Karl: Cass Street

Final Plans. & Specs. Please review at early date & give me your comments.

F.A.P. Route 607
(U.S. Route 30)
Section G-R-I(82)
Will County

CHECK SHEET FOR SUPPLEMENTAL SPECIFICATIONS AND MIMEOGRAPHED SPECIAL PROVISIONS

Adopted January 2, 1984

This Check Sheet contains a listing of SUPPLEMENTAL SPECIFICATIONS and frequently used MIMEOGRAPHED SPECIAL PROVISIONS and BRIDGE SPECIAL PROVISIONS.

SUPPLEMENTAL SPECIFICATIONS

The SUPPLEMENTAL SPECIFICATIONS listed below supplement the "Standard Specifications for Road and Bridge Construction," adopted October 1, 1983. All SUPPLEMENTAL SPECIFICATIONS are applicable to and included, by reference, in all contracts advertised and awarded by the Department.

Std. Spec. Sec.	
107	Legal Relations and Responsibility to Public (Eff. 10-1-83)
109	Measurement and Payment (Eff. 10-1-83)
406	Bituminous Concrete Binder and Surface Courses (Class I) (Eff. 10-1-83)
503	Concrete Structures (Eff. 10-1-83)
507	Steel Structures (Eff. 10-1-83)
509	Cleaning and Painting Metal Structures (Eff. 10-1-83)
660	Electric Cable (Eff. 10-1-83)
661	Unit Duct (Eff. 10-1-83)
662	Trench and Backfill for Roadway Lighting (Eff. 10-1-83)
663	Conduit (Eff. 10-1-83)
664	Control Installation (Eff. 10-1-83)
665	Light Pole Foundation (Eff. 10-1-83)
666	Light Tower Foundation (Eff. 10-1-83)
667	Light Pole (Eff. 10-3-83)
668	Light Tower (Eff. 10-1-83)
669	Luminaire Sodium Vapor (Eff. 10-1-83)
670	Sign Lighting (Eff. 10-1-83)
690	Electrical Testing (Eff. 10-1-83)
710	Metals (Eff. 10-1-83)
711	Timber and Preservative Treatment (Eff. 10-1-83)
712	Paint Materials and Mixed Paints (Eff. 10-1-83)
718	Miscellaneous Materials (Eff. 10-1-83)
719	Highway Lighting Materials (Eff. 10-1-83)

END OF SUPPLEMENTAL SPECIFICATIONS

January 2, 1984

The following MIMEOGRAPHED SPECIAL PROVISIONS and BRIDGE SPECIAL PROVISIONS indicated by an "X" are applicable to this contract and are included by reference:

MIMEOGRAPHED SPECIAL PROVISIONS

CHECK SHEET #		
1		R. R. Protection Liability Form (Eff. 6-10-58) (Rev. 9-29-67)
2	*	Required Contract Provisions - All Federal-Aid Construction Contracts (Form PR 1273) (Rev. 9-75)
3	*	Federal-Aid Proposal Notice
4	*	State Required Contract Provisions - All Federal-Aid Construction Contracts (Eff. 2-1-69) (Rev. 10-1-83)
5	*	Specific Equal Employment Opportunity Responsibilities - Federal-Aid Contracts (Eff. 3-20-69) (Rev. 10-15-75)
6		Specific Equal Employment Opportunity Responsibilities - Non-Federal-Aid Contracts (Eff. 3-20-69) (Rev. 10-15-75)
7		Required Provisions - State Contracts (Eff. 4-1-65) (Rev. 10-1-83)
8		Pozzolanic Base Course (Eff. 4-1-64) (Rev. 4-1-80)
9	*	Skid Resistant Bituminous Surface (Eff. 6-16-75) (Rev. 10-1-83)
10		Asphalt Repaving (Eff. 4-1-70) (Rev. 11-1-75)
11		Sand Module Impact Attenuators (Eff. 10-15-76) (Rev. 4-1-81)
12	*	Placement Temperature for Bituminous Concrete Binder and Surface Courses (Eff. 10-15-76)
13		P.C. Concrete Pavement Surface Test with 16-foot Straightedge (Eff. 7-1-77) (Rev. 4-1-81)
14		P.C. Concrete Pavement Surface Test with State Furnished Profilograph (Eff. 7-1-77) (Rev. 4-1-81)
15		P.C. Concrete Pavement Surface Test with Contractor Furnished Profilograph (Eff. 7-1-77) (Rev. 4-1-81)
16		PCC Pavement, PCC Base Course and PCC Base Course Widening (Eff. 1-2-80) (Rev. 11-1-81)
17		Open-Graded Asphalt Friction Course (Eff. 1-2-80)
18	*	Price Adjustment of Bituminous Materials (Eff. 7-1-79) (Rev. 10-10-79)
19		Temporary Concrete Barrier (Eff. 7-1-79) (Rev. 4-15-80)
20		Concrete Barrier (Eff. 7-1-79) (Rev. 10-15-80)
21	*	Drier Drum Hot Mix Plant (Eff. 7-1-79)
22	*	Permissive Use of Drier Drum Hot Mix Plant (Eff. 8-1-79)
23		Expansion Anchor Ties (Eff. 1-2-80) (Rev. 11-1-81)
24		Bituminous Curb (Eff. 4-1-80)
25		Calcium Nitrite Corrosion Inhibitor (Eff. 3-1-80) (Rev. 10-15-80)
26		Precast Concrete Box Culverts (Eff. 6-15-82)
27		Reserved
28	*	Bituminous Stabilized Mixture (Hot-Mix Recycling) (Eff. 10-1-83)
29		Reflective Crack Control Treatment (Eff. 9-1-81) (Rev. 10-1-83)
30		Erosion Control (Eff. 10-1-83)
31		Erosion Control Plan (Eff. 10-1-83)
32		Bituminous Concrete Binder Course (Hot-Mix Recycling) (Eff. 5-1-80) (Rev. 7-1-82)

January 2, 1984

MIMEOGRAPHED SPECIAL PROVISIONS - Cont'd.

CHECK SHEET #

33 Bituminous Concrete Leveling Binder (Machine Method) (Hot-Mix Recycling) (Eff. 7-1-82)
34 * Delays Caused by Unknown Utilities (Eff. 10-15-82)
35 Portland Cement Concrete Pavement Patching (PCC Replacement Material) (Eff. 8-1-83)
36 Portland Cement Concrete Pavement Patching (Bituminous Concrete Replacement Material) (Eff. 8-1-83)
37 Continuously Reinforced PCC Pavement Patching (Eff. 9-1-83)
38 Period of Establishment for Plant Material (Eff. 9-1-83)
39 Minority Business Enterprise Policy (Eff. 6-25-80)

BRIDGE SPECIAL PROVISIONS

BSP-1 * Bridge Seat Sealer (Eff. 7-1-71) (Rev. 10-1-83)
BSP-2 Portland Cement Mortar Fairing Course (Eff. 1-2-80)
BSP-3 Concrete Joint Sealer (Eff. 7-1-71)
BSP-4 Elastic Joint Filler (Eff. 7-1-71) (Rev. 11-1-81)
BSP-5 Deck Slab Repairs (Eff. 1-2-80)
BSP-6 Waterproofing Membrane System (Eff. 4-15-74) (Rev. 10-15-80)
BSP-7 Finishing Cast-in-Place Concrete Bridge Floors (Eff. 7-1-71)
BSP-8 Sand Backfill (Eff. 7-1-71) (Rev. 12-1-75)
BSP-9 Neoprene Expansion Joint (Eff. 7-1-75) (Rev. 10-1-83)
BSP-10 Temporary Bridge Rail (Eff. 1-2-80)
BSP-11 * Epoxy Grouting of Anchor Rods and Bolts (Eff. 7-1-73) (Rev. 10-1-83)
BSP-12 * Texturing Concrete Bridge Decks (Eff. 7-1-77) (Rev. 10-1-83)
BSP-13 Bituminous Density Test on Bridge Decks (Eff. 2-15-78) (Rev. 8-15-78)
BSP-14 * Epoxy Crack Sealing (Eff. 10-1-83)
BSP-15 * Epoxy Mortar Repair (Eff. 10-1-83)
BSP-16 Bridge Deck Concrete (Eff. 10-1-83)

STATE OF ILLINOIS

SPECIAL PROVISIONS

The following Special Provisions supplement the "Standard Specifications of Road and Bridge Construction," adopted October 1, 1983, the latest edition of the "Illinois Manual on Uniform Traffic Control Devices for Streets and Highways" in effect on the date of invitation for bids, the "Standard Specifications for Traffic Control Items," adopted July 1, 1981, and the "Supplemental Specifications and Mimeographed Special Provisions" indicated on the Check Sheet included herein which apply to and govern the construction of Federal Aid Primary Route 607 (U.S. Route 30), Project _____ ( ) Section: G-R-I-1(82) in Will County, and in case of conflict with any part or parts of said specifications, the said Special Provisions shall take precedence and shall govern.

FEDERAL-AID PRIMARY ROUTE 607

SECTION G-R-I-1(82)

PROJECT ( )

BRIDGE REHABILITATION

BRIDGE NO. 099-0101

CASS STREET (U.S. ROUTE 30)

OVER THE

DES PLAINES RIVER

WILL COUNTY

Location of Improvement. This improvement begins at Station 8+00, a point on the centerline of Cass Street, approximately 200 lineal feet west of the centerline of the Des Plaines River and extends in an easterly direction along the centerline of Cass Street to Station 13+20, a point approximately 320 lineal feet east of the centerline of the Des Plaines River for a total distance of 520 lineal feet (0.099 mile), all in the City of Joliet.

Description of Improvement. The work to be performed under this contract involves complete rehabilitation of a Scherzer rolling lift bridge. This includes repairs to the abutments with backwall replacement, piers with new timber fender system, and retaining wall with new railing. Repairs will be made to the structural steel, rolling tracks, segmental girders, pinion rack, and concrete counterweight. The concrete deck, steel deck grid, timber sidewalk and expansion joints will be replaced. Mechanical system repairs will consist of gear replacements, bearing and brake rehabilitation. Electrical system rehabilitation will include replacement of the operator console, motor control center, wiring and conduit, lighting, traffic signals, traffic gates, and motor rehabilitation.

Roadway construction includes new approach slabs, sidewalks, and minor resurfacing of bituminous.

Standards in the Plans. The Standards with the revision numbers listed in the Index of Sheets, included in the plans, shall hold precedence over the Standard numbers listed in the Special Provisions or in the Plans.

Construction Easements and Permits. The Contractor shall be responsible for obtaining all construction permits or easements that may be necessary for access to the jobsite for storage of materials, equipment or for construction operations. The cost of complying with these requirements shall be considered as incidental to the contract.

STATUS OF

UTILITIES TO BE ADJUSTED

Name and Address of Utility	TYPE	Estimated Date Relocation or Adjustment Complete
Illinois Bell Telephone	None	
Northern Ill. Gas Co.	None	
Commonwealth Edison Co.	None	

Relations with Coast Guard

Contractor is required to follow all rules and regulations of the U.S. Coast Guard and its "letter of approval" covering work under this contract. It is the Contractor's responsibility to keep the Coast Guard appriased of the work schedule. Contractor shall notify the Coast Guard in advance of any temporary restrictions to navigation by work barges. Minimum channel widths as shown on the plans must be maintained. It is also the responsibility of the Contractor to coordinate with other work in progress between the Lockport Locks and Brandon Locks to minimize disruption to river navigation. Work must be coordinated to avoid "snaking" river traffic back and forth across the channel.

If the Contractor finds it necessary to close the channel for short periods of time (2 hours maximum) the Contractor is responsible for giving the Coast Guard 24 hours' advance notice of such temporary closures. Contractor shall check with Coast Guard just prior to closure to insure that river traffic has been warned of the closure.

Closing Road to Traffic. Traffic shall be prohibited on the bridge for the entire construction period. Ingress and egress for all driveways shall be handled in a manner meeting the approval of the Engineer.

Traffic Control Plan

Traffic Control shall be in accordance with the applicable sections of the "Standard Specifications", the "Illinois Manual on Uniform Traffic Control Devices for Streets and Highways", these special provisions, any special details and Highway Standards contained herein and in the plans, and the "Standard Specifications for Traffic Control Items".

Special attention is called to Articles 107.09 and 107.14 of the Standard Specifications and the following Highway Standards, Details and Supplemental Specifications and Mimeographed Special Provisions contained herein, relating to traffic control.

The Contractor shall contact the District One Bureau of Traffic at least 72 hours in advance of beginning work.

Standards - 2298, 2299, 2300, and 2307.

Details - Modified U-2, U-1, and Detour Plan, Plan Sheets.

Supplemental Specifications and Mimeographed Special Provisions

Special Provisions - Traffic Control and Protection
Protection and Restoration of Traffic Signs

At the preconstruction meeting the Contractor shall furnish the name of the individual in his direct employ who is to be responsible for the installation and maintenance of the traffic control for this project. If the actual installation and maintenance are to be accomplished by a subcontractor, consent shall be requested of the Engineer at the time of the preconstruction meeting in accordance with Article 108.01 of the Standard Specifications. This shall not relieve the Contractor of the foregoing requirement for a responsible individual in his direct employ to supervise this work. The Department will provide the Contractor the name of its representative who will be responsible for the administration of the Traffic Control Plan.

Traffic Control and Protection. This item of work shall include furnishing, installing, maintaining, relocating and removing all traffic control devices used for the purpose of regulating, warning or directing traffic during the construction or maintenance of this improvement.

Traffic Control and Protection shall be provided as called for in the plans, these special provisions, applicable Highway Standards, applicable sections of the Standard Specifications, or as directed by the Engineer.

