

Reference:

DACW09-88-R-0001

**SPECIFICATIONS**

for

Property of  
Flood Control District of MC Library  
Please Return to  
2801 W. Durango  
Phoenix, AZ 85009

**NEW RIVER IMPROVEMENTS**

Maricopa County, Arizona

Authority:

Public Law 89-298,  
Flood Control Act of 1965

Appropriation:

96x3123, Construction, General  
96x8862, Contributed Funds, Required  
96x8862, Contributed Funds, Other  
Corps of Engineers, Civil



**US Army Corps  
of Engineers**

es District

**A371.503**

FLOOD CONTROL DISTRICT RECEIVED	
MAR 02 '88	
CH ENG	P & PM
DEI	HYDRO
ADMIN	LMGT
FINANCE	FILL
P & I	
ENGR	
REMARKS	



14. NAME AND ADDRESS OF OFFEROR (Include ZIP Code)	15. TELEPHONE NO. (Include area code)
CODE	16. REMITTANCE ADDRESS (Include only if different than Item 14)
FACILITY CODE	

17. The offeror agrees to perform the work required at the prices specified below in strict accordance with the terms of this solicitation, if this offer is accepted by the Government in writing within \_\_\_\_\_ calendar days after the date offers are due. (Insert any number equal to or greater than the minimum requirement stated in Item 13D. Failure to insert any number means the offeror accepts the minimum in Item 13D.)

AMOUNTS ▶ In Accordance with the attached Bidding Schedule

18. The offeror agrees to furnish any required performance and payment bonds

**19 ACKNOWLEDGMENT OF AMENDMENTS**

*(The offeror acknowledges receipt of amendments to the solicitation — give number and date of each)*

AMENDMENT NO										
DATE										

20A. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER <i>(Type or print)</i>	20B. SIGNATURE	20C. OFFER DATE
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**AWARD (To be completed by Government)**

21. ITEMS ACCEPTED

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22. AMOUNT

23. ACCOUNTING AND APPROPRIATION DATA

24. SUBMIT INVOICES TO ADDRESS SHOWN IN <i>(4 copies unless otherwise specified)</i>	25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO <input type="checkbox"/> 10 U.S.C. 2304(c) ( ) <input type="checkbox"/> 41 U.S.C. 253(c)(1)
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26. ADMINISTERED BY	27. PAYMENT WILL BE MADE BY
CODE	

**CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE**

28. NEGOTIATED AGREEMENT (Contractor is required to sign this document and return \_\_\_\_\_ copies to issuing office. Contractor agrees to furnish and deliver all items or perform all work, requisitions identified on this form and any continuation sheets for the consideration stated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications incorporated by reference in or attached to this contract.

29. AWARD (Contractor is not required to sign this document.) Your offer on this solicitation, is hereby accepted as to the items listed. This award consummates the contract, which consists of (a) the Government solicitation and your offer, and (b) this contract award. No further contractual document is necessary.

30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN (Type or print)	31A. NAME OF CONTRACTING OFFICER (Type or print)	
30B. SIGNATURE	30C. DATE	31B. UNITED STATES OF AMERICA
		BY
		31C. AWARD DATE

Continuation of Standard Form 1442

20D. (1) IF THE OFFEROR IS A JOINT VENTURER, COMPLETE THE FOLLOWING:

_____	_____	_____
(Company Name)	(Signature)	(Title)
_____	_____	_____
(Company Name)	(Signature)	(Title)
_____	_____	_____
(Company Name)	(Signature)	(Title)

NOTE: If a Corporation is participating as a member of a Joint Venture, the Certificate as to Corporate Principal in item (3) below must also be completed and signed.

(2) IF THE OFFEROR IS A PARTNERSHIP, LIST FULL NAME OF ALL PARTNERS

_____	_____
(Name)	(Signature)
_____	_____
(Name)	(Signature)
_____	_____
(Name)	(Signature)

(3) IF THE OFFEROR IS A CORPORATION, THE FOLLOWING CERTIFICATE SHOULD BE COMPLETED:

CERTIFICATE AS TO CORPORATE PRINCIPAL

I, \_\_\_\_\_, certify that I am the \_\_\_\_\_  
 (name)  
 Secretary of the corporation named as offeror in the within offer; that  
 \_\_\_\_\_, who signed said offer on behalf of the corporation,  
 (name)  
 was then \_\_\_\_\_ of said corporation; that the signature thereto  
 (title)  
 is genuine; and that said contract was duly signed, sealed and attested for  
 and in behalf of said corporation by authority of its governing body.

\_\_\_\_\_  
 (Name of Corporation)

(Affix)  
 (CORPORATE SEAL)

\_\_\_\_\_  
 (Secretary)

BIDDING SCHEDULE

Item No.	Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
1.	DIVERSION AND CONTROL OF WATER	1	Job	L.S.	_____
2.	CLEAR SITE AND REMOVE OBSTRUCTIONS	1	Job	L.S.	_____
3.	EXCAVATION				
	A. First 750,000 cubic yards	750,000	Cu.Yd.	_____	_____
	B. Over 750,000 cubic yards	260,000	Cu.Yd.	_____	_____
4.	LANDFILL EXCAVATION AND DISPOSAL	1	Job	L.S.	_____
5.	COMPACTED FILL				
	A. First 75,000 cubic yards	75,000	Cu.Yd.	_____	_____
	B. Over 75,000 cubic yards	36,000	Cu.Yd.	_____	_____
6.	BACKFILL, TOE	209,000	Cu.Yd.	_____	_____
7.	MISCELLANEOUS FILL	150,000	Cu.Yd.	_____	_____
8.	CEMENT FOR SOIL CEMENT	1,039,000	Cwt.	_____	_____
9.	SOIL CEMENT	259,700	Cu.Yd.	_____	_____
10.	MODIFICATIONS AT OLIVE AVENUE	1	Job	L.S.	_____
11.	MODIFICATIONS OF LUCKY'S PARKING LOT	1	Job	L.S.	_____
12.	ROAD MODIFICATION AT PEORIA AVENUE	1	Job	L.S.	_____
13.	RETAINING WALL, STA. 306+00 TO STA. 307+26	1	Job	L.S.	_____
14.	INLET CHANNEL STA. 348+44	1	Job	L.S.	_____
15.	STORM DRAIN CHANNEL STA. 322+00	1	Job	L.S.	_____
16.	SIDE DRAINS AND SPILLWAYS	1	Job	L.S.	_____
17.	BRIDGE PROTECTION, GLENDALE AVE.	1	Job	L.S.	_____
18.	BRIDGE PROTECTION, THUNDERBIRD AVE.	1	Job	L.S.	_____
19.	BRIDGE PROTECTION, PEORIA AVE.	1	Job	L.S.	_____
20.	BRIDGE PROTECTION, GRAND AVE.	1	Job	L.S.	_____
21.	AGGREGATE BASE COURSE	1,140	Cu.Yd.	_____	_____

BIDDING SCHEDULE (Continued).

Item No.	Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
22.	INVERT STABILIZER AT STA. 302+00	1	Job	L.S.	_____
23.	SAFETY RAILS	24,600	Lin.Ft.	_____	_____
24.	PIPE GATES	11	Ea.	_____	_____
25.	LANDSCAPING	1	Job	L.S.	_____
26.	SCOUR GAGES WITH MONUMENT	1	Job	L.S.	_____
27.	FENCE INSTALLATION	1	Job	L.S.	_____

TOTAL ESTIMATED AMOUNT \$ \_\_\_\_\_

NOTE: If a bid or modification to a bid based on unit prices is submitted which provides for a lump sum adjustment to the total estimated cost, the application of the lump sum adjustment to each unit price in the Bidding Schedule must be stated. If it is not stated, the bidder agrees that the lump sum adjustment shall be applied on a pro rata basis to every unit price in the Bidding Schedule.

Amounts and prices shall be indicated in either figures or words, not both.

Bids shall be submitted on all items of the Bidding Schedule.

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## INSTRUCTIONS TO OFFERORS

### 1. SOLICITATION DEFINITIONS (APR 1984) FAR 52.215-5.

"Offer" means "proposal" in negotiation.

"Solicitation" means a request for proposals (RFP) or a request for quotations (RFQ) in negotiations.

"Government" means United States Government.

### 2. ACKNOWLEDGEMENT OF AMENDMENTS TO SOLICITATIONS (APR 1984) FAR 52.215-8.

Offerors shall acknowledge receipt of any amendment to this solicitation (a) by signing and returning the amendment, (b) by identifying the amendment number and date in the space provided for this purpose on the form for submitting an offer, or (c) by letter or telegram. The Government must receive the acknowledgement by the time and at the place specified for receipt of offers.

### 3. SUBMISSION OF OFFERS (APR 1984) FAR 52.215-9.

3.1 Offers and modifications thereof shall be submitted in sealed envelopes or packages (1) addressed to the office specified in the solicitation and (2) showing the time specified for receipt, the solicitation number, and the name and address of the offeror.

3.2 Telegraphic offers will not be considered unless authorized by the solicitation; however, offers may be modified or withdrawn by written or telegraphic notice, if such notice is received by the time specified for receipt of offers.

3.3 Item samples, if required, must be submitted within the time specified for receipt of offers. Unless otherwise specified in the solicitation, these samples shall be (1) submitted at no expense to the Government and (2) returned at the sender's request and expense, unless they are destroyed during preaward testing.

4. EXPLANATION TO PROSPECTIVE OFFERORS (APR 1984) FAR 52.215-14. Any prospective offeror desiring an explanation or interpretation of the solicitation, drawings, specifications, etc., must request it in writing soon enough to allow a reply to reach all prospective offerors before the submission of their offers. Oral explanations or instructions given before the award of a contract will not be binding. Any information given a prospective offeror concerning a solicitation will be furnished promptly to all other prospective offerors as an amendment to the solicitation, if the information is necessary in submitting offers or if the lack of it would be prejudicial to other prospective offerors.

### 5. LATE SUBMISSIONS, MODIFICATIONS, AND WITHDRAWALS OF PROPOSALS (APR 1984) FAR 52.215-10.

5.1 Any proposal received at the office designated in the solicitation after the exact time specified for receipt will not be considered unless it is received before award is made and it:

5.1.1 Was sent by registered or certified mail not later than the fifth calendar day before the date specified for receipt of offers (e.g., an offer submitted in response to a solicitation requiring receipt of offers by the 20th of the month must have been mailed by the 15th); or

5.1.2 Was sent by mail (or was a telegram if authorized), and it is determined by the Government that the late receipt was due solely to mishandling by the Government after receipt at the Government installation; or

5.1.3 Is the only proposal received.

5.2 Any modification of a proposal or quotation, except a modification resulting from the Contracting Officer's request for "best and final" offer, is subject to the same conditions as in subparagraphs 5.1.1 and 5.1.2 above.

5.3 A modification resulting from the Contracting Officer's request for "best and final" offer received after the time and date specified in the request will not be considered unless received before award and the late receipt is due solely to mishandling by the Government after receipt at the Government installation.

5.4 The only acceptable evidence to establish the date of mailing of a late proposal or modification, sent either by registered or certified mail is the U.S. or Canadian Postal Service postmark on the wrapper or on the original receipt from the U.S. or Canadian Postal Service. If neither postmark shows a legible date, the bid, modification, or withdrawal shall be processed as if mailed late. "Postmark" means a printed, stamped, or otherwise placed impression (exclusive of a postage meter machine impression) that is readily identifiable without further action as having been supplied and affixed by employees of the U.S. or Canadian Postal Service on the date of mailing. Therefore, offerors or quoters should request the postal clerks to place a hand cancellation bull's-eye postmark on both the receipt and the envelope or wrapper.

5.5 The only acceptable evidence to establish the time of receipt at the Government installation is the time/date stamp of that installation on the proposal wrapper or other documentary evidence of receipt maintained by the installation.

5.6 Notwithstanding paragraph 5.1 above, a late modification of an otherwise successful proposal that makes its terms more favorable to the Government will be considered at any time it is received and may be accepted.

5.7 Proposals may be withdrawn by written notice or telegram (including mailgram) received at any time before award. Proposals may be withdrawn in person by an offeror or its authorized representative if the representative's identity is made known and signs a receipt for the proposal before award.

## 6. PREPARATION OF OFFERS (APR 1984). FAR 52.215-13.

6.1 Offerors are expected to examine the drawings, specifications, Schedule, and all instructions. Failure to do so will be at the offeror's risk.

6.2 Each offeror shall furnish the information required by the solicitation. The offeror shall sign the offer and print or type its name on the Schedule and each continuation sheet on which it makes an entry. Erasures or other changes must be

initialed by the person signing the offer. Offers signed by an agent shall be accompanied by evidence of that agent's authority, unless that evidence has been previously furnished to the issuing office.

6.3 For each item offered, offerors shall (1) show the unit price/cost, including, unless otherwise specified, packaging, packing, and preservation and (2) enter the extended cost/price for the quantity of each item offered in the "Amount" column of the Schedule. In case of discrepancy between a unit price/cost and an extended price/cost, the unit price/cost will be presumed to be correct, subject, however, to correction to the same extent and in the same manner as any other mistake.

6.4 Offers for supplies or services other than those specified will not be considered unless authorized by the solicitation.

6.5 Offerors must state a definite time for delivery of supplies or for performance of services, unless otherwise specified in the solicitation.

Time, if stated as number of days, will include Saturdays, Sundays, and holidays.

#### 7. CONTRACT AWARD (APR 1984). FAR 52.215-16.

7.1 The Government will award a contract resulting from this solicitation to the responsible offeror whose offer conforming to the solicitation will be most advantageous to the Government, cost or price and other factors, specified elsewhere in this solicitation, considered.

7.2 The Government may (1) reject any or all offers, (2) accept other than the lowest offer, and (3) waive informalities or minor irregularities in offers received.

7.3 The Government may award a contract on the basis of initial offers received, without discussions. Therefore, each initial offer should contain the offeror's best terms from a cost or price and technical standpoint.

7.4 The Government may accept any item or group of items of an offer, unless the offeror qualifies the offer by specific limitations. Unless otherwise provided in the Schedule, offers may be submitted for quantities less than those specified. The Government reserves the right to make an award on any item for a quantity less than the quantity offered, at the unit cost or prices offered, unless the offeror specifies otherwise in the offer.

7.5 A written award or acceptance of offer mailed or otherwise furnished to the successful offeror within the time for acceptance specified in the offer shall result in a binding contract without further action by either party. Before the offer's specified expiration time, the Government may accept an offer (or part of an offer, as provided in paragraph 7.4 above), whether or not there are negotiations after its receipt, unless a written notice of withdrawal is received before award. Negotiations conducted after receipt of an offer do not constitute a rejection or counteroffer by the Government.

7.6 Neither financial data submitted with an offer, nor representations concerning facilities or financing, will form a part of the resulting contract. However, if the resulting contract contains a clause providing for pricing

reduction for defective cost or pricing data, the contract price will be subject to reduction if cost or pricing data furnished is incomplete, inaccurate, or not current.

