heating of bearings, excessive vibrations, and any other abnormalities. If noise exceeds the specified limits, leaks are noted, bearing temperature exceeds the Manufacturer’s recommendations, atypical vibrations or sounds are evident without instrumentation, or other abnormalities are evident during testing, the unit shall be corrected and retested.

Run 150% FLT Test

Following the no load spin test, run gear boxes at rated speed at 150% of full load motor torque for ninety minutes in each direction. Monitor the reducer for oil leaks, excessive heating of bearings, excessive vibration, and any other abnormalities. Record bearing and oil sump temperatures every 15 minutes.

Sound level readings, taken at 3 feet from the reducer surface, shall not exceed 90 dB with the unit running at 100 percent of the rated speed. Closely monitor the reducer during the spin test for oil leaks, excessive heating of bearings, excessive vibrations, and any other abnormalities. If noise exceeds the specified limits, leaks are noted, bearing temperature exceeds the Manufacturer’s recommendations, atypical vibrations or sounds are evident without instrumentation, or other abnormalities are evident during testing, the unit shall be corrected and retested.

Run 200% FLT Test

Run a load test with the gear box loaded to 200 percent of the full load motor torque, at rated speed, for ten (10) revolutions of the output shaft in each direction.

At the end of these tests, remove inspection covers and examine all gear teeth for excessive wear and damage. Examine gear teeth for contact patterns. Take pictures of all examined components and provide to the Engineer for review. A minimum of 85 percent tooth flank contact must be evident. Any relative movement between two fixed mating components of a magnitude which cannot be explained through accepted engineering principles will be cause to require adjustment and retesting. All out of tolerance parts shall be replaced and adjustments made. Any discrepancies, including behavior which is consistently different from the other reducers, shall be corrected and the reducer shall be retested until all criteria are met. Retesting will be done at a load required to demonstrate that the defect is corrected.

Provide a recommended retest procedure to the Engineer for review and approval. The Engineer reserves the right to require additional no-load, 150%-load, or 200% full-load testing at no additional cost until the reducers demonstrate full compliance.

After re-assembly of the gear box and acceptance by the Engineer, if no material modifications are required, run the unit at 100 percent full speed at no load for 30 minutes in each direction and monitor for abnormal changes in operating conditions. If material modifications were required following the initial load test, perform additional load tests up to and including the 200 percent full load test as required by the Engineer at no additional compensation.

Conduct all required non-destructive testing of the gear boxes in the manufacturer's shop, and closely inspect the gear box for any oil leaks, and repair if necessary.

Remove temporary couplings and shaft keys used for the reducer test and install permanent couplings and keys as specified in the Plans.

Prior to shipping, clean the reducer of dirt, chips, grit, and all other injurious materials and apply the applicable rust-inhibiting preservative. Coat exterior finished metal surfaces and unpainted metal surfaces as soon as practicable after finishing with rust-inhibiting preservative. Coat the surfaces and components inside the reducers with a Manufacturer approved winterizing, rust-inhibiting compound. Remove these coatings from all surfaces prior to erection, final painting, and operation. Tag, bag, and crate mounting hardware and accessories for shipment and storage with the reducer. Mount assembled units on skids and crate for protection during handling, shipment, and storage.

Protect reducers from weather, dirt, and all other injurious condition during manufacture, shipment, and storage, including storage at the site if applicable. Store reducers indoors. During reducer storage, provide maintenance to seals, bearings, and other components as required by the manufacturer.

C.3 Defective Materials and Workmanship

Remove and replace, without additional cost to the City, components determined defective and not made acceptable during inspection and testing. No claims for additional compensation due to delays resulting from defective materials and/or components will be recognized.

Correct, without additional cost to the City, defects resulting from faulty materials, workmanship, components or installation errors that are revealed during the warranty period. If corrections are not made in a timely manner the City will make the necessary corrections and charge the costs to the contractor.

C.4 Guarantees and Warranties

The contractor will assign to the City all manufacturer's warranties and guarantees covering products, components and assemblies purchased by the contractor and used in fulfillment of this contract. The terms of those warranties and guarantees are to be consistent with the customary practices of the manufacturer in commercial trade upon acceptance of the contract.

The contractor shall warrant satisfactory service operation of the mechanical systems, components and associated equipment for a period of sixty (60) months following the date of final acceptance of the project. Manufacturer's standard warranties shall be extended to cover this period at no additional cost to the City.

C.5 Shipment and Storage

C.5.1 Protection for Shipment

Clean all machinery components and assemblies of dirt, grit, chips, corrosion and other injurious substances before shipment. Coat unpainted surfaces with an approved corrosion-inhibiting preservative.

Grease exposed shaft journals, wrap in oil-resistant paper, cover with oil-soaked burlap and securely timber lag for shipment. Take all precautions to assure the bearing surfaces are not damaged during shipping and handling.

Completely protect machinery parts from weather, dirt and foreign materials during shipment. Store machinery parts indoors while awaiting installation and erection at the site. Mount assembled units on skids or otherwise crate or protect during handling and shipping.

Bag and/or crate for shipment all mounting hardware and other small parts. Do not co- mingle the parts. Identify each part with its number and keep separate from other parts.

Provide tags recording the part number wired to the containers for each part prior to shipment. Coat bolts, nuts and other steel parts with approved rust-inhibitor.

C.5.2 Package and Deliver Spare Parts

Prepare spare parts for long term storage as recommended by the manufacturer. Wrap and box in a durable wooden container. Tag all individual spares with clear identification using the part number and description as shown on the approved shop drawings. Clearly and permanently mark the outside of the spare parts boxes, identifying the contents of the box.

C.6 Erection, Installation, & Alignment of Machinery

C.6.1 General

Erection and adjustment of machinery shall be by millwrights or experienced machinists with demonstrated skill in this type of work and shall have at least ten years of experience in the design, fabrication, installation, and testing of major systems of comparable size and type. See Technical Special Provision SPV 10X.XX A.6.4 for personnel experience requirements.

Install all machinery within the specified tolerances and such that satisfactory operation is achieved. In general, the order of assembly and alignment of bridge machinery is to start at the final driven component and work back to the prime mover.

The Engineer will send an inspector to the shop for verification of compliance prior to shipment of any equipment to the field.

C.6.2 General Alignment and Bolting

Erect and assemble the machinery in accordance with part number and match marks, and in accordance with manufacturer's recommendations. Adjust all parts for precise alignment and orientation by means of shims. Pull tightly against supporting members by use of clamps, temporary bolts, or other approved means before drilling and reaming holes for connecting fasteners. Tapered shims may be used, if required, and shall be furnished at no additional cost to the City.

Turned bolt holes into structural steel for attaching machinery components shall, generally, be drilled from the solid after final alignment of the machinery. During erection a sufficient number of ¼ inch undersized, sub-drilled holes are permissible for the use of undersize, temporary bolts. When final alignment is achieved, drill and ream the remaining bolt holes and install full size bolts. Remove the temporary bolts, ream the undersize holes and install full size bolts.

In locations where bolt holes in the bearings and structures are to be reamed to accept a larger diameter turned bolt, use some of those holes for temporary bolting to achieve alignment. When properly aligned, ream the unused holes to full size, install the full size bolts; remove the temporary bolts, ream the holes and install full size bolts.

Accuracy of the reamed holes through the machinery component, shims and structural steel is required to maintain correct alignment of the machinery. Use a structural steel reaming jig, affixed to the drill and secured to the work piece to prevent the reamer from deviating and assure a cylindrical hole throughout its length.

Provide a bolt-hole micrometer with a measuring increment of 0.0005" and an accuracy of ±0.0001" for use by the bolt installation personnel and the inspector. Verify the proper fit of every reamed hole in all machinery components with the bolt-hole micrometer. Torque all high strength bolts, and turned bolts as recommended by the equipment manufacturer.

C.6.3 Installation & Alignment of Speed Reducers

Utilize millwrights for erection and adjustment of machinery with required experience (See Technical Special Provision SPV 105.06 A.6.4Personnel Requirements). Verify that mounting surfaces are clean of cracks, dirt, paint and other foreign materials. Before installation, verify the match of the anchor bolt pattern to the hole pattern on foot/flange of gear box.

After speed reducer is in place, align with shims and pull tight against supporting members by use of clamps, temporary bolts, or other method as approved by the Engineer.

After alignment of drive machinery, securely tighten anchor bolts and nuts to torque values appropriate for the bolt and nut sizes.

Provide the services of a manufacturer's field Engineer to supervise and certify the installation and checkout of speed reducer(s). Operate the bridge in the manual mode for a sufficient distance to verify satisfactory manual operation.

C.6.4 Installation & Adjustment of Motor and Machinery Brakes

Factory set units for braking torque and application times as shown in the Plans from signal to fully set and signal to fully released. Do not set brakes at torque values more than 90% of their continuous rated capacity for normal operation. Adjust brake application and release times in the field during functional testing as directed by the Engineer such that motor brake will stop the leaf traveling at full speed between the near closed limit switch and the load shoe position.

Use competent millwrights experienced in such work to install and adjust brake. Fit brake wheels to motor and/or reducer shafts and press on in the shop. Adjust external torque spring, actuator reserve stroke and brake shoe clearance when released after installation of the brakes in the field.

After installation and alignment of the brakes, bed the brake pads into the drum per the

manufacturer's recommendation. Provide certification of brake torque settings upon completion

of installation.

C.6.5 Installation of Bumper Blocks

This work consists of furnishing, installing, and adjusting bumper block assemblies. Bumper block assemblies include bumpers, fasteners, shims, bearing and anchor bolts. Coordinate work with general machinery requirements and specific work described herein. The work includes shop drawing preparation, detailing, testing, fabrication, installation, erection, adjustment and alignment as required to place the bumper blocks assemblies into proper working condition.

Demonstrate bumper blocks contact points relative to leaf position and contact face parallelism. Record clearances between bumper blocks with leaf open to normal full open position.

C.6.6 Adjustment of Live Load Shoes

Before and after rear live load shoe adjustments, verify that the bascule leaves deck height between the two bascule leaves are level over the width of the roadway at both the forward and rear joints. The rear live load shoes shall be adjusted to achieve equal contact with all the strike plates. Adjust the rear live load shoes with no traffic on the bridge. The rear live load shoes can be adjusted by turning/screwing rear live load shoe component up and down until the assembly achieves full contact with the strike plate. Full contact will be considered when a 0.002 inch feeler gauge cannot be inserted between the rear live load shoe and the strike plate. After full contact, continue turning the rear live load shoe into the strike plate until the new keeper plate can be attached to the new fixed plate.

Operate the span and verify all rear live load shoes are in full contact. Make adjustments as required to achieve full contact on all rear live load shoes.

C.6.7 Open Gearing

Tooth Contact - Align gears so that the gear tooth makes contact with the mating pinion tooth over a minimum of the center 80 percent of the tooth width. This criterion must be satisfied by 80 percent of the gear and pinion teeth. Up to 20 percent of the remaining gear teeth may have less than 80 percent contact but no less than 65 percent contact. Check and demonstrate tooth contact for normal operation condition when operating the bridge with machinery.

Backlash - Set backlash within the tolerances established by AGMA for spur gears, based upon center-to-center distances and tooth pitch, unless otherwise specifically defined in the Plans.

Painting of the Gear Train shall be considered incidental to the painting of the machinery.

Do not paint the contact surfaces of gear teeth.

C.6.8 Bolting

Unless otherwise specified or shown in the plans, drill bolt holes in machinery parts for connection to supporting steelwork in the shop a minimum of 1/16-inch diameter smaller than the finished bolt diameter or drill from solid at assembly. Drill and ream at final assembly.

Where turned bolts are to be used for connecting machinery to structural steel or steel supports, do not pre-drill the bolts holes in the steel, unless otherwise specified or shown in the plans. Sub-drill turned bolt holes from solid at assembly or erection after proper alignment of the machinery. Do not ream turned bolt holes to the full size until final assembly after alignment is complete.

Clean all contact surfaces of structural steel to which machinery is to be bolted, in accordance to the specifications for structural steel to be bolted together, before bolting.

Spot face bolt holes through unfinished, rough cast surfaces for the head and nut.

Except as noted herein or in the plans, tension ASTM A325M and ASTM A449 bolts, used for connecting steel machinery parts together or to structural steel and whose nominal threaded diameter is less than or equal to 11/2 inches, in accordance to the bolted connection requirements of AASHTO and the standard specifications.

Tension turned bolts larger than 11/2 inches (nominal thread diameter) by turning the nut 1/4 turn past snug tight and adding a backing nut (double nuts) turned snug tight, unless otherwise noted in the plans. If the plans require a turned bolt larger than 11/2 inches to be tensioned, hydraulically tension the bolt as detailed below. If the plans require a turned bolt larger than 11/2 inches to be tensioned but do not specify a preload value, tension the bolt to 70 percent of the minimum tensile strength of the bolt, using the nominal area of the threaded section.

C.6.9 Hydraulic Tensioning of Fasteners

Hydraulically tension pre-tensioned anchors, including undercut anchors, anchored into concrete and high strength bolts whose length exceeds 12 bolt diameters. Bolts conforming to the requirements of ASTM A325M and ASTM A449 may be tensioned by the hydraulic tensioning method. Provide additional length of threaded shank as required to perform hydraulic tensioning operations. Hydraulically tensioned bolts are subject to the following requirements:

Unless specified otherwise in the plans, bolts must have a grip exceeding 12 inches or 12 bolt diameters, whichever is greater.

Tension anchors embedded into concrete by use of the following procedures:

6. Set and tension all bolts anchoring any one component at one time unless otherwise permitted in the contract documents.
7. Tension all bolts sufficiently to set them. The minimum setting load is as specified by the bolt manufacturer.
8. Perform final tensioning after all bolts are set. Tension all bolts by the use of a centerhole calibrated hydraulic ram. Mount the ram on a chair which permits access to the anchor bolt nut. Tension bolts to 70 percent of the specified minimum tensile strength of the bolt or the anchor bolt manufacturer's recommendation, whichever is greater, unless otherwise specified or shown in the plans. Snug the nut down prior to releasing the hydraulic pressure to the ram.
9. Just after installation and again 60 days later, check the preload by again applying hydraulic tension. The bolts must have a tension equal to 60 percent of the minimum specified tensile load applied. No movement of the nut shall be detected under this load.
10. If the preload test fails, the bolts must again be tensioned to original tensioning values and the nut retightened. Retesting at 60 day intervals will be required until the bolts are accepted.

C.6.8 Setting of Machinery on Concrete Structures

Utilize experienced millwrights, with qualifications described herein, to position, install, and make final adjustments to machinery and machinery pedestals installed on concrete structures. Use appropriate means and methods in setting machinery bases and pedestals, such as leveling screws or precision jacks such that the required positioning tolerances are obtained. If using steel shims between the concrete surface and the machinery or pedestal base, remove the shims prior to tightening anchor bolts. Where leveling grout is shown, remove all other temporary support devices, including leveling screws, jacks, and shims, prior to tightening anchor bolts. Unless otherwise indicated in the Plans, position all machinery pedestals that are installed prior to aligning the supported machinery to within the following tolerances:

1. Horizontal position: plus or minus 0.031-inch.
2. Vertical Position: plus or minus 0.031-inch.
3. Level (top of machined surface): plus or minus 0.005 inch/foot.
4. Orientation (parallel to Plan centerline): plus or minus 0.20 degrees.

C.6.9 Coatings

Coat threads for all turned bolts with anti-seize compound before assembly to avoid corrosion or galling and ease future removal.

C.7 Painting

C.7.1 General

Clean and paint all unfinished surfaces of machinery and equipment as required by the City using a system listed on Wisconsin Department of Transportation master list of pre- approved zinc rich three coat paint systems. Submit an outline of painting materials and methods with the shop drawings. Coat in accordance with section 517 of the standard specifications and the requirements herein.

Structural steel components shall be hot-dip galvanized and painted with the two coat system specified in article “Painting Epoxy System P-40-523”.

C.7.2 Shop Painting

Before painting unfinished surfaces in the shop, remove all burrs, chips, rust, scale, sand, grease and other foreign material by blasting, wire brushing or other approved means. Prepare surface for painting by blasting to achieve a SSPC-SP-10 “Near White Metal Blast Cleaning”.

Use masking to avoid painting machinery surfaces which are in normal rubbing contact, such as shaft journals and bushings, and sliding guides.

After properly cleaning the surfaces apply one prime coat of shop paint to all unfinished machinery surfaces. Use a primer compatible with the paints selected for subsequent coats.

C.7.3 Faying Surfaces

All finished contact surfaces which are not finally assembled in the shop shall be coated with waterproof National Lubricating Grease Institute No. 3 Multipurpose grease as soon as possible after being accepted and before removal from the shop, and shall be adequately protected during shipment by wrapping with burlap or canvas held by wooden bats securely wired together. During erection these surfaces shall be thoroughly cleaned and a field coat of grease applied prior to assembly.

C.7.4 Field Painting

After erection and installation is completed, clean and paint all remaining non-rubbing, exposed machinery surfaces with an intermediate, weather resistant free coat.

Upon completion of all operation and acceptance tests and after removing all accumulated grease, oil, dirt and other material, apply a final finish coat.

C.8 Contractor’s Inspection

Upon completion of the machinery installation, make a thorough inspection to confirm that all machinery components are free of obstructions and properly aligned; all bolts tightened in accord with section 506 of the standard specifications; all field painting is complete; bearings and other rotating and sliding parts are supplied with lubricants; and the lift span is balanced as required.

The City’s representative shall accompany the contractor during his final inspection to determine if the bridge is ready for field testing.

C.9 Startup Requirements

Implement startup procedures that protect the equipment from damage and ensure safe working conditions during bridge operations throughout construction. This section identifies specific requirements related to movable bridge startup operations.

C.9.1 Bascule Leaf Rotation

Do not perform initial rotation of the bascule leaf until the following conditions have been met (the intent of this requirement is to apply to the condition of initial rotation of a bascule leaf prior to completion of steel erection or drive machinery installation):

- Tread plate and track alignment has been verified within the specified tolerances. All tread plate assembly fasteners have been properly installed and tensioned as required.
- Calculations have been prepared for the current balance condition verifying that the bascule leaf unbalance, wind and construction loads are within the capacity of the mechanism used to rotate the bascule leaf.
- Shop drawings for connection to the bascule leaf of temporary mechanisms, crane attachments, or other temporary works have been submitted and reviewed by the engineer.

Perform initial movement of a complete or partially complete bascule leaf using a step-by-step procedure with incremental clearance checks to verify that there are no interferences between the bascule leaf, machinery, fixed structure, or other equipment. When moving the bascule leaf for the first time after elements have been initially installed or added, perform the following:

Rotate the bridge in increments of five (5) degrees or less.

At each increment, bring the bascule leaf to a complete stop and check clearances at applicable machinery and movable leaf/fixed pier interfaces, including rack frames, rear locks, gears, deck joints, handrail joints, traffic barrier joints, control house, counterweights, and bumper blocks.

C.9.2 Machinery Operation

Movable leaf must not be operated by the drive machinery until all of the following

conditions have been met:

Track and tread plate alignment has been verified within the specified tolerances. All tread plate assembly fasteners have been properly installed and tensioned as required.

Calculations have been prepared for the current balance condition verifying that the bascule leaf unbalance, wind and construction loads are within the capacity of the mechanism used to rotate the bascule leaf.

Drive machinery connections have been completed including installation of shims and pedestals and tensioning of fasteners. Any temporary measures used in lieu of full shims must first be approved by the engineer. Open gearing and speed reducers must have been installed and lubricated.

Drive system must have completed the Machinery Static Field Test and the test results have been reviewed by the engineer.

Movable leaf must not be operated at greater than the specified creep speed in any control mode at the electronic drive (or other interim controls that have been reviewed by the engineer) until all of the following conditions have been met:

All conditions listed in the section immediately above for operation of movable spans by the drive machinery.

Drive system must have completed the Drive System Dynamic Field Test and the test results have been reviewed by the engineer.

Bascule leaf control limit switches have been set and initially adjusted following Drive System Dynamic Field Tests.

The permanent bridge electrical service and power distribution equipment (motor control center, disconnect switch, VSD, etc.) has been installed, tested and energized and is in stable operating condition. All wiring must have been megger tested and verified.

Movable leaf must not be operated at greater than creep speed in any mode from the control desk until all of the following conditions have been met:

All conditions for operating from the drive, listed immediately above have been met.

The control panel and control desk are installed, wiring substantially complete with wires labeled (no splices or temporary connections). Interlocks are active and functioning.

All faults, trouble, and shutdown conditions from electronic drives are tested and verified that they properly interface with the control panel and the control desk. E-Stop operation has been verified.

C.10 Operational Testing

All testing must be performed in daylight hours without the presence of significant wind, rain, lightning or other adverse weather. Sufficient contractor personnel must be stationed to perform a single dedicated task. Two-way communication must be established between all locations and personnel. Testing must be witnessed by the engineer.

C.10.1 Drive System Static Field Testing

Complete initial programming of electronic drive system prior to testing and inspect all terminations. Drive system manufacturer’s representative must perform initial energization, programming and operation of all electronic drives for this testing. Do not exceed creep speed velocity during these tests. Demonstrate that the current bascule leaf balance condition is tip heavy within acceptable tolerances prior to initiating any tests or operations that require the mechanical drive to hold the load of the bascule leaf. Submit balance calculations for review by the engineer prior to testing.

Verify motor directional control. (Suggested procedure: With the motor couplings or floating shafts disconnected from the drive train and brakes manually released, drive the motors at creep speed or less, in both directions).

Verify set torque of each brake and capability of drives to produce torque. (Suggested procedure: With the floating shafts disconnected, drive motors against each set brake, gradually increasing torque until the brake slips. Be able to determine motor output torque based on information from the electronic drive such as the motor current draw).

Test load holding and drift functions.

If initial bascule leaf operation is from the open position, perform the following test:

Set all brakes.

Partially release the bascule leaf restraints to produce slack of the equivalent of at least four inches and no more than six inches measured at the bumper block. Verify that the load is held by the brakes.

Manually release the machinery brakes. Verify that the motor brakes hold the load.

Manually release the motor brakes slowly until the bascule leaf begins to drift down. Set the brakes just before the load is transferred to the bascule leaf restraints. Verify that the brakes hold the loads. Set all brakes.

Using manual control at the electronic drive cabinet, set to creep speed, raise the leaf back to its original position manually controlling the brakes.

Repeat the above steps to test the holding capacity machinery brakes.

If initial bascule leaf operation is from the closed position, perform the following test:

Using manual control at the electronic drive, set to creep speed, manually release the brakes and raise the bascule leaf approximately two to three inches off of the bearing plates at the uplift girders. Stop the bridge by setting the brakes and removing the raise signal at the drive.

Remove power from the motors and verify that the brakes hold the load.

Manually release the machinery brakes and verify that the motor brakes hold the load.

Slowly release the motor brakes and drift the leaf down to rest on the live load shoes.

Repeat the above steps to test the holding capacity of the machinery brakes.

C.10.2 Drive System Dynamic Field Testing and Adjustment

Do not initialize Dynamic Field Testing until Static Field Testing and Initial Bridge

Operation is completed and accepted by the engineer.

If console is not available, set up local manual control of movable spans, at drives, to demonstrate the operation of the bascule leaf drive. Record and explain any and all trips, faults and/or adjustments to the electronic drives which occur during or immediately after this testing.

Install all limit switches and position indication devices to initial settings.

Fully raise and lower the leaf in creep speed. Verify motion control signals and indicators, including limit switches, normal stop, and emergency stop.

After several operations check all areas for motor temperature and motor current draw, machinery alignment or sounds. Connect all control wiring for console system test.

C.10.3 Functional Checkout

Complete and document all testing of drive machinery components prior to or during the operational testing consisting of the “Functional Checkout.” Items to be verified and documented include:

Verification of brake setting torques.

Brake setting times in accordance to the plans or as field modified as noted herein.

Measurement of all coupling alignment.

Verification that no unusual noise is emitted from any of the drive machinery during operation of the leaf.

Verification that the speed reducers properly contain lubricant at all angles of bridge opening.

Measurement of temperature rise in all bearings (pillow blocks, main pinion bearings and speed reducer bearings) during operation of the bridge through five (5) complete cycles within a 30-minute period. Verification that this temperature rise does not exceed 50 °F.

Measurement and documentation of gear tooth contact for all rack and pinion sets.

Any other field testing information deemed necessary by the manufacturers of the various components.

Submit testing procedures for the functional testing, to include any tables or other forms to be used for documentation of the test results, for review and approval, prior to the functional checkout.

Payment for furnishing all testing and functional checkout activities related to all of the drive machinery is included in the lump sum payment for “Mechanical Work Bascule Span”.

C.11 Training

Provide instruction for the City’s Operation and Maintenance personnel. The instruction shall include classroom presentations and discussions, utilizing materials in the Operation and Maintenance Manuals, as well as observations of the equipment in place on the lift span, while stationary as well as in operation. Facilities for training will be provided by the City.

The topics covered during the training shall include, but not be limited to:

1. Function and purpose of the major components and systems
2. Normal, auxiliary, and manual operation
3. Routine maintenance, adjustments, and lubrication
4. Trouble shooting

D Measurement

The department will measure Mechanical Work Bascule Span as a single lump sum unit for the bascule span mechanical work, acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.06	Mechanical Work Bascule Span	LS

Payment is full compensation for furnishing all material and labor required to fabricate and install in working order the bascule span mechanical work as shown on the plans and as described herein; and for furnishing all tools, equipment and incidentals necessary to complete the contract work.

The cost of furnishing and fabricating machinery support weldments including furnishing and installing connection bolts between machinery and machinery supports is included in bid item Mechanical Work Bascule Span. Spare lubricant, spare parts, and tools are included in bid item Training, Manuals and Spare Parts.

v. **Rear Locks Bascule Span, Item SPV.0105.07.**

A. Description

This article covers all apparatus, material and labor required to properly detail, manufacture, ship, install, adjust, test, paint and put into approved working order all parts of the bascule span rear lock and rear lock actuator supports specified. Furnish, at no extra cost, any device, material, labor or effort not herein specified, yet required to complete or perfect the equipment in a manner suitable to the department.

B. Materials

B.1. General Material Requirements

Provide materials as specified on the plans and in the specifications. Wherever materials are not shown or specified, provide materials conforming to the current specifications as outlined in TABLE 1, Materials. An alternative material may be requested in writing; the request must provide complete data justifying suitability of the alternate materials and must be approved by the department prior to initiating manufacture or construction.

Materials and equipment must be essentially the standard catalogued products of manufacturers regularly engaged in production of such materials or equipment and must be the manufacturer's latest standard design that complies with the specification requirements. Materials and equipment must essentially duplicate items that have been in satisfactory commercial or industrial use at least two years prior to bid opening. Where two units of the same class of equipment are required, these units must be products of the same manufacturer. However, the component parts of the system need not be the products of the same manufacturer. Each major component of equipment must have the manufacturer's name and address and the model and serial number on a nameplate securely affixed in a conspicuous place. The nameplate of the distributing agent will not be acceptable.

B.2. Shop Drawings

Dimensions given on the plans are nominal and intended for guidance. Make note of any variations from nominal dimensions on the shop drawings or provide written notice to the engineer. Where additional information is required or changes must be made; prepare working, erection, and shop drawings and submit to the department as specified.

B.2.1. General Requirements

Shop drawings must detail and accurately dimension all parts. Shop drawings must define limits of accuracy and tolerances required for machining, surface finishes and allowances for fits.

B.2.2. Manufacturer's Literature

Submit catalog cuts and detailed manufacturer's literature for all components not detailed in the shop drawings. Clearly mark such items with the item number corresponding to the mark shown on the assembly drawing and the full and complete part number, extended to completely define the part including all optional or custom features. If the same cut sheet is used to define more than one item, submit multiple copies.

B.2.3. Material Certifications

Submit material certifications for all materials specified to require material testing within the plans and specifications or within a referenced material specification (e.g. ASTM, ANSI, or others).

B.2.4. Procedures

In addition to required detailed shop drawings, submit to the engineer for review various procedures described herein. The procedures must be thorough and be supplemented by sketches, calculations, details, catalog cuts, photographs, etc. as required to demonstrate that the specified requirements can be met.

B.2.5. Notification of Shop Work

Provide advance written notification to the department for all shop work and shop testing for which the specifications require or indicate that it is the intent of the department, to provide a representative to observe or witness such activities. Provide a minimum of 30 days advance written notice of such work.

B.2.6. Material Compatibility

Provide products which are compatible with other products of the rear lock and with other work requiring interface with the rear lock, including mechanical/electrical connections and control devices.

B.2.7. Nameplates

Provide each piece of rear lock equipment and apparatus with a permanent, corrosion-resisting metal nameplate on which is stamped the name of the manufacturer, the catalog or model number, and the rating or capacity of the equipment or apparatus. Nameplates on all proprietary elements must be readable, clean, and free of all paint before acceptance of the machinery.

B.2.8. Substitutions

Specification of a manufacturer's part number, product, and/or name is for the purpose of defining quality, configuration, rating and arrangement of parts. Part numbers shown in the contract documents are not necessarily complete numbers nor are they intended to describe details of the component beyond those that are required. Be aware that manufacturers may change product names and part numbers without advance notification. Select and provide manufactured products that meet the requirements and intent as shown in the contract documents. Provide complete, current part numbers for all proposed equipment and verify that the part as designated is appropriate for the intended function. Contractor is responsible for design changes resulting from substitutions.

B.3. Shop Inspection and Testing

B.3.1. Notification

Provide sufficient written notice to the department prior to the beginning of work at foundries, forge and machine shops so that inspection may be arranged. Provide free access to all premises where preparation, manufacture, assembly and testing of raw materials, materials in process and assembly is conducted.

B.3.2. Responsibility

Such inspections are to facilitate work and avoid errors. It is understood that inspection by the department does not relieve the contractor of the responsibility for compliance with requirements of the contract documents or for replacing defective materials and workmanship.

B.4. Material Acceptance

Furnish to the department test results of all certifications required of the contract documents, including copies of chemical and physical tests and certifications of compliance. Initial acceptance of materials and finished parts and assemblies will not preclude subsequent rejection if found deficient. Replacement of such materials will be the responsibility of the contractor.

TABLE 1 - MATERIALS

MATERIAL	DESCRIPTION	DESIGNATION (ASTM unless otherwise noted)
Steel castings	Structural, high strength Carbon steel, general application	A148 A27
Iron castings	Gray iron	A48
Bronze castings	Bronze castings for bridges (max. sulphur content 0.08%, chemical analysis required for each heat)	B22
Forgings	Carbon steel for industrial use Alloy steel for industrial use	A668
Hot rolled steel	Special quality carbon steel bars	A675
Dowel pins	American National Standard Unhardened Ground Dowel Pins (440 MPA minimum ultimate shear strength)	ANSI B18.8.2
Cold rolled steel	Carbon steel bars	A311
Stainless Steel Shims	Stainless Steel	A666, Grade 304 or 316
Shapes, plates, and bars	Structural steel High strength, weathering	A36 or A709 A588
Stainless Steel (corrosion resistant) bolts or anchors	High Strength Stainless steel Fasteners	A193, Grade B8, A193, Grade B8M

Corrosion resistant shapes, bars, and plates	Stainless steel	A276, Type 316

B.5. Actuator

Provide each rear lock with a mechanical actuator Earle EG-2 manufactured by Steward Machine Co. or approved equal. The actuator moves the rear lock strut about a pivot until the rocker arm first contacts the strike plate stop and any additional movement from the actuator forces the rocker arm to pivot decreasing the gap between the strike plate and rocker arm.

Each operator shall be driven by a high starting torque, induction type, 3 HP, 1675 RPM, three phase, 60-hertz, 208-volt, NEMA design D, TENV motor with a 15-minute duty rating with a 3 ft-lbf marine duty brake with manual release and safety interlock switch. The motor shall be totally enclosed, non-ventilated, equipped with ball bearings and designed especially for marine applications subjected to adverse weather conditions. Strip heaters shall be installed in the motor housing.

Travel of the rear lock struts in each direction shall be governed by internal limit switches that provide open and closed contacts for each length of travel. The rear lock strut shall take approximately 8 seconds to complete its 12-inch stroke and the operator shall be capable of delivering a thrust to overcome resistance in each direction at 50% stall torque of the motor.

Install internal end of travel limit switches as an integral part of the new lock bar operator. Provide a removable hand crank for manual operation and a removable cover over the shaft end.

B.6. Shafting and Pins

Rolled material may be used for shafting and pins up to four inches in diameter. Use forged material for larger diameter shafts and those having integral flanges or pinions. Homogeneity of forgings is required; shafts must be reduced to size from a single bloom or ingot at no less than red heat. The blooms or ingots must have a cross sectional area at least three times that required after finishing. The finished product must be free of injurious flaws such as seams, pipes or cracks. Forged shafts over eight inches in diameter must have a hole bored lengthwise through the center. Make the diameter of the hole about 1/5 the diameter of the shaft.

Test shafting materials for mechanical properties and furnish certificates to the department. Finished shafts must be free of camber and run without vibration, noise or chatter at all speeds up to and including 120 percent of design speed.

Test all cold-finished shafting for its mechanical properties and furnish a test certificate to the engineer.

Provide dowel pins per American National Standard. Unless otherwise specified, provide unhardened ground dowel pins with 64 ksi minimum ultimate shear strength. Provide hardened dowel pins with 120 ksi minimum ultimate shear strength.

B.7. Castings

Unless otherwise specified or shown in the plans, use castings that conform to AASHTO

Movable Specifications. Material grades must be as specified or shown in the plans.

B.8. Forgings

Unless otherwise specified or shown in the plans, use forgings that conform to AASHTO

Movable Specifications. Material grades must be as specified or shown in the plans.

B.9. Fasteners

B.9.1. High Strength Bolts

Unless otherwise specified, provide fasteners used for connecting rear lock parts to each other and to supporting steelwork that are turned bolts conforming to the minimum specified physical requirements of high strength, ASTM A325 or ASTM A449 cut thread, washer faced, hexagonal head bolts. Provide threads for turned bolts that conform to the requirements of ASTM A325. Do not use ASTM A490 bolts. Use nuts that conform to ASTM A563 or A194, Grade DH or 2H, heavy hex series.

B.9.2. Bolt Dimensions

Dimension bolt heads, nuts and hexagonal cap screws in accordance to ANSI B18.2.

Such fasteners are to be of the heavy series.

B.9.3. Socket Head Screws

Conform socket head cap screws, socket flat head cap screws and socket set screws to ANSI B18.3. Such screws must be heat treated alloy steel. Unless otherwise specified, set screws must be of the headless, safety type and be of the coarse thread series and have cup points. Do not use set screws to transmit torque nor as a stop for equipment that provides stability or contributes to operation of the bridge. Class 2 coarse thread tolerances are required for all bolts, nuts and cap screws.