The following traffic control requirements are of special importance. Conformance to these requirements, however, shall not relieve the Contractor from conforming to all other applicable requirements of the Standard Specifications for Road and Bridge Construction.

The governing factor in the execution and staging of work for this project is to provide the motoring public with the safest possible travel conditions along the roadway thru this construction zone. The Contractor shall so arrange his operations as to keep the closing of any lane of the roadway to a minimum.

All traffic control devices used on this project shall conform to the plans, special provisions, traffic control standards, "Standard Specifications for Traffic Control Devices" and the "Illinois Manual on Uniform Traffic Control Devices for Streets and Highways". No modification of these requirements will be allowed without prior written approval of the Engineer.

Traffic control devices include: signs and their supports, signals, pavement markings, barricades with sand bags, channelizing devices, warning lights, arrowboards, flaggers, or any other device used for the purpose of regulating, warning or guiding traffic thru the construction zone.

The Contractor shall be responsible for the proper location, installation, and arrangement of all traffic control devices. Special attention shall be given to advance warning signs during construction operations in order to keep lane assignment consistent with barricade placement at all times. The Contractor shall cover all traffic control devices which are inconsistent with detour or lane assignment patterns during the transition from one construction stage to another.

Construction signs referring to daytime lane closures during working hours shall be removed or covered during non-working hours.

The Contractor shall coordinate all traffic control work on this project with adjoining or overlapping projects, including barricade placement necessary to provide a uniform traffic detour pattern. When directed by the Engineer, the Contractor shall remove all traffic control devices which were furnished, installed and maintained by him under this contract, and such devices shall remain the property of the Contractor. All traffic control devices shall remain in place until specific authorization for relocation or removal is received from the Engineer.

The Contractor shall ensure that all traffic control devices installed by him are operational 24 hours a day, including Sundays and holidays.

The Contractor shall provide a manned telephone on a continuous 24-hour-a-day basis to receive notification of any deficiencies regarding traffic control and protection and shall dispatch men, materials and equipment to correct any such deficiencies. The Contractor shall respond to any call from the Department concerning any request for improving or correcting traffic control devices and begin making the requested repairs within two hours from the time of notification.

When traveling in lanes open to public traffic, the Contractor's vehicles shall always move with and not against or across the flow of traffic. These vehicles shall enter or leave work areas in a manner which will not be hazardous to, or interfere with, traffic and shall not park or stop except within designated work areas. Personal vehicles shall not park within the right-of-way except in specific areas designated by the Engineer.

Any drop off greater than three inches, but less than six inches within eight feet of the pavement edge shall be protected by Type I or II barricades equipped with mono-directional steady burn lights at 100 foot center to center spacing. If the drop off within eight feet of the pavement edge exceeds six inches, the barricades mentioned above shall be placed at 50 foot center to center spacing. Barricades that must be placed in excavated areas shall have leg extensions installed such that the top of the barricade is in compliance with the height requirements of Standard 2299. Vertical panels or other delineating devices may be substituted for Type I or II barricades with the approval of the Engineer.

Check barricades shall be placed in work areas perpendicular to traffic every 1,000 feet, one (1) per lane and shoulder, to prevent motorists from using work areas as a traveled way. Additional check barricades shall be placed in advance of any hazard in the work area which would endanger a motorist. Check barricades shall be Type I or II and equipped with a flashing light.

Placement of all signs and barricades shall proceed in the direction of flow of traffic. Removal of all signs and barricades shall start at the end of the construction areas and proceed toward oncoming traffic unless otherwise directed by the Engineer.

Delays to the Contractor caused by complying with these requirements will be considered incidental to the item for Traffic Control and Protection, and no additional compensation will be allowed.

Method of Measurement. This item of work will be measured on a lump sum basis for furnishing, installing, maintaining, relocating and removing the traffic control devices required in the plans and these special provisions, excluding Existing Pavement Marking Removal, Temporary Pavement Marking which will be paid for separately.

Basis of Payment. This work will be paid for at the contract lump sum price for TRAFFIC CONTROL AND PROTECTION, which price shall be payment in full for all labor, materials, transportation, handling and incidentals necessary to furnish, install, maintain, and remove all traffic control devices indicated in the plans and specifications. The salvage value of the materials removed shall be reflected in the bid price for this item.

The Engineer may require additional traffic control or traffic control to be installed in accordance with standards and/or designs other than those included in the plans. In such cases, the standards and/or designs will be made available to the Contractor at least one week in advance of the change in traffic control. Payment for any additional traffic control required will be in accordance with Article 109.04 of the Standard Specifications.

Revisions in the phasing of construction or maintenance operations, requested by the Contractor, may require traffic control to be installed in accordance with standards and/or designs other than those included in the plans. Revisions or modifications to the traffic control shown in the contract shall be submitted by the Contractor for approval by the Engineer.

Protection and Restoration of Traffic Signs. Prior to the beginning of construction operations, the Contractor will be provided a sign log of all existing signs within the limits of the construction zone. The Contractor is responsible for verifying the accuracy of the sign log. Throughout the duration of this project, all existing traffic signs shall be maintained by the Contractor. All provisions of Article 107.22 of the Standard Specifications shall apply except the last paragraph shall be revised to read: The Contractor shall maintain, furnish and replace at his own expense, any traffic sign or post which has been damaged or lost by the Contractor or a third party. The contractor will not be held liable for third party damage to large freeway guide signs.

Pavement Markings - Thermoplastic: The installation of Pavement Markings - Thermoplastic shall meet the requirements of Section T 500 and T 607 of the Specifications.

All Pavement Markings - Thermoplastic furnished in this contract are to be of the extruded (Type E) and no other types will be allowed.

Section Monuments and Bench Marks. In the event section monuments and/or permanent bench marks are encountered within the pavement area to be resurfaced, the Contractor shall adjust as directed by the Engineer. This work will be paid for in accordance with Article 109.04 of the Standard Specifications.

Specialty Items. In respect to Article VII, "Subletting or Assigning the Contract." which is part of the "Required Contract Provisions - All Federal - Aid Construction Contracts," included in the proposal, those items so indicated on the Summary of Quantities shall be considered as "Specialty Items" for this improvement.

Removal of Miscellaneous Items. Regarding the removal and disposal of any existing fences, gates, signs (except traffic signs) or other miscellaneous items which may interfere with the construction operations, the Contractor shall, with the approval of the Engineer, remove and dispose of these items outside the limits of the right-of-way at locations provided by him, and this work shall be considered as incidental to the contract.

However, if any fences, gates, signs (except traffic signs) or other miscellaneous items are to be removed and replaced as directed by the Engineer, the Contractor will be paid in accordance with Article 109.04 of the Standard Specifications.

Fine Aggregate for Portland Cement Concrete. The gradation for fine aggregate for PORTLAND CEMENT CONCRETE shall conform to Gradation Number FA 2, as called for under Article 703.01 (c) of the Standard Specifications.

Disposal of Surplus Material. The Contractor's attention is called to the present policy of the Department which prohibits the burning of any material within or adjacent to the improvement.

All excess or waste material shall either be hauled away from the site of the improvement by the Contractor and deposited at locations provided by him or disposed of within the right-of-way in a manner other than burning, subject to the approval of the Engineer.

No extra compensation will be allowed the Contractor for any expense incurred by complying with the requirements of the Special Provisions.

Preservation of Trees and Shrubs. It is imperative that tree and shrub removal on this contract be kept to an absolute minimum. The Contractor shall exercise extreme care when working near existing trees and shrubs to avoid damaging those not scheduled for removal, and shall either repair or replace any such damaged plants at his own expense. No trees or shrubs shall be removed without the Engineer's approval, regardless of whether or not they are designated on the plans to be removed.

Examination of Plans, Specifications, Special Provisions and Work. The bidder shall comply with Article 102.05 of the Standard Specifications relative to examination of plans, specifications, and site of work, and hereby is advised that due to the nature of the contract, he should place special emphasis on inspection in detail of the site of the proposed work and familiarize himself with all local conditions, traffic and otherwise, affecting the contract and the detailed requirements of construction.

All information and assistance will be made available at the District 1 office in Schaumburg.

Copies of Original Plans and Shop Drawings. The Contractor may purchase prints of the original construction drawings and the shop drawings from the Department. The drawings are available for review at the Department's Joliet Office, 105 Bridge Street. The first print of each drawing will be $25.00 per sheet. Additional prints of those drawings will be $5.00 per sheet per print.

Quantities for Removal and Replacement. The quantities called for in this contract indicate the approximate amounts of Removal and Replacement to be expected. It shall be understood and agreed upon that the unit prices for these items shall prevail throughout the period of the contract and that no adjustment in the unit price will be allowed for an increase or decrease in quantities for these items.

Bituminous Concrete Binder Course and Surface Course. At least four weeks prior to the start of construction the Contractor shall submit samples of the coarse aggregate(s), the fine aggregate(s), mineral filler and asphalt he proposes to use for the purpose of establishing a job mix formula. This requirement may be waived by the Engineer, provided the Contractor can show evidence that his proposed materials have produced a bituminous mixture meeting the requirements below.

> As a condition of approval of the proposed source(s) of materials, the samples of materials when combined in the laboratory shall provide a Marshall Stability of at least 1500 and a Flow no greater than 15 at the optimum asphalt content as determined by the Engineer. The blend of coarse and fine aggregates shall produce a mixture having a greater amount of material retained between the 10 and 40 sieves than retained between the 40 and 80 sieves. If the material will not produce a mixture meeting the above requirements, the Contractor shall submit samples of new material(s) that will comply.

Dust Control. This work shall consist of controlling dust resulting from construction operations. It shall be clearly understood by the Contractor that this item of work is not intended for use in the compaction of earth embankment as specified under Article 207.05 of the Standard Specifications.

Dust shall be controlled by the uniform application of sprinkled water, applied only when directed by the Engineer, in a manner meeting his approval. All equipment used for this work shall meet with the Engineer's approval and shall be equipped with measuring devices for metering the exact amount of water discharged. No additional compensation will be allowed the Contractor for compliance with the requirements of the Special Provision.

Bituminous Concrete Binder and Surface Course General Conditions. In addition to the weather and temperature limitations specified in Article 406.04 of the Standard Specifications, in the event of sudden rain, loading additional trucks shall immediately stop whether it be from the plant or storage bins.

Material in transit will be permitted to be laid at the Contractor's risk providing the pavement is free of standing water and the proper temperature of the asphaltic mix is maintained. Approval to unload the trucks in transit shall in no way relax the requirements for quality, density or smoothness of the bituminous mixture being placed.

Surface Tests. These shall be made in accordance with applicable portions of Article 406.20 of the Standard Specifications and as specified herein. The Contractor shall furnish and have available at the paving machine a standard ten-foot straightedge equipped with a level and another ten-foot straightedge as described below.

The Engineer will straightedge the surface course.

The ten-foot straightedge shall consist of a cast aluminum I-Beam with wheels fixed at each end, the distance between axles being ten feet. Three adjustable bolts shall be mounted in the I-Beam equally spaced between the wheels such that they can be adjusted to scratch the surface indicating variations in the pavement when pushed along it in an erect position.

The cost of furnishing the straightedges shall not be paid for separately, but shall be considered incidental to the contract.

Concrete Breakers. When removing curb, curb and gutter and any other structure, the use of any type of concrete breakers which might damage the underground public or private utilities will not be permitted.

Provisions for Curing Test Samples. The Contractor shall be required to provide storage space, meeting the approval of the Engineer, for the initial curing of Bureau of Materials test specimens made on the project. The storage space shall be such that it will give full protection against direct sunlight, the elements, pilfering and damage, and when requested by the Engineer, heat shall be provided by the Contractor, with a minimum temperature of 60 degrees Fahrenheit maintained for as long as required.

AGGREGATES: Revise the indicated portions of Articles 703.03(c) and 704.01(c) of the "Standard Specifications" to read as follows:

Article 703.03(c) - Add the following to the first paragraph:

> When FA 2 is used, the percentage passing the No. 80 sieve in Gradation FA 10 may be 50±30 percent provided a compatible gradation results.

Article 704.01(c) - Course Aggregate Gradation Table. Change to read:

> For Gradations CA 8, CA 11, CA 13 and CA 16, the percent passing No. 16 sieve should be changed to read 4±4.

It should be noted that the quality requirements are not changed and the individual sands used for blending must each meet the quality requirements.

Epoxy Mortar Repair. Revise the indicated portions of BSP-15 as follows:

Add to paragraph 3: The epoxy mortar shall be formulated to be placed and to take its initial set allowing the bridge to be opened within one 10-hour working shift.

Paragraph 10 shall be replaced with: The mortar shall be placed and finished to the contours of the member as originally constructed or as modified on the plans.

Polymer Mortar Repair. This work shall consist of the furnishing of all material and labor required to remove deteriorated concrete and replace it with a polymer mortar at those locations shown on the plans. The preparation of the areas to receive the polymer mortar shall be included under this item.

The areas to be patched shall all have loose, unsound concrete removed and then cleaned by sandblasting, vacuumed and/or blown clean with oil-free compressed air. The sound concrete remaining shall then be scrubbed with the polymer binder only (without aggregate) just prior to the placement of the polymer mortar.

Polymer modified cementitious system shall consist of two components and have the following properties:

Component A: Liquid polymer emulsion of an acrylic copolymer base and additives.
Component B: Blend of selected Portland cements, specially graded aggregates, organic accelerator, and admixtures for controlling setting time, water reducers for workability, and a corrosion inhibitor. System shall not contain chlorides, nitrates, added gypsum, added lime, or high alumina cements. System shall be non-combustible, either before or after cure.
Color shall be concrete gray.
Minimum compressive strengths: 5,000 psi.
Bond Strength: 100% concrete substrate failure (pull off method), minimum 400 psi.
System shall not produce a vapor barrier, shall be thermally compatible with concrete, and shall be freeze-thaw resistant.
The polymer mortar shall be suitable for placement in vertical and overhead positions.