8. UNNECESSARILY ELABORATE PROPOSALS OR QUOTATIONS (APR 1984). FAR 52.215-7.

8.1 Unnecessarily elaborate brochures or other presentations beyond those sufficient to present a complete and effective response to this solicitation are not desired and may be construed as an indication of the offeror's or quoter's lack of cost consciousness. Elaborate art work, expensive paper and bindings, and expensive visual and other presentation aids are neither necessary nor wanted.

9. FAILURE TO SUBMIT OFFER (APR 1984). FAR 52.215-15.

9.1 Recipients of this solicitation not responding with an offer should not return this solicitation, unless it specifies otherwise. Instead, they should advise the issuing office by letter or postcard whether they want to receive future solicitations for similar requirements. If a recipient does not submit an offer and does not notify the issuing office that future solicitations are desired, the recipient's name may be removed from the applicable mailing list.

10. RESTRICTION ON DISCLOSURE AND USE OF DATA (APR 1984). FAR 52.215-12.

10.1 Offerors or quoters who include in their proposals or quotations data that do not want disclosed to the public for any purpose or used by the Government except for evaluation purposes, shall:

10.1.1 Mark the title page with the following legend:

"This proposal or quotation includes data that shall not be disclosed outside the Government and shall not be duplicated, used, or disclosed-in whole or in part-for any purpose other than to evaluate this proposal or quotation. If, however, a contract is awarded to this offeror or quoter as a result of-or in connection with-the submission of this data, the Government shall have the right to duplicate, use, or disclose the data to the extent provided in the resulting contract. This restriction does not limit the Government's right to use information contained in this data if it is obtained from another source without restriction. The data subject to this restriction are contained in sheets (insert numbers or other identification of sheets)"; and

10.1.2 Mark each sheet of data it wishes to restrict with the following legend:

"Use or disclosure of data contained on this sheet is subject to the restriction on the title page of this proposal or quotatio."

11. DIRECTIONS FOR SUBMITTING OFFERS.

11.1 Envelopes containing offers, guarantee, etc., must be sealed, marked, and addressed as follows:

Offer Under Reference No:  
(DACW09-88-R-0001)

To: U.S. ARMY ENGINEER DISTRICT  
LOS ANGELES  
ATTN: Contracting Division  
P.O. Box 2711  
Los Angeles, California 90053-2325

11.2 Hand carried offers shall be deposited in the Brunswick Square Building, Room 308, 360 East Second Street, Los Angeles, California, 90013, prior to the time and date set for receipt of offers.

12. TYPE OF CONTRACT (APR 1984). FAR 52.216-1. The Government contemplates award of a Firm-Fixed Price contract.

13. BID (OFFER) GUARANTEE (APR 1984). FAR 52.228-1.

13.1 Failure to furnish a bid (offer) guarantee in the proper form and amount, by the time set for receipt of offers, may be cause for rejection of the offer.

13.1.2 The offeror (bidder) shall furnish a bid (offer) guarantee in the form of a firm commitment, such as a bid (offer) bond, postal money order, certified check, irrevocable letter of credit, or, under Treasury Department regulations, certain bonds or notes of the United States. The Contracting Officer will return bid (offer) guarantees, other than bonds, (1) to unsuccessful bidders as soon as practicable after the date set for receipt of offers, and (2) to the successful offeror upon execution of contractual documents and bonds (including any necessary coinsurance or reinsurance agreements), as required by the offer as accepted.

13.1.3 If the successful offeror, upon acceptance of its offer by the Government within the period specified for acceptance, fails to execute all contractual documents or give a bond(s) as required by the solicitation within the time specified, the Contracting Officer may terminate the contract for default.

13.1.4 Unless otherwise specified in the offer, the offeror will (1) allow 60 days for acceptance of its offer and (2) give bond within 10 days after receipt of the forms by the offeror.

13.1.5 In the event the contract is terminated for default, the offeror is liable for any cost of acquiring the work that exceeds the amount of its offer, and the bid (offer) guarantee is available to offset the difference.

14. AVAILABILITY OF SPECIFICATIONS LISTED IN THE DOD INDEX OF SPECIFICATIONS AND STANDARDS (DODISS) (APR 1984) FAR 52.210-2. Single copies of specifications cited in this solicitation may be obtained by submitting a written request to the supply point listed below. The request must contain the title of the specification, its number, date, applicable amendment(s), and the solicitation or contract number. In case of urgency, telephone or telegraphic requests are acceptable. Voluntary standards, which are not available to offerors and contractors from Government sources, may be obtained from the organization responsible for their preparation, maintenance, or publication.

Commanding Officer  
U.S. Naval Publication and Forms Center  
5801 Tabor Avenue  
Philadelphia, PA 19120  
Telex Number.....834295  
Western Union Number....710-670-1685  
Telephone Number.....(215) 697-3321

15. AVAILABILITY FOR EXAMINATION OF SPECIFICATIONS, STANDARDS, PLANS, DRAWINGS, DATA ITEM DESCRIPTIONS, AND OTHER PERTINENT DOCUMENTS (JUN 1977). FAR SUP 52.210-7003. The specification, standards, plans, drawings, descriptions, and other pertinent documents cited in this solicitation may be examined at the following locations:

Brunswig Square Building  
Plan Room, Room 300  
360 East Second Street  
Los Angeles, California 90013

16. EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE. Whenever a contract or modification of contract price is negotiated, the Contractor's cost proposals for equipment ownership and operating expenses shall be determined in accordance with the requirements of paragraph, EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE of the SPECIAL CLAUSES. A copy of EP 1110-1-8 "Construction Equipment Ownership and Operating Expense Schedule" is available for review at Room 7216, 300 North Los Angeles Street, Los Angeles, California.

17. SMALL BUSINESS AND SMALL DISADVANTAGED BUSINESS SUBCONTRACTING. Offerors are cautioned that failure to comply in good faith with the CONTRACT CLAUSES entitled (1) "Utilization of Small Business Concerns and Small Disadvantaged Business Concerns" and (2) "Small Business and Small Disadvantaged Business Subcontracting Plan (Alternate I)", when applicable, will be a material breach of contract. In order to assist prime contractors in developing a source list of Small and Small Disadvantaged Business Concerns, you are encouraged to contact minority Contractor associations, the Minority Business Development Agency, and the appropriate General Business Service Centers in your Standard Metropolitan Statistical Area, addresses of which may be obtained from:

Write: U.S. Army Engineer District, Los Angeles  
ATTN: SPLSD  
300 North Los Angeles Street, P.O. Box 2711  
Los Angeles, California 90053-2325

Telephone Alice Tafoya  
Small and Disadvantaged Business Utilization Specialist  
Area Code (213) 894-5679

18. ADDITIONAL INFORMATION pertaining to these plans and specifications may be obtained by writing or calling (collect calls not accepted) U.S. Army Engineer District, Los Angeles, Attn: Mr G. E. Davis, P. O. Box 2711, Los Angeles, California 90053-2325. Telephone (213) 894-5493.

18.1 All inquiries after the date specified for receipt of offers should be directed as specified hereinbefore, Attn: Mr. Bernard Meirowsky. Telephone (213) 894-5660.

19. SITE INSPECTION. Arrangements for visiting the site may be made by contacting: Mr. Neil Erwin, Telephone (602) 261-3023.

20. NOTICE OF TOTAL SMALL BUSINESS SET-ASIDE (APR 1984). FAR 52.219-6.

20.1 Definition. "Small business concern", as used in this clause, means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the size standards in this solicitation.

20.2 General.

20.2.1 Offers are solicited only from small business concerns. Offers received from concerns that are not small business concerns shall be considered nonresponsive and will be rejected.

20.2.2 Any award resulting from this solicitation will be made to a small business concern.

20.3 Agreement. A manufacturer or regular dealer submitting an offer in its own name agrees to furnish, in performing the contract, only end items manufactured or produced by small business concerns inside the United States, its territories and possessions, the Commonwealth of Puerto Rico, the Trust Territory of the Pacific Islands, or the District of Columbia. However, this requirement does not apply in connection with construction or service contracts.

20.4 Small Business Size Standard. For the purpose of this solicitation, in order to qualify as a "small business concern" the average annual receipts of the concern and its affiliates for its preceding three (3) fiscal years did not exceed 17,000,000.

21. NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY (APR 1984). FAR 52.222-23.

21.1 The offeror's attention is called to the Equal Opportunity clause and the Affirmative Action Compliance Requirements for Construction clause of this solicitation.

21.2 The goals for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Goals for minority participation for each trade	Goals for female participation for each trade
25.0 to 30.0%	6.9%

These goals are applicable to all the Contractor's construction work performed in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, the Contractor shall apply the goals established for the geographical area where the work is actually performed. Goals are published periodically in the Federal Register in notice form, and these notices may be obtained from any Office of Federal Contract Compliance Programs office.

21.3 The Contractor's compliance with Executive Order 11246, as amended, and the regulations in 41 CFR 60-4 shall be based on (1) its implementation of the Equal Opportunity clause, (2) specific affirmative action obligations required by the clause entitled "Affirmative Action Compliance Requirements for Construction," and (3) its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade. The Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor, or from project to project, for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, Executive Order 11246, as amended, and the regulations in 41 CFR 60-4. Compliance with the goals will be measured against the total work hours performed.

21.4 The Contractor shall provide written notification to the Director, Office of Federal Contract Compliance Programs, within 10 working days following award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the:

- (1) Name, address, and telephone number of the subcontractor;
  - (i) Employer identification number of the subcontractor;
- (2) Estimated dollar amount of the subcontract;
- (3) Estimated starting and completion dates of the subcontract; and
- (4) Geographical area in which the subcontract is to be performed.

21.5 As used in this Notice, and any contract resulting from this solicitation, the "covered area" is Maricopa County, Arizona.

## 22. BONDS.

22.1 Bid (Offer) Bonds. Each Offeror shall submit with his bid a Bid (Offer) Bond (Standard Form 24) with good and sufficient surety or surities acceptable to the Government, or other security as provided in Paragraph: BID (OFFER) GUARANTEE hereinbefore, in the form of twenty percent (20%) of the amount of the offer or \$3,000,000, whichever is lesser. The Bid (Offer) Bond penalty may be expressed in terms of a percentage of the amount of the offer or may be expressed in dollars and cents.

22.2 Performance and Payment Bonds. After the perscribed forms have been presented to the offeror to whom award is made for signature, two bonds, each with good and sufficient surety or sureties acceptable to the Government, shall be furnished; namely a Performance Bond (Standard Form 25) and a Payment Bond (Standard Form 25A). The penal sums of such bonds will be as follows:

22.2.1 Performance Bond. The penal sum shall equal one hundred percent (100%) of the contract price.

22.2.2 Payment Bond.

22.2.2.1 When the contract price is \$1,000,000 or less, the penal sum will be fifty percent (50%) of the contract price.

22.2.2.2 When the contract price is in excess of \$1,000,000 but not more than \$5,000,000, the penal sum shall be forty percent (40%) of the contract price.

22.2.2.3 When the contract price is more than \$5,000,000, the penal sum shall be \$2,500,000.

22.3 Any bonds furnished will be furnished by the Contractor to the Government prior to commencement of Contract performance.

23. EQUAL OPPORTUNITY PREAWARD CLEARANCE OF SUBCONTRACTORS (APR 1984). FAR 52.222-28. Notwithstanding the clause of this contract entitled "Subcontractors," the Contractor shall not enter into a first-tier subcontract for an estimated or actual amount of \$1 million or more without obtaining in writing from the Contracting Officer a clearance that the proposed subcontractor is in compliance with equal opportunity requirements and therefore is eligible for award.

\* \* \* \* \*

REPRESENTATIONS, CERTIFICATIONS AND OTHER STATEMENTS OF OFFEROR

1. CERTIFICATES OF INDEPENDENT PRICE DETERMINATION (APR 1985) FAR 52.203-2.

(a) The Offeror certifies that-

(1) The prices in this offer have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other Offeror or competitor relating to (i) those prices, (ii) the intention to submit an offer, or (iii) the methods or factors used to calculate the prices offered;

(2) The prices in this offer have not been and will not be knowingly disclosed by the Offeror, directly or indirectly, to any other Offeror or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a negotiated solicitation) unless otherwise required by law; and

(3) No attempt has been made or will be made by the Offeror to induce any other concern to submit or not to submit an offer for the purpose of restricting competition.

(b) Each signature on the offer is considered to be a certification by the signatory that the signatory-

(1) Is the person in the Offeror's organization responsible for determining the prices being offered in this bid or proposal, and that the signatory has not participated and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) above or

(2) (i) Has been authorized, in writing, to act as agent for the following principals in certifying that those principals have not participated, and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) above

(insert full name of person(s) in the Offeror's organization responsible for determining the prices offered in this bid or proposal, and the title of his or her position in the Offeror's organization);

(ii) As an authorized agent, does certify that the principals named in subdivision (b)(2)(i) above have not participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) above; and

(iii) As an agent, has not personally participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) above.

(c) If the Offeror deletes or modifies subparagraph (a)(2) above, the Offeror must furnish with its offer a signed statement setting forth in detail the circumstances of the disclosure.

2. CONTINGENT FEE REPRESENTATION AND AGREEMENT (APR 1984) FAR 52.203-4.

(a) Representation. The Offeror represents that, except for full-time bona fide employees working solely for the Offeror, the Offeror-

(Note: The Offeror must check the appropriate boxes. For interpretation or the representation, including the term "bona fide employee," see Subpart 3.4 of the Federal Acquisition Regulation.)

(1)  has,  has not employed or retained any person or company to solicit or obtain this contract; and

(2)  has  has not paid or agreed to pay to any person or company employed or retained to solicit or obtain this contract any commission, percentage, brokerage, or other fee contingent upon or resulting from the award of this contract.

(b) Agreement. The Offeror agrees to provide information relating to the above Representation as requested by the Contracting Officer and, when subparagraph (a)(1) or (a)(2) is answered affirmatively, to promptly submit to the Contracting Officer-

(1) A completed Standard Form 119, Statement of Contingent or Other Fees, (SF 119); or

(2) A signed statement indicating that the SF 119 was previously submitted to the same contracting office, including the date and applicable solicitation or contract number, and representing that the prior SF 119 applies to this offer or quotation.

3. TYPE OF BUSINESS ORGANIZATION-SEALED BIDDING (APR 1985) FAR 52.214-2.

The bidder, by checking the applicable box, represents that it operates as

a corporation incorporated under the laws of the State of \_\_\_\_\_,  
 an individual,  a partnership,  
 a nonprofit organization, or  a joint venture.

4. PARENT COMPANY AND IDENTIFYING DATA (APR 1984) FAR 52.214-8.

(a) A "parent" company, for the purpose of this provision, is one that owns or controls the activities and basic business policies of the bidder. To own the bidding company means that the parent company must own more than 50 percent of the voting rights in that company. A company may control a bidder as a parent even though not meeting the requirement for such ownership if the parent company is able to formulate, determine, or veto basic policy decisions of the Offeror through the use of dominant minority voting rights, use of proxy voting or otherwise.

(b) The bidder  is,  is not (check applicable box) owned or controlled by a parent company.

(c) If the bidder checked "is" in paragraph (b) above, it shall provide the following information:

Name and Main Office Address  
of Parent Company  
(including Zip Code)

Parent Company's Employer's  
Identification Number

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(d) If the bidder checked "is not" in paragraph (b) above, it shall insert its own Employer's Identification Number on the following line \_\_\_\_\_.