B.9.4. Locking of Fasteners

Provide approved type positive locks for cap screws and nuts on turned bolts unless noted otherwise in the plans. Use standard thickness nuts where double nuts are required in locations where occasional opening or adjustment is necessary. Use flat jam nuts only where space prohibits use of standard nuts. Lock washers must be made of tempered steel and conform to regular SAE dimensions and specifications. Properly tension high strength bolts and nuts, which will create a self-locking effect. If wire is used for locking it must be stainless steel.

B.9.5. Washers

Use hardened steel, plain washers conforming to ASTM F436 at the rotated end of high

strength ASTM A325 or A449 bolts.

B.9.6. Miscellaneous Fasteners and Hardware

Unless otherwise specified or shown in the plans, provide miscellaneous fasteners and hardware, including cotter pins and lock wire of corrosion resistant stainless steel, with material composition of type 304 or 316.

B.10. Bushings

Where required, provide solid bushings of one-piece bronze sleeve construction. Configure with spiral cut lubrication grooves. Provide lubricant fittings for rear lock items requiring lubrication.

B.11. Welding & Weldments

Fabricate weldments for support of rear locks and/or hydraulic equipment from structural steel of the type and grade specified in the plans. Where the type and grade of steel is not specified in the plans, fabricate weldments from ASTM A709, Grade 50 structural steel. Use of steel plate larger than that denoted in the plans may be required to obtain the final required dimensions.

Unless otherwise noted herein or in the plans, perform all welding and weld inspection of rear locks in accordance to ANSI/AASHTO/AWS D1.5. Unless otherwise noted herein or in the plans treat all welded rear lock members that support live load reactions as main members, all welds as subject to tension or stress reversal, and all welds as joining primary components. Do not perform field welding on these elements unless specifically required in the contract documents.

Unless otherwise shown in the plans, connect elements of weldments by complete joint penetration welds. Do not use fillet welds where they would require machining to provide clearance for machinery, fasteners, or other attachments. Clip stiffeners to avoid overlapping stiffener welds with welds at the intersection of main plates.

Stress-relieve weldments after welding and prior to final machining. Unless otherwise shown in the plans, finish machined surfaces of weldments to flatness as required herein and parallel to each other and to the bottom of the base plate. The height of the weldment must be per plan height ± 1/8 inch. All exposed edges of weldments must be ground to a chamfer or radius to eliminate sharp edges and burrs. Weldment base plates which will be placed against concrete or grout must have 3/4-inch minimum radii on the corners.

Thoroughly coat finished mounting surfaces with an approved corrosion inhibitor and skid or crate for protection during handling, shipment and storage. Prime weldment base surfaces which will have concrete or grout cast against them, but do not finish coat them.

B.12. Galvanizing

Where galvanizing of weldments is required, hot dip galvanize in accordance to ASTM A153 prior to machining. Provide lifting lugs and vent holes as needed for the galvanizing process. Mask surfaces to be machined as required. After fabrication and galvanizing of all weldments, paint unprotected surfaces with an epoxy paint system for structural steel in accordance to the standard specifications.

B.13 Lubrication of Rear Locks

B.13.1 Fittings

Provide button head fittings for use on all bearings and other machinery (not including gear teeth) requiring grease lubrication.

B.13.2 Lubrication Charts

Include the rear lock system lubrication information on the lubrication charts required for the drive machinery.

B.13.3 Lubrication Tubing

Use tubing of seamless brass pipe meeting the requirements of ASTM B43 and bronze fittings or ASTM A269 type 304 stainless steel tube with type 304 or 316 stainless steel fittings. Use stainless steel or corrosion resistant hardware to secure lubrication tubing and fittings. Provide one grease gun for each type fitting.

B.13.4. Shipping

Immediately after the completion of fabrication, plug all grease fittings until components are installed and regular lubrication is started.

B.13.5 Sleeve Bearings

The lubricant chosen must be approved for use in sleeve bearings by the lubricant manufacturer. Use NLGI No. 2 grease with rust and oxidation inhibiting additives, ASTM Drop Point, SUS 900 @ 100 °F, water resistant, anti-wear/extreme pressure.

B.13.6 Unpainted Contact Surfaces

Lubricate unpainted contact surfaces of dowel pins, strike plate and rocker arm with a dry moly or other corrosion inhibiting lubricant.

B.14 Shims

Provide shims required for leveling and alignment that are full depth shims, drilled for all bolts that pass through, and trimmed to the dimensions of the assembled unit. The nominal shim pack thickness will be 1/2 inch unless otherwise specified. Provide shim material from ASTM A666, type 316 stainless steel. Thin brass precision thickness shims may be used for final adjustment. Provide sufficient thicknesses to permit 0.005 inch variations of the nominal shim thickness plus one full allowance shim. Provide the department with one full set of additional shims for each type of component.

B.15 Epoxy Grout

Use epoxy grout manufactured for use in thickness range shown in the plans or detailed in approved shop drawings for each application.

Use epoxy leveling grout having the following minimum properties:

Minimum compressive strength: 10,000 PSI

Minimum tensile strength 2,000 PSI

Fire resistance: Self-extinguishing

Maximum linear shrinkage 0.0004 in/in

B.15 Paint for Rear locks

Use paint for rear locks and related equipment in accordance to an epoxy paint system meeting the requirements of the specifications for new structural steel, except as noted herein and as shown on the plans. Paint proprietary systems with coatings selected by the manufacturer for use in industrial applications.

B.16 Rear Lock Actuator

Provide linear actuators meeting the requirements in the plans, particularly thrust and speed. Do not exceed the specified maximum motor horsepower unless approved by the engineer. Provide linear actuators of a complete package to include all electrical motors, belts, pulleys, reducers, ball screws, rod ends, manual cranks with safety disconnect, trunnions, trunnion mounting brackets and accessories. Paint actuators and all mounted equipment with a factory finish intended for industrial applications. Provide storage compartment or clamp for the hand crank at each actuator location. Detail storage

mechanism in the shop drawings. Acceptable manufacturers include Earle, Raco, Duff-Norton, Nook or approved equal.

B.17 Hardware and Fasteners

Use ASTM A193, Grade B8M or ASTM A276 Type 316 Stainless Steel for all fastener bolts, nuts, washers and all other mounting hardware used on all the actuator mounts, supports, and connections unless otherwise specified.

B.18 Spare Parts

Provide one spare of the following items:

2 trunnion mounting brackets for linear electric actuator (1 LH, 1 RH if different).

C Construction

C.1 General

Subsection 506.3 of the standard specification applies to this item. Construct in accordance with the requirements defined herein and in the plans and the provisions of the AASHTO Movable Specifications. Where a conflict exists between documents, the requirements of the plans and specifications will govern over those of the AASHTO Movable Specifications.

Unless specified in the plans or herein, dimensions between machined surfaces have a tolerance of 0.010 inches and machined surfaces have a flatness tolerance of .040 inches.

All machinery must be set, aligned and verified by experienced millwrights. Millwrights must have a minimum 10 years of experience in setting and aligning heavy machinery and must have completed installation of machinery for a minimum of five bascule bridges. Submit to the engineer for review the qualifications of the proposed millwrights.

Erect and assemble rear locks in accordance to part numbers and match marks. Adjust all parts for precise alignment by means of shims and pull parts tightly against supporting members by use of clamps, temporary bolts, or other approved means before drilling and reaming holes for connecting bolts. Install rear locks within the specified tolerances and such that satisfactory operation is achieved. Utilize millwrights with demonstrated skill in this type work for all erection and adjustment of rear locks.

Unless otherwise approved by the engineer prior to construction, drill bolt holes in structural steel supports only after alignment of rear locks. Do not install rear locks unless mounting surfaces are clean of dirt, paint and other foreign materials. Securely tighten connecting screws, bolts and nuts to the specified torque values.

Only one rear lock may be removed from service at any time. One rear lock must be in the fully driven position at all times that roadway traffic is permitted to cross the span.

Maintain positive control of the leaf at all times. Temporary lock systems are permitted which secure the leaf in the closed position, in lieu of the permanent rear locks. Construction plans for all temporary locking systems sealed by a Registered Wisconsin Professional Engineer, and submit to the department for approval.

C.2 Installation Requirements

C.2.1 Support Weldments

Unless otherwise specified or shown in the plans, position all machinery pedestals that are installed prior to aligning the supported machinery to be within the following tolerances:

Horizontal position:	1/32 in.
Vertical position:	1/32 in.
Level (top of machined surface):	0.005 in./foot
Orientation (parallel to Plan centerline):	0.5 degrees

C.2.2 Actuator Adjustment

Adjust the actuator connection point, via shims to provide the required reserve stroke in the actuator with the rear lock strut in the fully driven position. Perform final shimming of actuator after the shimming of the rear lock strike plate. Provide no less than ¼ inch reserve stroke in the actuator with the rear lock assembly in the fully engaged position.

Prior to installing turned bolts, align the actuator such that no binding exists at the pivot point at any position of travel. Actuator trunnion columns must rest unsecured in the same position on the top plate of the linear actuator support, while connected to the secured strut, in the rear lock pulled and driven positions.

Initial installation of the actuator on the support weldment must be performed with a minimum of ¼" reserve stroke extended from the actuator, or with other means of ensuring that the required final reserve stroke will be present after final shimming of the assembly. Install the components of the assembly in accordance with the approved procedure. Include the sequence of installation and the tolerance for actuator alignment with the strut installation procedure submittal.

C.2.3 Rear Lock Adjustment

Do not perform final shimming of the rear lock assemblies until the following have been completed:

Final shimming of uplift girder bearing assemblies and roadway joint alignment, including final tensioning of all fasteners

All items of work on the related bascule leaf causing significant balance changes (±7.5 kip-ft)

Install strut such that clevis pins are parallel to main girder web, with leaf lowered, within 0.030 inches.

Align strike plate such that the line contact between the rocker arm and the strike plate is a minimum of 90% of the length of the rocker arm. Rotate rocker in the horizontal plane to create contact between both dowel pins and the respective back wall of the grooves. Rotate and shim the strike plate in the transverse plane to ensure the pins clear the top of the groove by a minimum of 1/8 inch throughout travel prior to contacting back wall.

When determining the initial full bearing point for the rear lock assemblies, all fasteners for the rear lock strike plate must be secure and the bearing assemblies at the uplift girder must be fully in bearing, either through imbalance, external temporary reactions, or a combination of both. Provide the full bearing condition at 70°F. Correct the final shim thickness based on the calculated temperature variation only after the initial full bearing condition has been established and approved by the engineer. Thermal expansion will be considered to apply to the length of the strut as well as the vertical distance along the main girder between the uplift girder bearing reaction and the rear lock strike plate location.

C.3 Field System Testing

After the bridge systems have been completely installed, conduct a full functional test of the rear lock operation. Include automatic and manual operations of both driving and retracting the locks at each location in this test.

Verify the fully driven and fully retracted indications at the control console for each of the rear locks.

C.4 Lubrication of Rear Locks

Connect grease fittings with tubing or fittings so that grease is introduced directly into the grease passages for distribution. Tubing is to be extended from the bearings to convenient lubrication stations. Install vibration absorbent braided stainless steel hose, 8-inch minimum length, between the pipe and the component lubricated in locations where vibration exists. Provide tubing supports at increments not to exceed 3 feet between supports.

Immediately after erection and before operation, lubricate all rotating and sliding parts.

C.5 Startup Requirements

Implement startup procedures that protect the equipment from damage and ensure safe working conditions during bridge operations throughout construction. The rear lock assemblies will not be left in the engaged position unless appropriate interlocking preventing the operation of the bascule leaf are in place, tested and working.

C.6 Protection of Equipment

During construction, all equipment must be protected from damage as a result of construction operations and contamination from dust and debris. Should any equipment become contaminated, immediately clean the equipment, re-lubricate, and protect from further contamination. The rear lock must not be operated and no enclosed equipment opened during any period in which construction operations can contaminate the equipment.

D Measurement

The department will measure Rear Locks Bascule Span as a single lump sum unit for the bascule span rear locks, acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.07	Rear Locks Bascule Span	LS

Payment is full compensation for furnishing all material and labor required to provide, install in working order and test the bascule span rear locks as shown on the plans and as described herein; and for furnishing all tools, equipment and incidentals necessary to complete the contract work.

w. Bridge Electrical Work B-70-324, Item SPV.0105.08.

A Description

This special provision describes furnishing labor, tools, equipment and materials necessary for the manufacture, installation, finishing, testing, and making fully operational the electrical components and systems for the bridge. All additional special provisions provide further information, requirements, and guidelines that are applicable to the work paid for under the bid items addressed by this special provision.

Comply with all local codes, all laws applying to electrical installations in effect, the regulations of the latest National Electrical Code, where such regulations do not conflict with the laws in effect and with the requirements of the utility company and AASHTO Movable Bridge Specifications.

It is the intention of the contract plans to call for completely finished work, fully tested and ready for reliable and consistent operation. Furnish, deliver, and install any apparatus, appliance, materials, or work not shown on the plans but mentioned in the special provisions or vice versa, or any incidental accessories necessary to make the work complete in all respects and ready for operation, to be furnished, delivered, and installed without additional expense to the Department.

A.1 Scope

The work under this item includes the following:

- Conduit, junction boxes, hand holes and wiring required for installation of all control cabinets, motors, brakes, rear locks, limits, gates, barriers, traffic signals, roadway lighting, CCTV, auxiliary equipment and bridge amenities (i.e. furnace, etc.) that require electrical connections.
- Lights and receptacles in bridge house, machinery rooms and on/in the bascule pier/abutment.
- Motor Disconnects
- Removal, Salvage and disposal of existing control equipment.
- Incoming power, utility transformer Conduit and metering, main disconnects and automatic Transfer switch.
- Lighting transformer and Panelboards

A.2 Related Provisions

Unless otherwise noted, work under this special provision conforms to the requirements of the following special provisions:

- Span Drives
- PLC Cabinet
- Control Console
- Motor Control Center
- Programming
- Traffic Gates
- Submarine Cable

- Auxiliary Equipment
- Lightning and Surge Protection
- Training, Manual and Spare Parts
- Tayco Street Remote Operations

A.3 Coordination of Electrical Work

The contract documents are diagrammatic in showing certain physical relationships which must be arranged within the electrical work, and which must interface with other work including utilities and mechanical work. Coordinate electrical work with the work of other trades to eliminate conflicts. Advise other trades of openings required in their work for the subsequent move-in of large units of electrical equipment.

Schedule and arrange electrical work in a neat, well organized manner.

Locate operating and control equipment to provide easy access and arrange entire electrical work with adequate access for operation and maintenance, as per the latest NEC requirements.

A.4 Electrical Journeymen

A.4.1 Designation of Electrical Journeymen

Provide a listing of pre-qualified electrical journeymen to perform the electrical work in accordance with this special provision. Perform all work either by, or under the immediate supervision of an electrical journeyman. For this project, “under the immediate supervision” is defined to mean that the journeyman is in the immediate vicinity and physically involved in performing the electrical work. It is the intention of this special provision that the journeyman’s knowledge, talents, and skills in performing certain critical work will be judged and approved by the engineer and that the journeyman will do the actual work utilizing those talents and skills. Helpers are expected to aid the journeyman in the performance of the work and not to act as non-credentialed surrogates of a remote journeyman. Non-approved helpers may only perform tasks of a support nature that do not directly involve responsibility for the installation, connection, or adjustment of electrical materials.

A.4.2 Qualification of Electrical Journeymen

Each electrical journeyman must hold, at a minimum, an active journeyman electrician’s license, by examination, in the State of Wisconsin, and have at least five (5) years of experience in industrial electrical work. The journeyman must also have knowledge and experience on emergency power systems and other electrical devices required to operate the movable bridges. Each journeyman must be pre-approved by the engineer based on submitted documentation of licensing, training and experience history. The engineer might also require a demonstration of knowledge of the tool and technique requirements of specialty electrical work to be performed including, but not limited to: conductor pulling, termination, testing, conduit and device mounting before the journeyman will be permitted to perform such specialty work.

B Materials

Provide all new materials that conform to the standards of the Underwriters Laboratories, Inc., in every case where such a standard has been established for the particular type of materials in question. Submit to the engineer for approval, prior to purchase of any materials or equipment required to be furnished and installed, a complete list of all such materials and equipment including manufacturer's catalog (part and/or model) numbers, catalog data sheets, illustrations, and shop drawings.

B.1 General

In addition to the standard specifications, provide and install all equipment in accordance with the applicable requirements of the following:

- AASHTO Standard Specifications for Movable Highway Bridges
- NFPA 70, National Electrical Code
- NFPA 79, Electrical Standard for Industrial Machinery

Ensure that equipment and its installation present a neat and attractive appearance. Use new heavy-duty industrial design, equivalent to the best grade of the particular type of equipment made by the leading manufacturers of such equipment.

Furnish new equipment that is compatible with all other associated equipment in the system. Ensure that all items furnished perform the function indicated on the approved drawings and as required by the design.

Equipment sizes and space shown on design drawings are approximate. Ensure that all required electrical equipment components can be adequately located in the operator's house and elsewhere on the project as required.

Provide the department a written warranty for operation of the bridge and for all the components furnished under this work, to cover a period of one year after Substantial Completion as described in article "Control of the Work." \Have normal manufacturer warranties extended to cover parts and labor for this period. Have normal manufacturer warranties extended to cover parts and labor for this period of one year after Substantial Completion.

B.2 Disconnect Switches

Furnish and install heavy-duty disconnect switches having electrical characteristics, ratings, and modifications shown on the drawings. Furnish and install fuses for fused disconnect switches. Provide fuses and switches conforming to the following:

- UL 248-1-Low Voltage Fuses- Part 1: General Requirements
- UL 248-12- Low Voltage Fuses- Part 12: Class R Fuses.
- FS W-F-870 - Fuse Holders and Fuse Clips (For Plug and Enclosed Cartridge Fuses).
- FS W-S-865 - Switch, Box, (Enclosed), Surface-Mounted.
- NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600V).

Provide the following:

- NEMA Type 4X (stainless steel) enclosures in the machinery room.
- NEMA 12 units in the rooms at the operator level, entry level and lower level.
- Metal front cover mounted factory nameplates that contain a permanent record of switch type, catalog number, and HP rating.
- Pad-lockable handles with easily recognizable positions are required.
- Switches that include visible blades, reinforced fuse clips, and non-feasible positive quick make-quick break mechanisms.
- Switch assemblies and operating handles that are an integral part of the enclosure base.
- Switches that are HP rated and meet Federal and NEMA Specifications.
- Switches that have defeatable door interlocks that prevent the door from opening when the operating handle is in the ON position.
- Heavy duty switches with line terminal shields.
- Fusible switch assemblies of NEMA KS 1 construction with quick-make, quick-break load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position and Handle lockable in OFF position. Furnish fuse clips designed to accommodate Class R fuses.
- Non-fusible switch assemblies of NEMA KS 1 construction Type HD with quick-make, quick-break load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position and Handle lockable in OFF position. One N.C. (normally closed) and one N.O. (normally open) set of auxiliary contacts is required.
- Fuses that are time delay, current-limiting type with 200KA interrupting rating at 600 VAC. Rejection type are required that are, UL listed to minimize short circuit damage. Use UL Class RK1 for service entrance, transformer feeder and panelboard feeder. Use UL Class RK5 for motor branch circuit.

B.3 Wiring Devices

B.3.1 General Requirements

Conform to UL 943- Ground-Fault Interrupters.

B.3.2 Toggle Switches

Toggle switches are to be heavy-duty use, totally enclosed type with bodies and, handles of thermosetting plastic, supported on a metal mounting strap. Provide wiring terminals of the screw type, side-wired. Back-wired, clamp-type terminals are not allowable. Use switches with snap type with toggle handle, rated quiet type, AC only, 20 A, 120/277 VAC, single pole. Use three-way switches as shown in plans. Install with OFF position down.

B.3.3 Receptacles

Receptacles are to be heavy-duty use, duplex grounding type rated 20 A and 125 VAC. Provide bodies with thermosetting plastic composition, supported on a metal mounting strap. Use receptacles with side-wired with binding-type terminals. Back-wired, clamp-type terminals are not allowable. Use grounded pole type that is connected to the mounting strap.

B.3.4 Ground Fault Circuit Interrupter (GFCI) Receptacles

Provide GFCI duplex receptacles that are feed-through type, convenience receptacle with integral ground fault current interrupter. Provide GFCIs that are rated at 125 VAC and 20 A and capable of detecting a current leak of five (5) mA. Receptacles shall be connected to protect the local load without disruption of the rest of the circuits.

B.4 Lighting

B.4.1 General Requirements

Furnish and install fixtures per the lighting schedule shown in plans. Unless otherwise specified, each luminaire shall be listed by the Underwriters' Laboratories as suitable for application and location shown and conform to any additional regulations necessary to obtain approval for use in locations shown. If Underwriters' Laboratories listing of luminaire is waived, all electrical components shall be UL recognized. Include provision for thru-branch circuit wiring for all recessed incandescent and high intensity discharge luminaires shall include provision for thru-branch circuit wiring. Provide internal wiring of luminaires with a minimum number of splices and make all splices with approved connectors. Ensure wiring and connectors are suitable for the current, voltage and temperature to which they will be subjected.

Manufacture luminaires with the minimum possible number of joints. Make joints only by means of approved welded, brazed, screwed, or bolted construction methods. Soldered joints are not acceptable. No self-tapping screws, bled metal tapping methods, or rivets shall be employed for fastening any parts which must be removed to gain access to electrical components requiring service or replacement, or for fastening any electrical component or support for same. Manufacture ferrous metal parts and supports of luminaires other than parts manufactured of stainless steel completely rustproofed after fabrication and before finishing coatings are applied, by treatment with an approved rust-preventing process. Pre-treated sheet steel shall not be accepted unless treated as above. Provide mounting frames and all screws, bolts, nuts, and other fastening and latching hardware of stainless steel, unless otherwise specified.

Final finish shall be uniform, even in appearance, free from runs and surface imperfections. Luminaires for use at wet or damp locations must be suitably gasketed to prevent access of moisture into electrical components or enclosing diffusers, lenses, or globes.

Unpainted aluminum parts of luminaires must be anodized with coating of sufficient weight to protect against corrosion. Anodize visible surfaces and trim with minimum coating of 35 mg per square inch.

Where stainless steel or non-ferrous metal surfaces (other than reflectors) are to remain unpainted, or where steel surfaces are to be electroplated, unless otherwise specified, coat with a baked-on clear lacquer. Reflectors must be free of ripples, tool marks and other surface imperfections.

Provide exterior fixtures, accessories, and enclosures complete with gaskets to form weatherproof assembly.

B.4.2 Emergency Lights

Provide self-contained LED emergency lighting units with rechargeable storage batteries, charger, and lamps. Equip each unit with an automatic power failure device, test switch, pilot light, and fully automatic high/low trickle charger. Provide sealed wet-cell type batteries, with 1.5 hour capacity to supply the connected lamp load, operate unattended, and be maintenance-free for a period of not less than 10 years. Emergency lighting units shall be rated for 12 V, except units having no more than two (2) unit-mounted lamps may be rated 6 V. Provide dual-rate charger, capable of maintaining the battery in a full-charge state during normal conditions, and capable of recharging discharged battery to full charge within

12 hours. Lamps shall be 12 watts minimum, sealed beam type in plastic housing. Unit shall have plastic enclosure. Provide lamps to indicate AC ON and RECHARGING. Provide TEST switch.

B.4.3 Walpack Fixtures

Furnish and install high performance LED style wall pack fixtures U.L. listed for wet locations. Provide fixtures with a rugged cast aluminum housing with a polyester powder coat finish. The input to the fixtures must be 100-240 volts AC, auto switching, and 60 hertz. Provide fixture with a minimum of 2500 lumen output.

B.4.4 Linear Ceiling Fixtures

Furnish and install high performance LED linear rough service LED fixtures U.L. listed for wet locations. Fixtures shall be approximately 4-5 feet in length and be 120 VAC rated with a minimum of 4000 lumen output.

B.4.5 Operator Level Modular Lighting System

Furnish and install a recessed 6" Linear integrated ceiling system. The system shall be a modular design shall be laid out in a grid as shown on the architectural plans. The fixture will include high performance LEDs with a color temperature of 3000K. The system shall be rated 120 VAC and dimmable. A translucent plastic diffuser shall cover the LEDs. The design is based on Pinnacle Edge ET6 integrated lighting system. Coordinate the design of this lighting system with the ceiling manufacture for installation and mounting details.

B.5 Boxes

B.5.1 Control Panels & Cabinets

Furnish and install NEMA 12 enclosures for all enclosures located in each Operator's house or as noted in plans. Wall mounted enclosures must be a minimum of 14 gauge sheet steel. Free standing enclosures must be a minimum of 12 gauge sheet steel. Provide enclosures with data pockets, 3 point latches and a continuous hinge. Provide back panels on all enclosures and side panels if required.

Furnish and install NEMA 4X stainless steel enclosures for all locations other than the rooms of the operator level, entry level and lower level of the operator house. Wall mounted enclosures must be a minimum of 14 gauge 304 stainless steel. Free standing enclosures must be a minimum of 12 gauge stainless steel. Provide enclosures with heavy duty three-point latching mechanism. Provide enclosures with data pockets, three-point latches and a continuous hinge. Provide back panels on all enclosures and side panels if required.

Install all electrical equipment in each cabinet on sheet steel back or side panels. The components will be front connected, front wired and removable from the front. Arrange the equipment in a systematic and neat arrangement that allows for ease of maintenance.

Provide all control cabinets with a door operated fluorescent light and a convenience receptacle. The power for these devices will be separate from control power. Provide an individual 5 A circuit breaker in each cabinet to isolate and protect the circuit.

B.5.2 Device Boxes

Provide wall-mounted boxes for wiring devices (toggle switches, duplex receptacle, GFCI) that are cast metal. Provide drain holes in the boxes. Provide all boxes with mounting lugs and securely fasten them to the structure with not less than four bronze or monel metal through-bolts.

Boss, drill, and tap for threaded conduit ends, which enter squarely, all cast iron boxes Fabricate from hot-dip galvanized structural steel Type A36 not less than 3/8-inch thick framework for supporting boxes, switches, and other externally mounted electrical devices.

Use brass, monel metal, or stainless steel for all mounting bolts, nuts, washers, and other hardware used for fastening boxes, disconnect switches, devices, lighting outlet boxes, conduit clamps, and similar devices. Use hexagonal bolt heads and nuts, and do not use bolts smaller than 3/8 inch in diameter except as may be necessary to fit the mounting holes in small devices, outlet boxes, and similar standard equipment.

B.5.3 Boxes and Enclosures

All pull boxes, junction boxes, and all enclosures, panels and cabinets, and all other miscellaneous housings used for pulling wires, terminating wires, or otherwise used to install electrical equipment must conform to the following requirements unless specifically stated elsewhere. For all locations, provide 4X (stainless steel) enclosures that are UL-listed for the application. If unavailable, then NEMA 4 rating may

be substituted. Specify all mounting hardware material for Supporting Devices. Specify construction requirements device boxes. Provide sheet metal enclosures with “O-ring” sealing hub connectors. Equip the conduit ends projecting into all boxes and enclosures with insulated bushings. Drill no box or enclosure for more conduits than actually enter it. Use of wireways (metallic or non-metallic) and/or sheet metal troughs with hinged or removable covers are acceptable provided their use is limited and locations are approved by the engineer. Comply with the 40 percent fill allowance per NEC.

B.5.4 Boxes and Enclosures

Use hand-holes that conform to the standard specifications.

B.6 Terminal Blocks

Provide terminal blocks for any conductor that enters or leaves a cabinet or junction box. Provide spring clamp style terminal blocks for conductors 10 AWG and smaller. Use terminal blocks rated at a minimum 600 Volts, 30 A. Provide terminal blocks with a minimum of three (3) conductors with field side of terminal blocks utilizing two (2) conductors. Use terminal blocks fabricated from Allen Bradley, Wago, Phoenix or approved equal.

Use manufacturer accessories for jumpers, end barriers, clamps and wire markers. All terminal block markers will be printed. Hand marked terminals will not be accepted.

B.7 Electrical Identification

B.7.1 Cabinets

Provide legend nameplates for all major pieces of equipment named on the plans, and for all control devices. Provide a plastic laminated engraved nameplate mounted with stainless steel screws for each device. Mark devices as indicated on electrical schematics, for fuses and breakers, include the amperage or fuse part number. Use white nameplates with black lettering. Taped labels can be used on the inside of the console top to identify the selector switches, pushbuttons lights and etc.

Provide nameplates for equipment identification with minimum letter height of 3/16 inch. Use a minimum ¼-inch high nameplates for the console top. Use 1/16-inch minimum thickness plastic nameplates.

Degrease and clean surfaces to receive nameplates. Install nameplates parallel to equipment lines. Secure nameplates to equipment fronts using stainless steel screws or approved manufacturer’s recommended adhesive. Secure nameplates to inside of recessed panelboard doors in finished locations.

B.7.2 Conduit Markers

Provide adequate marking of primary conduits, which are exposed or concealed, in accessible spaces, to distinguish each run as either a power or signal/communication conduit. Use orange banding with black lettering except as otherwise indicated. Provide snap-on type plastic markers. Indicate voltage ratings of conductors where above 240 VAC. Locate markers at both ends of conduit runs, near switches and other control devices, near items of equipment served by the conductors, at points where conduits pass through walls, floors or into non-accessible construction, and at spacing of not more than 50 feet along each run of exposed conduit. Switch-leg conduit and short branches for power connections need not be marked, except where conduit is larger than one (1) inch. Both ends of each marked conduit run shall be provided with a brass tag having a number stamped thereon in accordance with the conduit diagrams. These tags shall be securely and permanently fastened to the conduit ends with bare copper wire.

B.7.3 Console

Provide plastic laminated engraved nameplates for the top of the console. For new consoles, provide black lettering on white background plastic laminated engraved nameplates for the top of the console.

Secure nameplates not secured by a pushbutton or indicator light with stainless steel screws. Adhesive backed nameplates as the only means of securing nameplates will not be allowed.

Provide nameplates for equipment identification with minimum letter height of 3/16 inch. Use a minimum ¼-inch high nameplates for the console top. Use 1/16-inch minimum thickness plastic nameplates.

B.7.4 Wire and Cable Markers

Provide wire and cable markers that are vinyl cloth, split sleeve, or tubing type. Wire numbers printed on wire insulation are not acceptable.

B.8 Supporting Devices

B.8.1 General

Conduit and equipment supports and anchors and fasteners.

- NECA - National Electrical Contractors Association.
- ANSI/NFPA 70 - National Electrical Code.
- UL - Underwriter Laboratories, Inc.

B.8.2 Manufacturer's Instructions

Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

B.8.3 Regulatory Requirements

Conform to requirements of ANSI/NFPA 70. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

B.8.4 Material Requirements

Provide adequate corrosion resistance. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products. Minimum safety factor is 2.0. Framework for supporting boxes, switches, and other externally mounted electrical devices shall be hot-dip galvanized steel. For U-Channel strut systems utilizing bolted construction, all components shall be of the same manufacturer, and shall be 12 gauge and 1-5/8-inch width minimum.

B.9 Conduit and Wiring

B.9.1 General

Furnish and install conduit and raceways in the quantities and sizes required to complete the work as shown on the plans and as required by NEC. Conduit and circuits indicated on plans diagrams and schedule may be recombined in the field where appropriate, with the approval of the engineer. Section Includes: metal conduit, non-metallic conduit, liquid-tight flexible metal conduit, and fittings and conduit bodies.

Use rigid galvanized steel conduit for conduit in the lower, entry and operator’s level rooms. Use of thin wall EMT is allowed for lighting and receptacle circuits that are installed behind finished drywall. Use PVC coated rigid galvanized steel conduit for all exterior conduit that is located outside the three rooms listed above. Use PVC schedule 40 for concrete embedded and installed in a trench and in counterweight pits, unless the conduit is under a roadway, then use Schedule 80.

B.9.2 Conduit drawings

Before the initial start of construction, submit a full size drawing showing all conduit runs between all pieces of equipment for review and approval. Provide “as-built” drawing for riser diagrams and schedules.

B.9.3 Definitions:

- Conduit: Pipe that has been treated, threaded, and classified to be suitable for use as an electrical raceway.
- Conduit Body: Fitting with removable cover to allow pulling conductors and which may also provide means for making a tight turn or "tee" connection in conduit.
- Fitting: Accessory component for joining conduit (coupling), connecting conduit to box or enclosure (connector or hub), or providing other functions (such as expansion fitting).

B.9.4 Conform to the following:

- NEMA/ANSI C80.1 - Rigid Steel Conduit - Zinc Coated (GCR).
- NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
- NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
- NEMA TC 2 - Electrical Polyvinyl-Chloride (PVC) Tubing and Conduit.
- NEMA TC 3 - PVC Fittings for use with Rigid PVC Conduit and Tubing.

- NEMA TC 14 - Filament-Wound Reinforced Thermosetting Resin Conduit.
- UL 651 - Schedule 40 and 80 Rigid PVC Conduit.
- NCEA 101 - Standard Practice for Good Workmanship in Electrical Construction.
- NEMA VE 2 - Metal Cable Tray Installation Guidelines.
- UL 1684 - Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
- UL 514B - Fittings for Cable and Conduit.
- UL 360 - Liquid-Tight Flexible Steel Conduit.
- UL 6 - Rigid Metal Conduit.

B.9.5 Conduit Requirements:

- Minimum Size: ¾ inch minimum trade size for rigid and PVC, unless otherwise specified. ½ inch for EMT.
- PVC Coated Metal Conduit Description: NEMA RN 1; rigid steel conduit (ANSI C80.1) with external PVC coating, 40 mil thick. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.
- Liquid-tight Flexible Metal Conduit Description: UL 360; Interlocked steel construction with PVC jacket. Fittings: NEMA FB 1.
- Non-metallic conduit description: NEMA TC 2, schedule 80 (UL 651). PVC fittings NEMA TC 3 to match conduit. Embedded in concrete use only.

B.10 Conductors

B.10.1 General

For building wire and cable, wiring connectors and connections, and flexible cable,

Conform to the following:

- ANSI/NFPA 70 - National Electrical Code.
- ASTM B3/ANSI C7.1 - Standard Specifications for Soft or Annealed Copper Wire.
- UL 83 - Thermoplastic-Insulated Wires and Cable.
- UL 44 - Thermoset-Insulated Wires and Cable.
- UL 854 - Service Entrance Cables.
- UL 1063 - Machine-Tool Wire and Cables.
- UL 1685 - Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical Cables.
- Conform to requirements of ANSI/NFPA 70. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

B.10.2 Project Conditions

Verify that field measurements are as shown on plans. Wire and cable routing shown on plans is approximate unless dimensioned. Route wire and cable as required to meet project conditions. Where wire and cable routing are not shown, and destination only is indicated, determine exact routing and lengths required. Determine required separation between cable and other work. Determine cable routing to avoid interference with other work.

B.10.3 Building Wire and Cable

No aluminum or solid copper conductors allowed. For single conductor insulated wire use no wire smaller than No. 12 AWG for power and lighting circuits and no smaller than No. 14 AWG for control wiring, except that control wiring within a cabinet may be No. 16 AWG. Minimum field wire size is No. 12 AWG for control and No. 10 AWG for motor loads. Use minimum No. 10 AWG for 20 A, 120 VAC, branch circuit home runs longer than 75 feet, and for 20 A, 208/240/277 VAC, branch circuit home runs longer than 200 feet.