Polymer mortars meeting these requirements are manufactured by Sika Chemical Company, L&M Construction Chemicals, or equal.

The polymer mortar shall be mixed and placed in accordance with the manufacturer's printed instructions. Such instructions shall be supplied to the Contractor by the supplier of the polymer system.

The mortar shall be placed and finished to the contours of the member as originally constructed or as modified on the plans. Curing shall be in accordance with the manufacturer's printed instructions. Mortar shall be allowed to cure properly before it is subject to vibration or shock loadings caused by movement of the leaf spans or other construction activities.

The work herein described shall be paid for at the contract unit price per cubic foot for POLYMER MORTAR REPAIR.

Fiberglass Jackets. This work shall consist of the furnishing of all material and labor required to remove deteriorated concrete and replace it with epoxy grout and a stay-in-place fiberglass jacket at the locations shown on the plans. The preparation of the areas to receive the fiberglass jackets shall be included under this item.

The areas to be repaired shall have all loose, unsound concrete removed and then cleaned by sandblasting or waterblasting, vacuumed and/or blown clean with oil-free compressed air.

The fiberglass jacket shall be prefabricated to provide a 1/2 inch annular void between the concrete and the jacket. The bottom of the jacket shall be fitted with a compressible gasket.

The jacket shall be braced in accordance with manufacturer's written recommendations.

A small amount of epoxy grout shall be placed in the jacket and allowed to cure to form a solid seal at the bottom. The remainder of the epoxy grout may then be placed. Care shall be taken in placing the mortar such that the water is displaced and not trapped in the jacket.

The epoxy grout system furnished shall be compounded for and specifically recommended by the manufacturer for the use specified herein. Prior to approval and use of the product furnished, the Contractor shall submit a notarized certification by the formulator of these materials, stating that they meet the requirements as set forth herein.

Packaging: The epoxy adhesive shall be packaged in a kit with each component in a separate container. The containers of each kit shall be filled with the adhesive components in exact mixing proportions and one container shall be large enough to mix both of the components. The size of the kit shall be the total volume of the mixed adhesive which shall be one gallon or five gallons as specified.

The epoxy grout shall be mixed and placed in accordance with the manufacturer's printed instructions. Such instructions shall be supplied to the Contractor by the supplier of the epoxy system.

The work herein described shall be paid for at the contract unit price per square foot for FIBERGLASS JACKETS.

MACHINERY HOUSE ENCLOSURE: This work shall consist of the removal and disposal of the existing wall and roof panels, aluminum angles, and miscellaneous attachments, and furnishing all materials and labor required to construct a new exterior on the existing machinery house framing.

Contractor shall follow all safety regulations for the removal and proper disposal of the existing asbestos cement wall panels. Removal of the existing exterior and installation of the new work shall be coordinated with the mechanical and electrical work.

Roof panels shall be of the standing rib type with sealtant and mechanical interlock. They shall be a minimum of 24 gauge steel designed to support 40 psf live load and Class 90 wind uplift. The panels and connectors shall be coated with 1.25 oz. G-90 galvanizing or 0.5 oz./sq. ft. zinc-aluminum (GALVALUME). The finish on the exposed surface shall be antique white.

Wall panels shall be of the roll-formed type with sealed overlapping side-laps. They shall be a minimum of 26 gauge steel designed to support a 20 psf wind load. The panels shall be coated with 1.25 oz. G-90 galvanizing or 0.5 oz./sq. ft. zinc-aluminum (GALVALUME). The finish on the exposed surface shall be antique white.

The existing steel framing shall be supplemented with additional sub-girts to support the design loads and to ease in installation of the panels. All supplemental support members shall be minimum of 18 gauge G-90 galvanized steel. All attachments must be designed to withstand the forces and vibrations caused by opening and closing the bridge.

Translucent fiberglass panels shall be glass fiber-reinforced poleyester plastic panels meeting the standard specifications ASTM D3841-80. They shall be formed to be compatible with the overlapping design of the wall panels. The thickness and design of the panels shall withstand the loading specified for wall panels, and they shall be shatterproof. They shall have a minimum light transmission factor of 45%.

Translucent fiberglass security panel shall be constructed of zinc plated 1 1/2 inch expanded steel mesh sandwiched between glass fiber-reinforced polyester plastic. Minimum panel thickness shall be 1/8 inch. Color shall be semi-clear with minimum light transmission of 75%.

All flashing and trim shall be fabricated by the panel manufacturer from material that is the same gauge and finish as the panels to which they are attached. All openings shall be sealed to prevent water, snow, or birds from entering the machinery house.

Sufficient fasteners and clips shall be provided of the size, type, and holding strength required for proper erection according to manufacturer's standards and engineering requirements. Color on any exposed fasteners shall match the panel color. Exposed screws shall be hex head and neoprene sealing washer. The head and washer backer shall be capped with .008" thick, 302 stainless steel.

Dissimilar metals must be isolated from contact by bituminous paint or caulking tape. Factory applied baked finish or 1.25 oz. galvanized metal shall be considered adequate insulation between dissimilar metals.

This metal enclosure system shall be furnished with a one-year material and workmanship guarantee. The panels shall be furnished with a limited perforation guarantee of 20 years.

Before fabrication begins the contractor must prepare and submit complete detailed shop drawings, manufacturer's literature, and details of guarantee for review.

The work herein described and as shown on the plans shall be paid for at the contract lump sum price for MACHINERY HOUSE ENCLOSURE.

Removal of Existing Concrete Deck. This item shall consist of the removal and disposal of the existing concrete deck and concrete sidewalk. This work shall be done in accordance with the requirements of Section 501 of the "Standard Specifications".

The Contractor shall perform this work in such a manner that debris is not dropped into the river. Any debris dropped into the river shall be immediately removed as directed by the Engineer.

This work will be paid for at the contract lump sum price for REMOVAL OF EXISTING CONCRETE DECK, which price shall be payment in full for furnishing all labor and equipment as herein specified.

Removal of Existing Timber. This item shall consist of the removal and disposal of the existing timber sidewalk and timber fender system, and their associated hardware. This work shall be done in accordance with the requirements of Section 501 of the "Standard Specifications".

The Contractor shall perform this work in such a manner that debris is not dropped into the river. Any debris dropped into the river shall be immediately removed as directed by the Engineer.

This work will be paid for at the contract lump sum price for REMOVAL OF EXISTING TIMBER, which shall be payment in full for furnishing all labor and equipment as herein specified.

Removal of Existing Steel

This item shall consist of the removal, salvage, and/or disposal of existing steel that will be replaced including open steel deck, steel deck joist, stringers being replaced, floor beam cover plates and rivets, bearings, portions of track girders, segmental girders and pinion racks, and other miscellaneous steels. This work shall be done in accordance with the requirements of Section 501 of the "Standard Specifications".

Approximately 35 percent of the existing open steel deck shall be salvaged and delivered to the Owner's storage site as directed by the Engineer. The sections to be salvaged will be marked by the Engineer before removal begins. These sections shall be carefully removed in one piece, attachments trimmed off and stockpiled at the Owner's storage site. The remaining open steel deck becomes the property of the Contractor.

The contractor shall use extreme care in flame cutting steel for removal so as to not damage steel left in place. No flame cutting of rivet or bolt heads next to steel to be left in place shall be allowed. Rivets and bolt shanks must be driven or drilled out.

The Contractor shall perform this work in such a manner that debris is not dropped into the river. Any debris dropped into the river shall be immediately removed as directed by the Engineer.

This work will be paid for at the contract lump sum price for REMOVAL OF EXISTING STEEL, which shall be payment in full for furnishing all labor, equipment, and transportation as herein specified.

RIVET REPLACEMENT: This item shall consist of the removal and disposal of existing selected rivets and replacement with high strength bolts. This work shall be done in accordance with Section 507 of the "Standard Specifications".

Rivets with the head rusted off flush with the steel and severely rusted rivets will be marked for replacement by the Engineer. This bid item does not include rivets or bolts removed as part of REMOVAL OR EXISTING STEEL or FURNISHING AND ERECTING STRUCTURAL STEEL nor does it include rivets removed by the Contractor to facilitate other repairs.

The use of flame cutting to facilitate removal of these rivets is expressly forbidden unless approved by the Engineer on a case by case basis. Any remaining head of the rivet shall be sheared off and the shank driven or drilled out. Reaming may be required to facilitate installation of high strength bolts.

High strength bolts, nuts and washers shall be AASHTO M 164 and shall be of size equal to the replaced rivet.

This work will be paid for at the contract unit price each for RIVET REPLACEMENT of the size indicated, which shall be payment in full for furnishing all labor, materials and equipment as herein specified.

Steel Railing, Type TP-1. This work shall consist of furnishing of all the materials and necessary labor to construct and erect the complete STEEL RAILING, TYPE TP-1.

This work shall be done to the lines and grades as shown on the Plans, and in accordance with the applicable requirements of Section 508 of the Standard Specifications.

This work shall be paid for at the contract unit price per lineal foot for STEEL RAILING, TYPE TP-1.

STRAIGHTENING BEAM: This item shall consist of straightening existing steel beams in the field. This work shall be done in accordance with the requirements of Section 507 of the "Standard Specifications".

This work will be paid for at the contract unit price each for STRAIGHTENING BEAM, which shall be payment in full for furnishing all labor, material, and equipment as herein specified.

SURFACE FINISH: This item shall consist of finishing the exposed vertical surfaces of the existing, repaired, and replaced concrete of the abutments, piers, and retaining wall. This surface finish shall not be applied until all the requirements for normal finish of Section 504.14 of the "Standard Specifications" have been met.

This surface finish shall consist of a mixture of an approved acrylic, latex or other bonding agent with an approved commercially packaged or field-prepared mortar applied in one or more coats to the previously prepared surface. The color of the resulting surface finish, after curing and drying, shall be uniform and approximately the same color as the original concrete, but not darker.

The bonding agent, dry mortar ingredients and water shall be mixed in the proportions specified by the manufacturer or directed by the engineer. The bonding agent and resulting mixture shall be properly stored and protected and shall not be exposed to temperatures below 40 F.

After application of the normal surface finish, but prior to starting this surface finish, the surface shall be thoroughly cleaned and wetted to provide a uniformly damp surface. The cement mortar mix shall be applied using a sponge float, a heavy brush or by spraying. The application shall be thick enough to fill any pinholes and provide complete and uniform cover, but not so thick as to leave a plastered effect. Application shall not be made until this finish can be applied without interruption on any structure. Application shall not be made when the temperature is below 40 F or when a temperature below 40 F is predicted to occur during the succeeding 24 hours.

When a second application is required, at least 24 hours shall elapse between applications.

This surface finish shall be kept wet and covered for 48 hours, except that such curing may be omitted when recommended by the manufacturer of the bonding agent and when approved by the engineer.

Bonding agents and mortars not previously approved by the Department shall be tested in an approved commercial laboratory in accordance with procedures prescribed by the Department. A Certified Report of Test and Analysis shall be furnished by the contractor to the engineer for evaluation and approval before any application of such material will be permitted.

This work will be paid for at the contract unit price per square yard for SURFACE FINISH, which shall be payment in full for furnishing all labor, material, and equipment as herein specified.

RAIL POST REPAIR: This work shall consist of furnishing all materials and labor to repair the existing rail posts by welding. This work shall be done in accordance with the requirements of Section 507 of the "Standard Specifications".

This work shall be paid for at the contract unit price for RAIL POST REPAIR, which price shall be payment in full for furnishing all labor and equipment as herein specified.

WELDING CAST IRON

In addition to the applicable portions of section 507.04(s) of the standard specifications the following shall apply when welding of or to cast iron. The electrode shall meet the requirements of AWS A5.15 Class ENi-CI. Electrodes meeting these requirements are Lincoln Softweld, Macarco Ni-Rod, or equal electrode.

The surface of the cast iron to be repaired or joined shall be cleaned of all paint and other substances by sandblasting and/or grinding. The cast iron shall be prepared for welding as indicated on the drawings by grinding.

Preheat the cast iron to approximately 100°F; however, during the entire welding process the cast iron should not rise in temperature above 140°F. Welding in cold weather should be avoided or protection provided to eliminate rapid cooling of the material. During the welding process use short beads one or two inches long. Immediately peen each bead while it is hot to relieve shrinkage stresses and retard cracking. While one bead is cooling, deposit others at scattered points throughout the joint. All weld craters must be filled. Whenever possible, this is done by ending a bead by blending its crater into the start of a previously deposited bead. All beads should be deposited in the same direction. Ends of adjacent parallel beads should not line up with each other. Let each bead cool to where it can be touched with a bare hand before starting an adjacent bead. Cooling shall take place at ambient air temperature of 50°F or higher.

LAMINATED TIMBER: This work shall consist of furnishing and installing laminated timber as shown on the plans. This work shall be done in accordance with Section 510 of the "Standard Specifications".

Manufacture of the structural glued laminated timber shall conform to the requirements of the Voluntary Products Standard PS 56-73, "Structural Glued Laminated Timber".

Materials shall be white or red oak sized and selected to be bent to the radius shown on the plans. Adhesives shall meet the requirements for WET condition of service.

No treatment is required for white oak. Red oak shall be treated with creosote in accordance with Section 711 of the "Standard Specifications".

This work will be paid for at the contract unit price per F.B.M. for LAMINATED TIMBER, which shall be payment in full for furnishing all labor, materials, and equipment as herein specified.

Open Steel Floor. This work shall consist of furnishing all materials and labor to fabricate and install the open steel grid floor. This work shall be done in accordance with the requirements of Section 507 of the "Standard Specifications".

