Department of Transportation
Federal Highway Administration
Central Federal Lands Highway Division

AZ-NV HPP 93(3)
Hoover Dam Bypass, Colorado River Bridge
Hoover Dam Reservation Area
Clark County, Nevada
Mojave County, Arizona

INVITATION FOR BID

This invitation for bid cites Federal Highway Administration
Specifications FP-96, 1996

60%+ Work In Progress Submittal

April 29, 2003

Contractor:

Address:

State: NEVADA/ARIZONA

County: CLARK/MOJAVE

Federal Lands: HOOVER DAM RESERVATION AREA

Length: SCHEDULE A = 0 Miles

Type of Improvement: GRADING, DRAINAGE, STRUCTURE

Colorado River Bridge 60%+ Submittal

TABLE OF CONTENTS

Page No.

Notice to Bidders and Offerors ..... 1 to X

SF-1442 Solicitation, Offer, and Award ..... A-1 to A-X

Continuation of SF-1442 ..... A-X

Bid Schedule Instructions and Basis for Award ..... B-i to B-XX

Bid Schedule ..... B-1 to B-X

SF-24 Bid Bond ..... C-1 to C-X

SOLICITATION PROVISIONS

Representations and Certifications ..... D-1 to D-XX

Instructions to Bidders ..... E-1 to E-X

CONTRACT CLAUSES

Index - Contract Clauses F-1

Contract Clauses ..... F-2 to F-XX

Minimum Wage Schedule ..... G-1 to G-XX

SPECIAL CONTRACT REQUIREMENTS

General ..... I-1 to I-XX

Construction ..... I-XX to I-XX

Materials ..... I-XX to I-XX

Sample Subcontracting Plan; Full Text Clause ..... Appendix

SPECIAL CONTRACT REQUIREMENTS 1
Section 101. - TERMS, FORMAT, AND DEFINITIONS 1
Section 102. - BID, AWARD, AND EXECUTION OF CONTRACT 3
Section 103. - SCOPE OF WORK 3
Section 104. - CONTROL OF WORK 3
Section 105. - CONTROL OF MATERIAL 9
Section 106. - ACCEPTANCE OF WORK 10
Section 107. - LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC 16
Section 108. - PROSECUTION AND PROGRESS 27
Section 109. - MEASUREMENT AND PAYMENT 30
Section 152. - CONSTRUCTION SURVEY AND STAKING 34
Section 153. - CONTRACTOR QUALITY CONTROL 38
Section 154. - CONTRACTOR SAMPLING AND TESTING 44
Section 155. - SCHEDULES FOR CONSTRUCTION CONTRACTS 45
Section 156. - PUBLIC TRAFFIC 46
Section 157. - SOIL EROSION CONTROL 52
Section 158. - WATERING FOR DUST CONTROL 55
Section 203. - REMOVAL OF STRUCTURE AND OBSTRUCTIONS 56
Section 204. - EXCAVATION AND EMBANKMENT 57
Section 205. - ROCK BLASTING 61
Section 206. - SCALING 77
Section 208. - STRUCTURE EXCAVATION AND BACKFILL 79
Section 209. - RDWY STRUCTURE EXCAVATION AND BACKFILL 80
Section 552. - STRUCTURAL CONCRETE 81
Section 553. - PRESTRESSED CONCRETE 93
Section 554. - REINFORCING STEEL 106
Section 555. - STEEL STRUCTURES 107
Section 562. - FORMS AND FALSEWORK 119
Section 562. - TEMPORARY WORKS 119
Section 563. - PAINTING 124
Section 564. - BEARING DEVICES 128
Section 601. - MINOR CONCRETE STRUCTURES 137
Section 602. - CULVERTS AND DRAINS 137
Section 610. - BRIDGE DRAINS 138
Section 622. - RENTAL EQUIPMENT 138
Section 635. - TEMPORARY TRAFFIC CONTROL 140
Section 636. - SIGNAL, LIGHTING, AND ELECTRICAL SYSTEMS 142
Section 638. - ROCK BOLTS 144
Section 639. - PERMANENT TIEBACKS 148
Section 703. - AGGREGATE 156
Section 704. - SOIL 156
Section 705. - ROCK 156
Section 706. - CONCRETE AND PLASTIC PIPE 159
Section 708. - PAINT 159
Section 709. - REINFORCING STEEL AND WIRE ROPE 161
Section 710. - FENCE AND GUARDRAIL 161
Section 711. - CONCRETE CURING MATERIAL AND ADMIXTURES 163

Section 712. - JOINT MATERIAL. 163
Section 713. - ROADSIDE IMPROVEMENT MATERIAL 165
Section 717. - STRUCTURAL METAL 165
Section 721. - ELECTRICAL AND ILLUMINATION MATERIAL 168
Section 722. - ANCHOR MATERIAL 169
Section 725. - MISCELLANEOUS MATERIAL 170

SPECIAL CONTRACT REQUIREMENTS

The following Special Contract Requirements amend and supplement the *Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects (FP-96) - ENGLISH,* Department of Transportation, Federal Highway Administration.

Section 101. - TERMS, FORMAT, AND DEFINITIONS

101.02 Specifications Format. Delete the third and fourth paragraphs and substitute the following:

Division 150 consists of project contract requirements that are applicable to all contracts. Work under Division 150 is paid for directly or indirectly according to Subsection 109.05 and the Section ordering the work. When there is no pay item in the bid schedule, no direct payment is made.

101.03 Abbreviations.

(a) Acronyms - Add the following:

ADOT	-	Arizona Department of Transportation
ADEQ		Arizona Department of Environmental Quality
BOR	-	Bureau of Reclamation
CRC	-	Colorado River Commission
FWS	-	U.S. Fish and Wildlife Service
NDEP	-	Nevada Division of Environmental Protection
NDOT	-	Nevada Department of Transportation
NPS	-	National Park Service
PE	-	Professional engineer licensed in the State of Nevada
SPPP	-	Stormwater Pollution Prevention Plan
WAPA	-	Western Area Power Administration

101.04 Definitions.

Suitable Material - Add the following:

Suitable material may necessitate drying, the addition of moisture, reduction in size, screening, or other common methods of manipulation prior to use. Suitable material includes the classification(s) of materials, resulting R-values and other characteristics, for which the project was designed.

Construction Limits – Delete the text and substitute the following:

The limits along the left and right of the roadway that is intended to be disturbed during normal construction operations, including disturbance resulting from rock release or rock excavation. These operations would include clearing and grubbing, slope rounding and minor work to accommodate features in the project. In general, the normal construction limits shall be equivalent to the clearing limits

except when selective clearing may be required to remove such things as trees or minor clearing for drainage facilitation.

Lift – Delete the text and substitute the following:

When placing and compacting soils and aggregates, a lift is any single, continuous layer of material which receives, during a single work operation, the same compactive effort throughout. When installing culvert pipe less than or equal to 48-inches in diameter, the backfill material placed on both sides of the pipe is considered to be contained in the same lift when the material is placed to the same elevation on both sides of the culvert. The compactive effort applied to one side of the culvert is the same as the applied to the other, and the compactive effort is applied to both sides of the pipe in a continuous operation.

When excavating by blasting, a lift is any single continuous zone of rock whose top and bottom are defined by the maximum collar elevation and minimum tip elevation, respectively, of the blast holes drilled within it, exclusive of subdrill.

Unsuitable Material – Delete the text and substitute the following:

Material which the CO determines to be unsuitable for use in the construction of foundations, embankments, or roadbeds. Unsuitable materials generally include muck and soils with high organic contents and expansive soils.

Add the following:

Certificate of Compliance – A signed statement by a person having legal authority to bind a company or supplier to its product. Such certificate shall state that the materials or assemblies furnished fully comply with the requirements of the contract.

Slope Stake Limits – The catch point for the slope stakes at the top of cuts and the bottom (toe) of fills. These theoretical catches are generally included in the plans and are typically drawn on the plan and profile sheets. The designated slope catch points may be adjusted during the construction phase to accommodate such things as slope ratio changes, grade raises, line shifts, and/or drainage modifications.

Responsibility Zone – The zone for rock excavation extending from the abutments to the river defined by the boundary of instrumentation at which the peak ground velocity and frequency is specified; and within which rock fall is to be contained by the contractor; and beyond which the contractor is conditionally free of responsibility for rock fall. The boundaries for instrumentation are:

NV and AZ upstream offset from roadway centerline:	110 feet
NV and AZ downstream offset from roadway centerline:	110 feet

Peak ground velocity and frequency limits are in Section 205.

Section 102. - BID, AWARD, AND EXECUTION OF CONTRACT

102.03 Bid Guarantee.

(a) General. Delete the first sentence and substitute the following:

Submit a bid guarantee of 20 percent of the amount of the bid or $6 million, whichever is less.

102.06 Performance and Payment Bonds. Delete the first paragraph including lines (a), (b), and (c), and substitute the following:

FAR Clause 52.228-15 – Performance and Payment Bonds – Construction is supplemented as follows. Furnish a performance bond and a payment bond in the penal amounts of 100 percent of the original contract price.

Section 103. - SCOPE OF WORK

103.03 Value Engineering. Delete the second paragraph and substitute the following:

Value engineering proposals that modify the appearance of the bridge structure or change the design of the bridge will not be accepted.

103.05 Partnering. Delete the last sentence of the fourth paragraph and substitute the following:

The Government's share will not exceed $20,000.

Section 104. - CONTROL OF WORK

104.03 Specifications and Drawings. Delete the entire subsection and substitute the following:

FAR Clause 52.236-21 - Specifications and Drawings for Construction is supplemented as follows:

(a) General. Prepare drawings as necessary to adequately construct the work. Drawings include, but are not limited to, layouts that show the relative position (vertical and horizontal, as appropriate) of work to be performed, fabrication details for manufactured items and assemblies, installation and erection procedures, details of post-tensioning and other systems, earthwork operations plans, detailed trench and excavation procedures that conform to OSHA requirements, traffic control implementation drawings, and methods for performing work near existing structures or other areas to be protected.

Limit drawings to a drawing size of 11 inches by 17 inches. Include an electronic copy of each shop drawing in pdf format. Include on each drawing and calculation sheet, the project number, name, and other identification as shown in the contract.

Furnish 5 sets of cut sheets and supporting calculations for acceptance before performing work covered by the drawings. Furnish one paper copy along with the electronic copy of each shop drawing. If drawings are returned for revision, correct and resubmit for acceptance. Allow 40 working days per submission for segmental structures and 30 working days per submission for all other structures. Allow 90 working days for review of submittals for contractor alternative erection methods. If submittals are incomplete or if drawings must be resubmitted, the time for acceptance starts over. Obtain prior written approval for changes or deviations from accepted drawings. The CO will deduct the additional engineering costs to the Government for review of alternative erection methods from payment under 56201.

(b) Specific requirements for concrete and miscellaneous structures. Drawings will be reviewed in the order they are received. The review time as specified in (a) above is applied separately to each drawing submitted. The CO may request additional specific drawings for unique situations in order to clarify layout, construction details, or methodology.

(1) Furnish drawings for the following:

- **(a)** Fabrication drawings for bridge railings and parapets.
- **(b)** Fabrication drawings for pre-stressed members.
- **(c)** Fabrication and installation drawings for expansion joint assemblies.
- **(d)** Fabrication drawings for bearing assemblies.
- **(e)** Construction joint location and concrete deck placement sequences not shown on the plans.
- **(f)** Structural steel fabrication drawings.
- **(g)** Utility hangar details.
- **(h)** Detour layouts.
- **(i)** Fabrication and installation drawings for pre-cast items.
- **(j)** Fabrication and installation drawings for stay-in-place deck forms.
- **(k)** Temporary rock reinforcement, rock bolts, and rock dowels

(2) Furnish drawings which bear the seal and signature of a professional engineer licensed in the United States proficient in the pertinent design field, for the following:

- **(a)** Erection plans.
- **(b)** Engineered rock fall containment systems
- **(c)** Rock restraints designed in lieu of rock removal.
- **(d)** Reinforced soil slopes details.
- **(e)** Details and installation procedures for proprietary wall systems.
- **(f)** Temporary bridge structures.
- **(g)** All bridge forms except for railings, parapets, and components less than 6 feet in height.
- **(h)** Shoring systems and cofferdams greater than 6 feet in height.
- **(i)** All shoring systems that support traffic loadings.

(j) Forms and falsework for all structures greater than 6 feet in height.
(k) Post-tensioning systems.
(l) Ground anchors, soil nail, and rock bolt assembly details, layout, and installation and testing procedures.
(m) Tie back wall details.

(3) Furnish drawings which bear the seal and signature of a professional engineer licensed in the United States proficient in forms and falsework design, and who is licensed in the state where the project will be constructed, for the following:

(a) Falsework for any structure with a span exceeding 16 feet.
(b) Falsework for any structure with a height exceeding 15 feet.
(c) Falsework for structures where traffic, other than workers involved in constructing the structure, will travel under the structure.

(c) Special Requirements for precast segmental columns and CIP segmental arch structure.

Stamp submittals as "Reviewed by '*name of contractor*' for Construction" and sign by the Contractor's Superintendent or the Contractor's representative in charge of the construction. Make submittals in complete packages which will allow the CO to properly review them for conformance to the technical requirements and contract documents and to effectively evaluate the proposed methods of construction. Do not submit partial submittals. Partial submittals will be returned without action.

(1) General

Format of the shop drawings, working drawings, and other submittals as follows:

(a) Submit all shop drawings and working drawings in accordance with Section 104.03(a).

(b) There shall be a title block in the lower right-hand corner of each sheet. The title block shall show the project number, structure number, the location of the structure, and the contents of the sheet, designer/engineer, sheet number, and revision number.

(c) Submit design notes, calculations, lists, reports, descriptions, catalog cuts, and other non-drawing submittals on 8 1/2 x 11 inch sheets.

(d) Sign and seal the shop drawings, working drawings, and other submittals for engineered temporary works by a professional engineer registered in the United States. Submittals without the required signature and seal will not be accepted and will be returned to the Contractor without action.

(2) Shop Drawings

Supplement the plans with shop drawings to adequately control the work or as specified. Shop drawings is a general term that includes drawings, diagrams, illustrations, samples, schedules, calculations, and other data which provide details of construction and details for inspection of the permanent works by the CO.

The CO will review the shop drawings for general conformance with the design plans and specifications. The review does not extend to means, methods, techniques, or procedures of construction or to safety precautions or safety programs. The review of the CO is for the exclusive benefit of the Owner, and is not intended to be a check of the Contractor's work.

The CO may request additional details and require the Contractor to make changes in the shop drawings which are necessary to conform to the provisions of the plans and specifications without additional cost to the Owner.

After review, the CO will return one set of shop drawings to the Contractor. Returned shop drawings will be stamped with the CO's review stamp to indicate the following:

Reviewed	Shop drawings have been reviewed and do not require resubmittal.
Reviewed as Noted	Shop drawings have been reviewed and the Contractor shall incorporate the comments noted in the shop drawings and the work. The shop drawings do not require resubmittal.
Revise and Resubmit	Shop drawings require correction or redrawing and shall be resubmitted for review. If shop drawings are returned for correction or redrawing, corrections shall be made and the shop drawings shall be resubmitted by the Contractor in the same manner as the first submittal. Specific notation shall be made on the shop drawings to indicate the revisions.

Keep one set of as-built plans, shop drawings, and other submittals available at the site of the work at all times. Note on these drawings all changes and deviations from the work shown on the plans, shop drawings, working drawings, and other submittals. Keep drawings current as the work progresses and make notations within seven days of the change or deviation.

Upon completion of the work and prior to final payment, submit the as-built drawings to the CO. Submit 5 complete paper sets and 5 electronic copies in pdf format on CD.

The following list is the minimum list of shop drawing submittal requirements for the precast and cast-in-place segmental construction work. Additional submittals may be necessary to describe the work. Identify in writing those individual submittal requirements which are meet by a particular drawing with submittal of the drawing.

ITEM NO.	DESCRIPTION	SUBMITTALS	P.E. REQ'D.	SUBMITTAL TIME FRAME
1	Erection Method Proposal	Written description and drawings	No	30 days after award
2	Bearing Devices	Drawings showing complete dimensional	No	(2)

		details & provision for replacement		
3	Temporary supports or Bearings	Complete details for temp. restraints during erection and bearing installation	Yes	(1)
4	Erection Sequence, procedure and Construction Loads	Details of erection sequence, constr loads, erection analysis info, casting and erection schedules	Yes (3)	(2)
5	Contractor's modifications to PT	Changes due to post-tension systems and/or post-tensioning sequences, & calcs. details & drawings to demonstrate that changes produce the same dead load condition as shown on the plans.	Yes	(2)
6	Integrated Concrete Segment drawings	Integrated, scaled drawings depicting complete dimensions of each segment, all blisters, recesses and block outs; post-tensioning ducts and anchorages, reinforcing, and embedded items	No	(2)
7	Casting Machine	Complete drawings of the system to be used to fabricate precast segments	No	(1)
8	Casting Curves& const. Loads submittal	Numerical data showing curve to which segments are cast	Yes (3)	(2); After CO review of erection seq.
9	Casting Control	Details of segment casting and geometry control plan	No	(2); After CO review of erection seq.
10	Segment Handling	Details of precast segment handling, storage and transportation, including calculations showing sufficiency of procedures	Yes	Prior to submittal of integrated drawings
11	Erection Equipment	Design and testing program for erection	Yes	(1)

		equipment/form travelers		
12	Temporary erection structures	Drawings, details and calculations for all temporary structures and devices to be used for erection.	Yes	(1)
13	Erection Analysis	Complete analysis of erection process to confirm that erection stresses and final dead load condition conform to contract requirements, and to determine both casting curve and camber controls for construction (see Contract Plans for Erection notes).	Yes	(2)
14	Manual of Erection procedures	Erection manual defining complete erection procedures, including all methods for setting forms or segments, checking intermediate cambers, setting and releasing temporary structures, evaluating and correcting geometry during erection, procedures for evaluating and repairing segment damage	Yes	(2)
15	Post Tensioning procedures	Complete description of all jacking equipment, procedures for installing and verifying installation of tendons, calibration charts, and quality control procedures.	No	(1); 60 days prior to first installing post tensioning
16	Grouting Procedures	Description of materials and methods used for grouting	No	60 days prior to first installation of post tensioning
17	Epoxy bonding materials	Submittal of test report and material certs for all epoxy bonding agent formulations	No	60 days prior to erection

(1) As required by contractor's schedule for review and comment prior to ordering or purchase.
(2) As required by contractor's schedule for review, comment, comment resolution and approval prior to ordering, fabricating or purchase.
(3) If the contractor elects to use the entire erection scheme shown on the plans, then these items do not need a PE stamp. If any aspect of the method or detail of construction shown on then plans is modified by the contractor, the PE stamp requirement will apply.

104.04 Coordination of Contract Documents. Modify list as follows:

(a) Federal Acquisition Regulations
(b) Transportation Acquisition Regulations
(c) Plans
(d) Special contract requirements
(e) Supplemental specifications
(f) Standard specifications

Section 105. - CONTROL OF MATERIAL

105.01 Source of Supply and Quality Requirements. Add the following:

Submit samples of materials for quality verification testing for materials required to conform to Sections 703, 704, and 705.

Materials containing petroleum-based solvents such as cutback asphalts and traffic paints may be restricted from use by local laws or ordinances in certain geographic areas. Upon presenting proof of such restrictions, alternate materials considered acceptable to the CO may be substituted for the materials specified in the contract.

105.02 Local Material Sources. Add the following:

No designated material source has been established for this project.

105.04 Storing and Handling Material.

Add the following to Paragraph Two:

The CO will conduct a post construction assessment of Contractor staging areas to assure no residual contaminates are left from project construction activities. Any contaminates found will be disposed of by the Contractor in accordance with Section 107.

Add the following:

The Contractor may use area within the construction limits and/or the following two sites for a staging area:

(g) An off-site area located near US 93 Milepost 1.2, approximately ¼ mile northeast, known as the BOR "Bone yard". Coordinate BOR, NPS, and WAPA.
(h) Area adjacent to the corridor near the Arizona/Nevada Switchyard
(i) Area within right of way from Station 200+00 to 220+18 on Arizona side.

< other areas under development – will reference site map for final areas and facilities>

Section 106. - ACCEPTANCE OF WORK

106.01 Conformity with Contract Requirements. Delete the fourth sentence of the fifth paragraph and substitute the following:

If Contractor testing and inspection are verified by the Government, the Contractor's results may be used by the Government to evaluate work for acceptance.

Add the following:

When removal, replacement, or corrective measures are required, obtain approval for the proposed method of performing the work.

Where sample/testing procedures make reference to AASHTO, ASTM, or other standards (designated as FLH T), the procedure as modified in the Materials Manual shall govern. Where the specifications make reference to AASHTO Test T11, "Procedure B - Washing Using a Wetting Agent" shall be the procedure followed.

Delete references made to AASHTO T-238 or T-239 and substitute with ASTM D 2922 and D3017 or AASHTO T-310.

Reference to the Materials Manual means the Federal Lands Highway "Field Materials Manual, U.S. Department of Transportation, Federal Highway Administration," Publication No. FHWA-FL-91-002, dated March 1991, revised March 1994, and all amendments and supplements thereto. Copies are available from the Materials Engineer; Federal Highway Administration, Central Federal Lands Highway Division, Materials Branch, P.O. Box 25246, Denver, Colorado 80225-0246 Telephone: (303) 716-2176.

Reference to the Traffic Control Devices Manual means the "MUTCD 2000, Manual on Uniform Traffic Control Devices, U.S. Department of Transportation, Federal Highway Administration," Publication No. MUTCD-1, Millennium Edition, dated December 2000, and all amendments and supplements thereto. The electronic version posted on the MUTCD website is the official FHWA publication. The Internet website is located at:

http://www.mutcd.fhwa.dot.gov

Reference to NDOT Sign Standards refers to "Standard Highway Signs, Nevada Supplement, 1997 Edition", and all amendments and supplements thereto. Copies are available for a nominal fee from Administrative Services; Nevada Department of Transportation, 1263 South Stewart Street, Carson City, Nevada 89712, Telephone: (775) 888-7070, Fax: (775) 888-7101.

106.03 Certification. Add the following after the first paragraph:

Other than references in or to the FAR or Federal Law, when this contract references certifications; certificates; or certified documents, equipment or individuals, these references are not certifications within the meaning of Section 4301 of Public Law 104-106, the National Defense Authorization Act for Fiscal Year 1996. These references simply refer to documentation of peripheral contract requirements which is required to be validated by an individual or organization having unique knowledge or qualifications to perform such validation.

Add the following after the second paragraph:

See Table 106-3 for Schedule for Full or Partial Acceptance by Material Certification. Submit certification and sample of material for testing as required.

(a) Production Certification. Delete items **(2)** through **(5)** and substitute the following:

(2) Lot number or other means of cross-referencing to the manufacturer's inspection and testing system

(3) Substantiating evidence that the material conforms to the contract quality requirements as required by FAR 46.105(a)(4), including all of the following:

(a) Test results on material from the same lot and documentation of the inspection and testing system

(b) Manufacturer's statement that the material complies with all contract requirements

(c) Manufacturer's signature or other means of demonstrating accountability for the certification

106.05 Statistical Evaluation of Work and Determination of Pay Factor (Value of Work).

(b) Acceptance. Delete the last sentence of the second paragraph and substitute the following:

If a lot is concluded or terminated with fewer than three samples, the samples will be combined with those of an adjacent lot. In the event there is no adjacent lot, the material will be accepted according to Subsection 106.04.

Delete the third paragraph and substitute the following:

If the current pay factor of a lot falls below 0.90, terminate production. The current lot is terminated at this point and the material represented by the lot will be accepted as provided in the following paragraphs. After the Contractor has taken effective actions to improve the quality of the production, production may resume and a new lot will begin.

TABLE 106-3

SCHEDULE FOR FULL OR PARTIAL ACCEPTANCE BY MATERIALS CERTIFICATION					
SECTION	**DESCRIPTION**	**MATERIAL**	**PROPERTY\ SPECIFICATION**	**FREQUENCY**	
				CERTIFI-CATION	**SAMPLE**
306	Dust Palliative	Magnesium Chloride, Emulsified Asphalt, Lignin Sulfonate	As specified	1 per shipment	First Shipment
308	Minor Crushed Aggregate	Crushed Aggregate	Source, Quality and Gradation	1 per source	1 per source
402 and 417	Minor Hot Asphalt Concrete, Minor Cold Asphalt Mix	Aggregate Asphalt Mix	Source quality, Gradation, Stability, and Grade	1 per mix	1 per source
552	Cementitious Material	Silica Fume	As specified	1 per shipment	3 per shipment
552	Cementitious Material	Fly Ash	As specified	1 per shipment	3 per shipment
634 and 635	Permanent Pavement Markings, Temporary Traffic Control	634.02 as applicable 635 as applicable	As specified	1 per source	--------
701	Hydraulic Cement	Portland Cement, Blended Hydraulic Cement and Masonry Cement	AASHTO M 85, M 240, and as specified	1 per shipment	1 per 100 tons
702.01	Asphalt Material	Asphalt Cement	AASHTO M 20, M 226, MP 1 or as applicable	1 per shipment	1 per shipment

SCHEDULE FOR FULL OR PARTIAL ACCEPTANCE BY MATERIALS CERTIFICATION					
SECTION	**DESCRIPTION**	**MATERIAL**	**PROPERTY\ SPECIFICATION**	**FREQUENCY**	
				CERTIFI-CATION	**SAMPLE**
702.02	Asphalt Material	Cut-back Asphalt	AASHTO M 81 or M 82 as applicable	1 per shipment	1 per shipment
702.03	Asphalt Material	Emulsified Asphalt	AASHTO M 140 or M 208 as applicable	1 per shipment	1 per shipment
702.05	Asphalt Material	Asphalt Materials used for Damproofing and Waterproofing Concrete Surfaces	As specified for each type of asphalt material	1 per shipment	--------
702.06	Recycling Agent	As specified	As applicable	1 per shipment	1 per shipment
702.08	Antistrip	As specified	As applicable	1 per shipment	--------
706	Concrete and Plastic Pipe	As specified	As applicable	1 per shipment	--------
707	Metal Pipe	Metal Pipe as specified	As applicable	1 per shipment	--------
708	Paint	As specified	As applicable	1 per batch\lot	1 sample for quantities >100L

SCHEDULE FOR FULL OR PARTIAL ACCEPTANCE BY MATERIALS CERTIFICATION					
SECTION	**DESCRIPTION**	**MATERIAL**	**PROPERTY\ SPECIFICATION**	**FREQUENCY**	
				CERTIFI-CATION	**SAMPLE**
709	Reinforcing Steel and Wire Rope	As specified	As applicable	1 per shipment	For 709.01 & 709.03 submit (3) 3-foot bars of each size and grade of bar furnished. 709.02 submit (1) 6-foot length for each size furnished
710	Fence and Guardrail	As specified	As applicable	1 per shipment	--------
711	Concrete Curing Material and Admixtures	As specified	As applicable	1 per material source per material type	--------
712	Joint Material (all)	As specified	As applicable	1 per shipment	--------
713	Roadside Improvement Materials (all)	As specified	As applicable	1 per shipment	--------
714	Geotextile and Geocomposite Drain	As specified	As applicable	1 per shipment	1 per project per type
715	Piling	As specified	As applicable	1 per shipment	--------
716	Material for Timber Structures	Timber and Hardware	As applicable	1 per shipment	--------

SCHEDULE FOR FULL OR PARTIAL ACCEPTANCE BY MATERIALS CERTIFICATION					
SECTION	**DESCRIPTION**	**MATERIAL**	**PROPERTY\ SPECIFICATION**	**FREQUENCY**	
				CERTIFI-CATION	**SAMPLE**
717	Structural Metal	As specified	As applicable	1 per shipment	717.01(e) minimum 6 per shipment for each size used. 717.10 1 per project
718	Traffic Signing and Marking (all)	As specified	As applicable	1 per shipment	--------
720	Structural Wall and Stabilized Materials (all)	As specified	As applicable	1 per shipment per material type	--------
721	Electrical and Illumination Material (all)	As specified	As applicable	1 per shipment per material type	--------
722	Anchor Material	As specified	As applicable	1 per shipment per material type	--------
725	Miscellaneous materials	As specified	As applicable	1 per shipment per material type	--------

Section 107. - LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

107.01 Laws to be Observed. Add the following:

Comply with the Department of Army, The Corps of Engineers, Individual Permit Number 200250268. (See Appendix for permits)

(a) General. Implement the requirements of the National Pollutant Discharge Elimination System (NPDES) for erosion control due to stormwater runoff during construction as specified under the Environmental Protection Agency (EPA) General Permit for Nevada.

(b) Stormwater Pollution Prevention Plan (SPPP)

(1) General: Prepare a draft Stormwater Pollution Prevention Plan (SPPP), with descriptions of proposed measures to be implemented, a sequence of major activities as defined by the EPA, a schedule detailing the proposed coordination for accomplishing the erosion control features in a timely and appropriate manner, and site-specific diagrams indicating proposed locations where erosion and sediment control devices or pollution control measures may be required during the project construction stages. Make provisions within the SPPP for erosion control at all contractor use areas, storage areas and support locations.

Prior to preparation and submittal of the SPPP, convene a field review of the site with the CO to identify the Best Management Practices (BMP's) to be used on the project and to determine an implementation sequence for the erosion control features. Incorporate and designate the installation sequence of erosion control measures in the initial SPPP to address the priorities agreed to during the field meeting. The pre-SPPP field review is separate from other contractor/agency partnering meetings identified in these Special Contract Requirements.

Prepare, with assistance of the CO, the draft SPPP, file a Notice of Intent (NOI), implement the SPPP, and, after successfully satisfying requirements identified this subsection, file a Notice of Termination (NOT), all as described herein. Perform no clearing, grubbing, or earthwork until the SPPP has been approved and the NOI's have been filed in accordance with the requirements of these Special Contract Requirements.

Prepare the draft SPPP as described in the above references and incorporate the applicable requirements identified in Section 157 of these Special Contract Requirements. Incorporate within the draft SPPP an erosion control plan and other project requirements for pollution prevention and control as required by the EPA, including but not limited to:

(a) Site evaluation, including existing soils information, existing runoff water quality, location of surface waters on the construction site and name of receiving water;

(b) Site assessment, including measurements of the site area, determination of the drainage areas and an estimate of the runoff coefficient after construction;

(c) Select erosion control measures, including review and incorporate state and local requirements, select erosion and sediment controls, select other controls, select storm water management controls, indicate the location of controls on a site map, prepare an inspection and maintenance plan/procedures, and a sequence of major activities and descriptions and details of erosion controls, both temporary and permanent.

(d) Certification of the plan, including certification by a contractor's authorized representative and a Notice of Intent (NOI) form.

Prepare the draft SPPP, including the proposed erosion control features, the sequence of major activities, and phasing, and evaluate all SPPP requirements for adequacy in addressing pollution prevention during construction. Supplement the draft SPPP with an itemized list of "good housekeeping practices," and any proposed revisions or supplemental information, including changes to the proposed erosion control coordinator candidate position as required and submit two copies to the CO at or before the preconstruction conference.

Implement SPPP measures and maintain all related erosion control elements in proper working order throughout the project. Work under this section also includes inspections, record keeping, the implementation of "good housekeeping" practices and maintenance of records of the construction activities as described herein.

Within 12 calendar days from the start of construction, jointly review with the CO the draft SPPP, including any proposed revisions. All revisions shall meet the terms and conditions of the EPA permit, and shall be compatible with the contractor's proposed construction sequencing and maintenance of traffic plans.

When agreement has been reached, the CO will sign the revised SPPP. The CO's signature will constitute approval of the SPPP. The NOI's shall not be submitted until the project SPPP has been approved.

Specify within the SPPP the mechanism whereby revisions may be proposed by the Contractor or the CO and incorporated into the plan, including review and approval procedure. With the CO, jointly approve and sign each revision to the SPPP before implementation.

The SPPP must be revised whenever a change in design, construction method, operation, maintenance procedure, or other activity may cause a significant effect on the discharge of pollutants to surface waters. The SPPP must also be amended if inspections indicate that the SPPP is ineffective in eliminating or significantly reducing pollutants in the discharges from the construction site. In addition, the SPPP must be updated to identify any new operator who will be implementing a portion of the SPPP. The CO and the Contractor will determine if the changes require submittal of the revisions to the EPA.

List contractors and subcontractors responsible for implementing all or portions of the SPPP in the SPPP with the measures for which they are responsible. Authorized representatives of these organizations shall sign a statement that they understand the SPPP requirements.

A copy of the SPPP must be kept at the site from the time construction begins until the site is finally stabilized.

(2) Notice of Intent (NOI): After the project Stormwater Pollution Prevention Plan (SPPP) has been approved, the CO and Contractor will complete Notice-of-Intent (NOI) forms for the project. Submit the NOI to the EPA at the following address at least two days prior to the start of construction.

Stormwater Notice of Intent (4203)
401 M Street, S.W.
Washington, D.C. 20460.

At that time, copies must also be submitted to:

Stormwater Coordinator
Nevada Division of Environmental Protection
Bureau of Water Pollution Control
333 West Nye Lane
Carson City, Nevada 89706

And

Arizona Department of Environmental Quality
Stormwater Coordinator
3033 North Central Avenue
Phoenix, AZ 85007-2809

Post the CO and Contractor NOI's on the construction-site bulletin board throughout the duration of the project.

(3) Contractor's Operations: Designate a qualified employee as the Contractor's erosion control coordinator responsible for developing, implementing, monitoring and revising the SPPP, including authorizing corrective actions for deficient work and/or preparations in advance of anticipated rainfall events.

The erosion control coordinator shall be capable of identifying existing and predictable effects of the Contractor's operations upon the landscape, and be authorized to direct the Contractor's personnel and equipment (including subcontractors) as required to implement corrective measures to minimize or eliminate damage to the downstream watercourse resources. The erosion control coordinator shall be familiar with SPPP procedures and practices and shall ensure that emergency procedures are up to date and available at the project site.

Be aware of and comply with all requirements to obtain separate NPDES permits associated with industrial activities for any on-site or off-site asphalt and concrete plants that provide material for the project. The Government will not be responsible for the administration, coordination, or any costs associated with the contractor's permit responsibilities for these activities.

No condition of the NPDES Permits or the SPPP will release the Contractor from any responsibilities or requirements under other environmental statutes or regulations.

Maintain the SPPP along with completed inspection and maintenance forms and other NPDES records in a three-ring binder. Maintain a current copy of the SPPP, including all associated records and forms, at the job site throughout the duration of the project. Make the SPPP available for public inspection and for use by the CO.

Provide the SPPP (including inspection forms) and all data used to complete the NOI and NOT to the Government at the completion of the project. Retain records of these documents for a period of at least four years from project completion.

(4) "Good Housekeeping" Practices and Requirements: Specifically itemize and locate on a site map within the SPPP the Contractor's "good housekeeping" practices and requirements, including vehicle wash-down areas, on-site and off-site tracking control, protection of equipment storage and maintenance areas, and sweeping of highways and roadways related to hauling activities for each sequence or phase of the work. Include this information in the draft SPPP based on the intended site operations.

Take aggressive actions, considering all conditions, to prevent pollution of streams, lakes, and reservoirs with fuels, oil, bitumens, calcium chloride, fresh portland cement, fresh portland cement concrete, raw sewage, muddy water, chemicals or other harmful materials. Do not discharge any of these materials directly or indirectly into any channels leading to streams, lakes or reservoirs. Include within the SPPP identification of spill prevention and material management controls and practices intended to be used by the Contractor to prevent the release of pollutants into stormwater. Provide within the SPPP storage procedures for chemicals and construction materials; disposal procedures; cleanup procedures; the Contractor's plans for handling such pollutants; and other pollution prevention measures as required.

Locate machinery service, refueling, and storage areas a minimum of 100 feet away from streambeds or washes. Identify within the SPPP the planned locations of these areas.

Dispose of waste materials from blasting, including explosives containers, off-site in accordance with applicable state and federal regulations. Remove non-waste materials, such as used cans, oils, machine and equipment parts, paint, hazardous materials, plastic and rubber parts, discarded metals, and building materials, from the construction site and disposed of according to applicable state and federal regulations.

Stockpile or dispose of material off-site in accordance with all applicable laws and regulations.

Promptly clear watercourses of all falsework, piling, debris or other obstructions inadvertently placed thereby or resulting from construction operations within 24 hours of deposition.

Include spill prevention, containment and counter-measures in the SPPP if the volume of project-site fuel in a single container exceeds 660 gallons, or if the total fuel storage volume at any one site exceeds 1,320 gallons. Include this information, as applicable, in the draft SPPP.

In the event of a spill of a hazardous material, the follow the provisions of Section 107.08.

Assist in any efforts to clean up hazardous material spills, as directed by the CO or other authorities. Dispose of soil contaminated from spills according to applicable state and federal regulations.

(5) Inspections: Document inspections on forms provided by the Contractor and approved by the CO. Sign the inspection forms in accordance with the requirements of the SPPP and the EPA permit. Retain copies of the completed inspection forms on-site in the SPPP file throughout the construction period.

When deficiencies are noted by inspection or other observation, implement such changes within 24 hours following the inspection unless directed otherwise by the CO. Deficiencies must be corrected no later than 7 days after their initial inspection or observation. Direct inflows of sediment into a watercourse must be corrected by the end of the same day or work shift as observed.

(6) Maintenance of Records of Construction Activities: In addition to the inspection and maintenance reports, keep records of the construction activities on the site. In particular, keep a record of the following information:

(a) The dates when major grading activities (including clearing and grubbing, excavation and embankment construction) occur in a particular area or portion of the site.
(b) The dates when construction activities cease in an area, temporarily or permanently.
(c) The dates when an area is stabilized, temporarily or permanently.

(7) Notice of Termination (NOT): The regulations define "final stabilization" as meaning that all soil disturbing activities at the site have been completed, and that a uniform perennial vegetative cover with a density of 70% of the native background vegetative cover for unpaved areas has been established and/or equivalent permanent stabilization measures (such as the use of rip rap, gabions, or geotextiles) have been employed. The CO will determine if the unpaved areas meet the stabilization requirement. After determination by the CO that final stabilization has been achieved and upon final acceptance by the CO, the CO and the Contractor shall each complete and mail separate NOT forms for the project to the following address:

Stormwater Notice of Termination (4203)
401 M Street, S.W.
Washington, D.C. 20460.

Also send a copy of the NOT to the Nevada Division of Environmental Protection and the Arizona Department of Environmental Quality and provide one copy to the CO. The NOT must be filed within 30 days after cessation of construction activities and final stabilization of the permittee's portion of the site.

Measurement and payment for work specified in the SPPP will be made in accordance with the requirements of Section 157 of these Special Contract Requirements. Erosion control and pollution prevention work specified in the contract which is to be accomplished under any of the other various contract items will be paid for as specified under those items.

No measurement or direct payment will be made for time spent in reviewing or revising the SPPP, or providing other required documentation, the cost being considered as included in the price of contract items. No measurement or payment will be made for inspections or for "good housekeeping" practices and requirements, the costs being considered as included in contract items.

107.02 Protection and Restoration of Property and Landscape.

Add the following to the Third Paragraph:

The Contractor will need to perform work near the hairpin turn on US 93 at the Colorado River. The contractor shall submit the following twenty one (21) calendars days prior to performing any work within hairpin turn or adjacent areas:

(j) Construction / access plan
(k) Reclamation plan
(l) Additional permits, as applicable

The reclamation plan shall detail how the construction / access plan will be mitigated for impacts from the work. The reclamation plan shall be submitted in written and graphic form, and identify the acreage to be disturbed, resources within the area which will be preserved or disturbed, proposed activities and equipment to be used within the area, a schedule of the duration and extent of use of the area, and a post-project contour plan. The Contractor shall provide a native plant inventory and a site-specific revegetation plan to return the site to its original condition and natural appearance following completion of the work within the bridge ravine area. Reclamation grading shall be completed such that the ground plane texture has a visual appearance that is consistent with the surrounding, undisturbed landscape. Staining of rocks may be required and shall be preformed at the direction of the CO.

If the contractor impacts designated Waters of the United States outside of the limits identified in the Department of Army, The Corps of Engineers, Individual Permit Number 200250268, the contractor shall obtained the required permits.

The CO will determine the acceptability of the proposed plans and approve the limits of construction within this bridge crossing area fourteen (14) calendars days prior to any ground disturbing activities are allowed at this site. Complete all work associated with the construction / access plan, reclamation plan, and additional permitting will be no additional cost to the Government.