Furnish insulated conductors of seven or nineteen strand copper, minimum 98 percent conductivity and connector accessories for copper in sufficient quantities for a complete installation. Use twisted shielded

pairs in cases of low level audio or digital signal when required. Provide XHNW, THHW/THWN-MTW insulation rated 600 VAC unless otherwise noted. Provide type SE, USE-2, RHW-2 or RHW insulation for incoming conductors, unless otherwise noted. All field wiring shall be rated 90 ºC.

B.12 Lighting Transformer

Provide transformers with proven 220 °C, UL tested insulation system. Wind coils with copper. Insulate material with proven, high temperature resistant 220 °C material. Insure all materials in the transformer are flame retardant and do not support combustion as defined in ASTM Standard Test Method D635. Provide final insulation treatment by total immersion in a 220 °C insulating varnish that maintains superior bond strength, high dielectric strength, and outstanding power factors at temperatures normally associated with 220 °C system. After immersion, cure the varnish thoroughly at normal operating temperatures to assure the scourging of all volatiles in the varnish solvent.

Construct transformers with core materials of high quality and low loss characteristics to minimize exciting currents, no-load loss, and interlaminar vibrations. Incorporate built-in vibration dampening systems to minimize and isolate sound transmission. Mechanically brace the core-coil assembly to withstand short circuit tests as defined in NEMA TR-27. Coil construction and mechanical bracing members must prevent mechanical degradation of the insulation structure during short circuit.

Provide self-bracing transformer enclosure and provide drip-proof and rodent-proof protection. Include convenient knockouts for conduit entrance. Locate terminal compartment in bottom of transformer, below the core-coil assembly, for side or bottom conduit entrance. Temperature rise in terminal compartment must not exceed 5 °C above ambient. Run line and load conductors in separate conduits.

Provide transformers with two 22 percent full capacity taps above rated voltage and two 22 percent full capacity taps below rated voltage. Minimum basic impulse level (BIL) allowed is 10 kV. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap. Provide transformers 75 kVA and less, suitable for wall, floor, or trapeze mounting; transformers larger than 75 kVA shall be suitable for floor or trapeze mounting. Provide continuous winding coils with terminations brazed or welded. Include transformer connection data and overload capacity based on rated allowable temperature rise on the factory nameplate.

Conduct the following tests at the factory:

- Applied voltage test (one minute) 4 kV.
- Induced voltage test - two times normal for 7,200 cycles.
- Ratio and phase relation.

Test reports on electrically duplicated units must certify that the following tests have been completed on the first rating of any design:

- No load losses.
- Induced voltage.
- Total losses.
- Sound level.
- Applied voltage.
- Impulse test.
- Temperature rise.

Submit three (3) copies of test results to the engineer for approval.

B.13 Panelboards

Furnish and install, where indicated, a dead-front panelboard incorporating switching and protective devices of the number, rating, and type noted herein or shown on the Plans. Panelboards shall be circuit breaker equipped. Panelboards shall have general purpose enclosures and shall be surface mounted except where noted. All panelboards shall be rated for the intended voltage and shall be in accordance with the Underwriters' Laboratories, Inc. "Standard for Panelboards" and "Standard for Cabinets and Boxes" and shall be so labeled where procedures exist. Where panelboards are to be used as service entrance equipment, they shall be so labeled. Panelboards shall also comply with NEMA Standard for Panelboards, National Electric Code, and Federal Specification 115a (Power Distribution Panels) where

applicable. Manufacturer shall be a company specializing in manufacturing the product specified with a minimum of five (5) years documented experience.

Factory-assemble interiors with switching and protective devices, wire connectors, etc. All terminals shall be suitable for copper wire of the sizes indicated. Interiors shall be so designed that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be so designed that circuits may be changed without machining, drilling, or tapping. Arrange branch circuits using double row construction. Provide a factory nameplate listing panel type and ratings. Bus bars for the mains shall be copper and sized in accordance with UL standards. Unless otherwise noted, full size neutral bars shall be included. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of the branch circuit devices. The short circuit rating of the assembled panelboard shall be in accordance with UL standards and their test verification. Phase bussing shall be full height without reduction. Cross and center connectors shall be copper. Neutral bussing shall have a suitable lug for each outgoing feeder requiring a neutral connection. Spaces for future switching and protective devices shall be bussed for the maximum device that can be fitted into them.

Provide boxes made from galvanized code gauge steel of sufficient size to provide a minimum gutter space of six inches on all sides. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, size the box to include this wiring space. This wiring space shall be in addition to the minimum gutter space specified above and the limiting width may be increased accordingly. Provide a minimum of four (4) interior mounting studs.

Include hinged doors covering all switching device handles in all panel trims, except that panelboards having individual metal clad externally operable deadfront units may be supplied without such doors. In making switching device handles accessible, doors shall not uncover any live parts. Provide doors with a cylinder lock and catch. Key all locks alike. Furnish a directory frame and card having a transparent cover on each door. Fabricate the trim from code gauge sheet steel. Clean and finish all exterior and interior steel surfaces of the panelboard trim with gray ANSI-61 paint over a rust-inhibiting phosphatized coating. For flush panels overlap trim for the box by at least ¾ inch all around.

Protect electrical circuits with molded case circuit breakers with inverse time delay and instantaneous circuit protection. Operate the breakers with a toggle type handle with a quick-make, quick-break, over-center switching mechanism that is mechanically trip free from the handle. Include provisions so that the contacts cannot be held closed against short circuits and abnormal currents. Tripping because of overload or short circuit shall be shown by the handle automatically assuming a position midway between the manual ON and OFF positions. Ground and polish all latch surfaces. Plug-in type circuit breakers are not acceptable. Breakers must be completely enclosed in a molded case, bolt-on type construction. For non-interchangeable trip breakers seal their covers; for interchangeable trip breakers seal the trip unit sealed to prevent tampering. Provide non-welding silver alloy contacts with Arc chutes, consisting of metal grids mounted in an insulating support.

Circuit breakers shall conform to the applicable requirements of NEMA Standards and meet the appropriate classifications of Federal Specifications W-C-375b. Provide molded case breakers of the following types: Thermal magnetic standard type that provides inverse time delay overload and instantaneous short circuit protection by a thermal-magnetic element; or magnetic only standard (Motor Circuit Protector) that provides instantaneous short circuit protection by a front adjustable magnetic element with supplemental thermal overload protection. The adjustment button(s) shall have main setting points and mid-setting points following a linear scale so that each point has a significant value within calibration tolerance.

Provide multi-pole breakers with a single operating handle that is independently removable without disturbing adjacent units or other bus connections and is fastened to the main bus bars with a bolted connection. Plate all copper parts to prevent corrosion. Provide 100 A frame breakers with an interrupting rating of 10,000 A (minimum). Provide larger frame size breakers with an interrupting rating of 22,000 A (minimum).

B.14 MiniPower Centers

Furnish and install, where indicated, a combination single phase stepdown transformer panelboard power center. Mini power center shall be NEMA 3R rated and include all branch circuit breakers.

B.15 Automatic Transfer Switches

Provide a 400 amp service entrance rated automatic transfer switch rated with overcurrent protective devices (circuit breakers for each utility source) in a in a NEMA 12 cabinet. Switch shall have 3 poles with 3 position with an both breakers off position.

A permanently affixed operating handle shall be affixed to the cabinet to allow transfer of power without entering the cabinet. Indicator lights shall be installed on the door and connected to the line side of each source of power and the load side of the switch.

B.15.1 General

B.15.1.1 References

The automatic transfer switches and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of UL and NEMA as follows:

1. UL 1008 – Transfer Switches
2. UL 991 - Tests for Safety-Related Controls Employing Solid-State Devices
3. NFPA 70 – National Electrical Code
4. NFPA 99 – Essential Electrical Systems of Health Care Facilities
5. NFPA 110 – Emergency and Standby Power Systems
6. NEMA ICS 10 – AC Transfer Switch Equipment
7. IEEE 446 – Recommended Practice for Emergency and Standby Power Systems

B.15.1.2 References

The manufacturer of the assembly shall be the manufacturer of the major components within the assembly. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with

this requirement.

B.15.2 Construction

Provide a molded case type breaker transfer switch. All breaker transfer switches shall be UL listed for application in their intended enclosures for 100% of their continuous ampere rating.

- The automatic transfer switch shall be of double throw construction operated by a reliable electrical mechanism momentarily energized.
- Each transfer switch shall be positively interlocked both mechanically and electrically to prevent simultaneous closing of both sources under either automatic or manual operation.
- Main contacts shall be silver composition and mechanically held in both normal and emergency positions.
- Switches shall operate delayed transition, with a time delay in the neutral position adjustable from 0 to 120 seconds
- The switching panel shall consist of completely enclosed contact assemblies and a separate control or transformer panel. Control power for all transfer operations shall be derived from the line side of the source to which the load is being transferred. The transformer shall be multi-tap for ease of voltage adjustment in the field.
- Transfer switches shall be capable of being operated manually under full rated load conditions. Manual operation shall be accomplished by a permanently attached manual operator, or by integrally mounted pushbuttons. Removable manual operating handles and handles that may move in the event of an electrical operation during the manual operation, are not acceptable. Manual operators requiring source or load disconnection prior to manual operation are not acceptable.
- On transfer switches requiring a solid neutral, the neutral shall be fully rated.
- Supply transfer switch in a NEMA 12 Enclosure.
- Controller Display and Keypad - The microprocessor-based controller display shall be UV resistant and include a 2-line, 16-character, backlit LCD display. The controller shall be

capable of displaying transfer switch status, parameters, and diagnostic data. All set point parameters shall be password protected and programmable using the controller keypad or remotely using serial port access.

- Voltage and Frequency Sensing - The controller shall have a voltage range of 0-790 volts (50/60 Hz) and an accuracy of +/- 1% of nominal input voltage and a frequency range of 40-70 Hz and an accuracy of +/- .3 Hz.
- The normal and emergency sources shall include phase reversal protection. The preferred rotation is programmable as ABC or CBA
- Time Delays
    - A time delay shall be provided on transfer to source 2, adjustable from 0 to 1800 seconds.
    - A time delay shall be provided to override a momentary power outage or voltage fluctuation, adjustable from 0 to 120 seconds.
    - A time delay shall be provided on retransfer from source 2 to source 1, adjustable from 0 to 1800 seconds.
    - A time delay shall be provided after retransfer that allows the generator to run unloaded prior to shut down, adjustable from 0 to 1800 seconds.
    - A time delay shall be provided for engine failure to start, fixed setting of 6 seconds.
    - A pre-transfer time delay output adjustable from 0-120 seconds. The contact shall be a form-c contact rated for 10-Amp at 250-Vac and 10-Amp at 30-Vdc.
    - All delays shall be field adjustable from the microprocessor-based controller without the use of special tools.

B.16 Single Mode Fiber

The fiber optic cable shall:

- Be armored, dry-filled, loose-tube, dispersion-unshifted, single mode fiber (SMF) with low water peak, gel free, and suitable for underground (i.e., in conduit) and aerial outside plant installation.
- Meet or exceed the Telecommunications Industry Association (TIA) and Electronic Industries Alliance (EIA) TIA/EIA-492-CAAB specification, the U.S. Department of Agriculture Rural Utilities Service (RUS) 7 CFR 1755.900, Telcordia GR-20 standards, International Electrotechnical Commission (IEC) 60793-2-50 Type B1.3, and International Telecommunication Union ITU-T G.652.D requirements.
- Be splice-compatible with Menasha Utilities existing SMF and require no electronic equipment for dispersion compensation between new and existing fiber.
- Be continuous and be of the same material.
- Be in buffer tubes and shall be usable at attenuation of:
    - 1,310 nm, ≤0.4 dB/km loss
    - 1,550 nm, ≤0.3 dB/km loss
- The fiber shall be free of surface imperfections and inclusions.
- Only commercial off the shelf materials, equipment and components shall be furnished.
- All fiber optic core glass shall be from the same manufacturer.

The fiber optic jumper cables and connectors shall be compliant with the TIA/EIA-568-A and TIA/EIA-604 standards, as applicable, and shall be tested according to the Telcordia/Bellcore GR-326-CORE standard. When tested according to the TIA and EIA's Fiber Optic Test Procedure (FOTP)-171 (TIA/EIA-455-171), the connectors shall test to an average insertion loss of 0.4 decibel and a maximum loss of 0.75 decibel. The connectors shall be tested as detailed in FOTP-107 (TIA/EIA-455-107) to reflectance values of -50 decibels.

- The fiber optic jumpers shall be two 6.5-foot (2 meter) SMFO duplex LC-LC jumper cables manufactured by Corning, model number 040402R5Z20002M
- The Contractor shall install the armored, outdoor rated 12 strand SM fiber drop cable as indicated on the plans.

C Construction

C.1 General

C.1.1 Codes

Comply with all local codes, all laws applying to electrical installations in effect and with the regulations of the latest edition of the National Electrical Code, where such regulations do not conflict with the laws in effect and with the requirements of the utility company. Construct, wire, and install all luminaries in compliance with all applicable national, state and local codes.

C.1.2 Protection of Electrical Equipment

Protect electrical equipment from water damage, especially from rain, snow, condensation, and water dripping or splashing on equipment and wiring, at all times during shipment, storage and construction (prior to final acceptance). Provide temporary electrical connections to equipment heaters, or provide temporary heaters, as required to prevent damage from moisture.

Thoroughly dry out and put through a special dielectric tests as directed by the engineer at no cost to the City, or replace if not tested to the satisfaction of the engineer, any apparatus that has been subjected to possible injury by water or dampness (including the interiors of motor control equipment, submarine cable ends, or any other electrical devices).

C.1.3 Coordination of Bridge Electrical Work

The plans are diagrammatic in showing certain physical relationships which must be arranged within the electrical work, and which must interface with other work including utilities and mechanical work. Coordinate as necessary between trades to allow for proper installation of all electrical work and to eliminate conflicts. Locate operating and control equipment to provide easy access and arrange entire electrical work with adequate access for operation and maintenance, as per the latest NEC requirements.

C.1.4 Field Measurements and Surveys

Prior to development of submittals, conduct field surveys to verify construction dimensions. Identify field dimensions on submittals that have been field verified. Conduct field measurements and surveys as required to supplement information provided to provide a complete and satisfactory fitting and fully operational installation.

C.2 Submittals

Submit electrical equipment, hardware, drawings, testing plans, and documentation for all electrical items described in the contract documents, except for the submarine cables installation. Submarine cables installation is submitted as a separate bid item.

Submit working plans and shop drawings as prescribed in the contract documents and in this special provision. Clearly mark manufacturer's standard drawings that indicate dimensions and/or options for more than one piece of equipment to clearly indicate what data applies.

Provide a separate submittal package for this and all other electrical bid items unless otherwise indicated. Label each submittal package to indicate the project name and bid item number. Label data sheets for individual components such as motors, limit switches, etc. with the identification numbers shown in the plans and the special provisions.

Submit all components of a bid item by task (Traffic Gates, Traffic Signals, Navigational Lights & Aids, Sump Pump, etc.). Include shop drawings drawn to scale and certified by the manufacturer for all submittals for major electrical equipment. Where wiring diagrams, schematic diagrams, engraving schedules, conduit drawings, interconnection diagrams, one-line, three-line diagrams, etc. are called for or provided, they are to be site specific.

For motors, submit manufacturer’s product data, installation instructions, operation and maintenance data. Include assembly drawings, bearing data with replacement sizes, and lubrication instructions. Clearly identify the locations of each motor terminal connection box relative to the bridge drive machinery. Ensure proper clearances of all components.

Submittal approval shall be on an “all or none” basis. Provide complete resubmittals even if some items on the original submittals may not have been marked deficient. Provide sufficient time in project schedule to allow for the possibility of repetitious submittals without creating delays to the project. The City will not bear any responsibilities for delays caused by repetitious submittals.

C.3 As-Built Drawings

At the completion of the project, provide complete as-built drawings. As-built drawings will be essentially the same as the working plans and shop drawings submitted for approval but showing all of the changes made during construction.

C.3.1 Working Drawings

Prepare and submit to the engineer for approval the following working drawings and documents executed in accordance with the provisions of the contract:

- A drawing to scale showing the location, depth, and length of cables, together with the proposed method of installing the cables and all equipment. Submit drawings for approval prior to placing cable and equipment orders with any manufacturer.
- Typical published test data showing physical and electrical characteristics of the proposed submarine cable insulating compound.
- Manufacturer’s construction drawings of all submarine cables showing the sizes of conductors, thickness of insulation, makeup of the cable layers, type and size of jackets, armor, jute serving and other components, and the outer diameters of the finished cables.
- Detail drawings showing the construction of the submarine and terminal boxes and cabinets and all equipment and components mounted therein. Terminal and wire tagging must be shown prior to cable installation.
- Submit calculations and locations of heaters within each motor drive, programmable logic controller and termination cabinet. Provide thermostats that are internal to each self-contained heater unit. Size each heater unit per the internal space of each terminal cabinet, and per heater manufacturer’s recommendations.
- Provide Manufacturer’s data sheets (including type, length, and minimum bending radius), certified test data, and cross section drawings for each cable. Provide manufacturer’s data sheets for each type of cabinet, heater, terminal block, ground bar(s), and other devices within each cabinet. Provide detailed dimensioned drawings for termination cabinets including terminal/wire number designations, cable routing, cabinet and cable support devices and mounting details. Submit drawings showing configuration of conduits and devices entering submarine cable termination cabinets, and detailed layouts of terminal blocks within submarine cable termination cabinets. Submit details of termination cabinets, showing dimensions, segregation shields, and mounting arrangement of all equipment. Provide electrical schematics and system diagrams showing all system wiring. Provide dimensioned drawings that detail all surrounding mounting walls and structures. Where existing cables and conduit penetrations are to be re-used, provide details of how the new cables, conduits and fittings are to be installed. Where new submarine cables route through new or existing penetrations sleeves, provide details on sealing the openings.

C.4 Wiring Devices

Provide devices installed outside of control house with corrosion-resistant metal weatherproof covers. Furnish cover plates with a1 mm thick satin finished Type 302 stainless steel that fit Type FS or FD boxes without overlapping edges or corners.

C.5 Terminal Block Requirements

Provide terminal blocks with white marking strips. Group them for easy accessibility unrestricted by interference from structural members and instruments. Provide two (2) inches, minimum on each side of each terminal block to allow an orderly arrangement of all leads to be terminated on the block. Do not terminate more than two wires on any one terminal position. Permanently label each terminal block, device, fuse block, and both ends of each conductor to coincide with the identification indicated on the manufacturer’s wiring diagrams.

C.6 Electrical Identification (Nameplates)

Degrease and clean surfaces to receive nameplates and tape labels. Install nameplates and tape labels parallel to equipment lines. Secure nameplates to equipment fronts using a minimum of two (2) stainless steel screws or approved manufacturer's recommended adhesive. Secure nameplates to inside of recessed panelboard doors in finished locations.

Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on schematic and interconnection diagrams or equipment manufacturer's shop drawings for control wiring.

C.7 Supporting Devices

Do not fasten supports to piping, ductwork, mechanical equipment, or conduit. Do not drill any holes in any structural steel or concrete members without approval of engineer. All mounting bolts, nuts, washers, and other hardware used for fastening boxes, disconnect switches, devices, lighting outlet boxes, conduit clamps, and similar devices shall be monel metal, bronze, or stainless steel. Use hexagonal bolt heads and nuts with spring lock washers under all nuts. Use minimum 3/8-inch diameter bolts except as may be necessary to fit the mounting holes in small devices, outlet boxes, and similar standard equipment.

Fasten hanger rods, conduit clamps, and outlet and junction boxes to structure using proper fasteners. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction. Attachment to steel or concrete shall be by stainless steel straps or hangers held at not less than two points by galvanized bolts or lag screws. Concrete inserts shall be fabricated from stainless steel. Install surface-mounted cabinets and panelboards with a minimum of four anchors. Do not use powder-actuated anchors. Do not drill or weld structural steel members.

C.8 Motors

Megger all motors before final connection. Record these readings and submit with "as-built" drawings at time of functional testing. Coordinate motor shaft diameters and lengths with requirements for machine and service brakes. Before ordering motors, verify that the sizes and lengths of all shafts, location of conduit boxes match the requirements for the brake and mechanical equipment furnished.

C.9 Conduit and Wiring

Unless otherwise specified in the plans, install conduit in accordance with NECA Standard Practice. Install nonmetallic conduit in accordance with manufacturer's instructions. Arrange supports to prevent misalignment during wiring installation. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers. Do not use plastic straps or plastic hangers. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits. Fasten conduit supports to building structure and surfaces under provisions of supporting devices. Attachment to steel or concrete shall be by galvanized or stainless steel straps, hangers held at not less than two points by galvanized, stainless steel bolts, or lag screws. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary support.

Provide pull boxes or junction boxes wherever necessary to facilitate the installation of the conductors. Pull boxes are used for pulling conductors through. No splicing or terminations are permitted. Junction boxes are used for field connections of conductors. Conductors are to be connected using approved terminal blocks. Do not use condulets for pulling more than 10 conductors or for making such turns in conduit runs or for branching conductors, except for indoor wiring to lighting fixtures and receptacles. At any point where a conduit crosses an expansion joint, or where movement between adjacent sections of conduit can be expected, install a bronze or alloy expansion fitting.

Use of flexible conduit is allowed only for the connection of motors, limit switches, and other devices that must be periodically adjusted in position. Make connections between the rigid conduit system and all motors, and limit switches with flexible conduit with couplings and threaded terminal fittings. Do not exceed two (2) feet in length for flexible conduit extensions. Install flexible conduit with bonding jumpers and arrange to drain away from the device it serves.

Provide at both ends of each conduit run a brass tag having a number stamped thereon in accordance with the conduit diagrams. Secure and permanently fasten these tags to the conduit ends with bare copper wire. Run concealed in walls, ceiling, or floor conduits in the control room. Run exposed conduits in the bascule pier and bascule abutment. Where conduits pass through the floors or walls of the control room, provide galvanized rigid conduit sleeves for free passage of the conduits. After the conduits are

installed, caulk openings with an elastic compound and provide escutcheon plates on the interior walls, ceilings, and floors for airtight fits.

Arrange conduit to maintain headroom and present neat appearance. Route exposed conduit parallel and perpendicular to walls. Route conduit in and under slab from point-to-point. Maintain adequate clearance between conduit and piping. Maintain 12-inch clearance between conduit and surfaces with temperatures exceeding 104 ºF.

Connect conduit sections to each other with threaded couplings. Install conduits to be continuous and watertight between boxes or equipment. Protect conduits at all times from the entrance of water and other foreign matter by capping or well plugging overnight when the work is temporarily suspended.

Conduits mounted exteriorly on parts of the steel work must be set not less than 1½ inch clear from the supporting structure to prevent accumulation of dirt. Space parallel horizontal conduit one inch apart and securely clamp to the steel work to prevent rattling and wear. The clamps, in general, shall consist of U-bolts attached to angle or channel iron supports bolted to the members. The spacing of the clamps shall not exceed 6 feet of spacing per NEC 346 and 347 whichever is less.

Cut conduit square using saw or pipe cutter; de-burr cut ends. Bring conduit to shoulder of fittings; fasten securely. Long running threads will not be permitted. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum. Embedded conduit stub-outs shall be provided with threaded 316 stainless steel.

Use conduit hubs to fasten conduit to sheet metal boxes. Install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2 inches. All field bends shall be long sweep, free from kinks, and of such easy curvature as to facilitate the drawing in of conductors without injury to the conductors. Make conduit runs with as few couplings as standard lengths will permit.

Avoid moisture traps; provide junction box with drain fitting at low points in conduit system. Install all conduits so that they will drain properly and provide drainage tees at low points where required. Provide suitable pull string in each empty conduit except sleeves and nipples. Use suitable caps to protect installed conduit against entrance of dirt and moisture. Carefully clean all conduits before and after installation. Upon completion of the conduit installation, clear each conduit with a tube cleaner equipped with a mandrel of a diameter not less than eighty percent of the nominal inside diameter of the conduit, and draw in the conductors. Identify conduit under provisions of the Electrical Identification section of this special provision.

Provide a drain fitting with a tee in embedded conduits on roadways and sidewalks.

C.10 Conductors

Do not splice conductors (except for “pigtail” leads and lighting circuits). Use solderless pressure connectors with insulating covers for wire splices and taps, No. 8 AWG and smaller, for lighting circuits. Make lug connections with high-pressure indent connector tools as recommended by the lug manufacturer. Use split bolt connectors for wire splices and taps, No. 6 AWG and larger, and all motor connections or other approved method.

Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor. Make splices and taps to carry full ampacity of conductors without perceptible temperature rise. All splices shall be waterproof. Terminate spare conductors with electrical tape.

Neatly train and lace wiring inside boxes, equipment, and panelboards. Place an equal number of conductors for each phase (three-phase system) of a circuit in same raceway or cable. Make conductor lengths for parallel circuits equal. Pull all conductors into a raceway at the same time. Use soap base wire pulling lubricant for pulling No. 4 AWG and larger wire. Tighten all connections to manufacturer's recommendations. Take precautions to avoid “sawing” through PVC conduit. Pull ropes shall be braided. Bare conductors shall not be pulled through PVC conduits. Conduit shall be swabbed with lubricant prior to pulling the conductors.

Identify wire and cable under provisions of Electrical Identification. Identify each conductor with its circuit number or other designation indicated on plans.

C.10.1 Conductor Tests

Test each circuit for continuity and short-circuits for its complete length before being connected to its load. Verify identification numbers for the entire length of the circuit. Inspect wire and cable for physical damage and proper connection. Perform insulation testing on all power conductors.

C.10.2 Insulation Resistance Test

Perform insulation resistance test (wire-to-wire and wire-to-ground) at 1,000 VDC for one minute. Minimum insulation resistance for new cable shall be 100 mega-ohms or greater. When insulation resistance must be determined with all motor control centers, panelboards, switches, and over current devices in place, the insulation resistance when tested at 500 VDC shall be no less than 50 mega ohms. Test results shall be recorded and witnessed by the engineer. Submit test results to the engineer for review prior to energizing the circuit. Include a table of the test results with the "as-built" drawings with additional columns left blank for future readings to be recorded.

C.11 Luminaires

Construct, wire, and install all luminaires in compliance with all applicable national, state

and local codes.

C.12 Salvaging Equipment

Salvage the following equipment from the existing Racine Street Movable Bridge and turn over to the Department for spare parts.

- Flat Screen Monitors
- CCTV control and communication Equipment
- CCTV Cameras

See Special Provision Tayco Remote Operations for Remote operations equipment.

C.13 Panel Boards

Obey the following directives for the installation of panelboards:

- Install panelboards in accordance with NEMA PB 1.1.
- Install panelboards plumb. Install recessed panelboards flush with wall finishes.
- Height: 6 feet (1.8 m) to top of panelboard; install panelboards taller than 6 feet (1.8 m) with bottom no less than 4 inches (102 mm) above floor.
- Provide filler plates for unused spaces in panelboards.
- Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- Provide engraved plastic nameplates under the provisions of Article 508-4.11 Electrical Identification.
- Minimum space for five spare conduits (future).
- No 2 size breakers shall be used.
- Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the running phase loads to within 10 percent of each other. Maintain proper phasing for multi wire branch circuits.
- Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses. Take care to maintain proper phasing for multi-wire branch circuits. The engineer will witness this test.

Prior to energization of the panelboard:

- Megger check phase-to-phase and phase-to-ground insulation for proper resistance levels.
- Check panelboard electrical circuits for continuity and for short-circuits.

C.14 Incoming Bridge Power

New utility service shall include all meter sockets, CT cabinets, conduit and conductors from meter socket to the new utility transformers. Intercept existing conduits from Menasha utilities that are installed within 10 feet of the new utility transformers. All equipment shall meet the requirements of Menasha utilities. All connection fees shall be paid for separately.

D Measurement

The City will measure Bridge Electrical Work as a single lump sum unit for the work acceptably completed.

E Payment

The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.08	Bridge Electrical Work B-70-324	LS

Payment is full compensation for furnishing and installing the electrical service, electrical components, control system, and documentation, for the bascule span; and for furnishing all labor, tools, testing equipment, software, materials, and incidentals necessary to complete the contract work.

Coordinate with the engineer to determine how to handle the electrical service lateral installation costs. If the electrical utility bills the contractor directly, pay the utility promptly. The department will reimburse the contractor for invoice costs under the Electrical Service Lateral administrative item.

x. Span Drives and Motors B-70-324, Item SPV.0105.09.

A Description

This special provision describes furnishing labor, tools, equipment and materials necessary for the manufacture, transporting, installation, testing, and making fully operational main span motor drives and motors.

A.1 References

- IEEE 112 – Test Procedures for Polyphase Induction Motors and Generators
- NEMA MG 1 – Motors and Generators
- NEMA MG 2 – Safety Standards for Construction and Guide for Selection, Installation, and Use of Electric Motors and Generators

A.2 Related Provisions

Unless otherwise noted, work under this special provision conforms to the requirements of the following special provisions:

- Electrical Work
- PLC Cabinet
- Control Console
- Motor Control Center
- Programming
- Traffic Gates
- Submarine Cable
- Auxiliary Equipment
- Lightning and Surge Protection
- Training, Manual and Spare Parts
- Tayco Street Remote Operations

B Materials

B.1 General

Each span drive is a complete system that includes the motor, AC drive, dynamic braking resistors, brake chopper (as required), disconnect, cabinet, metering and miscellaneous equipment necessary to meet the performance requirements of this specification.

B.2 Three Phase Power - Squirrel Cage Motors

Refer to Plans for required electrical characteristics. Provide stamped, stainless steel visible nameplate indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model and serial number, design class and service factor. Provide a full test report for each motor. Provide conduit connection boxes, threaded for conduit.

Provide three phase power squirrel cage motors with the following minimum specifications:

- Continuous Duty in 40 °C environment.
- Start-Ups: 12 per hour. two (2) per 10 minute period.
- Power Output, Locked Rotor Torque, Breakdown or Pullout Torque: NEMA Design B Characteristics for pumps,
- Conform to NEMA MG one (1) for Design B & D Motors.
- Insulation System: NEMA Class F or better.
- Testing Procedure: In accordance with IEEE 112, Test Method B. Load test motors to determine freedom from electrical or mechanical defects and compliance with performance data. Perform additional testing to determine speed/torque curve relationship.
- Motor Frames: TENV or TEFC steel or cast-iron frames (no aluminum frames allowed). Motor bases have been designed based on a L3213 frame. Coordinate actual motor frame with machinery fabricator. No external blower allowed.
- Three PTC thermistors imbedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter.
- Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum AFBMA 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
- Sound Power Levels: To NEMA MG 1.
- Nominal Efficiency: Meet or exceed values in Schedules at full load and rated voltage when tested in accordance with IEEE 112.
- Nominal Power Factor: Meet or exceed values in Schedules at full load and rated voltage when tested in accordance with IEEE 112.
- Service Factor: 1.15. Horsepower ratios shall be referenced from a 1.0 service factor.

Motors are integral to assemblies being provided for gates, brakes and rear locks and are paid for as part of those assemblies.

B.3 Span Drives

Design, fabrication, and performance requirements for VSD:

- Rated for operation in 460 V, 3-phase, 60 Hz systems.
- Installed in NEMA 12 enclosure with a fused flange mounted disconnect.
- Incoming power line Reactor
- Dynamic braking Resistors
- Dynamic braking function capable of 100 percent braking of full load motor torque for three (3) minutes
- Include a brake chopper assembly located in each drive enclosure.
- Include suitable warning labels inside and outside the enclosure in those cases where it is possible for the maintenance electrician to wire circuits into the enclosure that are not disconnected by the disconnect device.
- Operate in an ambient temperature of 0 °C. to 40 °C., an altitude of up to 3,300 feet above sea level, and humidity of 0 to 95 percent non-condensing.
- Have complete front accessibility with easily removable assemblies.

- Human interface module with alphanumeric display, local/remote and start/stop buttons.
- The control shall be capable of providing selectable current/torque limit settings.
- Have complete front accessibility with easily removable assemblies.
- AC drive with the following requirements and features:
  - Contact outputs: two (2) form “c” min. (functionally programmable).
  - Programmable analog outputs
  - Reduced Torque Capability
  - Acceleration time: 0-3600 second with two (2) independently programmable timers.
  - Deceleration time: 0-3600 second with two (2) independently programmable timers.
  - Minimum of four (4) digital Speed inputs.
  - Sensorless Flux Vector Control to within 0.1 percent of base speed across 100:1 speed range.
  - Ethernet port
  - Control and Setup Parameters programmable from PLC program and programming software.
  - Electronic Class 10 overload protection.
  - Programmable current Limit
  - Able to withstand output terminal line-to-line short circuits without component failure.
  - Power ride-thru of 15 MS at full load.
  - Insensitive to input line rotation.
  - Over temperature protection.
  - Acceleration and deceleration control.
  - Electrical isolation between the power and logic circuits, as well as between the 120 VAC control power.
  - Line transient voltage protection.
  - Slip compensation speed regulation to 0.5 percent.

B.4 Cabinet

Provide heavy duty free standing NEMA type 12 enclosures manufactured with 10-guage steel. Furnish enclosure with a flange mount disconnect. Apply a baked powder coat gray finish on the outside and white finish on the inside of the enclosure.

Furnish two ground lugs, one for incoming line power and one for outgoing motor ground connections. Furnish and install vents or fans to dissipate heat generated by the drives.

C Construction

C.1 General

Coordinate motor frame size with brake and mechanical manufacturers. Install motors per manufacturers' instructions. Install motor mounting bases as required to accommodate motors. Properly align motor shaft with driven shaft before connecting motor coupling. Align if required. Megger motors before final connection. Record these readings and submit with “as-built” drawings. Connections shall be accomplished with bolted compression lugs.

C.2 Factory Load Testing

Before shipping, conduct a factory design proof test on each drive and motor system with a calibrated dynamometer to verify that the performance requirements have been met. The test will be witnessed by the engineer. Provide 30-day advanced notice and submit description of the test stand to document the accuracy of the torque readings.

Supply test results to confirm that the VSD has been tested to substantiate designs according to applicable ANSI and NEMA Standards. The tests shall verify not only the performance of each unit and

integrated assembly, but also the suitability of the enclosure venting and rigidity. All units shall be factory tested in accordance with ANSI standards in addition to the design proof tests conducted on all units.

Testing procedures shall include:

- Apply loads equal to the torques specified for AASHTO Condition A to motor shafts. Run motor at 100 percent speed for three (3) minutes (driving). Motor-drive combinations should be capable of driving the load.
- Apply overhauling loads equal to the AASHTO Condition A torque to motor shafts. Run motors at 100 percent speed for three (3) minutes (dynamic braking). Motor-drive combinations should be capable of dynamically braking the load.
- Demonstrate that motors/drive cannot produce or exceed the never-exceed torque value at zero or any other speed. NOTE: Zero speed is defined at 0-20 RPM max.
- Make final adjustments to installed drive to assure proper operation of fan system. Obtain performance requirements from installer of driven loads. Touch up scratched or marred surfaces to match original finish. Demonstrate operation of controllers in automatic and manual modes.