The flooring shall be fabricated of A.S.T.M. A588 steel with a minimum moment of inertia of 12.46 inch to the fourth. It shall be designed to support HS-20 truck loading for the given joist spacing. The approximate weight shall be 24.5 psf. Panel size and depth shall be as shown on the plans.

Steel grid shall be given a shop applied prime coat. Finish coat will be included in CLEANING AND PAINTING STEEL BRIDGE.

This work will be paid for at the contract unit price per square foot for OPEN STEEL FLOOR, which shall be payment in full for furnishing all materials, labor, equipment, transportation, and installation as herein specified.

The surface of the cast iron to be repaired or joined shall be cleaned of all paint and other substances by sandblasting and/or grinding. The cast iron shall be prepared for welding as indicated on the drawings by grinding.

Preheat the cast iron to approximately 100°F; however, during the entire welding process the cast iron should not rise in temperature above 140°F. Welding in cold weather should be avoided or protection provided to eliminate rapid cooling of the material. During the welding process use short beads one or two inches long. Immediately peen each bead while it is hot to relieve shrinkage stresses and retard cracking. While one bead is cooling, deposit others at scattered points throughout the joint. All weld craters must be filled. Whenever possible, this is done by ending a bead by blending its crater into the start of a previously deposited bead. All beads should be deposited in the same direction. Ends of adjacent parallel beads should not line up with each other. Let each bead cool to where it can be touched with a bare hand before starting an adjacent bead. Cooling shall take place at ambient air temperature of 50°F or higher.

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No treatment is required for white oak. Red oak shall be treated with creosote in accordance with Section 711 of the "Standard Specifications".

This work will be paid for at the contract unit price per F.B.M. for LAMINATED TIMBER, which shall be payment in full for furnishing all labor, materials, and equipment as herein specified.

Open Steel Floor. This work shall consist of furnishing all materials and labor to fabricate and install the open steel grid floor. This work shall be done in accordance with the requirements of Section 507 of the "Standard Specifications".

The flooring shall be fabricated of A.S.T.M. A588 steel with a minimum moment of inertia of 12.46 inch to the fourth. It shall be designed to support HS-20 truck loading for the given joist spacing. The approximate weight shall be 24.5 psf. Panel size and depth shall be as shown on the plans.

Steel grid shall be given a shop applied prime coat. Finish coat will be included in CLEANING AND PAINTING STEEL BRIDGE.

This work will be paid for at the contract unit price per square foot for OPEN STEEL FLOOR, which shall be payment in full for furnishing all materials, labor, equipment, transportation, and installation as herein specified.

Concrete Adjustment Blocks. This work shall consist of furnishing all materials and labor to fabricate, transport, install, and position the concrete adjustment blocks. Blocks shall be fabricated in accordance with Sections 503 and 504 of the "Standard Specifications".

Concrete used in the fabrication of the adjustment blocks shall be Class X.

Adjustment blocks shall be positioned in the counterweight pits to achieve the proper balance of the bascule leaves. After the balance of the leaves has been adjusted, tested, and approved by the Engineer the doors can be installed on the counterweight pits. All remaining adjustment blocks shall be delivered to the Owner's storage site as directed by the Engineer.

This work will be paid for at the contract unit price each for CONCRETE ADJUSTMENT BLOCKS, which shall be payment in full for furnishing all materials, concrete, labor, equipment, transportation, positioning and repositioning as herein specified.

Jacking Existing Structure: This work consists of all labor and materials involved in jacking and supporting steel girders and the superstructure in order to remove existing and install new bearings located on the West Abutment.

The Contractor shall furnish and place all cribbing, bracing, shoring, blocking, temporary structural steel, timber, shims, jacks and any other materials and equipment necessary for safe and proper execution of the work.

The Contractor shall submit details of his method of jacking, cribbing and supporting the girders and superstructure. Jacking between abutment seat and end diaphragms will be allowed, provided the contractor provides sufficient load distribution.

The Contractor shall assume all responsibility and be liable for any damage caused by improper supports or shoring in any respect. It is expressly understood and agreed that neither any additional precautions taken nor the failure of the Engineer to order such additional protection will in any way relieve the Contractor of his sole responsibility for this item of work.

This work will be paid for at the contract lump sum price for JACKING EXISTING STRUCTURE which price shall be payment in full for completing the work as specified.

MECHANICAL WORK

A. General

The item of mechanical work consists of furnishing or removing and refurbishing, installing, testing, and placing in satisfactory operating condition the mechanical system complete with all gear reducers, couplings, bearings, controls and other mechanical accessories on the bridge, all as indicated on the plans, revised in the Special Provisions, or as may be directed by the Engineer for completion of the work.

The intent and purpose of these specifications is to cover and include all mechanical equipment, material and labor necessary to properly install, or remove and refurbish, test, align and adjust, and place in approved working order, the mechanical installation herein specified. Any piece of equipment or mechanical element, material or labor not herein specifically mentioned or included, but that may be found necessary to complete or perfect the installation, operation and equipment in a substantial manner acceptable to the Engineer, shall be furnished by the contractor as if specifically included in these specifications, and without extra cost.

B. Materials and Workmanship

The mechanical equipment and its installation shall conform to the requirements of the AASHTO 1978 "Standard Specifications for Movable Highway Bridges", and the applicable requirements of the Standard Specifications except as amended herein.

Equipment, materials, and workmanship shall be first class in every particular and shall be manufactured and erected to fulfill the intent of the contract.

Each major piece of mechanical equipment shall have a permanent type, 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. All permits necessary for making the mechanical installation shall be obtained by the contractor at his own expense.

C. Working Drawings and Samples

The contractor shall submit for approval within 120 days after award of the contract, six (6) sets of the following working drawings executed in accordance with the provisions of the contract:

1. Certified dimension prints of all gears, pillow blocks, bearings, bushings, shafts, enclosed gearboxes, couplings, lubrication fittings, and other mechanical equipment included in the contract.

2. A complete set of layout and installation drawings for the mechanical work, showing the location and installation of all mechanical equipment and accessories. These drawings shall show the exact location of all motors, shafts, brakes, gears, bearings, couplings, and other mechanical accessories and the method of supporting them on the structure.

3. A schedule of mechanical equipment shall list each component by its designation as shown on the plans, and shall state for each device its manufacturer, catalog designation and number, capacity, gear ratio, torque setting, and other pertinent and applicable data.

4. Construction detail of all gears, couplings, and enclosed gearboxes.

5. Construction details of the rebabbited bearings, bushings and shaft assemblies.

6. A complete list of all tools and spare parts to be furnished as part of the contract.

7. Any other drawings which may, in the opinion of the Engineer, be necessary to show the mechanical work completely.

Each certified dimension print of each component shall state in the certification the name of the job, contract number, the application of the apparatus, component designation, number required, mechanical rating, number of teeth, bore diameters, fit with adjoining parts, key and keyway dimensions, and any other pertinent data to show that the apparatus meets the specified requirements.

D. Instruction Books and Display Drawings

The contractor shall furnish six (6) bound copies of a booklet containing the following:

1. Table of Contents.
2. Description of system, which shall describe in full the function of all components and accessories.
3. Detailed maintenance instructions for adjusting, lubricating, and operating all of the mechanical equipment, including manufacturers' recommended preventative maintenance lubrication types and schedule.
4. A set of descriptive leaflets, bulletins and drawings covering all items of equipment and accessories made a part of the completed mechanical system. The catalog number of each component shall be given, to be used in case it later becomes necessary to order replacement parts from the manufacturer. The information shall be furnished for all mechanical equipment such as gears, couplings, bearings, gearboxes, grease fittings, and components of the mechanical brakes.

The materials shall be permanently bound into each booklet between rigid plastic or cloth binding covers. The instruction booklets shall be approximately 9 inches by 12 inches, and shall be legibly entitled with a descriptive title, the name of the job, the location, year of installation, owner, manufacturer, contractor and engineer. Copies of drawings shall be in black and white background and shall be easily legible. The arrangement of the booklets, the method of binding, materials to be included, and the composite text shall be reviewed and approved by the Engineer.

E. Test of the Mechanical Installation

Under this item the contractor shall arrange for and provide all the necessary field tests, as directed by the Engineer, to demonstrate that the entire mechanical system is in proper working order and in accordance with the plans and specifications.

During the testing period, the contractor shall arrange to have at the site a representative of the manufacturer of major bridge drive components. This representative shall be capable of making adjustments to the equipment, of locating parts of misalignment and correcting them if necessary, and of obtaining from the manufacturer without delay due parts of replacements for equipment which, in the opinion of the Engineer, does not perform satisfactorily.

Should the tests show that any piece of equipment or accessory, in the judgment of the Engineer, is defective or functions improperly, such adjustments and/or replacements shall be made by the contractor to make the installation completely acceptable to the Engineer, at no extra cost.

F. Enclosed Gear Reducer

Furnish and install a complete enclosed gear reducer as indicated on the plans and as specified herein.

Equipment shall be manufactured in accordance with the requirements of the American Gear Manufacturers Association (AGMA), carry the AGMA symbol on the nameplate and be manufactured by Earle Gear & Machine Company, the Falk Gear Corporation, Xtek, Inc., or equal.

Gear reducer to be a self-contained gear reduction with a double common input shaft and two output shafts, a differential unit between the output shafts with the gear ratio, shaft height, and shaft center distance as shown on the plans. Gear reducer is to be made to be a direct replacement for the existing exposed gears without changing the location of the motors or output shafts.

Gear reducer housing is to be made of gray iron, fabricated steel, or cast steel. Finished product is to be cleaned and painted. Provisions to be made for filling and draining the oil as well as access openings for maintenance inspections. Finished housing to be vented and dust and oil tight in all subjected positions.

Input shafts, intermediate shafts and output shafts are to be forged alloy steel, and manufactured in accordance with the AGMA standards.

Bearings in the gearbox shall have a B-10 life of 40,000 hours (B-10 life as defined by the Anti-Friction Bearing Manufacturers Association).

Gears within the gearbox are to be either forged alloy steel or cast alloy steel. Pinions can be forged integral with their shafts. Teeth are to be machine cut.

Lubrication for the gearbox shall either be splash lubrication capable of operating satisfactorily in all subjected positions, or of the force feed lubrication type. A liquid level sight glass shall be installed which will indicate the level of liquid when the bridge is in the closed position. Lubrication type to be in accordance with AGMA 250.04-1981 for the temperature range of -20°F to 100°F.

Mounting flanges of the gearbox shall be case integral to the gearbox or shall be of welded steel construction. The location and size of the mounting flanges shall be so located to permit the gearbox to be installed on the existing steel girders on the bridge.

Gear reducer to be rated in accordance with AGMA 420.04-1975 for a service factor of 1.0.

Fittings equal to the Alemite buttonhead style shall be provided for grease lubrication of exterior bearings.

Gear quality shall be in accordance with the AGMA standards (AGMA 420.4-1975).

G. External Gears

Furnish and install gears as indicated on the plans.

Cast steel gears shall be made of material noted on the plans in accordance with the Standard Specification for mild to medium strength carbon steel castings, AASHTO designation M103-82, (ASTM designation A 27-80), and referenced applicable documents regarding mechanical testing, heat treatment and radiographic inspection.

Forged steel gears to be made of material noted on the plans. In accordance with the Standard Specification for steel forgings, carbon and alloy, AASHTO designation M102-82 (ASTM designation A668-79A), and applicable documents regarding mechanical testing, heat treatment, and material evaluation tests.

Gear teeth are to be fully machine cut to the form indicated on the plans, with the pitch diameter legibly marked on both sides of the teeth.

Replacement gears that will be installed on existing shafts in refurbished bearings shall be machined to the original pitch diameter standard tooth construction as specified, with the appropriate center distances being obtained at final machining of the bearings. No adjustments of pitch diameter and tooth form to accommodate non-original center distance is permitted. All machined surfaces, unless otherwise indicated on the plans, specified herein or specified in referenced standards, shall be finished to a surface texture of 125 RMS in accordance with ANSI B46.1.

Final bore dimensions and keyway dimensions determined from existing shafts shall result in the appropriate interference, locational or running clearance fit in accordance with ANSI B4.1 - Preferred Limits and Fits.

H. Babbit Bearings

Furnish and install rebabbitted bearings as shown on the plans.

The babbitt materials to replace the existing material in all the rebabbited bearings shall conform to the requirements of the ASTM Specifications B23, alloy #2.

The existing babbit shall be melted from the existing bearing castings and a new material cast-in-place. The finish bore diameter of the bearings shall be that which results in an RC6 fit in accordance with ANSI B4.1. The finish of the inside bore shall have a surface texture of 16 RMS, in accordance with ANSI B46.1

I. Bronze Bushings

Furnish and install new bronze bushings as shown on the plans.

The materials for the bronze bushings shall be cast bronze conforming to the requirements of AASHTO Specifications M107, alloy #937.

The replacement bronze bushing should be machined with an outside diameter suitable to produce an interference fit Class FN2 into the existing cast housing. Bushing retainer dowels should be reinstalled between the bronze bushing and the cast housing. The finish required on the outside diameter of the bronze bushing is 63 RMS.

Finish bore diameter shall be finished to result in an RC6 fit with the mating shaft and have a surface texture finish of 16 RMS.

Grease ducts in the existing casting shall be cleaned and new lubrication fittings installed.

Grooves shall be cut in the inside bore of the bronze bushing as shown on the plans and specified herein.

Final alignment of the bearing and mating shaft shall be done during final machinery alignment.

J. Lubrication Grooves

Grooves for lubrication shall be cut in all bearing surfaces. Grooves shall be so located that the entire bearing surface will be swept by lubricant in 90° rotation of shaft. Size of groove shall be 5/16" deep minimum with a 1/4" radius at bottom.