Construct the wildlife fence outside the clearing limits using equipment that results in minimal ground disturbance such that no tracks are visible following construction. Submit an access and construction plan to the CO describing how equipment and materials will be delivered to the fencing limits that are outside of the clearing limits. Describe in detail the construction techniques that will be used to construct the fence over the rugged terrain. Submit a restoration plan to the CO for approval prior to any ground disturbing activities to restore the ground to the visual character of the adjacent landscape.
<DETERMINING WHETHER OR NOT WE WANT RIVER BRIDGE CONTRACTOR TO CONSTRUCT ANY FENCE.>

Delete the fourth paragraph and add the following:

Colorado River Bridge 60%+ Submittal

Should any skeletons, artifacts, or other archeological remains be uncovered, suspend operations at the site of discovery, notify the CO immediately of the findings, and continue operations in other areas. Include with the notification a brief statement of the location and details of the findings. See FAR 52.236-2. Federal law prohibits the excavation, removal, damage, alteration, or defacement of any archeological resource on Federal or Indian Lands. Do not remove any natural resource from the project site. Control the actions of employees and subcontractors at the job site to ensure that any protected sites will not be disturbed or damaged. It is also the obligation of the Contractor to cease work in the event of a newly discovered site until further authorization is obtained. The Archeological Recourse Protection Act of 1979 (ARPA, Public Law 95-96) provides for civil penalties equal to the archeological value and cost of restoration and repair for damaged resources. In the event of a violation of these stipulations, the civil penalties provided for under ARPA may be brought to bear upon the Contractor.

Add the following:

The following utility companies have facilities within the project limits, and some are in conflict with the proposed construction. Adjustments and relocations will be made concurrent with the Contractor's work during construction.

Western Area Power Administration (WAPA 230kV Power Facilities)
Mr. Chuck McEndree
Desert Southwest Region
615 South 43rd Avenue
Phoenix, AZ 85009-0615
Phone: (602) 352-2790

WAPA has high voltage power facilities within and near the project site.

Southern California Edison
<locating contact>

The Contractor is responsible for the protection of transmission towers, overhead power lines, A/N Switchyard facilities and other facilities from damage by equipment, loss of ground, and flying rock during construction. Construction equipment shall be kept a minimum of 25 feet away from these power facilities. The contractor shall notify WAPA and the CO 48 hours prior to any activities within 50 feet of these power facilities. All blasting in the vicinity of the power facilities shall be performed as required in Section 205, Rock Blasting.

Bureau of Reclamation (2.3kV Power, Water Lines, Fiber Optic)
Mr. Donald Bader
P.O. Box 61470
Boulder City, NV 89006-1470
Phone: (702) 293-8248

BOR has a sanitary sewer on the Arizona side that has been relocated for the project. Contractor will not disturb new sewer pipe. Sewage Treatment ponds are located east of the construction site. No adjustments or relocations are required.

Citizens Utilities

Mr. Danny Caples
2498 Airway Avenue
Kingman, AZ 86401
Phone: (928) 716-2760

Citizens Utilities has an existing 69kV overhead powewer line installed west of the sewer evaporation ponds. The poles supporting this power line do not conflict with the proposed improvements. No adjustments or relocations of these facilities are required.

107.06 Contractor's Responsibility for Work: Add the following after the last paragraph:

During the conduct of bridge foundation excavation and bridge erection operations, a high degree of attention and skill must be directed toward restraining or intercepting material, that if allowed to fall, would damage river level structures, threaten public or worker safety, or adversely affect Hoover Dam operations. Rock fall source control practices will be needed in all phases of the excavation process, from clearing and grubbing through finish scaling, to minimize damage to the canyon environment or river level structures. Rock fall source control practices are expected to involve the use of special excavation sequences, extra care in rock excavation and blasting, and the application of engineered systems. Piecework, handwork, and deployment of special, site-specific containment and control techniques shall be used as required to control the release of earth materials outside the excavation limits. In the initial stages of excavation for the skewbacks and piers, development of surfaces from which mechanized excavation equipment may operate may entail labor and time-intensive techniques including hand drilling, hand loading, and use of small scale rock fall catchments down slope from the excavation activity which may need to be installed with hand methods. Scaling and rock removal within the work zone will need to be performed in such a way as to limit the potential for damage due to rock release. Suitable approaches to containment and control will need to be engineered by the contractor to meet changing geologic conditions and excavation geometries as excavations progress.

Coordinate with the Bureau of Reclamation as required in allowing safe transit of BOR staff along the Arizona Stony Gate trail within the responsibility zone. Prevent or repair all damage that results from rock fall originating within the Responsibility Zone as defined in Section 205.

Monitor and record canyon wall activities through the following measures:

1. Deliver to the CO a photographic baseline of the canyon walls from crest to river. Use a format that will resolve objects as small as 2.0 ft in smallest dimension. Establish photograph vantage points along each canyon rim that afford a roughly perpendicular view of the opposite canyon wall. Cover the full height down to the river as far upstream and as far downstream as the responsibility zone limits, as well as the permanent facilities from the Valve House to the end of the Nevada spillway outlet tunnel extension.

2. When rock is being handled within the excavations, provide a spotter and a vantage point where the spotter can see the entire canyon wall and the full width of the river channel. Equip the spotter with 10x binoculars, radio communications to the construction team, and 35 mm camera.
3. When actively engaged in excavation operations, maintain a videotape recording covering the area of the Responsibility Zone.

Prior to final written acceptance of the project by the CO, rebuild, repair, restore and make good all damages to any portion of the Work within the responsibility zone or any structure or facility outside the responsibility zone that is damaged by rock fall originating from within the responsibility zone. No reimbursement will be made for work necessary due to the Contractor's failure to comply with the requirements of the SPPP.

107.08 Sanitation, Health, and Safety. Add the following:

Institute a litter control program during construction to eliminate accumulation of trash. Remove all construction debris and other trash from the site as soon as construction is possible. Collect all trash so Ravens are not attracted to the site, and subsequently prey on juvenile Tortoises. Ravens are known predators on juvenile Tortoises. Remove trash from the construction site to trash receptacles at the close of each work day; and dispose of accumulated trash at the end of each work week.

107.10 Environmental Protection. Add the following:

All operators and contractors functioning within the project limits are responsible to properly clean up, mitigate, and remedy, if necessary, all unauthorized discharges of hazardous materials or non-hazardous chemical and biological products released from fleet or other support vehicles or stationary sources. Respond within the guidelines established by federal, state, and local regulations and as outlined in the Contractor's Safety or Hazardous Materials Business Plan.

When a spill, leak or other release of 50 gallons or greater occurs, notify the CO to initiate emergency response actions as soon as possible, without impeding cleanup. Perform cleanup actions in accordance to NDEP regulations.

In general, when gasoline, diesel fuel, antifreeze hydraulic fluid or any other chemical contained within the vehicle is released to the pavement or ground, immediately implement proper corrective cleanup and safety actions. All vehicles with a load rating of two tons or greater must carry, at minimum, enough absorbent materials to effectively immobilize the entire total volume of fluids contained within the vehicle.

Vehicles and operators transporting hazardous materials must be DOT certified and/or registered; operators must be state licensed and knowledgeable of local emergency response and personal safety protocol.

Repair immediately oil leaks from the various pieces of equipment when discovered. Provide oil pans and absorbent materials in place prior to beginning repair work. Have the "on scene" capability of catching and absorbing leaks or spillages of petroleum products including antifreeze from breakdowns

or repair actions with approved absorbent materials. Dig up soils contaminated with such fluids, place in appropriate safety containers, remove from the project site, and dispose of according to Nevada Division of Environmental Protection (NDEP) regulations. Sand or soil are not approved absorbent materials.

Absorbent materials may be ordered from:

Lab Safety Supply
P.O. Box 1368
Janesville, WI 53547-1368
(800) 356-0722
Polysorb Blankets JB 17921
Universal Sorbent Rolls JB8617

New Pig Corporation
1 Pork Avenue
Tipton, PA 16684
(800) 468-4647

(New Pig Corporation ships from
from distribution warehouses in California)

Submit for CO approval written proof prior to construction activities in off-project work areas (including but not limited to: non-commercial material sources; disposal sites; waste areas; haul roads; and staging areas) that such activities shall not encroach into or affect the following:

(1) Sites listed or eligible for the listing in the National Register of Historic Places. Prepare the written proof by a cultural resource specialist who meets the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation, 48 CFR 44716-44740. Submit written proof satisfactory to the State Historic Preservation Office (SHPO) for conformance to regulations in Section 106 of the National Historic Preservation Act.

(2) Species protected under the Endangered Species Act of 1973. Include in written proof a current list of all threatened or endangered species in the area of the proposed site(s) from the FWS and a "no effect" determination according to Section 7 of the Endangered Species Act from a biological specialist.

(3) Any regulated wetlands of the United States as defined by the U.S. Army Corps of Engineers' 1987 Wetland Delineation Manual. Prepare the written proof by a wetland specialist.

(a) Guidelines For Handling Mojave or Sonora Desert Tortoises and Gila Monsters: Attend an on-site Tortoise and Gila Monster training provided by the CO with all construction personnel. All personnel within the project site are required to first attend the Tortoise training before entering the project site. The CO will make arrangements to conduct these sessions using qualified personnel on an as needed basis to respond to changes in Contractor or FHWA staffing. Provide the CO two working days notice of all new staff that requires handling training. Any person found within the project site who has not been Tortoise educated is subject to immediate removal from the project site, and subject to fine by the NPS.

If any Tortoise or Gila Monster is found within or near the project area during, before, or after daily construction activities, all workers will follow handling procedures according to the training provided by a qualified biologist. Any Tortoise or Gila Monster discoveries, injuries, or deaths are subject to investigation by the NPS, Fish and Wildlife Service, or Nevada Division of Wildlife.

Take, possession, or harassment of wild desert Tortoises and Gila Monsters is prohibited by Nevada State law. Unless specifically authorized by the Nevada Division of Wildlife or as noted above, project personnel should avoid disturbing any Tortoise or Gila Monster.

(b) Guidelines for Wildlife (Bighorn Sheep) Sensitivity and Safety Training: Attend an on-site Wildlife (Bighorn Sheep) sensitivity and safety training provided by the CO with all construction site personnel. All personnel within the project site are required to first attend this training before entering the project site. All personnel will be responsible to adhere to the guidelines presented at this training and be able to provide certification of completing this training.

107.11 Protection of Forests, Parks, and Public Lands. Add the following:

The project limits are within the Hoover Dam Reservation Area. Limit construction activity to the construction limits/clearing limits unless otherwise directed by the CO. If disturbance does occur outside the construction limits, the CO may require that the Contractor install temporary construction fence at the construction limits for no additional compensation to provide a protective barrier and contain work within the construction limits. The CO, in conjunction with the NPS and BOR, will determine the cost to the Contractor to mitigate the area of disturbance beyond the construction limits. If the problem persists, the operation causing the disturbances will be shut down.

Under the direction of the CO, Contractor must allow designated Native American Tribal representatives the opportunity to monitor construction of the roadway facility in the vicinity of Sugarloaf Mountain area located on the eastern flank of Surgarloaf Mountain.

Steam clean all earth moving equipment of soil and noxious weed seeds to the approval of the CO prior to entering the project site. Re-clean equipment when re-entering the project site from other sites. Clean hauling vehicles before their initial entrance into the project site; subsequent re-entries will not require cleaning unless requested by the CO. Clean all equipment outside of the boundaries of the project site.

Section 108. - PROSECUTION AND PROGRESS

108.01 Commencement, Prosecution, and Completion of Work.

Delete the first sentence of the second paragraph and substitute the following:

A preconstruction conference will be held after the contract is awarded and before beginning work.

Add the following:

Limit operations as follows:

(a) No work or pre-bid activity will be performed on the project site on the following holiday periods:

Thanksgiving	November 27-30, 2003
Christmas to New Years	December 25, 2003 -January 1, 2004
Thanksgiving	November 25-28, 2004
Christmas to New Years	December 24, 2004 – January 1, 2005
Thanksgiving	November 24-27, 2005
Christmas to New Years	December 24, 2005 – January 2, 2006
Thanksgiving	November 23-26, 2006
Christmas to New Years	December 24, 2006 – January 2, 2007

No work will be performed on the project site on the following holidays:

Memorial Day of any year
Independence Day of any year
Labor Day of any year

No traffic delays of any kind will be allowed during the following holiday periods, one lane in each direction will be open to traffic with no work requiring lane closures to be permitted:

Labor Day	August 29 – September 2, 2003
Thanksgiving	November 22-December 1, 2003
Christmas to New Years	December 20, 2003 -January 4, 2004
Memorial Day	May 28-June 1, 2004
Independence Day	July 2-6, 2004
Labor Day	September 3-7, 2004
Thanksgiving	November 20-28, 2004
Christmas to New Years	December 20, 2004 – January 2, 2005
Memorial Day	May 27-31, 2005
Independence Day	July 1-5, 2005
Labor Day	September 1-6, 2005
Thanksgiving	November 17-27, 2005
Christmas to New Years	December 17, 2005 – January 3, 2006
Memorial Day	May 26-30, 2006

Independence Day	June 30 – July 5, 2006
Labor Day	September 1-5, 2006
Thanksgiving	November 16-26, 2006
Christmas to New Years	December 17, 2006 – January 2, 2007
Memorial Day	May 25-29, 2007
Independence Day	July 2 – July 5, 2007

See Section 156 for details of closures.

(b) Maintain access to the BOR Facilities on both sides of the Colorado River during construction.

(c) Private rafting companies and Colorado River User individual permittees have limited access to the Lower Portal Access Road to the Colorado River via the Lower Portal Access Road as described below:

1) Winter (November 1 through February 28): Typically none during the weekdays with minimal use during weekends.

2) Spring (March 1 to April 15): Heavy weekday and weekend usage.

3) Summer (April 15 to October 31): Minimal use during the weekdays with heavy use during weekends.

The contractor will be responsible for communicating his blasting plan and excavation schedule to the CO and National Park Service, and shall escort permitees to the river to control access during blasting operations. Contact National Park Service, Lake Mead National Recreation Area,
Mr. Jim Vanderford,
601 Nevada Highway
Boulder City, NV 89005
Phone: (702) 293-8916

(d) The Bureau of Reclamation (BOR) security checkpoint shall remain operational at all times during construction. The location of the Nevada checkpoint is near the BOR Warehouse Facility at milepost 1.6 of existing US 93. The Contractor shall coordinate all construction activities affecting the checkpoint with BOR contacts listed below:

Mr. Donald Bader
P.O. Box 61470
Boulder City, NV 89006-1470
Phone: (702) 293-8248

(e) Cooperate with WAPA to provide safe and reasonable access to WAPA facilities during the construction.

(f) WAPA representatives have removed lines from WAPA towers that are to be abandoned within the construction limits.

(g) The contractor shall limit closures to existing US 93 for blasting operations as required in Section 156.06.

(h) Construction of the Nevada and Arizona Approaches by separate Contracts will be ongoing. Coordinate the security of the project limits with the Nevada and Arizona Approach Contractors and such that the area remains secure after hours in accordance with subsection 156.06.

(i) Contractor is hereby advised of the continuous movement and crossing of the project site by Bighorn Sheep. The project impacts the current movements of sheep that inhabit Gold Strike Canyon as well as the shores of Lake Mead. Construction operations must not restrict the movement of this protected species. As these sheep may wander within the construction limits, keep all construction traffic (contractor equipment and vehicles) speeds below 25 mph.

(j) Application of the weathering agent will follow completion of the earthwork operations back station from pier 1, and will follow a review of the project site by the CO and agency representatives. Upon direction from the CO as to the limits and initial color requirements, apply the weathering agent from the completed roadway subgrade elevations to the completed earthwork surfaces. No interim staining will be permitted until the entire surface is exposed and evaluated.

(k) Prior to any blasting operations, except for blasts involving less than 20 lb total of explosives for safety scaling operations, complete rock stabilization requirements as required in Section 205 to protect Hoover Dam discharge facilities within Black Canyon and contain large rock masses from falling into the Colorado River.

(l) Provide monitoring of the canyon walls within the responsibility zone during excavation operations to assure that rock fall conditions that may threaten safe construction activities, or river uses below.

Add the following:

A Notice to Proceed must be issued before commencement of any work. The count of contract time will begin upon issuance of the Notice to Proceed and shall run continuously until final construction completion.

108.04 Failure to Complete Work on Time. Delete the second and third paragraphs and substitute the following:

Liquidated damages in the amount of $6,000.00 will be assessed for each day beyond the time allowed to complete the contract until substantial completion of the work.

Liquidated damages in the amount of $2000.00 will be assessed for each day beyond the time allowed to complete the contract beginning with the day after substantial completion and ending with the date of final completion and acceptance.

Delete the contents Table 108-1

Section 109. - MEASUREMENT AND PAYMENT

109.01 Measurement Methods. Add the following after the third paragraph:

Submit measurement notes to the CO within 24 hours of performing the work. For on-going work, submit measurement notes weekly. When work is not complete, identify the measurement as being an interim measurement. Submit the final measurement when the installation is completed. Measurement notes form the basis of the Government's receiving report (see Subsection 109.08(d)). For lump sum items, submit documentation to support invoiced progress payment on a monthly basis.

Use an acceptable format for measurement records. As a minimum, include the following information in all records of measurement:

(a) Project name and number
(b) Contract item number
(c) Date the work was performed
(d) Location of the work
(e) Measured quantity
(f) Calculations made to arrive at the quantity
(g) Supporting sketch and/or details as needed to clearly define the work performed and the quantity measured.
(h) Names of persons measuring the work
(i) Identification as to whether the measurement is interim or final
(j) Signed certification statement by the persons taking the measurements, performing the calculations, and submitting them for payment that the measurement and calculations are correct to the best of their knowledge and that the quantity being measured is subject to direct payment for the identified item under the contract.

109.06 Pricing of Adjustments.

(a) Proposal.

(3) Cost or pricing data. Delete the third paragraph and substitute the following:

Submit with the cost or pricing data a written proposal for pricing the work according to (1) above. See Table 15-2 following FAR Subpart 15.4 for guidance.

109.08 Progress Payments. Delete the text of this subsection and substitute the following:

109.08 Progress Payments. FAR Clauses 52.232-5 - Payments under Fixed-Price Construction Contracts and 52.232-27 - Prompt Payment for Construction Contracts are supplemented as follows:

(a) General. Only invoice payments will be made under this contract. Invoice payments include progress payments made monthly as work is accomplished and the final payment made upon final acceptance. Only one progress payment will be made each month. No progress payment will be made in a month when the work accomplished results in a net payment of less than $1,000. Full or partial progress payment will be withheld until a construction schedule or schedule update is submitted to and accepted by the CO.

(b) Closing date and invoice submittal date. The closing date for progress payments will be designated by the CO. Include work performed after the closing date in the following month's invoice. Submit invoices to the designated billing office by the 7th day after the closing date. Invoices received by the designated billing office after the 16th day following the closing date will not be accepted for payment processing that month. Include late, unprocessed invoice submittals in the following month's invoice.

(c) Invoice requirements. Submit the invoice to the government's designated billing office. Include the following items in the invoice:

(1) The information required in FAR Clause 52.232-27(a)(2)(i) through (a)(2)(x).

(2) A tabulation of total quantities and unit prices of work accomplished or completed on each pay item as of the monthly closing date. Do not include any quantities unless field note documentation for those quantities was submitted by the closing date. Do not include any work involving material for which test reports required under Sections 153 or 154 or certifications required by Subsection 106.03 are past due as of the closing date.

(3) The certification required by FAR Clause 52.232-5(c) and, if applicable, the notice required by FAR Clause 52.232-5(d). Provide an original signature on the certification. Facsimiles are not acceptable.

(4) If applicable, a copy of the notices that are required by FAR Clause 52.232-27(e)(5) and (g).

(5) The amount included for work performed by each subcontractor under the contract.

(6) The total amount of each subcontract under the contract.

(7) The amounts previously paid to each subcontractor under the contract.

(8) Adjustments to the proposed total payment which relate to the quantity and quality of individual items of work. Adjustments for the following may be made by the Government after validation of the invoice.

(a) Retent resulting from a failure to maintain acceptable progress.

(b) Retent resulting from violations of the labor provisions.

(c) Retent pending completion of incomplete work, other "no pay" work, and verification of final quantities.

(d) Obligations to the Government such as excess testing cost or the cost of corrective work pursuant to FAR Clause 52.246-12(g).

(e) Liquidated damages for failure to complete work on time.

(d) Government's receiving report. The Government's receiving report will be developed using the measurement notes received and accepted by the CO. Within 4 days after the closing date, the CO will be available by appointment at the Government's designated billing office to advise the Contractor of quantities and unit prices appearing on the Government's receiving report.

(e) Processing progress payment requests. No payment will be made for work unless field note documentation for the work was provided by the closing date.

(1) Invoices received by the 7th day following the closing date.

(a) ***Proper invoices.*** If the invoice meets the requirements of Subsection 109.08(c), and the quantities and unit prices shown on the contractor's invoice agree with the corresponding quantities and unit prices shown on the Government's receiving report, the invoice will be paid.

(b) ***Defective invoices.*** If the invoice does not meet the requirements of Subsection 109.08(c), or if any of the quantities or unit prices shown on the contractor's invoice exceed the corresponding quantities and unit prices shown on the Government's receiving report, the invoice will be deemed defective and the Contractor so notified according to FAR Clause 52.232-27(a)(2). Defective invoices will not be corrected by the Government and will be returned to the Contractor within 7 days after the Government's designated billing office receives the invoice.

Revise and resubmit returned invoices by the 18th day following the closing date. The CO will evaluate the revised invoice. If the invoice still does not meet the requirements of Subsection 109.08(c), the Contractor will be so notified according to FAR Clause 52.232-27(a)(2), and no progress payment will be made that month. Correct the deficiencies and resubmit the invoice the following month.

If the revised invoice meets the requirements of Subsection 109.08(c), but still had quantities or unit prices exceeding the corresponding quantities and unit prices shown on the Government's receiving report, the Government's data for that item or work will be used. The Contractor's invoice, as revised by the Government's receiving report, will be forwarded for processing by the 23rd day following the closing date. The Contractor will be notified by the 23rd day following the closing date of the reasons for any changes to the invoice.

(2) Invoices received between the 8th and 16th day following the closing date.

(a) Proper invoices. If the invoice meets the requirements of Subsection 109.08(d), and the quantities and unit prices shown on the Contractor's invoice agree with the corresponding quantities and unit prices shown on the CO's receiving report, the invoice will be deemed proper and forwarded for processing within 7 days of receipt.

(b) Defective invoices. If the invoice does not meet the requirements of Subsection 109.08(d), the invoice will be deemed defective, the Contractor so notified according to FAR Clause 52.232-27(a)(2), and no progress payment will be made that month. Correct the deficiencies and resubmit the invoice the following month.

If the invoice meets the requirements of Subsection 109.08(d), but has quantities or unit prices exceeding the corresponding quantities and unit prices shown on the Government's receiving report, the Government's data for that item of work will be used. The Contractor's invoice, as revised by the Government's receiving report, will be forwarded for processing within 7 days of the Government's receipt of the invoice, of the reasons for any changes to the invoice.

(f) Partial payments. Progress payments may include partial payment for material to be incorporated in the work, provided the material meets the requirements of the contract and is delivered on or in the vicinity of the project site or stored in acceptable storage places.

Partial payment for material does not constitute acceptance of such material for use in completing items of work. Partial payments will not be made for living or perishable material until incorporated into the project.

Partial payments for material will not exceed the lesser of:

(a) 80 percent of the contract bid price for the item, or
(b) 100 percent of amount supported by copies of invoices submitted.

The quantity paid will not exceed the corresponding quantity estimated in the contract.

Add the following after the second paragraph:

Full or partial progress payment may be withheld until a construction schedule or schedule update is submitted to and accepted by the CO.

Add the following to the fifth paragraph on page 60:

Partial payments for stockpiled manufactured material (aggregates) will be based on Contractor process control test results. If test results show the material to be out-of-specification, or in "reject" where statistical evaluation procedures are used, no payment for stockpiled materials will be made.

109.09 Final Payment. Delete the first sentence and substitute the following:

FAR Clause 52.232-5, Payment under Fixed-Price Construction Contracts, and FAR Clause 52.232-27 - Prompt Payment for Construction Contracts are supplemented as follows:

Section 152. - CONSTRUCTION SURVEY AND STAKING

Construction Requirements

152.02 General. Delete the first paragraph and substitute the following:

The Government will furnish to the Contractor one copy of each of the following information:

- Elevations and locations for subgrade stakes at a minimum of 25-foot intervals for the following roadways and station limits:

  US 93 Mainline St 170 to Sta 203 <zone under consideration>

- Coordinates and elevations of traverse control points (Consistent with Plan Sheet "NV Construction Control Point Plan").
- Benchmark data.
- Slope stake books containing centerline grade and slope catch information at a minimum of 25-foot intervals.
- Computer listings containing: horizontal alignment, vertical alignment, earthwork quantities, and staking details showing superelevation template data and slope information.

The Government will provide computer files for downloading xyz data. This information may be downloaded by accessing the CFLHD website at **www.cflhd.gov.** Click on "Project Information" and the appropriate "State" to access the project files. Following is the information that will be provided electronically:

- Coordinates and elevations of traverse control points and benchmarks.
- xyz coordinates of grade finishing stakes for all roadways.
-

The Government will perform the following:

- Establish basic survey control points (T-points) for vertical and horizontal control of the project.

Delete the second sentence of the second paragraph and substitute the following:

Reestablish missing control points and stakes before work begins.

Add the following to the fourth paragraph:

Protect all land survey monuments, property corners, USGS bench marks and USGS control points outside of the construction limits. Reference any remaining points which fall within the construction limits according to Subsection 107.02, Protection and Restoration of Property and Landscape. Coordinate the new locations with the CO.

Add the following to the fifth paragraph:

Use the procedures contained in the current "Location/Construction Surveying Guide" issued by the U.S. Department of Transportation, Central Federal Lands Highway Division, Denver, Colorado, as a guide to the work in this Section.

Add the following:

Furnish a practicable schedule of staking activities with the construction schedule submitted according to Section 155. Include the dates and sequence of staking requirements.

152.03 Survey and Staking Requirements.

(b) Roadway cross-sections. Delete the text of this paragraph and substitute the following:

Take roadway cross-sections normal to centerline. When the centerline curve radius is less than or equal to 250 feet, take cross-sections at a maximum centerline spacing of 25 feet. When the centerline curve radius is greater than 250 feet, take cross-sections at a maximum centerline spacing of 50 feet. Take additional cross-sections at significant breaks in topography and at changes in the typical section. Along each cross-section, measure and record points at breaks in topography, but no further apart than 15 feet. Measure and record points to at least the anticipated slope stake and reference locations. Reduce all cross-section distances to horizontal distances from centerline.

152.03(e) Centerline reestablishment. Delete the text of this paragraph and substitute the following:

Reestablish centerline from instrument control points. The maximum spacing between centerline points is 25 feet when centerline curve radius is less than or equal to 250 feet. When the centerline curve radius is greater than 250 feet, the maximum distance between centerline points is 50 feet. Reestablish centerline as many times as necessary to construct the work.

(g) Drainage structures. Add the following: <consideration to put in paving contract?>

Verify, in the field, the approximate location of each individual structure with the CO prior to surveying, designing, and staking culverts. Use the "Guide for Designing and Staking Culvert in the Field," dated January 9, 1996, issued by the Department of Transportation, Central Federal Lands Highway Division, Denver, CO, as a guide to the work in this Section.

(5) Add the following:

Colorado River Bridge 60%+ Submittal

Plot at a scale of 1" = 10'

Add the following:

(7) When the field design has been approved, set drainage structure survey stakes, reference stakes, and stake inlet and outlet ditches to make the structure, including end treatments (e.g., drop inlets) functional.

(8) Adjust slope stakes to provide for catch basins (and transitions into and out of catch basins) which correspond to the final culvert location and design. If the culvert was moved from location shown in the plans, review the slope stakes in the vicinity of the plan location and adjust the slope stakes to remove the planned catch basin.

(h) Bridges: Add the following:

Bridge survey and staking will consist of two components. The first component includes all bridge survey for staking control and measurement. The second component includes all specialized geometry control survey for constructing the main arch ribs and spandrel columns.

Use first order survey practices. Establish temporary bench marks on the centerline of each arch rib, at each of the Nevada and Arizona skewback footings. Establish controls for alignment and grade of each arch rib throughout casting of the ribs. Establish line and grade for setting form travelers or other form systems used for casting the arch, and either casting or setting the spandrel columns. Establish permanent control points embedding stainless steel screws with punch marks for grade and notched wires for centerline alignment at the end of each arch segment.

(l) Miscellaneous survey and staking. Add the following:

Misc survey and staking will be survey and staking ordered by the CO in order to check the work of the contractor, and to establish control for miscellaneous construction not part of bridge and roadway items.

(6) Re-establish missing T-control points and supplemental (S)-points and reference hubs.

(7) Upon completion of stockpiling topsoil, provide cross sections of all stockpiled topsoil and topsoil windrows.

(m) Intermediate surveying and staking. Delete the text of the third paragraph and substitute the following:

Re-measure quantities if it has been determined that any portion of the work is acceptable but has not been completed to the lines, grades, and dimensions shown on the plans or established by the CO.

Modify the following:

Table 152 Construction Survey and Staking Tolerances for General Survey and Bridge Arch and Columns

Staking Phase	Horizontal	Vertical
Bridge substructure	+/- 0.01 ft	+/- 0.01 ft
Bridge Arch Erection	+/- 0.005 ft	+/- 0.005 ft

Add the following:

Set reference hubs to a horizontal accuracy of ±0.2 feet of their theoretical locations. Set centerline points to be within ±0.3 feet horizontally.

Measurement

152.05 Add the following:

Do not measure survey and staking for payment for individual work items such as containment structures, responsibility zone, abutment wing walls, retaining walls, guardrail, riprap, etc. The only exception will be for survey and staking of culverts, as specified in Subsection 152.03 Survey and Staking Requirements, (g) Drainage structures.

Add the following:

Re-establishing missing Government-set terrain cross-section reference hubs, T-control points, S-point, and stakes will be measured under Miscellaneous Survey and Staking when it is paid by the hour. No payment will be made for re-establishing missing hubs, control points, or stakes after construction operations have begun.

Arch Layout will be measured by the lump sum.

Bridge Survey and staking will be measured by the lump sum.

Misc survey and staking will be measured by the hour for all CO ordered survey.

152.06 Add the following:

15210a Arch Layout and staking — Lump Sum
15210b Bridge Survey and staking — Lump Sum
15210c Misc survey and staking — Hour

Section 153. - CONTRACTOR QUALITY CONTROL

Construction Requirements

153.02 Contractor Quality Control Plan.

(a) Process control testing. Add the following:

See Table 153-1 for schedule of minimum sampling and testing for process control. Where no minimums are specified, submit proposed tests to be performed and the proposed sampling and testing frequencies.

Add the following:

For aggregates and/or aggregate/asphalt mixtures accepted under Subsection 106.03, sample and test for conformity with the Certification a minimum of one time per pay item.

(b) Inspection/control procedures.

(3) Production phase. Add the following:

(d) Inspect materials or assemblies accepted under Subsection 106.03 to ensure that the work and materials comply with all contract requirements. Furnish the results of the inspection, along with the product certification or commercial certification as applicable, to the CO prior to incorporating the materials into the work.

(c) Description of records. Add the following:

Identify the format for reporting test results and the procedures to be used to maintain inspection records.

(d) Personnel qualifications.

(1) Add the following:

Designate a Quality Control Supervisor (QCS) whose primary responsibility is managing the inspection system. The QCS shall not be the Contractor's Superintendent. Designate a QCS who is experienced to perform and supervise all sampling, testing, and inspection. The QCS shall monitor all phases of the work and identify deficiencies and take appropriate corrective action.

Add the following:

(3) Personnel assigned to sampling or testing shall have 1 year or more of recent job experience in the type of sampling and testing required by the contract, and the following:

NICET Level II certification in highway materials, or State or industry certification-related sampling and testing equivalent to their intended responsibilities,

or

Current or previous employment by an AASHTO accredited laboratory performing sampling and testing equivalent to their intended responsibilities.

Demonstrated proficiency or successful testing of one or more proficiency samples may be substituted for basic qualifications pending verification of test results.

153.03 Testing. Delete the title and the text and substitute the following:

153.03 Sampling and Testing. Perform the work required by Table 153-1 and by the acceptable Quality Control Plan.

(a) Sampling.

(1) Acceptance sampling. Acceptance sampling schedules and times or locations will be provided by the CO.

(2) Quality control sampling. Use a procedure for random sampling. Sample according to the acceptable Quality Control Plan. In addition, sample any material that appears defective or inconsistent with similar material being produced, unless such material is voluntarily removed and replaced or otherwise corrected.

(b) Testing. Furnish laboratory equipment which conforms to the applicable test requirements and is properly calibrated. Provide a certification stating the equipment conforms to requirements. The CO may require the Contractor to perform testing to demonstrate acceptable equipment and an acceptable level of technician competence.

Keep laboratory facilities clean and maintain equipment in proper working condition. Provide the CO unrestricted access to the laboratory for inspection and review.

153.04 Records. Add the following to the first paragraph:

When tests are on material being incorporated into the work, report test results within 24 hours.

Add the following to the second paragraph:

Detail inspection results including deficiencies observed and corrective actions taken.

153.05 Acceptance. Add the following:

If chronic deficiencies are noted in the Contractor's inspection or testing systems, the CO may order supplemental inspection and/or testing to be performed. The Government will charge to the Contractor all costs associated with such supplemental inspection or testing.

TABLE 153-1
SCHEDULE OF MINIMUM SAMPLING AND TESTING FOR PROCESS CONTROL
(To be performed by the Contractor)

Section(s): 204, 208, 209

MATERIAL	PROPERTY OR CHARACTERISTIC	TEST METHOD OR SPECIFICATION	FREQUENCY	SAMPLING POINT
Embankment Construction.	Classification	AASHTO M 145	1 per material/type	Source of material
Composition of Roadbed in Cuts.	Moisture/density	AASHTO T 99 or AASHTO T 180 (a min. of 5 points/proctor)	1 per material/type	Source of material
Bedding/Backfill for Structures and Culvert Pipe.	Gradation and liquid limit	AASHTO T 11 AASHTO T 27 AASHTO T 89 AASHTO T 90	1 per material/type	Source of material
	In-place density and moisture content	AASHTO T 310 ASTM D 2922 Or D 3017	For embankment and composition of roadbed in cuts -two per lift but not less than two for every 1000 cubic yards. For structure and culvert backfill -one per 50 feet/lift Minimum 2 per lift.	Compacted embankment, subgrade or backfill as applicable
	Classification and R-value	(Tested by FHWA Central Lab)	1 per 2,300 feet or change in material type	Sample Depth 0-12 inches
Rock Embankment		Document rolling pattern and watering methods per lift.	Continuous through all rock embankments.	

TABLE 153-1 (continued)
SCHEDULE OF MINIMUM SAMPLING AND TESTING FOR PROCESS CONTROL
(To be performed by the Contractor)

Section(s): 301, 303, 304, 305, 306, 308

MATERIAL	PROPERTY OR CHARACTERISTIC	TEST METHOD OR SPECIFICATION	FREQUENCY	SAMPLING POINT
Subbase, Base Courses, Aggregate Stabilization and Aggregate-Topsoil Courses.	Gradation (301)	AASHTO T 11 AASHTO T 27	2 per day	Crusher belt
	Moisture-density (max. density, a min. of 5 points/proctor)	AASHTO T 180 AASHTO T 99	1 per source of material	Source of material
	In-place density and moisture content.	ASTM D 2922 and D 3017 or AASHTO T 310	2 per lift at 1000 foot intervals alternating lanes	Compacted aggregate
	Plasticity index (aggregate surfacing only)	AASHTO T 90	2 per day	Crusher belt
	Gradation (304 materials processed in place)	AASHTO T 11 AASHTO T 27	1 per 1,200 feet	Processed materials
Magnesium Chloride and Calcium Chloride	Specific Gravity	Hydrometer	1 per shipment	Transport vehicle

Note: Make Density and Moisture calculations FLH 513...Density corrections based on moisture for recycled materials containing asphalts, or aggregates containing MgCl or CaCl based on samples taken from each test site and oven-dried in the laboratory.

TABLE 153-1 (continued)
SCHEDULE OF MINIMUM SAMPLING AND TESTING FOR PROCESS CONTROL
(To be performed by the Contractor)

Section(s): 401, 402, 403, 404, 405

MATERIAL	PROPERTY OR CHARACTERISTIC	TEST METHOD OR SPECIFICATION	FREQUENCY	SAMPLING POINT
Asphalt Concrete Pavement.	Gradation	AASHTO T 11 AASHTO T 27	2 per day/stock pile	Crusher belt (during production) and Cold feed or Hot Bins (as applicable during production of hot mix)
	Moisture content of aggregates	FLH T 509	1 per day	Cold feed (During production of hot mix)
	Adherent fines (course aggregates)	FLH T 512	1 per week	Crusher belt
	Compaction	AASHTO T 310 ASTM D 2922 Or D 3017	Test strip, first day of production to establish roller pattern - 12/1,500 feet then 3 per 1,500 feet	In-place after compaction
	Placement temperature	Thermometer	As directed	Behind lay down
	Surface tolerance	Straight Edge, and FLH T 504	During and after compaction	See Subsection 401.16
	Anti-strip additive (liquid)	FLH T 503(use naphtha)	1 per shipment	Storage tank after circulation.

TABLE 153-1 (continued)
SCHEDULE OF MINIMUM SAMPLING AND TESTING FOR PROCESS CONTROL
(To be performed by the Contractor)

Section(s): 552, 501, 601 <may revise table after review of current HD concrete testing program>

MATERIAL	PROPERTY OR CHARACTERISTIC	TEST METHOD OR SPECIFICATION	FREQUENCY	SAMPLING POINT
Concrete.	Gradation and fineness moduli	AASHTO T 11 AASHTO T 27	1 per day	Aggregate, before batching
	Moisture	FLH T 509	1 per day\stockpile	Aggregate, before batching
	Slump	AASHTO T 119	1 per 25 cubic yards, minimum 1 per day	See note
	Air content	AASHTO T 152	1 per 25 cubic yards, minimum 1 per day	See note
	Unit weight	AASHTO T 121	1 per 25 cubic yards, minimum 1 per day	See note
	Temperature	Thermometer	1 per 25 cubic yards, minimum 1 per day	See note
	Making test specimens, Compressive strength	AASHTO T 23	1 set per 25 cubic yards, minimum 1 set per day	At point of discharge

Note: If an extended set admixture is used for the sole purpose of extending discharge times for Class A concrete, sampling and testing shall be performed by the Contractor at point of batching and discharge location to insure compliance with subsection 552.08

Section 154. - CONTRACTOR SAMPLING AND TESTING

Description

154.01 Delete the second sentence and substitute the following:

When there is a pay item for Contractor testing included in the bid schedule, it also consists of testing and reporting required test results.

Construction Requirements

154.02 Sampling. Delete the last three sentences of the second paragraph and substitute the following:

Deliver the Government's portion of the sample or split sample in an acceptable container suitable for shipment. Label all samples with the following information:

(a) Project number
(b) Source of material
(c) Item number
(d) Sample number
(e) Date sampled
(f) Time sampled
(g) Location sample taken
(h) Name of person sampling
(i) Name of person witnessing sampling
(j) Type of test required on sample

Sample according to the Sampling and Testing tables included at the end of each section.

154.03 Testing. Delete the first sentence and substitute the following:

When there is a pay item for Contractor testing included in the bid schedule, perform all tests required by the Sampling and Testing tables included at the end of each section.

Add the following:

Where Process Control Sampling and Testing frequencies as per Table 153-1 are identical to the Sampling and Testing Tables for all applicable work the Process Control Samples may be used for acceptance.

Add the following subsection:

154.03A Laboratory (Contractor-Furnished). Furnish a laboratory equipped with all necessary test equipment and accessories to satisfy the testing required by the contract. Services of a commercial laboratory equipped with all necessary test equipment and accessories to satisfy the testing required by the contract may be used.

Use equipment that is calibrated and meets the applicable testing requirements of the contract. Tag all necessary equipment indicating the date of last inspection, inspector, and calibration number.

The CO may check equipment to verify condition and calibration. Repair or replace equipment not meeting applicable requirements.

Submit documentation supporting the calibration of all necessary equipment prior to actual testing. Include the following:

(1) Description of the equipment calibrated or verified, including model number, serial number, or other acceptable identification.