5. SMALL BUSINESS CONCERN REPRESENTATION (APR 1984) FAR 52.219-1.

The Offeror represents and certifies as part of its offer that it  is,  is not a small business concern and that  all,  not all supplies to be furnished will be manufactured or produced by a small business concern in the United States, its possessions, or Puerto Rico. "Small business concern," as used in this provision, means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the size standards in this solicitation.

6. SMALL DISADVANTAGED BUSINESS CONCERN REPRESENTATION (APR 1984) FAR 52.219-2.

(a) Representation. The Offeror represents that it  is,  is not a small disadvantaged business concern.

(b) Definitions.

"Asian-Indian American," as used in this provision, means a United States citizen whose origins are in India, Pakistan, or Bangladesh.

"Asian-Pacific American," as used in this provision, means a United States citizen whose origins are in Japan, China, the Phillipines, Vietnam, Korea, Samoa, Guam, The U.S. Trust Territory of the Pacific Islands, the Northern Mariana Islands, Laos, Cambodia, or Taiwan.

"Native Americans," as used in this provision, means American Indians, Eskimos, Aleuts, and native Hawaiians.

"Small business concern," as used in this provision, means a concern including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria and size standards in 13 CFR 121.

"Small disadvantaged business concern," as used in this provision, means a small business concern that (1) is at least 51 percent owned by one or more individuals who are both socially and economically disadvantaged, or publicly owned business having at least 51 percent of its stock owned by one or more socially and economically disadvantaged individuals and (2) has its management and daily business controlled by one or more such individuals.

(c) Qualified Groups. The Offeror shall presume that socially and economically disadvantaged individuals include Black Americans, Hispanic Americans, Native Americans, Asian-Pacific Americans, Asian-Indian Americans, and other individuals found to be qualified by the SBA under 13 CFR 124.1.

7. WOMEN-OWNED SMALL BUSINESS REPRESENTATION (APR 1984) FAR 52.219-3.

(a) Representation. The Offeror represents that it  is,  is not a women-owned small business concern.

(b) Definitions.

"Small business concern," as used in this provision, means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria and size standards in 13 CFR 121.

"Women-owned," as used in this provision, means a small business that is at least 51 percent owned by a woman or women who are U.S. citizens and who also control and operate the business.

8. CERTIFICATION OF NONSEGREGATED FACILITIES (APR 1984) FAR 52.222-21.

(a) "Segregated facilities," as used in this provision, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees, that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, or national origin because of habit, local custom, or otherwise.

(b) By the submission of this offer, the Offeror certifies that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The Offeror agrees that a breach of this certification is a violation of the Equal Opportunity clause in the contract.

(c) The Offeror further agrees that (except where it has obtained identical certifications from proposed subcontractors for specific time periods) it will-

(1) Obtain identical certifications from proposed subcontractors before the award of subcontracts under which the subcontractor will be subject to the Equal Opportunity clause;

(2) Retain the certifications in the files; and

(3) Forward the following notice to the proposed subcontractors (except if the proposed subcontractors have submitted identical certifications for specific time periods):

**NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENTS FOR CERTIFICATIONS OF NONSEGREGATED FACILITIES.**

A Certification of Nonsegregated Facilities must be submitted before the award of a subcontract under which the subcontractor will be subject to the Equal Opportunity clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semiannually, or annually).

**NOTE:** The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

**9. PREVIOUS CONTRACTS AND COMPLIANCE REPORTS (APR 1984) FAR 52.222-22.**

The Offeror represents that-

(a) It  has,  has not participated in previous contract or subcontract subject either to the Equal Opportunity clause of this solicitation, the clause originally contained in Section 310 of Executive Order No. 10925, or the clause contained in Section 201 of Executive Order No. 11114;

(b) It  has,  has not, filed all required compliance reports; and

(c) Representations indicating submission of required compliance reports, signed by proposed subcontractors, will be obtained before subcontract awards.

**10. CLEAN AIR AND WATER CERTIFICATION (APR 1984) FAR 52.223-1.**

The Offeror certifies that-

(a) Any facility to be used in the performance of this proposed contract is  , is not  listed on the Environmental Protection Agency List of Violating Facilities;

(b) The Offeror will immediately notify the Contracting Officer, before award, of the receipt of any communication from the Administrator, or a designee, of the Environmental Protection Agency, indicating that any facility that the Offeror proposes to use for the performance of the contract is under consideration to be listed on the EPA List of Violating Facilities; and

(c) The Offeror will include a certification substantially the same as this certification, including this paragraph (c), in every nonexempt subcontract.

11. DATA UNIVERSAL NUMBERING SYSTEM (DUNS) NUMBER REPORTING (DEC 1980) FAR SUP 52.204-7004.

In the block with its name and address, the Offeror should supply the Data Universal Numbering System (DUNS) Number applicable to that name and address. The DUNS Number should be preceded by "DUNS:". If the Offeror does not have a DUNS Number, it may obtain one from any DUN and Bradstreet branch office. No Offeror should delay the submission of its offer pending receipt of its DUNS Number.

12. PREFERENCE FOR LABOR SURPLUS AREA CONCERNS (APR 1984) FAR 52.220-1.

(a) This acquisition is not set aside for labor surplus area (LSA) concerns. However, the Offeror's status as such a concern may affect (1) entitlement to award in case of tie offers or (2) offer evaluation in accordance with the Buy American Act clause of this solicitation. In order to determine whether the Offeror is entitled to a preference under (1) or (2) above, the Offeror must identify, below, the LSA in which the costs to be incurred on account of manufacturing or production (by the Offeror or the first-tier subcontractors) amount to more than 50 percent of the contract price.

---

(b) Failure to identify the locations as specified above will preclude consideration of the Offeror as an LSA concern. If the Offeror is awarded a contract as an LSA concern and would not have otherwise qualified for award, the Offeror shall perform the contract or cause the contract to be performed in accordance with the obligations of an LSA concern.

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CONTRACT CLAUSES  
CONSTRUCTION-INSIDE THE U.S  
Issued by: Department of the Army, Corps of Engineers  
Edition of 15 NOV 85

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14.	52.219-13	UTILIZATION OF WOMEN-OWNED SMALL BUSINESSES

CLAUSES INCORPORATED BY REFERENCE (APR 1984) FAR 52.252-2.

This contract incorporates the following clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting officer will make their full text available.

- I. FEDERAL ACQUISITION REGULATIONS (48 CFR CHAPTER 1) CLAUSES.
- II. ENGINEER FEDERAL ACQUISITION REGULATION SUPPLEMENT (EFARS) CLAUSES.
- III. DEPARTMENT OF DEFENSE FAR SUPPLEMENT (DFARS) (48 CFR CHAPTER 2) CLAUSES.

(End of clause)

These clauses may be obtained from Contracting Division, 300 North Los Angeles Street, Room 6021, Los Angeles, California, 90053-2325.

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GENERAL WAGE DECISION NO. AZ87-2

Supersedes General Wage Decision No. AZ86-2

State: ARIZONA

County(ies): Statewide

Construction Type: Heavy & Highway

Construction Description: Heavy & Highway Construction Projects

Modification Record:

No.	Publication Date	Page No.(s)
1	Jan. 23, 1987	RW-1 - RW-4
2	Mar. 6, 1987	RW-1, RW-5
3	Mar. 13, 1987	RW-1, RW-2
4	June 19, 1987	RW-1, RW-5
5	Aug. 14, 1987	RW-1, RW-5
6	Nov. 6, 1987	RW-1, RW-3, RW-9, RW-10
7	Nov. 27, 1987	RW-1 - RW-3, RW-5, RW-6, RW-12, RW-13



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	Basic Hourly Rates	Fringe Benefits
<b>*BRICKLAYERS; Stonemasons:</b>		
<b>*Northern Area:</b>		
Zone A	14.95	2.39
Zone B	16.95	2.39
Zone C	17.95	2.39
Zone D	18.45	2.39
Zone E	20.45	2.39
<b>Southern Area:</b>		
<b>Zone A:</b>		
Bricklayers; Stonemasons	13.13	2.62
Manhole Builders	13.43	2.62
<b>Zone B:</b>		
Bricklayers; Stonemasons	13.50	2.62
Manhole Builders	13.80	2.62
<b>Zone C:</b>		
Bricklayers; Stonemasons	13.88	2.62
Manhole Builders	14.18	2.62
<b>Zone D:</b>		
Bricklayers; Stonemasons	14.63	2.62
Manhole Builders	14.93	2.62
<b>*CARPENTERS:</b>		
<b>Northern Area:</b>		
*Carpenters: Saw Filer	19.185	2.55
*Piledrivermen	19.55	2.55
Millwrights	19.29	2.59
<b>Central &amp; Southern Areas:</b>		
*Carpenters: Saw Filer	16.685	2.55
*Piledrivermen	17.05	2.55
Millwrights	16.29	2.59
<b>*CEMENT MASONS:</b>		
<b>Zone 1:</b>		
<b>Northern Area:</b>		
Cement Masons	18.505	3.05
Concrete Troweling Machine; Sawing and Scoring Machine; Curb and Gutter Machine	18.74	3.05
<b>Central &amp; Southern Areas:</b>		
Cement Masons	16.005	3.05
Concrete Troweling Machine; Sawing and Scoring Machine; Curb and Gutter Machine	16.24	3.05
<b>Zone 2:</b>		
Cement Masons	16.445	2.62
Concrete Troweling Machine; Sawing and Scoring Machine; Curb and Gutter Machine; Clary and similar type of power Screed Operator	16.68	2.62
<b>*ELECTRICIANS:</b>		
<b>Area 1:</b>		
Electricians	16.81	1.30+ 3.75%
Cable Splicers	18.16	1.30+ 3.75%
<b>*Area 2:</b>		
Electricians' Technicians; Cable Spli- cers:		



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Zone A	17.10	2.33+	3.5%
Zone B	20.22	2.33+	3.5%
*Area 3:	18.74	12%+	1.40
Area 4:			
Electricians on projects having an electrical contract value of less than \$20 million	16.00	2.14+	3%
Electricians on projects having an electrical contract value of \$20 million or more	17.95	2.14+	3%
Area 5:			
Electricians	17.00	1.00+	11.5%
Cable Splicers	17.25	1.00+	11.5%
*IRONWORKERS:			
Northern Area	18.00	5.82	
Southern Area	15.00	5.82	
LABORERS:			
Area 1:			
Group 1	13.08	2.77	
Group 2	15.61	2.77	
Group 3	16.19	2.77	
Group 4	16.46	2.77	
Group 5	18.01	2.77	
Barricade Setter:			
Placement, removal, transport, and maintenance of the traffic control devices	5.90	1.27	
Area 2:			
Group 1	10.58	2.77	
Group 2	13.11	2.77	
Group 3	13.69	2.77	
Group 4	13.96	2.77	
Group 5	15.51	2.77	
Barricade Setter:			
Placement, removal, transport, and maintenance of the traffic control devices	5.90	1.27	
(Tunnel and Shaft Work):			
Area 1:			
Group 1	15.985	2.77	
Group 2	16.24	2.77	
Group 3	16.44	2.77	
Group 4	16.98	2.77	
Group 5	17.295	2.77	
Area: 2			
Group 1	13.485	2.77	
Group 2	13.74	2.77	
Group 3	13.94	2.77	
Group 4	14.48	2.77	
Group 5	14.795	2.77	
LINE CONSTRUCTION:			
Zone 1:			
Groundmen	13.41	4.75+	3.5%
Equipment Operator; Powdermen & Mechanics	15.83	4.75+	3.5%
Linemen, Crane Operator, Sagger, and Pilot	18.15	4.75+	3.5%
Cable splicers	18.66	4.75+	3.5%
Zone 1-A:			



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Groundmen	14.41	4.75+ 3.5%
Equipment Operator; Powdermen & Mechanics	16.74	4.75+ 3.5%
Linemen, Crane Operator, Sagger, and Pilot	18.15	4.75+ 3-1/2%
Cable splicers	19.73	4.75+ 3-1/2%
Zone 2:		
Groundmen	15.40	4.75+ 3-1/2%
Equipment Operator; Powdermen & Mechanics	17.74	4.75+ 3-1/2%
Linemen, Crane Operator, Sagger, and Pilot	20.12	4.75+ 3-1/2%
Cable splicers	20.67	4.74+ 3-1/2%
PAINTERS:		
Area 1:		
Zone A:		
Brush	11.60	1.90
Brush, Steel & Bridge	12.10	1.90
Spray	12.05	1.90
Spray, Steel & Bridge	12.60	1.90
Zone B: (\$0.75 per hour above Zone A BHR)		
Zone C: (\$1.75 per hour above Zone A BHR)		
Zone D: (\$2.00 per hour above Zone A BHR)		
Area 2:		
Zone A:		
Brush and Roller; Sandblaster (Nozzleman); Sheetrock Taper; Floor Coverer; Sandblaster (pot tender)	13.54	1.30
Spray; Paperhanger	13.79	1.30
Creosote Applier	13.87	1.30
Swing Stage:		
Brush; Sandblaster	13.94	1.30
Spray	14.19	1.30
Steeplejack	14.40	1.30
Steel and Bridge, Brush; Nozzlemans and Pot Tender; Steel (steam cleaner); Electric and Air Tool Operator; Steel Sandblaster	14.67	1.30
Steel Sandblaster	14.67	1.30
Zone B: (\$1.00 per hour above Zone A (BHR))		
Zone C: (\$2.50 per hour above Zone A BHR)		
Area 3:		
Zone A:		
Brush	12.47	1.77
Spray; Sandblaster	13.07	1.77
Paperhanger	12.60	1.77
Swing Stage, under 40 feet:		
Brush	12.77	1.77
Spray	13.37	1.77
Swing Stage, over 40 feet:		
Brush	13.47	1.77
Spray	14.07	1.77
Structural Steel & Tanks:		
Brush	13.47	1.77

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Spray & Sandblasters	14.07	1.77
Creosote Base and Bituminous material	12.87	1.77
Zone B: (\$0.75 per hour above Zone A BHR)		
Zone C: (\$1.50 per hour above Zone A BHR)		
Zone D: (\$2.75 per hour above Zone A BHR)		
<b>PLUMBERS AND PIPEFITTERS:</b>		
Zone 1	16.50	3.33
Zone 2	18.50	3.33
Zone 3:		
Commercial	16.84	3.58
Industrial	18.34	3.58
<b>POWER EQUIPMENT OPERATORS:</b>		
Area 1:		
Group 1	13.75	3.08
Group 2	16.25	3.08
Group 3	16.83	3.08
Group 4	17.50	3.08
Group 5	18.32	3.08
Group 6	19.13	3.08
Group 7	19.60	3.08
Group 8	20.11	3.08
Group 9	21.04	3.08
Area 2:		
Group 1	11.25	3.08
Group 2	13.75	3.08
Group 3	14.33	3.08
Group 4	15.00	3.08
Group 5	15.62	3.08
Group 6	16.63	3.08
Group 7	17.10	3.08
Group 8	17.61	3.08
Group 9	18.54	3.08
<b>*TRUCK DRIVERS:</b>		
Area 1:		
Group 1	15.60	2.87
Group 2	15.80	2.87
Group 3	16.14	2.87
Group 4	16.68	2.87
Group 5	16.91	2.87
Group 5A	17.21	2.87
Group 6	17.42	2.87
Group 7	18.04	2.87
Group 8	18.84	2.87
Group 8A	20.17	2.87
Group 8B	19.35	2.87
Group 8C	20.21	2.87
Area 2:		
Group 1	13.10	2.87
Group 2	13.30	2.87
Group 3	13.64	2.87
Group 4	14.18	2.87
Group 5	14.41	2.87
Group 5A	14.71	2.87
Group 6	14.92	2.87