K. Lubrication Fittings

Furnish and install lubrication fittings at all bronze and babbitt bearings.

Lubrication fittings shall be the standard buttonhead style as manufactured by Alemite with spring-loaded check valve or equal. The size of the pipe thread for the lubrication fittings shall not be less than 1/4 inch n.p.t.

L. Shaft Couplings

Furnish and install shaft couplings as shown on the plans.

All shaft couplings shall be of the gear type transmitting the torque through metal parts and providing for both misalignment and shock.

Shaft couplings shall be as manufactured by Sier-Bath, Falk or equal.

Furnish and install a new double engagement type steel gear coupling at the high speed shafts of the enclosed gear reducers. This coupling is to provide for angular misalignment and offset misalignment.

Furnish and install a spacer type gear coupling, either the single engagement type (angular misalignment only) or the double engagement type (angular misalignment and offset misalignment) at the high speed shafts of the enclosed gear reducers and electric motor drives.

All couplings to be sized in accordance with the manufacturers' recommended torque/horsepower ratings. Horsepower, torque capacity and parallel misalignment capacity shall be based on 1.5° misalignment per gear mesh.

All couplings shall be keyed to the shafts with one rectangular key with the height of the key not greater than 75% of the width of the key.

The diameter of the couplings shall be machined such that an interference fit of Class FN-2 is obtained when installed on the shaft. No machining in excess of the nominal size shall be done on the shaft to accommodate the shaft coupling. The inside bore of all couplings shall be machined to a surface finish of 63 RMS.

All bolt heads and nuts of the gear coupling shall be recessed or protected by flanges.

Lubricants for the shaft couplings shall be in accordance with the manufacturers' recommendations on lubrication.

M. Pillow Blocks

Furnish and install pillow blocks as indicated on the plans.

Material for the pillow blocks shall be as indicated on the plans.

The finish casting shall be machined to accept the babbit lining with interlocks and grease ducts. Babbit material to be used shall be as specified herein.

The machined shaft height dimension of the casting should be made so that not more than 1/4 inch and not less than 1/8 inch of shims are to be placed between the steel structure and the bearing casting.

The mounting holes shall be machined 1/16 of an inch undersize in the shop and reamed in the field to match adjoining part for proper alignment.

N. Gear Housings

This item covers the refurbishing of the external gear housings for the machinery. Housings should be refurbished to provide drip-proof and oil tight housings acceptable in all subjected positions of the movable span.

Material to be used shall be sheet steel, minimum thickness of #14 gage.

The fit of the cover to the base housing shall be with a simple labyrinth style joint capable of keeping out rain and dust. Means of locking the cover shall be provided by a threaded rod and wing nut.

O. Shafts

Furnish and install new shafts as indicated on the plans.

If plans indicate removing, inspecting and reusing existing shafts, same shall be inspected for cracks, excessive scoring at journals, warping, skewing, and any other defect that may hinder performance of shaft or not provide service as intended. Replacement will be at the discretion of the Engineer.

Shafts over 6 inches in diameter shall be forged. All shafts over 3 1/2 inches in diameter shall not be cold finished.

All shafts shall be finished entire length. Finish at bearing journals to be 8 RMS. Finish at gears and hubs to be 8 RMS. Finish on balance of shaft to be 250 RMS or better.

All dimensions shown are nominal, actual dimension determined by Class Fit specified in accordance with ANSI B4.1, Preferred Limit and Fits for Cylindrical Parts.

P. Fasteners

All fasteners used to assemble machinery parts are to be high strength bolts ASTM A325. Fasteners used to connect machinery parts to each other or to their supports are to be turned bolts having the shank 1/16 inch larger in diameter than the threaded portion with a finish of 63 RMS.

The fit between turned bolts and their holes is to be Class LC-6 in accordance with ANSI B4.1. All other fasteners shall have holes 1/32 inch larger in diameter than the bolt.

All holes for fasteners shall be drilled to finish size or drilled and reamed to finish size.

All surfaces of machinery bearing on fasteners or other machinery are to be machined to a surface texture of 250 RMS.

All nuts and bolt heads are to be of the heavy series, course thread series of the ANSI. All heads to be hexagonal unless bolt heads are recessed in a casting in which case the heads shall be square.

Q. Setscrews

Setscrews to be of same material as fasteners, and of the headless type with cone points, set in counter bored seats.

Where applicable, setscrews are to be locked in position with lock nuts. In other locations, setscrews can be secured in position by peening over holes or welding.

R. Keys and Keyways

All keys used in the mechanical installation shall be of Rolled Steel (ASTM A-663 or A-675) or Forged Steel (ASTM A-668).

Tapered keys shall bear on the top, bottom, and sides. Parallel-faced keys shall bear on the sides only, secured in position with setscrews.

Dimension for keys shall match existing or as shown on the plans. Dimensions on the plans for tapered keys are for the small end.

Keyways machined in shaft are not to extend into the bearing in any case.

S. Brakes

All brake assemblies are to be dismantled, cleaned and inspected for worn parts. All parts determined to be worn beyond the point of satisfactory service as intended are to be replaced.

Brake linings shall have a minimum thickness of 3/8" throughout the entire surface. Replacement parts to be obtained from original manufacturer or their authorized spare parts supplier.

Brake assembly to be reassembled and lubricated per manufacturers' recommendation.

Existing brake springs shall be tested for force and deflection prior to reassembly and shall meet the manufacturer's original specifications, or be replaced.

T. Lubrication of External Gears

All external gear sets enclosed in sheet metal corners are to be lubricated with AGMA Lubricant No. 8, 8EP, 9 or 9EP for service at temperature ranges of -20°F to 100°F, in accordance with AGMA 251.02-1974.

The rack and pinion are to be hand or brush lubricated with AGMA Lubricant No. 14R, Residual Compound, Diluent type in accordance with AGMA 251.02-1974.

U. Domestic Water Piping System

Domestic water piping system includes removal of existing and installation of new exterior water supply piping, equipment and accessories specified herein or indicated on drawings.

Exterior water service pipe to be 1 inch Galvanized, Schedule 40, steel pipe, with Class 125 galvanized cast iron threaded fittings.

Pipe insulation should be of the calcium silicate type as manufactured by Johns-Manville, Thermo-12 or equal. Exterior insulation to be covered with 0.016 inch aluminum with longitudinal seams and circumfurential joints weather sealed. Insulation thickness to be 1.5 inches thick for exterior piping.

Insulation shall have composite (insulation, jacket or facing, and adhesive) fire and smoke hazard ratings as tested by procudure (ASTM E84-68, NFPA 255, UL 723) not to exceed a flame spread of 25 and smoke developed of 50.

Install piping, including mains, branches, and runouts with sufficient offsets to allow for free expansion and contraction and sufficient to prevent leaks and overstretching of piping system.

Comply with governing regulations which require products used and installation methods for domestic water piping work to be selected from lists in certain published standards or codes as indicated therein.

Provide standard products recommended by manufacturer for use in service indicated and which effectively isolate ferrous from non-ferrous piping, electrical conductants, prevent galvonic action, and stop corrosion.

Install each run with a minimum of joints and couplings but with adequate and accessible unions for disassembly and maintenance/ replacement of valves and equipment.

Hold piping close to walls, overhead construction, columns, and other structural elements, and locate insulated piping for 1.0-inch clearance outside of insulation.

Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports, and accessory items. Inspect pressure piping in accordance with procedures of ANSI B-31.

Pipe hangers to be as manufactured by Fee & Mason, Grinnel, Unistrut, or equal. Unless otherwise specified or shown, hangers for pipes shall be split ring, adjustable swivel type, clevis type or roller type. Strap hangers or wire hangers will not be acceptable. Hanger rods shall be in accordance with ASTM A36, threaded both ends or continuous threaded, and shall be at least 3/8 of an inch in diameter.

Pipe support spacing not to exceed 6 feet for steel pipe. Where piping connects to equipment or accessories, support by pipe support and not by equipment.

Install electrical pipe tracing cable on exterior water supply pipe. Cable to be manufactured by Chemelex, Nedson Electric or equal, meeting requirements of NFPA-70 National Electric Code and Underwriter's Laboratories.

Electrical pipe tracing cable to be 120 volt, 60 hz, single phase, parallel design with self-regulating heat output, capable of overlapping itself without creation of hot spots. System to be capable of maintaining pipe contents at a temperature of 40°F when the outside ambient temperature is -20°F with a 20 mph wind.

V. Tests of the Plumbing Installation

Under this item the contractor shall arrange for and provide all of the necessary field tests as directed by the Engineer, to demonstrate that the entire plumbing system is in proper working order and in accordance with the plans and specifications.

Should the tests show that any piece of equipment or accessory, in the judgment of the Engineer, is defective or functions improperly, such adjustments and/or replacements shall be made by the contractor to make the installation completely acceptable to the Engineer, at no extra cost to the state.

W. Basis of Payment

Mechanical work and material complying with the requirements of this item, furnished and erected complete in place, in accordance with the specifications, and accepted, will be paid for at the lump sum price for MECHANICAL WORK, which price shall be payment in full for all materials and for fabrication, shop work, transportation, erection, shop painting, parts, repairs, testing, and adjusting equipment.

ELECTRICAL WORK

A. General. The item of electrical work consists of furnishing, installing, testing, and placing in satisfactory operating condition, the electrical system, complete with all accessories, auxiliaries, motor control center, traffic signals, traffic gates, lighting, conduit, aerial cables, closed circuit television, electrical grounding, electrical service conductors, control devices, interlocking, existing navigation lights and motors, and all other electrical facilities on the bridge, on the piers, and in the control and equipment rooms; all as indicated on the plans, revised in these special provisions, or as may be directed by the Engineer for completion of the work.

The intent and purpose of these specifications is to cover and include all electrical apparatus, appliances, material and labor necessary to properly install, wire, equip, test, adjust, and place in approved working order the electrical and mechanical installation herein specified. Any apparatus, device, circuit, appliance, fixture, material or labor not herein specifically mentioned or included, but that may be found necessary to complete or perfect the installation, operation and equipment in a substantial manner acceptable to the engineer, shall be furnished by the contractor as if specifically included in these specifications, and without extra cost.

B. Materials and Workmanship. The electrical equipment and its installation shall conform to the requirements of the AASHTO 1978 "Standard Specifications for Movable Highway Bridges", and the applicable requirements of Section T400 of the standard specifications for traffic control items except as amended herein. Additionally, all equipment, material, and its installation shall meet the requirements of the latest editions of the National Electrical Code ANSI/NFPA 70 and the applicable requirements of the state of Illinois Electrical Codes.

Equipment, materials and workmanship shall be first-class in every particular, and shall be manufactured and erected to fulfill the intent of the contract.

Each piece of electrical equipment and apparatus shall have a permanent-type corrosion-resisting metal nameplate on which is stamped the name of the manufacturer, the catalog or model, and the rating or capacity of the equipment or apparatus. Unless otherwise approved or noted, all electrical equipment shall be manufactured by Square D, the General Electric Company, Westinghouse Electric Company, Cutler-Hammer, or equal. All permits necessary for making the electrical installation shall be obtained by the contractor at his own expense. The contractor shall also file with the engineer a certificate of final electrical inspection and acceptance by an approved inspection agency.

C. Working Drawings and Samples. The contractor shall submit for approval within 60 days after award of the contract, six sets of the following working drawings executed in accordance with the provisions of the contract:

(1). Certified dimension prints of all limit switches, disconnect switches, contactors, reactors, resistors, and other electrical apparatus external to the control console and Motor Control Centers.

(2). A complete schematic wiring diagram including all power, signal interlocking, control lighting, heating, internal and external wiring, and connections and interconnections. Each electrical device shall be identified by an individual designation of letters, numbers or a combination of both, and the same designations shall be used wherever the device appears on other drawings.

(3). Layout drawings and connection diagrams of the Control Console and Motor Control Center.

(4). A schedule of electrical apparatus which shall list each electrical device by its designation as shown on the schematic wiring diagram, and shall state for each device its manufacturer, voltage and ampere rating, number of poles or contacts, functions, catalog designation and number, and location.

(5). Layout of the secondary resistors for the leaf motors as required with resistances and impedances included.

(6). Detail drawings of all electrical panelboards.

(7). Construction details of all wiring ducts or raceways.

(8). Construction details of the multiconductor cable supports.

(9). A complete schematic conduit diagram or diagrams, showing the interconnection of all devices and equipment, including ducts and junction boxes, and showing multiconductor cables. The size of each conduit and the wire number of each conductor therein, and the number of each conductor in multiconductor cables shall be shown on the diagrams. Each conduit and multiconductor cable shall be suitably numbered or lettered.

(10). A complete set of layout and installation drawings for the electrical work, showing the location and installation of all electrical apparatus and equipment. These drawings shall show the exact location of all conduits, cables, wiring ducts, boxes, motors, brakes, limit switches, disconnect switches and other electrical equipment, and the method of supporting them on the structure.

(11). Arrangement of conduits, cables, boxes, flexible connections, etc., to the leaves, to the navigation lights, to the television camera, and to the lights.

(12). Arrangement of wiring for all traffic control and interlocking with leaf movements, and for lighting fixtures.

(13). A complete list of all tools and spare parts furnished as part of the contract.

(14). Any other drawings which may, in the opinion of the engineer, be necessary to show the electrical work completely.

Conduit layout drawings shall be submitted for approval so that the provisions required for the mounting of conduits, cables, and electrical apparatus, where required, can be shown on the steel drawings.

Each certified dimension print of apparatus shall state in the certification the name of the job, contract number, the application of the apparatus, device designation, number required, right-hand or left-hand assembly, electrical rating, number of poles or contacts, and any other pertinent data to show that the apparatus meets the specified requirements.