C.3 Shop Control Testing

Interconnect both drives and motors with the entire control system. Demonstrate the operation of both drives using the control system. Demonstrate the following in an unloaded condition during the shop test:

- Speed changes for both raising and lowering for each motor/drive in one motor operation
- Speed changes for both raising and lowering for in two (2) motor operation.
- Speed setpoint and ramp programming changes from Human Machine Interface (HMI) setup screen.
- Normal Stop sequence
- Emergency Stop sequence

D Measurement

The Department will measure Span Drives and Motors as single lump sum unit bid items acceptably completed.

E Payment

The Department will pay for measured quantities at the contract unit price under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.09	Span Drives and Motors B-70-324	LS

Payment is full compensation for furnishing and installing Span Drives and Motors and for furnishing all labor, tools, equipment, software, materials, and incidentals necessary to complete the contract work.

y. **Control Console B-70-324, Item SPV.0105.10.**

A Description

This special provision describes furnishing labor, tools, equipment and material necessary for the manufacture, installation, testing, and making fully operational a control console for the Racine Street Bridge.

A.1 Related Provisions

Unless otherwise noted, work under this special provision conforms to the requirements of the following special provisions:

- Electrical Work
- Span Drives and Motors
- PLC Cabinet

- Motor Control Center
- Programming
- Traffic Gates
- Submarine Cable
- Auxiliary Equipment
- Lightning and Surge Protection
- Training, Manual and Spare Parts
- Tayco Street Remote Operations

B Materials

B.1 Cabinet

Control enclosure will be NEMA 12 with hinged access doors and hinged control top plates. Provide access doors with flush lockable handles. Design the console with shipping splits for installation in the bridge house. Include gasketing and stainless steel hardware to connect each shipping split.

Manufacture console cabinet with 12 gauge steel painted an ANSI gray finish. Use minimum 10 gauge stainless steel with a smooth brushed finish for each console top.

Console top will have a stainless steel piano hinge for opening. Install two (2) gas filled shocks to assist in opening the console tops. Include an arm on each side to support the console top when it is open. Size shocks are to support the weight of the top and the weight of the components and wire.

Clean and phosphatize internal and external surfaces prior to application of high-quality rust inhibiting primer. Apply a light gray ANSI No. 61 baked enamel or polyester powder for the finish coat. Use a gloss white lacquer finish over suitable primers for the backplates.

B.2 Pushbuttons, Selector Switches and Indicator Lights

B.2.1 Indicating Lights

Use 30.5 mm push-to-test industrial heavy-duty, oil tight NEMA 13, 120 V transformer type, with LED bulbs. Lens colors are as indicated on plans.

B.2.2 Pushbuttons

Furnish single button operator with one normally open (1 N.O.) and one normally closed (1 N.C.) momentary contact, 30.5 mm corrosion resistant, heavy duty, oil tight pushbuttons.

B.2.3 Selector Switch

Supply selector switches with a lever operator knob, one N.O. and one N.C. contact in each position. Provide switches that are 30.5 mm corrosion resistant, heavy duty, and oil tight. Provide key switch operator where required.

B.3 Contact Blocks

Provide contact blocks rated at 10 A, NEMA Class A300. Blocks are to be clear to allow visual inspection and are oil-tight.

B.4 Span Control Switch

Pistol grip rotary switches will be multi-position with spring return-to-center mill duty type switches. Rotary contacts are to be double sided and knife type. There will be terminal screws for easy installation. Furnish controller with a handle interlock for movement and a detent for each position. Configure controller per the design plans. All connections will be finger safe. Contacts are to be rated at 10 A.

B.5 Pistol Grips

Pistol grip rotary switches will be 3-position with spring return-to-center capability. Rotary contacts are to be double sided and knife type. There will be terminal screws for easy installation. All connections are finger safe. Contacts are to be rated at 10 A.

B.6 Meters

Furnish red LCD programmable digital displays with 4½-digit resolution. Furnish meter with a minimum of 0.48-inch high digits, programmable decimal points and a NEMA 4x sealed front bezel.

They will have vertical orientation with colored bars for easy viewing. There is to be peak and valley hold capability and trend indication for signal direction. There will be an accuracy of at least 0.1 percent of full scale.

B.7 Legend Plates

Legend plates are to be rectangular and manufactured out of laminated plastic or any similar non-metal corrosion resistant material. Provide ½-inch black lettering on a white background.

B.8 HMI

Provide an Operator Interface Terminal with a color touch screen for the operator to view alarms and status of bridge devices. This Operator Terminal or HMI will also provide the capabilities for maintenance personnel modify key setpoints and parameters in the PLC and drives. These parameters will have the capabilities of being password protected, so only authorized personnel will have access to changing the values. Supply an HMI that meets the following minimum requirements:

- 15-inch color display with touchscreen control.
- Two USB Ports
- 18 bit Color Graphics with minimum 640 x 480 resolution
- NEMA 4 rated
- Ethernet communications
- 85 to 264 VAC or 18 to 32 VDC Power input
- The HMI will operate at 0 °C to 55 °C with a relative humidity of 5 percent to 95 percent non-condensing

Install HMI in an NEMA 12 enclosure with three (3) axis adjustable arm as shown in as shown in plans. Attach and adjust arm of console to provide the optimum operator view.

C Construction

C.1 Cabinets and Enclosures

Clean and phosphatize internal and external surfaces prior to application of high-quality rust inhibiting primer. Apply finish coat of light gray ANSI No. 61 baked enamel or polyester powder. Finish back panel with gloss white lacquer over suitable primers.

C.2 Wiring

Provide interconnection wiring between all electrical devices mounted in the panels and enclosures. If the devices are to be connected to external equipment, connect them to terminal blocks. Provide conductors that are UL listed type THWN-MTW. The minimum field installed control wire within the control console is No. 16 AWG. Everywhere else, use No. 14 AWG minimum wire size.

Install all interior wiring neatly and carefully, and terminate on UL approved terminal blocks as per manufacturer's instructions. Individually bundle wiring to each control switch and install with a "drop loop" of sufficient length to allow for its removal for maintenance without disconnecting the wiring. Use plastic wireways (open slot type) for routing all internal wiring in the control panels. Internal wiring in the factory prewired electronic system cabinets may be installed according to the manufacturer's standard as to wire size, insulation, and method of termination on internal equipment.

Permanently identify individual conductors. The marking will be done on a sleeve not less than ½ inch long. Mark each sleeve with permanent and waterproof identification. Do not use adhesive-type labels.

C.3 Terminal Blocks

Group for easy accessibility unrestricted from structural members and instruments. Provide sufficient space (2 inches minimum) on each side of each terminal block to allow an orderly arrangement of all leads to be terminated on the block. Do not terminate more than two (2) wires on any one (1) terminal position.

C.4 Marking and Labeling

Each terminal block, device, fuse block, terminal, and both ends of each conductor will be permanently labeled to coincide with the identification indicated on the manufacturer's wiring diagrams. Terminal blocks and devices already numbered in the plans are to be so numbered on the equipment supplied.

Mounted electronic components are to be identified by marking with contrasting colored ink beside the component.

D Measurement

The Department will measure Control Console B-70-324 as a single lump sum unit bid item acceptably completed.

E Payment

The City will pay for measured quantities at the contract unit price under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.10	Control Console B-70-324	LS

Payment is full compensation for furnishing and installing a new control console and for furnishing all labor, tools, equipment, materials, and incidentals necessary to complete the contract work.

z. **PLC Cabinet B-70-324, Item SPV.0105.11.**

A Description

This special provision describes furnishing labor, tools, equipment and materials necessary for the manufacture, installation, testing, and making a fully operational programmable logic controller (PLC) cabinet.

A.1 Related Provisions

Unless otherwise noted, conform work under this special provision to the requirements of the following special provisions:

- Electrical Work
- Span Drives and Motors
- Control Console
- Motor Control Center
- Programming
- Traffic Gates
- Submarine Cable
- Auxiliary Equipment
- Lightning and Surge Protection
- Training, Manual and Spare Parts
- Tayco Street Remote Operations

B Materials

B.1 Cabinet

Provide heavy NEMA type 12 enclosures manufactured with 10-guage steel. Apply a baked powder coat gray finish on the outside and white finish on the inside to the enclosure.

B.2 Programmable Logic Controller (PLC)

Provide an A-B Control Logix PLC system manufactured by a single source and that will be the product of a company with a minimum of five (5) years of experience in the manufacture and service of this type of equipment. The PLC systems must have the communication capability to communicate and program drive parameters and settings.

Provide the PLC processor with a minimum of two (2) Mb user memory, compactflash nonvolatile user memory a built in communication port, extensive instruction set and ladder logic programming capability.

Provide the PLC system with Ethernet communications, hubs and switches.

Provide a modem or a means of monitoring and troubleshooting the PLC from a remote location.

Provide 16 point digital input cards rated for 120 VAC. Provide output cards rated at 120 VAC. Provide 16-point output cards having a minimum 0.5 A per point rating. Individually isolate relay output cards with a rating of 2 A continuous. Supply digital input and outputs with 20 percent spares

Provide analog inputs and outputs with a 4-20 milliampere range.

B.3 Relays, Timers and Contactors

Furnish relays, timers and contactors that are listed and classified by UL as suitable for the purpose specified and indicated.

B.3.1 Relays

Provide ice cube type control relays for non-load carrying control circuits. Relays will be rated for 120 VAC with a minimum contact rating of 10 A. Provide all relays with LED indicating lamp across coil. Relays will be Allen Bradley 700-FS, Square D 8501 type K, Cutler Hammer D5 series or approved equal.

For load carrying circuits and latching circuits less than 10 A, provide industrial control/machine tool relays with contacts rated at a minimum of 20 A. Relays will be Allen Bradley 700-P, Square D 8501 type X, Cutler Hammer D26 series or approved equal.

B.3.2 Timers

Provide solid state multifunction timers. Timers will be rated for 120 VAC. Timers will be Allen Bradley 700-H, Square D RE7, Cutler Hammer TR series or approved equal.

B.3.3 Contactors

For all lighting loads, provide contactors with a minimum of 20 A tungsten contacts. Contactors are to be Allen Bradley, Square D, Cutler Hammer or approved equal.

B.4 Circuit Protection

B.4.1 Supplemental Protectors

Provide single pole UL listed or recognized miniature thermal magnetic circuit breakers. Provide breakers that are track mountable with a positive trip-free holding mechanism and a 10 kA interrupting rating.

B.4.2 Control Fuses

Provide ferrule end type, ceramic or fiberglass body, midget type, rated 250 VAC, 10 kA interrupting, UL listed for control circuit application. Automotive type, glass body fuses are not acceptable. Provide fuse blocks to house the control fuses. Provide terminal block style with isolating feature, and rail mounted, rated 600 VAC, 30 A maximum for midget type fuses. Provide a hinge type cover for isolating and automatic fuse extraction from circuit when cover is lifted.

B.5 Uninterruptible Power Supplies (UPS)

Provide backup power to the PLC power supply, Ethernet switch and HMI by a computer type on-line UPS.

Provide self-contained UPSs with battery chargers, internal battery banks, local controls, and on-line inverters that provides continuous power output when incoming power is lost. Loss of output power is unacceptable during loss of input power. Size UPSs to provide power for full load connected plus 25 percent (minimum) for a total of 20 minutes continuous output power at 120 VAC. Provide built in surge protection.

C Construction

C.1 Cabinets and Enclosures

Make all PLC equipment accessible through the front doors of the enclosure.

Clean and phosphatize internal and external surfaces prior to application of high-quality rust inhibiting primer. Apply finish coat of light gray ANSI No. 61 baked enamel or polyester powder. Finish back panel with gloss white lacquer over suitable primers.

C.2 Wiring

Provide interconnection wiring between all electrical devices mounted in the panels and enclosures. If the devices are to be connected to external equipment, connect them to terminal blocks. Conductors are to be UL listed type THWN-MTW. The minimum field installed control wire within the control console is No. 14 AWG.

Install all interior wiring neatly and carefully and terminate on UL approved terminal blocks as per manufacturer's instructions. Use plastic duct (open slot type) for routing all internal wiring in the control panels. Internal wiring in the factory prewired electronic system cabinets may be installed according to the manufacturer's standard as to wire size, insulation, and method of termination on internal equipment.

Permanently identify individual conductors. The marking will be done on a sleeve not less than ½ inch long. Mark each sleeve with permanent and waterproof identification.

C.3 Terminal Blocks

Group for easy accessibility unrestricted from structural members and instruments. Provide sufficient space (2 inches minimum) on each side of each terminal block to allow an orderly arrangement of all leads to be terminated on the block. Do not terminate more than two (2) wires on any one terminal position.

C.4 Marking and Labeling

Permanently label each terminal block, device, fuse block, terminal, and both ends of each conductor to coincide with the identification indicated on the manufacturer's wiring diagrams. Terminal blocks and devices already numbered in the plans will be so numbered on the equipment supplied. Identify mounted electronic components by marking with contrasting colored ink beside the component.

D Measurement

The department will measure PLC Cabinet B-70-324 as a single lump sum unit bid items acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.11	PLC Cabinet B-70-324	LS

Payment is full compensation for furnishing and installing a PLC cabinet and for furnishing all labor, tools, equipment, materials, and incidentals necessary to complete the contract work.

aa. **Programming B-70-324, Item SPV.0105.12.**

A Description

This special provision describes furnishing a laptop computer with development software for both PLC and HMI and programming the bridge PLC and HMI.

The program includes an automatic sequence that opens and closes the leaf using the motor drives. Control camera triggers with logic programmed in PLC.

A.1 Related Provisions

Unless otherwise noted, conform work under this special provision to the requirements of the following special provisions:

- Electrical Work
- Span Drives and Motors
- PLC Cabinet
- Control Console
- Motor Control Center
- Traffic Gates
- Submarine Cable
- Auxiliary Equipment
- Lightning and Surge Protection
- Training, Manual and Spare Parts

- Tayco Street Remote Operations

B Materials

Register all software and computers to a designee of the city of Menasha.

B.1 PLC Program Development Software

The programming software is to be an industry standard package supplied by an industrial controls manufacturer. Supply all security keys for development software.

Software is to be manufactured by the PLC manufacturer. Furnish the latest version of software. Make the software compatible with the laptop's operating system. One (1) package will be installed on the new laptop with all licenses.

Provide software package that allows PLC off line and on line programming as well as on line monitoring, utilizing the approved PC, displaying the labels ("nicknames"), coil and rung comments, search for registers and rungs, coils, contacts by address and by label. It must allow printing of selected rungs or the entire logic to either a file or a printer. The software must allow access to the PLC local network through all ports, including the PLC Ethernet module.

The software must be capable of creating logic to modify key setup parameters of each drive, such as speed setpoints and ramps.

B.2 HMI Program Development Software

Provide one development package for programming the HMI and downloading revisions in the future. The software is to be an industry standard package supplied by an industrial controls manufacturer. Supply all security keys for development software.

Software is to be manufactured by the HMI manufacturer. Furnish the latest version of software. Install one (1) package on the laptop with license.

B.3 Laptop Computer

Provide one new laptop computer to be used for programming and troubleshooting the PLC. The Laptop shall include sufficient memory to run all software programs. Include the following minimum requirements for the laptop computer, three (3) year warranty, Microsoft Office Professional, 3 USB ports and an ethernet port or an USB to ethernet adapter and necessary communication ports or adapters and cables to communicate with the PLC. Laptop computer is to be Dell, Compaq, IBM or equal as approved by the engineer.

C Construction

C.1 PLC Program

Develop the PLC application program for bridge control and alarm logic based on the function block chart in the plans. Submit hard copies and electronic files for review and approval. Provide user's manual(s) and instruction manual(s) and hardware, including cables and connectors.

All programming will be performed using ladder logic style programming method. Each address and rung of program will be well documented. The program will be organized to group the core bridge movement operations separate from any alarm or overhead type functions. Subroutines, and/or files, are to be utilized to separate and organize the program.

Avoid the use of latching/unlatching relays. Every step is to be interlocked to prevent movement, unless all conditions have been satisfied. Some of the circuits in the sequence are combined and interlocked with relay controls for added safeguards. All sequences can be stopped at any time and the sequence can be continued in either direction from the point the sequence was stopped, provided that all interlocks are satisfied.

C.2 Alarms

Program alarms with a debounce circuit or delay preventing nuisance trips. Group alarms in a separate file or subroutine that can be enabled at a later date. The following is a minimum list of alarms. Protect the HMI alarm screen via password, so only authorized personnel will have access to changing the values.

- Gate and Lock travel time exceeded
- Gate and Lock limit switch trouble (both limits tripped)

- Span limit/inclinometer out of range
- Drive Faults
- Motor overloads

C.3 HMI Program

Program a minimum of five (5) screens. Add additional setup parameters to setup screen as needed to allow field adjustments. Password-protect the setup screen. Provide color animation to devices on screen to indicate status of signals, gates, barrier, rear locks and span. Submit color copies of each screen for approval prior to testing.

D Measurement

The department will measure Programming B-70-324 as a single lump sum unit bid item acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.12	Programming B-70-324	LS

Payment is full compensation for programming the bridge PLC and HM), and for furnishing all software, laptop, materials, and incidentals necessary to complete the contract work.

bb. **Lightning and Surge Suppression B-70-324, Item SPV.0105.13.**

A Description

This special provision describes furnishing labor, tools, equipment and materials necessary for the installation and operation of a fully functional lightning protection and transient voltage surge-suppression (TVSS) system.

Comply with all local codes, all laws applying to electrical installations in effect and with the regulations of the latest NEC, where such regulations do not conflict with the laws in effect and with the requirements of the utility company.

It is the intention of the contract plans to call for completely finished work, fully tested and ready for operation. Furnish, deliver, and install any apparatus, appliance, materials, or work not shown on the plans but mentioned in the special provisions or vice versa, or any incidental accessories necessary to make the work complete in all respects and ready for operation, shall be furnished, delivered, and installed without additional expense to the City.

A.1 Scope

The work under this item includes the following:

- Lightning Protection System
- New incoming Service Transient Voltage Surge Suppression.

A.2 Related Provisions

Unless otherwise noted, work under this special provision shall conform to the requirements of the following special provisions:

- Electrical Work
- Span Drives
- PLC Cabinet
- Control Console
- Motor Control Center
- Programming
- Traffic Gates

- Submarine Cable
- Auxiliary Equipment
- Training, Manual and Spare Parts
- Tayco Street Remote Operations

A.3 Submittals

Submit the following for each component of the Lightning Protection and TVSS bid item:

- Submit Manufacturers shop drawings.
- Submit Product Data.
- Submit Manufacturer's installation instructions.
- Submit operation and maintenance data.

A.4 Regulatory Requirements

- National Fire Protection Association, NFPA-780, Standard for the Installation of Lightning Protection Systems, 2008.
- ANSI/IEEE Standard 81 Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.
- UL 96A Installation Requirements for Lighting Protection Systems.
- NFPA 70 - National Electric Code, NEC, Article 250, 1999.
- UL 467 - Grounding and Bonding Equipment.

B Materials

B.1 Lightning Protection

In general, use 316 stainless steel materials. In locations where system components are to be connected to aluminum surfaces, use tin plated or CU-AL marked fittings. Use Class I stainless steel air terminals with a threaded base. Height shall be no less than 18 inches for control house. Provide threaded stud base for air terminal and bolted clamp conductors. Provide main and down conductors of stranded stainless steel, 14 AWG minimum size strands, 133 CM overall. Provide bonding conductor of stranded stainless steel, 17 AWG minimum size strands, 28,000 CM overall. Bond connections between movable span and fixed pier, and traffic and barrier gate arms to the operator base bonded with No. 4 type W or extra flexible welding cable.

Use a grounding electrode of minimum of 1-inch by 10-inch feed copper clad steel for all ground points including submarine earth grounding electrodes. In general, connect bonds and taps by exothermic weld. Mechanical, bolted connections are allowed at the air terminals, the flexible cable ends, sheet piles and on aluminum surfaces. Provide bonding plates for aluminum surfaces of tin plated or copper-aluminum alloy.

Design the static discharge assembly to safely interface with other bridge components without degrading, in any way, its structural integrity and while blending with the appearance of the structure. Design the system to withstand a wind force of at least 80 MPH.

Install a minimum of two (2) air terminals on the peak of the control house roof. Bond the terminals to a main conductor installed around the perimeter of the roof. Install two (2) down conductors, each from opposite corners and extending down to submarine ground rods. Encircle a bonding conductor around the control house windows, with the window frame bonded at the corners. Route main conductors between ground rods as shown on the plans. Bond the ground system to the lightning protection system with conductors sized per NFPA 780. Bond all metal structures, including traffic light structures, traffic and barrier gate assemblies, and camera poles and any external lighting fixture, metal traffic barrier and all handrails to the lightning protection main conductors. Bond the handrail and guardrail to the main conductors at regular intervals. Bond the electrical system ground to the lightning protection system at the Motor Control Center ground bus. Exothermically weld all joints in the system. Use bolted connections where connections are accessible for inspection and maintenance.

B.2 Surge Suppression

B.2.1 General

Furnish and install surge suppression equipment as described in this article and shown on the plans. Provide Transient Voltage Surge Suppressors (TVSS) as described herein for incoming power, 120 VAC circuits shown on plans and communication circuits.

B.2.2 Conformance

Conform all materials and workmanship to the latest editions of the following standards and publications referenced in various parts of this article:

- ANSI/IEEE C62.1 Standard for Surge Arrestors for AC Power Circuits
- Underwriters Laboratories, UL 1449 Standard for Safety, Transient Voltage Surge Suppressors, Revised edition.
- UL 96A Installation Requirements for Lightning Protection Systems.

B.2.3 120 VAC Power

Provide control circuit suppressors that are multi-stage hybrid shunt-series-shunt design. Suppressors for balanced (two-conductor) circuits shall also clamp conductor to conductor when required by the nature of the circuit.

Provide suppression for each conductor consisting of a high energy dissipater parallel (shunt to ground) first stage, a series surge current-limiting impedance second stage, and a voltage clamping parallel connected third stage. Resistive limiting elements may be used where the voltage drop across the series resistance has no effect on circuit operation. Inductive series elements may be used on other circuits to effectively pass DC or low frequency AC currents while limiting passage of fast risetime surge waveforms.

Minimum performance criteria (each circuit) shall be as follows:

- Maximum single impulse conductor-to-ground current withstand: 10,000 A (8 x 20 µs waveform) plus power-follow.
- Pulse lifetime rating category B worst-case current waveform (8 x 20 µs at 3,000 A plus power-follow): 1,000 occurrences
- Minimum energy handling capability – 500 joules per conductor
- Worst case response time: 5 µs
- Worst case (3,000 A at 8 x 20 µs) clamping voltage: 200 percent of normal operating voltage amplitude and polarized or bipolar as appropriate for each circuit type.
- Initial clamping voltage: 150 percent of normal operating voltage peak amplitude $\pm$ 5 percent.
- Capacitance for DC or low frequency AC circuits: Do not exceed 2,000 picofarads, measured line to ground at the rated diode breakdown voltage.
- Capacitance for audio, video, high frequency, or high baud rate circuits: Install suppressors designed for use on such lines. Capacitance of such units shall be equated to equivalent cable length based on the type of cabling used for the particular circuit. The sum of equivalent cable length of suppressors and actual cable length shall not exceed manufacturer's recommended maximum values for the system on which those devices are installed.

B.2.4 Incoming Main for Control and Signal Circuit Protection

Provide an incoming main surge protective device that meets the following minimum criteria:

- Installed in a NEMA 12 enclosure
- L-L, L-N, L-G and N-G protection modes
- 10 year warranty
- U.L. 1449 listed
- Peak surge current rating per phase of 480 kA.
- Indicator LEDs for normal and fault conditions for each phase.
- Audible alarm with enable disable switch.

- Surge Counter

C Construction

C.1 General

Protect the tender house by a lightning protection system installed in accordance with U.L. 96A except as expressly otherwise specified herein. Furnish and install system by a U.L. listed installer of lightning protection systems and provide a Master Label or UL Letter of Finding for the system.

Protect the operator house fully in accordance with UL 96A as though it were a separate structure. Pay special attention to routing the down leads from the lightning system as to maintain a minimum 6-foot spacing from the control desk and interior equipment bonding down leads.

Protect the moving bascule leaves and their supporting piers in accordance with UL 96A Class II. Treat the bascule leaves as structural steel framing under UL 96A Section 13 assuming that the perimeter grounding requirements apply when the bascule leaf is in the upright position. The down conductors from the bascule leaf to the balance of the structure will be No. 2/0 AWG type W extra flexible cable such as welding cable or locomotive/diesel cable, all other main and secondary cables shall be standard Class II conductors. Provide the connection between the flexing cable from the bascule leaf and the main down conductor on the pier to route surges through the flexing cable. Bond all machinery, fixed equipment, and metal parts within the bounds established by the back faces of the bascule leaf piers, and excluding the fender system, in accordance with UL 96A. Treat metal handrails above road level air terminals and bond with main conductors except the "two-way" path requirement of UL 96A Paragraph 7.1 will not apply. There shall be no requirement to bond to any embedded reinforcement bar. Where structural steel members of the bridge are to be connected, piercing of the steel member is not allowed.

Protect isolated electrical equipment (e.g., traffic gates) or support poles or structures for electrical apparatus (e.g., signal lights) in accordance with standard UL 96A practice utilizing individual ground terminals. Bond traffic and barrier gates with No. 2/0 AWG copper. Bond the gate arm to the gate operator housing with (No. 1 AWG) extra flexible tinned copper bonding strap 25 mm wide by 10 mm thick.

The unique nature of the bridge must be taken into account in the selection of materials and techniques. The highly corrosive environment requires that externally mounted conductors, air connectors, and ground connectors shall be corrosion resistant either inherently (e.g., series 300 stainless steel or bronze construction) or by protection using plating or coating acceptable to the UL and the engineer. All conductors and ground terminal components within five feet above mean high water shall be inherently corrosion resistant sufficient to provide a minimum thirty year service life.

Access to the system will be restricted after the installation is completed and routine maintenance will be minimal. Install the system in a manner to assure long term reliability. Weld connections to the bascule leaf structure and other fixed metal parts, cable splices, and connections to ground terminal components. Restrict bolted connections to removable items (e.g., motors) and to the flexing cables from the bascule leafs to permit cable replacement. Crimp type connectors will not be acceptable in any part of the lightning protection system. Conductor guards shall be non-metallic.

Conductor or ground terminal exposure to the water only (e.g., "reservoir grounding") will not be an acceptable ground connection. Accomplish grounding in the submarine earth in accordance with UL 96A Paragraph 8.6 or 8.8 as applicable except that ground rod is used. Ground terminal components must be buried and anchored in a manner to provide the required service life. Furnish a diver and the necessary diving equipment for use of the UL Inspector, the engineer, or his representative in making inspections of the grounding installation. Upon completion of the installation, furnish the Master Label issued by Underwriters Laboratory for this system, thus certifying that this system complies with all UL requirements.

The desired primary bond to the TVSS system is to be at the TVSS equipment cabinets on the equipment (lower) floor.

C.2 Surge Suppressors

C.2.1 Bonding and Grounding Conductors and Materials

Use conductors for individual surge suppressor bonding specified in UL 96A for the lightning protection circuit unless otherwise specified. Make connections as specified in UL 96A unless otherwise specified. Aluminum conductors are not acceptable.

C.2.2 Installation of Suppressors

Mount, install, and ground all suppressors per the manufacturer's requirements. Give special attention to grounding requirements and minimum conductor sizes. Install individual suppressors as close as possible to the equipment to be protected consistent with available space. Where space permits and no code restrictions apply, install suppressors within the same cabinet as the protected equipment. Install bonding jumpers not exceeding two (2) inches in length between the chassis and suppressor ground terminals. Use bolted connections with star washers to insure electrical and mechanical integrity of connections to the equipment chassis. Install suppressors in a neat, logical manner. Lead dress shall be consistent with recommended industry practices for the system on which these devices are installed.

Keep bonding between ground terminals for power and control or signal line suppressors serving a particular item or cluster of equipment as short as possible. Where practical, install suppressors in a common location for the cluster with the ground terminals bonded closely together. For installations requiring separation between the various suppressor grounds and equipment chassis within an equipment cluster, use the following table to determine bonding conductor requirements (distances are measured between most distant suppressor or chassis grounds within the cluster):

Bonding Distance	**Material**
0-10 feet	No. 6 AWG bare copper (solid) or 1½-inch copper strip 0.051 inch thick (min.)
10-50 feet	57,400 CM main conductor or 3-inch copper strip 0.051 inch thick (min.)
Over 50 feet	115,000 CM main conductor or 6-inch copper strip 0.051 inch thick (min.)

D Measurement

The department will measure Lightning and Surge Suppression as a single lump sum unit for the Lightning and Surge Protection system construction and installation acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.13	Lightning and Surge Suppression B-70-324	LS

Payment is full compensation for furnishing and installing the lightning and surge protection equipment for the bascule span; and for furnishing all labor, tools, testing equipment, software, materials, and incidentals necessary to complete the contract work.

cc. **Traffic Gates and Signals B-70-324, item SPV.0105.14.**

A Description

This special provision describes furnishing labor, tools, equipment, and materials necessary for furnishing and installing traffic gate assemblies and traffic signals, including the anchorage assemblies and concrete pedestals.

A.1 Submittals

Submit the following for each component of the Traffic Gate Assembly bid item:

- Submit manufacturer's shop drawings
- Submit product data
- Submit anchor bolt design and concrete pedestal design
- Submit manufacturer's installation instructions
- Submit operation and maintenance data

A.2 Related Provisions

Unless otherwise noted, provide work under this special provision to conform to the requirements of the following special provisions:

- Electrical Work
- Span Drives
- PLC Cabinet
- Control Console
- Motor Control Center
- Programming
- Submarine Cable
- Auxiliary Equipment
- Lightning and Surge Protection
- Training, Manual and Spare Parts
- Tayco Street Remote Operations

B Materials

Furnish vertical to horizontal type, electrically operated with manual cranking ability gate assemblies at locations shown in the plans. Equip on-coming gate assembly enclosures with warning gongs, in accordance with manufacturer's instructions. Equip gate arms with steel hot-dip galvanized, sectional bolt-on counterweights with at least 10 percent adjustment and LED warning lights.

B.1 Traffic Gate Assemblies

House the operating mechanism and main control components in a weatherproof housing constructed of 0.188-inch (4.8-mm) carbon steel, hot dip galvanized after fabrication. Exterior surfaces shall be painted aluminum. All fasteners shall be corrosion resistant. Design the housing for easy removal of the arm shaft assembly as a unit, including bearings and main arm crank. Fully gasket and seal the arm assembly mounting and shaft openings.

Use full cross bronze straps for mounting front and rear access doors with slip-off type hinges and stainless steel pins. Furnish two (2) door handles per door, with a vise action to compress a neoprene bulb-type gasket to seal the door openings.

Design anchorages for new gate installations per manufacturer's recommendations. Provide anchorage assemblies with all associated hardware for attachment of traffic gates to gate overhangs on bridge structure or concrete pedestals off bridge structure. For traffic gate installations on the bridge structure, coordinate anchor design and locations to avoid conflict with gate overhang reinforcement. For traffic gate installations off the bridge structure, design and provide adequately-sized reinforced concrete pedestals to support those gate installations.

During the opening and closing cycles, begin the gate arm movement with zero velocity and accelerate smoothly, reaching maximum velocity at mid stroke (45 degrees) then decelerate smoothly to zero velocity at full stroke (90 degrees) without whip or bounce. Standard operating time is 13 seconds for full opening or closing cycle. Size gate assemblies and anchorages to handle the weight of the arm used and to operate against a wind speed of 75 MPH.

Design the main arm shaft with a minimum of 2-inch diameter AISI 4150 with a minimum tensile strength of 140,000 psi. Mount the shaft in heavy duty re-lubricable ball bearings. The warning arm shall pivot in the vertical plane via a mechanical 4-bar linkage utilizing cranks keyed to the main arm shaft and transmission shaft and an adjustable connecting rod between a pair of self-aligning spherical rod ends. The connecting rod shall be of 1-inch (25mm) diameter AISI 4150. The linkage shall be driven by a fully enclosed, double reduction, worm gear speed reducer. Gear ratio used shall produce an operation time of 11 seconds.

Equip gate with a manual motor disconnect switch and with an automatic disconnect switch to break control circuit when any door is opened. Ensure the light circuit is equipped with a heavy-duty, solid state, fully factory-wired, with two alternately flashing circuits and one steady burn circuit with a flash rate of 0.50 second ON, 0.50 second OFF. Provide all mounting hardware, solid state flashing circuitry, a clearly labeled terminal block, a heat sink, and a transformer when required.

Furnish and install limit switch unit assemblies consisting of eight individual switches with one set of normally open and one set of normally closed contacts each. Furnish and install contacts with a UL rating of not less than 15 A at 480 VAC. Use corrosion resistant non-ferrous materials for limit switch body, shafts and cams.

B.1.1 Gongs

Provide a warning gong mounted on top of the on-coming warning gate housings. Each warning gong must be weatherproof, motor-operated, vandal-proof, 12-inch gong mounted in a heavy-duty, cast-aluminum housing with hinged back door. The gong must be of cast-bronze. Each gong shall be approved equal to the G-12 Warning Gong as made by Roadway Manufacturing, the B&B Electromatic Z-555BR Warning Gong, the Western-Cullen No. 555, or the Security Products Division of Federal Signal Corporation Type 555. Paint and mount gongs with hardware in such a way as to prevent theft.

B.1.2 Gate Arms

Use 4-inch (102-mm) square, 6005-T5 aluminum extruded tubing for gate arm with 3-inch high strength UV-resistant fiberglass extension. Stainless steel truss cables and a damping type bumper rod shall be furnished with longer arms at the discretion of the manufacturer. Cover the front and rear arm surfaces with alternating red and white high intensity reflective sheeting.

Verify gate arm length and coordinate with final roadway design. Ensure that the gate arm is covered on both sides with alternating 16-inch reflective red and white engineering grade sheeting. Provide a break-away shear pin base for each gate arm so that when excessive force is applied to arm, the pin shears, the arm shall then swing 45 degrees horizontally and drop free of the gate operator thus minimizing damage to operator. Design shear pin base and lightweight arm assembly for easy, rapid reinstallation or replacement by one person.

Furnish and install weatherproof LED warning lights on all gates, to operate on 120 VAC. Provide high-intensity white xenon strobe lights on gate arms as shown on the plans. Strobes should be weatherproof and operate on 12 VDC.