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Group 7	15.54	2.87
Group 8	16.34	2.87
Group 8A	17.67	2.87
Group 8B	16.85	2.87
Group 8C	17.71	2.87

WELDERS -- Receive the rate prescribed for craft performing operation to which welding is incidental.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29 CFR, 5.5 (a) (1) (11))

**\*AREA DESCRIPTIONS**

**\*BRICKLAYERS; STONEMASONS:**

Northern Area: Apache, Coconino and Gila Counties; Graham County (west and north of the San Francisco River to the Gila River); Greenlee County (west and north of the San Francisco River to the Gila River); Maricopa, Mohave, and Navajo Counties; Pinal County (north of a boundary line drawn west along the Gila River to the western City limits of Florence, a straight line from the extreme southwestern City limits of Florence to the extreme southern City limits of Coolidge, then a straight line to the extreme southern City limits of Casa Grande, with the line extending to the Maricopa/Pinal County Line); Yavapai, Yuma and La Paz Counties:

- Zone A: 0-50 road miles from the City Hall in Phoenix
- Zone B: 50-75 road miles from the City Hall in Phoenix
- Zone C: 75-100 road miles from the City Hall in Phoenix
- Zone D: 100-200 road miles from the City Hall in Phoenix
- Zone E: 200 road miles and over from the City Hall in Phoenix

Southern Area: Cochise County; Graham County (east and south of the San Francisco River to the Gila River); Greenlee County (east and south of the San Francisco River to the Gila River); Pima County; Pinal County (south of a boundary line drawn west along the Gila River to the western City limits of Florence, a straight line from the extreme southwestern City limits of Florence to the extreme southern City limits of Coolidge, then a straight line to the extreme southern City limits of Casa Grande, with the line extending to the Maricopa/Pinal County Line); Santa Cruz Counties:

- Zone A: 0-15 road miles from Tucson City limits
- Zone B: 15-30 road miles from Tucson City limits
- Zone C: 30-40 road miles from Tucson City limits
- Zone D: Over 40 road miles from Tucson City limits

**CARPENTERS:**

Northern Area: Area north of a straight line drawn between a point 35 miles due north of the City Hall in Flagstaff and a point 35 miles due north of the City Hall in Kingman, extending to the Arizona/Nevada State Line on the west; and connecting to a point 35 miles due north of the City Hall in Holbrook, thence due east to the intersection of the Arizona/New Mexico State Line  
 Central and Southern Areas: All areas not included in the Northern Area



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**CEMENT MASONS:**

Zone 1: Apache, Coconino, and Gila Counties; Graham County (north of Sentinel-Casa Grande-Safford Line); Greenlee County (north of Sentinel-Casa Grande-Safford Line); Maricopa County (north of Sentinel-Casa Grande-Safford Line); Mohave, and Navajo Counties; Pinal County (north of Sentinel-Casa Grande-Safford Line); Yavapai, Yuma and La Paz Counties:

**NORTHERN AREA:** Area North of a straight line drawn between a point 35 miles due north of the City Hall in Flagstaff and a point 35 miles due north of the City Hall in Kingman, extending to the Arizona/Nevada State Line on the west and connecting to a point 35 miles due north of the City Hall in Holbrook, thence due east to the intersection of the Arizona/New Mexico State Line.

**CENTRAL and SOUTHERN AREAS:** All Areas not included in the NORTHERN AREA

Zone 2: Southern parts of Cochise, Graham, Greenlee, Maricopa, and Pinal Counties; Pima and Santa Cruz Counties

**ELECTRICIANS:**

Area 1: Apache County (north of Highway #66)

Area 2: Coconino County; Navajo County (north and west of a boundary line beginning at a point where Clear Creek crosses the Coconino/Navajo County Line and then extending in a northeasterly direction along Clear Creek and northeasterly to Cottonwood Wash, along Cottonwood Wash extending northeasterly to where it intersects the Navajo Indian Reservation, then easterly along the Navajo Indian Reservation boundary line to a point where it intersects the Navajo/Apache County Line):

Zone A: 5 miles north-south, east and west of the Post Offices of Williams, Sedona, and Winslow

Zone B: Remainder of Area 2 not covered by Zone A

Area 3: Apache County (south of Highway #66); Gila County; Navajo County (south and east of a boundary beginning at a point where Clear Creek crosses the Coconino/Navajo County Line, then extending in a northeasterly direction along Clear Creek and northeasterly to Cottonwood Wash, along Cottonwood Wash extending northeasterly to where it intersects the Navajo Indian Reservation, then easterly along the Navajo Indian Reservation boundary line to a point where it intersects the Navajo/Apache County Line); Pinal County (north of the line, "First Standard Parallel South" and east of the line "Second Guide Meridian East")

Area 4: Maricopa and Mohave Counties; Pinal County (north and west of the boundary line beginning at a point where the Papago Indian Reservation Road #15 crosses the Pima/Pinal County Line, then extending in a northeasterly direction on the Papago Indian Reservation Road #15 to the intersection with the Florence Canal, north and east on the Florence Canal to the intersection with the line, "Second Guide Meridian East", then north to the Pinal/Maricopa County Line); Yavapai County

Area 5: Cochise, Graham, Greenlee, and Pima Counties; Pinal County (south and east of the boundary line beginning at a point where the Papago Indian Reservation Road #15 crosses the Pima/Pinal County Line, then extending in a northeasterly direction on the Florence Canal, north and east on the Florence Canal to the intersection



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with the line, "Second Guide Meridian East", then north to the line, "First Standard Parallel South", and along that line to the Graham/Pinal County Line); Santa Cruz, Yuma, and La Paz Counties

**IRONWORKERS:**

Northern Area: Area from a line 10 miles north and parallel to Highway #66, north to the Arizona-Utah border and from the Arizona-California border east to the Arizona New Mexico border  
Southern Area: All Areas not included in the Northern Area

**LINE CONSTRUCTION:**

Zone 1: Phoenix and Tucson 30 miles radius from the center of Town; Area within 10 mile radius from the City Hall in Yuma  
Zone 1-A: Flagstaff, Globe, and Kingman; and 10 mile radius from the center of Town  
Zone 2: Other areas not covered by Zone 1 and Zone 1-A

**PAINTERS:**

Area 1: Apache, Coconino, Navajo, and Yavapai Counties (north of Woodruff/Camp Wood Line); Mohave County (north of a line following the Geodetic Hualapai Boundary Line to the Colorado River, a distance of 23 miles east of Pierce Ferry and then intersecting the Arizona/Nevada State Line):

Zone A: 0-20 road miles from Courthouse in Flagstaff  
Zone B: 20-35 road miles from Courthouse in Flagstaff  
Zone C: 35-80 road miles from Courthouse in Flagstaff  
Zone D: 80 road miles and over from Courthouse in Flagstaff

Area 2: Apache, Coconino, Navajo, and Yavapai Counties (south of the Woodruff/Camp Wood Line); Gila, Graham, Greenlee, Maricopa, and Pinal Counties (north of 33rd Parallel); Mohave County (south of a line following the Geodetic Hualapai Boundary Line to the Colorado River, a distance of 23 miles east of Pierce Ferry and then intersecting the Arizona/Nevada State Line):

Zone A: 0-40 paved road miles from Courthouse in Phoenix; also, Luke and Williams Air Force Bases  
Zone B: 41-60 paved road miles from Courthouse in Phoenix  
Zone C: 61 paved road miles and over from Courthouse in Phoenix

Area 3: Cochise County; Graham, Greenlee, Maricopa and Pinal Counties (south of 33rd Parallel); Pima, Santa Cruz, Yuma, and La Paz Counties:

Zone A: 0-30 paved road miles from Stone and Congress in Tucson or from the County Courthouse in Yuma  
Zone B: 31-40 paved road miles from Stone and Congress in Tucson or from the County Courthouse in Yuma  
Zone C: 41-50 paved road miles from Stone and Congress in Tucson or from the County Courthouse in Yuma  
Zone D: 51 paved road miles and over from Stone and Congress in Tucson or from the County Courthouse in Yuma

**PLUMBERS & PIPEFITTERS**

**ZONE 1**



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Base points shall be: Phoenix--the intersection of Central Avenue and Jefferson Street; Flagstaff, Yuma, Kingman, Prescott, Havasu City and Winslow -- the main Post Office building in each city. The "Free Zone" (Zone No. 1) from Phoenix shall be 40 miles from the stated base point. The Free Zone from Flagstaff, Yuma, Kingman, Prescott, Havasu City and Winslow shall be 20 road miles from the stated base point. In addition, all areas within the city limits of Phoenix, Chandler, Scottsdale, Tempe, Glendale, Mesa and Gilbert, as well as that area bordered or encompassed by Apache Trail on the north, Higley Road on the east, Elliott Road on the south and Arizona Avenue on the west, and Sun City West will be included as Free Zones. Any work contracted for outside of these Free Zones will be determined from the Phoenix base point.

**ZONE 2**

Pay Zone shall refer to all jobs outside of the Free Zones listed above.

**ZONE 3**

Seven Southern Counties of Arizona: Pima, Gila, Pinal, Graham, Greenlee, Santa Cruz, and Cochise

**LABORERS; POWER EQUIPMENT OPERATORS; and TRUCK DRIVERS:**

Area 1: Area north of a straight line drawn between a point 35 miles due north of the City Hall in Flagstaff and a point 35 miles due north of the City Hall in Kingman, extending to the Arizona/Nevada State Line on the west; and connecting to a point 35 miles due north of the City Hall in Holbrook, thence due east to the intersection of Arizona/New Mexico State Line  
Area 2: All Areas not included in Area 1

**\*GROUP DESCRIPTIONS**

**\*LABORERS**

Group 1: Laborer, General or Construction; Tool Dispatcher or Checker; Manually Controlled Signal Operator; Fence Builder; Guard Rail Builder - highway; Chat Box Man; Dumpman and/or Spotter; Rip Rap Stone Man; Rock Slinger; Head Rock Slinger (\$.25); Form Stripper; Packing Rod Steel and Form Stripper; Packing Rod Steel and Pans; Cesspool Diggers and Installers; Astro Turf Layer; Clean Up - Bull Gang Trackman; Railroad Chipper (clearing and grubbing); Kettleman - Tarman; Spikers; Wrenchers - Creosote Tieman; Floor Sanders - Concrete; Sandblaster (Pot Tender); Powderman Tender; Fine Grader; All Tenders not herein separately classified; Window Cleaner Flaggers

Group 2: Concrete Laborer (belt, pipe and/or Hoseman); Cement Mason Tender; Cutting Torch Operator; Power-type Concrete Buggy; Bander

Group 3: Chuck Tender (except tunnel); Guinea/Chaser; Operator and Tender of Pneumatic and Electric Tools; Concrete Vibrating Machines, Chain Saw Machines (on clearing and grubbing); Hydraulic Jacks and similar mechanical tools not separately herein classified; Pipe



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Caulker and/or Backup Man - Pipeline; Rigger and Signal Man - Pipeline; Pipe Wrapper; Cribber; Shorer (except tunnel); Pneumatic Gopher; Pre-cast, Manhole Erector

Group 4: Asphalt Raker and Ironer; Air and Water Washout Nozzlemán (low and high pressure); Scaler (using Bos n's Chair or Safety Belt); Tamper (mechanical - all types); Sandblaster (Nozzlemán); Concrete Saw (hand-guided); Concrete Cutting Torch; Gunité (Gunman, Mixerman, Rodman); bio-filter; Pressman; Installer; Operator; Hand-guided Trencher and similarly operated equipment; Driller (Jackhammer and/or Pavement Breaker); Grade Setter (pipeline); Pipe Layer (including but not limited to non-metallic transite and plastic pipe, water pipe, sewer pipe, drain pipe, underground tile and conduit)

Group 5: Drill Doctor and/or Air Tool Repairman; Scaler (Driller); Form Setter and/or Builder; Welder and/or Pipe Layer installing process piping; Driller - Core Diamond, Wagon, Air Track, Joy, Mustang, PR-143, 220 Gardner, Denver, Hydrasonic; Powder Man; Water Blaster Operator

(TUNNEL and SHAFT WORK)

Group 1: Bull Gang, Muckers, Trackman; Dumpmen; Concrete Crew (includes Rodders and Spreaders); Grout Crew; Swamper (Brakeman and Switchmen on tunnel work)

Group 2: Nipper; Chucktender, Cabletender; Vibratorman, Jackhammer, Pneumatic Tools (except Driller)

Group 3: Grout Gunman

Group 4: Timberman, Retimberman - wood or steel blaster, Driller, Powderman; Cherry Pickerman; Powderman - Primer House; Steel Form Raiser and Setter; Kemper and other Pneumatic Concrete Placer Operator; Miner - Finisher; Miners - Tunnel (hand or machine)

Group 5: Diamond Drill

Group 5A: Shaft and Raise Miner Welder

POWER EQUIPMENT OPERATORS

Group 1: Air Compressor Operator; Pump Operator; Conveyor Operator; Generator Operator (all); Power Grizzly Operator; Fireman (all); Welding Machine Operator; Tripper Operator; Concrete Mixer Operator, skip type; Highline Cableway Signalmán

Group 2: Oiler; Forklift and Ross Carrier Operator; Skiploader, 1 1/2 cu. yd. and less; Pavement Breaker; Roller Operator (except as otherwise classified); Wheel-type Tractor Operator (Ford-Ferguson type); Slurry Seal Machine Operator (driver Moto-paver); Power Sweeper

Group 3: Self-propelled Chip Spreading Machine Conveyor Operator; Dinky Operator, under 20 ton; Elevator Hoist Operator, Husky and similar



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Group 4: Motor Crane Driver; Beltcrete Operator; Curing Machine Operator, Boring Bridge and Texture; Cross Tining and Pipe Float; Straw Blower; Hydrographic Seeder; Hydrographic Mulcher; Jumbo Finishing Machine; Joint Inserter

Group 5: A-frame Boom Truck or Winch Truck Operator; Grade Checker (excluding Civil Engineer); Multiple Power Concrete Saw Operator; Screed Operator; Stationary Pipe Wrapping and Cleaning Machine Operator; Tugger Operator