(2) Identification of the individual performing the calibration or verification.

(3) Identification of the calibration or verification procedure used.

(4) The calibration number for each calibration.

154.04 Records. Add the following:

Report test results on forms containing all sample information required by Subsection 154.02. Label clearly all interim measurements used to determine the results. Attach work sheets used to determine test values to the test result forms when submitted.

Section 155. - SCHEDULES FOR CONSTRUCTION CONTRACTS

Construction Requirements

155.02 General. Delete the first sentence of the third paragraph and substitute with the following:

Provide both the Bar Chart Method (BCM) and Critical Path Method (CPM) described below to develop the construction schedule for the total contract work. Provide work item details for column and arch construction to show casting days for each segment and each lift of concrete placement, and to show the timing and sequence of dead load application to the arch.

Add the following to the fourth paragraph:

No progress payment will be made for any work until a construction schedule is submitted to the CO and accepted by the CO.

155.05 Written Narrative. Add the following:

(j) List anticipated monthly and cumulative contract earnings (including, for schedule updates, any contract modifications) for each month from the beginning of construction operations through the completion of the work. Calculate and list each month's anticipated earnings through the close of business on the date provided by the CO as the cut-off date for monthly project pay estimates.

155.06 Schedule Updates. Add the following:

No progress payment will be made for any work until an updated construction schedule has been submitted to and accepted by the CO.

Allow 7 days after receipt for acceptance of the updated construction schedule or a return for revisions.

Section 156. - PUBLIC TRAFFIC

Construction Requirements

156.03 Accommodating Traffic During Work. Delete the last two sentences of the first paragraph and substitute the following:

Submit situation-specific traffic control implementation drawings and alternate traffic control proposals according to Subsection 104.03 for acceptance at least 14 days before intended use.

Add the following:
(a) General Information.
Install temporary traffic control devices no more than 30 minutes prior to a closure and have the devices removed within 30 minutes of the end of the closure. Cover existing signs in conflict with construction signing as directed by the CO and uncover to restore existing signing after work activities are completed.

(b) Daily Schedule for Traffic Control Activities
In addition to schedule requirements of Section 155, provide daily schedules of activities and corresponding traffic control schemes. Provide information in advance during weekly construction meeting and specify the limits of work activities and related traffic control plan by location, direction and time.

Develop construction schedule and traffic control schemes in such a way that access is maintained at all times to adjacent roads, BOR, and WAPA facilities unless otherwise stipulated in the SCR's, plans or by the CO. Maintain access to the Lower Portal Access Road as discussed in Section 108. Update the traffic information as necessary to meet any schedule or traffic control changes.

156.06 Limitations on Construction Operations.

(d) Delete the first sentence and substitute the following:

For alternate one-way traffic control, provide a minimum width of 13 feet or half roadway paved width unless otherwise specified in the plans. For two-way traffic, provide a minimum roadway width of 26 feet, between temporary concrete barrier unless otherwise specified in the plans. See Traffic Control plans for details.

(j) Delete the text and substitute the following:

One lane closures will be permitted within the project limits at any given time. This does not include hauling and delivering equipment or materials into or out of the site. Traffic stops related to hauling and delivering equipment and materials into or out of the site are limited to less than 2 minutes per closure. Any excess of 2 minutes will be considered a lane closure and subject to the limitations stated below.

Add the following

(k) Restriction of Roadway by Contractor Operations/ Lane Rental System
The construction of this project will require the contractor to close the roadway for varying periods of time and also use the existing roadway for earthwork hauling operations. A "lane rental" system will be in effect for this project. Under this system the contractor will be permitted to rent the roadway to conduct construction activities. This lane rental system is intended to minimize impacts of the project construction on the traveling public by encouraging the contractor to (1) schedule tasks requiring roadway closures or restrictions during the preferred periods, and (2) minimizing the duration of the closure by maximizing the efficiency of his operations.

The CO will closely monitor the contractor's operation during periods when lane rental closures or hauling operations are in effect in order to document appropriate use of traffic control devices. If the CO determines deficiencies exist, work will be halted until the deficiencies are corrected.

A lane closure(restriction) is defined as a blockage of a traffic lane for more than 2 minutes within a 15 minute period. No lane closures are allowed on any weekends and holidays listed in Section 108.

The CO will approve the closures prior to contractor start of these activities.

No one lane closure will have a duration longer than 30 minutes. Two lanes closures will not go longer than 10 minutes.

Preferred Closure periods are included in Table 156-01 of these SCR's.

TABLE-156-01-Preferred Work Hours								
US 93 Station 22 to 177								
From	To	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday
12:00am	1:00am	PH	PH	P	P	P	P	P

1:00am	2:00am	PH	PH	P	P	P	P	P
2:00am	3:00am	PH	PH	P	P	P	P	P
3:00am	4:00am	PH	PH	P	P	P	P	P
4:00am	5:00am	PH	PH	P	P	P	P	P
5:00am	6:00am	PH	PH	P	P	P	P	P
6:00am	7:00am	PH	PH	P	P	P	P	P
7:00am	8:00am	PH	PH	N	P	P	P	P
8:00am	9:00am	PH	PH	N	N	N	N	N
9:00am	10:00am	PH	PH	N	N	N	N	N
10:00am	11:00am	PH	PH	N	N	N	N	N
11:00am	12:00pm	PH	PH	N	N	N	N	N
12:00pm	1:00pm	PH	PH	N	N	N	N	N
1:00pm	2:00pm	PH	PH	N	N	N	N	N
2:00pm	3:00pm	PH	PH	N	N	N	N	N
3:00pm	4:00pm	PH	PH	N	N	N	N	N
4:00pm	5:00pm	PH	PH	N	N	N	N	N
5:00pm	6:00pm	PH	PH	N	N	N	N	N
6:00pm	7:00pm	PH	PH	P	P	P	P	N
7:00pm	8:00pm	PH	PH	P	P	P	P	N
8:00pm	9:00pm	PH	PH	P	P	P	P	N
9:00pm	10:00pm	PH	PH	P	P	P	P	N
10:00pm	11:00pm	PH	PH	P	P	P	P	N
11:00pm	12:00am	PH	PH	P	P	P	P	N

N means non-preferred, P is preferred and PH is prohibited closure times.

(1) Lane Rental Rates

Table 156-02 lists the rental rates that will be charged to the contractor for closing lanes. For the purpose of applying the rates included in Table 156-02 an approved closure is a closure which has been approved in advance by the CO. The CO's approval does not waive the lane rental rates to be applied. The lane rental rates are determined by the day of week, and time of day the lane restriction is implemented. The schedule of preferred closure periods is included as Table 156-01.

A Lane rental item in the amount of <$xxxxxx> has been established for use by the contractor to rent lanes. Lane rental amounts, determined as described herein will be charged against this fund.

The amount of the lane rental fund is based on an estimate of the number and duration of closures, each closure occurring within preferred closure periods, which will be required to complete the project. If lane rental costs exceed the established lane rental fund, the excess will be deducted from monthly payments due the contractor. The lane rental provisions do not affect the provisions of Subsection 108.04 of the SCR's.

Table 156-02--Roadway Closure (Note 1)						
Lane Rental Rate ($/minute)						
From	To	Monday	Tuesday	Wednesday	Thursday	Friday
6:00am	8:00am	$30	$20	$20	$20	$20
8:01am	11:00am	$30	$30	$30	$30	$30

11:01am	2:00pm	$30	$30	$30	$30	$30
2:01pm	6:00pm	$30	$30	$30	$30	$30
6:01pm	12:00am	$5	$5	$5	$5	$30
12:01pm	6:00am	$5	$5	$5	$5	prohibited

Note 1--Closure rates double per minute if longer than 10 minutes during the non-preferred time or 30 minutes in the preferred time. CO will not approve closures during weekends and holidays.

(2) Lane Rental Cost Assessment Parameters

For each closure (restriction) of the roadway, the lane rental amount, as determined by the duration of the closure, will be deducted from the lane rental fund. The rate will be as defined in Table 156-2; the rate is dependent upon the day of the week and time of day of the closure.

A closure begins when the placement of the traffic control devices are operational and the lane is restricted; and ends when no further lane restrictions exist and traffic control devices are covered or removed. Time for each roadway closure will be measured to the nearest minute by the CO.

(3) Examples of Lane Rental Calculations

A—Lane Closure Examples

A1—Closure within preferred time period 10 minutes or less.

The Contractor has a flagger controlled stops for one lane closure between 6pm and 3am.

6pm to 3am 540 minutes @ $5 per minute=$2700

A2—Closure within preferred time period longer than 10 minutes

The Contractor has a flagger controlled stop to set off a blast between 6am and 7am. The roadway is closed from 6:16am to 6:30 am. The following lane rental charge will be assessed:

6:16 to 6:26 10 minutes @ $5 per minute=$50
6:26 to 6:30 4 minutes @ $20 per minute =$80
Total=$130

A3—Closure goes beyond the preferred time period and is longer than 10 minutes. The roadway is closed from 7:45 to 8:05.

7:45 to 8:00 5 minutes @ $20 per minute=$100
8:00 to 8:05 5 minutes @ $30 per minute =$150
Total= $450

(m) Blasting Plan Traffic Control Requirements

The blasting plan must include traffic control requirements as part of the overall submittal for approval per section 204 and Section 104.03. Requirements for blasting are included in Section 205.04 -Blasting Plan. The blasting plan must detail traffic control measures to be implemented during the blast and will be assessed lane rental charges per Section 156.06 (k). If traffic is backed up within the Contractor's designated safety zone around the blast site at the scheduled blasting time, disconnect the lead-in line and guard the blast until traffic has moved a safe distance away.

(n) Maintain one lane in each direction at all times on US 93 with the following exceptions:
One lane or two lane closures are allowed during the following construction activities and subject to the lane rental provisions established in 156.06(k):

1) Blasting near existing US 93, where Contractor anticipates a safety hazard for the traveling public. Limit two lane closures to 10 minutes unless blasting occurs at night between 6pm and 6am. At night closures are limited to 15 minutes.

2) Short term closures for bridge construction near existing US 93 during footing construction at the hairpin turn that may be a hazard. Limit two lane closures to 10 minutes unless at night between 6pm and 6am. At night closures are limited to 15 minutes.

3) Access and egress of construction equipment and/or materials to and from existing US 93. These flagged two lane closures will be limited to two minutes per closure and are not subject to lane rental. If closure is longer than 2 minutes the closure will be considered a short term closure and subject to the limitations set forth in Section 108.01 and the lane rental system described above.

Alternating one-way flagman controlled operation have the following limitations and requirements:

Provide BOR security personnel at both the Arizona and Nevada checkpoints with the radios using the same frequency as the flaggers to assist in apprising the BOR security officials of any traffic delays that may be expected, such as those due to blasting.

At no time will the contractor have more than one lane closure operation under way within the project limits, except for item (e) above.

(o) During Contractor use of the Lower Portal Access Road provide pilot car/ flaggers as necessary to allow access to the Lower Portal Access Road by rafting parties and BOR personnel as outlined in Section 108. <this activity has to be coordinated with NV roadway. Who controls?>

(p) No obstructions to traffic flow due to construction activities will be allowed during the holidays specified in Section 108.01.

(q) Provide access to the WAPA towers during construction as necessary.

(r) The BOR maintains a security checkpoint on both sides of Hoover Dam to check all traffic on US 93 approaching the dam. Coordinate access to the BOR Nevada security checkpoint during construction.

(s) Checkpoint operations will be ongoing throughout the construction project. The Contractor will coordinate with the BOR checkpoint staff on all temporary road closures by providing notice at least 48-hours in advance. The Contractor will coordinate with security personnel to evacuate the personnel during any blasting the Contractor determines is a safety hazard and then allow time for personnel to reassemble at the checkpoint prior to opening the roadway to traffic. This blasting effort must be accomplished between the hours of 6am and 8am Monday through Thursday to minimize traffic disruption.

(t) Deliveries to the Project Site. Contractor is responsible for all deliveries to the project site. As the Hoover Dam Reservation Area is within a National Security Zone, observe extra precautions provided as follows:

(1) Delivery Escort for Trucks greater than 1-ton. All deliveries made to the project, both material and equipment, will be stopped at the security check points in Arizona and Nevada and be held for escort to the project site by a Contractor provided pilot car. Only personnel with background checks completed and approved by the Hoover Dam Police Department shall act as escorts.

Provide a list of potential escort drivers at the preconstruction meeting and two weeks prior to any new escorts starting work for background checks by the Hoover Dam Police.

Provide credentials for all escorts including the following:

(a) Full Name
(b) Drivers License Information
(c) Social Security Number
(d) Date of Birth
(e) Contractor Name and Name of Supervisor of Escort

Approved escorts will wear Contractor provided photo identification badges that are clearly visible to the Hoover Dam security check point officials.

Escorts will maintain records of all deliveries and ingress/egress of delivery trucks from the project site. These records will be available for inspection by the CO. The records will include date of delivery, items delivered, and name of escort. Once delivered Contractor will control and store material as outlined in Section 105.04.

No trucks will be allowed to pass security check points without an accompanying, approved escort. Multiple escorts may be required during high-volume traffic periods or delays of deliveries at the check point may result.

Provide communication radios for all escorts and security check point personnel. Provide BOR security personnel at both the Arizona and Nevada checkpoints with the radios using the same frequency as the escorts to assist in apprising the BOR security officials of deliveries and of any traffic delays that may be expected, such as those due to blasting.

No separate measurement or payment will be made for providing escorts, escort cars, or the communication equipment specified above to escort deliveries to the project site.

(2) Inspection of Personal Vehicles and Trucks 1-ton Capacity or less. All personal vehicles and 1-ton trucks carrying materials are subject to existing, in-place search operations at the security check points. Contact the BOR Police Department (Don Bader at 702-293-8248) for existing security check point restrictions. Materials found in vehicles not meeting the requirements of the security checkpoint will not be allowed to pass.

(3) Traffic Delays. The Hoover Dam Site is a popular tourist attraction. As such, deliveries to the site may experience significant delays due to heavy traffic congestion, particularly from the Nevada side of the Dam. Make all necessary provisions for deliveries such that these delays will not impact construction operations. No extra payment will be made to the contractor for these delays.

(4) Hauling / Transport of Sensitive Materials. Haul all materials across the Hoover Dam in accordance with appropriate ATF and USDOT requirements. All materials escorted through the project site will be allowed to cross over the dam including fuel and blasting materials.

(u) Security at the Hoover Dam cannot be compromised. Secure any current paths or created paths resulting from construction activities within the project limits that overlook the Dam. It may be necessary to provide additional temporary fencing/gates or include the use of access guards to secure the site. It is the Contractor's responsibility to keep pedestrians and non-work related vehicles/personnel from entering the job site and from these secure areas.

Measurement and Payment

Add the following:
No separate measurement or payment will be made for provisions necessary to prevent traffic delays from impacting construction operations.

The CO will advise the contractor of the duration and charges associated with each lane rental charge within 12 hours of the end of the closure or hauling operation.

Installation of prewarning devices which do not restrict traffic will not be subject to lane rental.

Unused lane rental item i.e., those not deducted for lane rental, will be paid to the contractor upon completion of the project.

Accumulated rental costs that exceed the established lane rental fund amount will be deducted from monthly payments due the contractor.

Charges for lane rental are not a liquidated damage. Provisions for liquidated damages outlined in Subsection 108.04 will remain in full effect.

Pay Item

156xx	Lane Rental Allowance	Lump Sum

Section 157. - SOIL EROSION CONTROL

Description

157.01 Add the following after the first paragraph:

Colorado River Bridge 60%+ Submittal

The work under this section shall include furnishing, installing, maintaining, removing and disposing of temporary erosion control measures such as silt fences, rock check dams, erosion control berms, rock mats, straw barriers, sediment wattles, sediment logs and/or permanent erosion control devices or measures such as pipe inlet/outlet treatment, cut/fill transitions, headwall and wingwall treatments and other permanent erosion control devices as required to meet the pollution prevention criteria established for the Stormwater Pollution Prevention Plan (SPPP) described in Section 107 of the FP-96 and these Special Contract Requirements.

Construction Requirements

157.03 General. Delete the second paragraph and substitute the following:

Detail site-specific measures for controlling erosion and submit to the CO for acceptance prior to implementation. Provide working drawings and associated data that do not exceed 11 inches by 17 inches in size. Allow 7 days for acceptance of the drawings or a return for corrections. Include the following in the detailed design:

- Location of each proposed erosion control measure.
- Type of each erosion control measure.
- Quantities and estimated unit costs of proposed temporary erosion control devices to be implemented during construction.
- A schedule detailing coordination of erosion control measures with the various construction operations or stages. Include the furnishing, installation, maintaining, and removing of temporary devices and the installation of permanent erosion control features.
- A schedule outlining the proposed schedule of clearing and grubbing, excavation, embankment, and culvert operations such that the area of disturbed or erodible material is minimized. Schedule the work such that temporary and permanent erosion measures can be incorporated at the earliest practical time.
- Construction methods used in various items of work to minimize erosion.

Add the following:

At least 5 days prior to the preconstruction conference, designate in writing an Erosion Control Supervisor who is responsible for implementing the requirements of this Section.

Do not designate the project superintendent as the Erosion Control Supervisor.

When temporary erosion control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as part of the work in a timely manner, provide temporary measures at no cost to the Government.

157.04 Controls and Limitations on Work: Add the following after the first paragraph:

Install erosion control measures as early as possible after site areas become available or as directed by the CO, but in no case more than 72 hours after the slopes have been finished in the opinion of the CO. Where silt fence, erosion control berms, rock check dams and other similar devices are

providing perimeter enclosure or downslope containment, install the erosion control measures prior to the associated upslope ground disturbance. Sequence the erosion control installations as approved in writing by the CO.

The CO reserves the right to direct the Contractor at any time to implement specific erosion control measures from the SPPP as deemed appropriate to achieve the objectives outlined in these Special Contract Requirements. The CO shall determine if the requested changes will require modification to the SPPP and will issue instructions to the Contractor.

Temporary erosion control measures associated with a temporary activity or features (i.e., construction access route or haul road) shall remain in place until the temporary feature has been removed.

Delete the second paragraph and replace with the following:

Unless otherwise approved in writing, do not expose an area greater than 750,000 square feet at any one location until the erosion control devices proposed for that portion of the project have been installed and accepted by the CO. Indicate on the SPPP the geographical boundaries proposed by the Contractor and the sequence of major erosion control activities.
If the Contractor is unable to keep the finish grading and permanent erosion and pollution control measures current, the CO may terminate clearing and grubbing, excavation, and embankment operations until erosion control measures are current.

157.12 Inspection and Reporting. Delete the first paragraph and substitute the following:

The CO and contractor will inspect the site at least monthly, including disturbed areas that have not been finally stabilized, areas used for storage of materials, locations where vehicles enter or exit the site, and all of the erosion and sediment controls included in the SPPP. In addition, an inspection will be performed in all areas within 24 hours after each rainfall of at least 1/2 inch and as required by the contract permits. Monitor rainfall on the site with a commercially manufactured rain gauge accurate to within 0.10 inches of rain.

157.14 Acceptance. Add the following:

Soil erosion control will be evaluated under subsection 106.02 based on the demonstrated ability of the erosion control measures to result in minimal soil erosion, sedimentation and/or siltation within or adjacent to the project limits.

Measurement

157.15 Add the following:

No separate measurement will be made for this item.

Basis of Payment

157.16 Add the following:

Separate payment for all erosion control measures will not be made. Erosion control measures are incidental to excavation pay items.

Section 158. - WATERING FOR DUST CONTROL

Measurement

158.03 General. Add the following:

Watering for dust control does not include any watering necessary for embankment work or ground compaction.

Water for dust control will be available from Lake Mead. Coordinate the location of the extraction site with the NPS and BOR. Do not disrupt the operations of the dam or the Visitors Center with the water extraction equipment. Contact the following individuals to coordinate the extraction site requirements:

Mr. Donald Bader
Bureau of Reclamation
P.O. Box 61470
Boulder City, NV 89006-1470
Phone: (702) 293-8248

or

Mr. Alberto Marquez
Bureau of Reclamation
P.O. Box 61470
Boulder City, NV 89006-1470
Phone: (702) 293-8842

Mr. James D. Vanderford
Lake Mead National Recreation Area
601 Nevada Way
Boulder City, NV 89005
Phone: (702) 293-8916

One possible extraction point within the BOR Lands is near the northeasterly corner of the Arizona Spillway Parking Lot, the first parking facility east of the Hoover Dam. The top elevation of the dam is 1233 and the lake water elevation is approximately 1155, and falling. An area of approximately 100-ft by 100-ft will be available for pumping equipment, a stand tank, and room for loading water trucks. If a stand tank is used, provide necessary traffic control and flagging to move trucks through the parking lot without interfering with the parking operations. <WILL THIS SITE BE AVAILABLE FOR RIVER BRIDGE OR WILL OTHER WATER_--OR DO WE NEED TO DETERMINE MORE WATER? – other provisions being developed associated with site laydown areas.>

(a) Project dust control for public benefit. Add the following:

It is anticipated that watering for dust control will be ordered and required 24 hours a day, seven days a week, even when construction operations are restricted or closed during holiday periods. This includes all watering necessary for dust abatement within the project limits to prevent dust from leaving the site.

Measurement

158.05 Delete the first sentence and substitute the following:

When applied according to Subsection 158.03(a) and 158.03(b), measure watering for dust control by lump sum.

Add the following:

Do not measure any additional traffic control or flagging operations necessary for filling water trucks from the water take out location.

Basis of Payment.

158.06 Add the following:

Payment will be made under:

Pay Item	Pay Unit
15802 Watering for Dust Control	Lump Sum

Section 203. - REMOVAL OF STRUCTURE AND OBSTRUCTIONS

Construction Requirements

203.03 Salvaging Material: Add the following:

Photograph historic stone wall at US 93 switchback. Provide photographic documentation of general arrangement and detail of wall from both the US93 face and the rear face of the wall. Provide copies of all photographs to the CO.

Remove the guard railing and historic stone barrier wall along hairpin curve near River Bridge arch foundation as required for contractor's access. Salvage all stone materials from the stone barrier removal, stockpile and reconstruct to original configuration after completion of bridge construction. Submit design of temporary traffic barrier to replace metal guard rail and stone wall. Contractor design to provide same level of crash resistance as current metal guard rail.

Reconstruct stone wall using salvaged and new materials as necessary to re-create the historic stone wall appearance and structure. Plans for historic re-creation of stone walls may be obtained from Bureau of Reclamation, Hoover Dam.

Measurement

203.07 Add the following:

Removal and reconstruction of historic stone wall and metal guard rail, and storage of materials is measured as lump sum.

Payment

203.08 Add the following:

Payment for removal and reconstruction of historic stone wall will be full compensation for all documentation, engineering, labor, equipment, special tools, material salvage, material replacement, storage, reconstruction and cleanup of the US93 switchback guardrail and historic stone wall.

Pay Item	Pay Unit
20304 Removal and reconstruction of Historic Stone Wall	Lump Sum

Section 204. - EXCAVATION AND EMBANKMENT

Description

204.01 Add the following:

Include preparing, submitting, updating and re-submitting a comprehensive Earthwork Operations Plan.

204.02 Definitions.

(c) Embankment construction.

(1) Rock. Delete the text and substitute the following:

Rock is material containing particles that are retained on the 3 inch sieve and having less than 40 percent passing the No. 4 sieve or less than 35 percent passing the No. 10 sieve.

Add the following:

(f) Earthwork Operations Plan: Submit to the CO a comprehensive Earthwork Operations Plan. The Plan includes, but is not limited to, a detailed schedule of earthwork operations from clearing and grubbing through finishing, equipment to be utilized, anticipated production rates and a mass haul diagram. The Plan will be updated and re-submitted upon completion of 25, 50 and 75% of the Roadway Excavation item. Substantiate the updated plans by cross-sections and calculations of the work completed. Failure of the Contractor to submit the Plan or updated Plans will be grounds for the CO to order suspension of earthwork operations until compliance is attained.

(g) Excavation Plan: Submit to the CO a comprehensive Excavation Plan, to include, but not be limited to, a detailed schedule of earthwork operations from clearing and grubbing through finishing, equipment to be utilized, anticipated production rates and excavation sequence. The Plan will be updated and re-submitted upon completion of 25, 50 and 75% of the Excavation item. Substantiate the updated plans by cross-sections and calculations of the work completed. Failure of the contractor to submit the Plan or updated Plans will be grounds for the CO to order suspension of earthwork operations until compliance is attained.

Construction Requirements

204.06 Roadway Excavation.

(a) General. Add the following:

Once slopes have been finished according to the plans, additional shaping directed by the CO will be paid for under Section 622. See Subsection 622.01.

During clearing, grubbing, overburden removal and pioneering, use engineered restraints and containment systems as necessary to reduce rock accumulation on the slopes below work areas, or as necessary to reduce the potential for damage at river level. Remove excavated material from the canyon slopes. Have the CO approve the designs for containment systems or engineered restraints in advance of deployment. Install these restraints and systems prior to ground disturbance higher on the slope. Use berms or other containment features below work areas when pioneering or excavating access roads and trails. Use excavation sequences that direct the movement of material away from the natural canyon wall surfaces and toward the point of removal. Remove accumulation before 75% of the allowable load capacities of berms, containment devices, or restraints are reached.

Assure all equipment operators are aware of the need for rock fall containment and control. Develop and implement a training and orientation program for all operators and new hires on the types of containment systems used by the contractor.

(b) Rock cuts. Add the following:

When blasting rock, use controlled blasting methods according to Section 205. Use smooth blasting, cushion or step drilling for roadway cuts and only neat line (smooth) blasting techniques for structure foundations in rock.

204.10 Embankment Construction.

(c) Individual rock fragments and boulders. Delete the text and substitute the following:

Place individual rock fragments and boulders greater than 24 inches in diameter as follows:

(1) Push all rock fragments and boulders to the outside face of the embankment slope. Embed these boulders and fragments into the adjacent slope face without stacking or piling the rocks.

(2) Reduce rock to less than 36 inches in the largest dimension.

(3) Distribute rock not used on the embankment face within the embankment to prevent nesting and fill the voids between them with finer material.

(4) Compact each layer according to Subsection 204.11.

204.11 Compaction. Add the following:

Apply water to each lift of all embankment material.

Maintain the moisture content of the fine fraction of embankment fill (material passing the No. 4 sieve) within the limits of two to four percentage points above the optimum moisture content as determined by AASHTO T180 (Method D) or T99 (Method C), as applicable.

(b) Earth embankment. Delete the second sentence in the first paragraph and substitute the following:

For material classified A-1 or A-2-4, determine the optimum moisture content and the maximum density according to AASHTO T 180 method D.

Delete the first sentence of the third paragraph and substitute the following:

Compact material placed in all embankment layers, berms, and the material scarified in cut sections to at least 95 percent of the maximum density.

Measurement

204.16 Add the following:

(i) Excavation, embankment, temporary structures or tie-backs for access and haul roads will not be measured for payment.

Payment

204.17 Add the following:

Payment for Item 20401 is limited to ten percent of the plan quantity of excavation in the cut until the slope rounding in that cut is completed.

No separate payment will be made for the preparation and necessary modifications to the Preconstruction Conference submittal as described herein. The work is considered incidental to the contracted items.

No separate payment will be made for the preparation and submittal of the Earthwork Operations Plan or the monthly updates as described herein. The work is considered incidental to the contracted items.

No separate payment will be made for earthwork associated with temporary works. The work is considered incidental to the contracted items.

Section 205. - ROCK BLASTING

Description

205.01 Add the following:

(a) Preamble:

The scope of work for River Bridge rock excavation is based on granting the contractor a boundary of responsibility (Responsibility Zone) for scaling and excavation work. The plans <work in progress on site map > show the locations for a system of ground motion sensors that lie along the boundary of the Responsibility Zone. The Special Contract Requirements establish the ground motion upper limits that shall be observed by the contractor in order to limit the adverse effects of blasting operations to within the Responsibility Zone.

These specifications call for the contractor to fully control the canyon walls within the Responsibility Zone. The contractor shall be responsible for pre-scaling and scaling necessary to reduce the potential for, and hazards from, rock fall during construction. The contractor shall also be responsible for rock containment measures necessary to reduce the possibility of rock fall and fly rock within the Responsibility Zone, and of rock fall originating within the Responsibility Zone but traveling outside the Responsibility Zone.

Provided the contractor meets the ground motion limits at the boundary of the Responsibility Zone, the contractor will not be held responsible for rock fall or canyon wall degradation that originates outside the Responsibility Zone. The contractor will be held responsible for controlling blasting effects or consequences within the boundaries of the Responsibility Zone, for controlling or containing all fly rock, rock fall or canyon wall degradation within the boundaries of the Responsibility Zone, and for all effects or consequences of fly rock, rock fall or canyon wall degradation that originate within the Responsibility Zone and that leave the Responsibility Zone.

Below and at varying distances laterally from the bridge foundation excavations are man made structures that are components of the Hoover Dam site. These structures could sustain appreciable damage should they be impacted by rock or debris falling from the construction areas. In addition, the EIS requires that proactive measures be taken to “minimize rock fall” into the canyon in general. Rock containment, through source control and the application of engineered barriers, is intended to control rock movement from within the Responsibility Zone to destinations within and outside of the Responsibility Zone. The plans <work in progress> and SCRs include minimum criteria for the rock containment approach expected of the contractor, given the site conditions. The containment requirements pertain to the potential for rock release from scaling, blasting, slope reinforcement, and mucking operations.

(b) General Blasting Requirements

(1) Structural Excavation Blasting. Use smooth blasting (presplit or trim blasting) techniques for all structure excavation in rock, that is 0.6:1 (H:V) or steeper. Limit hole

spacings and limit subdrill to 6 in. when drilling for slopes where the resulting surfaces are to support concrete or bear structural loads.

(2) Night Blasting. If night blasting is proposed, provide a lighting plan in accordance with 156.07. Provide lighting such that shadows are prevented that could obscure delays or explosive products on the ground in the blast zone. Extend lighting such that blaster or a spotter in communication with the blaster will be able to monitor the canyon wall and river. Do not conduct night blasting within 20 ft of the canyon wall.

(3) Fly rock control. Use suitable cover for all blasting to prevent fly rock. If blasting mats are used in conjunction with nonelectric systems, use sand or other material as needed to cushion the lead lines beneath the mats to prevent pinching and cutoffs. During pioneering and boulder reduction, if blast covering is not feasible, reduce charge weight and use special stemming to control fly rock.

(4) Slope Warping. Where colluvium overlies rock, lay back/round the portions of foundation excavation side slopes in the colluvium. If backslope conditions are too steep to permit the colluvium to be laid back at an acceptably flat angle, substitute soil nailing or other temporary works as retaining structures to provide for safe removal of colluvium.

(5) Slope Finishing. Scale all slopes thoroughly for stability, regardless of excavation technique or slope finish required.

(c) Definitions

Controlled Blasting. Controlled Blasting consists of the controlled use of explosives and blasting accessories in carefully spaced and aligned drill holes to produce specific free surface(s) or shear plane(s) in the rock along the predetermined excavation backslope. Controlled blasting techniques covered by these SCRs include presplitting or trim blasting for smooth rock cuts. Use controlled blasting methods to minimize damage to the rock backslope to help insure long-term stability.

Controlled Blast Holes. Controlled Blast Holes are defined as the first row of non-horizontal drill holes (normally within 2 feet of the plane forming the final cut face), as shown on the approved blasting plan.

Production Blasting. Production Blasting includes the main fragmentation blasting resulting from more widely spaced production holes drilled throughout the main excavation area, and in the case of the skewbacks, specialized step drilling to form the bevels in the arch thrust block areas.

Blasting Supervisor. For this project, a Blasting Supervisor is that individual with overall responsibility for the activities of one or more blasting crews, and who makes decisions on the allocation of drilling and blasting personnel, drilling and blasting equipment, drilling and blasting methods, and the procurement and types of blasting materials and supplies.

Blaster in Charge. For this project, a Blaster in Charge is that individual who directly supervises the activities of a particular blasting crew when loading and firing a particular blast. The Blasting Supervisor may or may not also serve as a Blaster in Charge.

Engineered Barrier. For this project, an Engineered Barrier is a rock or debris containment system component composed of fabricated elements engineered to resist rock or debris loading.

(d) Protection of Utilities

Prevent damage to the natural environment outside the clearing limits from fly rock, operation of equipment, or other construction related causes in accordance with Subsection 107.02.

High-voltage transmission lines owned or operated by the U. S Department of Energy Western Area Power Administration (WAPA), Southern California Edison and Citizens Utilities cross or are close to the alignment. Observe the following requirements regarding blasting operations with respect to the transmission line areas:

(1) Within 500 ft of any transmission line, do not use electric detonators unless the safety of their use is demonstrated and documented in a manner satisfactory to the CO, including but not limited to measurements of stray and induced currents.

(2) Not less than 10 working days prior to blasting within 1000 ft of any WAPA transmission line, provide notification to Gary Bates, WAPA, 602-352-2694

(3) Once blasting operations beneath or adjacent to the transmission lines have begun, proceed as continuously as practicable with blasting operations in that area.

(4) Use special measures that will prevent fly rock when any portion of any blast is within 300 ft of the outside phase of the closest transmission line. Fly rock prevention measures include covering the entire shot with mats, soil, or other means approved by the CO.

(5) The contractor is responsible for the effects of his blasting operations on adjacent public or private property.

Use test blasts in accordance with 205.06, in similar rock and at a safe distance, to demonstrate the effectiveness of the proposed fly rock control measures. If requested by the CO, document such test blasting with still or high-speed photography, or other reasonable methods. If the CO determines that any blast has or may produce unacceptable levels of fly rock, redesign the blast or provide it with such fly rock control measures as will afford an acceptable level of fly rock control.

(e) Control of Vibrations and Air blast

Control ground vibrations and air blast when blasting near objects, structures or utilities that may be susceptible to damage from blasting. Use properly designed delay sequences and allowable charge weights per delay.

Designate, in the Excavation Technical Proposal, the Vibration and Air blast Coordinator who will be the individual responsible for the deployment, maintenance, and interpretation of the data from the seismographs. Submit the qualifications of the Vibration and Air blast Coordinator to the CO for approval. The Vibration and Air blast Coordinator need not necessarily be an independent contractor

or subconsultant but must be able to demonstrate not less than 5 years of experience installing, monitoring, and maintaining blasting seismographs and interpreting ground motion data associated with rock blasting.

Measure ground motions and air blast with calibrated seismographs located as approved by the CO. Use only seismographs whose transducers have been calibrated within one (1) year of their use. Not less than one week prior to the expiration of calibration, replace seismographs in previous service with calibrated units.

(1) General

Locate approved seismographs as approved by the CO, between the blast area and the closest susceptible object, structure or utility. Use seismographs capable of recording ground motion particle velocity for three (3) mutually perpendicular components of vibration in the frequency range generally found with controlled blasting. Use seismographs whenever the blast is located within 500 ft of a box culvert, retaining wall, bridge structure, pipeline, utility pole, surface structure, tunnel, or transmission tower.

Locate an air blast overpressure measurement device at the Visitor Center. Make measurements as required by the CO.

(2) Responsibility Zone

Use not less than three (3) ground motion sensors incorporating transducers bolted and grouted to the cliff face along each Responsibility Zone boundary (upstream and downstream - total of not less than six (6) sensors on each canyon wall) to record frequency and velocity. Include noise measurement (microphone transducer) on at least one (1) of the sensor stations on each canyon wall. Do not select transducer sites that are visibly separated or detached from the main canyon wall by open fractures or voids. Do not position the microphone where line of sight is not visible to the opposite excavation area. Install sensors not less than 30 days before beginning pioneering or scaling operations on that side of the canyon. Distribute the sensors uniformly over the uppermost 400 vertical ft of the Responsibility Zone boundary in the general area shown on the plans <work in progress>. Have the CO approve the particular transducer and microphone locations in advance. Furnish a diagram of proposed and final sensor locations, and a copy of the baseline photograph (see Section 107.02) showing the Responsibility Zone boundary and the exact position of each microphone and ground motion transducer. Update this information if the locations change.

Provide solar or independent hard-wired power supply to each sensor. Provide cellular-accessible data acquisition or storage system, or hard-wired cable to a location accessible without mountaineering equipment, independently for each sensor, to enable collection of data.

Set triggering value of each sensor at not more than 20% of the Responsibility Zone limit, but not so low as to record background noise from traffic and routine dam site operations. Set the triggering level for the microphone at between 115 and 130 dB.

Furnish to the CO a written summary of ground motions and air blast measurements weekly. Not less frequently than monthly, furnish a complete report to the CO including time histories of events measured, interpretation of any false trigger events, identification of all blasts taking place within the reporting period and their times of detonation, and discussion of any problems with the instrumentation array and recommendations for resolution.

(3) Permissible Thresholds

Do not allow any vibration component of ground motion to exceed the safe peak particle velocity of defined at the boundary of the responsibility zone or as required within that zone:

Structure	Maximum Peak Particle Velocity (Inches Per Second)
Green Concrete (less than 7 days)	2.0
Concrete more than 7 days old (ground motion frequency > 15 Hz)	4.0
Concrete more than 7 days old (ground motion frequency $\leq$ 15 Hz)	2.5
Transmission Towers (ground motion frequency > 15 Hz)	6.0
Transmission Towers (ground motion frequency 5-15 Hz)	4.0
Transmission Towers (ground motion frequency < 5 Hz)	3.0
Overhead tramways and machinery	4.0
Responsibility Zone Boundary	2.5

Furnish the data recorded for each shot to the CO prior to the next blast within 500 ft of the same structure, and include the following:

- Identification of instrument used;
- Maximum applicable charge weight per delay
- Blast identification number and location of blast, including station limits and left/right limits
- Name of seismograph operator;
- Distance and direction of sensor from blast area;
- Type of ground at recording station and material on which the sensor is sitting;
- A dated and signed copy of seismograph readings.

If the CO so directs, deploy and follow an air blast monitoring system between the main blasting area and the location subject to blast damage or annoyance. Use equipment of the type specifically manufactured for the purpose of making blasting overpressure measurements. Adjust blast hole patterns, detonation systems, and stemming to prevent venting of blasts and to bring air blast and noise levels produced by the blasting operations within acceptable limits. Maintain a permanent record of the peak overpressure measurements, signed and dated by the contractor, and furnish each new record to the CO immediately after each shot.

Materials

205.02 Add the following:

As the CO may request, provide the CO with copies of materials certifications, manufacturer cut sheets, and dates of manufacture for all materials used in containment systems and engineered barriers.

Construction Requirements

205.04 Blasting Plan. Delete the entire subsection and substitute the following:

(a) Contractor's Excavation Technical Proposal. Not less than 21 days before commencing ground-disturbing activities for bridge foundation excavation, submit an Excavation Technical Proposal for review by the CO. The Excavation Technical Proposal is to cover the overall approach to excavation and containment as follows:

1) Initial scaling and stabilization
2) Containment approach and designer
3) Blasting equipment and sequencing
4) Mucking methods and equipment
5) Hoisting methods and equipment
6) Personnel.

Include, at a minimum, the following information in the Excavation Technical Proposal:

1) Proposed location, excavation plan, and description of the test blasting program.
2) Proposed sequence of major foundation excavations.
3) Typical lift sequences, and blast sequences within typical lifts, for each skewback.
4) Typical excavation sequences for a representative pier and abutment excavation.
5) Qualifications of Blasting Supervisors, Blasters in Charge, Blasting Consultant, and Vibration and Air blast Coordinator. Blasters in Charge are required to have a minimum of 7 years experience in supervising the loading and firing of charges for rock excavation and have all necessary licenses and permits required by the State and other agencies having jurisdiction. The Blasting Supervisor shall have not less than 10 years experience in the loading and firing of charges for rock excavation, not less than 3 years of which shall be in blasting for heavy civil construction. Requirements for the Blasting Consultant are given in subsection (d) of this section. The Blasting Consultant may be approved in an earlier submittal. The required qualifications for the Vibration and Air blast Coordinator are given in this subsection 205.01(e).
6) Equipment list for scaling, drilling, blasting, pioneering, and excavating.
7) Method of forming smooth blasted slope and the skewback bevels. Describe how the blasting approach will account for various cut geometries, rock types, access problems, categories of fracturing and faulting, and required face contours.
8) Expected road closure requirements and method of maintaining specified traffic flow.

9) Intended measures for limiting dust, noise, and fly rock.
10) Night blasting requirements and plans for lighting.
11) Method and approach to rock fall containment, and the names and qualifications of those who will prepare the containment system designs.
12) Method of vibration control and vibration/air blast monitoring instrumentation, including expected locations for instrument deployment along the Responsibility Zone.
13) Excavation approach to pioneering, establishing initial benches, and access roadways.