B.1.3 Motors

Furnish and install totally enclosed, Class F insulation motors specifically designed for gate actuator capable of operating at full load when the voltage to the motor is ±10 percent of rated voltage. Use only motors having the voltage capacity as shown in the plans. Ensure the motor has the capacity to perform all necessary functions to the satisfaction of the engineer based on torque required for gate arm and accessories. Ensure the braking mechanism is equipped with a solenoid release, automatic motor brake that automatically releases when hand crank is inserted. Provide a hand crank to manually raise or lower gate arm in event of power failure. Door safety switches shall automatically disconnect the control circuit power and will positively prevent electrical operations of the gate arm when the door is open.

B.2 Traffic Signals

Furnish and install new red-yellow-Green LED traffic signals on an aluminum signal pole with a pedestal base and a “STOP HERE ON RED” sign. Signals and poles shall conform to sections 657 and 658 of the Standard Specifications. Traffic signal heads shall be 12 inch red LED type.

C Construction

Verify system voltage matches gate requirements, Install in accordance with manufacturer's instructions. Make all electrical connections to provide proper operation of the traffic gates, lights, gongs, etc. Make connections to control system, manually test hand crank, and power test traffic gates to ensure proper operation of gate operator, gate arm lights and gate interlock.

Install pressure type terminal blocks inside the housing on the roadway side and terminate all control wires on terminal blocks and clearly label all circuits. Use No. 16 AWG stranded or larger wire. Ensure that the color code or number conductors match wiring diagram.

Ensure that gear limit switches to the drive mechanism are always in step with the actual gate position, whether operation is by power or manual mode. Do not use cams or screws to set the limit switches. Do not use designs requiring battery backup methods to ensure position control in the event of power failure.

C.1 Testing

Visually observe the operation of gates. Adjust the balance weights of the gate arm to provide a smooth operation with little to no bounce. Adjust limits, cables and arm rods so gate arm is level when in the down position.

D Measurement

The department will measure Traffic Gates and Signals as a single lump sum unit for all Traffic Gates acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.14	Traffic Gates and Signals B-70-324	LS

Payment is full compensation for providing, installing, testing and making fully operational all traffic gates and traffic signals, including anchorage assemblies and concrete pedestals.

dd. **Motor Control Center B-70-324, Item SPV.0105.15.**

A Description

This special provision describes furnishing labor, tools, equipment and materials necessary for the manufacture, installation, testing, and making fully operational a Motor Control Center (MCC).

A.1 Related Provisions

Unless otherwise noted, conform work under this special provision to the requirements of the following special provisions:

- Electrical Work
- Span Drives
- PLC Cabinet
- Control Console
- Motor Control Center
- Programming
- Traffic Gates
- Submarine Cable
- Auxiliary Equipment
- Lightning and Surge Protection
- Training, Manual and Spare Parts
- Tayco Street Remote Operations

B Materials

B.1 MCC

B.1.1 Assembly

Structures are to be totally enclosed dead-front, free-standing assemblies. They will be 90 inches high and approximately 20 inches deep for front-mounted units. Structures will contain a horizontal wire way at the top, isolated from the horizontal bus and will be readily accessible through a hinged cover. Adequate space for conduit and wiring to enter the top or bottom will be provided without structural interference.

A vertical wire way with minimum of 35 square inches of cross-sectional area is to be adjacent to each vertical unit and covered by a hinged door. Wire ways are to contain steel rod cable supports.

All full voltage starter units through NEMA Size 5 will be of the draw out type. Draw out provisions will include a positive guide rail system and stab shrouds to absolutely ensure alignment of stabs with the vertical bus. Draw out units will have a tin-plated stab assembly for connection to the vertical bus. No wiring to these stabs will extend into the bus compartment. Interior of all units is to be painted white for increased visibility. Units will be equipped with side-mounted, positive latch pull-apart type control terminal blocks rated 600 volts. Provide knockouts for the addition of future terminal blocks. All control wire to be 14 gauge minimum.

All draw out units to be secured by a spring-loaded quarter turn indicating type fastening device located at the top front of the unit. Each unit compartment will be provided with an individual front door.

An operating mechanism will be mounted on the primary disconnect of each starter unit. It will be mechanically interlocked with the unit door to prevent access unless the disconnect is in the OFF position. A defeater will be provided to bypass this interlock. With the door open, an interlock will be provided to prevent inadvertent closing of the disconnect. A second interlock will be provided to prevent removal or reinsertion of the unit while in the ON position. Padlocking facilities will be provided to positively lock the disconnect in the OFF position with one (1) to three (3) padlocks with the door open or closed. In addition, means will be provided to padlock the unit in a partially withdrawn position with the stabs free of the vertical bus.

Provide each structure with a main horizontal copper tin-plated bus, with minimum ampacity of 600 A. Vertical bus feeding unit compartments will be copper and will be securely bolted to the horizontal main bus. All joints will be front-accessible for east of maintenance. The vertical bus will have a minimum rating of 300 A for front mounted units and 600 A for back-to-back mounted units or fully rated amperes.

Provide each MCC with a vertical bus that is completely isolated and insulated by means of a labyrinth design barrier. It will effectively isolate the vertical buses to prevent any fault-generated gases to pass from one phase to another. The vertical bus will include a shutter mechanism to provide complete isolation of the vertical bus when a unit is removed.

Buses are to be braced for a minimum of 42,000 A rms symmetrical minimum.

A copper ground bus is secured to each vertical section structure and will extend the entire length of the MCC.

Each structure will contain tin plated vertical ground bus rated 300 A minimum. The vertical ground bus will be directly connected to the horizontal ground bus via a tin-plated copper connector. Units are to connect to the vertical bus via a tin-plated copper stab.

Wiring will be NEMA Class 1B. Pull apart terminal blocks will not be used on motor leads.

Provide MCC with a NEMA 1 gasketed enclosure.

Provide an MCC such as the Allen Bradley 2100 series, Cutler Hammer Freedom series, Square D Model 6 or approved equal.

Shop paint will be UL recognized enamel finish, light gray (like NEMA 61) over a rust inhibitor and paint adhesion pretreatment.

Provide laminated nameplates on each door. Identification nameplates will have black characters on a white background. Attach nameplates with stainless steel screws. Each nameplate will identify each starter unit, circuit breaker or other control unit and include the horsepower or current rating of the device.

Provide high voltage safety warning name plates with white characters on red background. Also provide power disconnect locations for MCC compartments not equipped with a power disconnect.

Provide the MCC with shipping splits as required to be installed in the control house. These shipping splits will need to be coordinated with the contractor to allow for clearances in doorways or stairwells.

Incoming feeders, load and control line entrances to MCC are to be as indicated in the Plans. A ground will be provided in each vertical section as well as a connecting horizontal bus. Vertical sections will be provided with a vertical wireway and wireways on top and bottom. An insulated barrier with removable access covers will conceal vertical bus work.

B.1.2 Starter Buckets

Provide all starters with a minimum NEMA size 1 starter. Each starter will have its own control power transformer. Each starter will have a minimum of 1 N.O. and 1 N.C. contacts. Provide each starter with door mounted 120 volt LED “ON” indicator lights. Provide overload relays with Class 20 trip. Overload relays are to be re-settable from outside the enclosure by means of an insulated bar or button. Starters are to be protected by motor circuit protectors.

Provide 3-pole 480 VAC, full voltage, NEMA type starters of the magnetic combination type. Motor starters will be a combination circuit breaker, NEMA controller with overload relay protection. Connection to the bus will be by stab-type contacts, including ground, and a screw-type locking mechanism to hold the chassis firmly in place. Quantities are to be as shown in the plans. Provide through-the-door overload RESET button. For FVNR units a HAND-OFF-AUTO switch and pilot lights for OFF, RUN, and OL TRIPPED status will be provided. For FVR units provide a HAND-OFF-AUTO switch, a FORWARD-

OFF-REVERSE spring return to center switch and pilot lights for FORWARD, OFF, REVERSE, and OL TRIPPED status.

Furnish, where indicated or required, motor controls having the electrical characteristics, ratings, and modifications shown in the plans. All magnetic starter coils shall be 120 VAC.

- NEMA ICS 1 - Industrial Control and Systems- General Standards
- NEMA ICS 2 - Industrial Control and Systems- Controllers, Contractors and Overload Relays Rated not more than 200 VAC or 750 VDC
- NEMA ICS 4 - Industrial Control and Systems- Terminal Blocks
- NEMA ICS 5 - Industrial Control and Systems- Control Circuit and Pilot Devices
- NEMA ICS 6 - Industrial Control and Systems- Enclosures
- NEMA ST 1- Standard for Specialty Transformers (Except General Purpose Type)

B.1.2.1 Non-Reversing Starters (Across-the-line magnetic starters for motors up to 100 HP, 600 VAC):

Provide starters that are built and tested in accordance with the latest NEMA standards. Non-reversing starters shall be equipped with three NEMA Class 20 overload relays. Provide for field installation of up to 3 N.O. and 4 N.C. NEMA ICS 2, Class A300, auxiliary contacts in addition to the hold-in interlock.

B.1.2.2 Reversing Starters (Reversing magnetic starters for motors up to 100 HP, 600 VAC):

Provide starters that are built and tested in accordance with the latest NEMA standards. Reversing starters shall be equipped with three NEMA Class 20 overload relays. Provide for field installation of up to 4 N.O. and 4 N.C. NEMA ICS 2, Class A300, auxiliary contacts in addition to the normal interlocks.

B.1.2.3 Overload Relays

Overload relays shall be block-type with a push-to-test feature. An isolated, field-mountable alarm contact shall be available.

B.1.3 Feeder Buckets

Provide thermal magnetic molded case heavy duty breakers of the correct size for all feeder type breakers. Operating handle will always remain connected to the MCP or circuit breaker. The operating handle is not to be mounted in the door of the enclosure, but to the side of the door for safe “stand-aside” operation. Position of the operating handle will indicate ON, OFF, or TRIPPED condition. Interlock provision will prevent unauthorized opening or closing of the cubicle door with the disconnect in the ON position as well as turning the switch ON with the door open.

B.1.4 Main Breakers

Furnish a molded case circuit breaker with an adjustable electronic trip unit and rated for service entrance and minimum interrupting rating of 10,000 KA. Operating handle will always remain connected to circuit breaker. The operating handle is not to be mounted in the door of the enclosure, but to the side of the door for safe “stand-aside” operation.

C Construction

C.1 Motor Control Center

Deliver MCC individually wrapped in factory fabricated fiberboard type containers and with lifting angles on each MCC supporting structure. Handle MCC carefully to prevent internal component damage and denting or scoring of enclosure finish. Do not install damaged MCC. Store MCC in a clean, dry space. Protect units from dirt, fumes, water, construction debris and traffic.

D Measurement

The department will measure Motor Control Center B-70-324 as a single lump sum unit bid item acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT

Payment is full compensation for furnishing and installing a Motor Control Center and for furnishing all labor, tools, equipment, materials, and incidentals necessary to complete the contract work.

ee. **Limits and Sensors B-70-324, Item SPV.0105.16.**

A Description

This special provision describes furnishing labor, tools, equipment and materials necessary for the manufacture, installation, adjusting, calibrating, testing, and making fully operational new span position limits, brake limits rear lock limits, gate violation sensors, gate limits and span position inclinometers as indicated in the plans for the Racine Street Bridge.

A.1 Scope

The work under this item includes the following:

- Span Proximity Limit Switches
- Position Inclinometers
- Rear lock limit switches

A.2 Related Provisions

Unless otherwise noted, conform work under this special provision to the requirements of the following special provisions:

- Electrical Work
- Span Drives and Motors
- PLC Cabinet
- Control Console
- Motor Control Center
- Programming
- Traffic Gates
- Submarine Cable
- Auxiliary Equipment
- Lightning and Surge Protection
- Training, Manual and Spare Parts
- Tayco Street Remote Operations

B Materials

B.1 Rear Lock Limits

Provide non-contact, magnetically operated proximity style switches. Switch contacts shall be DPDT rated 10A at 120 VAC. Both contacts shall be operated by the same armature. Supply switches that are heavy duty NEMA Type 4 Construction with a stainless steel housing and temperature rating between -40 ºC and 105 ºC.

B.2 Inclinometer – Span Position Transmitter

Install a leaf angle position transmitter/inclinometer to the bascule girder at a suitable location to the centerline of bridge rotation as practical. Power unit with 120 VAC and provide a voltage or current output signal relative to leaf angle. This output signal is 4 to 20 mA as required to properly interface with the PLC. House position transmitters in a NEMA 4X rated enclosures with terminal blocks, and power supply as required for connecting to power source and angle position meters. The position transmitter itself is adjustable and calibratable without having to physically move the NEMA enclosure.

Do not exceed 0.01 percent per °C for the position transmitter temperature drift. Have suitable vibration resistance and dampening for a bridge leaf application. Non-Linearity is <1*10 –3 full scale. Transverse sensitivity is < 1 percent at 45 degree tilt.

B.3 Span Position Limits

Provide non-contact, magnetically operated proximity style switches. Switch contacts shall be DPDT rated 10 A at 120 VAC. Both contacts shall be operated by the same armature. Supply switches that are heavy duty NEMA Type 4 Construction with a stainless steel housing and temperature rating between -40 ºC and 105 ºC.

B.3 Span Seated Limits

Provide a heavy duty weather sealed plunger limits switch designed for the movable bridge industry. The limit shall have a minimum of four sets of contacts with a minimum rating of 40 amps make and 15 amps break at 120 volts. the plunger shall be field adjustable with a heavy duty spring.

C Construction

Install limit switches in accordance with manufacturer's instructions. Provide all mounting hardware and supports as required. The method of mounting and hardware allows for field adjustment at construction and for future maintenance. Terminate all limit switches on terminal blocks. Install drainage “T” below takeoff for limit switches on all applicable conduit runs. Submit to the engineer, for review, prior to installation the limit switch target materials, shapes, and mounting methods.

C.1 Testing

After installation, test switches, in the presence of the engineer, to determine if operation is as intended. Switches will relay signal to the control console and/or control panel at intended "point of operation." Switches will provide positive indications with no intermittent signals or flickering of lights on control console. Adjust position of switches as required.

C.2 Installation

Fabricate brackets out of stainless steel material with 3-axis adjustability. Use stainless steel material for all mounting hardware. Use painted steel for sensing plates.

D Measurement

The department will measure Limits and Sensors B-70-324 as a single lump sum unit bid item acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.16	Limits and Sensors B-70-324	LS

Payment is full compensation for furnishing and installing limits and sensors and for furnishing all labor, tools, equipment, materials, and incidentals necessary to complete the contract work.

ff. **Training, Manuals, and Spare Parts B-70-324, Item SPV.0105.17.**

A Description

This special provision describes testing of equipment, training of personnel, provision of spare parts, and the provision of operation and maintenance manuals for the movable bridge electrical and mechanical systems installed on the bridge. This includes testing at the factory, preliminary onsite testing, and final acceptance testing. Provide manuals for both operations and maintenance. Training shall include separate sessions for both the bridge operators and the bridge maintenance personnel.

A.1 Related Provisions

Unless otherwise noted, provide work under this special provision to conform to the requirements of the following special provisions:

- Electrical Work
- Span Drives and Motors

- PLC Cabinet
- Control Console
- Motor Control Center
- Programming
- Traffic Gates
- Submarine Cable
- Auxiliary Equipment
- Lightning and Surge Protection
- Training, Manual and Spare Parts
- Tayco Street Remote Operations

B Materials

B.1 Operator and Maintenance Manuals

Clearly print all materials so that the submittals, drawings, catalogue cuts and all other information is legible, accurate and distinct. Ensure that reduced size drawings and illustrations are such that lettering and dimensioning are readable. Fold drawings to the page size necessary for inclusion in the manuals. Print the material on durable mediums with water resistant inks. Use printing methods that offer permanence and durability.

B.1.1 Operator Manuals

Include the following sections, and/or chapters in the operator's manual at a minimum. Use tabbed dividers for each section.

1. TABLE OF CONTENTS

Identify the title of each chapter.

2. CONDENSED OPERATOR INSTRUCTION

Provide a condensed set of instructions for the operator with simple, one (1) to four (4) word, descriptions of each step (for example lower near on-coming gate). Write separate instructions for manual and automatic operations. With each set of instructions, provide a console layout with the switches and pushbuttons sequence labeled with a number that is associated with the instructions. Provide separate sheets for manual open, manual close, automatic open and automatic close.

3. DETAILED OPERATOR INSTRUCTION

Write a detailed set of operator instructions that describes every step in the sequence for both manual and automatic operations. Describe, in detail, each step of the operation. Steps in this sequence should include any visual and audio checks of roadway or waterway prior to making a movement.

4. BYPASS INSTRUCTIONS

Describe how and when to use each bypass switch. Emphasize the dangers of using a bypass and the importance fixing the problem.

5. ALARM LIST

Include all alarms with their definition.

6. EMERGENCY CALL LIST

Include a list of local municipality emergency contacts, phone numbers and addresses, City contacts and numbers and the contractor's emergency call number. Consult the City for the key contacts.

B.1.2 Maintenance Manuals

Furnish six (6) hard copy maintenance manuals and four (4) .pdf copies on CD or DVD to the Department for reference and the training of future maintenance technicians. Include the following sections, and/or chapters in the operator's manual at a minimum.

1. TABLE OF CONTENTS

Identify the title of each chapter.

2. CONDENSED OPERATOR INSTRUCTION

Provide a condensed set of instructions for the operator with simple, one (1) to four (4) word, descriptions of each step (for example lower near on-coming gate). Write separate instructions for manual and automatic operations. With each set of instructions, provide a console layout with the switches and pushbuttons sequence labeled with a number that is associated with the instructions. Provide separate sheets for manual open, manual close, automatic open and automatic close.

3. DETAILED OPERATOR INSTRUCTION

Write a detailed set of operator instructions that describes every step in the sequence for both manual and automatic operations. Describe in detail each step of the operation. Steps in this sequence should include any visual and audio checks of roadway or waterway prior to making a movement.

4. BYPASS INSTRUCTIONS

Describe how and when to use each bypass switch. Emphasize the dangers of using a bypass and the importance fixing the problem.

5. ALARM LIST

Include all alarms with their definition.

6. EMERGENCY CALL LIST

A list of the names, addresses, and telephone numbers of all subcontractors and manufacturers furnishing and installing the equipment and systems together with a record of the local representatives for the equipment and systems installed.

7. VIDEO AND CAMERA INSTRUCTIONS

Include instructions for setting up presets on cameras, recording video and burning it to DVD.

8. ALARM AND DATA PRINTING AND COPYING INSTRUCTIONS

Include instructions for printing and copying alarms to DVD.

9. SETPOINT ADJUSTMENTS

Describe how to adjust setpoints on the operator interface. Include a description of each setpoint, the as-built setting and the range.

10. ELECTRICAL SCHEMATICS

Fold 11-inch by 17-inch final as-built schematics. Include new components and existing components being reused where applicable.

11. MECHANICAL DRAWINGS

Fold 11-inch by 17-inch final as-built schematics. Include new components and existing components being reused where applicable. Also, include drawings of certified parts and proprietary units.

12. MOTOR MEGGER READINGS

Include all motor readings in a table with a column for as-built and a column to be used yearly for the next 20 years.

13. SPARE PARTS LIST

Furnish a complete list of each spare part, including, their manufacturer and part number and the quantity supplied.

14. COMPLETE PARTS LIST

Furnish a complete parts list that describes every electrical, mechanical or hydraulic component furnished. Include manufacturer literature, cutsheets and instruction manuals for all components. Divide the parts into chapters with similar components. Include a cover sheet for each chapter with all part descriptions, their numbers and manufacturer included. A separate binder is recommended for the complete parts list.

15. MAINTENANCE SCHEDULES AND LUBRICATION

Recommended procedures and frequency for cursory and detailed inspections of the electrical and mechanical equipment. Provide lubrication charts.

16. TROUBLESHOOTING PROCEDURES

Information on trouble-shooting problems that may be encountered during operation for each of the major pieces of equipment. Include things to look for, signs of irregular operation and suggested solutions.

17. WARRANTY

Provide warranty documentation of all equipment, including start and end dates of warranty periods.

B.2 Spare Parts

B.2.1 General

Furnish the following spare parts:

- A minimum two (2) limit or proximity switches of each type installed, including limit lever arms.
- One spare seated plunger limit switch
- A minimum of one (1) operating coil for every ten (10) of each size contactor installed.
- A minimum of one (1) relay for every ten (10) of each kind and size of control, timing, or overload relay installed.
- A minimum of three (3) heaters for every ten (10) thermal overload relays of each size.
- A minimum of three (3) spare fuses of each size and type used throughout the bridge
- A minimum of ten (10) spare indicator lamps of every type used. Include lamp extractor(s).
- A minimum of one (1) PLC card for every five (5) of each type installed, including power supplies, I/O cards and communication modules.
- A minimum of one (1) power supply, electronic module and/or converter for every five (5) of each type installed.
- One (1) spare inclinometer
- One (1) complete camera assembly with cables, lens, lens filters, transient suppressors, power supplies, manuals and accessories.
- Other spare parts as called out in individual sections.
- One (1) spare traffic gate arm (complete with lights, and striping) in proper length
- One (1) spare motor for traffic gates
- One (1) spare traffic gate arm fiberglass end extension. (if part of standard gate arm)
- One (1) spare gate operator motor and gearbox for each type of gate installed.
- For Navigational lights (LED) – two (2) spare fixtures of each size, type and color used.

Provide spare parts in sealed, uniform-sized cartons, with typed and clearly varnished labels to indicate their contents and store them in a lockable box. Also, provide a directory of permanent type describing the parts. The directory must state the name of each part, the manufacturer's number, and the rating of the device for which the part is a spare. Mark spare parts to correspond with their respective item numbers as indicated on the elementary wiring diagram. Plastic laminate and store in the same cabinet the schematic diagrams for the control console.

C Construction

C.1 Operator and Maintenance Manuals

Bind all manuals in heavy duty white three-ring binders with stiff plastic covers that are moisture, oil, and grease resistant. Provide binder sizes of approximately 9 x 12 inches. Use plastic dividers with tabs to divide each chapter. Use reinforced edge sheets for all copies for binder holes. Number all pages with the chapter and page (for example II-4).

Label the edge of each binder with a type written label with the title of manual and the bridge name. Label the front cover with a type written sheet indicating the title, the bridge name, structure number, project and date.

C.2 Training

C.2.1 Operator Training

Provide Operator training in two (2) 8-hour sessions held at the bridge. Design each session for up to six (6) people. Provide a syllabus, a copy of the operator instructions, a pad of paper and pen to each trainee. Include the following as part of the training:

1. INTRODUCTION

Start each session shall start with a brief description of the work performed and the features of the bridge. Following the description, open the bridge as a demonstration. Provide a tour of near side piers and machinery rooms.

2. OPERATOR INSTRUCTIONS

Explain the operation of the bridge using the instructions as an aide. Discuss and demonstrate each mode of operation. Demonstrate how to use the HMI operator station including how to interpret and acknowledge the alarms.

3. TRAINEE OPENINGS

Each trainee will be required to open the bridge at least four (4) times: two (2) of the four (4) openings under normal automatic mode; one (1) opening using manual mode; and the last operation using a bypass. During the bypass operation, create a simple scenario that would require the use of a bypass. The scenarios shall be simple and should not risk damage to equipment. Before using the bypass, investigate the problem to determine if it is safe to operate. Record each opening with time, date, operator, and a witness for a record of the training.

4. SUMMARY

At the end of the day, summarize the training and emphasize the use of indications and the operator interface to diagnose a problem.

C.2.2 Maintenance Training

Provide Maintenance training in two (2) 8-hour sessions. Design one (1) session for the classroom and one (1) session at the bridge for up to eight (8) people. Provide a syllabus, a copy of the operator instructions, a pad of paper and pen to each trainee.

CLASSROOM

1. INTRODUCTION

Start each session shall start with a brief description of the work performed and the features of the bridge.

2. OPERATOR INSTRUCTIONS

Explain the operation of the bridge using the instructions as an aide.

3. MECHANICAL

Include an overview of the mechanical gearing, brakes and center lock systems. Provide a lubrication schedule and instructions on how to properly lubricate each item.

4. ELECTRICAL

Explain how to read and use the electrical schematics to locate problems.

5. PLC

Provide a brief description of a PLC and how to interpret a rung of logic. Include a demonstration on how to access the online programming.

BRIDGE

1. BRIDGE TOUR

Prior to the tour, open the bridge to demonstrate the operation. Tour the near side pier, roadway and machinery rooms.

2. TRAINEE OPENINGS

Each trainee will be required to open the bridge at least one time in automatic mode.

3. MECHANICAL

Demonstrate how to lubricate, maintain and repair the mechanical equipment on the bridge.

4. ELECTRICAL

Demonstrate where and how to isolate power, adjust limits, adjust cameras, connect to the PLC and print reports.

5. TROUBLESHOOTING AIDES

Explain and demonstrate control system aides such as indicator lights, alarms and data logs. Create at least four scenarios that prevent bridge operation and have the trainees use the aides to identify and repair the problem.

C.2.3 Submittals

Submit PDF sample copies of each manual and a training syllabus for approval prior to any training.

Submit five (5) copies of the manuals and two (2) CDs with electronic copies in adobe acrobat format.

D Measurement

The department will measure Training, Manuals and Spare Parts B-70-324 as a single lump sum unit bid item acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.17	Training, Manuals and Spare Parts B-70-324	LS

Payment is full compensation for furnishing manuals and spare parts and providing training to operators and maintenance personnel.

gg. **Auxiliary Electrical Equipment B-70-324, Item SPV.0105.18.**

A Description

This special provision describes furnishing labor, tools, equipment and materials necessary for the manufacture, installation, testing, and making fully operational miscellaneous electrical auxiliary equipment. The following equipment is included in this provision:

- P.A. System
- CCTV Cameras and Control
- Commercial Fire and Security System
- Air Horn
- Navigational Lights
- Sump Pump
- Marine Radio

A.1 References

In addition to those listed in article “Definitions and Acronyms”, numerous acronyms are used in this special provision. Interpret acronyms used throughout as follows:

AGC Automatic Gain Control

BNC Bayonet Neill Concelman (Connector)

CCD Charged Coupled Device

Cd Candela

CD Compact disc

dB Decibel

DVR Digital Video Recorder

DSL Digital Subscriber Line

IP Internet Protocol

PA/IC Public Address/Intercom

RH Relative Humidity

TV Television

THD Total Harmonic Distortion

UV Ultra-violet

XGA Extended Graphics Array

SXGA Super Extended Graphics Array

A.2 Related Provisions

Unless otherwise noted, work under this special provision shall conform to the requirements of the following special provisions:

- Electrical Work
- Span Drives and Motors
- PLC Cabinet
- Control Console
- Motor Control Center
- Programming
- Traffic Gates
- Submarine Cable
- Lightning and Surge Protection
- Training, Manual and Spare Parts
- Tayco Street Remote Operations

B Materials

B.1 P.A. System

Equipment will be a NEMA Class 1 or NEMA Class 4 (as required) wall mounted unit incorporating an intercom and public address systems served by a common handset, as specified below. Supply equipment by a single manufacturer with at least five (5) years' experience of manufacturing this type of equipment. Manufacturer of the equipment is to be ISO 9002 (or equivalent) certified. Employ a communications system with the capability of providing several different communications functions.

Depressing a pushbutton switch will allow the operator to select the desired communication system function. Functions include one-way page (PA system) and Intercom communications. Provide a common interface for switching the handset (and speaker) between communications zones, matching impedance to selected zone.

Mount the selector switch assembly with push buttons in a row. The handset, with a press bar page switch in the handle will be used on the master control station and intercom stations. The speakers connected to the intercom stations must monitor the intercom zone. Mute a speaker connected to an intercom station when the intercom station handset press bar is depressed. Provide adjustable speaker volume control at the intercom or speaker amplifier that connects to the speaker.

Furnish one distributed PA amplifier per speaker and mount in close proximity to the speaker. The amplifier must deliver 10 watts RMS minimum to each speaker. Two (2) speakers for roadway and two (2) speakers for marine channel (separately controlled) are required. Maximum distortion is five (5) percent for first and third harmonics. Use industrial type equipment. Provide speakers immune to salt

spray and be capable of 120 degree dispersion at 12 watts. Frequency response at 3 dB is 450 to 8000 Hz, ±0.5 dB.

The intercom system consists of page/party stations located at all levels of the operator house, pier and the machinery room areas. Provide 25-foot coiled cords with the interior or exterior type units as required. Equip units with page speakers. Page and private voice communication (party line communication) between intercom station locations are indicated in the plans. Provide transmit/receive page line communication with duplex party line communication between two or more intercom stations.

Master control station operator selects intercom zone by depressing selection pushbutton associated with intercom zone. A page is initiated by lifting handset, depressing press bar, and speaking into the handset microphone. A responding individual approaches the nearest intercom station and lifts the handset. Duplex telephone type communication can occur on the intercom system party line without broadcast to all intercom system stations. Pages can be initiated from all intercom system handset locations.

Install the desk or wall mount the intercom master control unit as directed by engineer with standard molded plastic telephone handset with 25 foot long permanently coiled cord. Provide the master unit with a speaker amplifier rated 12 watts output with less than 5 percent total harmonic distortion and frequency response of 250 to 4,000 Hz. Provide the handset amplifier circuit with a minimum rated 1.5 VRMS nominal output level into 33 ohm load, 55 dB nominal gain (below limiter level of 1.5 VRMS nominal). Provide adequate input sensitivity to deliver rated amplifier output when no more than 10 dynes per square centimeter impinge on speaker.

B.2 CCTV

B.2.1 Pan/Tilt/Zoom Cameras

Furnish and install high resolution digital IP Pan/Tilt/Zoom dome-type cameras. Set camera up to control and monitor over an IP network. The CCTV cameras are based the Department's standard Axis Camera systems. Provide the models listed or an approved equal.

B.2.2 Digital Dome HD IP PTZ

Use an Axis Q6055-E 60 Hz Series camera high-definition camera or approved equal to meet the following minimum standards:

Use one of the following approved models or approved equal for the selection of the CCTV Camera:

- Axis (Model Q6155-E) – 60 W Midspans PoE
- Axis (Model Q6055-E) – 60 W Midspans PoE (alternative to Q6155-E)

B.2.3 Mounting Hardware:

There are two methods specified below for mounting CCTV cameras:

- Wall-and-Pole Mounting
- Wall-Mounting

Refer to the plans to determine CCTV camera locations. Use wall-and-pole mounting for all pole locations and wall-mounting for all wall locations.

B.2.3.1 Wall-and-Pole Mounting:

Use the following method to mount the CCTV camera at any pole location specified in the plans:

- Use an Axis T91L61 Wall-and-Pole Mount to mount the Axis camera.
- Mount the Axis T91L61 Wall-and-Pole Mounting bracket onto an Axis T98A18-VE Media Converter Cabinet A.
- Mount the Axis T98A18-VE Media Converter Cabinet A on a pole with the Axis T91B57 Pole Mount.

B.2.3.2 Wall Mounting:

Mount the Axis camera on an Axis T91G61 Wall-and-Pole Mount.

Mount the Axis T91L61 Wall-and-Pole Mounting bracket onto an Axis T98A18-VE Media Converter Cabinet A.

Mount the Axis T98A18-VE Media Converter Cabinet A on the wall.

Mount the Axis T8154 60 W SFP Midspan onto a DIN Rail in the Axis T98A18-VE Media Converter Cabinet A.

B.2.4 Power Injectors

Furnish PoE model CCTV cameras with an Industrial Temperature rated PoE injector (Axis T8154 60 W SFP Midspan) recommended by the CCTV manufacturer. Mount the Axis T8154 60 W SFP Midspan onto a DIN Rail in the Axis T98A18-VE Media Converter Cabinet A for either mounting method.

B.2.6 CCTV Camera Network Cables

Install all CCTV Cameras with an Outdoor Rated CAT-6 cable, manufactured by Axis.

Install all Axis T8154 60 W SFP Midspans with an Outdoor Rated CAT-6 cable, manufactured by Axis to the Axis T8604 Media Converter Switch.

Install an Axis T8611 SFP Module LC.SX in all Axis T8604 Media Converter Switches for Multimode Fiber Optic Cable connectivity.

B.2.7 Power Supplies

Provide individual 24 VAC, 60 Hz camera power supplies for each camera assembly. Fuse power supply and size to provide 125 percent of full load amperes for camera and accessory loads. Account for voltage drops to provide 24 VAC @ +/- 15 percent (with heaters on) at each camera power input connector. Install, mount, and label into the 19-inch rack cabinet and provide service access to fuses. One (1) power supply for multiple cameras is not permitted unless each output is fused.

Power supplies must be in a NEMA 4 minimum rated enclosure, 120 VAC input, 24 VAC, with five (5) A minimum output per camera assembly.

B.2.8 Surge Suppression

Furnish all CCTV camera models with an Axis T8061 Ethernet Surge Protector to protect against power surges in the communication cable.

Mount the Axis T8061 Ethernet Surge Protector to the wall or pole to keep mounting consistent with the CCTV camera using

B2.4 Digital Video Recorder

Digital video server system includes an industrial rack mounted work station running Milestone professional plus with the following minimum requirements.

- External fiber connection for connecting to city's network.
- Capable of recording high quality digital images and data at a minimum of 15 frames/second, for six cameras, 24 hours/day, for up to 15 days. After 15 days of recording, the system has an option to write over the video file(s). Size the hard disk(s) accordingly to provide 25 percent minimum free disk space with 30 days of image data, plus all other software.
- Include USB ports to easily backup timed sections of the video recorded hard disk.
- Operate digital video server and all peripheral equipment on 120 VAC, 60 Hz, with an operating temperature of 41 °F to 104 °F, 80 percent RH non-condensing.
- Capable of setting up custom views and sizes of each camera on the single video screen.
- Include an x86 32-bit processor, 1.2 GHz minimum, with 1 Gb RAM, 10/1000 NIC, USB, 480GB HD, 24x CD-RW (minimum), mouse & keyboard, four (4) USB ports (minimum).
- Applications software: Event logging, live viewing, search video, motion detection, alarm-based recording, image alteration recognition, multiple camera display, time/date/camera stamping, hardware watchdog, playback by date/time/camera.
- Provide any necessary keyboards, monitors or controls necessary to set up, adjust and maintain cameras views.
- Certifications: CE class B, UL, FCC class B

B.2.5 Cabinet

Provide a half height (approx. 42”) industrial 19-inch rack chassis on a swing out frame with slide out rails and rack ears. Front door of the server cabinet is to be a glass front. Furnish cabinet with lockable access door. Install fans and filters as necessary to dissipate heat generated by the equipment. The fans are to be temperature switch controlled. Install a fluorescent cabinet light with a built-in ON/OFF switch and a separately mounted door switch. All connections are to be made from the rear of the enclosure. Conform the enclosure to the following minimum standards:

- NEMA 1 minimum rated steel, vented back and side panels
- Slide out rails for all equipment
- Rack slide supports
- 19-inch LCD monitor
- Slide out Keyboard and mouse.
- Blank panels installed over unused space

B.2.6 Monitors

Provide a single 55 flat screen TV color monitor that will be functional components of the digital video server system located inside of the bridge operator house. Attach monitor to a height and tilt adjustable ceiling bracket located above the control console in the operator’s room as shown in the plans. Monitors that conform to the following performance requirements shall be provided:

- Have a minimum brightness of 900 Cd/m^2, a minimum contrast ratio of 500:1, a minimum horizontal viewing angle of 170 degrees, and a maximum response time of 11 ms.
- Produce a minimum resolution of 1280 x 1024 dpi at 75 Hz.
- Be compatible with digital video server and cameras specified.
- Be powered by 95 – 130 VAC, 60 Hz. and include a grounded power cable plug.
- Have dual inputs: BNC NTSC video and DVI VGA. Provide NTSC to DVI converters as required.
- All wiring, cables, and adjustments shall be provided as required.
- Connections to monitor with sufficient service loops for easy removal shall be provided.
- High-resolution and high contrast in night time fluorescent overhead room lighting conditions and day time high ambient external room lighting and not “wash out” or become dark during operation shall be provided.
- Operate in a minimum 32 °F to +104 °F environment.
- Pictures shall be free of video artifacts including noise, hum bars, and flicker.