The contractor shall submit for inspection and test, if directed by the engineer, samples of any apparatus or device which he proposes to use as a part of the electrical installation. These samples will be returned to the contractor after inspection.

D. Instruction Books and Display Drawings. The contractor shall furnish six bound copies of a booklet containing the following:

(1). Table of Contents.

(2). Operator's Instructions, which shall cover in full the step-by-step sequence of operations of the traffic control, the bridge and its auxiliaries, and shall note all precautions required for correct operation. Complete instructions for the following shall be included:

a. Procedure for traffic control.
b. Operation of both leaves simultaneously.

(3). Description of Control, which shall describe in full the functions of all protective devices, limit switches, contactors, relays, and all other electrical equipment used in connection with each step in the operating sequence. Wire numbers and apparatus numbers appearing on the wiring diagrams shall be used in this description for identifying the various devices and circuits.

(4). Detailed maintenance instructions for adjusting, lubricating, and operating all of the electrically operated equipment, including manufacturer's recommended preventative maintenance lubrication schedule.

(5). A set of descriptive leaflets, bulletins and drawings covering all items of equipment and apparatus made a part of the completed bridge operation and control. The catalog number of each piece shall be given, to be used in case it later becomes necessary to order replacement parts from the manufacturer. This information shall be furnished for all electrical equipment such as motors, brakes, limit switches, circuit breakers, relays, controllers, closed circuit television system, etc.

(6.) The contractor shall also furnish six bound copies of a booklet containing reduced size photostatic copies of the following drawings, corrected to show the work as constructed:

a. The complete spare parts list.
b. All schematic wiring diagrams.

(7). The control console and control panel layouts and wiring diagrams for all equipment at bridge.

(8). The schedule of electrical apparatus.

(9). The complete speed-torque-current curves for the leaf motors.

(10). All conduit layout and installation drawings.

The materials shall be permanently bound into each booklet between rigid plastic or cloth binding covers. The instruction booklets shall be approximately 9 inches by 12 inches, and the diagram booklet large enough to contain the drawings without excessive folding so that they may be easily opened. The booklets shall be neatly entitled with a descriptive title, the name of the job, the location, year of installation, owner, manufacturer, contractor and engineer. Copies of drawings shall be in black and white background and shall be easily legible. The arrangements of the booklets, the method of binding, materials to be included, and the composite text shall be reviewed and approved by the engineer.

The contractor shall furnish one black and white print or photostatic copy each of the complete schematic wiring diagram, the wiring diagram of the control desk and control panels, and of the schematic conduit diagram. Each print shall be provided with a heavy-gauge, clear plastic envelope with bound edges, in which the drawing shall be inserted. An approved cabinet or rack for storage of the envelopes shall be furnished and installed on the wall of the control room where directed by the engineer. The drawings shall be corrected, wherever necessary, to agree with the actual connections of all equipment as installed.

E. Tests of the Electrical Installation. Under this item the contractor shall arrange for and provide all the necessary field tests, as directed by the engineer, to demonstrate that the entire electrical system and operation is in proper working order and in accordance with the plans and specifications. During the construction and testing period, electric power for operation of the bridge shall be furnished by the owner.

During the testing period, the contractor shall arrange to have at the site a representative of the manufacturer of the bridge control equipment. This representative shall be capable of making adjustments to the equipment, of locating faults or defects and correcting them, and of obtaining from the manufacturer without delay new parts or replacements for apparatus which, in the opinion of the engineer, does not perform satisfactorily.

Should the tests show that any piece of equipment or cable wiring in the judgment of the engineer, is defective or functions improperly, such adjustments and/or replacements shall be made by the contractor as to make the installation completely acceptable to the engineer, and at no extra cost to IDOT.

F. Commercial Power Supply. Secondary commercial electric power for operation of the bridge and its auxiliaries is supplied at 480 volts nominal, 3-phase, 3-wire, 60-hertz by Commonwealth Edison Corporation from a transformer vault on the east side approach. The transformers are owned and operated by Commonwealth Edison Corporation.

The contractor shall furnish and install new secondary service electrical service from the transformer vault to the disconnect switch located in the tenderhouse. These service cables shall be composed of 500 MCM, stranded copper, 600 volt conductors conforming to the requirements set forth elsewhere herein. All materials including cables, conduits where necessary, hangers and fittings shall be furnished and installed by the contractor. The contractor shall verify all service information with the Commonwealth Edison Corporation.

G. Motor Control Center. Furnish and install a complete integrated control system including motor control centers to provide the control functions indicated on the plan diagrams, equipment schedules, frontal elevation drawings and as further described herein.

Equipment shall be as manufactured by Allen-Bradley, Cutler Hammer, Square D, or equal.

Individual units shall be designed to form a complete control system, including all necessary electrical interlocking and interwiring between units within the structure, with terminal block provisions for connecting all remote mounted devices associated with the control system.

Door mounted engraved nameplates shall be provided for each unit.

Number and type of motor starters, circuit breakers, motor circuit protectors, selector switches, pilot lights, interlocks and other special features shall be as indicated on the plan diagrams, and further described herein.

All structure wireways and bus bars shall be designed in accordance with the requirements of NEMA Standards and U.L. 845. All control centers shall be in NEMA I enclosures with Class I, Type B wiring.

The center shall consist of the required number of independent free standing steel sections, 84 inches high, 60 inches wide, and 15 inches deep, bolted and bussed together to form an integrated structure. Exceptions, control panels and other special panels may be 30 inches in width.

All horizontal and vertical bus shall be copper braced for 22,000 amps RMS sym. Vertical bus shall run the height of each section including spaces and be bolted with large plated flat washers to main bus.

Each section shall be dead front. Units shall be mounted on the front of the sections as indicated on the plans.

Full width pan type doors with 1/4 turn latches and concealed hinges shall be provided for all units and future spaces as specified.

All sections shall have a top and bottom horizontal wireway isolated from bus bars by a steel barrier, white interior, and connected between sections by grommeted holes. One vertical wireway shall run the full height of each section and be approximately 4-1/2" x 8-3/4" deep.

The full height of the unit mounting space shall have a plastic protective cover over the bus to prevent accidental contact with live bus. Unit stabs onto the vertical bus shall be located at 6 inch intervals and be covered with a removable clear shield.

All enclosures shall be furnished with two coats of an ovenbaked DuPont enamel after a phosphatizing treatment and a zinc chromate primer have been applied. Enclosure exterior shall be medium light gray #49 per ANSI 255.1. Enclosure interior shall be white.

A copper ground bus shall be mounted in the bottom of the structure and shall extend the full length of the motor control center.

All MCC units shall be of the plug-in type with a steel vertical mounting pan, top and bottom plate; handles, white interiors and pull apart terminal blocks.

Units shall be of modular dimensions so that it is possible to readily interchange units of the frame size without modification in structure.

Units shall be supported in the structure on side support brackets and stab onto the bus bar by means of free floating self-aligning silver plated clips.

Units shall be secured with 1/4 turn latches in the plug-in position to assure positive bus alignment.

A disengaged test position with padlocking provisions shall be provided.

The breaker operating mechanism shall have an up-down motion clearly indicating the on-off position. The operator shall be interlocked with the unit door so access is prohibited with the breaker (except by use of a defeater mechanism) and capable of being padlocked in the off position.

All motor starters shall be of standard NEMA sizes except no smaller than NEMA Size 1 shall be used in any unit and shall contain:

(1). A starter nameplate with:

a. NEMA Size, HP and voltage
b. Replacement contact part number
c. Renewal parts publication number

(2). Three coil eutectic alloy overload relays

a. Heater elements shall be Class 20.
b. High temperature operation trip elements shall be used to prevent nuisance tripping under high ambient condition.

(3). Provisions for up to 8 auxiliary contacts including coil holding circuit as well as pneumatic timing attachments and terminal blocks.

(4). 120 volt control circuits.

(5). Color coded cover controls as indicated.

(6). Door interlock switch to de-energize control power.

(7). Other special equipment shall be as indicated on the plans or as further specified herein.

H. Grounding. The electrical systems and equipment are to be grounded as required by Code, Utility, local ordinances and the requirements contained herein.

An electrical grounding system shall be installed which consists of driven copperweld ground rods not less than 3/4 inch diameter and 15 feet long driven full length into the earth on the downstream side of the bridge, one on each side of the river.

The main grounding conductor shall be continuous from driven grounds to electrical service equipment and the steel superstructure. This grounding conductor shall consist of not less then 2/0 bare, soft annealed copper wire.

Grounding conductors shall be connected by exothermic weld to a bared superstructure steel member. The movable section of the bridge shall be bonded to the main structure with exothermic weld connectors and flexible copper braid straps. Each movable leaf shall be bonded in this manner on each side of the bridge. All damaged painting shall be restored.

All metallic conduits, supports, cabinets and other equipment shall be grounded so that the ground will be electrically continuous from service to all outlet boxes. Provide grounding conductor in all non-metallic conduit to complete equipment ground continuity.

Grounding conductors shall be so installed as to permit shortest and most direct path from equipment to ground. Where grounding conductor runs through metallic conduit, it shall be securely bonded to the conduit at the entrance and exit and the conduit shall be fitted with a bolted clamp to secure same to ground.

The metal framing and enclosure of all electrical equipment such as control console, Motor Control Center, motors and other apparatus shall be attached to or bonded to the structural steel or the electrical grounds.

Grounding system terminals shall be solderless type, secured by means of hexagonal-head, zinc-plated steel machine bolts with lock washers. Grounding system conductors shall be continuous unspliced connections between terminal lugs.

Flexible metallic conduit is not to be considered an effective grounding conductor. In all cases where flexible metallic conduit is used, a grounding conductor shall be installed.

I. Leaf Drive Motors. The two identical electric drive motors for operation of each leaf shall be removed, rehabilitated, tested, and reinstalled. This rehabilitation shall include disassembling the motors, cleaning, replacing brushes and bearings, turning the slip rings, inspecting the housing, and inspecting and testing the rotor and stator windings. Based on the results of the inspection and tests, the rotor and stator windings shall be dipped and baked or rewound at the direction of the Engineer. If it is determined that a rotor or stator needs rewinding, then both rotor and stator of both motors on that leaf shall be rewound.

After the motors have been reassembled, speed-torque-current curves shall be determined by test with rotor short-circuited. In addition, the short commercial test shall be performed on each motor. Motors shall not be installed until the test reports have been approved by the Engineer.

J. Leaf Control. Resistance controllers for the span-driving motors shall provide for power control of the motors. Six steps of resistance shall be provided. These steps shall match the existing system and be such that the motor torque will differ as little as practical from the average torque required for uniform acceleration from zero speed to full speed. The steps of resistance shall be such that the bridge will start slowly and will accelerate smoothly. Separate resistors shall be provided for each motor.

The resistance controller shall be so arranged that a small amount of resistance shall always be left in the rotor circuits of each motor. This permanent resistance section shall be adjustable after installation and shall be proportioned for continuous duty. The resistors for motor control shall be non-breakable, corrosion-resistant, edgewise-wound or punched-grid resistor units. The resistors shall be of a capacity equal to NEMA intermittent cycle rating providing for 60 sec. on out of each 90 sec. With the resistors there shall be furnished a steel frame on which the units or sections shall be so mounted as to be free from injurious vibration and to permit free circulation of air around them; and so that any unit or a part of a unit may be removed and replaced without disturbing the others. The units shall be insulated from their supports.

For control, the span motors and brakes on each leaf shall be controlled from separate cam-type master switches mounted in the control console. The controller on the bridge for each leaf shall have six power points numbered 1 thru 6 for either direction of travel and point 0 to release leaf motor brakes without energizing leaf drive motor. On point 1, the reversing contactors shall be closed, applying power to the motor and on the remaining five power points the motors shall be accelerated with full speed on power point 6. The two directions of the controller shall be marked "Raise" and "Lower".

The master switches for the span-driving motors shall be cam-operated switches with a single handle, and provided with necessary contacts and contact fingers for operating the magnetic contactors. The contacts and wearing parts shall be easily removable and replaceable. Master switch shall be similar to Square D Class 004 TYPE VO-12 or equal.

Magnetic contactors shall be Square D, Allen-Bradley, Westinghouse, General Electric, or equal. The continuous current rating of the open contactors shall be not less than that shown on the plans, and no starter shall be smaller than NEMA Size 2. All contact poles shall be provided with arc-chutes, and contactors rated 150-amperes and above shall be equipped with magnetic blowout.

Power should normally be reduced manually prior to reaching the nearly open or nearly closed positions. However, if this is not done prior to when a leaf reaches the nearly open or nearly closed position, it shall automatically be limited to power points 0 thru 3 by span limit switch actuation, regardless of master switch position. Upon reaching the nearly open or nearly closed position, the forward power shall be shut off to the drive motors and then the braking shall apply. If the operator does not do this manually a span limit switch shall.

K. Drive Controllers. Two leaf drive controllers shall be installed below the control room. All electrical control devices and auxiliaries shall be mounted dead-front in these panels installed in cabinets accessible from the front. All circuit breakers, fuses, magnetic contactors, switches, relays, resistors, and other control equipment not elsewhere specifically located shall be installed in these cabinets. Shop drawings of the cabinets, the make-up of their components, and location layouts will be required for review, approval, and records.

These panels shall be NEMA Type 1 General Purpose enclosures constructed of not less than No. 11-gauge sheet steel, suitably reinforced with steel angles or channels, and shall not exceed 84 inches high by 60 inches wide. Hinged door panels shall be provided for access to the equipment on the fronts of the panel. Hinge pins shall be removable. All hardware and fittings shall be non-corrodible. The enclosures and all metal reinforcing shall be painted inside with two coats, and outside with three coats of paint consisting of one coat of primer followed by two coats of ANSI #49 gray enamel outside, and primer and one coat of gray enamel inside.