An approved proposal shall be required before any ground disturbing activities may commence. The CO will either approve the Proposal, or return it for revisions, within 2 weeks of receipt. Any change in, or addition to, the personnel shown in the approved Proposal must be submitted to the Engineer for approval.

(b) Primary Blasting Plan. Not less than 2 weeks prior to commencing drilling and blasting operations, submit a Primary Blasting Plan to the CO for review and approval:

1) Methods for and locations of explosives storage, delivery, and security. Provide a scaled drawing of the location of any magazine to be located within 5 miles of the site. Give the contact person responsible for assuring the security of blasting materials and supplies stored for use on the project.
2) Name, address, and telephone number of all explosives suppliers. Identify all explosives delivery vehicles and operators.
3) Manufacturers' data sheets (MSDS and cut sheets) for all explosives, primers, and initiators to be employed.
4) Methods to be employed for traffic control and other public safety precautions in the use of explosives.
5) Synopsis of access, blasting and containment methods covered in the Excavation Technical Proposal.
6) Location and patterns proposed for test blasting.
7) Equipment intended to be used in or in support of blasting operations.
8) Methods to prevent fly rock.
9) Methods for preventing rock material from escaping the construction limits, and contingency measures for unanticipated rock fall.
10) Identification and calibration data for all vibration and air blast monitoring devices, and appurtenant or supporting hardware and software.
11) Working procedures and safety precautions for handling explosives.
12) Working procedures and safety precautions for blasting, including audible warning system and procedures for clearing the canyon and river areas.
13) Contact point for coordination with BOR and WAPA

Submit revisions and updates to the CO within 48 hours of any change in the above information.

Have the approved Blasting Consultant review and approve the Primary Blasting Plan.

(c) Detailed Blasting Plans. Not less than 48 hours prior to drilling in the following instances, or at any time the Contractor proposes to substantially change the drilling and blasting methods, submit a "Detailed Blasting Plan" to the CO for review:

1) All controlled blasting: plans for each blast in each lift
2) Pioneering blasts requiring more than 10 lb explosives
3) Blockholing or boulder reduction: no detailed plans required in advance unless any portion of the rock is within 15 ft of the canyon wall
4) Test blasting.

The CO will review and approve each Detailed Blasting Plan before any drilling or blasting work commences in the area to be covered by the detailed blasting plan.

Have the Blasting Supervisor and Blasting Consultant approve in writing all blasting plan submittals and modifications. Utilize a standard format for the blasting plan submittal. Include the following minimum information in the blasting plan:

1) Proposed excavation sequence for the cut.
2) Station limits and plan view extent of the proposed shot, showing how it fits into the lift excavation sequence.
3) Elevations of the tops and bottoms of each lift.
4) For each shot, scale drawings showing access, containment and plan and section views of all variations of the proposed drill pattern, including clearing limits, free face, burden, blast hole spacing, drill hole location, subdrill depths, lift height, blast hole diameters, and blast hole angles.
5) For each shot, provide a loading diagram showing powder factor, type and amount of explosives, primers, initiators, and types and heights of stemming for all substantial variations within the pattern.
6) For each shot, show the initiation method and sequence of blast holes, including delay times, delay system, and actual down hole firing times.
7) Fly rock control measures that will be used.
8) Estimated quantities of volume of rock in-place and length of both production and controlled blast drill hole.
9) Location and attitude of significant fracturing, rock type changes, faulting, and special circumstances to be accounted for in the plan.
10) Vibration criteria and predicted ground motions at sensors
11) Expected air blast response at identified sensor locations.

The CO may require modifications of any blasting plan during the duration of the project. Modifications may be identified by the contractor based on drilling data, but obtain approval by the CO for any modification in the blasting plan, before the shot is loaded.

Blasting plans are not required for pioneering shots less than 8 ft in maximum height, boulder reduction blasts (mudcapping or blockholing), or secondary trim blasts of less than 50 square feet, unless the CO so directs.

After the blast holes have been drilled in accordance with the final approved blasting plan, load the holes with the planned quantity of explosives. Load explosives and blast only during daytime hours. Do not leave loaded holes overnight. Load and shoot blasts in time to clear the roadway and to provide at least one lane for public traffic at the new road-open period specified.

(d) Blasting Consultant. <use of this provision under review> Retain the professional services of a qualified Blasting Consultant, to assist the Contractor in the design of all blasting. The Blasting Consultant shall assist the Contractor in creation or modification of the blasting plans, and shall review the progress of excavation to evaluate the blasting and containment procedures. Prior to the submittal of each test blast plan, have the Blasting Consultant inspect the area covered by the detailed blasting plan. Have the Blasting Consultant inspect the site when requested by the CO. Have all blasting plan submittals, reports, and modifications approved in writing by the Blasting Consultant, except that blasting plan modifications directed by the CO will not have to be approved by the Blasting Consultant.

The Blasting Consultant shall be an expert in the field of drilling and blasting, who derives his primary source of income from providing drilling and blasting services. The consultant shall also be able to demonstrate proficiency in applying geologic principles and practices to blasting and rock excavation, and the ability to recognize and account for geologic as well as physical factors in the preparation and execution of blasting plans. The consultant shall not be an employee of the Contractor, Contractor affiliate or subsidiary, blasting subcontractor, explosives manufacturer, or explosives distributor.

Not later than the preconstruction conference, submit the resume of the proposed Blasting Consultant, which shall include educational background, overall qualifications, and a list of at least 5 recent rock excavation projects of similar size, scope, and difficulty to the work required herein, that demonstrate the consultant's successful and instrumental involvement. At least one project shall entail controlled blasting in a confined environment where rock fall control and containment were primary objectives. The list shall contain a description of the projects, blasting methods, modifications made during the project, and the names and telephone numbers of project owners with sufficient knowledge of the projects to verify the submitted information. The CO must approve the Blasting Consultant prior to the Contractor's submittal of the Primary Blast Plan

205.06 Test Blasting. Add the following:

Test blasting is required when commencing blasting in each major formation type: Switchyard Basalt, Sugarloaf Mountain Dacite, and Hoover Dam Tuff.

Do not start full-scale production blasting in a new formation until a test blast for that formation has been excavated and the results have been evaluated and approved by the CO.

Demonstrate the adequacy of the proposed blast plan by drilling, blasting, and excavating test blasts, up to 100 cy in volume, in an area designated by the Contractor and approved by the CO to determine which combination of method, hole spacing, and charge works best. Include with the test blasting the controlled blasting methods the contractor proposes for use in the cut. Create a smooth-blasted test face at a location other than the required finished slope. When conditions warrant, as determined by the CO, the Contractor may be ordered to use additional test blasts of up to 100 cy prior to beginning blasting in other areas.

Conduct test blasting in areas of low rock fall risk as approved by the CO.

Requirements for controlled and production blasting operations covered elsewhere in this specification, including but not limited to safety, drilling controls, rock fall containment, fly rock control, and control of vibrations and air blast, also apply to the test blasting.

Do not drill ahead of the test blast area until the test blast area has been excavated and the results have been evaluated by the CO and blasting consultant. If results of the test blast(s), in the opinion of the CO, are unsatisfactory, adopt such revised methods as are necessary to achieve the required results. Unsatisfactory test blast results include an excessive amount of disturbance beyond the indicated lines and grade, drilling inaccuracy, excessive fly rock, or failure to meet the other requirements within these specifications. All costs incurred by the Contractor in adopting revised blasting methods necessary to produce an acceptable test blast are considered as a subsidiary obligation to the work.

If at any time during the progress of the work the methods of drilling and blasting do not produce the desired slope and shear face within the tolerances specified, drill, blast, and excavate small volumes, not exceeding 100 cy, varying technique until one is found that produces the desired results. Extra cost resulting from this requirement area is considered as a subsidiary obligation to the work.

205.07 Controlled Blasting.

(a) General. Delete the text of the entire subsection and substitute the following:

Conform to the following general requirements:

> **Smooth (Presplitting and Trim) Blasting**. Perform smooth blasting for the sides of all excavations in rock requiring blasting that are staked at 0.6:1 (H:V) or steeper, and elsewhere when directed by the CO. Smooth blasting techniques are those whose purpose is to propagate a shear plane or tension crack through, rather than around, rock blocks bounded by natural fractures, seams, faults, or joints.
>
> **Step Drilling and Cushion Blasting**. Use step drilling on slopes flatter than 0.6:1 where blasting is required. Reduce hole spacing and limit subdrill to 6 in. when forming the foundation bevels at the bases of the skewbacks. Reduce subdrill to 2 ft or less when forming any other surfaces that will receive concrete or bear structural load. Use cushion blasting to provide a natural appearance if so directed by the CO.
>
> **Pioneering.** When pioneering or removing hazardous or unstable rock formations, use fan or downhole angle holes as appropriate to the access available. Limit the blast hole diameters and hole spacings to values that will not cause loss of control of the rock, but not more than 2.5 in. and 5 ft, respectively.

(b) Drilling. Delete the text of the entire subsection and substitute the following:

Notify the CO prior to drilling each shot.

Stake all lifts and excavation limits within the cut as it is brought down.

Remove all overburden soil and loose or decomposed rock along the top of the excavation for a distance of at least 30 ft beyond the end of the production hole drilling limits, or to the end of the cut, before drilling any blast holes. Do not remove such materials by blasting. Pioneer the tops of cuts as stipulated in the Excavation Technical Proposal. Do not perform clearing further than 8 ft beyond the staked cut limits unless approved by the CO.

Include language for access and pioneer roads on NV side. Pioneering the tops of cuts and preparing a working platform to begin the controlled blasting drilling operations may require unusual working methods and use of equipment. For rock cut areas not accessible for use of standard track drill equipment, use hand drilling, specialized drill equipment, or horizontal drill holes. Use close hole spacing and light charges to prevent rock escaping beyond the construction limits.

Following approval of the blasting plan, drilling for blast holes may commence. Log the holes and record drilling production. Record and keep a log of each blast hole drilled that identifies the depth, color, and character of the cuttings, penetration rate, hole collar location and hole attitude, and other pertinent information such as sticking steel, loss of air, or sloughage. Keep the log available for inspection by the CO at any time, and provide a copy upon request. When variations in the rock formation are indicated by the drill holes that are significant enough to call into question the suitability of the blast pattern, stop the drilling and revise and resubmit the blasting plan to the CO for review. After approval of the revised plan, commence drilling according to the revised plan.

Affix mechanical devices permanently or temporarily to all drilling equipment used to drill controlled blast holes, to determine accurately the angle at which the drill steel enters the rock. Do not drill controlled blast holes if these devices are either missing or inoperative. Drill controlled blast holes within a radius from the staked collar location of not more than 5% of hole spacing. The CO may require redrilling of holes drilled outside the 10% tolerance. Stake and locate drill holes in accordance with the approved blasting plan.

Control the drilling operations for smooth blasting by using proper equipment and technique to insure that at any depth down a drill hole, the hole is not deviated, either parallel or normal to the slope, by more than 4% of that depth. The CO may require stoppage and correction of blasting operations if this tolerance is not met. This requirement is only applicable to smooth blasting and not to step drilling or cushion blasting.

Use the minimum horizontal offset between lifts to allow for drill equipment clearance. Observe a maximum 24 in. horizontal offset between lifts. Allow for the required horizontal offset when starting the cut, or obtain the approval of the CO to drill slightly (but not more than 4 degrees) steeper than the average slope angle shown on the plans. Compensate for any drift that may have occurred in the upper lifts. Construct the working benches so the final ditch alignment and grade conform to the typical section shown on the plans. Obliterate any shelves resulting from the drilling offset.

Do not exceed 20 ft for the bench height and length of drill holes for any individual lift unless the Contractor can demonstrate that he can stay within approved tolerances and produce the desired cut face. Do not drill lifts taller than 30 ft, measured from the lowest point of the ditch to the highest catch point along the lift.

Limit subdrilling of controlled blast holes to one-half of the hole spacing or 2 ft, whichever is deeper.

(c) Blasting. Add the following: Before placing any charges, determine that each hole is free of obstructions for its entire depth. Reopen any blocked holes. Exercise all necessary precautions so that placing of the charges will not cause caving of material from the walls of the holes. Measure and record the depths of drill holes. The CO may request the Contractor to perform additional measurements of the depth and alignment of drill holes at any time prior to loading.

Monitor and record the acceptance of powder in each hole with sufficient frequency that overloading of individual holes does not occur and that the actual powder factor can be determined.

Adjust the burden, loading, and timing of so as to prevent rock fall into the Colorado River canyon due to blasting. Excavate rock in carefully sequenced, small blasts in this area to maintain control of rock, and to prevent the loosening or destabilization of rock formations that may fall into the canyon. Use care when digging out to prevent spillage of rock.

Do not allow the maximum diameter of explosives used in controlled blast holes to be greater than one-half of the diameter of the drill hole.

Drill hole conditions may vary due to variability of material and moisture conditions. The Contractor may be required to use various types of explosives and/or blasting accessories as necessary to accomplish the specified results.

Use explosives in controlled blast holes specifically manufactured for controlled blasting. If segmental cartridges are used with detonating cord downline, affix the cartridges in such a way that they do not slip. Assemble and affix continuous column cartridge type of explosives to the detonating cord in accordance with the explosive manufacturer's instructions.

The bottom charge of a controlled blast hole may be larger than the line charges but not be large enough to cause overbreak. Place the top charge of the controlled blast hole far enough below the collar and reduce it sufficiently to avoid overbreaking and heaving.

Stem the upper portion of all controlled blast holes from the topmost charge to the hole collar. Use sand or other dry angular granular material, all of which passes the 3/4-inch sieve, for stemming materials.

Observe the entire blast area for a sufficient time following a blast to ensure that rock fall will not endanger personnel commencing work in the cut. Do not allow production crews to enter the cut following a blast until fumes have dissipated and the shot has been checked for misfires and any misfires have been safely neutralized.

Control fly rock through the use of mats or other methods approved by the CO before the firing of any blast in areas where flying rock may result in personal injury, damage to property or the work, or result in the inability to conform to road closure limitations.

Design blasts to meet the following minimum criteria for slope quality:

NV skewback: 50% minimum hole trace retention in skewback

NV piers/abutment: 40% minimum hole trace retention
AZ skewback: 70% minimum hole trace retention
AZ pier/abutment: 40% minimum hole trace retention
(All) No radial cracking of bore hole walls

Drill hole trace retention is computed over any portion of a slope formed by any blast, so long as the perpendicular area of the slope portion in question is greater than 20% of the total perpendicular slope area drilled for that blast. The drill trace retention percentage is based on the sum total length of evident drill holes, divided by the sum total length of controlled blast holes drilled to form that slope portion. Evident drill hole traces are those traces marked by not less than 10% of the original drill hole circumference.

205.08 Production Blasting.

(a) General. Replace with the following: Perform all production blasting, including that carried out in conjunction with the blasting test section requirements of Subsection 205.06 in accordance with the approved Detailed Blasting Plan and the following general requirements:

When cushion or smooth blasting, drill the first row, a buffer row, of production holes adjacent to the trim line, on a parallel plane adjacent to the controlled blast holes.

Drill buffer holes between 2.5 and 3.5 inches in diameter. Drill buffer holes 3 to 6 ft out from the controlled blast line. Do not exceed 25 percent of the full explosive load that could be placed in a 4-inch production hole.

Detonate the buffer holes last on a delay sequence toward a free face when presplitting, and next to last when cushion blasting.

Do not drill production blast holes closer than 5 ft to the buffer hole line unless approved by the CO.

For all controlled blasting, do not exceed 4 inches in diameter for any production holes bottoming within 20 ft of the cut slope toe, unless approved by the CO.

Reduce production hole diameters if necessary to reduce cut slope disturbance, to reduce maximum fragment size from blasting, or to reduce vibrations or air blast.

Detonate production holes on a delay sequence toward the point of best relief. Develop relief using trench blasting or sinker cuts if required to generate adequate relief without risking rock spillage into the canyon. Slash out to the final cut limits.

Adjust blast hole burden according to the mass of rock remaining, in order to prevent horizontal displacement and blowouts. When widening the cut toward the canyon wall in rock with minimum fracture spacing of 3 ft or more, limit the burden on blast holes to no more than 1/2 the width of intact, unfractured rock between the last row of blast holes and the canyon wall. When widening the cut toward the canyon wall in rock with minimum fracture

spacing 3 ft or less, limit the burden to a maximum of ¼ the width of such fractured rock between the last row of blast holes and the canyon wall.

Use sand or other dry angular granular material, all of which passes the 3/4 inch sieve, for stemming materials.

Employ all necessary precautions in the production blasting to minimize blast damage to the rock backslope.

Adjust production blasting to prevent escape of material beyond the construction limits shown on the plans and in accordance with Subsection 107.02.

Contain material that may migrate over the canyon faces when production blasting, pioneering, blockholing, mudcapping, or breaking rock down mechanically, and to prevent rock escape beyond the construction limits.

Reduce subdrill to maximum 6 in. when forming the skewback bevels and to 2 ft or less when blasting to the designed bearing elevation in all structure foundations in rock that will receive concrete or bear structural load. Adjust the pattern and loading accordingly.

Halt production blasting, and submit a written plan for remedial action to the CO, if any of the following occur:

(1) Slopes are unstable.

(2) Slopes exceed tolerances.

(3) Unsafe quantities of rock are released.

(4) Safety of the public is jeopardized.

(5) Property or natural features are endangered.

(6) Excessive fly rock is generated.

The CO may require modification of the production blasting. In addition, limit production blasting to the amount of material that can be loaded and hauled to embankment and designated disposal areas so the roadway will be open to traffic at the times specified under Subsection 156.03.

Remove or stabilize, to the satisfaction of the CO, all rock on the cut face that is loose, hanging, or which creates a potentially dangerous situation during or upon completion of the excavation in each lift. If scaling is not adequate to stabilize the cut, use rock reinforcement in accordance with Section 638.

Add the following

(d) Containment System and Engineered Barriers

Colorado River Bridge 60%+ Submittal

Design and have the CO approve an engineered barrier system in conjunction with an overall containment approach, for each lift of skewback, pier, or abutment excavation, and for all pioneering, where the potential for rock fall exists. Submit the following for each design, as further outlined in this subsection:

1) Shop drawings.
2) Engineering calculations and system capacities.
3) Geological evaluation.
4) Deployment scheme: plan and sections drawn on site topography
5) Manner and method for removal of material

Choose engineered barrier designs that are adapted to each lift or blasting site individually. Design engineered containment to retain 90% of excavated rock material, or additional proportion as is required to contain rock within the responsibility zone. Deploy engineered barriers prior to starting excavation in a new lift or area.

Use netting or fences below containment deployment areas to catch spillage when installing or moving engineered barrier systems.

Use engineered barrier systems that are conformable to the rock surfaces. Design engineered barriers with the goal of rock fall source restraint, rather than arresting rock fall once it has occurred. Consider overhang geometries, cantilever forces, and support calculations in the design. Use adaptable systems that are capable of active rock restraint but of sufficient capacity to support overhangs when encountered, and are readily maintainable. More than one approach/design will likely be needed. Consider the density of the rock and the potential rock load in the design. Identify geologic features that may govern the active rock load. Diagram the deployment of the engineered barrier in accordance with the proposed excavation sequence for each lift. Have a registered Professional Engineer design temporary rock reinforcement and tiebacks if these are included in the engineered barrier system.

Furnish manufacturer certifications on materials and modular designs as required by 205.02.

Submit to the CO, for approval, the following information for each lift's engineered barrier system:

a. Manufacturer cut sheets
b. Design calculations
c. P.E. Stamp
d. Sketches drawn to scale, with cliff face contour and vertical sections.

The CO will either approve, or return for revisions, the submittal within 5 working days of receipt.

To the maximum extent practicable, use sinker cuts and slab rounds in slices that progressively narrow as the canyon wall is approached, in order to reduce the demand on the engineered barrier system.

Pull loosened material into the interior of cut with minimal spillage. Hoist all fragmented rock out of the excavation. Use equipment of suitable capacity, reach and maneuverability for the size of the excavation to reduce demand on the containment system.

Use techniques such as hydraulic splitters, expansive chemicals, propellant-driven rock fracture devices, feather wedges, and hand labor to remove rock where energy release from conventional high explosives cannot be sufficiently controlled.

When planning the excavation sequence, take into account overhangs and geologic features such as faults and fracture zones that may act as release surfaces or that may develop high localized rock loads. Restrain overhangs and unstable masses using tiebacks, tendons, or props as appropriate.

205.09 Blasting Log. Delete the entire subsection and substitute the following:

Blasting Report. For all blasts, whether or not a detailed blasting plan was required, submit a "Blasting Report" to the CO and prior to any further blasting. Include the following information in the report:

(1) The start and finish of drilling and loading, along with a log of actual explosive loading and any changes in pattern.

(2) A copy of the approved detailed blasting plan, as applicable, amended to show any significant changes in pattern, loading, or timing. If no blasting plan was required in advance, submit a diagram showing the location, pattern, typical loading diagram, and timing used.

(3) Approximate average drilling rate, soft seams or faults, and any occurrences of water, lost circulation, voids, stuck steel, or other complications to drilling.

(4) Depth measurements of all production and control holes.

(5) Name of blasting foreman and date and time of blast.

(6) Vibration records (original printout).

(7) Comments on success of the blast in terms of: fly rock, overbreak and drill trace retention, approximate maximum and average fragment sizes, and containment.

After mucking operations for each lift, measure the excavated slopes to determine overbreak quantities and slope toes. Measurement may be done after each individual blast or after a series of blasts in the cut. Incorporate these quantities as a part of the final blasting report.

Make a videotape recording of each blast. Make available at any time the unedited videotape recording to the CO for review. Provide a copy of the unedited videotapes at the end of each month to the CO. Obtain approval by the CO of the methods used to record the videotape.

The blasting plan submittal and blasting report are for quality control and record keeping purposes. Review of blast design and techniques by the CO do not relieve the Contractor of responsibility for

adequacy, accuracy, safety, proper supervision, and compliance with these SCRs, when implemented in the field.

Measurement.

205.11 Measurement. Delete the entire subsection and substitute the following.

Do not measure rock blasting (controlled blasting or production blasting) for payment separately from roadway or structure excavation.

Deployment of the sensor array at the Responsibility Zone boundary will not be measured for payment.

Measurement preparation of the Contractor's rock stability evaluation, engineered barrier and containment system deployment, and temporary rock stabilization measures to control rock and debris release by the lump sum.

Payment

205.12 Payment. Delete the entire subsection and substitute the following.

Rock blasting, including controlled and production blasting, is considered incidental to the contracted items for roadway or structure excavation.

Pre-scaling and scaling within the Responsibility Zone will be paid under Section 206.

The Responsibility Zone boundary instrumentation is incidental to structure excavation.

Pay Item	Pay Unit
20502 Rock Blasting containment system	Lump sum

Section 206. - SCALING

(ADDED SECTION)

Description

206.01 This work consists of pre-scaling and scaling within the responsibility zone as described in Section 205. All scaling within this zone is the responsibility of the Contractor. There are two components to this work. The general prescaling and scaling, and special item removal.

Construction Requirements

206.02 Pre-scaling of canyon walls inside Responsibility Zone

Before commencing full scale excavation or pioneering, remove or stabilize rock from within the Responsibility Zone as specified herein or shown on the plans. Take precautions to control collateral spillage while scaling the adjoining rock.

Determine all rock features requiring removal in order to secure the responsibility zone through contract completion.

During the course of excavation and bridge construction, remove loosened rock and debris that, a result of construction activities, may present hazards to the bridge foundations or structural elements, construction workers, Hoover Dam operations, and other users of the river and canyon. Perform such removal proactively, before such material presents an imminent threat of falling.

Scale rock outside the Responsibility Zone only as directed by the CO under Section 622.

206.02 Special Item Removal. Use special care when removing large-scale rock formations designated for removal.

Special rock features requiring removal inside the responsibility zone are:

1. Rock wedge removal NV side near Abt 1 – Approximate N1826054 E405954
2. AZ side rocks at Pier 15 - Approximate N1825138 E407462
3. AZ rock wedge near Abt 2 – Approximate N 1825026 E407460

On the AZ side, the blocks to be removed consist of basalt located in the upper wall of Black Canyon, just west of the west end of the project, at approximate Stations 196+80, 55’ left and 197+20, 50’ right. Removal of the two blocks of basalt may require removal of temporary support installed during the Arizona Approach Roads contract, and the deployment of engineered containment barriers.

Complete and submit a proposal for the systematic and safe removal of the blocks, considering the existing block geometries, temporary support, and the need for engineered barrier containment at different stages in the removal process. Provide this evaluation to the CO for review and approval prior to any stabilization or blasting activities. Include within the plan a proposed design of the temporary support systems required to stabilize the blocks during removal.

Design a proposed temporary support system as required to prevent ground loss during removal. Include a description of all materials proposed for use in the temporary support system, as well as providing the details on installation procedures to be utilized. Have a qualified registered engineer experienced in the design of rock and earth support systems prepare and seal the design. Include a

description of the proposed blast-monitoring plan to ensure that acceptable vibrations consistent with the evaluation and stabilization plan are not exceeded at the block locations.

206.03 Collection and Disposal. Collect and hoist the rock and debris removed, and transport it from the canyon to a waste site. Install containment fencing or other primary engineered devices below each rock scaling area and laterally a distance sufficient to protect river level features from sideways deflection of falling rock outside the responsibility zone.

Measurement

206.04 Measure rock scaling inside the responsibility zone by the lump sum. Measure special item removal by the lump sum. Do not measure containment, collection, haul or disposal of scaled material for payment.

Payment

206.05 Payment for scaling will be full compensation for all materials, equipment, engineering, labor and disposal costs as measured above.

Pay Item		Pay Unit
20601	Responsibility zone scaling	Lump Sum
20602	Special item removal	Lump Sum

Section 208. - STRUCTURE EXCAVATION AND BACKFILL FOR SELECTED MAJOR STRUCTURES

Description

208.01 Add the following:

Major Structures are:
Hoover Dam Colorado River Bridge

Construction Requirements

208.04 General. Delete the last two sentences of the third paragraph and substitute the following:

Where support systems, shield systems, or other protective systems are to be used, design the shoring according to Section 562 and submit working drawings and construction details according to Subsection 104.03.

Measurement

208.13

(a) Add the following:

Where footings or foundations are cast against rock, the pay quantities will be based on the material excavated inside the excavation sections shown on the plans and against the neat lines of the footings or foundations as shown on the plans. Measurement will be based on the trucking weight of material within the pay limits removed from the site to a disposal area.

Delete the third paragraph and substitute the following:

Measure structural backfill by the cubic yard in place. Limit the volume of structural backfill measured to that placed between the excavation neat lines and structural members shown on the plans.

Payment

208.14

Add the following:

Pay Item	Pay Unit
20801 Structure Excavation Arch Skewbacks	Ton
20802 Structure Excavation	Ton

Section 209. - RDWY STRUCTURE EXCAVATION AND BACKFILL

Construction Requirements

209.09 Bedding.

(b) Culverts. Amend the third sentence as follows:

When no class is specified, use bedding material that conforms to class C and to Table 2 of AASHTO M 145 for Classifications A-1, A-2, or A-3 soils.

Add the following:

If lean concrete backfill is used, the bedding requirements for (2) Class B and (3) Class C are waived.

Where installing plastic pipe, use Class B bedding.

209.10 Backfill.

(b) Culvert. Delete the first sentence and substitute the following:

Where installing plastic pipe, use backfill material conforming to the requirements of Class B bedding.

Add the following:

As an alternative to backfill material, the Contractor may use lean concrete backfill for backfill of pipe culverts. When utilizing lean concrete backfill, furnish materials and perform the work according to Section 614. Do not use lean concrete backfill with aluminum or aluminum-coated structures or plastic culverts.

Section 552. - STRUCTURAL CONCRETE

<requirements subject to results of HS concrete program in progress>

Material

552.02 Add the following:

Elastomer Seals (Strip)	712.09
Welded Stud Shear Connectors	717.05
Precast Concrete Units	725.11

Construction Requirements

552.03 Composition (Concrete Mix Design). Delete the first sentence of the first paragraph and Table 552-1 and substitute the following:

Design and produce concrete mixtures that conform to Tables 552-1 and 552-1A for the class of concrete specified.

Table 552-1
Composition of Concrete

Class of Concrete	Minimum Cement Content (lbs/y^3)	Maximum W/C Ratio	Slump[(1)](inches)
A	Contractor design	0.38	<10
A(AE)	607	0.40	1 to 4
B	522	0.58	2 to 4

B(AE)	522	0.58	2 to 4
C	658	0.49	2 to 4
C(AE)	658	0.44	1 to 3
D(AE)[2]	607	0.40	1 to 3
E(AE)[3]	607	0.40	4 to 6[4]
P	658	0.44	0 to 4
Seal (AR)	658	0.54	4 to 8
AR			
A(R) (10,000)	Contractor design	0.35	<10
P(C) (6000)	Contractor design	0.38	<10

(1) Maximum slump is 10-inches if approved mix design includes a high-range water reducer. The maximum slump for any mix utilizing a water reducing agent may be adjusted pending mix design approval. Adjustment must be based on approved adjustment to the water reducing agent - water content shall not be modified.
(2) Concrete with a water reducing and retarding admixture conforming to AASHTO M 194 type D.
(3) A latex modified concrete with .037 gallons of modifier per pound of cement.
(4) Measure the slump 4 to 5 minutes after the concrete is discharged from the mixer.
(5) For all concretes with slumps 8 inches or greater, design forms for full fluid head
(6) Use only Type II or Type V cement for all mixes.

Air entrainment is not required. However, air content for A, A(R) and P(C) class concretes shall be measured during trial batching and during production in accordance with 552.09. Air content of production batches shall not exceed the trial batch air content by more than 1.0%.

Append paragraph (g) as follows:

These limitations for cementitious materials shall not apply to Class A, P(C) or A(R) concretes. Mix proportions for those concretes will be determined by trial batch and mix qualification testing performed by the contractor.

Append paragraph (h) as follows:

Use Type V cement for all concrete cast against rock or in contact with earth.

Delete paragraph (l) and substitute the following:

(l) Dosage of admixtures. When requested by the CO, provide a qualified person from the admixture manufacturer to help establish the proper dosage. Do not mix chemical admixtures together in a mix unless they are certified as compatible. Furnish supporting documentation of compatibility from the manufacturers. Use only admixtures and quantities of admixtures that are included in trial batches for classes A, P(C) and A(R) concretes.

Add the following:

Colorado River Bridge 60%+ Submittal

552.03.A Special Requirements for Class A(R) Arch Concrete (added section)

(a) General: Conduct high-strength concrete mixture proportioning in accordance with ACI 211.1 in conjunction with the recommendations detailed in Chapter 3 of ACI 363, and verify through a trial testing program. <text of requirements to be added>

Minor adjustments in mixture proportioning by the concrete producer can facilitate consistent mixture performance and maintain the performance-based specification. Minor adjustments include variations in the allowable dosage rate of chemical admixtures, such as high-range water reducers, or the optional inclusion of a set-retarding chemical admixture when environmental conditions warrant. Included the desired range of all such adjustments in the trial batch program, and verify that all admixture combinations satisfy performance requirements. Do not adjust the water content and cementitious materials content of the mixture without CO's approval of additional trial batch test results.

Use of set accelerating admixtures, air-entraining admixtures, or non-potable water is not permitted.

(b) Materials: Use no substitutions or alterations of any raw material used in the production of high-strength concrete without verification testing to determine its adequacy for complying with specified performance criteria. Record date and location of manufacture for all cementitious materials. Label all bills of lading and containers with a date of production and shelf life. Protect all cementitious materials from all moisture until batched.

Select raw materials according to the following standards, or others as approved by the CO:

Material	Type	Standard
Portland Cement	Type II or V	AASHTO M 85 or ASTM C 150
Fly Ash	Class F	AASHTO M 295 or ASTM C 618
Silica Fume	Slurry or Densified	ASTM C 1240
Coarse Aggregate	No. 7, 8 or 89	AASHTO M 43, M 80 or ASTM C 33
Fine Aggregate	-----	AASHTO M 6 or ASTM C 33
Retarding Water-Reducer	Type D	AASHTO M 194 or ASTM C 494
High-Range Water Reducer	Type F or G	AASHTO M 194 or ASTM C 494
Water	Potable	ASTM C 94 or AASHTO M 157

Supply aggregates for use in high-strength concrete free from any type of coating that would impair paste-to-aggregate bonding. Wash all aggregates at the aggregate production facility prior to shipment. Upon delivery to the concrete production facility, take measures to prevent fugitive dust contamination from these aggregate materials.

The minimum Sand Equivalency (AASHTO T 176) value of fine aggregate is 85.
The maximum absorption value for coarse aggregate is 1.0%.
The maximum absorption value for fine aggregate is 1.5%.

(1) Aggregate Testing: Test **a**ggregates proposed for use to determine its potential for deleterious alkali-silica reaction. Tests less than 12 months old for comparable aggregate from the same production facility may be acceptable for this purpose, subject to the approval of the CO.

Evaluate the aggregates in accordance with ASTM C 1260. Do not use aggregates exhibiting mean mortar bar expansions at 14 days greater than 0.10%.

(c) Mixture submittal requirements: Submit the selection and documentation of proportions for high-strength concrete pursuant to procedures outlined in Figure R5.3 of ACI 318.

Include the following information in the mix design submittal:

1. The proposed mix design listing raw material quantities, sources and types
2. Results of at least two laboratory trial batches conducted under normal and elevated temperature conditions. Results should address all fresh and hardened concrete properties specified in the contract.
3. Raw material statistical summary for the previous 12 months for:
4. Cement mill certificate information, including shelf life and age of cement, and blaine of cement used in the trial batches.
5. Supplementary cementitious or pozzolanic material mill certificate information
6. Aggregate gradation and cleanliness results
7. Raw material certificates
8. Method statement for site adjustments, if proposed
9. Material handling procedures

Assure delivery and inventorying procedures prevent against material contamination. During hot weather periods, employ preconditioning aggregate to compensate for the effects of moisture evaporation to control slump and maintain temperature control.

(d) Temperature Control: The maximum placement material temperature for a concrete batch is 95 degrees F. The minimum mixing and placement temperatures are in accordance with Table 3.1 of ACI 306R-88.

When temperature control measures are taken, hold batch-to-batch temperature differences to a minimum. Take measures to limit batch-to-batch temperature differences to no greater than 10 degrees F.

During hot weather periods use ice, use chilled water or liquid nitrogen to lower the temperature of the fresh concrete. If ice is used, measure on a weight-basis and include as part of the mixing water. Make temperature control materials available in a sufficient quantity to provide consistent batch-to-batch temperatures.

(e) Production: Mix high-strength concrete a minimum of 100 revolutions, or for a sufficient period necessary to comply with the concrete uniformity requirements (Annex A1) of AASHTO M 157 or ASTM C 94.

Completely empty trucks of all wash water prior to receiving a batch of high-strength concrete. Completely wash trucks containing a different mix design out prior to receiving a batch of high-strength concrete.

Empty the working aggregate bins of the batch plant after each day's production. Do not leave aggregate materials for high-strength concrete overnight in working bins. Equip the concrete production facility with an automated measuring device having the capability to measure the moisture content of fine aggregate. Provide a batching system with the capability to automatically adjust the amount of batch water required based on the fine aggregate moisture content.

Prior to the start of each day's production, determine the moisture content of fine and coarse aggregates in accordance with AASHTO T 255 or ASTM C 566. Repeat moisture content determination for each 100 cubic yards or fraction of high-strength concrete produced. Should there be reason to believe that the moisture content of the aggregates has changed significantly from those established by AASHTO T 255 or ASTM C 566 testing, take new moisture content determinations immediately.

Provide determinations of moisture contents far enough in advance such that the results are available prior to the scheduled batching time. Produce a record of aggregate moisture content testing and make the record available at the concrete production facility at all times.

Do not rinse the truck collection hopper and internal drum workings (blades, fins) after batching. Assure that only plant personnel specifically trained for the production of high-strength concrete batch high-strength concrete.

(f) Delivery: Fill out delivery tickets completely and do not surrender tickets by drivers until completion of discharge. Record all pertinent information on the delivery ticket regarding the load of concrete being delivered, such as delivery time and discrepancies in observed sampling procedures.

(f) Placement: Do not add any water beyond the programmed batch amount at initial batching.

In the event the need to increase placement slump arises, high-range water-reducing admixture of the same brand and type used at the concrete production facility may be used, provided that the contractor has run trial batches bracketing the amount of redosing proposed for in-transit or site

redosing. If approved for use, add site added high-range water-reducing admixture (HRWR) to the batch by means of a pipe or wand that can introduce the product to the center of the drum using an automated metering device. Allow only trained personnel to add HRWR. If the concrete becomes overdosed with HRWR and segregation occurs, reject the concrete. Submit a method statement by the contractor for the site addition of HRWR and submit a record of jobsite added HRWR that is maintained and available at the project site at all times.

Provide a consistency of concrete that can be effectively consolidated using a minimum amount of vibration.
Provide curing, methods, materials and monitoring procedures in accordance with ACI 308R.

Unless it is demonstrated otherwise through approved thermal modeling computations or testing submitted by the contractor that it is not detrimental to the structure, provide temperature controls and insulation so that the maximum temperature differential within a pour is less than or equal to 35 degrees F.

Unless it can be demonstrated by the contractor through approved testing that higher internal temperatures will not result in delayed ettringite formation (DEF), provide temperature controls and procedures that assure the maximum internal concrete temperature will not exceed 160 degrees F.

Apply water curing on a continuous basis throughout the curing duration. Do not allow the surface of the concrete to dry at any time from initial placement through the 7 day moist cure period.

(g) Raw material sampling and testing: Sample raw materials for high-strength concrete on a weekly basis in accordance with the following schedule:

Material	**Test Method**
Cement	AASHTO T 153 or ASTM C 204 (Fineness) AASHTO T 192 or ASTM C 430 (% passing 325 sieve) AASHTO T 106 or ASTM C 109 (Cube strength)
Fly Ash	AASHTO T 153 or ASTM C 204 (Fineness) AASHTO T 192 or ASTM C 430 (% passing No. 325 sieve) AASHTO T 106 or ASTM C 109 (Strength activity index)
Coarse Aggregate	AASHTO T 27 or ASTM C 136 (Grading) AASHTO T 11 or ASTM C 117 (% passing No. 200 sieve)
Fine Aggregate	AASHTO T 27 or ASTM C 136 (Grading) AASHTO T 11 or ASTM C 117 (% passing No. 200 sieve)

Randomly select the day of the sampling, with approval by the CO.

In addition to the routine weekly sampling and testing, collect samples at the concrete production facility, and properly identify and retain for a period of two years after completion of the project in accordance with the following sampling schedule:

Material	**Minimum Amount to Retain**
Cement	10 lbs.
Fly Ash (if used)	10 lbs.

Slag (if used)	10 lbs.
Silica Fume (if used)	5 lbs.
Chemical Admixtures	1 pint

(h) Concrete mixture sampling and testing: Perform concrete mixture sampling at the project site in strict accordance with AASHTO T 141 or ASTM C 172. Produce and cure test specimens in strict accordance with AASHTO T 23 or ASTM C 31, and test in accordance with the applicable test methods indicated below.

When initial curing field-cast specimens, immerse the specimens in lime-saturated water. Use only non-absorptive mold materials.

Include the following mixture sampling and testing schedule in the contractor quality control program:

- For the first batch of the day and for each 25 cubic yards, or fraction produced, or at any time the quality of the batch is suspect:

Slump	ASTM C 143
Air content	ASTM C 231
Density	ASTM C 138
Temperature	ASTM C 1064

- For each 50 cubic yards, or fraction produced in one day:

Compressive Strength at 2, 7, 28 and 56 days	ASTM C 39

- For each 2000 cubic yards produced:

Modulus of elasticity (56 days)	ASTM C 469
Creep through one year (7-day loading age)	ASTM C 512
Shrinkage through 180 days	ASTM C 157

552.08 Delivery. Add the following after the second paragraph:

Deliver and place the concrete within one hour from the time the mixture is charged in the mixer.

(a) Truck mixer/agitator. Delete Table 552-2:

552.09 Quality Control of Mix.

Add the following:

At least 2 weeks prior to the start of concrete placement operations, arrange a pre-concrete placing conference. Coordinate attendance with the CO and any applicable subcontractors. Be prepared to discuss and/or submit the following:

1. Proposed concrete placement schedule.

2. Review approved concrete mix design and determination of batch weights.

3. Discuss Section 153, Contractor Quality Control, minimum frequency schedule for process control sampling and testing (to be performed by the Contractor).