B.2.7 Quality Control

All items specified in this article must be compatible and tightly integrated with the rest of the CCTV system to produce a high quality, high-resolution, high contrast, and artifact free picture.

B.3 Air Horn

Furnish and install a weatherproof, self-contained, air driven, dual projector, 120 dB air horn equipped with a rapid response, direct drive, oil-less piston type compressor, powered by a 60 Hz, 120 VAC one (1) HP motor with sealed, self-lubricated ball bearings. Ensure the horn mechanism is air pressure actuated with free floating, vibrating type, tempered phosphor bronze diaphragm and coupled to a resonant chrome plated zinc die-cast trumpet style projector capable of producing 120 dB (as measured at a distance 10 feet) at 320 cycles per second.

B.4 Navigational Lights

Provide a complete navigation hazard lighting system operating at 120 VAC and complying with USCG CFR 118.80(b). Furnish all Fender and Clearance lights with shock proof LED lamps and surge suppressors. Lamps shall consist of 48 individual LED beams arranged in four tiers in an optically clear elastomer medium. The viewing angle of the individual LED beams shall not be less than 22 degrees for red, 20 degrees for green. The MTBF rating of the LED’s shall be 100,000 hours. Lamp base shall be Rynite FR350 or approved equal. Provide lamp lens of UV Polycarbonate. Wattage consumption should

not exceed 1.8 watts for red, 1.44 watts for green. Candela output should be not less than 78 candelas for red, 270 candelas for green. Provide lamps with integral surge suppression with a clamping voltage of not less than 380 VAC at two (2) A. Provide clear silicon filled lamps that have been field tested and documented for not less than six (6) months continuous service in extremely high vibration movable bridge applications.

B.4.1 Fender/Pier Lights

Furnish and install unpainted housings of cast bronze construction with a one-inch threaded conduit opening at the bottom, equipped with a red 180°, standard marine Fresnel type, rigid, heat resistant glass lens, 7- to 8-inch diameter. Furnish manufacturer's recommended wall mounting bracket and 90° post. Furnish all stainless steel closure bolts, lens tie rods, and attachment hardware. Use only marine type junction boxes. All joints, including lid shall be sealed with weatherproof gaskets. All fastenings shall be tamper resistant. Access cover shall require a special wrench.

B.4.2 Channel Lights

Furnish and install unpainted housings of cast bronze with cushioned lenses, weatherproof gasketed joints and large service access door equipped with 180°, standard marine molded single-piece Fresnel type, rigid, heat resistant glass, 7- to 8-inch diameter. with the Lower Section; Red, Upper Section; Green. Furnish all stainless steel closure bolts, lens tie rods, and attachment hardware. Ensure swivel assembly is cast bronze housing and bracket with stainless steel pivot, watertight "O" ring seal, bronze bearings, cable entrance fitting, and #35 stainless steel service chain rated for 225 pounds. Use a hanger stem 1½- or 2-inch galvanized pipe as recommended by manufacturer with anti-swing brake and automatic lock. No solid wire conductors shall be permitted.

B.5 Sump Pump

Provide duplex sump pumps capable of pumping 45 gallons per minute with a head of 32 feet. Each Pump shall be sewage duty rated with the ability to pass 2-inch spherical solids. Pump and motor housing, switch case, and base to be of cast iron construction with a non-clogging, vortex type bronze class 85-5-5-5 impeller and all stainless steel hardware. Pumps shall be UL approved. Furnish and install a float for each pump and a high level alarm float.

Pump motor shaft output must be 375 watts minimum, single phase, 120 VAC, 60 Hz with motor control via float switch and contactors integral to each pump unit. Power for sump pump supplied from a separate GFI circuit breaker form local lighting panelboard. Connect pumps and floats in a NEMA 4X junction box located within ten feet of the pump motor. . Mount junction box a minimum of three (3) feet above the highest grade of the counterweight pit floor. Provide 316 grade stainless steel hardware for all anchors and fasteners. Submit shop drawings that include dimensioned layout drawings and data sheets for sump, mesh screen, conduits, and all related components.

Furnish and install a separate high level float switch for alarming the PLC of high level. Monitor each sump pump breaker feed in the PLC for power and alarm if breaker is tripped or turned off.

B.5.1 Heat Trace

Provide self-regulating industrial grade flexible heat tracing for the sump discharge line for freeze protection. Heat tracing must account for a minimum ambient temperature of -40 °F and account for a 2-inch thickness of insulation. Heat tracing should be Chromalox SRF/P series, Raychem BTV series, BriskHeat SL series, or approved equal. Provide junction box, power termination and end seal fitting. Provide aluminum tape and caution labels.

B.6 VHF Marine Radio

Provide a separate, battery powered, marine radio VHF transceiver (157 - 160 MHz) with an output of 1.0 watts capable of scanning channels 9 and 16, transmitting on at least three additional channels as required by the engineer. Couple the system to a stainless steel or fiberglass whip antenna of 39 inches in length mounted as directed by the engineer. Ensure the Maximum audio distortion is less than five (5) percent. Radio must comply with FCC Rules and Regulations, Part 80. Provide a battery charger capable of maintaining the radio battery fully charged.

B.7 Fire and Security System

Provide a commercial combination fire and security alarm system to monitor, alarm and callout to a programmed phone number. Furnish the system control center in a wall mounted cabinet.

The system shall include the following features:

- Minimum of eight (8) programmable zones for two (2) wire detectors.

- UL listed
- Auxiliary contacts for alarms
- Arm/disarm keypad at entry door.
- Smoke detectors in each room and machinery room. Smoke detectors shall be multiplex photoelectric smoke detector with 57 °C heat detector.
- Door open sensors for each entrance to the pier and operator house.
- Built in automatic telephone dialer with digital coder
- Built in power supply with backup battery and charger
- Programmable auxiliary relay
- External voice siren driver to provide audible selectable tones and two voice synthesized channel
- Strobe Light
- Agency Listings - UL609 Grade A, UL1610A, UL864, NFPA72A & NFPA71

C Construction

C.1 PA System

Interface all PA and common audio party signal lines to the submarine cable system. Provide a submittal to the engineer detailing the interfacing and testing of the PA/IC system. Provide manufacturer recommended cables and wiring and consult with the PA/IC manufacturer to provide seamless integration that is void of feedback, hum, distortion, and noise. Adjust the PA/IC system for maximum performance as determined by the engineer. Install new communications system and balance system. Adjust roadway and waterway speakers as required to provide the optimum audio signals to the roadway and waterways.

C.1.1 Wiring

All wiring is to be run in separate conduits. All interconnecting conductors between various units will be manufacturer approved twisted shielded pairs of conductors. Inter-wiring between units will not be smaller than No. 18 AWG. Wiring for units on the far side of the channel is to be incorporated in the bridge submarine cables.

C.1.2 Testing

Arrange for and provide all necessary field tests required by the engineer to demonstrate that the entire public address/intercom system is in proper working order and in accordance with the plans and these special provisions.

Adjust intercom speaker volume to be heard over operating noise and to a level that can be easily understood anywhere in the room.

Operational tests of the complete installation are to be conducted by the Contractor in the presence of the engineer to demonstrate to his satisfaction that all components and systems are installed, connected and operate in accordance with the plans, specifications and approved shop drawings. If the tests show that any piece of equipment, in the judgment of the engineer, is defective or functions improperly, make such adjustments and/or replacements so that the installation is satisfactory to the engineer, and at no extra cost to the department.

C.2 CCTV

Perform the following tasks for the installation of the camera assemblies:

- Verify system voltage matches camera requirements.
- Install in accordance with manufacturer’s instructions.
- Attached the proper test instruments and adjust AGC, video levels and field of vision to ensure proper operation for day, night and inclement conditions. Do not rely on video monitors only to properly adjust the levels.
- All connections shall be tested for tightness and for intermittent connections.

- Furnish and install new camera assemblies into the enclosures at the locations shown in the plans.
- Make all electrical connections and adjustments to provide proper operation of the cameras as specified herein.

Install interior wiring neatly and carefully with proper connectors of video and power connections per manufacturer's instructions. Use conductors approved by the camera manufacturer.

C.3 Sump Pump

Confirm available voltage for sump pump matches manufacturer's specifications. Install all equipment and fasteners in accordance with manufacturer's instructions. Verify the installation and operation at the rated throughput. Verify current drawn and power consumption is within limits specified by the lighting panel breakers and conductors. Refer to the contract plans for details.

D Measurement

The department will measure Auxiliary Electrical Equipment B-70-324 as a single lump sum unit bid items acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.18	Auxiliary Electrical Equipment B-70-324	LS

Payment is full compensation for furnishing and installing Auxiliary Electrical Equipment and for furnishing all labor, tools, equipment, materials, and incidentals necessary to complete the contract work.

hh. **Submarine Cable B-70-324, Item SPV.0105.19.**

A Description

This special provision describes furnishing, installing and testing a new electrical service submarine cable and termination cabinets for the Racine Street Bridge.

The submarine cable system includes the physical cable that crosses the channel, the submarine cable termination cabinets, all mounting hardware and cable supports, and all electrical and mechanical connections to and from the submarine cable termination cabinets.

A.1 Related Provisions

Unless otherwise noted, provide work under this special provision to conform to the requirements of the following special provisions:

- Electrical Work
- Span Drives
- PLC Cabinet
- Control Console
- Motor Control Center
- Programming
- Traffic Gates
- Submarine Cable
- Auxiliary Equipment
- Lightning and Surge Protection
- Training, Manual and Spare Parts

B Materials

B.1 Submarine Cable

Furnish the following 2000 volt rated submarine cables.

- 1- Power/VFD cable
- 2 – Control Cables
- 1 – Instrumentation Cable with a 1-½" polyduct.

Verify the conductor count of the cable with the vendor of the bridge control system to ensure the specified number of spare conductors is provided. Ascertain the correct continuous length of submarine cable, including sufficient excess length to accommodate pulling eyes, adequate slack for submarine cable settling, cable clamping, connections, testing, and for samples. Ascertain the correct conductor counts (to include spares) based on approved working drawings. In no case can the conductor counts be less than those herein before specified.

Obtain the submarine cable from one manufacturer that is experienced in producing submarine cable of similar types to those described.

B.1.1 Cable Materials

Furnish cable with a weather and UV resistant high density polyethylene (HPDE) outer jacket with galvanized steel armor conforming to the requirements of ICEA S-95-658 and NEMA WC70. Provide soft annealed copper wire conductors conforming to the requirements of ICEA Publication. Provide Class B concentric stranding conductors. Provide a moisture-resisting, cross-linked, polyethylene compound insulation for each conductor conforming to the requirements of ICEA #S-95-658/NEMA WC70, Part 3.7. Conform the thickness of insulation as given under Column A of Table 3-1 for 2,000 volts rated circuit voltage. Provide mineral filler (not carbon) insulation to inhibit treeing.

Before cable orders are placed with any manufacturer, determine the true length of each cable between the submarine cable terminal cabinets. Splicing or joining of conductors between these points will not be permitted. Ascertain and order the correct continuous length of submarine cable, including sufficient excess length to accommodate pulling eyes, adequate slack for submarine cable settling, cable clamping, connections, testing, and for samples.

B.1.2 Conformance

Conform all materials and construction of the submarine cable to the requirements of ICEA Publication #S-95-658/NEMA No. WC70.

Conform all electrical equipment and installations to the requirements of the Standard Specifications for Movable Highway Bridges of the American Association of State Highway and Transportation Officials, except as may be otherwise provided herein. Conform all materials and construction items to the requirements of the Electrical Code of Wisconsin and to any applicable local rules and ordinances.

B.2 Terminal Cabinets

Furnish and install terminal cabinets to provide termination for the submarine cable. Provide adequate size for each to mount all terminal blocks and to provide ample space between blocks for routing of the wires. Size will be determined by the number of conductors and available wall space.

Provide Stainless Steel type NEMA 4X terminal cabinet enclosures fabricated from No.10 gauge, Type 316 stainless steel reinforced by steel angles. Install framed overlapping door(s) hung on continuous stainless steel piano hinges to provide access to the equipment inside. Construct the door(s) from No. 10 gauge stainless steel, suitably reinforced with a three-point, vault-type latch and padlock. Provide door(s) with rubber gaskets to prevent water from entering the cabinets. Weld reinforcing plates to the walls where conduits and cable enter the cabinets. Provide each cabinet with drain fittings of the same type as specified for conduit drains under this bid item.

Provide for grounding and bonding of all termination cabinets. Provide grounded vertical stainless steel segregation shield between the power terminal blocks and the control and signal terminal blocks. Extend the segregation shield at a height from the backplate of the terminal cabinet to the inside of the cabinet door. Bolt the shield to the bare metal backplate with stainless steel fasteners and test for proper grounding.

B.3 Hardware

Use a threaded cable support clamp screwed onto the end of the threaded conduit for supporting each submarine cable at the top end of its pier encased conduit run. Provide clamp assemblies that are fabricated of hot dipped galvanized steel and made specifically for this use. Provide stainless steel

hardware conforming to the requirements of ASTM Designation A276, Type 316. Provide bolt heads and nuts that are hexagonal and with medium series lock washers.

Secure each jacketed core of each submarine cable entering terminal cabinets at the entrance wall by a watertight, bronze cable entrance sealing bushing. Do not drill a box for more conduits or cable than actually enter it.

Furnish and install a stainless steel cover to protect the cable from the floor brackets to the bottom of the cabinet. Use grommet and or cord grips to seal the cable's entrance into the cabinet.

C Construction

C.1 Submarine Cable

In each cable, provide insulated conductors cabled to a full circular section using non-hygroscopic fillers, where necessary, to fill out the section. Cover each layer of the conductors with a single serving of binder tape. Identify conductors in each layer by coloring or marking the outer surface of the insulation. Apply one (1) layer of binder tape over the cabled conductors followed by a homogeneous synthetic sheath conforming to the requirements of NEMA WC7, Part 4.4.2, Polyethylene, Black. Conform the thickness of the sheath in accordance with the requirements of Table 4-7. Apply cable armor over the sheath consisting of a single layer of galvanized plow steel wire, each wire covered with a layer of polyethylene. Apply a high-density polyethylene jacket over the armor. Conform the polyethylene jacket, jacket thickness, and armor jacket to NEMA WC70 and be sunlight and weather resistant. Submit any variations in cable construction or materials to the engineer for review and approval.

Provide approved non-hygroscopic filler material suitable for submarine cable application, such as jute, in the interstices between and over the insulated conductors to give the complete cable a circular cross-section. Apply binder tape of approved suitable, flame-resistant, and moisture-resistant fabric material with a thickness not less than 10 mils over the multi conductor/filler assembly and overlapped not less than 10 percent of its width between turns.

C.2 Submission of Proposed Method of Installation

Submit, in detail, the proposed method for installing the submarine cable, submarine cable termination cabinets, and all other equipment, and obtain the approval of the engineer before any work is started. Coordinate submarine installation with US Coast Guard and the US Army Corps of Engineers. Obtain approval of those agencies before any work is started.

C.3 Factory Tests of Submarine Cable

Test all cable at the factory in accordance with the test methods of ICEA/NEMA Standards for the types of cable and insulating materials specified and meet or exceed the minimum requirements and criteria for acceptance as set forth therein. Test to demonstrate the quality of the production run prior to assembly and fabrication of the submarine cables, the individual insulated conductors to be incorporated in the cable.

Conform the conductors and insulating compounds to meet the minimum physical and electrical requirements set forth in NEMA Publication No. WC-70. After each multi conductor cable is completely assembled and armored, subject the entire cable to tests for insulation resistance and high voltage. Perform high-voltage tests at the same voltage used on the individual wires and the insulation resistance cannot be less than 80 percent of the original values for the individual wires. Submit the test reports for approval prior to shipping any cable.

Submit to the engineer certified copies of all the factory test data for approval before accepting shipment of cable from the manufacturer. Include, in a tabulated form, the test data, a description of the material undergoing tests, a description of each test performed, the measured or observed results, and the value and limits required by the ICEA/NEMA Standard for acceptance. In addition, submit to the engineer copies of a statement certifying that the cable delivered for use under this contract has passed the required factory inspections and tests and complies with all the requirements, including electrical, materials and construction, of the standards and specifications in the contract.

C.4 Submarine Cable Field Testing

Test the submarine cable system as described in the plans and special provisions. Replace and retest at no additional cost to the City any cable or component of the submarine cable system that does not pass the required testing. Testing shall include insulation resistance measurements (meggering). Record readings and submit to Engineer.

C.5 Installation

Install new submarine cable across the channel at the location shown on the contract plans. Provide all labor, permits, and equipment sufficient to perform all work necessary to install and place in satisfactory operating condition submarine cables and terminating equipment for carrying the power, control, and ground across the navigable channel.

Provide certified diver(s) and equipment necessary to install and inspect physically the cables as required by the engineer. Look for any damage, snags crossed cables and that cable is laying in the trench or is settled below the trench. Verify the cables are covered by rip rap.

Under this item, coordinate installation with the engineer, the cable manufacturer, and pertinent Federal, state and local agencies, including, but not limited to, the City, the U.S. Coast Guard, the U.S. Army Corps of Engineers (USACE), and the Wisconsin Department of Natural Resources (WDNR). Install the submarine cables at a depth as required by the U.S. Army Corps of Engineers. Coordinate any channel obstructions with waterway agencies in accordance with all applicable laws, regulations and permits. Install submarine cables in accordance with USACE and WDNR permits.

Make every effort to minimize disruption of the channel bottom. Comply with all requirements of agency permits and approvals.

Route the cable to avoid unforeseen obstructions. Do not exceed the minimum bending radius of each cable at any time before, during, or after installation. Perform the cable installation without damaging the bridge structure or any existing substructure and as directed by the engineer. Exercise proper care so as not to overstress, score, nick, or cut the conductors, insulation, outer jacket or armor, or otherwise damage the cable. During the installation of the cables, arrange to have a representative of the cable manufacturer, experienced in submarine cable handling and installation procedures, on site to provide advice to the contractor and the engineer in these matters.

Take special care to prevent the new cable ends from being damaged or wet during the installation. Provide sealed cable ends from the cable manufacturer. Install all cables per all manufacturer's recommendations. Install cables as shown in the contract plans.

Allow cables to settle for a period of a minimum of 48 hours, after the last cable has been placed, before any rigid connections or attachments are made. Provide submarine cables of sufficient length to allow for slack in settlement and to allow for making permanent connections. Provide proper equipment for lifting or lowering the submarine cables at the abutments/piers. Determine the proper type of lifting or lowering device for the cables, subject to approval by the engineer. Include considerations for the quantity and size of conductors in the submarine cable and distances involved.

D Measurement

The department will measure Submarine Cable B-70-324 as single lump sum unit bid item acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.19	Submarine Cable B-70-324	LS

Payment is full compensation for all excavation and backfilling required for installing the submarine cable; for all labor, materials, and equipment needed to perform the underwater installation in accordance with all requirements of WDNR and USACE; furnishing, installing and testing the submarine cable and its termination cabinets; providing divers and underwater inspection; and for furnishing all labor, tools, equipment, materials, and incidentals necessary to complete the contract work. Payment includes furnishing and placing riprap over the submarine cable as shown on the plans and removing any existing riprap required for installation of the new cable.

ii. **Tayco Street Remote Operations B-70-324, Item SPV.0105.20.**

A Description

This special provision describes Removing, storing, installing the existing equipment for Tayco Street Remote Operations. This will include all communication equipment, control console, pa system, CCTV components used at the existing Racine Street Bridge for the remote operations.

A.1 Related Provisions

Unless otherwise noted, conform work under this special provision to the requirements of the following special provisions:

- Electrical Work
- Span Drives and Motors
- PLC Cabinet
- Control Console
- Programming
- Motor Control Center
- Traffic Gates
- Submarine Cable
- Auxiliary Equipment
- Lightning and Surge Protection
- Training, Manual and Spare Parts

B Materials

B.1 System Equipment

The existing PLC is Allen Bradley Control Logix with Allen Bradley HMI software application running on the HMI panel. The PLC is installed in the control console. The plc processor communicates with the multiplexer using ethernet protocol. The HMI in console communicates using Ethernet protocol. A UPS is installed in base of control console.

Other than a few control conductors for CCTV or P.A. controls, all I/O conductors are internal to console. For bidding purposes allow for 10 conductors.

P.A. system communicates analog audio signals between master station and multiplexer. The selector switch on master system uses digital I/O to PLC that is

Transmitted to PLC located at Tayco street bridge.

CCTV monitors and controls are not original. Existing CCTV cabinet houses camera controls for both Tayco street and Racine street bridges. Coordinate with the engineer prior to removal of camera control equipment.

Multiplexer has I/O for cameras, plc data and pa system that converts signals to 2 pair of

Fiber. The fiber between the bridges is leased from Menasha Utilities.

C Construction

C.1 Preparation for Removal

Prior to removal of existing control equipment, identify and tag all existing interconnection conductors, noting any conductors that are not included on as-built documentation. Backup 3 copies PLC and HMI programs to USB thumb drives. Store one copy with the control console, one copy with the contractor and one copy with the Department.

C.2 Demo

Remove the following equipment from existing Racine Street Bridge.

- Control Console
- PA Station
- CCTV Monitor
- CCTV/Server Equipment/rack
- Communication Cabinet(Multiplexer)
- Manuals & Documentation
- Spare Parts

C.3 Demo

Store equipment in an environmentally and temperature controlled space. Put a moisture absorbing desiccant package in each piece of equipment. Shrink wrap each piece of equipment and secure a skid. Equipment and storage space shall be inspected by the Engineer for compliance.

C.4 Installation

Install new equipment in the new Bridge in locations as shown on the plans. Install a new 12 strand single mode fiber from the new bridge house to a Menasha Utilities handhole located near the utility transformers. Coordinate the new fiber with Menasha utilities. Menasha Utilities will splice new fiber to their existing system.

After installation, power up equipment and interconnect and test all communications. Coordinate with the department testing of the remote operation of the bridge.

D Measurement

The department will measure Tayco Street Remote Operations B-70-324 as a single lump sum unit bid item acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.20	Tayco Street Remote Operations B-70-324	LS

Payment is full compensation for removing, storing, installing and testing the remote operations

jj. **Steel Stairs, Platforms and Railings, Item SPV.0105.21.**

A Description

This special provision describes furnishing, fabricating, galvanizing, transporting, and fully installing all steel stairs, stairway landings, service platforms, and pipe hand railing systems required for the project as shown on the plans. This work includes the following:

- All stairs, landings and attached pipe railing beneath sidewalk level and within bascule pier and bascule abutment.
- All service platforms and attached pipe railing at rack areas.
- All pipe railing systems within the bascule pier and bascule abutment.
- All pipe railing systems within the operator house.
- Pipe railing along both fender systems attached to the faces of the bascule pier and bascule abutment.
- All associated connection hardware, brackets, connectors and anchorage assemblies required for fully erected and complete components.
- Safety chains.

B Materials

B.1 General

Furnish structural carbon steel conforming to ASTM A 709 grade 36 and in accordance to the pertinent requirements of section 506 of the standard specifications.

B.1.1 Bolts and Anchors

Subsection 506.2.5.1 of the standard specifications is amended as follows:

Where bolt diameters less than ½ inch or greater than 1½ inch are called for on the plans, use ASTM A449, Type I bolts except where another type of bolt is specifically called for.

Furnish galvanized masonry anchors conforming to the requirements of subsection 502.2.12.2 of the standard specifications and as shown on the plans.

B.1.2 Submittals

Prepare and submit complete steel shop detail drawings and steel erection drawings.

B.2 Galvanizing

B.2.1 General

Hot dip galvanize all steel elements for the work included in this special provision, including all appurtenant parts, in accordance with ASTM A 123 or A 153 as applicable.

B.2.3 Repair of Damaged Galvanized Coating

Repair any galvanized areas that are damaged by welding, abrasion, or other causes in accordance with ASTM A 780, using either the Zinc-Based Solders or the Zinc-Rich Paints type of materials. Follow the requirements of Annexes A1, Repair Using Zinc-Based Alloys, and/or A2, Repair Using Zinc-Rich Paints.

Alternatively, repair damaged areas as specified in subsection 635.3.4 of the standard specifications.

B.3 Painting

Clean and paint the following items in accordance with sections 517 and 506.3.32 of the standard specifications using the Epoxy System, unless otherwise noted, and the applicable portions of special provision Structural Steel Bridge.

- All pipe railing systems within the operator house.
- Pipe railing along both fender systems attached to the faces of the bascule pier and the bascule abutment.
- Access hatch, ladder and grab rails to the rest pier fender.

Paint galvanized pipe railings, ladders and their associated end connection angles and plates. Provide a wash coat and a tie coat appropriate for painting of galvanized surfaces before painting these members with the same paint system as the rest of the bridge. Provide a urethane finish coat with color that matches the color of the pedestrian railing for the project. Include color number for finish coat in shop drawings for railing.

C Construction

C.1 General

Perform all work in accordance to the pertinent requirements of section 506 of the standard specifications.

C.1.1 Bolts and Anchors

Install galvanized masonry anchors conforming to the requirements of subsection 502.3.14.2 of the standard specifications and as shown on the plans.

Anchor bolts may be either embedded anchor bolts or concrete masonry anchors. If the contractor elects to use embedded anchor bolts, obtain from the fabricator of the Steel Stairs, Platforms and Railing, anchor bolt setting plans. Set each group of anchor bolts together using a single template. Mark worklines on the templates to facilitate the accurate placement of the anchor bolt groups to the precise dimensions of the anchor bolt setting plans. Verify the exact location of each anchor bolt after the concrete is poured and cured. If necessary, revise the anchor bolt setting plans to show the as-built condition and take appropriate measures with the fabricator of the Steel Stairs, Platforms and Railing to assure that the rub rails and anchor bolts fit properly.

D Measurement

The department will measure Steel Stairs, Platforms and Railing as a single lump sum unit acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.21	Steel Stairs, Platforms and Railing	LS

Payment is full compensation for furnishing and installing all steel stairs, platforms and railing in and on the bascule pier, bascule abutment, and operator house including all labor, tools, materials, equipment and incidentals necessary to complete the contract work.

kk. **Tool Box with Tools, Item SPV.0105.22.**

A Description

This special provision describes furnishing a tool box and tools for placement in the bridge operator house.

B Materials

Provide a 24¼-inch wide steel tool box with removable tote tray, baked enamel finish and minimum of two metal cover latches. Tool box must have adequate storage to contain all tools listed below which do not have a separate durable carrying case provided.

Provide a 3/8-inch drive 6-point socket set containing both standard & metric sockets. Socket set is to contain both deep and standard depth sockets. Socket sizes are to be clearly marked. Standard sockets will range in size from 5/16 inch to 7/8 inch; metric sockets will range in size from 9 mm to 18 mm.

Provide a standard 3/8-inch drive quick release one-hand reversing ratchet.

Provide a set of slotted screwdrivers with blade widths varying in size from 3/8 inch to ¾ inch.

Provide a set of Phillips screwdrivers with blade sizes varying in size from P0 to P3.

Provide an adjustable six-point crescent wrench set with 6, 8, 10 and 12-inch sizes.

Provide a 16-ounce curved-claw hammer.

Provide a hex key set containing standard hex keys ranging from 1/20 inch to 3/8 inch, and metric hex keys ranging from 1.5 mm to 10 mm.

Provide a pipe wrench with a 24 inch length, and a minimum 3-inch jaw capacity.

Provide a pliers set containing an 8-inch bent wide jay diagonal, 8-inch long nose, 9½-inch arc joint and 6¾-inch slip joint pliers. Pliers handle grips are to be rubber, or other ergonomic surface. Similarly sized pliers are acceptable.

All materials required for this provision are to be professional grade by Craftsman, Mac, Snap-on or approved equal.

C (Vacant)

D Measurement

The department will measure Tool Box with Tools as a single lump sum unit of work acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.22	Tool Box with Tools	LS

Payment is full compensation for furnishing and delivering tool box, socket set, ratchet, screwdriver set, adjustable wrench set, hammer, hex key set, pipe wrench, and pliers set.

ll. **Substructure Temporary Dewatering System South Abutment, Item SPV.0105.23; Substructure Temporary Dewatering System Pier 1, Item SPV.0105.24; Substructure Temporary Dewatering System Pier 2, Item SPV.0105.25; Substructure Temporary Dewatering System Pier 3, Item SPV.0105.26; Substructure Temporary Dewatering System Pier 4, Item SPV.0105.27; Substructure Temporary Dewatering System South Bascule Pier, Item SPV.0105.28; Substructure Temporary Dewatering System North Bascule Abutment, Item SPV.0105.29; Substructure Temporary Dewatering R-70-161 Segment B, Item SPV.0105.34.**

A Description

This special provision describes furnishing, installing and removing an engineered system designed to enable substructure construction under dry conditions. The temporary dewatering system may consist of a cofferdam or cofferdam variant, sandbags, or another system that produces a watertight and stable structure that allows for dewatering of the inside work area.

The bascule pier and bascule abutment foundations are designed to bear on and key into bedrock, so concrete seals will not be permitted for use. The south abutment and piers 1 through 4 are designed for construction with concrete seals. Seal concrete will be paid for separately.

B Materials

All materials and fabricated items must be furnished by an established and reputable manufacturer or supplier.

C Construction

C.1 Methods

Perform all work for this item in accordance with all applicable requirements of the standard specifications in general and section 206 in particular, except as modified herein or shown on the plans.

Investigate and verify existing stream conditions before selecting and designing the temporary dewatering system. The system used should be designed, at a minimum, based on the 2-year high water elevation and stream velocity as stated in the plan.

Construct one or more sumps located within the excavation but outside the limits of the footing. Provide continuous pumping to maintain a dry work environment for foundation construction.

Prior to removal of the cofferdam for the bascule pier and bascule abutment and after the walls have been completed and exterior surface waterproofing applied, flood the space between the cofferdam and exterior walls of the pier and abutment to test the substructure for water tightness for at least 3 days. If the pier or abutment show any signs of seepage or leakage, do not remove the cofferdam until remedial waterproofing measures have been completed and it has been demonstrated that the substructure is watertight. For further requirements regarding this, see Article “Waterproofing Bascule Pier and Bascule Abutment”.

Design the cofferdams to maintain a navigation channel between them that conforms to the requirements of the U.S. Coast Guard permit for the project.

Do not leave cofferdam bracing permanently embedded in any concrete pour.

If the contractor chooses to provide cofferdams larger than the size shown on the plans, no additional compensation will be made for furnishing or installing additional cofferdam materials, seal concrete or excavation that may be needed.

C.2 Submittals

The approval of the engineer is required for the contractor’s dewatering system designs, schedule of installation and removal, and the proposed access to the substructure site.

Submit sufficient detail of barges and other items, as well as dewatering enclosure sizes, and the schedule of placing and removing these items, so that the engineer may determine what effect the work will have upon river conditions.

Submit, for review of the engineer, design calculations and drawings for the dewatering system to be used at each substructure.

D Measurement

The department will measure Substructure Temporary Dewatering System (Location) as a single lump sum for each of the substructures acceptably completed.

E Payment

The department will pay for the measured quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.23	Substructure Temporary Dewatering System South Abutment	LS
SPV.0105.24	Substructure Temporary Dewatering System Pier 1	LS
SPV.0105.25	Substructure Temporary Dewatering System Pier 2	LS
SPV.0105.26	Substructure Temporary Dewatering System Pier 3	LS

SPV.0105.27	Substructure Temporary Dewatering System Pier 4	LS
SPV.0105.28	Substructure Temporary Dewatering System South Bascule Pier	LS
SPV.0105.29	Substructure Temporary Dewatering System North Bascule Abutment	LS
SPV.0105.34	Substructure Temporary Dewatering R-70-161 Segment B	LS

Payment for Temporary Dewatering System is full compensation for design of the temporary dewatering system and for furnishing all labor, tools, equipment, materials, and incidentals necessary to complete the contract work. Separate payment will be made for concrete seals and excavation and disposal of streambed material, soil and/or rock within the temporary dewatering system as required in the plan.

mm. **Plumbing Work, Item SPV.0105.31**

A Description

A.1 Work Summary

This special provision describes the installation of new plumbing systems. Work required for the project is indicated on the plans.

A.2 Regulatory Requirements

A.2.1 State & Local Codes

Conform to all state and local code requirements.

A.2.2 Standards, Codes and Permits

All work shall be installed in accordance with National, State and Local plumbing codes, laws, ordinances and regulations. Comply with all applicable OSHA regulations.

All materials shall have a U.L. label where a U.L. standard and/or test exists.

Prepare and submit to all authorities having jurisdiction, for their approval, all applications and working drawings required by them. Secure and pay for all permits and licenses required.

A.3 Delivery, Storage & Handling

Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

A.4 Equipment Accessibility

Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

A.5 Submittals

A.5.1 Equipment and Material Shop Drawings

Submit shop drawings which include equipment information and product data for equipment listed below for review:

1. Water Heater & Accessories
2. Plumbing Fixtures
3. Plumbing Faucets
4. Floor Drains
5. Floor Cleanouts

B Materials

B.1 Common Work Results for Plumbing

B.1.1 Pipe Threads and Fittings

Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

B.1.2 Joining Materials

Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

Solvent Cements for Joining Plastic Piping:

PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

B.1.3 Dielectric Fittings

Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

Insulating Material: Suitable for system fluid, pressure, and temperature.

Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

Manufacturers:

Eclipse, Inc.

Epco Sales, Inc.

Hart Industries, International, Inc.

Watts Industries, Inc.; Water Products Div.

Zurn Industries, Inc.; Wilkins Div.

B.1.4 Sleeves

Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

Underdeck Clamp: Clamping ring with setscrews.

PVC Pipe: ASTM D 1785, Schedule 40.

B.1.5 Escutcheons

Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

Finish: Polished chrome-plated and rough brass.

B.2 Domestic Water Piping – Interior and Exterior Systems

B.2.1 Copper Tube and Fittings

Hard Copper Tube: ASTM B 88, Types L, water tube, drawn temper.

Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought- copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.

Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

For exterior Domestic Piping Systems, reuse existing piping material wherever possible.