Group 6: Aggregate Plant Operator (including crushing, screening, and sand plants, etc.); Asphalt Laydown Machine Operator; Asphalt Plant Mixer Operator; Boring Machine Operator; Concrete Mechanical Tamping, Spreading or Finishing Machine Operator (including Clary, Johnson or similar types); Concrete Pump Operator; Concrete Batch Plant Operator, all types and sizes; Conductor, Brakeman, or Handler; Drilling Machine Operator, all types and sizes except as otherwise classified; Field Equipment Serviceman; Kolman Belt Loader Operator or similar type, with belt width 48" or over; Locomotive Engineer (including Dinky 20 tons weight and over); Moto-paver and similar type equipment Operator; Operating Engineer Rigger; Pneumatic-tired Scraper Operator, up to and including 12 cu. yds. (Turnapull, Euclid, Cat, D.W. Hancock, and similar equipment); Power Jumbo Form Setter Operator; Pressure Grout Machine Operator (as used in heavy engineering construction); Road Oil Mixing Machine Operator; Roller Operator, on all type asphalt pavement; Self-propelled Compactor, with blade; Skip Loader Operator, all types with a rated capacity over 1-1/2 but less than 4 cu. yds.; Slip Form Operator (power driven lifting device for concrete forms); Soil Cement Road Mixing Machine Operator, single pass type; Stationary Central Generating Plant Operator, rated 300 K.W. or more; Surface Heater and Planer Operator; Traveling Pipewrapping Machine Operator

Group 7: Pneumatic-tired Scraper Operator, all sizes and types over 12 cu. yds. MRC (Turnapull, Euclid, Cat, D.W. Hancock and similar equipment); Tractor Operator (Pusher, Bulldozer, Scraper); Trenching Machine Operator

Group 8: Asphalt or Concrete Planing, Rotomill, and Milling Machine Operator; Auto Grade Machine Operator (CMI and similar equipment); Boring Machine Operator (including Mole, Badger and similar type); Concrete Mixer Operator, paving type and Mobile Mixers; Concrete Pump Operator, with boom attached (truck mounted); Crane Operator, Crawler and Pneumatic type under 100 ton capacity MRC; Crawler-type Tractor Operator, with boom attachment or Slope Bar; Derrick Operator; Forklift Operator for hoisting personnel; Gradall Operator; H.D. Mechanic and/or Welder; Helicopter Hoist Operator; Highline Cableway Operator (less than 20 tons rated capacity); Mass Excavator Operator (150 Bucyrus Erie and similar types); Mechanical Hoist Operator (two or more drums); Motor Grader Operator, any type power blade; Motor Grader Operator, with Elevating Grader attachment; Mucking Machine Operator; Overhead Crane Operator; Piledriver Engineer (portable, stationary or skid rig); Pneumatic-tired Scraper Operator, all sizes and types (Turnapull, Euclid, Cat, D.W. Hancock and similar equipment over 45 cu. yds. MRC); Power driven Ditch Lining or Ditch Trimming Machine Operator; Skip Loader Operator, all



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types rated capacity 4 cu. yds. but less than 8 cu. yds.; Slip Form Paving Machine Operator (including Gunnert, Zimmerman and similar types); Specialized Power Digger Operator, attached to wheel-type tractor; Tower Crane (or similar type) Operator; Tugger Operator (two or more); Universal Equipment Operator, Shovel, Backhoe, Dragline, Clamshell, etc., up to 8 cu. yds.

Group 9: Crane Operator, Pneumatic or Crawler, 100 ton hoisting capacity and over MRC rating; Helicopter Pilot, FAA qualified, when used in construction work other than executive travel and single casual rental; Highline Cableway Operator, over 20 ton rated capacity and using Traveling Head and Tail Tower; Remote-control Earth Moving Equipment Operator; Skip Loader Operator, all types with rated capacity of 8 cu. yds. or more; Universal Equipment Operator, Shovel, Backhoe, Dragline, Clamshell, etc., 8 cu. yds. and over

#### TRUCK DRIVERS

Group 1: Teamsters; Pick-ups; Station Wagon; Man Haul Driver

Group 2: Dump or Flatrack (2 or 3 axle); Water Truck (under 2500 gallons); Buggymobile (1 cu. yd. or less); Bus Driver; Self-propelled Street Sweeper; Shop Greaser

Group 3: Dump or Flatrack (4 axle); Dumpster or Dumpster (less than 7 cu. yds.); Water Truck (2500 gallons but less than 4000 gallons); Tireman

Group 4: Dumpster or Dumpster (7 cu. yds. but less than 16 cu. yds); Dump or Flatrack (5 axle); Water Truck (4000 gallons and over); Slurry type equipment Driver or Leverman; Vacuum Pump Truck Drivers; Flaherty Spreader or similar type equipment or Leverman; Transit Mix (8 cu. yds. or less mixer capacity); Ambulance Driver

Group 5: Dump or Flatrack (6 axle); Transit Mix (over 8 cu. yds. but less than 10.5 cu. yds. mixer capacity); Rock Truck (i. e. Dart, Euclid and other similar type end dumps, single unit) less than 16 cu. yds.

Group 5A: Oil Tanker or Spreader and/or Bootman, Retortman or Leverman

Group 6: Transit Mix (over 10.5 cu. yds. but less than 14 cu. yds. mixer capacity); Ross Carrier, Fork Lift or Lift Truck; Hydro Lift, Swedish Crane, Iowa 300 and similar types; Concrete Pump (when integral part of Transit Mix Truck); Dump or Flatrack (7 axle); Transport Driver (unless axle rating results in higher classification)

Group 7: Dump or Flatrack (8 axle)



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Group 8: Off-highway equipment Driver including but not limited to: 2 or 4 wheel power unit, i.e Cat, DW Series, Euclid, International and similar type equipment transporting material when top loaded or by external means including pulling Water Tanks, Fuel Tanks or other applications under Teamster Classifications; Rock truck (Dart, Euclid, or other similar end dump types) 16 cu. yds. and over; Ejectalls; Dumptor or Dumpster (16 cu. yds. and over); Dump or Flatrack (9 axle)

Group 8A: Heavy-duty Mechanic/Welder; Body and Fender Man

Group 8B: Field Equipment Servicemen or Fuel Truck Driver

\*Group 8C: Body and Fender man

**SPECIFICATIONS**

for

**NEW RIVER IMPROVEMENTS**

Maricopa County, Arizona

Authority:

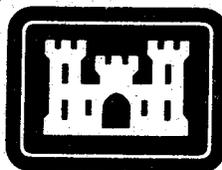
Public Law 89-298,  
Flood Control Act of 1965

Appropriation:

96x3123, Construction, General

96x8862, Contributed Funds, Required

96x8862, Contributed Funds, Other  
Corps of Engineers, Civil



**US Army Corps  
of Engineers**

Los Angeles District

## SPECIAL CLAUSES

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1. COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (1984 APR) FAR 52.212-3. The Contractor shall be required to (a) commence work under this contract within 5 calendar days after the date the Contractor receives the notice to proceed, (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than 240 calendar days after the date of receipt of notice to proceed, except for seeding and planting. Seeding and planting shall be completed as soon as practicable and within the time limits stated in the Technical Provisions or as directed by the Contracting Officer. The time stated for completion shall include final cleanup of the premises.

#### 2. LIQUIDATED DAMAGES-CONSTRUCTION (APR 1984) FAR 52.212-5.

2.1 If the Contractor fails to complete the work within the time specified in the contract, or any extensions, the Contractor shall pay to the Government as liquidated damages, the sum of \$750.00 for each day of delay.

2.2 If the Government terminates the Contractor's right to proceed, the resulting damage will consist of liquidated damages until such reasonable time as may be required for final completion of the work together with any increased costs occasioned the Government in completing the work.

2.3 If the Government does not terminate the Contractor's right to proceed, the resulting damage will consist of liquidated damages until the work is completed or accepted.

#### 3. CONTRACT DRAWINGS AND SPECIFICATIONS. (JAN 1965) DFARS 52.236-7002.

3.1 Ten sets of large scale contract drawings and specifications will be furnished the Contractor without charge except applicable publications incorporated into the technical provisions by reference. Additional sets will be furnished on request at the cost of reproduction. The work shall conform to the following contract drawings which form a part of these specifications and are available in the office of the U.S. Army Engineer District, Los Angeles, 300 North Los Angeles Street, Los Angeles, California. The list of drawings set out in the following drawing is hereby incorporated by reference into the contract:

District File No.

252/320

3.2 Omissions from the drawings or specifications or the misdescription of details of work which are manifestly necessary to carry out the intent of the drawings and specifications, or which are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work but they shall be performed as if fully and correctly set forth and described in the drawings and specifications.

3.3 The Contractor shall check all drawings furnished him immediately upon their receipt and shall promptly notify the Contracting Officer of any discrepancies. Figures marked on drawings shall in general be followed in preference to scale measurements. Large scale drawings shall in general govern small scale drawings. The Contractor shall compare all drawings and verify the figures before laying out the work and will be responsible for any errors which might have been avoided thereby.

#### 4. SUBMITTALS. (ER 415-1-10)

4.1 General. Reference is made to the CONTRACT CLAUSE: SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION. The Contractor shall submit for approval all shop drawings, certificates of compliance, equipment data, and/or material samples called for by these specifications.

4.2 Submittal Register. Within 15 days after receipt of notice to proceed, the Contractor shall complete and submit to the Contracting Officer, in duplicate, Submittal Register, ENG FORM 4288, listing all submittals and dates. Blank ENG FORMS 4288 will be furnished by the Contracting Officer on request. In addition to the items listed on the register, the Contractor will furnish submittals for any deviation from the plans or specifications. The scheduled need dates must be recorded on the register for each item for control purposes. In preparing the register, adequate time, a minimum of 30 days, shall be allowed for review, approval and possible resubmittal. Scheduling shall be coordinated with the approved progress schedule. The Contractor's Quality Control representative shall review the listing at least every 30 days and take appropriate action to maintain an effective system. Copies of updated or corrected listing shall be submitted to the Contracting Officer at least every 60 days in the quantity specified. Payment will not be made for any material or equipment which does not comply with contract requirements.

4.3 Transmittals. The Contractor shall complete ENG FORM 4025, "Transmittal of Shop Drawings, Equipment Data, Material Samples, or Manufacturer's Certificates of Compliance" with each set of shop drawings, certificates, equipment data or samples submitted. Blank ENG FORM 4025 will be furnished by the Contracting Officer on request. Six (6) copies of each submittal will be required.

4.4 Shop Drawings. The Contractor shall submit to the Contracting Officer for approval 10 copies of all shop drawings called for by these specifications. One set will be returned to the Contractor.

4.5 Certificates of Compliance (1969 MAY OCE). Any certificates required for demonstrating proof of compliance of materials with specification requirements shall be executed in six copies. Each certificate shall be signed by an official

authorized to certify in behalf of the manufacturing company and shall contain the name and address of the Contractor, the project name and location, and the quantity and date or dates of shipment or delivery to which the certificates apply. Copies of laboratory test reports submitted with certificates shall contain the name and address of the testing laboratory and the date or dates of the tests to which the report applies. Certification shall not be construed as relieving the Contractor from furnishing satisfactory material, if, after tests are performed on selected samples, the material is found not to meet the specific requirements.

4.6 Resubmittals. If a submittal is returned for correction or is not satisfactory and is disapproved by the Contracting Officer, the Contractor shall resubmit the corrected material, in the same quantity, as specified for the original submittal, for approval within 14 days after receipt of the disapproved material.

5. PHYSICAL DATA (APR 1984) FAR 52.236-4. Data and Information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.

5.1 The indications of physical conditions on the drawings and in the specifications are the result of site investigations by foundation investigations and test trenches.

5.2 Weather Conditions. The Contractor shall satisfy himself as to the hazards likely to arise from weather conditions. Complete weather records and reports may be obtained from any U.S. Weather Bureau Office.

5.3 Transportation Facilities. The Contractor shall make his own investigation of the condition of available public and private roads, railroads, and of clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress at the site work. It shall be the Contractor's responsibility to construct and maintain at his own expense, any haul roads required for construction operations.

5.4 Additional Information, including but not necessarily limited to, results of laboratory tests of material encountered in test holes or other explorations and field logs, is available for inspection and study in the office of District Engineer, Geotechnical Branch, 300 N. Los Angeles Street, Los Angeles, California.

6. LAYOUT OF WORK (APR 1965) EFARS 52.2/9108(b).

6.1 The Government has established bench marks and horizontal control points at the site of the work. These are described and indicated on contract drawings.

6.2 From these control points the Contractor shall lay out the work by establishing all lines and grades at the site necessary to control the work and shall be responsible for all measurements that may be required for the execution of the work to the location and limit marks prescribed in the specifications or on the contract drawings. The Contractor shall place and establish additional stakes and markers as may be necessary for control and guidance of his construction operations. All survey data shall be recorded in accordance with standard and approved methods. All field notes, sketches, recordings, and computations made by

the Contractor in establishing above horizontal and vertical control points shall be available at all times during the progress of the work for ready examination by the Contracting Officer or his duty authorized representative.

6.3 The Contractor shall furnish, at his own expense, all such stakes, spikes, steel pins, templates, platforms, equipment, tools, and materials and all labor as may be required in laying out any part of the work from the control points established by the Government. It shall be the responsibility of the Contractor to maintain and preserve all stakes and other markers established by him until authorized to remove them. If any of the control points established at the site by the Government are destroyed by or through the negligence of the Contractor prior to their authorized removal, they may be replaced by the Contracting Officer, and the expense of replacement will be deducted from an amount due or which may become due the Contractor. The Contracting Officer may require that work be suspended at any time when horizontal and vertical control points established at the site by the Contractor are not reasonably adequate to permit checking the work. Such suspension will be withdrawn upon proper replacement of the control points.

7. QUANTITY SURVEYS (APR 1984) FAR 52.236-16. EFARS 52.2/9102(d).

7.1 Quantity surveys shall be conducted, and the data derived from these surveys shall be used in computing the quantities of work performed and the actual construction completed and in place.

7.2 The Government shall conduct the original and final surveys and make the computations based on them. The Contractor shall conduct the surveys for any periods for which progress payments are requested and shall make the computations based on these surveys. All surveys conducted by the Contractor shall be conducted under the direction of a representative of the Contracting Officer, unless the Contracting Officer waives this requirement in a specific instance.

7.3 Promptly upon completing a survey, the Contractor shall furnish the originals of all field notes and all other records relating to the survey or to the layout of the work to the Contracting Officer, who shall use them as necessary to determine the amount of progress payments. The Contractor shall retain copies of all such material furnished to the Contracting Officer.

8. DAMAGE TO WORK (1966 MAR OCE). The responsibility for damage to any part of the permanent work shall be as set forth in the CONTRACT CLAUSE: PERMITS AND RESPONSIBILITIES. However, if, in the judgment of the Contracting Officer, any part of the permanent work performed by the Contractor is damaged by flood or earthquake, which damage is not due to the failure of the Contractor to take reasonable precautions or to exercise sound engineering and construction practices in the conduct of the work, the Contractor will make the repairs as ordered by the Contracting Officer and full compensation for such repairs will be made at the applicable contract unit or lump sum prices as fixed and established in the contract. If, in the opinion of the Contracting Officer, there are no contract unit or lump sum prices applicable to any part of such work an equitable adjustment pursuant to CONTRACT CLAUSE: CHANGES, will be made as full compensation for the repairs of that part of the permanent work for which there are no applicable contract unit or lump sum prices. Except as herein provided, damage to all work (including temporary construction), utilities, materials, equipment and plant shall be repaired to the satisfaction of the Contracting Officer at the Contractor's expense, regardless of the cause of such damage.