4. Discuss batching, mixing, placing, and curing requirements.

5. Discuss Subsections 106.03, Certification, and 106.05, Statistical Evaluation of Material for Acceptance.

(b) Delivery and Sampling.

Add the following:

Furnish and maintain curing facilities for compressive cylinders meeting the requirements of AASHTO T 23. The facilities shall have capacity sufficient to cure 4 cylinders from each compressive strength sample set.

Use an approved form release agent which will produce a minimum of staining, air holes, and hydration discoloration.

552.10 Temperature and Weather Conditions.

(b) Hot Weather. Add the following paragraph after the first paragraph:

(3) Add the following:

Flaked or crushed ice may be substituted for part of the mix water on a pound for pound of water basis.

Add the following:

(e) Mass Concrete

Portions of structure are mass concrete (ref ACI 207), including pier footings, caps, skewback footings and diaphragms. Include modeling (analysis), temperature control and monitoring during placement of mass concrete elements.

Use Type V or Type 2 II Modified cement for mass concrete. The sum of the Tricalcium Silicate and Tricalcium Aluminate shall not exceed 58 percent in accordance with the optional chemical requirements of ASTM Designation, C 150.

The water to cementitious materials ratio shall not exceed 0.40.

Use either Type A, D, F or G admixture conforming to the requirements of ASTM Designation C 494. Use admixture at such dosage that it will not cause an increase in drying shrinkage of the mass concrete in excess of that permitted in ASTM Designation C 494.

Do not exceed concrete temperature of 90°F at time of discharge from the mixer the point and time of placement except when ice is substituted for 100 percent of the mixing water, in which case do not exceed 75° F. Assure that when ice is used, all the ice is melted before discharging the concrete from the mixer.

After the mass concrete pour has been topped out and finished it shall be revibrated and refinished. Revibration shall extend below the top mat of reinforcement and shall be done as late as the concrete will again respond to vibration. For concrete pours without top reinforcement, revibration shall extend to a depth of 6 inches.

Control the internal and surface temperature of mass concrete during curing to control thermal cracking due to heat generation and dissipation. Control the maximum internal temperature of the mass concrete once placed so maximum does not exceed 155°F. control the maximum temperature difference between any surface of the mass concrete and the hottest portion in accordance with the cracking criteria established in the Thermal Control Plan of these provisions.

The concrete temperature shall be monitored by thermocouples placed into the concrete, as required in "Thermal Control Plan" of these provisions. Use ice, liquid nitrogen, insulated curing blankets, insulated forms, cooling pipes and other measures as necessary to satisfy the temperature requirements.

(1) Thermal Control Plan: For each mass concrete structure component, prior to commencing any mass concrete placement, submit a Thermal Control Plan to the CO for approval. Include the length and method of curing, procedures to control maximum concrete temperature at time of placement, report of thermal modeling, temperature sensor types and locations, data acquisition method, proposed method of controlling temperature differentials, and provisions for field measures to ensure meeting the maximum concrete temperature and temperature differentials requirements.

The CO will not approve mix designs until the Thermal Control Plan is approved.

Perform a two-dimensional finite-difference analysis in accordance with ACI 207.1R-96 for temperature modeling of mass concrete placement for the pier footings, pier cap, skewback footings and arch diaphragms. Perform analysis for estimating crack widths in accordance with the requirements in ACI 207.2R-95. Calculated crack widths shall not exceed 0.15 mm for caps and diaphragm elements and 0.25 mm for pier and skewback footings. Perform analysis based on the Contractor's proposed mix designs. Test the coefficient of thermal

expansion of the concrete with the aggregate to be used in the proposed mixes in accordance with US Army Corps of Engineers Method CRD-C39-81, "Test Method for Coefficient of Linear Thermal Expansion of Concrete." Test the heat of hydration of the cementitious materials including mineral admixtures to be used in the mixes at 1, 3, 7, and 28 days in accordance with ASTM C186-98, "Heat of Hydration of Hydraulic Cement". Clearly state all assumptions for the modeling including use of cooling and insulation. Submit the report and summary of the modeling calculations and assumptions to the CO for approval in accordance with Section 104.

Monitor concrete temperatures at the centroid of concrete, on at least two outer faces, on at least two corners, and on the top surface. Record the air temperature. Automatically record temperature readings on an hourly basis. Include a redundant set of sensors near the primary set. Discontinue temperature monitoring when the maximum allowable temperature difference is greater than the difference between the interior concrete temperature and the coldest nighttime temperature for three consecutive days.

Protect wiring to thermocouples that must be cast into the concrete to prevent damage. Make wire runs as short as possible. Temperature monitoring equipment shall be capable of printing and data storage and shall be able to download monitoring data to a computer. Store recording instruments in a heavy duty lockable box and download readings daily and submit to the CO. Take immediate measure as specified in the Thermal Control Plan if the specified maximum internal temperature of the mass concrete is exceeded or the maximum allowable temperature difference between any surface of the mass concrete and the hottest portion is exceeded. If the actual readings do not compare within 10% of those predicted by the modeling, find the cause of differences, revise the procedure and modify the Thermal Control Plan as necessary. Submit any revision to the procedure or modification to the Thermal Control Plan to the CO for approval prior to the next mass concrete placement.

For the arch diaphragms, pier footings and caps, the requirement for monitoring every mass concrete placement may be reduced at the discretion of the CO upon evidence of consistently meeting the requirements of these provisions. Continue minimum monitoring of 25% of the mass concrete placements.

(2) Demonstration Pours: Cast one trial pour of not less than 6 feet cubed to demonstrate adequacy of temperature modeling and thermal control plan.

552.14 Finishing Plastic Concrete.

(b) Straightedging. Delete the text of the Section and substitute the following:

Provide a smoothness evaluation of the completed bridge deck and concrete approach slab riding surfaces by a California-type profilograph in accordance with the criteria of this section and according to FLH T 504. Furnish this evaluation through an independent provider approved by the CO using equipment calibrated by the CO. The riding surfaces subject to this evaluation include all traffic lane and shoulders. There will be a minimum of 2 profiles per lane, each 3 feet from the lane lines and one profile for each shoulder approximately 3 feet from the curb or barrier face. All profilograph runs will be made in a direction parallel to and in the direction of traffic. In addition,

such surfaces shall not vary by more than 0.01 foot from the lower edge of a 12 foot long straightedge placed transversely to traffic between lanes.

Prior to initial profilograph testing and grooving, complete work on the bridge deck, except for expansion joint assembly installations. Thoroughly clean and clear the bridge deck and approach slab area to be evaluated for smoothness of all obstructions and provide the smoothness evaluation. Ensure that no radio transmissions or other activities that might disrupt the automated profilograph equipment are allowed during the evaluation.

Average the Profile Index value for the bridge deck, including the concrete approach slabs, for each lane. The maximum allowable Profile Index value for acceptable smoothness is 10 inches per mile utilizing the 0.2-inch wide blanking-band. Apply this criterion to each 300 feet of each lane. Additionally, remove all bumps and depressions exceeding a cutoff height of 0.25" from a chord of 25 feet on the profilograph trace and ensure that the surface meets a 0.01-ft in 12 foot straightedge check made transversely across the deck and approach slabs. A single testing series will occur only when the initial profilograph results satisfy all acceptance criteria. Provide additional profilograph testing as necessary following longitudinal grinding and any other actions taken to improve smoothness, until a profile meeting the acceptance criteria is obtained.

For bridges that do not pass the straightedging criteria given above, perform grinding until a profile meeting the acceptance criteria is obtained. Produce ground areas of uniform texture and of neat and approximately rectangular patterns which extend laterally to the nearest lane line or edge and longitudinally to lines normal to the centerline. Use grinding machines that are power driven, self-propelled and specifically designed to remove, profile, smooth, and texture concrete riding surfaces. The grinding machine shall have a wheel base of not less than 12 feet, equipped with a rotating powered mandrel drum, diamond grinding blades of the appropriate bond hardness and a cutting head not less than 3 feet wide. The machine shall be constructed and operated in such manner that it does not cause strain or damage to the deck surface, excessive ravels, aggregate fractures or spalling. Equip the grinding machine with an effective means for controlling dust and other particulate matter.

(c) Texturing. Delete the second sentence and substitute the following:

Use a saw-cut grooved finish on the bridge decks and approach slabs. Groove the surfaces after the concrete has cured, has attained a minimum 3000 psi compressive strength, and after any grinding to meet straightedging surface tolerances.

(1) Grooved finish. Delete the first two sentences of the first paragraph and substitute the following:

Use an approved machine designed specifically for sawing grooves in concrete pavements.

Add the following to the third paragraph:

Terminate grooves a maximum of 12 inches from expansion joints or any devices embedded in the concrete, such as metal joints, access plates, etc. Line up the grooves across construction joints or stopping points to produce grooves that are continuous across the surface.

552.15 Curing Concrete. Delete the third paragraph regarding curing compound and replace with the following:

Apply the water cure within 10 minutes of finishing, or earlier if required to prevent drying of the concrete surface.

Delete the last sentence of subsection (a), and replace with the following:

After the rubbing is complete, continue curing process using the water curing method.

552.16 Finishing Formed Concrete Surfaces.

(a) Class 1 - ordinary surface finish. Add the following:

(4) All surfaces of bridge and drainage structures to be painted in accordance with Section 563.

(b) Class 2 - rubbed finish. Delete section.

552.19 Acceptance. Delete the third sentence of the second paragraph and substitute the following:

Perform sampling and testing according to Table 552-7.

Measurement

552.20 Add the following:

The volume of concrete required, outside the neat lines of the footing, to pour against undisturbed rock as shown on the plans will not be measured for payment. Work slabs for rebar placement will not be measured for payment. When the CO directs the removal of material below the established elevation of the bottom of the footing, the volume of concrete required to fill the void will be measured for payment.

Payment

552.21

Delete pay items and replace with the following:

Pay Item	Pay Unit
55202a Structural concrete Class A for deck (f'c = 4500)	Cubic Yard
55202b Structural concrete Class A for footings and abutments (f'c = 4000)	Cubic Yard

55202c Structural concrete Class A or P(C) for columns and caps (f'c = 6000) Cubic Yard
55202d Structural concrete Class A(R) for arch (f'c = 10,000) Cubic Yard

Section 553. - PRESTRESSED CONCRETE

Description

553.01 Add the following:

This work also consists of special sections for precast columns and cast-in-place arch construction. Requirements for concrete are contained in Section 552.

Construction Requirements

553.09 Post-Tensioned Members. Delete and replace with the following:

553.09 Post-Tensioned Members. Construct post-tensioned members to the tolerances shown in Table 553-09-1. Provide post-tensioning systems that meet the requirements of PTI "*Acceptance Standards for Post-Tensioning Systems*", as amended herein below.

(a) Metal Ducts. Use rigid, mortar tight, galvanized ferrous metal ducts fabricated with either welded or interlocked seams with sufficient strength to maintain correct alignment during concrete placement and with minimum wall thickness as follows:

(1) 26 gage for ducts <= 2.625 inch diameter
(2) 24 gage for ducts > 2.625 inch diameter
(3) 31 gage when bar tendons are preassembled with the duct

Provide greater wall thicknesses if necessary to withstand the grouting pressures without causing bursting stresses within the surrounding concrete.

Make positive metallic joints between duct sections. Do not make angles at joints. Use waterproof tape or mastic to seal at the joints. Provide duct system that can hold 50 psi pressure for 3 minutes. Bend ducts without crimping or flattening. Use sealed ferrous metal or polyethylene couplings to connect ducts to anchoring devices.

(b) Plastic Duct for Post-tensioning. Do not use ducts manufactured from recycled material. Use seamless fabrication methods to manufacture ducts.

Use corrugated duct manufactured from the following materials:

1. Non-colored, unfilled polypropylene meeting the requirements of ASTM D4101 "Standard Specification for Polypropylene Plastic Injection and Extrusion Materials" with a cell classification range of PP0346B44544 to PP0346B65884*, having a minimum thickness as*

defined in the following table. Also, the polypropylene shall contain 0.2 % hindered amine light stabilizer non-yellowing type which when tested yields an environmental stress crack rating as determined by ASTM D 1693, Condition C, of not less than 192 hours.

2. High density polyethylene (HDPE) plastic pipe meeting the requirements of ASTM D 3035 "Standard Specification for Polyethylene (PE) Plastic Pipe. Meet the specific cell category requirements for class PE 304433 and class PE 305534 materials as defined by Table 1 of ASTM D 3350. Supply material that does not react with any cementitious grout, grout admixtures, prestressing steel, corrosion inhibiting coating or any other material it is to come in contact with; and provide material that is free of water soluble chloride. Meet property ranges for HDPE as follows:

Property	**ASTM Test Method**	**Value**
Density, g/cm3	D1505	0.941-0.955
Melt Index	D1238	Max of 1.0
Flexural Modulus, (psi)	D790	80,000-160,000
Tensile Strength at Yield, (psi)	D638	3050-4050
Environmental Stress Crack Resistance,F20, hrs.	D1639 (Cond C)	192
Hydrostatic Design Basis, (psi)	D2837	150

Provide wall thickness sufficient to withstand handling and construction loadings as well as 150 psi grouting pressure without leaking or cracking surrounding concrete, but not less than the following minimum values:

Duct shape	**Duct Diameter**	**Min Duct Thickness**
Flat	any size	0.08 in. (2.0 mm)
Round	0.9 in (23mm)	0.08 in. (2.0 mm)
Round	2.375 in. (59mm)	0.08 in. (2.0 mm)
Round	3.0 in. (76 mm)	0.1 in. (2.5 mm)
Round	3.35 in.(85 mm)	0.1 in. (2.5 mm)
Round	4.0 in. (100 mm)	0.12 in. (3.0 mm)
Round	4.5 in. (115 mm)	0.14 in. (3.5 mm)

Round	5.125 in. (130 mm)	0.16 in. (4.0 mm)
Round	5.71 in. (145 mm)	0.16 in. (4.0 mm)

Manufacturing and Testing Requirements for Corrugated Plastic Duct:
Construct corrugations with three connecting longitudinal channels which facilitate the removal of air or water during grouting and stiffen the duct to resist loads from reinforcing bars. Test components for compliance with the requirements of Chapter 4 Articles 4.1 through 4.1.8 of FIB Technical Report, Bulletin 7, titled Ensure that the duct system components and accessories meet the requirements of Chapter 4 Articles 4.1 through 4.1.8 of FIB Technical Report, Bulletin 7, titled "Corrugated Plastic Duct for Internal Bonded Post-Tensioning" as modified herein. To order the technical report, contact the International Federation of Structural Concrete (FIB) at http://fib.epfl.ch. The requirements in FIB Technical Report, Bulletin 7, are modified as follows: Perform all tests at 100^{o}F (38^{o}C). Conduct lateral load resistance test (FIB 4.1.4) without the use of a duct stiffener plate using a load of 150 lbs.(667 N) for all sizes; Wear resistance of duct (FIB 4.1.7) shall not be less than 0.06 in (1.5 mm) for duct up to 3.35in. (85mm) diameter and not less than 0.08 in. (2.0mm) for duct greater than 3.35 in. (85mm) diameter; Bond behavior of duct (FIB 4.1.8) shall be achieved in 40 diameters.

Corrugated Duct Connections and Fittings: Make all splices, joints, joints between segments (segmental construction), couplings and connections to anchorages with devices or methods (i.e. mechanical couplers, plastic sleeves in conjunction with shrink sleeve) producing a smooth interior alignment and an airtight sealed connection with no lips or kinks. Duct tape is not permitted to join or repair duct connections.

Provide all ducts or anchorage assemblies with metal or collapse-proof plastic threaded pipes or other suitable connections for the injection of grout after prestressing. Grout ports shall be provided for each 50 feet of column rise for precast columns, or at each anchor plate and coupler, whichever is less.

Provide ducts with an inside diameter at least 0.375 inches larger than the nominal diameter of a single wire, bar, or strand tendon, and at least 2.25 times the area of the tendon. For multiple wire, bar, or strand tendons, provide a duct cross-sectional area at least 2 times the net area of the prestressing steel. When tendons are to be placed by the pull-through method, provide a duct cross-sectional area at least 2.5 times the net area of the prestressing steel.

Securely fasten ducts in place to prevent movement. Maintain distances from the forms by stays, blocks, ties, hangers, or other approved supports. Use precast mortar blocks of approved shape and dimensions. Separate layers of ducts by mortar blocks. Cover the ends of ducts to prevent the entry of water or debris. Vent all ducts for continuous structures at the high points and low points of the duct profile, and at intermediate points as required for grouting. Make water tight vents with 0.5-inch minimum diameter standard pipe or suitable plastic pipe, and water tight caps for closing vents after grouting. Connect vents to ducts with metallic or plastic structural fasteners. Do not use components that react with the concrete, cause corrosion of the prestressing steel, or contain water soluble chlorides.

(b) Placing concrete. Where the end of a post-tensioned assembly will not be covered by subsequent lifts of concrete, recess the anchoring devices so that the ends of the prestressing steel and all parts of the anchoring devices are at least 2 inches inside the end surface of the members.

Before placing concrete, demonstrate that all ducts are unobstructed. Immediately after concrete placement, blow out the metal conduit with compressed, oil-free air to break up and remove all mortar in the conduit before it hardens. Alternatively, swab ducts in precast members to verify ducts remain open.

For post-tensioned members that are to be steam cured, do not install prestressing steel until curing is complete.

(c) Anchorages and distribution.
Anchor post-tensioned prestressing steel at the ends by means of permanent type anchoring devices capable of developing not less than 95 percent of the ultimate tensile strength of the prestressing steel. Cast all anchors in place with concrete placement. Provide anchorages and local zone reinforcing in accordance with AAHSTO LRFD. Enclose loop tendon anchorages in ducts for their entire length.

(d) Prestressing steel. Use only bright, corrosion free 7 wire strand or HS bar as shown on the Plans. Use a corrosion inhibitor to protect prestressing steel installed in ducts before placing and curing of the concrete. Use a corrosion inhibitor that does not adversely affect the steel, concrete, or bond strength of the steel to concrete. If prestressing steel is installed in the ducts after concrete curing, and stressing and grouting are completed within 20 days after installation, then no corrosion inhibitor is required.

(e) Post-tensioning. Wait until tests on concrete cylinders indicate that the concrete has attained the minimum compressive strength of 4000 psi before stressing. Demonstrate that the prestressing steel is free and unbonded in the duct. Straighten strand as is necessary to produce equal stress in all strands that are stressed simultaneously. Remove all side forms for girders before post-tensioning. Record gauge pressures and prestressing steel elongation at all times while tensioning prestressing steel and submit records. Determine the friction loss in the prestressing process (i.e., the difference between tension at the jack and minimum tension in the prestressing steel) according to the AASHTO LRFD. Use suitable shims, power seating or other approved procedures to attain the specified anchor set loss.

(f) Grouting. Bond all post-tensioned prestressing steel to the concrete by completely filling the void space between the duct and tendon with grout. Provide prestressing steel to be bonded to the concrete, which is free of dirt, loose rust, grease, or other deleterious substances. Clean all ducts of material that would impair bonding of the grout or interfere with grouting procedures. Blow out each duct with compressed, oil-free air. Grouting hardware, materials and procedures shall be in accordance with PTI *Specification for Grouting of Post-Tensioned Structures*, 2001 (PTI-G); Grout Class C. Interpret all recommendations in PTI-G as requirements unless noted otherwise in these SCR's. In addition to requirements of PTI-G, run Gelman pressure test for grout qualification and in field according to PTI-G T4-1b. If grouting is to take place when daily maximum ambient temperature is in excess of 100 degrees F, complete grouting prior to sunrise, when the structure is at the lowest diurnal temperature. Provide chilled water batching or other measures as necessary to

produce temperature of grout at time of placement no greater than 90 degrees F. Take other measures as necessary to prevent flash set of grout. If circumstance arise that prevent complete filling of duct in one operation, complete grouting of duct with installation of special grout vents, ports and vacuum grouting procedures approved by the CO.

Abrasive blast clean the concrete surface of recessed anchorage assemblies within 24 hours of filling recess. Paint all exposed steel surfaces in accordance with 553.10. Fill anchor recesses with concrete conforming to the requirements for the structure and finish flush. Inject any shrinkage cracks greater than .002 inch in pour-back with epoxy as incidental to the work.

Remove ends of vents 1 inch below the roadway surface after grouting has been completed. Verify that all vents are solidly filled with grout to the level of removal prior to capping vents with a permanent water tight cap or seal.

Do not release the falsework supporting the post-tensioned structure until at least 48 hours after grouting of the post-tensioned prestressing steel or until the grout strength is obtained.

553.12 Measurement

Delete the second paragraph, and replace with the following: Measure prestressing system by the pound of prestressing steel, measured from anchor face to anchor face in place. Do not measure anchors or couplers or other hardware which are incidental to the presetressing system.

553.09.A Precast Column Segments (added section)

(a) General. This work consists of performing all operations necessary to construct precast concrete segments including manufacturing, storage, and transportation of the segments to the bridge site. Furnish segments complete including all concrete, bar reinforcing steel, miscellaneous metal, grout vents, prestressing steel ducts, anchorages, and other appurtenances in connection therewith.

Precast concrete segment age is measured from the date a segment casting is complete. Prior to release for erection, furnished precast concrete segments shall be stored in the Contractor's casting yard or storage facility until the segments are 60 days old.

Submit shop drawings that include complete details, information, and substantiating calculations for the methods, materials, equipment, and procedures the Contractor proposes to use in constructing, handling, storing, and transporting the precast concrete segments.

Submit proposed methods of geometry controls for the casting operation and a quality control plan for geometry control. Submit a "Casting Manual" that includes the following:

- A detailed explanation of the geometry control theory for casting.
- A detailed narrative of the step-by-step geometry control procedure.
- Detailed calculation forms, and a set of sample calculations for geometry controls, including sample input and output of computer programs.

- Identifications of all measuring equipment, procedures, and the location of control points to be established on each segment.
- The location and values of all permanent bench marks and reference points in the precasting yard.
- Qualifications of personnel who will carry out geometry control.
- A geometry control procedure for the vertical and horizontal alignment control of the precasting segments; including survey control and procedures, observations, checks, computational and graphical methods and correction techniques.
- A production schedule with rates of production and number of casting units.
- The provisions to protect instruments from construction activities and to minimize the effects of wind and temperature variations on the accuracy of readings.

Include all geometry control operations necessary within the manual. Coordinate with the erection manual and the chosen methods of casting and erection, including erection survey, elevation and alignment control.

(b) Handling, Storage and Transport. Exercise care in the handling of segments to prevent damage. Handle only by using devices intended for this purpose as shown on the approved shop drawings. Do not lift segments until a minimum compressive strength of 3000 psi is reached. Store segments in the upright position for column segments. Firmly support segments on a bearing system under the webs that is statically determinate, at calculated locations as shown on the approved working drawings. Design the bearing system to prevent twist or warping of the segments during the entire period of storage, transportation, and handling.

Inform the CO in writing at least 10 working days prior to shipment of each segment to allow for inspection. Make repairs to minor spalls or chipped areas on the match cast joint surfaces in the match cast position after prior notice to the CO. Record all repairs on the drawings and submit all repair records and drawings to the CO no more than 2 working days after the repairs are complete. Clean the faces of all match cast joints of laitance, bond breaking compound, and other foreign material by wire brushing or light sand blasting immediately prior to shipment. Upon arrival at the bridge site, inspect each segment. If any damage has occurred during shipment that could impair the structural or other function of the segment, the segment will be rejected.

Provide a CPM schedule that includes at least the following activities for the production of precast segments:

A. Working drawing review;
B. Form fabrication;
C. Set up of precasting yard;
D. Form assembly;
E. Segment casting and curing period;
F. Shipment schedule for each segment

(c) Casting Requirements. Mast-cast segments so that a segment is cast against the preceding segment to produce a matching interface that will permit re-establishment of the cast geometry at the time of erection. Give each segment a distinct erection mark indicating its location and order in the

erection sequence. Place this mark on each segment before it is removed from the casting cell. Match mark abutting edges of adjacent segments. Show erection marks on the shop drawings.

Correct dimensions from segment to segment to compensate for deviations within a single segment so that the overall dimensions of the completed structure will conform to the dimensions shown on the plans.

Table 553.09-1

Finished Tolerance for Production of Precast Segments	
Item	**Tolerance**
Length of individual match cast segment (not cumulative)	1/8 in/ft, not to exceed 3/4 in
Wall thickness	-1/8 + 3/8 in
Overall width of individual match cast segment	1/16 in/ft, not to exceed 1/2 in
Tendon hole location	+/- 1/8 in
Position of shear keys	+/- 1/4 in

Do not twist the match-cast segment. Cover the abutting surface of the bulkhead segment with a thin film of a bond breaker consisting of flax soap and talc, or other suitable material as approved by the CO. The soap and talc mixture shall be 5 parts flax soap and 1 part talc, or otherwise as determined by the contractor in order to prevent bonding while casting and curing the match cast joint. Determine the acceptability of a material other than soap and talc prior to casting of the segments by demonstration of a large specimen that has a facial area of at least 10 sq ft.

Immediately before and after segment casting (before bond breaking), record the geometry of the segment from the approved control points. Mount instruments used for the horizontal and vertical geometry control on rigid permanent platforms with sufficient height to sight on all control points. Establish a minimum of two permanent benchmarks on line with the instrument mounting pad in the casting yard. Prior to beginning casting operations using the short line method, establish horizontal and vertical control points on the a fixed bulkhead. Check readings on the alignment, elevations, and shape of the fixed bulkhead by taking readings on these control points each time the geometry of adjoining segments is checked. If any settlements or distortions beyond tolerance occur, discontinue casting with these forms until the distortion is corrected.

Immediately after casting of a segment is completed, measure and record the length of the segment along the line of each web and establish references for horizontal and vertical control as follows:

4) Horizontal control shall include a wire stirrup on the horizontal control line at both ends of the segment. A line not more than 0.3 mm in width shall be scribed or a punchmark placed in a permanent manner into each stirrup. Wire stirrups shall be stainless steel.
5) Vertical control shall include a flat head bolt, with a pin hole in the head, approximately flush with the surface of the concrete over each web at both ends of the segment. Bolts shall be stainless steel.

During casting operations, the produce and maintain on a daily basis a graphical plot of the alignment and offset “as cast” geometry along each vertical and horizontal control line to an exaggerated scale in order to clearly highlight variations. Graph these against both the theoretical geometric vertical

and horizontal alignment (station and offset for vertical members) casting curves on a continuous layout of an entire bridge column. Maintain this plot in electronic form so that it may be used and referenced during erection.

Include the following additional requirements to geometry control for short line casting of segments.

1) The instruments used to measure elevations shall be precision levels equipped with parallel plate micrometers capable of obtaining first order control and one piece Invar rods with centering point bases.
2) The instruments used to make horizontal measurements shall be one-second theodolites.
3) A centerline offset measuring tool shall be directly calibrated in intervals of 0.02 inches and offset measurements shall be observed in an accuracy of 0.01 inches.
4) Within 5 working days of casting all data from the geometry control program, including theoretical and actual reading prior to and following casting the segment (but prior to form release) shall be submitted to the CO.

Support metal ducts at intervals of not more than 4 feet and plastic ducts at intervals of no more than 2 feet.. At the segment joints, connect ducts by rigid mandrels. Do not displace ducts during casting. Provide additional supports at segment joints as required to maintain segment alignment at bulkhead.

After installation in the forms, seal the ends of the ducts to prevent entry of water and debris. Tie ducts in position, inspect, and repair ducts prior to placing of the concrete. Following concrete placement and prior to shipment and erection, demonstrate to the CO that all empty ducts are free of mortar and water, properly aligned, and are unobstructed and undamaged.

(d) Concrete Placement. Consolidate concrete by means of vibrators together with other equipment necessary to consolidate all concrete to an equivalent minimum in-place concrete density of not less than 145 pcf. Provide internal vibrators with a minimum frequency of 8,000 vibrations per minute and sufficient amplitude to consolidate the concrete effectively. Provide at least 2 stand-by vibrators in working condition for emergency use in case of malfunction. The use of external vibrators for consolidating concrete is permitted and is required when the concrete is inaccessible for adequate consolidation. When external vibration is used, construct forms sufficiently rigid to resist displacement or damage. Place and vibrate concrete with care and in such a manner as to avoid displacement of reinforcing, conduits, and other items to be fixed in place.

Do not place construction joints or cold joints within a segment. Any interruption of more than 30 minutes in the continuous placement of concrete in a segment will result in rejection of that segment.

(e) Demonstration Segment Pours. Cast at least one full scale demonstration of match-cast segments at the precast concrete plant. Use design materials and procedures identical to those proposed to be used in production. Produce demonstration segments sufficiently before production segments are cast to demonstrate geometry control methods, placement procedures, and that segments can be cast without segregation of the concrete. Failure to meet any of the acceptance criteria for permanent segments will result in the rejection of the demonstration segments. If a demonstration segment is rejected by the CO, cast additional demonstration segments until all acceptance criteria are met. The successful demonstration segments may be used in production.

(f) Erection of Precast Concrete Segments. This work consists of furnishing all labor, equipment, and materials and performing all work involved in erecting precast concrete segments, including all erection equipment, and temporary prestressing steel for erection.

Submit shop drawings that describe the erection methods for precast segments. Include complete details, information, drawings, and substantiating calculations of the methods, materials, equipment, and procedures that the Contractor proposes to use in erecting the segments. Include a statement of methods with complete description of geometry control procedures for erecting the columns in order to achieve the final geometry called for on the plans.

(f).1 Tolerances. The erection tolerances are as follows:

A. Maximum differential offset between outside faces of adjacent segments in the erected position shall not exceed 1/8 inch.
B. The completed segmental column shall not deviate from the theoretical line of the column by more than 0.0005 radians, measured along the centerline of column.
C. The angular deviation from the theoretical alignment in either vertical plane between two successive segments shall not exceed 0.002 radians.
D. Dimensions from segment to segment shall be adjusted so as to compensate for any deviations within a single segment so that the overall dimensions of the completed structure will conform to the dimensions shown on the plans such that the accumulated maximum error should not exceed 1/1200 of the column height. The column dimensions shall include adjustment for epoxy joint thickness.

The survey for erection geometry control shall be supervised by an engineer who is registered as a Land Surveyor or as a Professional Engineer in the United States.

To guard against false reading due to temperature differentials, take readings only when all portions of the column box section are stabilized at the same temperature (typically at or before sunrise). Use precautions in devising methods to guard against false readings and corresponding adjustments due to temperature differentials.

If measured line or grade deviates out of tolerance, suspend further erection of segments. Submit to the CO for approval a correction plan for restoration and maintenance of geometry control in accordance with the specifications.

(f).2 Application of epoxy bonding agent. Bond all precast segment joints with an approved epoxy bonding material. Provide epoxy bonding material conforming to the requirements in Section 725.21 and the following requrements. Clean all segments of all laitance, flax soap or other debonding agent, dirt or other material that can inhibit bonding. Apply materials in accordance with manufacturer's instructions.

Prior to applying epoxy bonding materials, submit a plan for the safe storage, mixing, and handling of the epoxy bonding agent and for applications during cold weather conditions, and sample product for review and approval by the CO.

Provide epoxy bonding agent for match-cast joint between precast segments with a thermosetting 100 percent solid composition that does not contain solvent or any non-reactive organic ingredient except for pigments required for coloring. Provide epoxy bonding agents with two components, a resin and a hardener. The two components shall be distinctly pigmented, so that mixing produces a third color similar to the concrete in the segments. Package the components in pre-proportioned, labeled, ready to use containers. Use labels to designate the resin, hardener, temperature range, and shelf life date for application recommended by the Manufacturer.

Formulate epoxy bonding agents to provide application temperature ranges that will permit erection of match-cast segments at substrate temperatures from 40 to 115 degrees Fahrenheit. Do not apply epoxy bonding agent outside of this substrate range. Provide formulations with a fast-reacting system for erection when the substrate temperature is between 40 to 65 degrees F, medium-reacting system for erection when the substrate temperature is between 55 to 90 degrees F, and slow-reacting system for erection when the substrate temperature is between 72 to 115 degrees F. If two surfaces to be bonded have different substrate temperatures, apply the adhesive applicable at the higher temperature.

Provide bonding agents insensitive to damp conditions during application and, after curing, that exhibit specified bonding strength to cured concrete, water resistivity, the specified creep characteristics, and tensile strength greater than the concrete. In addition, provide epoxy bonding agents that function as a lubricant during the joining of the match cast segments, and as a water-tight bond at the joint. For precast concrete segments, hardened epoxy bonding agent must provide a friction mechanism to transfer shearing stresses across the joint at the shear keys.

Mix two components of the epoxy resin in accordance with the manufacturer's instructions, using only full and undamaged containers. Do not use containers that have been damaged or previously opened. Check substrate temperatures immediately before opening containers.

1) Containers that have been previously opened shall be rejected. Mixing shall be carried out in a mechanical mixer in accordance with the recommendations of the epoxy manufacturer.
2) No mixing shall start until the new segment to be joined is within 10 feet of its final position.
3) Each container of epoxy material shall be thoroughly agitated before mixing, and the mixing shall continue until the uniform color is achieved. A continuous check shall be kept on the temperature of the mix.
4) A component that has exceeded its shelf life shall be rejected.

Provide and mix epoxy bonding agents proportioned as designated by the manufacturer and mixed in accordance with the manufacturer's recommendations to meet the physical requirements of ASTM C 881 Type VI.

Before applying epoxy, clean the interfaces of all laitance and bond breaking material. Completely remove oil, diesel residue, dirt, dust and other materials that may affect bond and maintain cleanliness until epoxy application is complete. Remove all free moisture from mating surfaces. Free moisture shall be considered to be present if a rag wiped over the surface gathers any dampness.

Begin application of epoxy immediately after a batch has been mixed. Apply a nominal thickness of 1/6 in on both faces of vertical or inclined joints and 1/8 on one face of horizontal joints if approved by the manufacturer.

No epoxy shall be applied after the specified gel time has elapsed. Do not apply epoxy within 3/4 inch of any duct. Ensure that epoxy does not extrude into ducts. Immediately after both faces are covered with epoxy, bring the unit shall into position and apply the designated prestress. Provide for a minimum contact pressure of 40 psi compression over the entire joint of precast concrete segments while the epoxy is curing in the joint. Plan the erection and post-tensioning operations such that, for the particular formulation of epoxy bonding agent being used, the time elapsing between initial mixing of the components for the first batch of epoxy bonding agent and application of the minimum contact pressure shall not exceed 70 percent of the contact time. Prior to beginning erection, submit to the CO for review, details covering how compliance with the contact pressure and the time limit will be achieved during erection of segments. Apply the contact pressure through temporary or permanent post-tensioning. Maintain the minimum contact pressure continuously across the joint.

If specified minimum contact pressure is not attained within the contact time, pull the segments apart and remove all the epoxy on both interfaces with spatulas and a suitable solvent that will remove all remaining epoxy. Do not apply epoxy to the joint until 24 hours after the solvent has been used.

"Swab" the ducts at the match cast joint after temporary prestressing to smooth out any extruded epoxy within the duct. When slow-set epoxy is used, pass the swab after each new segment is erected through all the segments adjacent to uncured epoxy. Capture excess epoxy squeezed from the joint and do not allowed to fall down on the structure or to the ground or water below. Trim outside epoxy bead to be flush with exterior concrete for a smooth surface finish. Clean all excess epoxy after jointing from outer faces in such a way as not to damage or stain the concrete face.

Apply epoxy bonding agent during erection of precast segments only when the substrate temperatures of the mating surfaces are between 40 and 115^{o} F. In cold weather, provide an artificial environment to maintain the substrate temperature within the permissible limits by use of an enclosure heated by circulating air or by radiant heaters. Do not use localized heating. Apply heat in a manner that prevents surface temperatures greater than 35°C during the epoxy hardening period. Do not use direct flame heating of concrete.

Keep a record of each joint with the following details:

1) Span number or column number (L or R) and joint number for superstructure construction;
2) Time of mixing first batch of epoxy bonding agent applied to the joint;
3) Date and time of jointing;
4) Time of applying specified contact pressure to the joint;
5) Batch numbers of resin and hardener;
6) Maximum temperature of mix;

Measurement

Furnish and erect precast concrete will be measured by cubic yard in accordance with 552.21.

553.09.B Cast In Place Arch Erection by Form Traveler (added section)

This work consists of building the arch superstructure by segments cast-in-place in form travelers. See contract plans for conditions of erection engineering and methods that apply to casting the arch.

(a) Contractor's Qualifications. The Contractor shall have experience in constructing concrete segmental bridges with form travelers or precast cantilever segmental bridges on at least two US bridge projects, and the contractor's full-time site staff shall include a superintendent and a project engineer with responsible experience in the use of form travelers for cast-in-place bridge construction. In addition, the Contractor shall have in his employ a construction engineer registered in the United States with at least 3 years experience in cantilever erection of cable-stayed bridges.

(b) Specialized Construction Equipment. Design all temporary works, including form traveler and forms that are not detailed on the plans as part of the permanent works. Design formwork as specified in Section 562. The Plans contain additional requirements for formwork. The plans are based on the assumption of wood or wood based plyform forms, and replacement of those forms as necessary in order to meet the dimensional tolerances and finish requirements of the specifications. Wood is assumed necessary to control contact temperature during casting.

Design, detail and fabricate form travelers in accordance with the applicable provisions of the AASHTO Standard Specifications for Highway Bridges, Section 562, and other design standards as may be approved by the CO. Provideform traveler materials in accordance with appropriate ASTM specifications. Design form travelers to support all environmental, dead and live loads, and provide sufficient stiffness to prevent lenses or cracking of the match cast joint during erection.

The structural design is based upon the construction equipment and loading shown on the plans. Redesign of the permanent structure to accommodate construction equipment other than that shown is the responsibility of the Contractor.

Include the following information in the form traveler submittal:

- Design calculations and detailed drawings of the form travelers; showing loading assumptions and stresses in principal members; tie-down, anchoring and advancing designs; component lists with weights; detailed descriptions of methods of assembly, installation, operation, maintenance and removal; and a list of the standards to which the materials will conform. Include a listing of all loads from the traveler applied to the permanent works at each stage of operation.

- Design calculations and detailed drawings for the form system, including mechanisms for stripping and advancing.

- Areas of block out, penetrations or other impacts on the permanent works; and methods for filling and pathching all such areas in order to finish concrete to the final lines shown on the plans.

- Procedures for curing the concrete, including any follow-on scaffolds, blankets, misting equipment, and other devices planned for maintaining the continuous concrete cure required.

- Operation of the traveler for form setting, control of deflection, stripping and launching.

(c) Geometry Control Plan. Submit a geometry control plan to the CO for approval. Include within the plan the adjusting procedure to be utilized should the structure, as erected, deviate from the required alignment by more than one inch at any point. Include detailed drawings and calculations to support the procedures within the plan.

Include detailed camber calculations, tables, and diagrams, indicating the predicted elevation of all segment joints at each stage of construction. The calculations shall consider the exact construction equipment to be used and the schedule to be followed, and shall follow the assumptions stated on the plans. Cambers and deflections shall be such that the structure vertical profile, after 10 years, will correspond to the final design elevations shown on the plans. Include the procedure for measurement of construction camber.

Include a table of elevations and alignments required at each stage of construction, at check points which include segment joints prior to placing concrete for each segment, after placing concrete in each segment, and at such other check points as the Contractor may propose, and the CO accept.

Design details of a locking device proposed for locking opposing arch cantilevers to prevent relative rotation or movement during construction of the closure segments. The locking device shall hold the cantilevers rigidly in correct vertical, transverse and longitudinal alignment.

Include full details of the proposed segment construction cycle with the time scheduled for each separate operation, and an overall schedule for completion of the arch, spandrel columns, caps and superstructure.

Sign and seal all drawings and calculations by a Professional Engineer registered in the United States.

(d) Construction Requirements. Continuously check the elevations and alignment of the structure against predicted values and maintain a record of these checks, and of all adjustments and corrections made. Record the elevation and alignment at the 3 leading segment joints for each stage of erection. Record the elevation and alignment at each segment joint prior to casting each diaphragm (spandrel column support) segment. Furnished a complete record to the CO at the time each check is made. Correct any misalignment at no additional cost to the Owner, and submit to the CO an explanation of the cause of such misalignment and a plan for correcting it. Include calculations of any stresses which will result from misalignment corrections.