B.3 Valves for Plumbing Systems

B.3.1 Copper-Alloy Ball Valves for Potable Water Systems

Manufacturers:

Copper-Alloy Ball Valves:

Grinnell Corporation.

Milwaukee Valve Company

NIBCO INC.

Watts Industries, Inc.; Water Products Div.

Copper-Alloy Ball Valves, General: MSS SP-110.

Two- or Three-Piece, Copper-Alloy Ball Valves: Bronze body with full -port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.

B.3.2 Isolation Valves and Check Valves for Sanitary Systems

For piping 2" and less: provide PVC inline check valves and PVC isolation valves.

For piping over 2": provide Bronze or Iron swing check valves and butterfly or gate valves.

B.4 Sanitary Waste Piping – Interior & Exterior

B.4.1 PVC Sanitary Piping

Sanitary waste and vent piping: utilize the following:

PVC Pipe: Schedule 40 ASTM D 2665, solid-wall drain, waste, and vent.

PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

PVC Special Fittings: ASTM F 409, drainage-pattern tube and tubular fittings with ends as required for application.

B.5 Hangers & Supports for Plumbing Piping & Equipment

B.5.1 Manufacturers

Subject to compliance with requirements, provide products by one of the following:

B-Line Systems, Inc.

Carpenter & Patterson, Inc.

Grinnell Corp.

Michigan Hanger Co., Inc.

National Pipe Hanger Corp.

Unistrut Corp.

B.5.2 Manufactured Units

Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.

Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.

Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

Thermal-Hanger Shield Inserts: 100-psi minimum compressive-strength insulation, encased in sheet metal shield.

Material for Cold Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.

Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.

For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.

For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.

Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

B.5.3. Miscellaneous Materials

Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

B.6 Plumbing Pipe Insulation & Jackets

B.6.1 Manufacturers

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Mineral-Fiber Insulation:

CertainTeed Manson.

Knauf Fiber Glass GmbH.

Owens-Corning Fiberglas Corp.

B.6.2 Insulation Materials

Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:

Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket.

Mineral-Fiber Insulating Cements: Comply with ASTM C 195.

hydraulic-setting, mineral-fiber cement is suitable for temperatures from 100 to 1200 deg F (38 to 649 deg C) and for a smooth surface.

Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

B.6.3 Jackets – Field-Applied Jackets

General: ASTM C 921, Type 1, unless otherwise indicated.

Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils (0.5 mm) thick; roll stock ready for shop or field cutting and forming**.**

Adhesive: As recommended by insulation material manufacturer.

PVC Jacket Color: White.

Standard PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil- (0.5-mm-) thick, high-impact, ultraviolet-resistant PVC.

Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.

Adhesive: As recommended by insulation material manufacturer.

B.7 Piping Identification Devices

Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

Colors: Comply with ASME A13.1, unless otherwise indicated.

Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers extending 360 degrees around pipe at each location.

Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

Shaped Pipe Markers: Preformed semirigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.

Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.

Plastic Tape: Continuously printed, vinyl tape at least 3 mils thick with pressure-sensitive, permanent-type, self-adhesive back.

Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): 3/4-inch (19 mm) minimum.

B.8 Electric Tank Type Water Heaters

Manufacturers: AO Smith, Rheem, Bradford White., State Industries, American.

Description: Comply with UL 1453.

Construction: Steel with 150-psig working pressure rating

Tapping: Factory fabricated of materials compatible with tank for piping connections, relief valve, pressure gage, thermometers, grain, anode rods and controls as required. Attach tappings to tank shell before testing and labeling.

NPS 2 and Smaller: Threaded ends according to ASME B1.20.1, pipe threads.

Interior Finish: Materials and thicknesses complying with NSF 61, barrio materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.

Jacket: Steel with enameled finish

Heating Elements: Electric screw-in or bolt-on, immersion type.

Temperature Control: Adjustable thermostat.

Safety Control: Automatic, high-temperature-limit cutoff device or system.

Drain Valve: ASSE 1005, corrosion-resistant metal, factory installed.

Anode Rods: Factory installed magnesium

Dip Tube: Factory installed. Not required if cold water inlet is near bottom of storage tank.

B.8.1 Water Heater Accessories

Combination Temperature and Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into tank.

Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include pressure setting less than heat-exchanger working-pressure rating.

Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated, steel bracket for wall mounting and capable of supporting water heater and water. Support bracket shall be field primed & painted to prevent corrosion. Field touch up to owner’s satisfaction.

B.9 Plumbing Specialties

B.9.1 Miscellaneous Piping Specialties

Roof Flashing Assemblies: Manufactured assembly made of 4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch- (1.6-mm-) thick, lead flashing collar and skirt extending at least 8-inches (200 mm) from pipe with galvanized steel boot reinforcement, and counter flashing fitting.

Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.

Fixed Air-Gap Fittings: Manufactured cast-iron or bronze drainage fitting with semi-open top with threads or device to secure drainage inlet piping in top and bottom spigot or threaded outlet larger than top inlet. Include design complying with ASME A112.1.2 that will provide fixed air gap between installed inlet and outlet piping.

Stack Flashing Fittings: Counter flashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.

Vent Caps: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.

Vent Terminals: Commercially manufactured, shop- or field-fabricated, frost-proof assembly constructed of galvanized steel, copper, or lead-coated copper. Size to provide 1-inch (25-mm) enclosed air space between outside of pipe and inside of flashing collar extension, with counter flashing.

B.9.2 Sleeve Penetration Systems

Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.

Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.

Stack Fitting: ASTM A 48 (ASTM A 48M), gray-iron, hubless-pattern, wye-branch stack fitting with neoprene O-ring at base and gray-iron plug in thermal-release harness in branch. Include PVC protective cap for plug.

B.9.3 Flashing Materials

Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

General Use: 4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.

Vent Pipe Flashing: 3-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.

Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.

Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch (1.01-mm) minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.

Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.

Fasteners: Metal compatible with material and substrate being fastened.

Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

Solder: ASTM B 32, lead-free alloy.

Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

B.9.4 Cleanouts

Cleanouts: Comply with ASME A112.36.2M .

Application: Floor cleanout, Wall cleanout, For installation in exposed piping.

Manufacturers:

Josam Co.

Sioux Chief Manufacturing Co., Inc.

Smith, Jay R. Mfg. Co.

Tyler Pipe, Wade Div.

Watts Industries, Inc.

Zurn Industries, Inc.

Body or Ferrule Material: Cast iron.

Outlet Connection: Threaded.

Closure: Brass plug with straight threads and gasket.

Adjustable Housing Material: Cast iron with setscrews or other device.

Frame and Cover Material and Finish: Nickel-bronze, copper alloy.

Frame and Cover Shape: Round.

Top Loading Classification: Light Duty.

B.9.5 Floor Drains

Provide Floor Drains as specified in Plumbing Fixture Schedule

C Construction

C.1 Plumbing - General

C.1.2 Piping Systems - Common Requirements

Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

Install piping to permit valve servicing.

Install piping free of sags and bends.

Install fittings for changes in direction and branch connections.

Install piping to allow application of insulation.

Select system components with pressure rating equal to or greater than system operating pressure.

Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

New Piping:

Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.

Insulated Piping: One-piece, stamped-steel type with spring clips.

Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.

C.1.3 Piping Joint Construction

Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

C.1.4 Piping Connections

Make connections according to the following, unless otherwise indicated:

Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.

Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

C.1.5 Equipment Installation – Common Requirements

Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

Install equipment to allow right of way for piping installed at required slope.

C.2 Domestic Water Piping

C.2.1 Pipe and Fitting Applications.

Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

Aboveground Domestic Water Piping: Use any of the following piping materials for each size range:

NPS 3-1/2 and Smaller: Hard copper tube, Type L with: Threaded, soldered or brazed connections.

C.3 Sanitary Waste Piping

C.3.1 Pipe and Fitting Applications.

Reuse existing exterior above ground piping where ever possible. Maintain existing cleanout locations.

Install waste piping with a minimum of 2% downward slope in direction of flow.

Pipe joints:

Copper – Soldered joints

PVC – Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

C.4 Valves for Plumbing – Examination

Examine piping system of compliance with requirements for installation tolerances and other conditions affecting performance.

Proceed with installation only after unsatisfactory conditions have been corrected.

Examine valve interior for cleanliness, freedom from foreign matter, and corrosion.

Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

Examine threads on valve and mating pipe for form and cleanliness.

Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

Do not attempt to repair defective valves; replace with new valves.

C.4.1 Valve Applications

Domestic water Piping: Ball Valves NPS 2" and Smaller: Two-piece, 600-psig CWP rating, copper alloy.

For Copper Tubing, NPS 2" and smaller: Solder-joint or threaded ends.

Sanitary Piping: Check and isolation valves as listed in Section B.

C.4.2 Valve Installation

Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

Locate valves for easy access and provide separate support where necessary.

Install valves in horizontal piping with stem at or above center of pipe.

Install valves in position to allow full stem or handle movement.

C.4.2 Joint Construction

Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

C.4.3 Adjusting

Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs

C.5.Hanger and Support Applications

C.5.1 Horizontal-Piping Hangers and Supports:

Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.

Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.

Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.

Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.

Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.

Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.

Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.

Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various

types of building attachments.

Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

C.5.2 Hanger & Support Installation

Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure. All exterior hangers and Hanger Accessories shall be fabricated with 316 stainless steel.

Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.

Field assemble and install according to manufacturer's written instructions.

Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.

Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

Note: For exterior pipe hanger locations, all hangers & hanger accessories shall be fabricated from 316 Stainless Steel.

Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.

Insulated Piping: Comply with the following:

Attach clamps and spacers to piping.

Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

Do not exceed pipe stress limits according to ASME B31.9.

Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

Option: Thermal-hanger shield inserts may be used

Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.

Option: Thermal-hanger shield inserts may be used

Shield Dimensions for Pipe: Not less than the following:

NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

Insert Material: Length at least as long as protective shield.

Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

Install hangers for exterior piping systems per the following maximum horizontal spacings and minimum rod diameters (NOTE: if Structural drawings & details indicate rod diameter for hangers, defer to diameters so indicated):

NPS 1-1/4: 72” with 3/8-inch rod

NPS 1-1/2 – NPS 2: 96” with 3/8-inch rod

NPS 2-1/2: 108” with ½-inch rod

NPS 3 –NPS 5: 10 feet with ½-inch rod

NPS 6: 10 feet with 5/8-inch rod

C.5.3 Equipment Supports

Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

C.5.4 Metal Fabrication

Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

C.5.5 Adjusting

Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

C.5.6 Hanger Painting

Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

C.6 Insulation Execution

C.6.1 General Application Requirements

Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.

Apply multiple layers of insulation with longitudinal and end seams staggered.

Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

Keep insulation materials dry during application and finishing.

Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

Apply insulation with the least number of joints practical.

Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.

Apply insulation continuously through hangers and around anchor attachments.

For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.

Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

Apply adhesives and mastics at the manufacturer's recommended coverage rate.

Apply insulation with integral jackets as follows:

Pull jacket tight and smooth.

Circumferential Joints: Cover with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches (100 mm) o.c.

Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches (40 mm). Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.

Exception: Do not staple longitudinal laps on insulation having a vapor retarder.

Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.

At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.

C.6.2 Mineral-Fiber Insulation Application

Apply insulation to straight pipes and tubes as follows:

Where pipe expansion is anticipated, detail expansion compensation for insulation on Drawings and indicate intervals for its occurrence. See MICA's "National Commercial & Industrial Insulation Standards," Plate No. 41A.

Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.

Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet (4.5 to 6 m) to form a vapor retarder between pipe insulation segments.

For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches (150 mm) o.c.

For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

Apply insulation to fittings and elbows as follows:

Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.

Cover fittings with standard PVC fitting covers.

Apply insulation to valves and specialties as follows:

Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.

When premolded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to stainer basket without disturbing insulation.

Apply insulation to flanges as specified for flange insulation application.

Use preformed standard PVC fitting covers for valve sizes where available.

Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

C.6.3 Metal Jackets

Install metal jacket with 2-inch minimum overlap at longitudinal and butt joints. Overlap longitudinal joints to shed water. Seal but joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel draw bands 12 inches on center and at butt joints.

C.6.4 Insulation Application Schedule, General

Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.

Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

C.6.5 Interior Insulation Application Schedule

Service: Interior - All domestic hot water piping and domestic cold water.

Operating Temperature: 35 to 140 deg F (15 to 60 deg C).

Insulation Material: Mineral fiber with ASJ Jacket

Insulation Thickness for piping up to and including 2": 1 (one) inch minimum.

Insulation Thickness for piping over 2": 1-1/2 (one and one-half) inch minimum.

Field-Applied Fitting covers: PVC

Vapor Retarder Required: No.

Finish: Painted.

Service: Exposed sanitary drains and domestic water supplies and stops for fixtures for the disabled.

Operating Temperature: 35 to 120ºF (2 to 49ºC).

Insulation Material: Mineral fiber.

Insulation Thickness: 1 (one) inch

Field-Applied Jacket: PVC P-trap and supply covers.

C.7 Piping Identification

Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

Pipes with OD, Including Insulation, Less Than 6 Inches: Pretensioned pipe markers. Use size to ensure a tight fit.

Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior non-concealed locations as follows:

Near each valve.

Near each branch connection, excluding short takeoffs for fixtures. Where flow pattern is not obvious, mark each pipe at branch.

Near penetrations through walls, floors, ceilings, and non-accessible enclosures.

At access doors, manholes, and similar access points that permit view of concealed piping.

Near major equipment items and other points of origination and termination.

Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.

C.8 Water Heater Installation

Install water heaters, level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

Anchor water heaters to substrate.

Install temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend relief valve outlet with water piping in continuous downward pitch and discharge onto closest floor drain.

Fill water heaters with water.

C.8.1 Connections

Install piping adjacent to equipment to allow service and maintenance.

Connect hot- and cold-water piping with shutoff valves and unions.

Make connections with dielectric fittings where piping is made of dissimilar metal.

Electrical Connections: Power wiring and disconnect switches are specified in Electrical work Sections. Arrange wiring to allow unit service.

Ground equipment

Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

C.9 Plumbing Specialties

C.9.1 Installation

Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.

Locate at each change in direction of piping greater than 45 degrees.

Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.

Locate at base of each vertical soil and waste stack.

Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.

Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.

Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch (25-mm) clearance between vent pipe and roof substrate.

Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

Position floor drains for easy access and maintenance.

Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.

Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.

Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.

Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

Fasten recessed-type plumbing specialties to reinforcement built into walls.

Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.

Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Division 15 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.

Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

C.9.2 Connections

Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

Install piping adjacent to equipment to allow service and maintenance.

Connect plumbing specialties to piping specified in other Division 15 Sections.

Ground equipment.

Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

Connect plumbing specialties and devices that require power according to Division 16 Sections.

C.9.3 Flashing Installation

Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

Lead Sheets: Burn joints of lead sheets 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.

Copper Sheets: Solder joints of copper sheets.

Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.

Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.

Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.

Set flashing on floors and roofs in solid coating of bituminous cement.

Secure flashing into sleeve and specialty clamping ring or device.

Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 7 Section "Sheet Metal Flashing and Trim."

Fabricate and install flashing and pans, sumps, and other drainage shapes.

C.9.4 Protection

Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

Place plugs in ends of uncompleted piping at end of each day or when work stops.

D Measurement

The department will measure Plumbing Work as a single lump sum unit of work acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.31	Plumbing Work	LS

Payment is full compensation for furnishing sink, toilet, water heater, floor drain, domestic water plumbing, sanitary waste plumbing, and all labor, tools, equipment and incidentals necessary to complete the work shown on the plumbing plans.

nn. **Operator House Masonry, Item SPV.0105.37.**

A DESCRIPTION

Furnish all labor, material and tools required for the satisfactory completion of the brick façade and cast stone panels and cornice at the Racine Street bridge house in accordance with the drawings and as set forth in these specifications.

Included are the following:

1. Metal Fabrications
2. Brick Masonry Veneer Assembly.
3. Precast Stone Veneer Panels and Cornice Assembly.

B MATERIALS

B.1 Metal Fabrications

B.1.1 Reference Standards

ASTM A36/A36M – Standard specification for Carbon Structural Steel, 2014

ASTM A123/A123M – Standard specification for Zinc (Hot-dip Galvanized) Coating on Iron and Steel Products, 2017.

B.1.2 Steel Sections: ASTM A36/A36M.

Steel angles lintels for support of masonry.

B.1.3 Mechanical Fasteners:

Same material as or compatible with materials being fastened; type consistent with design and specified quality level.

Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.

B.1.4 Touch-Up Primer for Galvanized Surfaces:

SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

B.1.5 Fabrication

Fit and shop assemble items in largest practical sections, for delivery to site.

Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight

flush, and hairline. Ease exposed edges to small uniform radius.

Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

Lintels: As detailed; galvanized finish.

B.1.6 Finishes – Steel

Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.

B.1.7 Fabrication Tolerances

Squareness: 1/8 inch maximum difference in diagonal measurements.

Maximum Offset Between Faces: 1/16 inch.

Maximum Misalignment of Adjacent Members: 1/16 inch.

Maximum Bow: 1/8 inch in 48 inches.

Maximum Deviation From Plane: 1/16 inch in 48 inches.

B.2 Masonry Veneer Brick

B.2.1 Submittals

Submit Brick Product Data and Samples for Verification of color and size.

Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6. Do not use units with defects. Provide shapes with exposed surfaces matching finish and color of exposed faces of adjacent units. Do not expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.

B.2.2 Clay Face Brick: Facing brick complying with ASTM C 216.

Basis of Design: Bridge House veneer brick – Interstate Brick, Monterey L-4 Modular

Grade SW

Type FBX.

Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested according to ASTM C 67.

Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."

Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches `long.

B.2.3 Mortar Materials

Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color.

Hydrated Lime: ASTM C 207, Type S.

Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

Water: Potable.

B.2.4 Ties and Anchors

General: Ties and anchors shall extend at least 1-1/2 inches (38 mm) into veneer but with at least a 5/8-inch (16-mm) cover on outside face.

Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.

Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.

Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

Corrugated-Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from 0.105-inch thick steel sheet, galvanized after fabrication with dovetail tabs for inserting into dovetail slots in concrete.

B.2.5 Flashing

Stainless steel; ASTM A167, Type 304, soft temper; smooth finish, with 40 mil thick EPDM sheet, uncured on top surface. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.

Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

B.2.6 Miscellaneous Accessories:

Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self-expanding.

Mortar Net Drainage System, as manufactured by Mortar Net, or equal.

Weep Vents: 1/2 inch x 2-1/2 inch x 3-1/2 inch standard sized, polyester honeycomb; as manufactured by Mortar Net, or equal; in color to match mortar color.

B.2.7 Masonry Cleaners

Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

B.2.8 Mortar Mixes

General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated. Do not use calcium chloride in mortar or grout. Use portland cement-lime mortar unless otherwise indicated.

Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Use Type N unless another type is indicated.

B.3 Cast Stone Panels and Cornice

B.3.1 Submittals

Submit Product Data: For cast-stone units. Include qualification data for manufacturer test reports for concrete mix based on testing according to ASTM C 1364 and including test for compressive strength, water-absorption and resistance to freezing and thawing.

Submit Shop Drawings showing fabrication and installation details for cast-stone units. Include dimensions, details of reinforcement and anchorages, and indication of finished faces.

Submit 12 by 12 by 2 inches samples for color and texture of cast stone required.

B.3.2 Quality Assurance

Fabricator Qualifications: A firm that assumes responsibility for engineering precast stone units with a minimum of 5 years successful experience in manufacturing precast stone units similar to those required

Designated a PCI-certified plant for Group A, Category AT

Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."

B.3.3 Performance Requirements

Delegated Design: Engage a qualified professional engineer to design precast stone units.

Design Standards: Comply with ACI 318 and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast stone units indicated.

B.3.4 Materials

Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed, ASTM A 775/A 775M, epoxy-coated, with less than 2 percent damaged coating in each 12-inch bar length.

Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.

Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet epoxy coated or galvanized.

Portland Cement: ASTM C 150/C 150M; Type I, or III.

For surfaces exposed to view in finished structure, use gray or white, as required for selected color, of same type, brand, and source throughout production.

Metakaolin: ASTM C 618, Class N.

Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33/C 33M, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.

Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.

Gradation: To match approved sample.

Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand compatible with coarse aggregate; to match approved finish sample.

Coloring Admixture: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures, temperature stable, nonfading, and alkali resistant.

Water: Potable; complying with chemical limits in PCI MNL 130.

Polymer-Curing Admixture: Acrylic thermoplastic copolymer dispersion complying with PCI MNL 130.

Air-Entraining Admixture: ASTM C 260/C 260M, containing not more than 0.1 percent chloride ions.

Chemical Admixtures: ASTM C 494/C 494M, containing not more than 0.1 percent chloride ions.

Sealer: Colorless, pure acrylic water-repellent penetrating sealer which maintains natural look of concrete surface with no glaze or gloss, darkening or color change.

B.3.5 Concrete Mixes

Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

Compressive Strength (28 Days): 5000 psi minimum.

Water Absorption: 6 percent by weight or 14 percent by volume, tested according to ASTM C 642, except for boiling requirement.

Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.

B.3.6 Fabrication General

Cast-in recesses for stainless steel pins and other anchorage hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position recesses for attachment to pins where they do not affect position of main reinforcement or concrete placement.

Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.

Reinforce precast stone units to resist handling, transportation, and erection stresses and specified in-place loads.

Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

Place face mixture to a minimum thickness after consolidation of the greater of 1 inch or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover required.

Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.

Place backup concrete mixture to ensure bond with face-mixture concrete.

Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 117.

Comply with PCI MNL 117 for hot- and cold-weather concrete placement.

Identify pickup points of precast concrete units and orientation in structure with permanent markings.

Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until

compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Engineer's approval.

Tolerances: Fabricate precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

B.3.7 Cast Stone Units

Cast-Stone Units: Comply with ASTM C 1364. Units shall be manufactured using the vibrant dry tamp or wet-cast method. Units shall be resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.

Fabricate units with sharp edges and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated. Provide drips on projecting elements unless otherwise indicated.

Cure Units as Follows:

Cure units in enclosed, moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F (38 deg C) for 12 hours or 70 deg F (21 deg C) for 16 hours.

Keep units damp and continue curing no fewer than seven days at mean daily temperature of 50 deg F (10 deg C) or above.

Acid etch units after curing to remove cement film from surfaces to be exposed to view.

B.3.8 Finishes

Exposed faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast stone units to match approved sample and as follows:

Color: Limestone

Finish unexposed surfaces of architectural precast stone units with as cast finish.

B.3.9 Mortar

Comply with requirements in Section B.1 "Masonry Veneer" for mortar mixes.

For setting mortar, use Type N unless otherwise recommended by manufacturer.

For pointing mortar, use Type N unless otherwise recommended by manufacturer.

B.3.10 Accessories

Furnish loose hardware items including stainless steel pins and other hardware shapes for securing precast stone units to supporting construction.

Anchors: Type and size indicated, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.

Dowels: 3/8-inch diameter round bars, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.

Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cast-stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.

C. CONSTRUCTION

C.1 Metal Fabrications

C.1.1 Field Conditions and Preparation

Examine and verify that field conditions are acceptable and are ready to receive work.

Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

C.1.2 Installation

Install items plumb and level, accurately fitted, free from distortion or defects.

Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

Obtain approval prior to site cutting or making adjustments not scheduled.

C1.3 Tolerances

Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

Maximum Offset From True Alignment: 1/4 inch.

Maximum Out-of-Position: 1/4 inch.

C.2 Masonry Veneer

C.2.1 Field Conditions

Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

C.2.2 Installation, General

Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested according to ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

Tolerances

Dimensions and Locations of Elements:

For dimensions in cross section or elevation, do not vary by more than plus 1/4 inch or minus 1/4 inch.

For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.

For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch (total.

Lines and Levels:

For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.

For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet or 1/2 inch maximum.

For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2 inch maximum.

For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet or 1/2 inch maximum.

For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet or 1/2 inch maximum.

Joints:

For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch

For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

C.2.3 Laying Masonry Walls

Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

C.2.4 Mortar Bedding and Jointing

Lay masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

C.2.5 Anchored Masonry Veneers

Anchor masonry veneers to concrete back up with masonry-veneer anchors to comply with the following requirements:

Fasten anchors to concrete structure with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.

Embed tie sections in masonry joints.

Locate anchor sections to allow maximum vertical differential movement of ties up and down.

Space anchors not more than 16 inches o.c. vertically and 24 inches o.c. horizontally, with not less than one anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 12 inches around perimeter.

Provide not less than 2 inches of airspace between back of masonry veneer and face of insulation.

C.2.6 Flashing, Weep Holes, and Vents

General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

Install flashing as follows unless otherwise indicated:

Prepare substrate surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape.

At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.

Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.

Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal flashing termination.

Install weep holes in veneers in head joints of first course of masonry immediately above embedded flashing. Use specified weep/vent products to form weep holes.

Space weep holes 24 inches o.c. unless otherwise indicated.

Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

Install vents in head joints in exterior wythes at 24 inches o.c unless otherwise indicated. Use specified weep/vent to form vents.

C.2.7 Repairing, Pointing, and Cleaning

In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.

Protect adjacent stone and non-masonry surfaces from contact with cleaner.

Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.

Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.

Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

C.3 Cast Stone

C.3.1 Setting Cast Stone in Mortar

Install cast-stone units to comply with requirements in Section C.1 "Masonry Veneer"

Set units in full bed of mortar with full head joints unless otherwise indicated. Fill dowel holes and anchor slots with mortar. Fill collar joints solid as units are set.

Build concealed flashing into mortar joints as units are set.

Keep head joints in copings and between other units with exposed horizontal surfaces open to receive sealant. Keep joints at shelf angles open to receive sealant.

Rake out joints for pointing with mortar to depths of not less than 3/4 inch (19 mm). Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch (10 mm). Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.

Tool exposed joints slightly concave when thumbprint hard. Use a smooth plastic jointer larger than joint thickness.

Rake out joints for pointing with sealant to depths of not less than 3/4 inch (19 mm). Scrub faces of units to remove excess mortar as joints are raked.

Provide sealant joints at head joints of copings and other horizontal surfaces; at expansion, control, and pressure-relieving joints; and at locations where indicated.

Keep joints free of mortar and other rigid materials.

Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 9 "Joint Sealants."

C.3.2 Setting Anchored Cast Stone with Sealant-Filled Joints

Set cast stone as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.

Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place. Shim and adjust anchors, supports, and accessories to set cast stone in locations indicated with uniform joints.

Fill anchor holes with sealant. Where dowel holes occur at pressure-relieving joints, provide compressible material at ends of dowels.

Set cast stone supported on clip or continuous angles on resilient setting shims. Use material of thickness required to maintain uniform joint widths. Hold shims back from face of cast stone a distance at least equal to width of joint.

Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 9 "Joint Sealants."

Installation Tolerances. See Section C.1 “Masonry Veneer”.

C.3.3 Adjusting, and Cleaning

Remove and replace stained and otherwise damaged units and units not matching approved Samples. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

In-Progress Cleaning: Clean cast stone as work progresses.

Remove mortar fins and smears before tooling joints. Remove excess sealant immediately, including spills, smears, and spatter.

Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:

Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Owners Representative will provide review and approval.

Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.

Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.

Clean cast stone by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.

Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions.

D. Method of Measurement

The department will measure completed Operator House Masonry, constructed in accordance to the contract and accepted, a single complete unit of work.

E. Basis of Payment

The department will pay for the measured quantity at the contract price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.37	Operator House Masonry	LS

Payment is full compensation for all materials, labor and incidentals for Pedestal Cap and Brick Facing, including precast concrete cap, foam thin brick applied with mortar in accordance with the drawings and as set forth in these specifications.

oo. **Counterweight Concrete Sealer, Item SPV.0165.01.**

A Description

This special provision describes furnishing and applying a 2-part epoxy resin type concrete sealer to the back and bottom surfaces of the concrete counterweights.

B Materials

Furnish material conforming to the requirements Bridge Seat Protection as specified in Article 502.3.12 of the Standard Specifications.

Submit data on proposed sealer to the engineer for approval prior to ordering.

C Construction

Prepare concrete surfaces and apply sealer and in accordance with the requirements of Article 502.3.12 of the Standard Specifications.

D Measurement

The department will measure Counterweight Concrete Sealer by square feet acceptably completed based upon the actual length, width and depth dimensions of the counterweight constructed over the limits of those counterweight surfaces shown on the plans that are to be sealed.

E Payment

The department will pay for the measured quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0165.01	Counterweight Concrete Sealer	SF

Payment is full compensation for preparing surfaces, furnishing and applying the concrete sealer and furnishing all labor, tools, equipment and incidentals necessary to complete the work.

pp. **Steel Grid Floor Concrete Filled, Item SPV.0165.02.**

A Description

This special provision describes furnishing, erecting and attaching a grid deck system for the roadway on the bascule leaf between the curb lines. Details in the plans and this special provision are based on a welded steel grid system; an equivalent riveted grid system may be provided, subject to the approval of the engineer. The contractor is responsible for all adjustment of steel and bridge balance necessary if an alternate riveted grid system is used.

B Materials

Provide a system that is a Half-Filled Grid Deck type as designated by the BGFMA.

Provide steel grid, trim bars and connection plates conforming to ASTM A709 Grade A50 structural steel with a minimum copper content of 0.2 percent.

Provide grid flooring consisting of panels fabricated with standard ribbed main bars 5-3/16 inches deep, spaced 10 inches on-center with cross bars ¼ inch by 2½ inches at 4-inch spacing. Intersect the cross bars by supplemental bars ¼ inch by 1 inch evenly spaced between main bars. Interconnect the main beams and supplemental bars by welding in accordance with manufacturer's standards.

Provide a grid system having a minimum section modulus to top of steel of 3.5 cubic inches per foot and a minimum section modulus to bottom of steel of 3.28 cubic inches per foot for steel only.

Provide a grid system with a 20 gauge form pan located 2½ inches below the top of the main beams.

Provide connection plates shop welded to the bottom of the main bearing bars for bolting of the grid system to the supporting steel framing system. Field welding of the grid system to the supporting steel framing system will not be permitted.

Hot-dip galvanize the shop assembled units of the steel grid floor including grid, connection plates, and all appurtenant items in accordance with ASTM A123 or A153 as applicable. Repair any and all galvanized areas that are damaged by welding, abrasion, or other causes in accordance with ASTM A780, using either the zinc-based solders or the zinc-rich paints type of materials. Follow the requirements of annexes A1, repair using zinc-based alloys, and/or A2, repair using zinc-rich paints.

C Construction

C.1 Fabrication

Fabricate the grid deck within the limits of the following tolerances:

- Overall panel length and width: Plus (+0) to minus one-eighth (-1/8) inch maximum from the approved drawings.
- Panel squareness: Diagonal lengths between extreme corners of a panel; within one-quarter (¼) inch from each other.
- Panel flatness: The transverse camber (width) of panel; no more than 0.001 times the width of the panel. The longitudinal camber; no more than 0.003 times the length of the panel.
- Sweep: The side bow; no more than plus or minus one-quarter (¼) inch per 10 linear feet in either direction.

- Main bar verticality: no more than one-sixteenth (1/16) inch out of vertical on the full height.
- Cross bar verticality: no more than one-sixteenth (1/16) inch out of vertical on the full height.
- Main bar spacing: Center to center spacing of the main bar; no more than plus or minus one-sixteenth (1/16) inch from the detailed bar spacing.
- Cross bar spacing: center to center spacing of the cross bar; no more than plus or minus one-sixteenth inch (1/16) inch from the detailed bar spacing.

Perform all work for this item in accordance with all applicable requirements of the standard specifications in general and section 515 in particular, except as modified herein or shown on the plans.

Shop-drill holes in the connection plates welded to the bottom of the main bearing bars of the grid system for bolted attachment in the field to the underlying structural framing system. Coordinate locations of all holes in connection plates to assure they will correspond to locations where attachment can be made to the top flanges of supporting stringers.

Assemble the units on top of the stringers and at right angles to them. Provide units with length sufficient to cover the full width of the roadway without splicing. Place the grid units, as shown on the erection drawings, and bolted to the stringers as shown on the plans.

In the erection of the units, exercise care to place each unit in its proper position, measuring in all cases from the same reference point, as otherwise cumulative errors in spacing are likely to appear, making necessary either the flame cutting of the final unit to fit, or inserting additional steel to fill the gap. Splice the units together along their edges by the bolting of bars to form a rigid assembly. Field splice the trim and splice bars by bolting.

Place the fabricated floor in accordance with the manufacturer's specifications as approved by the engineer. All transverse bars are to be spliced.

Connect grid assembly to the roadway stringers with field drilled holes in the stringers. Drill the holes for the connection bolts in the field to assure proper alignment and fit.

Do not perform welding to galvanized surfaces.

Submit complete construction drawings, shop details, and erection plans for review in accordance with Section 105.2 of the Standard Specification, and as specified herein. Show spacing and size of all longitudinal and transverse members of the grid units, sizes and lengths of welds, sizes and locations of bolts, splices and trim on the drawings.

C.2 Installation Tolerances

Install the grid panels within the limits of the following tolerances:

- Cross bar alignment between adjacent grid deck panels; no more than plus or minus one-sixteenth (1/16) inch.
- The overall cross bar alignment of grid deck panels from end to end of the movable span leaf; no more than plus or minus one-quarter (¼) inch.

D Measurement

The department will measure Steel Grid Floor Concrete Filled by the square foot acceptably completed. The department will measure quantities for payment based on those shown on the engineer-approved bridge plans.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0165.02	Steel Grid Floor Concrete Filled	SF

Payment is full compensation for furnishing and erecting of the steel grid roadway floor and furnishing all labor, tools, equipment and incidentals necessary to complete the contract work. The cost of field drilling holes in supporting steel framing and all associated galvanized bolts, nuts and washers for the bolted attachment of the grid system will be considered included in this payment.

Payment will be considered to include all adjustments necessary to the steel details and bridge balance to accommodate the alternate system, if an alternate riveted grid system is used.

Separate payment will be made for lightweight concrete fill placed in the steel grid.

qq. **Fiberglass Sidewalk Floor Plates, Item SPV.0165.04.**

A Description

This special provision describes furnishing and installing fiberglass floor plate on the bascule leaves.

B Materials

B.1 General

The minimum requirements for fiberglass sidewalk plates, splice bars, and stainless steel hardware shall be as follows:

All items, details of construction, services or features not specifically mentioned which are regularly furnished in order to provide fiberglass sidewalk plates and stainless steel hardware shall conform in strength, quality and workmanship to that typically provided by the practice indicated in this specification.

Floor Plate composition shall consist of a glass fiber reinforced polyester resin matrix, approximately 50% glass by weight. A synthetic surface veil shall be the outermost layer covering the exterior surfaces. Glass strand rovings shall be used internally for longitudinal strength. Continuous strand glass mats or stitched reinforcements shall be used internally for transverse strength.

The fiberglass sidewalk floor plates shall be manufactured by the pultrusion process and made from isophthalic polyester resin with fire retardant additives to meet a flame spread rating of less than 25 per ASTM E-84 and meet the self-extinguishing requirements of ASTM D-635. All structural shapes shall contain a UV inhibitor.