9. VARIATION IN ESTIMATED QUANTITIES-SUBDIVIDED ITEMS (1985 JAN HQ USACE) EFARS 52.2/9109(g). This clause is applicable only to Item Nos. 3, 4, and 5.

9.1 Variation from the estimated quantity in the actual work performed under any second or subsequent sub-item or elimination of all work under such a second or subsequent sub-item will not be the basis for an adjustment in contract unit price.

9.2 Where the actual quantity of work performed for Item Nos. 3, 4, and 5 is less than 90 percent of the quantity of the first sub-item listed under such item, the Contractor will be paid at the contract unit price for that sub-item for the actual quantity of work performed and, in addition, an equitable adjustment in contract price shall be made upon demand of the Contractor. The equitable adjustment in price for the under-run shall be made on the basis that the Contractor has assumed the risk and is entitled to no adjustment for the first 10 percent under-run.

9.3 If the quantity of work performed under Item Nos. 3, 4, and 5 exceed 105 percent or is less than 96 percent of the total estimated quantity of the sub-items under that item and if such variation causes an increase or a decrease in the time required for performance of this contract the contract completion time will be adjusted as follows.

9.3.1 If the quantity variation is such that it will cause an increase in the time necessary for completion, the Contracting Officer shall, upon receipt of a written request for an extension within 10 days from the beginning of such delay or within such further period of time which the Contracting Officer grants prior to the date of final settlement of the contract, ascertain the facts and make such adjustment for extending the completion date as in his judgment the findings justify.

9.3.2 If the quantity variation is such that it will cause a decrease in the time necessary for completion, the Contracting Officer shall ascertain the facts and promptly notify the Contractor in writing of his findings and the extent of adjustment.

9.4 If the parties fail to agree upon the adjustment to be made the dispute shall be determined as provided in the CONTRACT CLAUSE: DISPUTES.

10. EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE. (1985 JAN HQ USACE) EFARS 52.2/9108(f).

10.1 Allowable cost for construction and marine plant and equipment in sound workable condition owned or controlled and furnished by a Contractor or subcontractor at any tier shall be based on actual cost data when the Government can determine both ownership and operating costs for each piece of equipment or equipment groups of similar serial and series from the Contractor's accounting records. When both ownership and operating costs cannot be determined from the Contractor's accounting records, equipment costs shall be based upon the applicable provisions of EP 1110-1-8, "Construction Equipment Ownership and Operating Expense Schedule," Region VII. Working conditions shall be considered to be average for determining equipment rates using the schedule unless specified otherwise by the Contracting Officer. For equipment not included in the schedule, rates for comparable pieces of equipment may be used or a rate may be developed

using the formula provided in the schedule. For forward pricing, the schedule in effect at the time of negotiations shall apply. For retrospective pricing, the schedule in effect at the time the work was performed shall apply. For retrospective pricing, the schedule in effect at the time the work was performed shall apply.

10.2 Equipment rental costs are allowable, subject to the provisions of FAR 31.105(d)(ii) and FAR 31.205-36 substantiated by certified copies of paid invoices. Rates for equipment rented from an organization under common control, lease-purchase or sale-leaseback arrangements will be determined using the schedule except that rental costs leased from an organization under common control that has an established practice of leasing the same or similar equipment to unaffiliated lessees are allowable. Costs for major repairs and overhaul are unallowable.

10.3 When actual equipment costs are proposed and the total amount of the pricing action is over \$25,000, cost or pricing data shall be submitted on Standard Form 1411, "Contract Pricing Proposal Cover Sheet." By submitting cost or pricing data, the Contractor grants to the Contracting Officer or an authorizing representative the right to examine those books, records, documents and other supporting data that will permit evaluation of the proposed equipment costs. After price agreement the Contractor shall certify that the equipment costs or pricing data submitted are accurate, complete and current.

#### 11. PERFORMANCE OF WORK BY THE CONTRACTOR (1984 APR) FAR 52.236-1.

11.1 The Contractor shall perform on the site, and with its own organization, work equivalent to at least thirty-five (35) percent of the total amount of work to be performed under the contract. This percentage may be reduced by a supplemental agreement of this contract if, during performing the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the Government.

#### 12. PERFORMANCE EVALUATION OF CONTRACTOR (1985 JAN HQ USACE) EFARS 52.2/9006(f).

12.1 As a minimum, the Contractor's performance will be evaluated upon final acceptance of the work. However, interim evaluation may be prepared at any time during contract performance when determined to be in the best interest of the Government.

12.2 The format for the evaluation will be SF 1421, and the Contractor will be rated either outstanding, satisfactory, or unsatisfactory in the areas of Contractor Quality Control, Timely Performance, Effectiveness of Management, Compliance with Labor Standards, and Compliance with Safety Standards. The Contractor will be advised of any unsatisfactory rating either in an individual element or in the overall rating, prior to completing the evaluation, and all Contractor comments will be made a part of the official record. Performance Evaluation Reports will be available to all DOD Contracting offices for their future use in determining Contractor responsibility, in compliance with DFARS 36.201(C)(1).

13. HAZARDOUS MATERIAL IDENTIFICATION AND MATERIAL SAFETY DATA (APR 1984)  
FAR 52.223-3.

13.1 The Contractor agrees to submit a Material Safety Data Sheet (Department of Labor Form OSHA-20), as prescribed in Federal Standard No. 313A, for all hazardous material 5 days before delivery of the material, whether or not listed in Appendix A of the Standard. This obligation applies to all materials delivered under this contract which will involve exposure to hazardous materials or items containing these materials.

13.2 "Hazardous material," as used in this clause is as defined in Federal Standard No. 313A, in effect on the date of this contract.

13.3 Neither the requirements of this clause nor any act or failure to act by the Government shall relieve the Contractor of any responsibility or liability for the safety of Government, Contractor, or subcontractor personnel or property.

13.4 The Contractor shall comply with applicable Federal, state, and local laws, codes, ordinances, and regulations (including the obtaining of licenses and permits) in connection with hazardous material.

13.5 The Government's rights in data furnished under this contract with respect to hazardous material are as follows:

13.5.1 To use, duplicate, and disclose any data to which this clause is applicable. The purposes of this right are to (i) apprise personnel of the hazards to which they may be exposed in using, handling, packaging, transporting, or disposing of hazardous materials; (ii) obtain medical treatment for those affected by the material; and (iii) have others use, duplicate, and disclose the data for the Government for these purposes.

13.5.2 To use, duplicate, and disclose data furnished under this clause, in accordance with subparagraph 13.5.1 above, in precedence over any other clause of this contract providing for rights in data.

13.5.3 That the Government is not precluded from using similar or identical data acquired from other sources.

13.5.4 That the data shall not be duplicated, disclosed, or released outside the Government, in whole or in part for any acquisition of manufacturing purpose, if the following legend is marked on each piece of data to which this clause applies-

"This is furnished under United States Government Contract No. \_\_\_\_\_ and shall not be used, duplicated, or disclosed for any acquisition or manufacturing purpose without the permission of \_\_\_\_\_. This legend shall be marked on any reproduction of this data."

13.5.5 That the Contractor shall not place the legend or any other restrictive legend or any data which (i) the Contractor or any subcontractor previously delivered to the Government without limitations or (ii) should be delivered without limitations under the conditions specified in the Federal Acquisition Regulation in the clause at 52.227-18, Rights in Data.

13.6 The Contractor shall insert this clause, including this paragraph, with appropriate changes in the designation of the parties, in subcontracts at any tier (including purchase designations or purchase orders) under this contract involving hazardous material.

14. AS-BUILT DRAWINGS (ER 415-345-38).

14.1 General. The Contractor shall furnish 3 full size sets of as-built blue-line prints for use in preparation of as-built drawings by the Government. The as-built prints shall be a record of the construction as installed and completed by the Contractor. They shall include all the information shown on the contract set of drawings and a record of all deviations, modifications, or changes from those drawings, however minor, which were incorporated in the work, all additional work not appearing on the contract drawings, and all changes which are made after final inspection of the contract work. In event the Contractor accomplishes additional work which changes the as-built conditions of the facility after submission of the as-built drawings, the Contractor shall furnish revised and/or additional drawings as required to depict as-built conditions. The requirements for these additional drawings will be the same as for the as-built drawings included in the original submission. The prints shall show the following information, but not be limited thereto:

14.1.1 The location and description of any utility lines or other installations of any kind or description known to exist within the construction area. The location includes dimensions to permanent features.

14.1.2 The location and dimensions of any changes within the building or structure.

14.1.3 Correct grade or alignment of roads, structures or utilities if any changes were made from contract plans.

14.1.4 Correct elevations if changes were made in site grading.

14.1.5 Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor including but not limited to fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.

14.1.6 The topography and grades of all drainage installed or affected as a part of the project construction.

14.1.7 All changes or modifications which result from the final inspection.

14.1.8 Options. Where contract drawings or specifications allow options, only the option selected for construction shall be shown on the as-built drawings.

14.1.9 Submittal to Contracting Officer for review and approval. Not later than 2 weeks after acceptance of the project by the Government, the Contractor shall deliver to the Contracting Officer 3 full size sets of blue-line prints marked up to depict as-built conditions. If upon review, the drawings are found to contain errors and/or omissions, they shall be returned to the Contractor for corrections. The Contractor shall complete the corrections and return the drawings to the Contracting Officer within ten (10) calendar days.

14.2 Preliminary As-Built Prints. The Contractor shall maintain one set of paper prints to show the as-built conditions. These as-built marked prints shall be kept current and available on the jobsite at all times. All changes from the contract plans which are made in the work or additional information which might be uncovered in the course of construction shall be accurately and neatly recorded as they occur by means of details and notes. The as-built marked prints will be jointly inspected for accuracy and completeness by the Contracting Officer's representative and responsible representative of the construction Contractor prior to submission of each monthly pay estimate. Information to be included on the preliminary prints shall conform to the requirements of final as-built prints.

15. ENVIRONMENTAL LITIGATION (1974 NOV OCE) EFARS 52.2/9109(j).

15.1 If the performance of all or part of the work is suspended, delayed, or interrupted due to an order of a court of competent jurisdiction as a result of environmental litigation, as defined below, the Contracting Officer, at the request of the Contractor, shall determine whether the order is due in any part to the acts or omissions of the Contractor or a subcontractor at any tier not required by the terms of this contract. If it is determined that the order is not due in any part to acts or omissions of the Contractor or a subcontractor at any tier other than as required by the terms of this contract, such suspension, delay, or interruption shall be considered as if ordered by the Contracting Officer in the administration of this contract under the terms of the CONTRACT CLAUSE: SUSPENSION OF WORK. The period of such suspension, delay or interruption shall be considered unreasonable, and an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) as provided in that clause, subject to all the provisions thereof.

15.2 The term "environmental litigation", as used herein, means a lawsuit alleging that the work will have an adverse effect on the environment or that the Government has not duly considered, either substantively or procedurally, the effect of the work on the environment.

16. TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER (DAEN-ECC-Q LTR 3 APR 84).

16.1 This provision specifies the procedure for the determination of time extensions for unusually severe weather in accordance with the CONTRACT CLAUSE: DEFAULT. The listing below defines the monthly anticipated adverse weather for the contract period and is based upon NOAA or similar data for the geographical location of the project.

MONTHLY ANTICIPATED ADVERSE WEATHER CALENDAR DAYS

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
PRECP	.10"	2	2	1	0	0	0	2	3	2	2	1	2	17
TEMP	32°F	8	4	1	0	0	0	0	0	0	0	2	7	22
TOTAL		10	6	2	0	0	0	2	3	2	2	3	9	39

## 16.2 Determination.

16.2.1 The above schedule of anticipated adverse weather will constitute the base line for monthly (or portion thereof) weather time evaluations. Upon acknowledgment of the notice to proceed and continuing throughout the contract on a monthly basis, actual adverse weather days will be recorded on a calendar day basis (including weekends and holidays) and compared to the monthly anticipated adverse weather in subparagraph 16.1 above. For purposes of subparagraph 16.2, the term actual adverse weather days shall include days impacted by actual adverse weather days.

16.2.2 The number of actual adverse weather days shall be calculated chronologically from the first to the last day in each month. Once the number of actual adverse weather days anticipated in subparagraph 16.1 above have been incurred, the Contracting Officer will examine any subsequently occurring adverse weather days to determine whether a Contractor is entitled to a time extension. These subsequently occurring adverse weather days must prevent work for 50 percent or more of the Contractor's work day and delay work critical to the timely completion of the project. The Contracting Office will convert any delays to meeting the above requirements to calendar days and issue a modification in accordance with the CONTRACT CLAUSE: DEFAULT.

16.3 The Contractor's schedule must reflect the above anticipated adverse weather delays on all weather dependent activities.

## 17. CONCRETE AGGREGATE SOURCES (1965 APR OCE) EFARS 52.2/9108(b).

17.1 Concrete aggregates can be produced from existing commercial sources along the Salt River and Cave Creek and on the Auga Fria River.

17.2 Concrete aggregates may be furnished from any of the above listed sources or at the option of the Contractor may be furnished from any other sources designated by the Contractor and approved by the Contracting Officer, subject to the conditions hereinafter stated.

17.3 After the award of the contract, the Contractor shall designate in writing only one source or one combination of sources from which he proposes to furnish aggregates. If the Contractor proposes to furnish aggregates from a source or from sources not listed above, he may designate only a single source or single combination of sources for aggregates. Samples for acceptance testing shall be provided as required by SECTION: CONCRETE of the "Technical Provisions". If a source for coarse or fine aggregate so designated by the Contractor is not approved for use by the Contracting Officer, the Contractor may not submit for approval other sources but shall furnish the coarse or fine aggregate, as the case may be, from an approved source listed above at no additional cost to the Government.

17.4 Listing of a concrete aggregate source is not to be construed as approval of all materials from the source. The right is reserved to reject materials from certain localized areas, zones, strata, or channels, when such materials are unsuitable for concrete aggregate as determined by the Contracting Officer. Materials produced from an approved sources shall meet all the requirements of SECTION: CONCRETE of the Technical Provisions of these specifications.

18. CONTINUING CONTRACTS (1985 JAN HQ USACE) EFARS 52.2/9109(d).

18.1 This is a continuing contract, as authorized by Section 10 of the River and Harbor Act of September 22, 1922 (33 U.S. Code 621). The payment of some portion of the contract price is dependent upon reservations of funds from future appropriations. The responsibilities of the Government are limited by this clause notwithstanding any contrary provision of the CONTRACT CLAUSE: PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS or any other clause of this contract.

18.2 The sum of \$6,500,000 has been reserved for this contract and is available for payments to the Contractor during the current fiscal year. It is expected that Congress will make appropriations for future fiscal years from which additional funds will be reserved for this contract.

18.3 Failure to make payments in excess of the amount currently reserved, or that may be reserved from time to time, shall not entitle the Contractor to a price adjustment under the terms of this contract except as specifically provided in paragraphs 18.6, 18.7, 18.8, and 18.9 below. No such failure shall constitute a breach of this contract, except that this provision shall not bar a breach-of-contract action if an amount finally determined to be due as a termination allowance remains unpaid for one year due solely to a failure to reserve sufficient additional funds therefore.