L. Operating and Emergency Leaf Brake Motors. The four electrically operated thrustor brake motors installed in the machinery room for each leaf shall be cleaned, inspected, and checked for proper operation.

M. Traffic Control Signals. Provide an audible alarm wiring a 12" diameter, 2" deep steel gong with clapper operating note of 100 to 225 strikes per minute. Alarm shall be audible out to 1000 feet on a windless day and with negligible interfering noises.

Each signal head shall be of the adjustable, colored light, vertical traffic control type with the number and type of lights as shown on the plans; shall provide a light indication in one direction only; shall be adjustable through 360 degrees about a vertical axis, and shall be mounted at the location and in the manner shown on the plans. All signal heads shall be standard and shall contain lights as shown on the plans. All signal heads shall be of the same make and type.

The optical units shall consist of a lens, a reflector, a lamp holder, and an A-21, 130-volt, clear, group replacement, traffic signal lamp of 150 watts nominal in the 12-inch signals, visible to the traffic to be controlled, at all distances from 10 feet to 500 feet, under all light and traffic conditions except dense fog.

Lenses shall be of the color indicated, circular in shape, with a visible diameter of 12 inches, as indicated, and of such design as to give an outward and downward distribution of light with a minimum above the horizontal. Each lens shall be true to color, of best quality glass, free from imperfections, of high illumination transmission, and shall conform to latest specifications of the Institute of Traffic Engineers.

Each reflector shall consist of a one-piece best quality clear glass parabolical reflector, free from bubbles and striae. The convex surface shall be silvered by chemical deposit to such thickness that the lighted filament of an incandescent lamp will not be visible through the silver layer. The silvered surface shall be protected by an additional coating of electrolytically deposited copper. An opening in the back of the reflector for the lamp holder shall be so constructed that there will be no dark spots cast on the lens.

The lamp holder shall be of weatherproof molded construction, immune to the operating temperatures in the unit, of the vibration proof type, and shall be substantially supported independent of the reflector. The lamp holder shall be provided with two wires of sufficient length to be connected to the terminal block specified below.

Each reflector, lens, and hood shall be designed in such a manner as to reduce sun-phantom to a minimum.

The signal head housing, or case, shall consist of an assembly of separate section, expansible type for vertical mounting, substantially secured together in a watertight manner to form a unit of pleasing appearance. Each section shall house an individual optical unit.

Each section shall be complete with a one-piece hinged door, mounting for the lens and other parts of the optical system, watertight gaskets, and a simple, non-corrodible door locking device. The optical system shall be so mounted that the various parts may be swung open for ready access or removal. The sections shall be interchangeable and so constructed that sections can be removed or added. There shall be a round opening in the top and bottom of each head to receive 1-1/2 inch supporting pipe frame. All parts of the housing, including the doors and end plates, shall be of die cast anodized aluminum conforming to the provisions of ASTM Designation B 85, and all parts shall be clean, smooth, and free from flaws, cracks, blow holes, or other imperfections. All parts such as hinge pins, lens clips, locking devices, etc., shall be made of non-corrodible material.

A terminal block of an approved type shall be mounted inside at the back of the housing. All sockets shall be so wired that a white wire will be connected to the shell of the socket. These wires shall in turn be connected to the terminal block mounted in the housing, in the proper manner. The terminal block shall have sufficient studs to terminate all field wires and lamp wires independently to the block, with separate screws. The terminals to which field wires are attached shall be permanently identified to facilitate field work. Where terminal compartment is used, terminal block in associated heads may be omitted.

Each lens shall be protected by a removable hood 0.030 inch thick, sheet anodized aluminum of the full-circle type completely closed, except at the ends, eight inches long and so designed as to prevent a false indication to traffic not intended to be controlled by that particular signal face. The inside surface of all hoods shall be painted a flat black to prevent reflection.

Signal heads shall be so designed that they can be mounted on a standard pole and base.

N. Traffic Barriers. The Electric Bridge Gates shall consist of a reciprocating crank drive mechanism in a heavy duty welded steel housing. The electric bridge gate shall be capable of driving a maximum of a 35 foot roadway arm. The electric motor shall drive the reciprocating crank drive mechanism through a power train consisting of a heavy duty worm reducer and spur gears. The actual length of the roadway arm shall be as shown on the plans. Gates shall include, for simultaneous operation, members which lower and raise across pedestrian ways. It shall be equipped with removable hand crank for manual operation in case of power failure.

The housing furnished shall be of a welded steel type fabricated of 1/4" steel plate and given a heavy coat of hot dip galvanizing. This housing shall be designed with bearings for arm shafts and welded in place as integral parts of the housing, and babitted with a #4 grade babbit material.

Mounting holes shall be provided in the base of the housing, consisting of four 1" diameter holes arranged for anchor bolts.

The housing shall have one large gasketed weatherproof door on both faces for easy access for maintenance of the gate operating mechanism within the housing. Each housing shall include a minimum of 250 watt electric heater with a 20°F to 60°F adjustable thermostat.

The bottom of the housing shall be entirely open for incoming conduit and cable.

The power transmission shall limit the gate arm travel to 90 degrees motion in a vertical plane. The mechanism shall accomplish this in 11 seconds. The power transmission shall consist of a Reciprocating Crank Assembly and a Power Train Assembly as follows:

1. Power train assembly shall consist of a motor, worm gear reducer mounted on a single rugged structural steel base. The output shaft of the motor is coupled by spur gears into the intermediate shaft. The intermediate shaft shall be coupled by spur gears into the input shaft of the gear reducer. The output shaft on the gear reducer shall turn 180 degrees in the specified operating times. The motor shall be equipped with Magnetic Disc Brake and the intermediate shaft bearing shall be equipped with an Alemite type grease fitting.

   The totally enclosed worm gear reducer shall consist of a leaded steel worm, 86-20 carburized and hardened to 60-62 Rockwell C, and a centrifugally cast bronze worm gear welded to a hub housed in a cast aluminum housing. The bearings on the input and output shaft shall be Timken tapered roller bearings. The worm gear reducer shall be self-locking for any position of the gate arm, when the driving motor is de-energized. No roller chains, open worm gear unit or segmented worm gear units shall be used in the power train.

2. Reciprocating crank assembly shall consist of a roadway shaft, limit switch cams, connecting rod and a crank on the output shaft of the gear reducer. When the output shaft of the gear reducer turns 180 degrees, the connecting rod will drive the roadway shaft 90 degrees.

   The operating mechanism for the gate arm shall start its acceleration at "0" degree position and accelerate to the 45 degree position. From the 45 degree position to the 90 degree position, the gate arm shall de-accelerate to enable the mechanism to come to a slow stop and eliminate undue strain on both the gate arm and operating mechanism. All bearings in the reciprocating crank mechanism shall be equipped with Alemite type grease fittings.

Limit switches shall be provided and shall be rated as follows:

1. 30 AMP at 125-250 VAC non-inductive
2. 1 HP at 125 VAC
3. 2 HP at 250 VAC

The limit switches shall be supported from an adjustable steel bracket mounted to the gate housing. The limit switches shall be actuated by cams mounted on the roadway shaft. Each limit switch shall be actuated by adjustable cams on the roadway shaft for indication and stopping the drive motors at limits of travel.

The operating mechanism shall be a 1/2 HP motor with a Magnetic Disc Brake. This motor shall be three phase, rated for 460 volts, 60 hertz.

The motor shall be rated for 40° C rise continuous. The motor shall be of a protected open frame construction, equipped with ball bearings. All windings shall be resistant to heat, electrical strain, oil and water vapors. The motor shall be designed to permit instant reversal.

All internal wiring from lights, limit switches and motors shall be terminated at a terminal block for connection to external circuits. These terminals shall be mounted inside the housing on one wall.

Wood roadway arms of a double boarded or wishbone construction shall be furnished in lengths as shown on the plans. They shall be made of clear, straight grain select, White Pine, free of knots and pitch checks, properly braced and trussed, and shall be designed for ample strength and lightness, consistent with their specified length, and painted with one coat of primer, and a finish of white enamel and striped with safety orange diagonal stripes 16" long on a 45 degree angle.

The wood arms shall be furnished factory wired and equipped with three gate arm light fixtures, and complete wiring to terminal blocks in the base of the unit. Lenses of gate arm light shall be mechanically secured to fixture to eliminate breakage or loosening from gate movement and vibration. Insulated conductors shall be installed between each terminal box and flexible drip loop provided from fixture nearest gate housing to terminals in gate housings provided for this purpose. The fixtures shall be rated for 130 volts and shall be controlled by the flasher unit in the Control Console. Each gate shall include a traffic signal bell activated from the control console.

The roadway arms shall be designed for installation on channels furnished with the gate mechanism for mounting on each end of the roadway shaft. These channels shall also have mounted on them the correct amount of counterweights comprised of plates and sliding weights so that an accurate balance may be obtained after gate arms are installed.

O. Barrier Control. For normal span operation, the operation of the barriers at each approach to the bascule span shall be wired so as to be controlled from selector switches mounted in the control room.

The reversing contactors for each barrier motor shall be electrically and mechanically interlocked, and they shall be equipped with three-element thermal overload trips.

All wiring provided to and for each barrier shall be completely weatherproof, and all electrical work shall be approved type for outdoor service in an unprotected location. Each barrier will be provided with cast-iron, gasketed conduit boxes for connections of the motors, limit switches and brake leads.

P. Operating Procedure. The detailed sequence of operation of the bridge shall be as noted on the plans.

The leaf operating circuits shall be so arranged so that the leaf motor starters will open if any of the following conditions exist.

(1). The overloads for the leaf motor or brakes are open.

(2). In-sight switches for the leaf motors are opened.

(3). A starter problem develops.

At the full closed position, the action of the operator shall be backed up by limit switch and timer action so that if for any reason the operator should not turn the controller to the "off" position in the designated time, power will automatically be removed from the span motor and the brakes will set.

The various control operations shall be so interlocked that they can be performed only in their proper sequence, and that no damage shall result from an incorrect operation. This interlocking shall be arranged as follows:

(1). The traffic barriers cannot be closed if the traffic lights are not red.

(2). Span cannot be operated unless:

1) Traffic signals are red
2) Barriers are closed

(3) Barriers cannot be opened unless:

1) Traffic signals are red
2) Leaves are seated

Key operated switches for bypassing the sequence interlocks in an emergency shall be provided and keyed to match all other keyed switches in the tenderhouse, and installed on the control console.

Q. Control Console . A control console as shown on the plans shall be furnished and installed in the control house for the electrical control and operation of the span and its auxiliaries. Controls shall be assembled and tested in shop prior to delivery to site.

The control console shall be installed in the control room of the house where indicated on the plans. On this console shall be mounted all devices necessary for the signal and electrical control of the bridge.

The control console shall be of neat, substantial construction. It shall be fabricated from not less than No. 11 gauge sheet steel properly formed and suitably reinforced by steel angles to provide adequate strength. The top shall be of non-reflecting finish. Removable doors shall be provided on the front and side panels of the console, pivoted on 90-degree hinges and secured with 3-way latches. The console shall be neatly fitted up with close joints, and all rough edges or corners shall be ground off smoothly and all projecting edges rounded off. All metal hardware shall be of substantial construction, and shall have a satin-chrome plate finish. The sheet steel portions of the console and all metal reinforcing shall be painted inside with two coats and outside with three coats of paint consisting of one coat of primer followed by two coats of gray enamel on the outside surfaces, and one coat of gray enamel inside.

Leaf controllers, control switches and other control devices shall be mounted within the body of the console. All keyed switches shall be keyed identical, both on console and in equipment room. The indicating lights for each operation shall be mounted adjacent to the control device governing that operation.

The escutcheon plates of all control switches, pushbuttons, pilot lights, tumbler switches and bypass switches shall be made of hot-polished, laminated phenolic compound not less than 1/16-inch thick. The compound shall have a black surface, an intermediate white layer and a black back. All corners shall be rounded, and the edges of the plates shall be chamfered. All engraving shall be upper case, standard gothic characters, cut through the surface into the intermediate white layer. Engraving of device title shall be 3/16 in. high and engraving of function shall be 1/8 in. high. All plates shall be securely fastened to the desk top with monel or stainless steel screws, or aluminum pop rivets.

The wiring within the control console shall be thermo-plastic-insulated switchboard wire conforming to the requirements of back-of-panel wiring of the normal control panel. The wiring shall be arranged systematically so that all circuits can be readily traced. All conductors shall be terminated on easily accessible terminal blocks mounted inside the console at the rear. Spare terminals totalling at least 10 percent of those actually used shall be provided. Wiring shall be identified at equipment terminals by marking the adjacent area with bridge yellow painted numbers to correspond to conductor designations appearing on the contractor's wiring diagrams. Control console shall be as manufactured by Square D, Cutler Hammer, General Electric, or equal.

R. Indicating Lights. Indicating lights shall be "Press-to-test" and mounted on the control desk to show that the various steps in the sequence of operation have taken place so that the operator may proceed to subsequent steps at the proper time.

The functions to be indicated, and the color of the lens for such indication shall be as shown on the plans. Each indicating light shall be suitable for mounting on the console as shown on the drawings.

S. Leaf Position Indicators. Leaf position indicators shall be provided for each leaf, and shall be mounted on the control console. The indicators shall be driven electrically by transmitters mounted in the pier machinery rooms and geared to the operating machinery. These units shall be as follows:

(1) High accuracy selsyn receivers shall be installed to indicate the position of each leaf. Each receiver shall be driven by a high-accuracy selsyn transmitter which shall be geared to the operating machinery. Each selsyn receiver shall drive a vernier pointer directly.