B.2 Properties

The fiberglass sidewalk floor plates shall have the following properties:

Color:	Haze Gray
Resin:	Isophthalic Polyester
Fire Retardant Properties:	Meets Class I Frame Rating of 25 or less per ASTM E-84
Anti-Skid Surface:	Permanently bonded grit baked epoxy surface

Fiberglass sidewalk floor plates shall have a gray-ultra-violet resistant polyurethane top coat.

B.3 Minimum Ultimate Coupon Properties

Fiberglass sidewalk floor plates shall meet the following test results for the ultimate coupon properties per the referenced ASTM procedures:

Mechanical Property	Test	Value	Thickness
• Flexural stress, Flatwise LW	D790	24,000 psi	
• Flexural stress, Flatwise CW	D790	17,000 psi	
• Flexural Modulus, Flatwise LW	D790	1,000,000 psi	2”
• Flexural Modulus, Flatwise CW	D790	1,000,000 psi	1.4”
• Tensile Stress, LW	D638	20,000 psi	
• Tensile Stress, CW	D638	10,000 psi	
• Tensile Modulus, LW	D638	1,000,000 psi	1.1”-1.4”
• Tensile Modulus, CW	D638	1,000,000 psi	08”-1.3
• Comprehensive Stress, Edgewise, LW	D695	24,000 psi	
• Comprehensive Stress, Edgewise, CW	D695	20,000 psi	
• Comprehensive Modulus, Edgewise, LW	D695	1,000,000 psi	1.8”
• Comprehensive Modulus, Edgewise, CW	D695	1,000,000 psi	1.0”

• Notched Izod Impact, LW	D256	20 ft-lbs/in
• Notched Izod Impact, CW	D256	5 ft-lbs/in
• Bearing Stress, LW	D953	32,000 psi
• Bearing Stress, CW	D953	32,000 psi
• Perpendicular Shear Stress, LW(1)	D3946	6,000 psi
• Perpendicular Shear Stress, CW	D3946	6,000 psi
• Poisson's Ratio, LW		0.31 in/in
• Poisson's Ratio, CW		0.29 in/in
Physical Property	**Test**	**Value**
• Barcol Hardness		40
• 24 Hr. Water Absorption (2)	D570	0.6% Max.
• Density	D792	060-068 lbs/in^3
• Coefficient of Thermal Expansion	D696	1,000,000 8.0in/in/ F
Electrical Property	**Test**	**Value**
• Arc Resistance	D495	120 seconds
• Dielectric Strength, PF	D149	N.T.
• Dielectric Strength, LW1	D149	35 KV/ in
• Dielectric Constant, PF	D150	5 @ 60 Hz.

The following abbreviations pertain to the information on the above properties:

- LW = lengthwise
- CW = crosswise
- PF = perpendicular to the laminate face
- N.T. = not tested

Submit a sample of the sidewalk plate for to the engineer for review along with the shop drawing submittal.

Provide countersunk stainless steel bolts for attaching fiberglass plates to supporting structural steel members and for attaching fiberglass surface plates to underlying splice plates at butt joints as shown in the plans.

C Construction

Drill all the holes connecting the plates to the 6.5-inch fiberglass splice plate in the shop and all other holes in the field.

Furnish sufficient fiberglass patch kits to patch all holes and cuts made in the field.

Stainless steel ½" diameter countersunk head screws, ½" nylon plug type key lock nuts, ½" washers and beveled washers shall be AISI Stainless Steel 304, or an approved equal.

Fiberglass plate shall be anti-skid abrasive grit with a surface buildup equal to 3550 mesh silica, as manufactured by Joseph T. Ryerson and Son, Inc., IKG Industries, or an approved equal. The 5" fiberglass splice plate does not require an anti-skid surface.

Fiberglass plates that do not meet the requirements set forth by these specifications and the plans shall be returned for a product that will receive the ultimate inspection and approval by the Engineer.

Drilled holes in fiberglass are to have a minimum edge distance equal to 1 ½" measured from the center of the hole to the free edge of the material.

Fasteners for the non-metallic sidewalk plates shall comply Standard Specifications Subsection 513.2.2.5

Bolts shall be socket type flat countersunk head cap screws, with washer and prevailing torque locking hex nuts.

The lock nuts shall be Anco lock nuts with a locking pin as manufactured by Lok-Mor Inc., IKG Industries, or an approved equal

Predrill at the shop before delivery all holes where the plates are attached to adjacent plates and 6.5" splice plates. The splice plates shall be drilled in order that the smooth surface is up against the bottom of the walk plates.

Provide a qualified person to instruct the crews in the type of tools to use and proper methods to install and fabricate the fiberglass plates. Provide a minimum of 24 hours of on-the job instruction oversight of work by crews.

D Measurement

The department will measure the Fiberglass Sidewalk Floor Plates by square feet acceptably completed.

E Payment

The department will pay for the measured quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0165.04	Fiberglass Sidewalk Floor Plates	SF

Payment is full compensation for furnishing, fabricating and installing all fiberglass sidewalk floor plates in conformance with the plans and this special provision; and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the work.

12. Retaining Walls

a. Backfill Coarse Aggregate Size No. 2, Item 209.0300.S.

A Description

This special provision describes furnishing and placing coarse aggregate backfill as the plans show.

B Materials

Provide clean concrete aggregate graded in accordance with the requirements as specified under standard spec 501.2.5.4.5. The soundness and wear requirements are deleted from this material.

C Construction

Construct the coarse aggregates in accordance with standard spec 209.3.

D Measurement

The department will measure Backfill Coarse Aggregate Size No. 2 in volume by the cubic yard in the vehicle.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
209.0300.S	Backfill Coarse Aggregate Size No. 2	CY

Payment is full compensation for furnishing and installing the aggregate.

stp-209-030 (20161130)

b. Anchoring System for Sheet Pile Wall R-70-159, Item SPV.0105.32; Anchoring System for Sheet Pile Wall R-70-160, Item SPV.0105.33.

A Description

This special provision describes the design and installation of the anchoring system for retaining walls R-70-159 and R-70-160 located along the north shore of the Fox River. Perform all work for this item in accordance with all applicable requirements of the standard specifications in general and section 512 in particular, except as modified herein or as shown on the plans.

The work includes, but is not limited to, the following items:

- Design of a permanent sheet pile wall anchoring system, including tie-back anchor system, toe anchoring system and method of maintaining the soil stability during construction.

- Permanent steel wales, splice plates, connection bolts, nuts, washers and other required hardware.
- Tieback anchor rods, including nuts, washers, couplings and other required hardware.
- Corrosion protection system for tieback anchor rods including coating with an approved corrosion inhibitor and covering with a polyethylene sheathing the entire length of the anchor rod.
- Tieback anchor system, including, depending on design, reinforced concrete deadmen, sheet pile wall anchor, H-pile anchor or another selected system.
- Toe anchor system, including, depending on design, rock anchors/pins or another selected system.
- Excavation required for installation of sheet piling, tieback anchor rods and anchor system.

B Materials

B.1 Submittals

Submit to the engineer full design calculations, construction drawings, shop drawings, catalog data, etc. for the proposed sheet pile wall anchoring systems. Submit for all materials for the bracing, wale system, tie back system, toe anchor system and corrosion protection system for the tie rods. Follow the submittal process as described in section 105.2.2 of the standard specifications.

Design the dock wall anchoring systems in accordance with AASHTO LRFD Bridge Design Specifications, 8th Edition, Chapter 11.5.6. The design calculations and drawings are to be sealed by a Wisconsin Licensed Professional Engineer.

B.2 Tie rods

Furnish tie rods in accordance with ASTM A722, Type II, with bar deformations in a thread-like pattern. Coat tie rods with an approved corrosion inhibitor. Provide a polyethylene sheath for the entire length of the tie rod. Provide a corrosion protection system for the tie rods with a 75-year design life.

B.3 Rolled steel shapes and plates

Provide all rolled steel shapes and plates conforming to the requirements of ASTM A36 and all applicable requirements of section 506 of the standard specifications.

B.4 Bolts and hardware

Furnish high-strength, galvanized bolts and connection hardware conforming to section 506.2.5 of the standard specification.

B.5 Anchor system

Provide anchor system materials based on the design conforming to the requirements of all applicable sections of the standard specifications. If concrete deadmen are provided, furnish sub-foundation material conforming to section 210 of the standard specifications. Steel reinforcing bars are uncoated.

C Construction

C.2.1 Underground conflicts and coordination

There are several underground conflicts existing in the area of the proposed dock walls and anchor systems as shown on the plan. Coordinate the construction sequence of the new retaining walls with the installation of the new storm sewer pipes and other utilities in the area. Coordinate construction of the new walls with construction of the north bascule bridge abutment.

C.2.2 Storm sewer pipe opening

Provide an opening in the steel sheet piling wall for the 36-inch diameter concrete storm sewer pipe to pass through. After the pipe is placed through the opening, seal the gap around the pipe with a poured concrete collar.

C.2.3 Wales

Install wales on the inside face of the sheet piling. Bolt the wales to every sheet pile.

C.2.4 Toe Anchors

Install toe anchors on the river side of the sheeting at the inner pan/belly of the sheet pile. Utilize an installation method that accurately places the toe anchors and minimizes the distance between the sheet pile and the anchor. Install the toe anchor system at regular intervals or continuously along the base of the sheet piling. If individual anchors are used, install at a minimum frequency of one per sheet pair.

D Measurement

The department will measure Anchoring System for Sheet Pile Wall R-70-159 and Anchoring System for Sheet Pile Wall R-70-160 each as a single lump sum unit of work acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.32	Anchoring System for Sheet Pile Wall R-70-159	LS
SPV.0105.33	Anchoring System for Sheet Pile Wall R-70-160	LS

Payment is full compensation for the complete design of a sheet pile wall anchoring system for walls R-70-159 and R-70-160, and furnishing and installing all materials, including all labor, tools, equipment and incidentals necessary to complete the contract work.

13. Drainage & Erosion Control

a. Inlets 2x2.5-FT, Special, Item SPV.0060.02

A Description

This special provision describes providing Inlets 2x2.5-FT, Special as the plans show. Conform to standard spec 611 and as follows.

B Materials

Materials shall be conforming to standard spec 611.2. The rubber adjustment riser ring is to be on the department's approved product list.

Use manufacturer approved mastic adhesive and polyurethane adhesive with a flexible set. Supply manufacture's recommendations prior to installation.

C Construction

Construction shall be conforming to the plans and with standard spec 611.3.

Replace standard spec 611.3.3(1) with the following:

(1) Set inlet cover on rubber adjustment riser ring. Use mastic adhesive between the ring and the inlet structure. Use polyurethane adhesive with a flexible set between the ring and the inlet cover. Use two 5/16-inch beads of adhesive placed 1 inch and 2 inches in from the outside edge of the ring. If multiple adjustment rings are necessary, a maximum of two adjustment rings can be used. A maximum of 3 inch adjustment is allowed. Use manufacturer approved polyurethane adhesive with a flexible set to join the two rings. If the adjustment rings must be cut, the joints must be staggered, and a polyurethane adhesive used to reattach the cut ends. No concrete adjustment rings or mortar is to be placed between the top of the structure and the inlet cover.

D Measurement

The department will measure Inlets 2x2.5-FT, Special as each individual inlet acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.02	Inlets 2x2.5-FT, Special	EACH

Payment shall be conforming to standard spec 611.5.

ner-611-030 (20190712)

b. Trench Drains 4-inch, SPV.0090.08.

A Description

This special provision describes furnishing and installing Trench Drains 4-Inch at the locations shown on the plans.

Perform work under these items according to the requirements of Standard Spec 501 and the details as shown on the plans.

B Materials

Furnish concrete conforming to the requirements of the of Standard Spec 501.

Furnish trench drain systems manufactured from polyester polymer concrete with the minimum properties as follows:

Compressive strength: 14,000 psi
Flexural strength: 4,000 psi
Water absorption 0.07%
Frost proof, Salt proof, Resistant to Dilute acid and Alkali

The nominal clear opening shall be 4” (100mm) with overall width of 5.12” (130mm). Pre-cast units shall be manufactured with either an invert slope of 0.5% or with neutral invert (as noted on plans and plan details) and have a wall thickness of at least 0.50” (13mm). Each unit will feature a partial radius in the trench bottom and a male to female interconnecting end profile. Units shall have horizontal cast in anchoring keys on the outside wall to ensure maximum mechanical bond to the surrounding bedding material and pavement surface. The galvanized steel edge rail will be integrally cast in by the manufacturer to ensure maximum homogeneity between polymer concrete body and edge rail. Each edge rail shall be at least 3/32” (2.5mm) thick. All trench drains shall terminate with an invert depth as called for on the plans and utilize a manufactured outlet end cap.

Grates shall be constructed of galvanized steel or cast iron and shall have ADA compliant openings in the primary direction of travel or in all directions and shall be rated for Load Class C per EN 1433.

C Construction

Perform concrete work according to the requirements of Standard Spec 501.

Install trench drain system in accordance with the manufacturer’s installation instructions and recommendations.

D Measurement

The department will measure Trench Drains 4-Inch by the LF in place, furnished, installed, and acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0090.08	Trench Drains 4-Inch	LF

Payment is full compensation for furnishing and installing the trench drain, grates, concrete and formwork and subgrade preparation and excavation.

c. **Drain Pipe PVC 4-Inch, Item SPV.0090.09.**

A Description

This special provision describes furnishing and installing Drain Pipe PVC at the locations shown on the plans.

Perform work under these items according to the requirements of Standard Specifications for Sewer and Water Construction in Wisconsin (most recent edition with all addendums) and the details as shown on the plans.

B Materials

Furnish materials conforming to the requirements of Chapter 8.10.0 of the Standard Specifications for Sewer and Water Construction in Wisconsin (most recent edition with all addendums).

Furnish Sch. 40 PVC for drain pipe between trench drains and connecting storm sewer structures.

C Construction

Perform work according to the requirements of Part III of the Standard Specifications for Sewer and Water Construction in Wisconsin (most recent edition with all addendums).

D Measurement

The department will measure Drain Pipe PVC by the linear foot acceptably completed. This measurement equals the distance along the centerline of the pipe, from the pipe end at a free outlet to the center of the end catch basin, manhole, inlet, junction or other drainage structure; or from center to center of catch basins, end manholes, inlets, other drainage structures or junctions. The department will make no deduction from these measured lengths for intermediate drainage structures, junctions, or fittings.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0090.09	Drain Pipe PVC 4-Inch	LF

Payment for the Drain Pipe PVC bid items is full compensation for providing drain pipe; for excavating; for providing and removing sheeting and shoring; for constructing the foundation and backfilling; for cleaning out; and for restoring the work site.

d. Catch Basins 5-FT Diameter, Special, Item SPV.0060.10

A Description

This special provision describes providing Catch Basins 5-FT Diameter, Special as the plans show. Conform to standard spec 611 and as follows.

B Materials

Materials shall be conforming to standard spec 611.2. The rubber adjustment riser ring is to be on the department's approved product list.

Use manufacturer approved mastic adhesive and polyurethane adhesive with a flexible set. Supply manufacture's recommendations prior to installation.

C Construction

Construction shall be conforming to the plans and with standard spec 611.3.

Replace standard spec 611.3.3(1) with the following:

(1) Set inlet cover on rubber adjustment riser ring. Use mastic adhesive between the ring and the inlet structure. Use polyurethane adhesive with a flexible set between the ring and the inlet cover. Use two 5/16-inch beads of adhesive placed 1 inch and 2 inches in from the outside edge of the ring. If multiple adjustment rings are necessary, a maximum of two adjustment rings can be used. A maximum of 3 inch adjustment is allowed. Use manufacturer approved polyurethane adhesive with a flexible set to join the two rings. If the adjustment rings must be cut, the joints must be staggered, and a polyurethane adhesive used to reattach the cut ends. No concrete adjustment rings or mortar is to be placed between the top of the structure and the inlet cover.

D Measurement

The department will measure Catch Basins 5-FT Diameter, Special as each individual Catch Basin acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.10	Catch Basins 5-FT Diameter, Special	EACH

Payment shall be conforming to standard spec 611.5.

e. Turbidity Barrier Special, Item SPV.0090.11.

A Description

Furnish, and install turbidity barrier as shown on the plans, as directed by the engineer, and as hereinafter provided.

B Materials

Barrier system material shall be in accordance to the plans and industry standard Type II Floating Turbidity Curtains. Minimum material design values shall be equal to or exceed those identified in “Engineering and Design – Handbook for the Preparation of Storm Water Pollution Prevention Plans for Construction Activities”, U.S. Army Corps of Engineers, Publication # EP 1110-1-16, Appendix C, BMP-27, 1997. http://140.194.76.129/publications/eng-pamphlets/ep1110-1-16/

C Construction

Install turbidity barriers and danger buoys at locations shown on the plans or as directed by the engineer. Install per manufacturer specifications. Acceptance by the engineer is required.

Place all barriers, before beginning adjacent construction, in a manner that causes minimum disturbance of the lake bed and banks. Extend the barrier into the banks far enough to preclude washing out or eroding around the ends.

Maintain the integrity of the barrier as necessary to contain erosion from adjacent construction operations. Promptly correct all deficiencies. Barrier maintenance includes removing and disposing of accumulations of soil and other detrimental material. Adjust the barrier depth to account for fluctuating lake levels, wave action, current velocities, and water equilibrium on both sides of barrier.

Remove the barrier after completing the adjacent work. Delay removal until removing and disposing of accumulated soils and other suspended materials, and all suspended materials settle. Minimize disturbing the streambed and banks during removal operations.

D Measurement

The department will measure Turbidity Barrier Special by the linear foot acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0090.11	Turbidity Barrier Special	LF

Payment is full compensation for furnishing, assembling, installing, maintaining, repairing, and removing the turbidity barrier; for sandbags, buoys, navigational markers, anchors and anchor ropes, and for furnishing all labor, tools, equipment and incidentals required to complete the work. No payment will be made for reinstallation of turbidity barrier.

f. **Insulation Board 2-Inch, Item SPV.0165.03**

A Description

This special provision describes providing insulation board.

B Materials

Furnish materials conforming to Chapter 8.50.2 of the Standard Specifications for Sewer and Water Construction in Wisconsin (latest edition).

C Construction

Perform all construction conforming to Chapter 4.17.2(a) of the Standard Specifications for Sewer and Water Construction in Wisconsin (latest edition).

D Measurement

The department will measure Insulation Board 2-Inch by the square foot acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0165.03	Insulation Board 2-Inch	SF

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g. Street Sweeping, Item SPV.0075.01.

A Description

Remove small dirt and dust particles from the roadway using a street sweeper for cleaning the roadway before traffic switches or cleaning of roadways from non-contractor vehicle traffic.

B (Vacant)

C Construction

Provide a self-contained mechanical or air conveyance street sweeper and dispose the accumulated material.

D Measurement

The department will measure Street Sweeping by the hour that the street sweeper is on the project picking up and removing debris from the roadway.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0075.01	Street Sweeping	HRS

Payment is full compensation for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

All street sweeping due to the contractors hauling operations is considered incidental to the contract.

14. Lighting

a. General Requirements for Lighting work

Unless otherwise indicated, State Specifications in this section shall be in reference to the State of Wisconsin Department of Transportation, Division of Highways, “Standard Specifications for Highway and Structure Construction”, Latest Edition, including Supplemental Specifications.

Lighting items for above ground equipment and hardware, equipment and materials furnished under each of the various bid items shall be exactly the same manufacturer, model, part, and style for every installation in this contract.

Contact City of Menasha prior to starting street lighting construction.

City of Menasha Contact – Adam Alix 920-967-3611

b. Electrical Service Meter Breaker Pedestal Racine Street & Ahnaip Street, Item 656.0200.01; Electrical Service Meter Breaker Pedestal Racine Street & Main Street, Item 656.0200.02;

Replace standard spec 656.2.3, Meter Breaker Pedestal Service, paragraph (1) with the following:

(1) Furnish an approved service having a meter breaker pedestal, 22,000-AIC circuit breakers unless the local utility requires otherwise, grounding electrodes and connections, conduit and fittings, and all necessary conductors and equipment required by the WSEC and the utility for a service connection. Furnish a pedestal with a 100 A 2-pole main breaker and a 30 A spare breaker. When the meter breaker pedestal is energized, install an approved meter seal at all access points on the meter trough. Meter shall be time of use type.

c. Luminaires Utility LED, Item SPV.0060.03

A Description

This special provision describes furnishing and installing a LED luminaire fixture in accordance to the pertinent provisions of section 659 of the standard specifications and as hereinafter provided. Specific items are noted in the plans.

B Materials

Furnish Eaton NVN Navion Model #NVN-AF-02-D-U-T3R-10K-BK luminaire fixtures. The luminaire fixture shall be black.

C Construction

Install luminaire fixture in accordance with section 659.3 of the standard specifications.

D Measurement

The department will measure Luminaires Utility LED as each individual unit acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.03	Luminaires Utility LED	EACH

Payment is full compensation for providing materials including luminaires, fittings, brackets, hardware and attachments; and for luminaire fusing.

d. Concrete Bases Type 7 Modified, Item SPV.0060.04

A Description

This special provision describes constructing concrete bases for street lighting.

B Materials

Provide all materials in accordance with section 654.2 of the standard specifications and as shown in the plan details. The Concrete Bases Type 7 Modified shall use a 12 ½-inch bolt circle as shown on plans.

C Construction

Construct concrete bases in accordance with section 654.3 of the standard specifications.

D Measurement

The department will measure Concrete Bases Type 7 Modified as each unit acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.04	Concrete Bases Type 7 Modified	EACH

Payment is full compensation for providing concrete bases; for embedded conduit and electrical components; for anchor templates, rods, nuts, and washers; for bar steel reinforcement; and for excavating and backfilling.

e. Decorative Light Pole Assembly 12 FT, Item SPV.0060.05; Decorative Light Pole Assembly 16 FT, Item SPV.0060.06; Decorative Light Pole Assembly 30 FT, Item SPV.0060.07

A Description

This special provision describes installing furnishing and installing decorative light pole assemblies.

B Materials

Each assembly includes luminaire fixtures, light pole, and luminaire arms. A description of the lighting equipment included in each lighting assembly is provided in the tables below. Furnish each lighting assembly in accordance to the applicable portions of standard spec 659, the manufacturer's recommendations, and as shown in the plan details.

Decorative Light Pole Assembly 12 FT

Lighting Equipment	Manufacturer	Catalog No.	Description
Luminaire Fixture	Hadco	3100DBLKT64NA3NNNNSP1 MOD luminaires	2 decorative luminaire fixtures
Light Pole	Hadco	P5092-12ATG MOD 6" DOWN FROM TOP pole	12’ black decorative tapered fluted aluminum pole with GFI outlet and 3” OD tenon
Luminaire Arm	Hadco	PTH2220-P3A MOD W/FLAT CAP arm	Twin decorative arm bracket

Decorative Light Pole Assembly 16 FT

Lighting Equipment	Manufacturer	Catalog No.	Description
Luminaire Fixture	Hadco	3100DBLKT64NA3NNNNSP1 MOD luminaires	2 decorative luminaire fixtures
Light Pole	Hadco	P5092-16ATG6S MOD pole	16’ black decorative tapered fluted aluminum pole with GFI outlet and 3” OD tenon
Luminaire Arm	Hadco	PTH2220-P3A MOD W/FLAT CAP arm	Twin decorative arm bracket

Decorative Light Pole Assembly 30 FT

Lighting Equipment	Manufacturer	Catalog No.	Description
Luminaire Fixture	Hadco	3100DBLKT64NA3NNNNSP1 MOD luminaires	2 decorative luminaire fixtures
Light Pole	Valmont	FL210 900E300-FPGV-HH-AB-DECO BASE-(2)BURNSVILLE-ARMS	30’ decorative pole with 2 decorative arm brackets
Luminaire Arm	Included with Light Pole		

Verify all model/catalog numbers before ordering. Provide catalog cut sheets of the luminaire fixture, light pole, and luminaire arm for review by the engineer and Adam Alix of the City of Menasha at **920-967-3611** prior to finalizing the order to the manufacturer. Furnish all other hardware and materials necessary to install decorative light pole assemblies. The color of luminaire fixture, light poles, and luminaire shall be black.

C Construction

Construct in accordance to the applicable portions of standard spec 659 and the manufacturer’s recommendations. Fill in any open holes in the light pole using a grommet or other engineer-approved device to prevent water from entering the pole.

D Measurement

The department will measure Decorative Light Pole Assemblies (Length) as each unit acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.05	Decorative Light Pole Assembly 12 FT	Each
SPV.0060.06	Decorative Light Pole Assembly 16 FT	Each
SPV.0060.07	Decorative Light Pole Assembly 30 FT	Each

Payment is full compensation for providing and installing all materials including hardware, fittings, mounting devices, and attachments necessary to completely install Decorative Light Pole Assemblies.

f. Lighting Control Cabinet Special, Item SPV.0060.08

A Description

This special provision describes furnishing and installing a WisDOT Lighting Control Cabinet 120/240 30-Inch with the addition of festoon circuits as shown in the plans. This special provision includes all power and control components within the cabinet as shown on the Plans and as described hereinafter.

B Materials

Furnish a WisDOT Lighting Control Cabinet 120/240 30-Inch in accordance with section 659 of the standard specifications and as shown in the plan details.

Submit shop drawings for all parts and wiring plans to the Engineer for approval prior to ordering the equipment. The equipment shall not be ordered prior to approval of the shop drawings by the Engineer.

C Construction

Construct the Lighting Control Cabinet in accordance with Section 659 of the standard specifications.

Connect the control cabinet to the concrete base in accordance with the cabinet manufacturer's recommendations and industry standards.

Place a copy of the control cabinet wiring schematic in a plastic protector and affix to the inside of the door to the cabinet.

D Measurement

The department will measure Lighting Control Cabinet Special completed in accordance with the contract and accepted, as a unit of work.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.08	Lighting Control Cabinet Special	EACH

Payment is full compensation for furnishing and installing the lighting cabinet including circuit wiring connections, hardware, and fittings the plans show; and for making the lighting system fully operational.

g. Salvage Existing Traffic Signal and Lighting Equipment, Item SPV.0105.35

A Description

This special provision describes removing and salvaging existing traffic signal and lighting equipment, CCTV cameras and removing electrical wire at all the locations specified in the plans and as hereinafter provided. Specific salvage items are noted in the plans.

B Materials (Vacant)

C Construction

Arrange for the de-energizing of the signal and lighting system with the local electrical utility after receiving approval from the engineer that the existing systems can be removed.

Notify the engineer and Adam Alix of the City of Menasha, **920-967-3611** at least three working days prior to the removal of the signal and lighting equipment. Complete this work immediately following shut down of equipment.

Salvage signal poles, trombone arms, signal heads, light poles, luminaire arms, luminaire fixtures, and CCTV cameras per plan from their concrete footing and disassemble out of traffic in accordance to

section 204 of the standard specifications and as shown on the plans. Remove wiring/cabling from the pole and dispose of off City right of way. Ensure that access handhold doors and hardware remain intact. Make a reasonable effort to inspect salvaged equipment for damage or defects.

Coordinate with Adam Alix of the City of Menasha, **920-967-3611** to determine an acceptable location to stockpile salvaged equipment to be retained for the City of Menasha to pick up.

D Measurement

The department will measure Salvage Existing Traffic Signal and Lighting Equipment as a single lump sum unit of work acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.35	Salvage Existing Traffic Signal and Lighting Equipment	LS

Payment is full compensation for removing, salvaging, disassembling, disposing of scrap material, protecting from damage, and incidentals necessary to complete the contract work.

h. Lighting Equipment Painting, Item SPV.0105.36

A Description

This special provision describes the painting of the exterior surfaces of street lighting equipment and associated mounting hardware as indicated in the plans. Individual lighting equipment is paid for in separate bid items.

B Materials

Contact Adam Alix of the City of Menasha, **920-967-3611** prior to ordering lighting equipment to obtain the exact color code.

Obtain lighting equipment powder-coated in the black color from the manufacturer or supplier. Lighting equipment includes luminaire arms, lighting poles, and metal bases as indicated in the plans. All black items shall match in color. All lighting hardware, sign hardware and stainless steel banding used on poles, shall be cleaned and painted with a primer and two finish coats of the best rust resistant synthetic resin enamel in the color that exactly matches the color code provided by the City of Menasha.

C Construction

Install per manufacturer's instructions. Marks and scratches on painted equipment and hardware shall be touched up with two coats of synthetic resin enamel consistent in color and texture to the original finish, or as directed by the engineer.

D Measurement

The department will measure Lighting Equipment Painting as a single lump sum unit of work acceptably completed.

E Payment

The department will pay for the measured quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRPTION	UNIT
SPV.0105.36	Lighting Equipment Painting	LS

Payment is full compensation for furnishing lighting equipment, hardware, and banding in the color specified by the City of Menasha.

15. Landscaping

a. Furnishing and Planting Plant Materials

A Description

Perform the work under this item in accordance to the plans, Section 632 of the standard specifications, and as hereinafter provided.

B Materials

Modify subsection 632.2.5 of the standard specifications to add the following:

Treegator “Treegator Original” tree watering bags or approved equal, one per tree planted, shall be installed and considered incidental to the individual tree bid price.

C Construction

Modify subsection 632.3.19.1 to add the following:

Tree watering shall comply with the manufacture’s instruction for the tree watering bag.

Remove and dispose of all tree watering bags after the final inspection of the plantings.

b. Planting Mixture, Item SPV.0035.04

A Description

This special provision describes providing planting mixture at the locations the plans show. Conform to standard spec 632 and as follows.

B Materials

Provide Planting Mixture, as shown on plan. The planting mixture consists of the following blend by volume:

1. Two parts topsoil. Topsoil shall conform to standard spec 625.
2. One-part sand. Obtain the engineer’s approval for the sand.
3. One-part compost.

   Compost shall be either well-rotted shredded leaf mulch, free of disease; or well-rotted, unleached, stable or cattle manure containing no more than 25 percent by volume of straw, sawdust, or other bedding materials and free of toxic substances. Either shall be free of stones, sticks, soil, weed seeds, debris, and other material harmful to plant growth.
4. One part peat moss. Peat moss shall conform to standard spec 632.

C Construction

Ensure proper excavation of planting area for all areas to receive Planting Mixture. Prepare planting beds by removing any construction materials, stone, or other debris larger than 2 inches in length or diameter for entire area of planting bed and to depths indicated on plans.

Provide planting mixture over entire planting bed area and fine grade to match grades as indicated on plans or to adjacent back of curb or other hardscape surface as indicated on plans and account for settling. Place Planting Mixture in 6-inch to 8-inch lifts, watering in or tamping to reduce settling potential. A minimum of 12-inch depth shall be provided in all locations; depth varies, see plans.

Obtain approval of Planting Mixture depths, locations, and elevations by supervising engineer.

D Measurement

The department will measure Planting Mixture by the cubic yard acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRPTION	UNIT
SPV.0035.04	Planting Mixture	CY

Payment is full compensation furnishing and installing all materials and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

ner-632-020 (20190710)

c. Landscape Edging, Item SPV.0090.10

A Description

This special provision describes providing black polyethylene landscape edging at the locations the plans show.

B Materials

Landscape edging shall be black Polyethylene supplied in 20-foot minimum lengths.

Landscape edging shall be a minimum of 5 inches in depth with a double “V” anchor on the bottom edge and a hollow 1-inch diameter round top edge.

Landscape edging segments shall be joined at the top edge with manufacturer’s supplied fittings that fit securely into the hollow top edge of each length.

C Construction

Place Landscape edging in trench to a depth allowing the top edge to be 1” above finished grade.

Compact soil in trench so landscape edging is securely anchored in planting bed.

D Measurement

The department will measure Landscape Edging by the Linear Feet acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0090.10	Landscape Edging	LF

Payment is for providing and installing the edging and disposing of all excess and waste materials.

ner-645-015 (20190710)

d. **Shredded Hardwood Bark Mulch, Item SPV.0180.01**

A Description

This special provision describes furnishing and installing Shredded Hardwood Bark Mulch at the locations shown on the plans and in accordance with the requirements of Section 632 of the Standard Specifications, the plans, and as hereinafter provided.

B Materials

Provide Shredded Hardwood Bark Mulch, as shown on plan and in accordance with Section 632.2.6.

Shredded Hardwood Bark Mulch shall be finely shredded hardwood bark mulch and shall be the product of a mechanical chipper, hammermill, or tub grinder. The material shall be fibrous and uniformly dark brown in color, free of large wood chunks, and shall be substantially free of mold, dirt, sawdust, and foreign material. No portion of the material shall be in an advanced state of decomposition. The material shall not contain chipped up manufactured boards or chemically treated wood, including but not limited to wafer board, particle board, and chromated copper arsenate (CCA) or penta-treated wood. The material shall contain no bark of the black walnut tree. The material, when air dried, shall all pass a 4-inch screen and no more than 20 percent by mass of the material shall pass a 0.10-inch sieve. Unattached bark or greenleaf composition, either singly or combined, shall not exceed 20 percent each by mass. The maximum length of individual pieces shall not exceed 4 inches.

C Construction

Install mulch in accordance with Section 632.3.9 to a depth of 3 inches.

Place the hardwood bark mulch in such a manner as to not damage plants already in place.

D Measurement

The department will measure Shredded Hardwood Bark Mulch by the square yard acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0180.01	Shredded Hardwood Bark Mulch	SY

Payment is full compensation furnishing and installing all materials and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

ner-627-005 (20190710)

16. Miscellaneous

a. United States Post Office Bench

At the United States Post Office on Racine Street north of Broad Street, a bench is present on the southern edge of the property along the sidewalk adjacent to Racine Street. The bench must be protected at all times during construction. Moving of the bench is permitted as long as the integrity of the bench is maintained. This is incidental to the contract.

b. Fence Safety, Item 616.0700.S.

A Description

This special provision describes providing plastic fence at locations the plans show.

B Materials

Furnish notched conventional metal "T" or "U" shaped fence posts.

Furnish fence fabric meeting the following requirements.

Color:	International orange (UV stabilized)
Roll Height:	4 feet
Mesh Opening:	1 inch min to 3 inch max
Resin/Construction:	High density polyethylene mesh
Tensile Yield:	Avg. 2000 lb per 4 ft. width (ASTM D638)
Ultimate Tensile Strength:	Avg. 3000 lb per 4 ft. width (ASTM D638)
Elongation at Break (%):	Greater than 100% (ASTM D638)
Chemical Resistance:	Inert to most chemicals and acids

C Construction

Drive posts into the ground 12 to 18 inches. Space posts at 7 feet.

Use a minimum of three wire ties to secure the fence at each post. Weave tension wire through the top row of strands to provide a top stringer that prevents sagging.

Overlap two rolls at a post and secure with wire ties.

D Measurement

The department will measure Fence Safety by the linear foot along the base of the fence, center-to-center of posts acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
616.0700.S	Fence Safety	LF

Payment is full compensation for furnishing and installing fence and posts; maintaining the fence and posts in satisfactory condition; and for removing and disposing of fence and posts at project completion.

stp-616-030 (20160607)