18.4 The Government may at any time reserve additional funds for payments under the contract if there are funds available for such purpose. The Contracting Officer will promptly notify the Contractor in writing of any additional funds reserved for the contract.

18.5 If earnings will be such that funds reserved for the contract will be exhausted before the end of any fiscal year, the Contractor shall give written notice to the Contracting Officer of the estimated date of exhaustion and the amount of additional funds which will be needed to meet payments due or to become due under the contract during that fiscal year. This notice shall be given not less than 45 nor more than 60 days prior to the estimated date of exhaustion.

18.6 No payments will be made after exhaustion of funds except to the extent that additional funds are reserved for the contract. The Contractor shall be entitled to simple interest on any payment that the Contracting Officer determines was actually earned under the terms of the contract and would have been made except for exhaustion of funds. Interest shall be computed from the time such payment would otherwise have been made until actually or constructively made, and shall be at the rate established by the Secretary of the Treasury pursuant to Public Law 92-41, 85 STAT 97, for the Renegotiation Board, as in effect on the first day of the delay in such payment.

18.7 Any suspension, delay, or interruption of work arising from exhaustion or anticipated exhaustion of funds shall not constitute a breach of this contract and shall not entitle the Contractor to any price adjustment under the CONTRACT CLAUSE: SUSPENSION OF WORK or in any other manner under this contract.

18.8 An equitable adjustment in performance time shall be made for any increase in the time required for performance of any part of the work arising from exhaustion of funds or the reasonable anticipation of exhaustion of funds.

18.9 If, upon the expiration of sixty (60) days after the beginning of the fiscal year following an exhaustion of funds, the Government has failed to reserve sufficient additional funds to cover payments otherwise due, the Contractor, by written notice delivered to the Contracting Officer at any time before such additional funds are reserved, may elect to treat his right to proceed with the work as having been terminated. Such a termination shall be considered a termination for the convenience of the Government.

18.10 If at any time it becomes apparent that the funds reserved for any fiscal year are in excess of the funds required to meet all payments due or to become due the Contractor because of work performed and to be performed under the contract during the fiscal year, the Government reserves the right, after notice to the Contractor, to reduce said reservation by the amount of such excess.

\* \* \* \* \*

**SUBMITTAL REGISTER**

(ER 415-1-10)

TITLE AND LOCATION **New River Improvement**

CONTRACTOR

CONTRACT NUMBER

NAS ACTIVITY CODE	SUBMITTAL IDENTIFICATION (ITEM NUMBER)	SPECIFICATION PARAGRAPH NUMBER	DESCRIPTION OF SUBMITTAL	TYPE OF SUBMITTAL							ACTION ELEMENT	CONTRACTOR SCHEDULED DATES			CORPS ACTION DATES		REMARKS
				SHOP DRAWING	SAMPLE	GUARANTEE	MFR'S DATA	CERTIFICATE	TEST REPORT	OTHER, AS NOTED		*TECH REVIEW BY	SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	SUBMITTED TO CORPS	
		SC, 4.2	Submittal Register	X													
		SC, 15.1.9	As-Built Drawings							X							
		1A, 9.5.2.1.1	Plans and Cales for Shoring and Cribbing														
		1A, 9.5.2.1.2	Construction Schedule							X							
		1A, 14.2	Copies of Agreements							X							
		1C, 2.1	Contractor Quality Control Plan							X							
		1D, 3	Environmental Protection Plan							X							
		1D, 7	Restoration Landscape Damage Plan							X							
		1E, 2.1	Landfill Excavation Monitoring Plan							X							
		2A, 1.1	Dewatering Plan							X							
		2C, 10	Method of Transportation							X							
		2D, 3	Moisture Density and Field Density							X							
		2E, 3	Manufacturer's Recommendations					X									
		2E, 4	Pipe Specifications							X							
		2E, 7.6	Gasket Joint Installation Instructions							X							
		2E, 7.6	Gasket Test Results							X							
		2F, 3.1	Aggregate Base Course Test Results							X							

\*AE-Architect Engineer

ED-Engineering Division

CD-Construction Division

AREA-Area Engineer

RE-Resident Engineer

SUBMITTAL REGISTER		(ER 415-1-10)	TITLE AND LOCATION New River Improvement		CONTRACTOR		CONTRACT NUMBER										
NAS ACTIVITY CODE  I J	SUBMITTAL IDENTIFICATION (ITEM NUMBER)	SPECIFICATION PARAGRAPH NUMBER	DESCRIPTION OF SUBMITTAL	TYPE OF SUBMITTAL							ACTION ELEMENT  *TECH REVIEW BY	CONTRACTOR SCHEDULED DATES			CORPS ACTION DATES		REMARKS
				SHOP DRAWING	SAMPLE	GUARANTEE	MFR'S DATA	CERTIFICATE	TEST REPORT	OTHER, AS NOTED		SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	SUBMITTED TO CORPS	ACTION CODE	
		2F, 3.3	Base Course Test Results														
		2F, 3.4	Material Preliminary Reports														
		2F, 15	Waybills and Delivery Tickets														
		2G, 2.7	Gravel Color Samples		X												
		2H, 3.1	Topsoil Sample		X												
		2H, 3.2	Certificates of Conformance or Compliance for Plants, Fertilizer, and Fumigants														
		2H, 3.3	Plant Maintenance Instructions														
		2H, 7.2.1	Variance in Planting Conditions														
		2H, 10.1	Notice Requesting Inspection														
		2I, 11	Variation in Arrangement of the Sprinklers		X												
		2I, 12	Garantees				X										
		2I, 13	Manufacturer's Literature				X										
		2J, 6.4	Erosion Control Netting Literature														
		3A, 2.1	Request for Approval of Materials														

\*AE-Architect Engineer

ED-Engineering Division

CD-Construction Division

AREA-Area Engineer

RE-Resident Engineer

SUBMITTAL REGISTER		(ER 415-1-10)	TITLE AND LOCATION New River Improvement					CONTRACT NUMBER									
NAS ACTIVITY CODE I J	SUBMITTAL IDENTIFICATION (ITEM NUMBER)	SPECIFICATION PARAGRAPH NUMBER	DESCRIPTION OF SUBMITTAL	TYPE OF SUBMITTAL						ACTION ELEMENT  *TECH REVIEW BY	CONTRACTOR SCHEDULED DATES			CORPS ACTION DATES		REMARKS	
				SHOP DRAWING	SAMPLE	GUARANTEE	MFR'S DATA	CERTIFICATE	TEST REPORT		OTHER, AS NOTED	SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	SUBMITTED TO CORPS		ACTION CODE
		3A, 2.3	Plan for Batching, Conveying, Placing, Compacting, Finishing and Curing Soil Cement														
		3A, 4.4.2	Soil Sample	X													
		3A, 15.2.5	Density Test Results						X								
		3A, 15.2.9	Moisture Content						X								
		3A, 15.4	Test Results						X								
		3B, 14	Waybills and Delivery Tickets						X								
		3C, 4.5	Sample Panels	X													
		3C, 10.4	Results of Tests						X								
		4A, 2.2	Source and Material				X										
		4A, 2.3	Quality Compliance					X									
		4A, 2.4	Test Results						X								
		4B, 2.1.1	Source and Aggregate Certificate					X									
		4B, 3	Mix Design						X								
		4C, 4.1	Samples	X													
		4C, 4.2	Certificate of Conformance					X									
		4C, 4.3	Certified Laboratory Test Reports						X								



T A B L E O F C O N T E N T S

TECHNICAL PROVISIONS

<u>Section</u>	<u>Title</u>
1A	General Requirements
1B	Measurement and Payment
1C	Contractor's Quality Control
1D	Environmental Protection
1E	Landfill Excavation Monitoring
2A	Diversion and Control of Water
2B	Clearing Site and Removing Obstructions
2C	Excavation
2D	Fills and Subgrade Preparation
2E	Culverts
2F	Aggregate Base
2G	Miscellaneous Aggregates
2H	Trees, Shrubs, and Ground Cover
2I	Irrigation System
2J	Hydroseeding
2K	Scour Gages and Monuments
3A	Soil Cement
3B	Concrete
3C	Shotcrete
4A	Stone Protection
4B	Grouting Stone Protection
4C	Reinforced Masonry
5A	Flapgates and Miscellaneous Metals
16A	Electrical Work(for Irrigation Landscaping)

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## SECTION 1A

### GENERAL REQUIREMENTS

#### Index

- |   |   |
|---|---|
| 1. Applicable Publications                        | 9. Public Utilities, Notices, and Restrictions          |
| 2. Project Facilities                             | 10. Public Safety                                       |
| 3. Construction Signs                             | 11. Occupational Safety and Health Act (OSHA) Standards |
| 4. Project Engineer's Office                      | 12. Water Contamination                                 |
| 5. Bulletin Board                                 | 13. Dust Control  |
| 6. Maintenance and Disposal of Project Facilities | 14. Permits   |
| 7. Scrap Materials                                | 15. Required Insurance                                  |
| 8. Archaeological Findings During Construction    |   |

1. APPLICABLE PUBLICATIONS. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

#### 1.1 Federal Specifications (Fed. Spec.).

FF-B-575C	Bolts, Hexagon and Square
FF-N-105B & Am-3	Nails, Brads, Staples and Spikes: Wire, Cut and Wrought
FF-N-836D & Am-1	Nut: Square, Hexagon, Cap, Slotted, Castle, Knurled, Welding and Single Ball Seat
MM-L-751H	Lumber; Softwood
TT-E-529F	Enamel, Alkyd, Semi-Gloss
TT-P-25E & Am-2	Primer Coating, Exterior (Undercoat for Wood, Ready-Mixed, White and Tints)

1.2 U.S. Department of Commerce National Bureau of Standards, Product Standard (Prod. Std).

PS 1-74	Construction and Industrial Plywood
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2. PROJECT FACILITIES. The Contractor shall construct and/or erect the following project facilities.

2.1 Construction Signs. The signs shall be erected as soon as possible and within 15 days after commencement of work under this contract.

2.1.1 Eight Project signs at locations designated by the Contracting Officer.

2.1.2 Warning Signs facing approaching traffic on all haul roads crossing under overhead power transmission lines.

2.1.3 Hard hat signs at six locations as directed by the Contracting Officer.

2.2 Project Engineer's Office, including a fenced parking area.

2.3 Bulletin Board at the Contractor's office.

2.4 Sanitary Facilities.

3. CONSTRUCTION SIGNS.

3.1 Materials.

3.1.1 Lumber shall conform to Fed. Spec. MM-L-751, and shall be seasoned Douglas Fir, S4S, Grade D or better except that posts, braces and spacers shall be construction Grade (WCLB).

3.1.2 Plywood shall conform to Prod. Std. PS 1, grade A-C, Group 1, exterior type.

3.1.3 Bolts, Nuts and Nails. Bolts shall conform to Fed. Spec. FF-B-575, nuts shall conform to Fed. Spec. FF-N-836, and nails shall conform to Fed. Spec. FF-N-105.

3.1.4 Paints and Oils. aints shall conform to Fed. Spec. TT-P-25 for primer and TT-E-529 for finish paint and lettering.

3.2 Construction.

3.2.1 Project and hard hat signs shall be constructed as detailed on Figures 1, 1a, 2 and 3. Decals and safety signs will be furnished by the Contracting Officer.

3.2.2 Warning Signs shall be constructed of plywood not less than 1/2 inch thick and shall be securely bolted to the supports with the bottom of the sign face 3 feet above the ground. The sign face shall be 2 x 4 feet, all letters shall be 4 inches in height, and the wording shall be: "WARNING: OVERHEAD TRANSMISSION LINES."

3.3 Painting. All exposed surfaces and edges of plywood shall be given one coat of linseed oil and be wiped prior to applying primer. All exposed surfaces of signs and supports shall be given one coat of primer and 2 finish coats of white paint. Except as otherwise indicated, lettering on all signs shall be black and sized as indicated.

4. PROJECT ENGINEER'S OFFICE.

4.1 General. The Contractor shall provide a suitable office trailer for the Project Engineer. The exact site will require the Contracting Officer's approval. The trailer shall be adequately heated, well lighted, suitably ventilated, and cooled with an exterior mounted, 1,000 cubic feet per minute minimum size refrigeration unit, complete, with electrical connections. An adequate supply of cooled drinking water shall be furnished and maintained. Open parking space for 6 vehicles and water and sanitary facilities shall be located convenient to the office. The combined parking and building area shall be enclosed with a woven wire fence approximately 6 feet high with a 10-foot wide lockable gate accessible from a road or street. The fenced area shall be of sufficient size to permit ease

in the parking of vehicles. Materials for the facilities need not be new provided they are adequate for the intended use. Power and telephone connections to the Projects Engineer's Office shall be installed and paid for by the Contractor.

4.2 Office Trailer shall be approximately 10 feet wide by 40 feet in length.

4.3 The Project Engineer's Office shall be available for occupancy within 10 days of the notice to proceed and not be removed prior to the completion date of the contract.

5. BULLETIN BOARD. A weatherproof bulletin board, approximately 36 inches wide and 30 inches high, with hinged glass door shall be provided adjacent to or mounted on the Contractor's project office. If adjacent to the office, the bulletin board shall be securely mounted on no less than 2 posts. Bulletin board and posts shall be painted or have other approved factory finish. The bulletin board shall be easily accessible at all times and shall contain wage rates, equal opportunity notice, and such other items required to be posted.

6. MAINTENANCE AND DISPOSAL OF PROJECT FACILITIES. The Contractor shall maintain the project facilities in good condition throughout the life of the project. Upon completion of work under this contract, the facilities covered under this section will remain the property of the Contractor and shall be removed from the site at his expense.

7. SCRAP MATERIAL. Materials indicated to be removed and not indicated to be salvaged, stored or reinstalled are designated as scrap and shall become the property of the Contractor and be removed from the site of work. The Contractor by signing this contract hereby acknowledges that he made due allowance for value, if any, of such scrap in the contract price.

8. ARCHAEOLOGICAL FINDINGS DURING CONSTRUCTION. Should the Contractor or any of his employees in the performance of this contract find or uncover any archaeological remains, he shall notify the Project Engineer immediately. Such notifications will be a brief statement in writing giving the location and nature of the findings. Should the discovery site require archaeological studies resulting in delays and/or additional work, the Contractor will be compensated by an equitable adjustment under the General Provisions of the contract.

9. PUBLIC UTILITIES, NOTICES, AND RESTRICTIONS.

9.1 General. The approximate location of all railroads, pipe lines, power and communication lines, and other utilities known to exist within the limits of the work are indicated on the drawings. The sizes, locations, and names of owners of such utilities are given from available information, but their accuracy is not guaranteed. Except as otherwise indicated on the drawings, all existing utilities will be left in place and the Contractor shall conduct his operations in such a manner that the utilities will be protected from damage at all times, or arrangements shall be made by the Contractor for their relocation at the Contractor's own expense. The Contractor shall be responsible for any damage to utilities known to exist and shall reimburse the owners for such damage caused by his operations.