Base tolerances during erection on the camber adjusted furnicular curve shown on the plans. Use control points at each segment joint. Due not allow the erection in progress to deviate by more than 1 inch from a smooth curve passing through each segment joint to the arch crown; and do not allow any

segment slope to deviate from theoretical (cambered) slope by more than 0.003. The tolerance on crown final crown grade of the arch is +6"/-0" from theoretical (cambered) grade.

Track diurnal thermal movements of arch ribs at every 3rd segment joint for 3 weeks prior to setting closure forms. Bring the two cantilevered arches of each rib in to line within 3/4 inch of alignment relative to each other (+/- 3/8 inch relative to profile line) prior to locking form supports across closure. Verify this tolerance prior to placing concrete for the closure. Cast and align adjacent ribs within 2 inches in grade relative to each other at the time of closure. Perform all measurements at a time of minimum temperature influence, assumed to be within 1 hour of sunrise.

Measurement

Furnish and erect arch concrete will be measured by cubic yard in accordance with 552.21.

Section 554. - REINFORCING STEEL

Construction Requirements

554.05 Bending. Add the following to the first paragraph:

Do not shear reinforcing bars in bundles.

554.09 Splices.

Add to the third paragraph:

All welded reinforcing shall conform to ASTM A706 specifications. Obtain prior approval from CO for welding rebar not shown as welded on the plans. Use reinforcing bar welding procedures according to AWS D1.4.

Add the following:

Where shown on the plans, use reinforcing bar terminal end anchors that develop a minimum of 125% of the actual yield strength of the reinforcing bar. Provide terminal ends that conform to ASTM A970 as provided by Erico, Headed Reinforcement Corporation, or approved equal.

Mechanical splices, at locations where approved for use or at locations shown on the plans, may be made using approved devices that develop 125% of the actual yield strength of the reinforcing bar, and provide a positive mechanical attachment of the reinforcing bars through swaged or threaded connections. All reinforcing bars that are to be spliced with mechanical couplers shall be marked to evidence full engagement of the coupler after installation.

Approval of mechanical splices will be based on technical data, including test results, and other necessary proof of satisfactory performance submitted by the manufacturer. Acceptance of swaged or threaded couplers on Washington DOT or Caltrans "Approved Products List" will be considered in reviewing submittal for use on this project.

Provide splice components with a clear cover of not less than 1.5 inches measured from the surface of the concrete to the outside face of the splice component.

Provide 24-inch minimum distance between butt splices of adjacent bars as measured along the longitudinal axis of the beam, shaft or column.

Use splicing procedures in accordance with the manufacturer's standard equipment, jigs, clamps, and other required accessories. Procedures used in making the mechanical butt splices shall be as recommended by the manufacturer and approved by the CO.

Clean all rebar, couplers and terminal end anchors of all oil, grease, loose scale or other substances deleterious to adhesion and bond with concrete prior to placing bars in forms.

554.11 Measurement

Add the following: Mechanical bar couplers and bar terminal end anchors will not be measured for payment. These items are incidental to reinforcing steel.

Section 555. - STEEL STRUCTURES

<work in progress on steel specs. 555 will have separate provisions for joints and steel superstructure>

Section 555. – STEEL STRUCTURES As Applied to Steel Superstructure

Construction Requirements

555.03 General. Amend to read as follows:

Fabricate the structural steel in a fabricating plant that is certified under the AISC Quality Certification Program for Major Steel Bridge (MBr) with fracture critical qualifications and proven experience in the construction of this type of bridge. The fabricator selected by the contractor will be subject to the approval of the CO. The Contractor shall provide written evidence documenting the fabricator's qualifications to perform this work. Documentation shall include information regarding the education and level of experience of the fabricator's key personnel at the fabrication plant; the name, location, and capacity of the fabrication plant to be used and available capacity as of the date of this contract; and the recent history of the fabricator (a minimum of the five preceding years) in the quality and timely delivery of major structural steel bridge components for other projects of similar or larger scope. Fabrication shop drawings shall not be initiated until the CO has received the required

documentation and has approved the fabricator in writing. Perform all welding according to AWS D1.5, latest edition.

Furnishing and fabricating steel for members and components of members designated as fracture critical on the project plans shall conform to the requirements of AASHTO *Guide Specifications for Fracture Critical Non-Redundant Steel Bridge Members* and meet or exceed the longitudinal Charpy V-Notch (CVN) impact value requirements specified herein.

Material	Impact Value (ft-lb)
AASHTO A709, Grade 36	25 at 40 deg.F
AASHTO A709, Grade 50, 50W (2" and under)	25 at 40 deg.F
AASHTO A709, Grade 50, 50W (over 2" to 4")	30 at 40 deg.F
HPS 70W	35 at -10 deg.F

Furnishing and fabricating steel members and components of members designated as tension members and components, but not designated as fracture critical, shall meet or exceed the longitudinal Charpy V-Notch (CVN) impact value requirements specified herein.

Material	Impact Value (ft-lb)
AASHTO A709, Grade 36	15 at 40 deg.F
AASHTO A709, Grade 50, 50W (2" and under)*	15 at 40 deg.F
AASHTO A709, Grade 50, 50W (over 2" to 4")*	20 at 40 deg.F
HPS 70W	25 at -10 deg.F

*If the yield strength of the material (as reported in the certified "Mill Test Report") exceeds 65 ksi, the temperature for the CVN value for acceptability shall be reduced by 15 deg. F for each increment of 10 ksi above 65 ksi.

Welding of fracture critcal designated and tension designated members and components of members shall conform to the requirements of AASHTO/AWS D1.5 *Bridge Welding Code.*

Sampling procedures for CVN testing shall conform to the requirements of ASTM A673. The H (Heat) frequency of testing shall be used for all grades of non-fracture critical structural steel. The P (Piece) frequency of testing shall be used for all grades of fracture critical structural steel.

CVN impact values shall be determined in accordance with ASTM E23. All tests shall be performed in the presence of and approved by the CO's authorized representative. Broken test specimens shall be properly identified and shipped to a location to be determined by the CO for storage.

A complete set of non-destructive testing results with interpretive reports shall be included for welding procedure qualification tests where required by ANSI/AASHTO/AWS Bridge Welding Code D1.5, latest edition.

555.06(a) Shop drawings. Add the following:

Colorado River Bridge 60%+ Submittal

Member dimensions shown on the shop drawings shall take into account camber requirements noted on the project plans and steel temperature at the time of fabrication such that the completed bridge will conform to the dimensions shown on the project plans under full dead load at 75 degrees F.

555.06(b) Erection drawings. Amend the next to the last statement as follows:

Calculations showing temporary loads, stresses, and deflections at each stage of erection for temporary and permanent members and supporting technical data for any manufactured items shall be submitted to the CO as part of the erection submittal for review and approval.

555.06(b) Erection drawings. Delete the last sentence and substitute the following:

See Section 562 for additional requirements.

555.06(d) Transportation drawings. Delete the last two sentences and substitute the following:

Furnish transportation drawings and supporting calculations to the CO for review and approval prior to transporting any members or components.

All members and components are to be shipped and stored in a manner that does not impose any deleterious effects on the members or components. Ship members and components upright, unless otherwise approved by the CO. Load, support, and unload members and components in a manner that will not damage, excessively stress, or deform the steel, nor subject it to repeated stress reversals. Damaged members and components, as determined by the CO, will not be accepted. Costs associated with the replacement of the damaged items (or repair, if approved by the CO), will be the sole responsibility of the contractor.

555.08 Fabrication. Table 555-1 is modified to add the following:

Grade	Color
HPS 70W	xxxx

555.17(c) Installation. Add the following:

High-strength bolts shall conform to the requirements of ASTM A 325, Type 1 or 2, and shall be installed in Class ‘B’ friction connections unless otherwise specified or noted on the project plans. Nuts for high-strength bolts shall be heavy hex nuts conforming to the requirements of ASTM A 563, Grade DH or ASTM A 194, Grade 2H unless otherwise specified or noted on the project plans.

All high-strength bolts shall be installed with a flat hardened washer conforming to the requirements of ASTM F436, Type 1 under the turned element. A washer may also be provided under the unturned element as required to accomplish the work. Special washers as may be required due to a lack of parallelism, oversized and slotted holes, or as shown on the project plans, shall be provided as required to accomplish the work in accordance with the requirements specified herein.

All high-strength bolts, nuts, and washers shall be of domestic material and manufacture, and be plain (uncoated) unless otherwise specified or noted on the project plans.

All high-strength bolts shall be installed and inspected using direct tension indicators (DTI's).

555.17(c)(3) Turn-of-nut tightening. Delete.

555.17(c)(4) Calibrated wrench tightening. Delete.

555.17(c)(5) Direct tension indicator tightening. Add the following:

DTI's shall be furnished "plain" and permanently marked for use with ASTM A325 high-strength bolts. Each shipment of DTI's shall be accompanied by the manufacturer's test reports showing the bolt tension achieved using the DTI's and certification in accordance with Subsection 106 of the Standard Specifications. Test Reports shall be furnished for each representative sample of each lot or heat and each size DTI in the shipment. Packaging shall be such that individual lots or heats can be identified at any stage prior to installation.

All bolts in a joint shall be "snugged" to draw the connected members into close contact. Then, all bolts shall be tightened until the average gap of each bolt installation is reduced to 0.005 inches or less. Tightening shall progress systematically from the most rigid part of the joint to its free edges until all DTI's are closed to at least the required gap. Correct tightening will be determined by the inspector by inserting a correct-thickness feeler gauge into the opening between adjacent flattened protrusions. One hundred percent of the bolt installations will be inspected.

The installation will be considered acceptable if the gauge will not enter the opening. While a zero gap is not desirable, it will not necessarily be cause for rejection. The gap may not be uniform around the bolt, in which case, acceptance will be based on the average gap. "Average" is not intended to mean a mathematical average, but rather the gap will be checked at several points around the bolt and if the gauge will not enter the gap on at least half of the tries, the installation will be acceptable.

DTI's shall not be reused.

Prior to proceeding with the installation of high-strength bolts in the fabrication plant or at the site, the Contractor shall arrange a meeting to review the installation and inspection procedures and the criteria for acceptability with the CO. The Contractor shall have a qualified representative from the DTI manufacturer at the meeting(s).

555.17(c)(6) Installation of alternate design bolts. Delete.

555.19 Erection. Add the following:

The contractor shall be responsible for the stability of all elements of the partially erected structure under any and all erection loading for all stages of erection. The steel erector will be subject to the approval of the CO. The contractor shall provide written evidence documenting the erector's qualifications to perform the work, including information regarding education and level of experience of the erector's key personnel assigned to the work. The recent history of the erector's work for at least the five preceding years in the erection of structural steel bridge components for other projects

of similar or larger scope shall be included in the submittal. The documentation for each project shall include the location and a brief description of the project, methods of erection, names of key personnel (including the design engineer), and the name of the contracting authority.

The steel erection plan shall be prepared and sealed by a registered professional engineer and shall provide complete details for all steps of the erection process. The condition of each connection for given stages of erection shall also be shown. Should the contractor's proposed erection plan require the substitution of members or connections having different dimensions or properties of equal or greater value than those shown on the project plans, the substitutions shall be provided by the contractor at no additional cost to the project and be subject to the approval of the CO as specified herein. Members of lesser value will not be permitted.

Bolt assemblies shall be installed in the orientation shown on the project plans. Where no orientation is shown, the installation shall be such that the heads are located on the exposed-to-view/exterior side of the elements of the members being connected.

The contractor shall be solely responsible for job site safety and shall comply with all local, state, and federal requirements for providing a safe work zone. These provisions shall include, but not be limited to, fencing, handrailing, safety lines, netting, and warning and recovery systems as may be appropriate.

Section 555. – STEEL STRUCTURES As Applied for Modular Deck Joint Assemblies

Materials

555.02 Add the following:

Construction Requirements

555.04 Add the following:

Furnish and install modular deck joint expansion devices in conformity with the project plans and the requirements of these specifications.

The modular deck joint expansion devices shall consist of a shop-fabricated modular assembly of transverse elastomeric strip seals and transverse separation beams supported on stainless steel clad support bars spanning the joint gap. The assembly shall be kept stable under all conditions of expansion and contraction by a system of compression springs and upper and lower support beam bearings and springs.

The modular deck joint expansion devices will be constructed of the following components and materials:

Preformed elastomeric: strip seal type (full length, continuous, without splices).

Hot-rolled or extruded steel sections and support bars conforming to the requirements of ASTM A36, A572, or A588.

Stainless steel sheets for the sliding surfaces of support bars shall conform to the requirements of ASTM A240, Type 304.

All other steel shapes and plates conforming to the requirements of ASTM A36.

High-strength bolts conforming to the requirements of ASTM A325, with appropriate nuts and washers.

Cold-finished low carbon low steel welded headed studs conforming to the requirements of ASTM A108 with proper ferules and flux.

Lubricant/Adhesive for installing the preformed elastomeric elements will be a one-part moisture-curing polyurethane and hydrocarbon solvent mixture as recommended by the Joint Manufacturer and containing not less than sixty-five percent solids.

Support bar bearings fabricated from urethane compound with polytetrafluorothylene (PTFE) self-lubricating surfaces with engineering properties equivalent to Adiprene and Teflon, respectively (i.e., high-load bearing and high-impact resistance characteristics, plus low coefficient of friction).

Aluminum components are not be permitted

The elastomer and metal assemblies of the modular deck joint expansion devices are to be anchored to the concrete at the joint. The seal armor is to be cast in the concrete. The completed assembly shall be as shown in plan position; shall satisfactorily resist the intrusion of foreign material and water; and shall provide bump-free passage of traffic.

The Contractor shall install the joint with a secondary concrete pour to dimensions coordinated with the Joint Manufacturer and shown on the approved shop drawings. The surface of the existing concrete shall be coated with an approved adhesive specifically formulated for bonding new concrete to existing concrete prior to the concrete being placed. All reinforcement that is to remain shall be clean, dry and free of oil, rust and paint or any foreign material.

Joints shall be covered or otherwise protected at all times prior to installing the elastomer portion of the assembly. The elastomer shall be installed at such time and in such manner that it will not be damaged by construction operations.

The seal element shall be installed subject to these specifications and to the approval of the CO. Immediately prior to the installation of the seal element, the metal contact surfaces of the joint armor shall be sandblasted clean, dry, and the lubricant/adhesive applied. Any perforation or tearing of the seal element due to installation procedures or construction activities will be cause for rejection of the installed seal element.

The installation of the modular deck joint expansion devices are to be supervised on site by a qualified technical service representative of the joint manufacturer. This representative is to be a full-time employee of the manufacturer of the joint system to be installed on this project. Recommendations made by the joint manufacturer's representative on or off the project site, and approved by the CO, will be adhered to by the Contractor.

555.08 Add the following:

(g) Modular Deck Joint Expansion Devices. The manufacturer of the modular deck joint expansion devices shall have a minimum of five years experience in the design, manufacture, and installation of modular expansion joint systems.

Modular joint assemblies shall be fabricated in a facility owned and operated by the joint manufacturer, and certified through the AISC Quality Certification Programs under the category Simple Steel Bridges (SBr).

Certification conforming to the requirements of Subsection 106 of the Standard Specifications for each size and type of seal on the project, shall be submitted to the CO.

Modular joint assemblies shall be equipped with temperature adjustment devices to allow for adjustment of the joint opening for ambient temperature at installation.

All steel components shall be of domestic material and manufacture.

(1) Control Springs. Control springs shall be equilibrium-type springs that work parallel with the compressive forces of the seal elements and shall maintain equidistant spacing between each transverse steel element across the joint.

(2) Support Bars. Support bars shall have stainless steel sliding surfaces; be supported above, below, and laterally to prevent lifting; transmit bearing loads; and maintain positioning of the transverse rails. Each transverse rail (separation beam) shall rest on a separate support bar at each support assembly.

(3) Support Boxes. Spacing of support boxes shall not exceed four feet on center.

(4) Separation Beams. Separation beams shall be continuous; shall not be less than two inches in top width and five inches in height; shall be capable of supporting the design loads; and shall be attached to support bars with complete penetration welds.

(5) Edge Beam. Edge beams shall be continuous; shall consist of a horizontal and vertical leg; and shall have one-half inch diameter bleed holes at a maximum spacing of twelve inches along the horizontal leg.

(6) Movement Capacity. The movement of individual seal elements shall not exceed three inches.

(7) Welding. Welding materials and welding procedures shall be in compliance with the current ANSI/AASHTO/AWS D1.5 Bridge Welding Code.

At the time of shop drawings submittal, the Contractor shall submit to the CO the following certifications for review and approval:

(a) Certification that welding personnel are qualified in accordance with the requirements of the current ANSI/AASHTO/AWS D1.5 Bridge Welding Code.

(b) Certification that welding inspection personnel are qualified and certified as welding inspectors under AWS QC1, Standard for Qualification and Certification of Welding Inspectors.

(c) Certification that personnel performing nondestructive testing (NDT) are qualified and certified as NDT Level II under the American Society for Nondestructive Testing (ASNT) Recommended Practice SNT-TC-1a.

(8) Galvanizing. All exposed steel surfaces of the modular joint assemblies, except stainless steel sliding surfaces or those in direct contact with strip seals, shall be galvanized after fabrication in accordance with the requirements of ASTM A123 and A153.

Bolts shall be provided with a protective coating of cadmium or zinc, followed by a chromate and baked organic coating conforming to ASTM F1135, Grade 3, 5, 6, 7, or 8 and Color Code A.

Any damage to the corrosion protection system occurring during shipping, handling, or as a result of installation, as determined by the CO, shall be repaired to the satisfaction of the CO. All material and labor shall be paid by the Contractor.

(9) Shop Drawings. Prior to fabrication, the contractor shall submit shop drawings to the CO for review in accordance with the requirements of Subsection 104 of the Standard Specifications. The shop drawings shall show complete details of the deck joint assemblies and the method of installation to be followed, including a temperature correction chart for adjusting the dimensions of the joint according to ambient temperature. The shop drawings shall show any revisions that are required to the details on the project plans in order to accommodate the modular joint assemblies.

The Contractor shall also submit complete design calculations for modular joints to the CO for review in accordance with the requirements of Subsection 104 of the Standard Specifications. The design calculation shall show that the modular joint assemblies and their components satisfy the strength and fatigue requirements stipulated in the National Cooperative Highway Research Program (NCHRP) Report 402, "Fatigue Design of Modular Bridge Expansion Joints", National Academy Press, Washington, D.C., 1997; based on the loadings specified herein.

Design Axle Loads and Impact Factors

The centerbeams, support bars, bearings, connections, and other structural components shall be designed for the simultaneous application of vertical and horizontal loads from a tandem axle. The tandem axle shall consist of a pair of axles spaced 4.0 ft apart with vertical and horizontal loads as specified in this Special Provision. The transverse spacing of the wheels shall be 6.0 ft. The distribution of the wheel load among centerbeams shall be as stipulated in this specification.

The vertical load range for fatigue design shall be a 32.0 kip tandem. This tandem shall be taken as two 16.0 kip axles spaced 4.0 ft apart. Only one of these tandem axles must be considered in the design, unless the joint opening exceeds 4.0 ft. The load range shall be increased by the dynamic load allowance (Impact Factor) of 75%. Load factors shall be applied in accordance with Table 3.4.1-1 of the AASHTO LRFD Bridge Design Specifications - Second Edition.

The vertical load for strength design shall be a 50.0 kip tandem. This tandem shall be taken as two 25.0 kip axles spaced 4.0 ft apart. Only one of these tandem axles must be considered in the design, unless the joint opening exceeds 4.0 ft. This load shall be increased by the dynamic load allowance (Impact Factor) of 75%. Load factors shall be applied in accordance with Table 3.4.1-1 of the AASHTO LRFD Bridge Design Specifications - Second Edition.

The horizontal load range for strength design and fatigue design shall be 20% of the amplified vertical load range (LL+IM) specified in this Special Provision. For modular expansion joint systems installed on vertical grades in excess of 5%, the horizontal component of the amplified vertical load range (LL+IM) shall be added to this horizontal load range.

Distribution of Wheel Loads

The following table specifies the centerbeam distribution factor as a function of centerbeam top flange width. This factor is the percentage of the design vertical axle load and the design horizontal axle load which shall be applied to an individual centerbeam for the design of that centerbeam and its associated support bars. Distribution factors shall be interpolated for centerbeam top flange widths between those explicitly denoted in the table. In no case shall the distribution factor be taken as less than 50%. The remainder of the load shall be divided equally and applied to the two adjacent centerbeams or edge beams.

Width of Centerbeam Top Flange	Distribution Factor
2.5 inch	50%
3.0 inch	60%
4.0 inch	70%
4.75 inch	80%

Fatigue Limit State Design Requirements

Modular expansion joint system structural members, bolted and welded splices and connections, and attachments shall be designed to resist the Fatigue Limit State load combination specified in Table 3.4.1-1 of the AASHTO LRFD Bridge Design Specifications - Second Edition. The vertical and horizontal load ranges shall be applied simultaneously and shall be distributed as specified in this Special Provision.

The nominal stress ranges, □f, at all fatigue critical details shall be obtained from a structural analysis of the expansion joint system applying the design vertical and horizontal load ranges, distributed as specified in this Special Provision. The expansion joint system shall be analyzed with a minimum gap opening corresponding to the midrange configuration (at least half of the maximum gap opening). The design axle load shall be applied as two wheel loads, each having a transverse width of 20 inches. For each detail under consideration, the wheel loads shall be positioned transversely on a centerbeam to achieve the maximum nominal stress range at that detail. The vertical and horizontal wheel loads shall be applied as line loads to the top of the centerbeams at their centerlines. The design stress range in the centerbeam-to-support-bar connection shall be calculated in accordance with the procedures presented in NCHRP Report 402.

To assure an infinite fatigue life, all modular expansion joint system structural members, connections (bolted and welded), splices, and attachments shall satisfy the following:

$$\Delta f \le \frac{F_{TH}}{2}$$

where:

Δf = the nominal stress range obtained from a structural analysis of the joint system applying the design vertical and horizontal loads in accordance with this Special Provision and the procedures presented in NCHRP 402.

F_{TH} = constant amplitude fatigue limit (CAFL) or fatigue threshold as specified below.

The fatigue resistance of all details shall be characterized in terms of the fatigue categories specified in Table 6.6.1.2.5-1 of the AASHTO LRFD Bridge Design Specifications – Second Edition. Many details composing modular expansion joint

systems may clearly correspond to specific structural details depicted in Figure 6.6.1.2.3-1 of the AASHTO LRFD Bridge Design Specifications – Second Edition. In these cases, the applicable fatigue categories specified in Table 6.6.1.2.3-1 may be used for design. In cases where the CO establishes that a detail does not clearly correspond to a structural detail depicted in Figure 6.6.1.2.3-1, fatigue testing of specimens exhibiting that detail shall be conducted, in accordance with this Special Provision, to establish the appropriate constant amplitude fatigue limit (CAFL) for that detail.

Strength I Limit State Design Requirements

Modular expansion joint system structural steel members, connections (bolted and welded), splices and attachments shall be designed to resist the Strength I Limit State load combination specified in Table 3.4.1-1 of the AASHTO LRFD Bridge Design Specifications – Second Edition. The vertical and horizontal loads shall be applied simultaneously and shall be distributed as specified in this Special Provision.

Fatigue Testing

When constant amplitude fatigue testing is required, it shall be performed in accordance with the procedures and guidelines specified in NCHRP 402, and the results shall be submitted to the CO for review.

Fatigue testing shall be performed by an independent testing laboratory. The following individuals have stated that they have access to facilities capable of performing the fatigue testing:

Prof. Charles W. Roeder
Department of Civil Engineering
233B More Hall
University of Washington
Seattle, WA
Tel: (206) 543-6199
Fax: (206) 543-1543

Dr. John W. Fisher <Get new name>
ATLSS Research Center
Lehigh University
117 ATLSS Drive
Bethlehem, PA 18015-4793
Tel: (215) 758-3535
Fax: (215) 758-5553

Prof. Robert J. Dexter
Department of Civil Engineering
University of Minnesota

122 CivE
500 Pillsbury Drive S.E.
Minneapolis, MN 55455-0220
Tel: (612) 624-0063
Fax: (612) 626-7750

In determining the quality or suitability of a modular joint assembly submitted for approval for each application, the factors to be considered will include, but will not be limited to, the ability of the assembly to resist the intrusion of foreign material and water throughout the full range of movement; the capability of installing or removing elastomeric portions of the assembly at any amount of closure; and the ability to function without distress to any component.

Replacement of parts subject to wear shall be allowed for in the design. The Contractor shall submit for the CO's approval, a written maintenance and part replacement plan prepared by the Joint Manufacturer. This plan shall include a list of parts and instructions for maintenance inspection, acceptable wear tolerances, methods for determining wear, procedures for replacing worn parts, and procedures for replacing seals.

(10) Certification. The Contractor shall submit certification that the materials furnished conform to the requirements of the project plans and these specifications; that the manufacturer of the modular joint assemblies satisfies the experience and quality certification requirements specified herein; that the modular joint assembly installation has been supervised by a qualified technical service representative of the manufacturer; and that the modular joint assembly installation has been accomplished in accordance with the manufacturer's recommendations. Certification shall conform to the requirements of Subsection 106 of the Standard Specifications.

(11) Shop Inspection. In order that shop inspection may be provided for modular joint assembly fabrication, written notice shall be given to the CO at least one month prior to beginning work in the shop and the CO shall be verbally notified at least 24 hours prior to the need for inspection in the shop.

The Contractor shall furnish all facilities for the inspection of material and workmanship in the shop in accordance with the requirements of Subsection 106 of the Standard Specifications.

Inspection at the shop is intended as a means of facilitating the work and avoiding errors, and it is expressly understood that it will not relieve the contractor from any responsibility in regard to defective material or workmanship and the necessity of replacing defective material or doing the work again. Re-inspection costs incurred by the CO due to contractor errors shall be reimbursed by the Contractor.

(12) Warranty. **<warranty provisions under review>** The Contractor shall provide a ten-year warranty guaranteeing the performance and durability of the expansion joint system. Conditions constituting unsatisfactory performance and durability as determined by the CO, shall include, but not be limited to, broken welds or bolts (including field splices), cracks in

steel members, fatigue damage, loss of precompression in springs or bearings, debonded PTFE, breakdown of corrosion protection, and leakage. The Contractor shall replace or repair any expansion joint system component demonstrating unsatisfactory performance or durability within the ten-year period commencing from the date of completion of the contract. All material and labor costs shall be paid by the Contractor.

555.21 Amend the first paragraph as follows:

Measure structural steel by the pound computed according to the AASHTO LRFD. Include all metal items incidental to the structure and required by the contract such as castings, steel plates, anchor bolts and nuts, bearings, rockers, rollers, pins, and nuts, expansion dams, roadway drains and scuppers, weld metal, bolts and structural shapes, except as herein noted.

555.21 Add the following:

Measure modular deck joint assemblies by the linear foot. Measurement will be from made along the centerline of the joint and at the surface of roadway or sidewalk from face-of-curb or barrier to face-of-barrier and to the nearest linear foot. No measurement will be made for that portion of the deck joint assembly required by plan details to extend into the curb or barrier.

555.22 Add the following:

Pay Item	Pay Unit
55502 Expansion Joints (12” Modular) at Abutments	Linear Foot

Section 562. - FORMS AND FALSEWORK

Delete the text of the Section and substitute the following:

Section 562. - TEMPORARY WORKS

Description

562.01 This work consists of the design, construction, inspection, and removal of temporary works for the construction and repair of permanent structures. Temporary works includes all temporary facilities used in construction that do not become part of the permanent structure. Such temporary works include, but are not limited to, falsework, formwork, form travelers, temporary towers, foundations for temporary works, temporary stay cables and attachments, cofferdams, and excavation supports.

Material

562.02 Select material consistent with the safety and quality required by the design assumptions. All steel and concrete materials shall satisfy applicable ASTM requirements, and shall be in new or like new condition. Furnish manufactured devices complying with the *Certification Program for Bridge Temporary Works* (FHWA-RD-93-033).

Design Requirements

562.03 Design. Design and construct safe and adequate temporary works that will support all loads imposed and provide the necessary rigidity to produce in the final structure, the lines and grades shown on the plans. Temporary works shall be designed according to the *AASHTO Guide Design Specification for Bridge Temporary Works* or the AASHTO LRFD Code, Second Edition with 2001 Interims. Stay cables shall be designed in accordance with the PTI Recommendations for Stay Cable Design (3rd or 4th Edition) for the construction condition. If criteria for temporary works design are shown on the Plans, said criteria will take precedence over the *AASHTO Guide Design Specification for Bridge Temporary Works*. When a manufactured device is to be employed, ensure that the design load on the device is within the load rating recommended by the manufacturer. Design falsework and forms supporting deck slabs and overhangs on girder bridges so that there will be no differential settlement between the girders and the deck forms during placement of deck concrete.

Design forms and provide insulation and/or shading as is necessary to assure that the form surface temperature that comes in to contact with as-cast concrete does not exceed 10 degrees F above ambient temperature, or 95 degrees F, whichever is less.

Fit the form traveler with a segmental removable top form, which shall be used for casting the arch rib from the skewback footing past the piers 7/11, or further as is necessary to assure that the top slab of the arch does not sag or run after finishing in accordance with the plans and specifications.

Do not use styrofoam as a form for any surface of concrete that is either exposed to view after finishing, scheduled for staining or painting, or serves as a construction joint for later pours.

562.04 Drawings. Prepare and submit drawings according to Subsection 104.03. Furnish design calculations and supporting data in sufficient detail to permit a structural review of the proposed design. Show all information necessary to allow the design of all components to be checked independently. When manufactured devices are used as a part of the temporary works, provide catalog or equivalent data indicating the manufacturer's recommended safe load capacities of the devices.

When concrete placement is involved, indicate on the drawings the proposed sequence, rate of placement, direction of placement, and location of all construction joints. Show anticipated total settlements and/or deflections of the falsework and forms on the drawings. Include falsework footing settlements, joint take-up, and deflection of beams or girders.

For steel girder erection, submit the erection procedure and temporary support system. Include calculations in sufficient detail to substantiate that the girder geometry is correct. Design supporting falsework to accommodate the erection procedure without over stressing the structural steel and to

produce the required final structural geometry, intended continuity, and structural action. See Subsection 555.06 for additional requirements.

Do not start construction of any temporary work for which drawings are required until the drawings have been accepted by the CO.

Construction Requirements

562.05 Foundations. Determine the allowable bearing capacity of the foundation material on which the supports for temporary works will rest. Perform load tests to verify proposed bearing capacity values that are in doubt, marginal or in other high risk situations.

Foundation support values shown in the contract for the permanent structure may be used in the design of falsework foundations provided foundations are at the same elevation and on the same soil as those of the permanent structure. If temporary works are to be supported on temporary fill, construct the fill according to Section 204 and verify the bearing capacity of the placed material.

Provide adequate site drainage and soil protection to ensure the integrity of the foundation material for the temporary works supports.

If piles are used, capacities may be estimated and later confirmed during construction using standard procedures based on the driving characteristics of the pile. In the absence of more sophisticated methods of determining pile capacity, use the dynamic formula according to Section 551 to determine ultimate pile capacity. The contractor may elect to use load tests to confirm the estimated capacities. Perform load tests to verify bearing capacity values that are in doubt, marginal or in other high risk situations.

Submit all foundation design calculations and other relevant foundation design data to the CO for acceptance.

562.06 Construction. Construct temporary works according to the accepted drawings. Use material and workmanship consistent with that assumed in the design of the temporary works.

Do not weld falsework members to any portion of the permanent structure.

Provide tell-tales with surveyed measurements, or other acceptable means, for accurate measurement of falsework settlement. Do not use the ground surface near falsework supports as a reference elevation. During concrete placement, record settlement to the nearest 0.10 inches. Compressive settlement and/or deflection of falsework system shall not exceed 1/2 inch. For cast-in-place concrete structures, the calculated deflection of falsework flexural members shall not exceed 1/360 of their span regardless of whether or not the deflection is compensated by camber strips. For form traveler pours, deflections shall be computed based on the structural system including form traveler, and administratively controlled through form traveler operations so as not to exceed computed values, and so as to preclude any settlement or separation of plastic concrete.

562.07 Maintenance and Inspection. Inspect and maintain temporary works in an acceptable condition throughout the period of use. Clearly mark the capacity of each manufactured device according to the *Certification Program for Bridge Temporary Works*.

In the presence of the CO, perform an in-depth inspection of the temporary works not more than 24 hours before beginning each concrete placement or before allowing people to enter a cofferdam or excavation support structure. Inspect other temporary works at least once a month to ensure they are functioning properly. Inspect shoring and load test support systems before loading.

Make inspections and certifications according to the *Certification Program for Bridge Temporary Works*. Furnish written results of the inspections to the CO before placing concrete, allowing people to enter a cofferdam or excavation support structure, or loading temporary works. Include a certification that the system meets the requirements of the contract and the drawings.

562.08 Removal. Remove temporary works in such a manner as to permit the structure to uniformly and gradually take the stresses due to its own mass. Removal of stay cables or other temporary works supporting arch construction shall be in accordance with an engineered release sequence developed by the Contractor and approved by the CO. Intermediate stresses and load demands shall satisfy the Strength I and Service III requirements of the AASHTO LRFD Code.

Patch all form holes, hanger holes, exposed shear keys and other temporary attachments with a permanent concrete or approved epoxy mortar patch so as to conform to the lines called for on the plans for the finished work. This patching requirement includes patching shear keys shown for the temporary stay anchors, and all hanger holes and thrust pockets for the form traveler. Vertical holes shall be tapered so the finish plug tightens under gravity. Include an epoxy bonding agent with all patches, and seal the patch against the ingress of moisture. Epoxy inject any patches that show cracking width greater than .002 inches.

Unless otherwise permitted, remove all temporary works upon completion of the work. Do not disturb or damage the finished work. Restore the area to its original or planned condition. Clean up all debris. The removed temporary works remain the property of the contractor.

562.09 Acceptance. Temporary works will be evaluated under Subsections 106.02, 106.03, and 106.04.

Measurement

562.10 Temporary Works for Arch Erection will be measured as a complete unit for all structures and equipment provided by the contractor specifically for arch erection, and removed by the contractor at the completion of the work. Components of and connections to permanent works shown on the plans that are not removed at completion of the work will considered incidental to construction. These incidental items include, but are not limited to, tie-back anchor blocks over footings, cable connection blisters within the arch, cable towers, stay cables, and backstay anchor deadmen blocks. Incidental items will not be measured for payment as either temporary or permanent works. All materials, equipment and labor for other temporary works shall be considered incidental to the work, and will not be measured for payment.

Payment

All temporary works other than those specifically for arch erection shall not be paid for separately, and shall be considered incidental to construction.

	Pay Item	Pay Unit
56201	Temporary Works for Arch Erection	Lump Sum

Lump Sum not to exceed 5% of the original contract amount.

Section 563. - PAINTING

Description

563.01 Add the following:

This work also consists of applying a penetrating desert varnish stain, hereinafter referred to as Weathering Agent, to selected freshly exposed rock cut surfaces, or other surfaces as directed by the CO. <use of stain for river bridge ex is under evaluation>

This work consists of surface preparation, test panels, and painting the exposed concrete components of the Hoover Dam Colorado River Bridge. The surfaces to be painted are defined in 563.10. Test panels will be used for color selection.

This work also consists of surface preparation and painting exposed steel components of the Hoover Dam Colorado River Bridge. The surfaces to be painted are defined in 563.07. Paint the exposed steel surfaces with the same paint color to be determined by test panels.

Materials

563.02 Add the following:

Weathering Agent	725.24A

563.03 Protection of Public, Property, and Workers. Delete (a) and substitute the following:

(a) Manufacturer's material safety data sheets and product data sheets listing the application or use requirements, the paint or stain constituents, and their proportions for all cleaning, painting and staining products.

Add the following:

(h) Methods of protecting vehicular traffic.

563.06 Paint Application, General Add the following:

(a) Stain Application, General: Clean all surfaces to be stained prior to the stain being applied, in accordance with the manufacturer's written recommendations for the removal of all dirt, dust, trash or other foreign substances which could be detrimental to the stain penetration or color. Clean, completely dry, and free all surfaces to be stained of frost or other foreign substances at the time of the application of the stain.

Inspect the surfaces to be stained after all surfaces have been prepared for staining and prior to application by the contractor and a representative from the manufacturer and, if in agreement, notify

the CO in writing that the surfaces are satisfactory for the stains to be applied. Do not commence application of stains without specific direction from the CO.

Apply the stain in accordance with the manufacturer's specifications. The method of application along with the rate of application, and the surface temperature range of application shall be in accordance with the manufacturer's written recommendations.

Apply stains using a state licensed painting contractor or manufacturer's representative applicator, who has a minimum of one year of experience in the application of desert varnish stains, as approved by the CO.

(b) Stain Application, Desert Application: Application of the Weathering Agent will occur after completion of the excavation and embankment slopes, welded wire retaining walls, as well as the installation of all riprap. Following completion of the slopes, welded wire retaining walls, and riprap, the CO, including other agency representatives, will review the appearance of the exposed surfaces and determine where Weathering Agent will be applied. Apply Weathering Agent to the full height of finished cut slopes and embankments from the finished subgrade after most of the other project elements have been completed.

Prepare sample tests of the selected stains and mix proportions for each application for approval as directed by the CO. Different rock types and locations will require different staining formulas in order to blend with the tone of the existing terrain and the overall visual goals. The desired tone in a given rock type may differ from place to place depending on the tones of the surrounding terrain. Adapt the staining techniques to the different major rock types within the project limits. Do not acquire the Weathering Agent until written notification of the final color selection has been received from the CO.

Prepare a minimum of three test sections, each on a 10 ft by 10 ft, before spraying the project slopes, walls or riprap. Leave the test sections in place for the duration of the project. Use different dilutions and application methods on the test sections, to determine mix and method to be used, to best match the surrounding terrain where the weathering agent is being applied. Mark each section and record mixture and application used for each section. Within 48 hours, the CO will determine the application rates and mixtures to be applied to the project slopes.

After the preliminary test panels sample has been approved by the CO, furnish one set of full-scale test panels covering between 100 square feet and 250 square feet on exposed surfaces, measuring at least 10 feet in any dimension or as directed by the CO. Use the same application rates, methods, and dilutions as were approved for the preliminary panels for the full-scale test panels. Prepare the test panels as specified herein and locate them at the project site for two weeks of observation. Provide one full-scale test panel for each of the rock types noted above for Weathering Agent test panels.

If, in the opinion of the CO, the results of any test panel are not satisfactory, the CO may require that additional test panels be performed in these or other rock types. Do not begin full-scale staining until final approval of the products and test panels in that rock type is received from the CO. Shade and tone adjustments are made in accordance with aesthetic considerations, and final approval may require such adjustments.

Apply Weathering Agent to selected freshly exposed rock cut or embankment surfaces, selected riprap, welded wire retaining walls**,** existing rock cuts where new cuts extend into them and certain other newly exposed rock areas designated by the CO.

563.07 Structural Iron and Steel. Add the following:

For the Colorado River Bridge, paint all exposed steel surfaces. Paint interior of all box and cap sections with 2 coats of white primer. <spec under development>

The prime coat shall result in a Class B coating on the faying surfaces of all high-strength bolted connections with a mean slip coefficient of not less than 0.50. The mean slip coefficient shall be established in accordance with "Test Method to Determine Slip Coefficient for Coatings Used in Bolted Joints" as adopted by the Research Council on Structural Connections. The testing shall have been performed by an independent testing laboratory under the direction of a registered professional engineer licensed in the State of Nevada .

563.10 Painting Concrete Structures. Delete the first sentence of the third paragraph and substitute with the following:

Apply two coats of paint to all concrete structures, each coat being 1-2 mils dry. Vary the tint of the initial coat slightly to contrast from the approved, finish color. Do not apply the succeeding finish coat until the previous coat has dried at least 24 hours, or longer if required by the paint manufacturer.

Add the following:

For the bridge structures, apply acrylic emulsion paint conforming to the requirements of Subsection 708.03 to the exposed concrete surfaces listed below. Do not apply paint to the top surface of the bridge deck or approach slab.