(2) All indicator dials shall be approximately 6 inches in length, and shall be internally illuminated. The indicators shall have a black pointer, and the scale shall be graduated in degrees of travel from 0 degrees to 87 degrees with figures for every 10 degrees. The interval from the open position (60 degrees) to the maximum opening (71 degrees) shall be marked in red, while the balance of the dial shall be marked in black. The indicator dial pointers shall be held as close to the dial face as possible to eliminate parallax. Scale of receiver shall start at zero and indicate 87° at full 270° rotation of indicator.

T. Closed Circuit Television System. Provide and install a video surveillance system as shown on the drawings and specified herein. Provide all incidentals and accessories required for the complete operational installation whether or not specifically mentioned herein. Principal items required include, but are not necessarily limited to, camera, lens, mounting, housing, 12" video monitor and necessary cables.

The outdoor camera installation shall consist of a prepackaged camera with integral environmental housing, including sun visor or sun-shield, and be designed for operating temperatures ranging from -25°F to 122°F. The camera shall provide a useable picture at low light levels with scene illumination as low as 0.03 footcandles. Camera shall be 1" extended range, high resolution and be equipped with automatic light range and automatic beam control. Power source shall be 120 VAC, 60 Hz. Acceptable manufacturers include RCA, COHU, or equal.

Camera support shall be rated to support a minimum of 200 pounds loading. Camera shall be supported by an extremely rigid structure. Small camera movement created by wind or shaking of support can destroy effectiveness of the camera.

Vendor is to provide equipment, mounting and assembly of system, final connections and warranty for a period of one year from date of acceptance. This warranty is to include parts, labor, and travel time required to maintain the system in full operation.

U. Conduits and Junction Boxes. Remove all existing exposed conduit 1 1/2 inch and smaller. All existing conduits over 1 1/2 inches shall be inspected and those which are found to be in less than satisfactory condition shall be replaced as directed by the Engineer. All conduits shall be either specification ANSI C-80.1 Rigid Steel Conduit, zinc coated inside and out or NEMA Standard #RN-1 PVC coated rigid metal conduit; 40 Mil thick PVC ocatings, conduit fittings, pull boxes, and ells shall be either zinc coated ASTM-A 153, malleable or cast iron, or full weight 40 mill PVC jacketed, matching the type of conduit being used.

All conduit, fittings and boards located above deck level shall be the rigid steel type and below deck level shall be the PVC coated type including PVC coated hanger, spacers, etc.

After conduits are installed, the openings shall be caulked with an elastic compound and escutcheon plates provided on the interior walls, ceilings and floors for air-tight fits.

Conduit runs exposed shall be attached to steel or concrete by galvanized straps or hangers held at not less than two points by galvanized bolts or lag screws. Expansion bolts for securing devices or supports to concrete surfaces shall consist of hexagonal-head, galvanized machine bolts with Closed-Back Expansion Shields. Conduits mounted exteriorly on parts of the steel work shall be set not less than 2 inches clear from the steel members to permit access for painting, and they shall be clamped securely to the steel work to prevent rattling and wear. All U-bolts and all other detail parts shall be hot-dip galvanized, and shall be included for payment under this item of Work. The spacing of the clamps shall not exceed 4 feet.

All conduits shall be installed so that they will drain properly and drainage tees shall be provided at low points where required.

At any point where a conduit crosses an expansion joint, or where movement between adjacent sections of conduit can be expected, bronze or alloy expansion fittings shall be installed as Type EX made by the O.Z. Electrical Manufacutring Co., Inc., Crouse Hinds, or equal.

Connections between the rigid conduit system and all motors, brakes, and limit switches shall be made with bronze flexible hose with brazed-on brass couplings and threaded terminal fittings. The hoses shall be fully interlocked and shall be Type RT-6 as made by the Flexonics Corp., or flexible, liquid-tight Type UA-OR as Anaconda's Sealtite, or equal.

All conduits shall be carefully cleaned both before and after installation. Upon completion of the conduit installation, the contractor shall clear each conduit by snaking with a steel brush to which shall be attached an approved tube cleaner equipped with a mandrel of a diameter not less than 85 percent of the nominal inside diameter of the conduit, and shall then draw in the conductors.

All terminal boxes shall be of welded plate construction as indicated on plans. All other exterior pull, junction, and splice boxes shall be cast-iron, hot-dip galvanized inside and out, and shall be provided with hinged covers of the same material and gaskets to insure their being water-tight. They shall be of waterproof construction with overlapping cover and brass wing-nut fastenings, and shall be Type YW as made by the O.Z. Electrical Manufacturing Company, Crouse Hinds, or equal.

All interior pull, junction and splice boxes shall be cast-iron, hot-dip galvanized inside and out, and shall be provided with gasketed, recessed covers held with monel metal screws. They shall be Type YS as made by the O.Z. Electrical Manufacturing Company, Crouse Hinds, or equal.

Drain holes shall be provided in the boxes. All boxes shall be provided with mounting lugs and shall be securely fastened to the structure with not less than four bronze or monel metal through-bolts.

All cast-iron boxes shall be bossed, drilled and tapped for threaded conduit ends, which shall enter squarely. Sheet metal enclosures shall be drilled to receive the conduit ends which shall be secured with two lock-nuts. The conduit ends projecting into all boxes and enclosures shall be equipped with insulated bushings, O.Z. Type HB, Crouse Hinds, or equal. No box enclosure shall be drilled for more conduits than actually enter it.

Framework for supporting boxes, switches and other externally mounted electrical devices shall be fabricated from structural steel not less than 1/4-inch thick, or if material or thickness less than 1/4-inch is used, it shall be hot-dip galvanized.

All mounting bolts, nuts, washers, and other details used for fastening boxes, conduit clamps and similar devices shall be brass, monel metal, or stainless steel. Bolt heads and nuts shall be hexagonal, and bolts smaller than 3/8-inch in diameter shall not be used, except as may be necessary to fit the mounting holes in small limit switches, outlet boxes and similar standard devices.

V. Wires and Cables. All existing exterior wire and cable shall be replaced and all interior wire and cable shall be inspected and those wires or cables not conforming to this specification shall be replaced as directed by the Engineer. All existing aerial cable shall be replaced.

The existing aerial cable shall be replaced with multiple-conductor, power and control cables suitable for aerial suspension. These cables shall be suspended by double spiral wrapped with stainless steel polypropylene coated lashing tape attached to a copperweld messenger at two revolutions per foot. The messenger shall support the cables under extreme conditions of ice, wind and temperature and terminated with a Kellems strain relief grips. Contractor shall submit in writing calculations determining messenger size. The cable outer jacket shall exhibit superior resistance to weathering, sunlight and aging. The cable shall consist of the number and size of copper conductors as shown on the drawings.

Provide the following cable Type W Insulation as shown below:

Type	No. of Conductors	AWG Size	Stranding	Individual Insulation	Overall Jacket	Grd. Wire
A	4	#2	CLASS B 7	XHHW	Neoprene	Yes
	4	#4	CLASS B 7	XHHW	Neoprene	Yes
	54	#10	CLASS B 7	XHHW	Neoprene	Yes
B*	8	#2	CLASS K 133	XHHW	Neoprene	Yes
	8	#4	CLASS K 133	XHHW	Neoprene	Yes
	44	#10	CLASS K 105	XHHW	Neoprene	Yes

* - Extra flexible type portable type power cable.
- If single multi-conductor cable is not available three separate cables may be used.
- Cable to be installed to prevent being damaged by bridge movement.

The manufacturer shall make tests of conductors and other component parts as required by the applicable I.P.C.E.A. Standards, and shall submit six (6) certified copies of all such test reports to the engineer. The contractor shall provide adequate equipment for installation of the cable. All cable bends shall be of large easy curvature well within that recommended by its manufacturer so as not to damage or overstress the cable or its insulation.

All cables in conduits or ducts shall generally be single conductors. Multiple-conductor cables shall be used for suspended aerial loops of power and control cables between the leaves and the piers, and for all flexible control and lighting cable connections. Flexible stranded conductors shall be used in aerial cable to carry the circuits from the piers to the leaves, and for connections of lighting circuits to the suspended navigation lights. Multiple conductor cables shall be installed open, and supported as indicated.

All conductors shall be of stranded copper, large enough to carry safely the maximum currents required, without injurious heating or serious voltage drop, and they shall conform to the Standardization Rules of the Institute of Electrical and Electronics Engineers and of Under-writer's Laboratories, Inc. No conductors shall be smaller than No. 10 American Wire or Browne and Sharpe gauge, except as approved specifically for the internal wiring of lighting fixtures and controllers. All insulated wires and cables and their insulation and covering shall have the marks always used on the particular brand for identifying it. All resistor bank wiring shall be with type IA or better insulation.

All wire and cables shall equal or exceed the requirements of I.P.C.E.A. Publication S-19-81 (NEMA Publication WC-3-1969) Rev. 4 dated October, 1974, Standards for Rubber Insulated Wire and Cables, latest edition, I.P.C.E.A. S-68-516 NEMA WC8.

All conductors shall be soft annealed copper wire. All conductors shall have a Class B concentric stranding except for conductors in flexible cables. Flexible power and control cables shall be Class K stranding.

The insulation of all conductors in conduits shall be 90 degrees C vulcanized compound of Ethylene-Propylene rubber base. Insulation shall meet the requirements of applicable I.P.C.E.A. and ASTM Specifications, and shall bear UL approved as type RHH-RHW USE. Power and control cables shall be General Electric, Rockbustor Phalo, or equal. In addition, the insulation shall exceed the requirements for moisture absorption of I.P.C.E.A. - NEMA Part 6, Accelerated Water Absorption Test Methods of Rubber and Rubber-Like Insulations.

Except where indicated otherwise, the thickness of insulation for all conductors in conduits shall be that required for 600 volts rated circuits voltage.

Over the insulation of each single-conductor cable there shall be applied a heavy duty black neoprene. Hypalon jacketing may be used in lieu of neoprene.

W. Roadway Lighting. Provide and install new lighting fixtures for the bridge approach, bridge roadway, pedestrian walkway and bridge superstructure as shown on the plans. All lighting levels shall exceed the minimum level required by A.A.S.H.T.O. for movable highway bridges.

Navigation lights shall be maintained in operation during the entire construction period.

X. Miscellaneous Equipment. The following equipment shall be provided and installed as specified herein. (1.) Lighting Transformer. Transformer shall be 25 KVA, dry-type, single phase, 60-cycle, totally-enclosed, moisture-proof, wall-mounted, 2-winding type, 480-volt primary, and 115/230 volt secondary with grounded neutral. Transformer shall have Class B insulating and shall be designed for continuous operation in a 40 degree C ambient with a temperature rise of 80 degrees C. Transformer shall have 2 - 2 - 1/2 per cent taps above and below straight ratio, shall comply with IEEE and NEMA standards, shall be U.L listed, shall have decibel rating of 45 decibels or below measured in accordance with NEMA standard 1-4.11 and shall be mounted on vibration eliminators.

(2.) Convenience Outlets. New outlets shall be installed in the operators house and both machinery rooms. All receptacles shall be 20-ampere, 125-volt, 3-wire, grounding-type, polarized, duplex convenience outlets, Hubbell Catalog Number 62624, Arrox Hart, or equal. Install weatherproof receptacle in the machine sheds. They shall be in a waterproof, cast-iron, surface-mounted box, and shall be provided with a cast-iron, weathertight cover with gasketed, spring-hinged flap equal to Crouse Hinds Catalog No. DS70g, Hubbel, or equal.

Y. Spare Parts. The contractor shall furnish the following spare parts:

1. Three fuses of each kind and size installed.

2. One operating coil for each size contactor installed.

3. One complete relay for each kind and size control, timing or overload relay installed.

4. A minimum of two heaters for every five thermal overloads of each size.

5. For the control desk lights:

   12 indicating lamps
   1 color cap of each color and legend
   2 contact blocks of each type used

Spare parts shall be provided in sealed, uniform-sized cartons, with typed and clearly varnished labels to indicate their contents and they shall be stored on open steel shelving similar to Republic's Clip shelving where directed by the engineer. The contractor shall also provide a directory of permanent type describing the parts. The directory shall state the name of each part, the manufacturer's number thereof, and the rating of the device for which the part is a spare. The spare parts shall also be marked to correspond with their respective item numbers as indicated on the elementary wiring diagram.

Z. Bridge Operator. For two weeks after the bridge is tested and proven in satisfactory operating condition the contractor shall provide, at his own expense, a competent engineer to supervise the operation of the bridge. This engineer must be in addition to the services of any representatives of the electrical control equipment manufacturers. This engineer shall be competent to operate the bridge, to supervise its operation, to make any adjustments that may be required in the electrical or mechanical equipment, and to provide the instruction for the bridge operators as regards operation, lubrication and maintenance of all electrical equipment. This man shall be of service when bridge operations are required.

During the entire construction period the Department will generally staff the tenderhouse with an operator round the clock. The Contractor shall maintain all existing utilities to the tenderhouse during the construction period. Circuit breakers for temporary power sources shall be accessible to the Department at all times.

The contractor shall furnish and install in the operating house, charts for the guidance of the operator outlining sequences for the operation of the span under all different conditions. He shall also furnish and install as directed detailed wiring diagrams conforming to the actual installation.

AA. Basis of Payment. Electrical work and material complying with the requirements of this item, furnished and erected complete in place, in accordance with the specifications, and accepted, will be paid for at the lump sum price for ELECTRICAL WORK, lump sum price for ROADWAY LIGHTING, and unit price each for REWIND ELECTRIC MOTORS, which price shall be payment in full for all materials and for fabrication, shop work, transportation, erection, shop painting, parts, repairs, testing, and adjusting equipment.