For the bridge structures, paint the following exposed concrete surfaces:

1) The top, inside and outside surfaces of the traffic railing barrier and the median barriers on the bridge structure, approach slabs, and adjacent retaining walls.
2) The outside edge of the bridge deck slab, the bottom surface of the bridge deck slab on the overhangs, and the entire bottom surface of the deck slab if forming other than steel stay-in-place forms are used at the Hoover Dam Colorado River Bridge.
3) All exterior surfaces, except the top surface of the deck.
4) All exposed surfaces of bridge abutments, wingwalls, retaining walls adjacent to abutments, and piers, to at least one foot below finished grade

For bridge structures, build five square 2-foot by 4-foot concrete test panels at the project site to obtain one concrete paint color acceptable to the CO. Use concrete with the same mix design as Structural Concrete, Class P(C), f'c=6000 psi. Complete a Class 1 finish according to 552.16(a). Allow a minimum of 30 days between concrete cure and painting the test panels. Prepare the surfaces in accordance with 563.10 and apply the paint in accordance with the manufacturer's written recommendations. The intent is to produce test panels in a range of shades from concrete-colored gray to white. Protect the approved color sample panel on-site at all times during the work until all painting operations are complete. Paint all designated surfaces in accordance with the manufacturer's written recommendations and to match the color of the approved sample.

The acrylic emulsion paint applied to the concrete test specimens or to the final concrete surface will be subjected to one or both of the methods of adhesion testing described below, after a minimum period of 7 days of sunlight after application.

Adhesion will be measured in accordance with the requirements of ASTM D 3359. When Test Method A is used, a rating of 3A will be required. When Test Method B is used, a rating of 2B will be required.

Random inspection testing of the completed paint finish will be performed by the CO according to the above performance requirements. Non-compliance with these test results will require remedial action which may include substitution of the paint supplied, modification to the application plan, removal and repainting of the non-compliance section(s), or other action as deemed appropriate by the CO.

Measurement

563.12 Add the following:

Measure Weathering Agent by the square foot of surface to be stained, which will be based on the neat line slope length and distances of the rock cut as shown in the project plans. No additional measurement or payment will be made for test panels, staining edges, ledges, crevices, or surface relief in the rock face, the cost of which shall be included in the square foot measurement for the item.

No separate measurement will be made for providing test panels, the cost of which is included in the square foot measurement for these items.

Payment

563.13 Add the following:

Pay Item		Pay Unit
56301CB	Painting, Concrete Structures, Bridges	Lump Sum
56301AB	Painting, Steel Structures, Bridges	Lump Sum
56304A	Weathering Agent, Desert Application	Square foot

Section 564. - BEARING DEVICES

Description

564.01 Amend to read as follows:

This work consists of furnishing and installing high-load multi-rotational disc type bearings including, but not limited to, grout pads, ancillary plates, anchor bolts, headed welded studs, etc., as required for a complete installation in accordance with the project plans and these specifications. The bearings shall consist of a hard polyether disc between upper and lower steel plates with an internal shear restriction mechanism to resist horizontal load. The bearings are to be supplied as free, guided, or pinned as shown on the project plans. Free bearings shall allow rotation, longitudinal, and transverse movement. Guided bearings shall allow rotation and longitudinal movement only . Pinned bearings shall only allow for rotation.

The manufacturer shall demonstrate a minimum of 5 years experience in the design, manufacture, and installation of high-load multi-rotational disc bearings of load capacity and movement rating similar to those required on the project plans; and be certified under the AISC Quality Certification Program for Simple Steel Bridges (SBr). The Contractor shall submit with the bid a list of at least 5 projects on which they successfully installed disc bearings, and include, for each one, the contract value, a brief description of the work, and the name, address and current telephone number of the Owner.

Bearings shall be prefabricated at facilities owned and operated by the manufacturer; the manufacturer being the single entity that designs, fabricates, and installs (or supervises the installation of) the bearings.

Bearings must be warranted by the manufacturer to have a functional life of 10 years. <warranty provisions under review>

Materials

564.02 Add the following:

Grout for setting bearings	725.22(g)
Preformed Fabric Pads	725.29

Construction Requirements

564.03(a) Drawings. Add the following:

The Contractor shall submit the following to the CO for review and approval:

Mill test certificates, showing conformance of all materials to the standards referenced herein.

Calculations, showing conformance of the bearings to the specified design requirements.

Shop drawings for all components and assemblies, including general arrangements and large scale details. The drawings shall include tables showing load capacity and movement rating for each bearing; and complete installation instructions, including the initial offset required at various temperatures.

Inspection and test reports and certificates, showing conformance of the bearings to the project plan and specification requirements.

Certification from the manufacturer that each bearing conforms to the project plan and specification requirements.

Welding procedures and welder qualifications.

Review and approval of the calculations and drawings by the CO, or acceptance of the test certificates, will not relieve the Contractor of sole responsibility for their accuracy and completeness; and for the performance of the bearings.

564.03(b) Fabrication. Add the following:

(1) Shop Inspection. The CO reserves the right to visit the manufacturer's fabrication shop for the purpose of inspecting the manufacturing, assembly, and testing of the bearings in accordance with Subsection 104 of the Standard Specifications. The Contractor shall give the CO at least 15 days notice of all visits to the fabrication shop by the agency that will perform the inspection required by these specifications.

564.03(c) Packaging, handling, and storage. Amend to read as follows:

(1) Identification. Each bearing shall be stamped with the manufacturer's name, the bearing type or model number, the bearing number and lot number, and the installed location. The stamp shall be on a surface visible after installation.

Each bearing shall be stamped with graduated scales, both above and below the sliding surface, on surfaces visible after installation. These shall show the design movements: minimum, maximum, and initial offset.

(2) Storage. All bearings, whether in the fabrication shop, in a warehouse, or at the worksite, shall be stored in a clean, dry, covered facility. When in storage, the bearings will be kept banded, wrapped, and secured in a condition suitable for shipment or handling. At the worksite, all bearings shall be placed on dunnage, under cover, and protected from damage and deterioration until incorporated in the work and accepted by the CO.

(3) Handling. Bearings shall be lifted with soft slings, not wire rope or chain.

(4) Initial Offset of Bearings. Prior to shipment, bearings shall be initially offset as shown on the plans. They shall be restrained in the set position until after placement of superstructure concrete. An adjustment for the difference of the concrete temperature from the mean temperature assumed for design shall be made as shown on the project plans. The concrete temperature will be determined by the CO.

564.03(d) Construction and installation. Add the following:

The Contractor shall arrange for the manufacturer to have a qualified representative present at the worksite to supervise installation of the first bearing of each type, and to train the Contractor and the CO in installation procedures. At the option of the CO, the representative may be required to be present for the placement of any number of additional bearings.

The Contractor shall ensure that all components are received at the worksite in good time for incorporation in the work, in accordance with the approved construction schedule.

Materials shall conform to the following standards:

Steel Plate. ASTM A36, A588 or A572.

Stainless Steel. ASTM A167 or A240, Type 304.

Headed Welded Studs. ASTM A108.

Anchor Bolts and Connecting Bolts. ASTM A325 or A449.

Polytetrafluoroethlyene (PTFE). PTFE shall be manufactured from pure virgin unfilled TFE resin conforming to ASTM D1457. PTFE shall be resistant to acids, alkalis and petroleum products; non-absorbing of water; stable up to 500^{O}F; and non-flammable. It shall meet the following test requirements:

Physical Property	ASTM Test Method	Requirement (min.)
Ultimate tensile strength	D638	2800 psi
Ultimate elongation	D638	200%
Specific gravity	D292	2.12

Elastomer Adhesive. Adhesive shall be a two-component, solvent-free epoxy resin of the type recommended by the elastomer manufacturer.

Elastomer. Elastomer shall be 100% virgin polyether urethane. It shall meet the following test requirements:

Physical Property	ASTM Test Method	Requirement

Hardness, shore A durometer	D2240	62±2
Tensile strength, min.	D412	5000 psi
Ultimate elongation, min.	D412	220%
Tensile stress	D412	
@ 100% elongation		2000 psi
@ 200% elongation		3700 psi
Tear strength, min.	D470	110 lb./in.
Comp. set after 22 hrs.	D395 (mth. B)	
Temperature		158°F
Compression set, max.		40%
Low temp. brittleness(-40°F)	D746 (mth. B)	no failure

Zinc-Metalizing. Steel components, other than of stainless steel, shall be zinc-metalized in accordance with AWS C.2.18-93 to a coating thickness of 6 mils. The surfaces to be metalized shall be shown on the shop drawings. Galvanizing will not be permitted.

Painting. The exposed surfaces of all zinc-metalized bearing components, except anchor bolts, shall be painted with one shop-applied prime coat and two field-applied finish coats conforming to the requirements of Subsection 563 of the Standard Specifications for Paint System 1. Before primer application, surfaces shall be cleaned free of all foreign matter by light wire brushing, scraping or sandpapering. Care shall be taken not to damage the zinc-metalizing. The coats shall be sufficiently different in color to permit detection of incomplete application. The dry film thickness of each coat shall be measured with a calibrated magnetic film thickness gauge, in accordance with the Steel Structures Painting Council Specification SSPC-PA2. Shop primer application shall be performed in a dust-free atmosphere. No prime or finish coat shall be applied when the ambient temperature is below 55°F or above 95°F, or when the relative humidity exceeds 95%.

Non-Shrink Grout. Grout shall be cementitious, conforming to Subsection 725 of the Standard Specifications.

Bearings shall be installed in strict accordance with the manufacturer's instructions, this specification, and the advice of the manufacturer's representative. In the event of any conflict, the advice of the manufacturer's representative shall prevail.

Anchor bolt assemblies shall be aligned with templates and held rigidly in place during placement of concrete. The bolts shall be plumb to within 1/16 inch of vertical.

Masonry plates shall be set to accurate elevation with the leveling bolts shown on the plans. The plates shall be level to within 1/16 inch of horizontal.

Non-shrink grout shall be mixed, placed, and cured in accordance with the manufacturer's recommendations. Grout pads shall completely fill the voids beneath the masonry plates.

Bearings shall be set to the indicated plan position to within 1/2 inch and to the indicated level to within 1/4 inch. They shall be set to the indicated azimuth to within 0°01'30".

Anchor bolts shall be tensioned as indicated on the plans.

Bearings shall be restrained in the set position until after placement of superstructure concrete.

After installation, bare and damaged painted surfaces shall be touched-up with one prime coat and two finish coats of the specified paints, brush-applied.

Measures shall be taken to limit the rotation of the bearing to 0.02 radians or the maximum design rotation, whichever is less, during construction.

564.03 General. Add the following:

(e) Design. Bearings shall be designed for the loads and movements given on the project plans and as herein noted. Designs shall be made considering the simultaneous application of load, movement, and rotation effects. Designs shall be made according to the design methods and specifications noted on the project plans. All elements of the bearings, between sole and masonry plates shall be designed to be replaceable. The plans show conceptual details only; the manufacturer may modify these details, subject to review and approval by the CO.

Design of bearings shall meet the following additional requirements:

(1) Top Plate and Upper and Lower Bearing Plates. The top plate and upper and lower bearing plates shall be designed to distribute the bearing loads in accordance with the allowable bearing pressures. Designs shall consider that the vertical loads are applied at an eccentricity of 5% of the disc diameter in combination with the lateral loads given on the plans. The thickness of the plates shall be at least 1/22 of the disc diameter, but not less than 3/4 inch.

Each plate shall be machined from a single piece of steel.

A minimum 1/8 inch clearance shall be maintained between the upper and lower bearing plates when the bearing is in a rotated position.

(2) Limiting Means. The limiting means shall be designed to prevent excessive creep of the elastomeric disc. It shall not interfere with the rotation of the bearing and shall withstand the internal pressures caused by the elastomer.

The depth of the limiting means shall be at least 0.014 * disc thickness.

(3) Shear Restriction Mechanism. The shear restriction mechanism shall carry the lateral loads, and tolerate twice the design rotation.

(4) Sole and Masonry Plates. The sole and masonry plates shall be designed to distribute the bearing loads into the superstructure and substructure in accordance with the allowable bearing pressures stated on the plans. Designs shall consider that the vertical loads are applied at an eccentricity of 5% of the pad or disc diameter in combination with the lateral loads given on the project plans. The thickness of the sole and masonry plates shall be at least 1/22 of the pad or disc diameter, but not less than 3/4 inch.

(5) Finish of Steel Components. All steel surfaces in contact with elastomer, PTFE, or other steel surfaces, shall be finished to a smoothness of 125 micro-inch (rms) or less.

(6) Stainless Steel Sheet. Stainless steel sheets shall be of 16 gage minimum thickness. Stainless steel sheets shall be attached to their backing plates by continuous fillet welding along their edges. Bonding and/or mechanical fastening of sheets will not be permitted. The attachment of sheets to their backing plates shall be capable of resisting the frictional force set up in the bearing, in the serviceability limit state. Welding shall be in accordance with AWS D1.1. The backing plates shall extend beyond the edge of the stainless steel sheets to accommodate the welds and the welds shall not protrude above the stainless steel sheets. It is essential that stainless steels sheet remain in contact with base metal throughout their service life such that interface corrosion cannot occur.

The stainless steel sheets shall completely cover the PTFE sheets in all operating positions, plus one additional inch in the direction of movement. The surfaces in contact with the PTFE shall be finished to a smoothness of 5 micro-inch (rms) or less.

(7) PTFE Sheets. PTFE sheets shall be of 1/8 inch minimum thickness. The sheets shall be recessed and bonded to substrate plates. The shoulders of the recesses shall be sharp and square. The sheets shall be recessed into the substrate plates for at least half of their thickness. After completion of the bonding operations the PTFE surfaces shall be smooth and free from blisters and bubbles.

Allowable bearing pressures for PTFE sheets shall be as follows:

Design Load Effect	Allowable Bearing Pressure
Permanent loads	3000 psi
Other design loads	3500 psi
Edge stresses	5000 psi

The coefficients of friction, static and dynamic, for stainless steel sliding on PTFE sheets shall be less than the following:

Bearing Stress	Coefficient of Friction
750 psi	0.08
1500 psi	0.06
3000 psi	0.04

3500 psi and over	0.035

Note: Linear interpolation may be used for intermediate values

(8) Elastomeric Pads For Disc Bearings. The disc shall be individually molded and monolithic in section. No layering of elastomer will be allowed. The edge groove shall be molded into the disc during its original fabrication. No cutting or grinding of the groove will be allowed.

The thickness of the disc shall be at least 1/14 of the disc diameter.

The area of the disc shall be designed to limit the bearing pressure on the pad to 5000 psi under the design loads.

(9) Guide Bars. Each guide bar shall be fabricated from a single piece of steel; either bolted or welded to the top plate.

The guiding surfaces shall be faced with opposing strips of stainless steel and PTFE. No metal to metal contact will be permitted. The PTFE shall be chemically bonded and mechanically fastened. The total gap throughout the guiding mechanism shall be 1/16 inch or less.

The guiding mechanism shall be designed to transfer the lateral loads shown on the project plans, or 10% of the vertical capacity of the bearing, whichever is greater.

The guiding mechanism shall be designed so that its surfaces remain parallel during bearing movement and either longitudinal or transverse rotation.

(10) Flatness. All load bearing surfaces shall be flat within to 0.006 inches/foot as determined by a precision straightedge and feeler gauge, or other approved method. Opposing load bearing surfaces of plates shall be parallel to within 0.006 inches/foot also.

564.05 Rocker, Roller and Sliding Bearings. Amend the section title to read:

Delete the first sentence of the second paragraph and substitute the following:

Fabricate rocker, roller, sliding, and fixed bearings according to the details shown on the plans and to Section 555.

Add the following:

Thoroughly coat pins and all contact surfaces with oil and graphite just prior to assembling the fixed bearings.

564.08 Anchor Bolts. Amend the second paragraph to read as follows:

Anchor bolts for bearings shall be accurately installed to insure proper fit without modification. At a

minimum, the Contractor shall install all anchor bolts with a (temporary) steel plate template conforming to ASTM A36 with a minimum thickness of 1/8 inch. Contractor may also use bolt sleeves at his option. Bolt sleeves shall be grouted after final alignment in accordance with Section 553. The templates shall be match drilled and removed prior to installation of the bearing unless otherwise approved in writing by the CO. The Contractor may submit additional or alternative details to ensure accurate placement of the anchor bolts for consideration by the CO. The shop drawings shall indicate the anchor bolt installation details. Review of the shop drawings by the CO shall not relieve the Contractor of sole responsibility for accurate installation of anchor bolts.

564.10 Acceptance. Add the following:

Each lot will accepted or rejected based upon the following criteria:

The inspected bearing satisfies the project plan and specification requirements.

The deflection of the tested bearing under the design vertical load shall not exceed 10% of the disc thickness.

There shall be no separation of plates from each other or from elastomer or PTFE surfaces.

The measured static and dynamic coefficients of friction shall not exceed the limits specified herein.

The physical properties of elastomer and PTFE shall be within the limits specified herein.

There shall be no extrusion or cold flow of elastomer or PTFE.

There shall be no deformation or cracking of PTFE, stainless steel, or other components or welds.

Bearings which satisfy all inspection and testing requirements may be installed in the structure.

(a) Sampling, Testing, and Inspection. Sampling, testing, and inspection shall be performed in accordance with the following requirements:

(1) Inspection Agency. Testing shall be performed by the manufacturer and observed by an independent testing laboratory nominated by the Contractor and approved by the CO. Inspection, and sampling for inspection and testing shall be performed by the same agency.

(2) Lot Size. Sampling and testing will be made on a per lot basis; a lot being defined as those bearings presented for acceptance at a specific time or date. A lot may not

exceed 25 bearings in number, however. A lot shall consist of bearings of the same type, with vertical load capacities differing by no more than 500 kips.

(3) Testing Requirements. The tests performed and number of samples to be tested shall be as follows:

Test	Samples Required
Proof load and comp. strain	One production bearing per lot
Rotation	One production bearing per lot
Coefficient of friction	One production bearing per lot
Physical prop. of elastomer	One elastomeric elem. per lot
Physical properties of PTFE	One 10x15 inch PTFE sheet

(4) Proof Load and Compression Strain Test.

(a) For vertical load. Preload the bearing to 10% of its design maximum vertical load, and zero the deflection measurement gauges. Load the bearing to 150% of its design maximum vertical load in 10 or more equal increments, recording deflection at each increment. Hold the load for one hour. Note any deformation, cracking or extrusion of elastomer or PTFE.

(b) For lateral load. Preload the bearing to its design vertical load. Load the bearing to 150% of its design lateral (other than seismic) load or 100% of its design seismic load, whichever is greater. Hold the load for one hour. Note any deformation, cracking or extrusion of PTFE.

(5) Rotation Test. Load the bearing to 75% of its design vertical load while simultaneously subjecting it to the design rotation. Hold the load and rotation for one hour. Note any separation of plates from each other or from the elastomer or PTFE surfaces.

(6) Coefficient of Friction Test. Load the bearing to its design vertical load while simultaneously subjecting it to the design rotation. Determine the first movement static and dynamic coefficients of friction, at a sliding speed of 1.0 inches/minute or less. Subject the bearing to 100 cycles of sliding movement with amplitude 1.0 inches or greater and speed 1.0 foot/minute or less. Determine the 101st movement static and dynamic coefficients of friction. Note any deformation or cold flow of PTFE.

(7) Physical Properties of Elastomer. Determine the physical properties of the elastomer in accordance with the ASTM specifications referenced herein.

(8) Physical Properties of PTFE. Determine the physical properties of the PTFE in accordance with the ASTM specifications referenced herein.

(9) Inspection Requirements. The inspection agency shall inspect each tested bearing for general conformance to the project plan and specification requirements;

the manufacturer shall assist the agency to disassemble the bearing as required by the agency. Additionally, the inspection agency shall make at least three visits to the manufacturer's fabrication shops at uniform intervals throughout the period of manufacture. The agency shall note the general conformance of the manufacturing process to the project plan and specification requirements; the manufacturer shall assist the agency as required. Inspection by the inspection agency will in no way relieve the manufacturer from responsibility to perform his own inspection and quality control, as required to meet the project plan and specification requirements.

Payment

564.12 Amend the second paragraph to read as follows:

Payment will be made under:

Pay Item	Pay Unit
56401 Bearings (Free)	Each
56402 Bearings (Guided)	Each
56403 Bearings (Pinned)	Each

Section 601. - MINOR CONCRETE STRUCTURES

Material

601.03 Concrete Composition. Add the following:

Use Type V high sulfate resistant cement for all minor structure concrete and all concrete cast against earth or rock.

Section 602. - CULVERTS AND DRAINS

Material

602.02 Add the following:

Precast Concrete Units	725.11

Construction Requirements

602.03 General. Delete the text and substitute the following:

Colorado River Bridge 60%+ Submittal

Furnish culvert pipe with a wall thickness not less than that shown on the plans or determined from the fill-height tables included in the plans. Use the same material and coating on all contiguous pipe sections and special sections, such as elbows and branch connections. For culvert extensions, furnish the same material as the existing culvert.

Apply structural stain as required in Special Contract Requirements Subsection 563.06(c), Stain Application, Structures Application, to exposed inlets, end sections, headwalls, and as directed by the CO.

The plans show the approximate size, location and length of culverts. Determine final size, location, skew, length, elevations, and grade according to Subsection 152.03(g). Do not order culvert material until the CO has accepted the final structure size, length, and alignment.

Use Type V high sulfate resistant cement for all concrete.

Perform excavation and backfill work under Section 209.

602.05 Laying Metal Pipe. Delete the second paragraph and substitute the following:

Join pipe sections together with coupling bands according to AASHTO M 36 or M 196. Limit the use of coupling bands with projections (dimples) to attaching prefabricated flared end sections.

602.06 Laying Plastic Pipe. Add the following:

Provide watertight joints for plastic pipe culverts.

If plastic end sections are used, reinforce and stiffen them such that inward buckling during construction is less than 3/8 inch with 110 pounds of force.

Section 610. - BRIDGE DRAINS

<work is in progress>

Section 622. - RENTAL EQUIPMENT

Description

622.01 Add the following:

This work includes, but may not be limited to, the following:

Reshaping of cut and fill slopes to obtain more natural appearing contours, after payment for items 20401, and 21101 and as described in subsection 204.01 and 204.13. This reshaping effort may adjust the cut or fill slope face and work the surface to produce a rough, uneven surface with moguls and undulations.

This work will not include any equipment necessary for the successful completion of any item listed in the bid schedule.

622.02 Rental Equipment. Add the following: <WIP to define specific equipment needs and pay items for rock scaling>

Use the following types of equipment:

Crawler Tractor (Dozer), 65 hp flywheel power.

Crawler Tractor (Dozer), 160 hp flywheel power.

Truck, highway, 10-wheel, 3-axle, tear dump, 10 cubic yard minimum capacity.

Hydraulic Excavator, track type, 165 hp flywheel power, 1.3 cubic yard bucket, equivalent to a Caterpillar 225B, with a ram hoe attachment.

Loader with backhoe, wheel type, 65 hp low flywheel power, 1 cubic yard bucket with 24-inch minimum B/H dipper, equivalent to a Case 580 or John Deere 410.

Front-end Loader, wheel type, 3.0 cubic yard minimum bucket, equivalent to a Caterpillar 966E.

Add the following:

Pre and Post excavation canyon wall scaling outside the Responsibility Zone. All rock on the faces of the canyon walls, or along the edge of the canyon that is loose or hanging; that creates a potential hazard shall be removed or stabilized as directed by the CO. The face of the canyon walls shall be hand scaled or scaled by other approved methods to remove all loose and hazardous rocks or overhangs. If in-place stabilization is required, use rock bolting or other approved stabilization techniques.

Take the necessary precautions to minimize the quantity of rock material released. This will include the use of retrieval systems designed to promote capture of material and hoisting to the surface, in-place stabilization techniques, and other methods to limit the total rock accumulation on the slopes.

Furnish acceptable hoisting, lifting, and climbing equipment. Have available hand drilling, cabling, eye bolting, and netting equipment as required.

Prepare and submit for the CO's review and approval a scheme detailing the methods, approach, and safety considerations for canyon wall post-excavation scaling, removal, containment, and/or stabilization. This scheme will be based on direction by the CO of the evaluation of hazards identified through inspection of the canyon walls and edges.

Pay Item	Pay Unit
62201 High Scaler	Hour

Section 635. - TEMPORARY TRAFFIC CONTROL

Construction Requirements

635.03 General Add the following to the first paragraph:

Use barricades, cones, tubular markers, drums, portable sign supports, vertical panels, truck mounted attenuators, and temporary crash cushions that meet crash testing requirements of NCHRP 350 or that have been accepted by the FHWA for nation-wide use. Submit a written certification that traffic control devices in use on the project meet crash-testing requirements. Information regarding NCHRP 350 and crash-tested FHWA accepted work zone traffic control devices can be found at:
http://safety.fhwa.dot.gov/fourthlevel/hardware/wzd.htm.

635.05 Barricades. Delete the second sentence and substitute the following:

Use type III, IV, or V retroreflective sheeting.

635.06 Cones and Tubular Markers. Delete the third sentence and substitute the following:

Use type III, IV, V, or VI retroreflective sheeting.

635.07 Construction Signs. Delete the first sentence and substitute the following:

Use NDOT Type X (Flourescent Orange) reflective sheeting.

635.08 Drums. Delete the third sentence and substitute the following:

Use type III, IV, V, or VI retroreflective sheeting.

635.09 Flaggers. Delete the first sentence and substitute the following:

Furnish flaggers certified by ATSSA, the National Safety Council, the International Municipal Signal Association or a state agency.

635.11 Temporary Concrete Barriers. Add the following:

Colorado River Bridge 60%+ Submittal

Barriers must meet all requirements of NCHRP 350 or have been accepted by the FHWA for nation-wide use.

635.13 Temporary Pavement Markings and Delineation. Delete the text and substitute the following:

Before opening a pavement surface to traffic, remove all conflicting pavement markings by sandblasting or other methods that do not damage the surface or texture of the pavement. Make removal pattern uneven so it does not perpetuate the outline of the removed pavement markings. Lightly coat sandblasted or removal areas on asphalt surfaces with emulsified asphalt.

Provide acceptable pavement markings or delineation and signing according to Section 156 and the MUTCD. Install and maintain temporary pavement markings that are neat, crack free, true, straight, and unbroken. For temporary pavement markings, use preformed retroreflective tape, traffic paint, or temporary raised pavement markers as follows:

(a) Preformed retroreflective tape. Apply according to the manufacturer's instructions. Remove all loose temporary preformed retroreflective tape before placing additional pavement layers.

(b) Traffic paint. Do not apply temporary traffic paint to the final surface. Apply traffic paint as the temporary pavement marking if no work will be performed on the project for at least 30 consecutive days. Apply temporary traffic paint at a 0.015-inch minimum wet film thickness (0.9 gallons per 100 square feet). Immediately apply type 1 glass beads on the paint at a minimum rate of 6 pounds per gallon of paint.
Install temporary pavement markings and delineation as follows:

(1) Two-lane, two-way road with a radius of curvature greater than or equal to 500 feet. Provide a 4-foot broken line: a 4-foot stripe followed by a 36-foot gap.

(2) Two-lane, two-way road with a radius of curvature less than 500 feet. Provide a 2-foot broken line: a 2-foot stripe followed by a 18-foot gap.

(c) Raised pavement markers. Do not use raised pavement markers during seasonal suspensions. When chip seals, slurry seals, or tack coats are used after marker placement, protect the markers with an approved protective cover, which is removed after the asphalt material is sprayed.

Temporary raised pavement markers may be used as temporary pavement markings as follows:

(1) 10-foot broken line. Four pavement markers spaced 3.33 feet apart followed by a 30-foot gap.

(2) 4-foot broken line. Three pavement markers spaced 2 feet apart followed by a 36-foot gap.

(3) 2-foot broken line. Two pavement markers spaced 2 feet apart followed by an 18-foot gap.

(4) Solid line. Pavement markers on 5-foot centers.

Remove all temporary raised pavement markers before placing additional pavement layers.

Remove all temporary pavement markings from the surface course before placing permanent pavement markings.

Provide permanent pavement markings within 14 days. If permanent pavement markings are not placed within 14 days, provide, at no cost to the Government, additional temporary delineation equivalent to the permanent pavement marking pattern required by the contract.

Install R4-1 "DO NOT PASS" signs at the beginning of "no passing" zones and at ½ mile intervals within "no passing" zones.

Install R4-2 "PASS WITH CARE" signs at the end of "no passing" zones.

635.14 Vertical Panels. Delete the third sentence and substitute the following:

Use type III, IV, or V retroreflective sheeting.

Measurement

635.26

(d) Add the following:

"DO NOT PASS" and "PASS WITH CARE" signs required to be used with temporary pavement markings and delineation are subsidiary to the temporary pavement markings item. Do not measure these signs as construction signs.

(k) Delete the text and substitute the following:

Measure temporary pavement markings by the linear foot along the centerline of the roadway. Do not deduct for standard gaps between stripes. Measure only one application of temporary pavement markings per lift. "DO NOT PASS" and "PASS WITH CARE" signs required to be used with temporary pavement markings are subsidiary to the measurement of temporary pavement markings.

Section 636. - SIGNAL, LIGHTING, AND ELECTRICAL SYSTEMS

636.05 Conduit. Add the following:

Install the following conduit on the Colorado River Bridge as shown on the project plans:

> **(a)** Two 2" diameter PVC ducts in the concrete bridge railing on each side of the bridge for future traffic management systems. Terminate the conduits in an area outside the bridge approach slabs in pull boxes. Installation includes, but is not limited to, spacers, caps, expansion joints, junction boxes, and pull boxes as required for a complete installation.

Provide conduit expansion joints at the abutments that are compatible with the movement rating of the deck expansion joints.

(b) One 1-1/2" diameter PVC duct in the concrete bridge railing on the north side of the bridge for sidewalk lighting. Terminate the conduit in the concrete bridge railing at the east end of the superstructure. Extend the conduit on the west end of the bridge to the end of the concrete bridge railing on the approach slab. Installation includes, but is not limited to, spacers, caps, expansion joints, junction boxes, and pull boxes as required for a complete installation. Provide a conduit expansion joint at the west abutment that is compatible with the movement rating of the deck expansion joint.

(c) One 2" diameter metal conduit in each of the concrete arches and in each of the steel box girders to provide power for maintenance inspection. Terminate the conduit at the skewbacks in the arches and at the end of the superstructure in the box girders. Installation includes, but is not limited to, spacers, caps, junction boxes, pull boxes, inlets, and conduit required between the girders and arches as required to provide a continuous circuit.

Add the following new subsection:

636.06A Installation of Bridge Conduit. Install communications duct banks consisting of two – 2" diameter conduits within each of the bridge structure's traffic railing barrier and in the area outside of the bridge approach slabs terminating in pull boxes as shown in the project plans. Installation includes spacers, expansion joints, junction boxes, and pull boxes to complete the conduit installation within the barrier wall, outside of the bridge structures and ultimately to the pull boxes located outside the limits of the bridge approach slabs as shown in the project plans.

Install conduit expansion joints across both bridge abutments.

Measurement

636.12 Add the following after the first paragraph:

Electrical installation includes all conduit crossings associated with the Colorado River Bridge installed in concrete bridge railing, concrete arches, and steel box girders to the limits described herein and as shown on the project plans. . Measurement includes, but is not limited to, all necessary electrical conductor, light fixtures, conduit, fittings, sweeps, spacers, expansion joints, connections to structures, pull cords, and pull boxes as required for a complete installation.

Section 638. - ROCK BOLTS

(ADDED SECTION)

Description

<we have still to resolve the field modification CO directed element of this work scope>
638.01 This work consists of furnishing and installing rock bolts for cut slopes. Install rock bolts at the locations shown on the plans for permanent rock slope stabilization and protection. Total bolt length shall be as indicated in the Plans. Provide bonded length and unbonded length as determined by contractor in order to achieve the capacity shown on the plans.

Material

638.02 Conform to the following Sections and Subsections:

Grout	725.22 (a)
Rock Bolts	722.03

Construction Requirements

638.03 Submittal. At least 14 days before the installation of rock bolts, submit the following information:

(a) Evidence that the foreman has a minimum of 1500 hours and the drill operator has a minimum of 1000 hours of satisfactory work in similar installation of post-tensioned rock bolts.
(b) Construction sequence and schedule.
(c) Drilling methods and type of equipment.
(d) Proposed tendon, couplers, bearing plate, anchor unit, flat washer, and beveled washer specifications including manufacture's data sheets.
(e) Proposed grout mix design.
(f) Calibration data for each torque wrench to be used. Submit results of calibration tests performed by an independent testing laboratory within the last 60 days.

Allow 7 days for acceptance or rejection of submittals. Do not begin work until submittals have been approved.

638.04 Rock Bolt. Size the bolt tendon so the design load does not exceed 60 percent of the minimum guaranteed ultimate tensile strength of the tendon. Select and fabricate tendons to carry the specified loads.

638.05 Handling and Storage. Protect tendons from dirt, mud, water, and other harmful substances to avoid damage and corrosion. Do not use tendons that are heavily corroded, pitted, damaged due to welding, or show signs of abrasions, cuts, or nicks.

638.06 Installation. Drill holes at locations shown on the plans and to depths as shown in the Plans. Drill holes to a minimum diameter of three times the tendon diameter or to the minimum diameter specified by the bolt manufacturer and to a depth that will provide a minimum of one foot of open hole beyond the end of the specified rock bolt. Clean holes of all drill cuttings, sludge, and debris before the rock bolt is inserted or grout is injected into the hole. Drill holes normal to the rock surface at the bolt location unless otherwise specified by the Plans or the CO.

Couple tendon sections together when standard, commercially available lengths are exceeded utilizing center-stop type couplers so that an equal length of thread connects each section. Provide couplings that equal the manufacturer's guaranteed ultimate strength for the tendon. Do not fabricate couplings in a manner that interferes with the flow of grout.

Position approved centralizers on the tendon at a maximum spacing of 5 feet on-center.

Insert bolt into the hole with the end of the bolt positioned approximately one foot from the bottom of the hole. Inject sufficient grout into the drill hole to fill the bond zone around the bolt. Apply tension to bolt after the time specified in Table 638-1. Attach the bearing plate, washer, and nut to the bolt with the threaded outer end of the bolt projecting beyond the nut a minimum of 2 inches.

Table 638-1
Grout Curing Time

Cement Type	Curing Time (Days)
I	5
II	5
III	3
Proprietary	Per manufacturer

638.07 Load Testing. All rock bolts shall be proof-tested. Proof testing shall be performed after the bonded length is grouted and the grout cured, but before the unbonded length is grouted. Bearing pads for load testing shall be kept a minimum of 12 inches away from the edges of the drilled hole. A calibrated hydraulic jack and pump shall be used to load the rock bolt, and the jack and pump shall be calibrated as a unit. The Contractor shall submit the calibration curve to the CO for approval prior to performing any load tests. The total movement and creep movement of the rock bolt shall be measured to the nearest 0.01 inch with a dial gauge. The gauge shall be supported on a reference independent of the rock bolt system.

The proof test shall be performed by incrementally loading the rock bolt (tendon) in accordance with the schedule in Table 638-2. The load shall be increased from one increment to the next immediately after recording the tendon movement. The tendon movement shall be measured and recorded to the

nearest 0.01 inch with respect to an independent fixed reference at the alignment load (AL) and at each increment of load.

Table 638-2
Proof Test

Load
AL
0.25DL
0.50DL
0.75DL
1.00DL
1.20DL
1.33DL (maximum test load)
1.00DL
AL
Adjust to lock-off load (DL)

(DL = Design/Lock-off load)
(AL = Alignment load)

The maximum test load (1.33DL) shall be held for ten (10) minutes. The load-hold period shall start immediately upon application of the maximum test load and the tendon movement with respect to the independent fixed reference shall be measured and recorded at intervals of 1, 2, 3, 4, 5, 6 and 10 minutes. If the tendon movement between one (1) minute and ten (10) minutes exceeds 0.05 inches, the maximum test load shall be held for an additional 50 minutes. If the load hold is extended, the tendon movement shall be recorded at 15, 20, 30, 40, 50 and 60 minutes. If the load is held for 60 minutes, a creep curve showing the creep movements between one minute and 60 minutes shall be plotted as a function of the logarithm of time.

If a maximum test load of 133 percent of the design/lock-off load (1.33DL) cannot be obtained, the rock bolt shall be redesigned, reinstalled, and proof-tested.

A proof-tested rock bolt shall be considered acceptable if:

(1) The total movement at the maximum test load exceeds 80 percent of the theoretical elongation of the unbonded length; and

(2) The creep movement at the maximum test load between 1 and 10 minutes is less than 0.05 inches.

(3) Proof-tested rock bolts which fail to meet acceptance criterion (2) above shall be accepted if the maximum test load is held for 60 minutes and the creep curve plotted from the movement data indicates a creep rate of less than 0.08 inches for the last log cycle of time. If a rock bolt fails during load testing, the Contractor shall modify the design or construction procedures, subject to review and approval by the CO. These modifications may include reducing the rock bolt design load by increasing the number of rock bolts, increasing the tendon or drill hole diameter, or increasing the bond length. Any modifications of the design or construction

procedure shall be installed and tested as previously defined at no additional cost to the Government. A rock bolt which fails the proof test may be incorporated once the Contractor proposes a reduced design load and performs a retest. Acceptance of such rock bolts shall depend on satisfactory rock bolt response to load testing. Any changes or modifications to the type or method of installation of rock bolts may require additional load testing as directed by the CO.

638.08 Tensioning. Tension the rock bolt to 100 percent of the specified design/lock-off load (DL).

Tension grouted bolts after completion of proof testing.

Upon tensioning, lock the rock bolt off at the specified design/lock-off load.

Accept the rock bolt if:

(1) The bolt can be tensioned to the design/lock-off load.

(2) The design/lock-off load is maintained after final grouting on the unbonded length has been accomplished.

Replace any rock bolt that does not meet (a) or (b) above in a manner and in a location approved by the CO.

638.09 Records. The Contractor shall provide the Government with the following records:

(1) Record Drawings which show the location of the rock bolts, total tendon lengths, bonded lengths and unbonded lengths.

(2) Steel and grout verifications and/or mill reports.

(3) Grouting records indicating the cement type and quantity of grout used.

(4) Proof test results.

638.10 Acceptance. Material for rock bolts will be evaluated under Subsections 106.02 and 106.03.

Installation of rock bolts will be evaluated under Subsections 106.02 and 106.04.

Measurement

638.11 Measure rock bolts by the linear foot of installed bolt, which is the length of the un-bonded bolt lengths shown in the plans.

Measure rock bolt performance test by the each.

No separate measurement will be made for proof testing.

No separate measurement will be made for temporary rock bolting, rock bolting and screening required for screening. Temporary rock bolting and screening is incidental to Structure Excavation, Section 208.

Payment

638.10 The accepted quantities, measured as provided above, will be paid at the contract price per unit of measurement for the pay item listed below that are shown in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Payment will be made under:

Pay Item		Pay Unit
63801	Rock bolt	Lineal Foot
63802	Rock bolt performance test	Each

Section 639. - PERMANENT TIEBACKS

(ADDED SECTION)

Description

639.01 This work consists of furnishing and installing permanent tiebacks for walls. Install permanent tiebacks at the locations specified on the plans for permanent rock slope stabilization and protection and for anchoring structures. Tendon total length of the permanent tiebacks shall be as shown on the plans. Tendon type and diameter, bond length and unbonded length shall be as determined by contractor in order to achieve the tieback capacity called for on the plans.

Material

639.02 Conform to the following subsection:

Paint	563.0X
Anchor Material	722.0X
Grout	725.22 (a)

Submittals

639.03 Qualifications. The Contractor or subcontractor performing the permanent tieback installations shall have completed at least five permanent tieback projects within the last three years. Submit a brief description of each project, including the Owner's name and current telephone number.

Provide an engineer with at least three years experience in the design and construction of permanent tiebacks. Provide on-site supervisors and drill operators with at least one year experience installing permanent tiebacks.

At least 30 days before starting ground anchor work, identify the engineer, onsite supervisors, and drill operators assigned to the project and submit a summary of each individual's experience.

639.04 Drawings. At least 30 days before starting tieback work, submit drawings according to subsection 104.03. Include the following:

(a) A permanent tieback schedule giving the following information:

(1) Permanent tieback number
(2) Permanent tieback design load
(3) Type and diameter of tendon
(4) Drillhole diameter, orientation and inclination
(5) Total tieback length
(6) Bond length
(7) Unbonded length

(b) Permanent tieback system drawings including the following details:
(1) Spacers and their locations
(2) Centralizers and their locations
(3) Unbonded length corrosion protection system
(4) Bond length corrosion protection system
(5) Transition between the unbonded length and the bond length corrosion protection systems
(6) Anchorage system, including trumpet; bearing plate, anchor head, wedges, nut and washers as applicable to the tendon type.
(7) Anchorage corrosion protection system, including anchorage cover and corrosion-inhibiting grease filler.

Construction Requirements

639.05 Tendon Fabrication.

(a) General. Fabricate the tendons in either the shop or field as indicated on the plans. Size the tendon such that:

(1) The design load (lock-off load) does not exceed 70 percent of the specified ultimate tensile strength of the tendon; and

(2) The maximum test load does not exceed 80 percent of the minimum specified

ultimate tensile strength of the tendon.

(b) Bond length. The bond length necessary to develop the design load and satisfy both proof and performance testing shall be determined by the contractor.

(c) Corrosion protection. Provide the following:

(1) Bar-type tendon. Double corrosion protection as follows:
Full length of tendon (unbonded plus bond lengths): Sheathing consisting of corrugated polyvinyl chloride (PVC) tubes or corrugated high-density polyethylene (HDPE) tubing with end caps. The inside diameter of the corrugated sheathing shall be a nominal 0.4 inch greater than the nominal bar diameter. The tendon shall be centralized within the sheathing and the annular space between tendon and sheathing fully grouted before installation.

Unbonded length of tendon: Smooth outer sheathing consisting of polyethylene tube, extruded polypropylene tube, or extruded high-density polyethylene (HDPE) tube, or plastic pipe.

(2) Multi-element type tendon. Double corrosion protection as follows:
Bond length of tendon: Corrugated polyvinyl chloride (PVC) or high-density polyethylene (HDPE) sheathing with end caps. The sheathing shall be sized such that the total cross-sectional area of the steel elements (strands) shall be a maximum of 30% of the cross sectional area defined by the inner (nominal) diameter of the sheathing. The multi-element tendon shall be centralized within the sheathing and the annular space between strands and sheathing fully grouted before installation.

Unbonded length of tendon: Encapsulate each individual tendon element within a smooth high-density polyethylene (HDPE) or polyvinyl chloride (PVC) sheath filled with corrosion-inhibiting grease. Completely coat the unbonded length and fill the spaces between individual elements of the multi-element tendon with corrosion-inhibiting grease, and provide seals or other measures to prevent grease from escaping at the ends of the sheath. Encapsulate the multi-element tendon in corrugated inner sheathing and smooth PVC or HDPE outer sheathing. Provide non-structural filler within the annular space between the drill hole wall and the outer smooth sheathing, along the unbonded length of the tendon.

(d) Centralizers and spacers. Provide the following:

(1) Multi-element type tendon only. use spacers along the bond length to separate the individual elements of the tendon. Spacers shall be sized to permit the free flow of grout up the drillhole, and shall be designed to provide adequate grout cover (minimum of 0.5 inch) and bond of the tendon elements to the surrounding grout.

(2) Multi-element and bar-type tendons. Centralizers shall be designed to ensure a minimum of 0.5 inch of grout cover over the tendon bond length encapsulating sheathing, and shall be sized so as to not impede the free flow of grout up the borehole. Position centralizers so their center-to-center spacing does not exceed 10 feet. Locate the uppermost centralizer not more than 5 feet from the top of the tendon bond length. Locate the lowermost not more than 1 foot from the tip of the tendon (tip of bond length).

(e) Anchorage. Provide the following:

(1) Bearing plate. Size the bearing plate such that:
The bending stresses in the plate do not exceed the yield strength of the steel when a load equal to 95 percent of the minimum specified ultimate tensile strength of the tendon is applied; and
The average bearing stress in the bearing plate does not exceed that recommended in Section 3.1.7 of the Post Tensioning Institute (PTI) *Guide Specification for Post-Tensioning Materials.*

(2) Trumpet. The inside diameter of the trumpet shall be equal to or larger than the hole in the bearing plate, and the trumpet shall be of sufficient length to accommodate tendon movements during testing and stressing. For multi-element tendons with encapsulating sheathing over the unbonded length, provide a trumpet of sufficient length to enable the tendon to make a transition from the diameter of the tendon in the unbonded length to the diameter of the tendon at the anchorage without damaging the encapsulation. Weld the trumpet to the bearing plate. Provide a permanent Buna-N synthetic rubber seal or an approved equal between the trumpet and the unbonded length smooth outer sheathing. For restressable permanent tiebacks, fill the trumpet with corrosion-inhibiting grease. For non-restressable permanent tiebacks, fill the trumpet with grout.

(3) Anchorage cover. Provide a steel cover over the anchorage assembly. Bolt the cover to the bearing plate to permit removal of the cover and restressing of the permanent tieback. Paint the cover in accordance with subsection 563.

(4) Restressable permanent tiebacks. For restressable permanent tiebacks, provide a restressable anchorage compatible with the type of tendon.

639.06 Storing and Handling. Handle and store tendons in a manner to avoid damage or corrosion. Replace tendons exhibiting abrasions, cuts, welds, weld splatter, corrosion or pitting. Repair or replace any tendons exhibiting damage to encapsulation or sheathing. Degrease the bond length of tendons and remove solvent residue before installation.

639.07 Installation. Drill permanent tieback holes within 12 inches of the required location. Drill the longitudinal axis of the drill hole parallel to the longitudinal axis of the tendon. Install the permanent tieback within three degrees of the required inclination from horizontal. Install the permanent tieback with a horizontal angle within 3 degrees of a line drawn perpendicular to the plane of the structure.

Insert the tendon in the drill hole to the required depth without driving or forcing. Where the tendon cannot be completely inserted, remove the tendon and clean or re-drill the hole to permit insertion. Use a positive displacement pump to grout tendons into drill holes using either a neat cement grout or a sand/cement grout. Use a grout pump equipped with a pressure gauge capable of measuring pressures of at least 150 pounds per square inch or twice the actual grout pressure, whichever is greater. Use well-mixed grout that is free of lumps or other indications of prior cement hydration. Continuously agitate the grout during placement. Place the grout in one continuous operation.

Provide a grout tube with inside diameter sufficient to enable the grout to be pumped to the bottom of the drill hole, and able to withstand the minimum 150 psi grout pressure.

Inject grout from the lowest point of the drill hole utilizing the grout tube. Place the grout tube either before or after insertion of the tendon. Record the quantity of injected grout and the grout pressure for each permanent tieback installation. Control grout pressures to avoid heaving or fracturing.

Pressure grouting shall be utilized for grout-protected tendons anchored in rock. After sealing the drill hole, pressure inject grout until a 50-pound per square inch grout pressure at the top of the drill hole is maintained for 5 minutes.

Place non-structural filler for the entire unbonded length.

After completion of grouting, fill the grout tube with grout if it will remain in the drill hole.

Extend the corrosion protection surrounding the unbonded length upward to beyond the bottom seal of the trumpet, or a minimum of 12 inches into the trumpet if no trumpet seal is provided. Place trumpet grease at any time during construction.

Trim the corrosion protection surrounding the unbonded length of the tendon as necessary so that it does not contact the bearing plate of the anchorage during testing and stressing.

Place the bearing plate and anchorage so the axis of the tendon is within 3 degrees of perpendicular to the bearing plate and the axis of the tendon passes through the center of the bearing plate without bending the tendon. For the multi-element tendon, properly seat the wedges as recommended for the tendon type and anchorage provided.

The permanent tieback may be stressed after the curing time specified in Table 639-1.

Table 639-1

Grout Curing Time

Cement Type	Curing Time (Days)
V	5
Proprietary grout	Per manufacturer

If grout protected tendons are used, epoxy paint the bearing plate, anchorhead, and trumpet from the surrounding concrete, soldier pile, or any metallic element embedded in the structure.

Place trumpet grout after the permanent tieback has been tested and locked-off.

Bolt the anchorage cover to the bearing plate and completely fill cover with corrosion-inhibiting grease or grout after the permanent tieback has been tested and locked-off. Grout in accordance with PTI-G (see SCR 553).

639.08 Testing and Stressing. Test each permanent tieback using a maximum test load not to exceed 80 percent of the minimum ultimate tensile strength of the tendon. Apply the test load to the bar-type tendon or simultaneously to all elements of multi-element tendons.

(a) Testing equipment. The testing equipment shall consist of the following:

(1) Movement measuring device. A dial gauge or vernier scale capable of measuring to 0.001 inch and having a minimum travel equal to the theoretical elastic elongation of the total tendon length at the maximum test load. Use a device with sufficient travel such that the total tieback movement at the maximum test load is measured without resetting the device.

(2) Hydraulic jack and pump. Use a jack and a calibrated pressure gauge to measure the applied load. The jack and pressure gauge shall be calibrated as a unit by an independent firm within 45 days of the start of permanent tieback work. Use a pressure gauge graduated in 25 psi increments or less. Use a jack having a minimum ram travel equal to the theoretical elastic elongation of the total tieback length at the maximum test load.

(3) Calibrated reference gauge. Have the reference gauge calibrated with the test jack and pressure gauge. Keep it at the project site.

(b) Performance tests. Place stressing equipment over the permanent tieback tendon such that the jack, bearing plates, load cells, and stressing anchorage are axially aligned with the tendon and the tendon is centered within the equipment.

Performance test a minimum of five percent of the permanent tiebacks or a minimum of three tiebacks, whichever is greater, at each separate location or structure. The tiebacks to be performance tested shall be selected by the CO.

Perform the performance test as indicated in Table 8.1 of the PTI "Recommendations for Prestressed Rock and Soil Anchors", 3rd Edition.

Raise the load from one increment to the next immediately after recording the tieback movement. Measure and record the tieback movement to the nearest 0.001 inch with respect to an independent fixed reference point at the alignment load and at each load increment. Monitor the load with a pressure gauge. Place the reference pressure gauge in series with the pressure gauge during each performance test. If the load measured by the pressure gauge and the load measured by the reference pressure gauge differ by more than 10 percent, recalibrate the jack, pressure gauge, and reference pressure gauge as a unit. At load increments other than the maximum test load, hold the load just long enough to obtain the movement reading.

Hold the maximum test load for a minimum of 10 minutes. Re-pump the jack as necessary in order to maintain a constant load. Begin the load-hold period as soon as the maximum test load is applied.

Measure and record the tieback movement at intervals of 1, 2, 3, 4, 5, 6, and 10 minutes. If the tieback movement between 1 and 10 minutes exceeds 0.04 inch, continue holding the maximum test load and record tieback movement at 15, 20, 25, 30, 45, and 60 minutes.

Plot the tieback movement versus the maximum load for each test sequence in Table 8.1 of PTI and plot the residual movement of the tendon at each alignment load versus the highest previously applied load.

(c) Proof tests. Proof test all ground anchors which are not performance tested. Perform the proof test as indicated in Table 8.2 of the PTI "Recommendations for Prestressed Rock and Soil Anchors", 3rd Edition.

Raise the load from one increment to the next immediately after recording the tieback movement. Measure and record the ground anchor movement to the nearest 0.001 inch with respect to an independent fixed reference point at the alignment load and at each load increment. Monitor the load with a pressure gauge.

Hold the maximum test load for a minimum of 10 minutes. Re-pump the jack as necessary in order to maintain a constant load. Begin the load-hold period as soon as the maximum test load is applied.

Measure and record the tieback movement at 1, 2, 3, 4, 5, 6, and 10 minutes. If the tieback movement between 1 and 10 minutes exceeds 0.04 inch, continue holding the maximum test load and record tieback movements at 15, 20, 25, 30, 45, and 60 minutes.

Plot the ground anchor movement versus load for each load increment in Table 8.2 of PTI.

(d) Lock off. Upon completion of performance and proof tests, reduce the load to the specified lock-off load and transfer the load to the anchorage device. After transferring the load and before removing the jack, measure the lift-off load. If the load is not within 10 percent of the specified lock-off load, reset the anchorage and re-measure the lift-off load. Repeat as necessary.

639.09 Acceptance. Material for permanent tiebacks will be evaluated under subsections 106.02 and 106.03.

Construction of permanent tiebacks and services will be evaluated under subsections 106.02 and 106.04.

Installed permanent tiebacks will be evaluated based on one of the following performance or proof test results:

(a) After a 10-minute load hold, the tieback carries the maximum test load with less than 0.04 inch of movement between 1 and 10 minutes and the total movement at the maximum test load exceeds 80 percent of the theoretical elastic elongation of the unbonded length.

(b) After a 60-minute load hold, the ground anchor carries the maximum test load with a creep rate that does not exceed 0.08 inch/log cycle of time and the total movement at the maximum test load exceeds 80 percent of the theoretical elastic elongation of the unbonded length.

Replace all permanent tiebacks with unacceptable performance or proof test results.
Do not retest failed permanent tiebacks.

Measurement

639.10 Measure permanent tiebacks by the lineal foot for the free length shown on the plans.

No separate measurement will be made for proof testing.

Measure performance tests by the each.

Payment

639.11 The accepted quantities, measured as provided above, will be paid at the contract price per unit of measurement for the pay items listed below that are shown in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Payment will be made under:

Pay Item	Pay Unit
63901 Permanent tieback	Lineal foot
63902 Performance test	Each

Section 703. - AGGREGATE

DAVE YOU MAY WANT TO ADD TO THIS SPEC

703.02 Coarse Aggregate for Portland Cement Concrete.

(b) Delete the text and substitute the following:

(b)	Adherent coating, FLH T 512 or ASTM D 5711	1.0% max.
(c)	Grading, AASHTO M 43	Maximum aggregate size for Class A concrete shall be No. 57. Maximum aggregate size for Class C concrete shall be No. 7. Nos. 8, 9 or 10 are not acceptable.

Section 704. - SOIL

704.10 Select Granular Backfill. Delete the text in Table 704-4 for 200 Sieve and substitute the following:

200 Sieve	0-5%

Section 705. - ROCK

705.02 Riprap Rock. Delete the first paragraph and conformance criteria **(a)** to **(d)** and substitute the following:

Furnish hard, durable, angular rock that is resistant to weathering and water action and free of organic or other unsuitable material. Do not use shale, rock with shale seams, or other fissile or fissured rock that may break into smaller pieces in the process of handling and placing. Use native materials for the rock obtained from within the construction limits of the project, to the amount practical. Match the material color to the surrounding soil material. If an outside source is used, it shall be as approved by the CO prior to use. Weathering Agent may be required on the visible surfaces of the rock as described in Section 563, Painting, of these Special Contract Requirements. Application, measurement and payment of Weathering Agent shall be in accordance with the above referenced section.

Conform to the following:

(a)	Apparent specific gravity, AASHTO T 85	2.50 min.

(b)	Absorption, AASHTO T 85	4.2% max.
(c)	Coarse durability index, AASHTO T 210	50 min.
(d)	Gradation for the class specified	Table 705-1
(e)	Los Angeles abrasion, AASHTO T 96	50% max.

705.02 Riprap Rock. Delete Table 705-1 and substitute the following:

Table 705-1
Gradation Requirements for Riprap

Class	Percent of Rock by Mass	Mass lbs	Approximate Cubic Dimension [2][3] inches
1	20	22 to 33	6 to 8
	30	11 to 22	5 to 6
	40	1 to 11	2 to 5
	10 [1]	0 to 1	0 to 2
2	20	55 to 110	8 to 10
	30	22 to 55	6 to 8
	40	2 to 22	3 to 6
	10 [1]	0 to 2	0 to 3
3	20	220 to 330	14 to 16
	30	110 to 220	10 to 14
	40	11 to 110	5 to 10
	10 [1]	0 to 11	0 to 5
4	20	550 to 770	18 to 20
	30	220 to 550	14 to 18
	40	22 to 220	6 to 14
	10 [1]	0 to 22	0 to 6
5	20	1540 to 2200	26 to 28
	30	770 to 1540	20 to 26
	40	55 to 770	8 to 20
	10 [1]	0 to 55	0 to 8
6	20	1870 to 3530	28 to 34
	30	1100 to 1870	22 to 28
	40	110 to 1100	10 to 22
	10 [1]	0 to 110	0 to 10

(1) Furnish spalls and rock fragments graded to provide a stable dense mass.
(2) The volume of a rock with these cubic dimensions will have a mass approximately equal to the specified rock mass.
(3) Furnish rock with breadth and thickness at least one-third its length.

Section 706. - CONCRETE AND PLASTIC PIPE

706.08 Plastic Pipe.

(b) Corrugated polyethylene pipe. Delete the text of this subsection and substitute the following:

Furnish 12-inch to 48-inch diameter pipe conforming to AASHTO M 294.

Add the following:

For pipe culvert, furnish pipe conforming to types **(a)**, **(b)**, or **(c)** for the size specified.

Section 708. - PAINT

<Text under development>

708.01 General. Delete the first paragraph and substitute the following:

Paint all exposed concrete and metal drainage structures a "Yosemite Brown" color. For the bridge structures and retaining walls adjacent to bridge structures, paint the exposed concrete surfaces listed in Section 563.10 with a paint color to be determined by test panels. For the bridge structures, paint the exposed steel surfaces listed in Section 563.07 with the same paint color to be determined by test panels. If requested, provide color chips from the paint supplier.

(b) Volatile organic compound (VOC) content.

(1) Delete the text and substitute the following:

(1)	Clear (unpigmented) coatings	4 lb/gallon max.

708.03A Paint for Concrete Bridge Structures. Provide acrylic emulsion paint consisting of water-borne and conforming to the requirements of Federal Specification TT-P-19D Paint, Acrylic Emulsion Exterior.

This paint may be tinted using "Universal" or "all purpose" concentrates.

Test acrylic emulsion paints in accordance with the following procedure:

> **(a) Resistance to Accelerated Weathering**. Apply the paint to concrete test panels and weathered in a Q-U-V accelerated weathering tester, according to ASTM G 53, for 300 hours utilizing UVB-313 lamps and the exposure cycle as specified in Subsection 4.3.5.2 of Federal Specification TT-P-19D. The paint weathered in this manner shall show no appreciable change in color or appearance due to fading, chalking, or material reaction.

(b) TT-P-19D Requirements. All performance requirements listed in Section 3 of Federal Specification TT-P-19D will be met as specified when tested according to the applicable test methods as specified in Section 4 of Federal Specification TT-P-19D.

708.04 Paint for Steel Structures. Delete the text and substitute the following:

708.04 Paint for Steel Structures. A single manufacturer shall supply all paint and paint products.

Submit paint manufacturer's product information, directions for use, sample color chips, and certification of conformance to the Engineer for review and approval prior to use.

Use one of the following manufacturer's Coating Systems on this project:

Ameron Protective Coatings	
Group 2401A Waterman Boulevard	
Suite 4 Unit 153	(707) 435-9948
Fairfield, CA 94533	(707) 435-9222 (Fax)
Carboline Protective Coatings	
350 Hanley Industrial Court	(314) 644-1000
St. Louis, Missouri 63144	(415) 887-5775
Wasser Hi-Tech Coatings	
1004 West James	(800) 627-2968
Suite 100	(253) 850-2967
Washington, DC 98032	(253) 850-3098 (Fax)

Section 709. - REINFORCING STEEL AND WIRE ROPE

709.01 Reinforcing Steel.

(b) Reinforcing bars. Delete the text of this subsection and substitute the following:

Furnish deformed bars conforming to AASHTO M 31 Grade 60 or ASTM A706, as specified.

(d) Tie bars. Delete the text of this subsection and substitute the following:

Furnish deformed bars conforming to AASHTO M 31 Grade 60 or ASTM A706, as specified or unless otherwise noted.

(e) Hook bolts. Delete the first sentence and substitute the following:

Furnish plain, grade 60 bars conforming to AASHTO M 31 with M14 rolled threads or M16 cut threads.

Section 710. - FENCE AND GUARDRAIL

710.06 Metal Beam Rail.

(a) Galvanized steel rail. Delete the text and substitute the following:

Furnish thrie beam-type members, comprised of rail members and end or terminal sections, conforming to AASHTO M180, Class A, Type I, except galvanize after fabrication.

710.09 Guardrail Posts. Delete the text and substitute the following:

Conform to the AASHTO-AGC-ARTBA "Guide to Standardized Highway Barrier Hardware," 1995 edition.

Do not use a wood guardrail post that has a through check, shake, or end split in the same plane as, or a plane parallel to the bolt hole and extending from the top of the post to within 3 inches of the bolt hole.

710.10 Guardrail Hardware. Delete the text and substitute the following:

Provide bolts, nuts, washers, and other fittings for beam-type guardrail, consisting of galvanized steel and conforming to AASHTO M180.

Provide all bolts, nuts and washers of 5/8 inch size. Provide button-head style bolts and hexagonal nuts. Provide coarse-threaded [11 threads per 1 inch] bolts and nuts, with nuts tapped oversize not to exceed 1/32 inch. Provide boltheads, nuts, and washers with the following minimum outside dimensions: boltheads, 1 ¼ inch; nuts, 1 5/16 inch; and washers, 1 ½ inch. Provide splice bolts 1 ¼ inch in length, and post connections bolts of lengths required to fit the post dimension and extend beyond the tightened nuts thereon within limits of ¼ to ½ inch. Provide washers, 1/8 inch thick, for use under nuts on all post bolts, and under any nut which has a width of less than 1 1/16 inch.

Provide cable and fitting for guardrail anchors conforming to AASHTO M30, Class C, for Type II cable.

Galvanize all fittings according to AASHTO M111.

Add the following subsection:

710.13 Wildlife Fence. Furnish materials for the wildlife fence that conform to the following:

Galvanize the steel components, except the tension wire and fabric fasteners, in accordance with AASHTO M-111. Repair where the galvanization is destroyed by welding as directed by the CO. Except for the fence fabric, coat all steel components of the wildlife fence (galvanized or not) with brown Permeon or Eonite, or an approved equal staining material as specified in Subsection 725.24A.

Fence posts shall be in accordance with ASTM Specification ASTM A-53 or A-501. Provide line posts with a weight of 1.33-lbs/ft. of T-post. Provide line posts that are painted brown.

All bolts and nuts shall be in accordance with ASTM A 307.

Provide steel fence fabric that conforms to ASTM A 116, No. 12 ½ gage, Farm, with the following minimum breaking strength requirements:

High Tensile:	1362-1870 lbs.
Medium Tensile:	700-850 lbs.
Low Tensile:	430-525 lbs.

Dip fence fabric in a vinegar solution that is 6 percent to 7 percent vinegar to 94 percent to 93 percent water. Perform vinegar treatment either by dipping each roll of fence fabric in a vat for 20 minutes then rinse, or roll solution onto erected fence with a thick-nap roller with no need to rinse.

The tension wire shall be 12-1/2 inch gauge and be aluminum or zinc coated in accordance with Section 710.03. Fabric fasteners shall be aluminum or zinc coated in accordance with Section 710.03.

NEED TO ADD TORTOISE FENCE HERE if we have river bridge contractor install fence

Section 711. - CONCRETE CURING MATERIAL AND ADMIXTURES

711.03 Chemical Admixtures. Delete the text and substitute the following:

Furnish water-reducing, retarding, set-accelerating, and hydration stabilizing admixtures, or combinations thereof, conforming to AASHTO M 194. For hydration stabilizing admixtures, conform to AASHTO M 194, type B or D.

Section 712. - JOINT MATERIAL.

712.01 Sealants, Fillers, Seals and Sleeves.

(a) Joint sealants and crack fillers. Add the following:

(5) Multi-component joint sealant, conforming to TT-S-00227E, type 1, class A or ASTM C 920, type M, grad P, class 25, use T. Provide sealant matching the color of the adjacent ***XXXX***. Conform to the sealant manufacturer's recommendations for use of primers.

(c) Preformed joint seals and sleeves. Delete the text and Table 712-1 and substitute the following:

(1) Paving applications. Conform to AASHTO M 220. Use a lubricant conforming to ASTM D 2835, which was manufactured within 9 months of use.

(2) Circular concrete sewer and culvert pipes using rubber gaskets. Furnish oil resistant gaskets conforming to AASHTO M 315M and the following:

(a) Minimum thickness	Recommendation of drainage element manufacturer
(b) Tear resistance, pounds/inch, ASTM D624 (die B)	
(1) Ethylene propylene di monomer (EPDM)	230 lbs/in min.
(2) Neoprene	115 lbs/in min.

(3) Resilient connectors between reinforced concrete manhole structures and pipes. Conform to ASTM C 923M.

(4) Preformed flexible joint sealants for concrete pipe, manholes, and precast box sections. Conform to ASTM C 990M.

(e) Cold-poured sealer. Delete the title and text and substitute the following:

(e) Silicone joint sealant. Conform to ASTM D 5893 type NS.

(f) Low-modulus silicone joint sealant. Delete the text and substitute the following:

Conform to ASTM D 5893 type SL.

(g) Backer rod. Delete the text and substitute the following:

Conform to ASTM D 5249 type 1. Use a compatible sealant as recommended by the rod manufacturer. For size of backer rod, conform to Table 712-2.

712.03 Watertight Gaskets. Delete the text and substitute the following:

For ring gaskets for rigid pipe, conform to AASHTO M 198. For ring gaskets for flexible metal pipe, conform to ASTM C 361M. For continuous flat gaskets for flexible metal pipe with flat bands or bands with projects, conform to ASTM D 1056 grade SCE 41 and use a gasket with a thickness 0.5 inches greater than the nominal depth of the pipe corrugations. For continuous flat gaskets for flexible metal pipe with corrugated bands, conform to ASTM D 1056 grade SCE 43 and use a 3/8-inch thick gasket.

Text under development. Refer to subsequent SCR submittal with bridge edits.

Add the following subsection:

712.09 Bridge Deck Joint Seals. Provide elastomer for joint seal elements made of polychloroprene rubber (Neoprene) compatible with concrete and resistant to abrasion, oxidation, aging and sunlight, and to oils, gasoline, salt and other materials that may be spilled on or applied to the surface.

Provide joint seals of the strip type.

Submit Certificates of Compliance conforming to the requirements of Subsection 106.03.

Provide strip seals with preformed non-reinforced, polychloroprene strip seal glands that mechanically lock into steel retainers. Anchor the steel retainers into the structure in accordance with the contract requirements.

Provide adhesive lubricant used to install the strip seal gland into the locking steel retainer with one part moisture curing polyurethane and hydrocarbon solvent mixture, meeting the requirements of ASTM D 4070.

The strip seal gland for each expansion joint assembly shall be installed as a single continuous unit. Field splicing is not permitted. Bends to accommodate variation in horizontal skew or vertical upturn shall be permitted to the extent allowed by the manufacturer's recommendations. Otherwise, seal may be shop vulcanized only in order to achieve the required configuration.

Clean all steel surfaces that come in contact with the strip seal gland to meet the requirements of Steel Structures Painting Council Surface Preparation No. 6 (SSPC-SP6) – Commercial Blast Cleaning.

Shop fabricate special conditions such as mitres, tees, and crosses in a mold under heat and pressure.

Strip seal gland installation at joint openings of less than 1-1/2 inches will not be permitted.

Provide the elastomer for strip seal elements conforming to the requirements of AASHTO M220. In addition, the gland used shall be capable of resisting a movement parallel to the centerline of joint of up to 50% of the joint's total movement capacity.

Section 713. - ROADSIDE IMPROVEMENT MATERIAL

Add the following:

713.17 Sediment logs. Furnish a sediment log manufactured for the purpose of controlling erosion by slowing high flow water velocity and trapping silt sediments. The sediment logs have a non-degradable, open plastic weave containment mesh (1 inch x 1 inch nylon mesh) filled with 100% aspen excelsior curled wood fibers (1/32 inch) with interlocking barbs. The diameter of the sediment log is 20 inches (+/-10%). The length is 10 feet (+/-10%).

713.18 Sediment wattles. Furnish a sediment wattle of high altitude Rocky Mountain aspen excelsior. The aspen excelsior wattle consists of machine-produced curled wood excelsior of 80% six inch (+/- 10%) fiber length with a consistent width of fiber evenly distributed throughout the wattle. The fiber is incased in a black polyproplene netting with a mesh size of approximately ½ inch x ½ inch. The netting is photodegradable with a life expectancy of 12 to 24 months, depending on amount of UV exposure. The wattle is not less than 9 inches in diameter and normally 10 feet in length.

Section 717. - STRUCTURAL METAL

717.01 Structural Steel. Delete this subsection and substitute the following:

(a) Structural carbon steel. Structural carbon steel for riveted, bolted, or welded construction shall conform to AASHTO M 183. In addition, steel for primary bridge members and fracture critical bridge members shall meet the supplementary requirements for Charpy V-notch test.

(b) High-strength low-alloy structural (HSLA) steel. High-strength, low-alloy structural steel, or steel acquiring enhanced atmospheric corrosion resistance for riveted, bolted, or welded construction, use steel conforming to AASHTO M 222. In addition, steel for primary bridge members and fracture critical bridge members shall meet the supplementary requirements for Charpy V-notch test.

(c) Bolts and nuts. Conform to ASTM A 307.

(d) High-strength bolts, nuts, and washers. Conform to either AASHTO M 164 or AASHTO M 253, as specified. Use Type 3 bolts in combination with unpainted weathering structural steel.

(e) High–performance steel (HPS). Conform to the requirements of AASHTO M270, Grade HPS70W (ASTM A709).

(f) Direct tension indicators for high-strength bolts. Direct tension indicators (DTI) for installing high-strength bolts shall be compressible-washer-type indicators conforming to the requirements of ASTM F959.

717.04 Delete the text of **(a) Steel castings** and substitute the following:

(a) Steel castings. Conform to AASHTO M 103, grade 485-250.

717.06 Steel Pipe. Delete the text and substitute the following:

717.06 Steel Pipe. Furnish galvanized steel pipe conforming to ASTM A 53, Type F, standard weight class, and plain ends for the designation specified in the contract.

717.09 Steel Grid Floors. Delete the text and substitute the following:

717.09 Steel Grid Floors. Conform to ASTM D5484, Type I. Furnish galvanized steel grid floors unless painting is specified.

717.10 Elastomeric Bearing Pads. Delete the title and text and substitute the following:

717.10 Bearings.

(a) Elastomeric bearings, plain or laminated. Conform the AASHTO M 251.

(b) Elastomeric bearings, high load rotational confined. Conform to ASTM D 5212.

(c) High-load multi-rotational bearings. Conform to ASTM D 5977. <VERIFY>

717.11 Tetrafluoroethylene (TFE) Surfaces for Bearings. Delete the text and substitute the following:

717.11 Polytetrafluoroethylene (PTFE) Surfaces for Bearings. When PTFE surfaces are specified for bearings which are not listed in subsection 717.10, conform to the following:

<NEED TO COORDINATE WITH SCR FOR SUBSECTION 564>

(a) PTFE resin. Furnish virgin PTFE resin material conforming to ASTM D 4895 and the following:

(1)	Specific gravity	2.13 to 2.19
(2)	Melting point	623º F ±2 º F

(b) Filler material. Furnish milled glass fibers, carbon, or other approved inert material.

(c) Adhesive material. Furnish epoxy resin adhesive conforming to FSS MMM-A-134, FEP film, or an approved equal.

(c) Unfilled PTFE sheet. Furnish unfilled PTFE sheet made from PTFE resin. Conform to the following:

(1)	Tensile strength, ASTM D 638	2,800 psi min
(2)	Elongation, ASTM D 638	200% min.

(e) Filled PTFE sheet. Furnish filled PTFE sheet made from PTFE resin uniformly blended with filler material. For filled PTFE sheets containing glass fibers or carbon, conform to Table 717-1.

(f) Fabric containing PTFE fibers. Furnish fabric made from oriental multi-filament PTFE fluorocarbon and other fibers. Use PTFE fibers conforming to the following:

(1)	Tensile strength, ASTM D 2256	24,000 psi min.
(2)	Elongation, ASTM D 2256	75% min.

Table 717-1
Filled Polytetrafluoroethylene Sheeting

Property	ASTM Method	15% Glass Fibers	25% Carbon
Mechanical:			
Min. Tensile strength	D 638	2,000 psi	1,300 psi
Min. Elongation	D 638	150%	75%
Physical:			
Min. Specific gravity	D 792	2.20	2.10
Melting point	D 638	620 ± 18ºF	620 ± 18ºF

(g) Interlocked bronze and filled PTFE components. Furnish a phosphor bronze plate conforming to AASHTO M 108 with an 0.010 inch thick porous bronze surface layer conforming to ASTM B 103M into which is impregnated a PTFE compound. Overlay the surface with compounded PTFE not less than 0.001 inches thick.

(h) PTFE metal composite. Furnish virgin PTFE molded on each side and completely through a 1.32-inch perforated stainless steel sheet conforming to ASTM A 240 type 304.

(i) Surface treatment. For epoxy bonding, factory treat one side of the PTFE sheet with a sodium naphthalene or sodium ammonia process.

(j) Stainless steel mating surface. Conform to ASTM A 240 type 304 and the following:

(1)	Thickness	0.0359 inches min.
(2)	Surface finish	20 μ inches root mean square max.

Polish or roll stainless steel mating surfaces as necessary to meet the specified friction properties.

717.13 Aluminum Alloy for Bridge Rail. Delete the text and Table 717-3 and substitute the following:

717.13 Aluminum Alloy for Bridge Rail. Conform to AASHTO-AGC-ARTBA "A Guide to Standardized Highway Barrier Hardware."

717.16 Elastomeric Compression Joint Seals. Delete the text and substitute the following:

717.16 Elastomeric Compression Joint Seals. Conform to AASHTO M 297.

Section 721. - ELECTRICAL AND ILLUMINATION MATERIAL

721.01 Electrical Material.

(a) Conduit.

(1) Nonmetallic conduit and duct couplings, elbows, bends, and nipples. Add the following:

For all exposed conduit placed under the deck of bridge structures, furnish fiberglass reinforced epoxy (F.R.E.) conduit and fittings per NEMA TC 14B-ID and Section 352 of the National Electrical Code. Provide conduit meeting the following additional properties:

(A) Provide conduit conforming to testing requirements for impact resistance, flame retardant properties, and weather resistance as outlined in U.L. 1684, Reinforced Thermosetted Resin Conduit.

(B) Provide conduit suitable for use at -40°F to 230°F without significant changes in mechanical properties.

(C) Provide conduit and fittings with the outside diameter equal to the trade size based on Iron Pipe Size (IPS) dimensions.

(D) Provide a gasketed joint system consisting of an integral bell and spigot to ensure joint water tightness. On the belled end, provide a triple seal gasket in addition to the interference joint.

721.02 Lighting Material. Add the following:

(f)(3) Sidewalk luminaries. Furnish……<Spec development in progress>

Section 722. - ANCHOR MATERIAL

Add the following:

722.0 A. Permanent Tieback Material.

(a) Tendons. Shall consist of the following:

(1) Bar-type tendon. Shall consist of Grade 150, uncoated high-strength steel bar conforming to ASTM A 722 Type II (deformed) bar.

(2) Multi-element tendon. Shall consist of 0.6-inch diameter, uncoated seven-wire steel strand conforming to ASTM A 416 and shall be weldless and low-relaxation grade.

(b) Bar couplers. Couplers for bar-type tendons shall consist of Grade 150 stop-type couplers capable of developing a minimum of 100 percent of the specified minimum ultimate tensile strength of the bar-type tendon. Couplers shall be protected

(c) Sheathing. Conform to the following:

(1) Smooth (unbonded length) sheathing. Smooth (unbonded length) sheathing shall consist of polyethylene tube, hot-melt extruded polypropylene tube, hot-melt extruded polyethylene tube, or plastic pipe conforming to the applicable requirements of subsection 722.02(c)(1).

(2) Corrugated sheathing. Corrugated sheathing shall consist of either high-density corrugated polyethylene tubing or corrugated polyvinyl chloride (PVC) tubes conforming to the applicable requirements of subsection 722.02(c)(2).

(d) Seals. Seals (between trumpet and unbonded length smooth outer sheathing) shall consist of permanent Buna-N synthetic rubber seal or an approved equal.

(e) Corrosion-inhibiting grease. Corrosion-inhibiting grease shall conform to the requirements of subsection 722.02(d).

(f) Neat cement grout. Grout shall consist of a pumpable mixture of cement, water, and admixtures according to subsection 725.22(a). Use Type V high sulfate resistant cement conforming to subsection 701.01. The maximum permissible water/cement ratio shall be 0.44. The maximum addition of fly ash, if used, shall not exceed 20 percent of the cement content (by weight).

Grout shall be chemically compensated for shrinkage (non-shrink). Admixtures to reduce water content, improve flowability, control bleeding, or control shrinkage may be added according to manufacturer's recommendations. Admixtures shall be free of chlorides, fluorides, sulphites, and nitrates.

The minimum 7-day compressive strength shall be 3,500 psi tested in cube strength (AASHTO T 106).

(g) Non-structural filler (unbonded length). Non-structural filler shall consist of _____.

(h) Centralizers and spacers. Centralizers and spacers shall conform to subsection 722.02(f) and shall be appropriate for the tendon diameter and/or corrugated sleeve diameter (when used over the tendon) and the drill hole diameter.

(i) Anchorage devices. Anchorage devices, including trumpet, bearing plate, anchor head and wedges, washers, anchor nuts and other threadable hardware, shall conform to the requirements of Section 4.3 of the Post Tensioning Institute (PTI) *Recommendations for Prestressed Rock and Soil Anchors* and subsection 722(g) with the following additions:

(1) Washers. Washers (flat hardened) shall conform to ASTM A-325-66B, quenched and tempered.
(2) Washers. Washers (beveled) shall consist of malleable-grade iron.
(3) Nuts. Hexagonal nuts shall be Grade 150 conforming to ASTM A 536.

Section 725. - MISCELLANEOUS MATERIAL

725.11 Precast Concrete Units. Delete the title and the text and substitute the following:

725.11 Precast Concrete Units and Accessories.

(a) Reinforced concrete manholes sections.	Conform to AASHTO M 199M.
(b) Concrete barrier.	Conform to ASTM C 825.
(c) Reinforced concrete crib wall members.	Conform to ASTM C 915.
(d) Underground concrete utility structures.	Conform to ASTM C 858.
(e) Concrete water and waste water structures.	Conform to ASTM C 913.
(f) Solid concrete interlocking paving units.	Conform to ASTM C 936.

(g) Other precast concrete units not covered by the preceding requirements. Cast the units in substantial permanent steel forms. When reinforcing steel is required, conform to Section 709. Provide additional reinforcement as necessary for handling the units.

Use concrete conforming to the following:

(1)	28-day strength, AASHTO T 22	3,600 psi min.
(2)	Air content by volume, when required	5% min.
	(a) 0.375 inch max. size aggregate	5% min.
	(b) >0.375 inch max. size aggregate	4% min.

Cure the units according to AASHTO M 170M.

Cast a sufficient number of concrete cylinders from each unit or lot of units to permit compression tests at 7, 14, and 28 days. Make at least 3 cylinders for each test. If the strength requirement is met at 7 or 14 days, the units can be certified for use 14 days from date of casting.

Do not use precast concrete units when:

- Cylinders that are properly sampled, cast, and cured, do not meet the strength requirement by an age of 28 days.
- Cracks, honeycombed, or patched areas are larger than 30 square inches.

Add the following Subsections:

725.24A Weathering Agent

Provide Weathering Agent meeting the requirements specified herein. Provide laboratory test reports certifying compliance of their stain product with each of the physical, chemical and performance requirements specified. Examples of this product include:

Permeon, manufactured by: Advanced Concrete Technologies
11622 Newport Avenue
Santa Ana, California 92705
(714) 731-0906

Eonite, manufactured by: Eonite Inc.
6100 South Maple Avenue, Suite 117
Tempe, Arizona 85283
(480) 820-5688

Provide Weathering Agent of an aqueous solution containing salts of iron and manganese, built-in oxidizers and other trace elements including copper and zinc. Weathering Agent involves applying a stable one-step or two-step component solution directly to rock or concrete surfaces.

Provide Weathering Agent with a projected life expectancy range from 50 to 100 years. Develop full coloration within two weeks after application. The final color of the Weathering Agent can be controlled or modified by custom blending of the basic ingredients, application techniques, dilution rate of the color concentrate with water or a combination of these methods.

Chemical components within the Weathering Agent shall have no adverse reactions or effects on soils, plants or animals. No corrosive by-products shall be present once the Weathering Agent has been applied, only nitrate fertilizer products shall be present as soluble residues.

Provide Weathering Agent ready-mixed at the manufacturer's plant.

Furnish Weathering Agent in new, airtight containers, clearly labeled with the exact title of the Weathering Agent, Federal Specification Number when applicable, name and address of the manufacturer and lot or batch number. The containers shall meet the U.S. Department of Transportation Hazardous Material Shipping Regulations when applicable to the product. Precautions concerning the handling of the Weathering Agent shall be shown on the label of the stain containers. Store containers at room temperatures in accordance with the manufacturer's written recommendation and shall not be opened until ready for use.