9.2 Relocation or Removal. Utilities to be relocated or removed not as part of this contract are designated "To be Relocated by Others" or "To be Removed by Others," respectively. Utilities shown on the plans and not so designated will be

left in place and be subject to the CONTRACT CLAUSE: PROTECTION OF EXISTING VEGETATION, STRUCTURES, UTILITIES, AND IMPROVEMENTS. The Contractor may make arrangements with the owner for the temporary relocation and restoration of utilities not designated to be relocated, or for additional work in excess of the work needed to relocate utilities designated for relocation at no additional cost to the Government.

9.3 Utilities Not Shown. If the Contractor encounters, within the construction limits of the entire project, utilities not shown on the plans and not visible as of the date of this contract and if such utilities will interfere with construction operations, he shall immediately notify the Contracting Officer in writing to enable a determination by the Contracting Officer as to the necessity for removal or relocation. If such utilities are left in place, removed or relocated, as directed by the Contracting Officer, the Contractor shall be entitled to an equitable adjustment for any additional work or delay.

9.4 Coordination. The Contractor shall consult and cooperate with the owner of utilities that are to be relocated or removed by others to establish a mutual performance schedule and to enable coordination of such work with the construction work. These consultations shall be held as soon as possible after award of the contract or sufficiently in advance of anticipated interference with construction operations to provide required time for the removal or relocation of affected utilities.

9.4.1 During construction other contractors may be working in the area. The Contractor shall be responsible for coordinating work as required to interface with each other's work in progress.

#### 9.5 Notices.

9.5.1 The Contractor shall notify the Contracting Officer, in writing, not less than 14 days in advance of the date on which he will complete trenching, excavation, fill or rough grading, as applicable, at each location where such completed work is required for temporary or permanent relocations by others. The Contractor shall allow a period of 14 calendar days at each relocation, after which time the Contractor may resume his operations.

9.5.2 Coordination with the AT&SF Railway Company. During the construction period the AT&SF Railway Company may be modifying their bridge. The AT&SF Railway Company has agreed to fully cooperate with the Government in the construction of the channel within their rights-of-way and the Contractor will be expected to fully cooperate with the AT&SF Railway Company. The AT&SF Railway Company shall have the right to inspect the channel construction in progress, for conformance to the plans and specification. Although, the AT&SF Railway Company has the right to inspect construction of the channel, the Contractor is responsible only to the Contracting Officer.

9.5.2.1 The Contractor shall furnish the Contracting Officer with the following items so they may be coordinated with the AT&SF Railway Company. No work will be allowed until they have been submitted and approved by the Contracting Officer.

9.5.2 1.1 The Contractor shall furnish to the Contracting Officer, who will forward to the AT&SF Railway Company for review and approval, four copies of plans and two sets of calculations for any shoring or cribbing that may be planned to be used under or adjacent to the railroad tracks.

9.5.2.1.2 The Contractor shall provide the Contracting Officer with a construction schedule for any construction within the limits of the AT&SF Railway Company's rights-of-way.

#### 9.6 Restrictions.

9.6.1 Representatives of Other Agencies. Personnel representing owners and agencies may be present for various portions of the work. However, the Contractor will be responsible only to the Contracting Officer.

10. PUBLIC SAFETY. Attention is directed to the CONTRACT CLAUSE: PERMITS AND RESPONSIBILITIES. The Contractor shall furnish, install, maintain and remove temporary fencing, barricades, and/or guards, as required, to provide protection in the interest of public safety and in conformance with applicable Federal, State, and local laws and ordinances. As a minimum, this will include an 8-foot chain-link fence which completely encloses each and every part of the project (except at optional disposal areas) which the Contractor worked in or is working on. The plan of this temporary fencing shall be furnished to the Contracting Officer for approval and the fence erected prior to commencement of any work. Whenever the Contractor's operations create a condition hazardous to the public, he shall furnish at his own expense and without cost to the Government, such flagmen and guards as are necessary to give adequate warning to the public of any dangerous conditions to be encountered and he shall furnish, erect, or maintain such fences, barricades, lights, signs and other devices as are necessary to prevent accidents and avoid damage or injury to the public. Flagmen and guards, while on duty and assigned to give warning and safety devices, shall conform to applicable city, county, and state requirements. Should the Contractor appear to be neglectful or negligent in furnishing adequate warning and protection measures, the Contracting Officer may direct attention to the existence of a hazard and the necessary warning and protective measures shall be furnished and installed by the Contractor without additional cost to the Government. Should the Contracting Officer point out the inadequacy of warning and protective measures, such action of the Contracting Officer shall not relieve the Contractor from any responsibility for public safety or abrogate his obligation to furnish and pay for those devices. The installation of any general illumination shall not relieve the Contractor of his responsibility for furnishing and maintaining any protective facility. Traffic control shall conform to the Traffic Barricade Manual, City of Phoenix; and Part 400 of the Uniform Standard Specifications for Public Works Construction, Maricopa Association of Governments, Arizona.

11. OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA) STANDARDS. The OCCUPATIONAL SAFETY and HEALTH ACT (OSHA) STANDARDS for CONSTRUCTION (Title 29, Code of Federal Regulations Part 1926 as revised from time to time) and the Corps of Engineers General Safety and Health Requirements Manual, EM 385-1-1, are both applicable to this contract. The most stringent requirement of the two standards will be applicable.

12. WATER CONTAMINATION. In order to prevent contamination of water along the river all refuse, oil, greases, and other petroleum products; all toxic materials; all cement or concrete; or water containing such materials shall be disposed of in a manner to prevent contamination of the water.

13. DUST CONTROL. The Contractor shall provide an acceptable plan for preventing the generation of dust due to his operation in construction zones, along haul routes, in equipment parking areas, and in waste areas. This plan may consist of water sprinkling or an equivalent service.

14. PERMITS.

14.1 General. Reference is made to the CONTRACT CLAUSE: PERMITS AND RESPONSIBILITIES, which obligates the Contractor to obtain all required licenses and permits.

14.2 Railroad. Before entering upon the premises of the Atchison, Topeka and Santa Fe Railway Company hereinafter called the railroad, for or in connection with performance of the contract work, the Contractor will be required by the railroad to enter into an agreement. Such agreement will include provisions requiring the Contractor to (a) furnish public liability insurance or indemnification bonds in an amount designated by the railroad; (b) to indemnify the railroad for any claims which result from performance of the contract work on or use of railroad premises by the Contractor; (c) to pay for service of any inspectors, flagmen, or watchmen, furnished by the railroad during performance of the contract work on or use of the premises of the railroad by the Contractor; and (d) conform with any other conditions relative to use and occupancy, and the performance of work on railroad premises. The Contractor shall submit to the Contracting Officer a true copy of any agreements entered into. No separate or additional payment will be made by the Government to the Contractor for costs incurred by the Contractor as result of compliance with these provisions.

14.2.1 The attached pages at the end of this section are the requirements and forms of the Atchison, Topeka and Santa Fe Railway Company.

15. REQUIRED INSURANCE. The Contractor shall maintain required insurance for the entire period of the contract. The required insurance shall meet the requirements of the Maricopa County Flood Control District.

\* \* \* \* \*

## RAILROAD PROTECTIVE INSURANCE

In addition to any other form of insurance or bonds required under the terms of the contract and specifications, the Contractor will be required to carry insurance of the kinds and in the amounts hereinafter specified. Such insurance shall be approved by:

### THE ATCHISON, TOPEKA AND SANTA FE RAILWAY COMPANY

hereinafter called "Railroad" before any work is performed on Railroad property and shall be carried until all work required to be performed on or adjacent to the Railroad's property under the terms of the contract is satisfactorily completed as determined by the Engineer, and thereafter until all tools, equipment and material have been removed from Railroad's property and such property is left in a clean and presentable condition.

The insurance herein required shall be obtained by the successful bidder, and the original and certified copies of all policies as hereinafter specified shall be furnished to the Engineer,

The Contractor shall furnish the Engineer with one (1) certified copy of each of the executed policies required by 1, 2, and 3 below, and in addition, shall furnish Railroad through the Engineer, one (1) certificate reflecting the existence of the executed policies required by 1 and 2 and the original policies of the insurance required by 3 below.

A certification on such copies of insurance shall guarantee that the policy under 1 and 2 will not be amended, altered, modified, or canceled insofar as the coverage contemplated hereunder is concerned, without at least thirty (30) days notice mailed by registered mail to the Engineer and to Railroad.

Full compensation for all premiums which the Contractor is required to pay on all the insurance described hereinafter shall be considered as included in the prices paid for the various items of work to be performed under the contract, and no additional allowance will be made therefor or for additional premiums which may be required by extensions of the policies of insurance.

The approximate ratio of the estimated cost of the work over or under or within 50 feet of Railroad's tracks to the total estimated contract cost is 0.---

#### 1. Contractor's Public Liability and Property Damage Liability Insurance

The Contractor shall, with respect to the operations he performs within or adjacent to Railroad's property, carry regular contractor's Public Liability and Property Damage Liability Insurance providing for the same limits as specified for Railroad's Protective Public Liability and Property Damage Liability Insurance to be furnished for and in behalf of Railroad as hereinafter provided.

If any part of the work within or adjacent to Railroad's property is subcontracted, the Contractor in addition to carrying the above insurance, shall provide the above insurance in behalf of the subcontractors to cover their operations.

#### 2. Contractor's Protective Public Liability and Property Damage Liability Insurance

The Contractor shall, with respect to the operations performed for him by Subcontractors who do work within or adjacent to Railroad's property, carry in his own behalf regular Contractor's Protective Public Liability and Property Damage Liability Insurance providing for the same limits as specified for Railroad's Protective Public Liability and Property Damage Liability Insurance to be furnished for and in behalf of Railroad as hereinafter provided.

#### 3. Railroad's Protective Public Liability and Property Damage Liability Insurance

The Contractor shall, with respect to the operations he performs within or adjacent to Railroad's property or that of any of his subcontractors who do work within or adjacent to Railroad's property, have issued and furnished separately, policy or policies of insurance in the Railroad Protective Liability Form as hereinafter specified in favor of The Atchison, Topeka and Santa Fe Railway Company, One Santa Fe Plaza, 5200 East Sheila Street, Los Angeles, CA 90040.

Railroad Protective Liability Form

\_\_\_\_\_  
(Name of Insurance Company)

DECLARATIONS:

Item 1. Named Insured:

The Atchison, Topeka and Santa Fe Railway Company  
One Santa Fe Plaza, 5200 East Sheila Street  
Los Angeles, CA 90040

Item 2. Policy Period:

From \_\_\_\_\_ to \_\_\_\_\_  
12:01 a.m., Standard Time, at the designated job site as stated herein.

Item 3. The insurance afforded is only with respect to such of the following coverages as are indicated in Item 6 by specific premium charge or charges. The limit of the company's liability against such coverage or coverages shall be as stated herein, subject to all the terms of this policy having reference thereto.

Coverages

Limits of Liability

A Bodily Injury Liability	\$2 million Combined Single Limit per occurrence, with an aggregate limit of \$6 million for the term of the policy.
B Property Damage Liability	
&	
C and Physical Damage to Property	

Item 4. Name and Address of Contractor:

Item 5. Name and address of Government Authority for whom the work by the Contractor is being performed:

Item 6. Designation of the Job Site and Description of Work:

Premium Bases	Rates per \$100 of Cost		Advance Premiums	
	Coverage A	Coverages B&C	Coverage A	Coverages B&C
Contract Cost	\$	\$	\$	\$
Rental Cost	\$	\$	\$	\$

Countersigned \_\_\_\_\_ 19\_\_\_\_ By \_\_\_\_\_

POLICY

\_\_\_\_\_  
(Name of Insurance Company)

A \_\_\_\_\_ insurance company, herein called the Company, agrees with the insured named in the declarations made a part hereof, in consideration of the payment of the premium and in reliance upon the statements in the declarations made by the named insured and subject to all of the terms of this policy:

## INSURING AGREEMENTS

### Coverage A - Bodily Injury Liability

To pay on behalf of the insured all sums which the insured shall become legally obligated to pay as damages because of bodily injury, sickness, or disease, including death at any time resulting therefrom, hereinafter called "bodily injury", either (1) sustained by any person arising out of acts or omissions at the designated job site which are related to or are in connection with the work described in Item 6 of the declarations, or (2) sustained at the designated job site by the contractor or any employee of the contractor or by any designated employee of the insured whether or not arising out of such acts or omissions.

### Coverage B - Property Damage Liability

To pay on behalf of the insured all sums which the insured shall become legally obligated to pay as damages because of physical injury to or destruction of property, including loss of use of any property due to such injury or destruction, hereinafter called "property damage", arising out of acts or omissions at the designated job site which are related to or are in connection with the work described in Item 6 of the declarations.

### Coverage C - Physical Damage to Property

To pay for direct and accidental loss of or damage to rolling stock and their contents, mechanical construction equipment, or motive power equipment, hereinafter called loss, arising out of acts or omissions at the designated job site which are related to or are in connection with the work described in Item 6 of the declarations; provided such property is owned by the named insured or is leased or entrusted to the named insured under a lease or trust agreement.

## II. Definitions

- (a) Insured - The unqualified word "insured" includes the named insured and also includes any executive officer, director or stockholder thereof while acting within the scope of his duties as such.
- (b) Contractor - The word "contractor" means the contractor designated in Item 4 of the declarations and includes all subcontractors of said contractor but shall not include the named insured.
- (c) Designated employee of the insured - The words "designated employee of the insured" mean:
  - (1) any supervisory employee of the insured at the jobsite;
  - (2) any employee of the insured while operating, attached to or engaged on work trains or other railroad equipment at the jobsite which are assigned exclusively to the contractor, or
- (d) Contract - The word "contract" means any contract or agreement to carry a person or property for a consideration or any lease, trust or interchange contract or agreement respecting motive power, rolling stock or mechanical construction equipment.

## III. Defense, Settlement, Supplementary Payments

With respect to such insurance as is afforded by this policy under coverages A and B, the Company shall:

- (a) defend any suit against the insured alleging such bodily injury or property damage and seeking damages which are payable under the terms of this policy, even if any of the allegations of the suit are groundless, false or fraudulent; but the Company may make such investigation and settlement of any claims or suit as it deems expedient;
- (b) pay, in addition to the applicable limits of liability:
  - (1) all expenses incurred by the Company, all costs taxed against the insured in any such suit and all interest on the entire amount of any judgment therein which accrues after entry of the judgment and before the Company has paid or tendered or deposited in court that part of the judgment which does not exceed the limit of the Company's liability thereon;
  - (2) premiums on appeal bonds required in any such suit, premiums on bonds to release attachments for an amount not in excess of the applicable limit of liability of this policy, but without obligation to apply for or furnish any such bonds;
  - (3) expenses incurred by the insured for such immediate medical and surgical relief to others as shall be imperative at the time of the occurrence;
  - (4) all reasonable expenses, other than loss of earnings, incurred by the insured at the Company's request.

#### IV. Policy Period, Territory

This policy applies only to occurrences and losses during the policy period and within the United States of America, its territories or possessions, or Canada.

#### EXCLUSIONS

This policy does not apply:

- (a) to liability assumed by the insured under any contract or agreement except a contract as defined herein;
- (b) to bodily injury or property damage caused intentionally by or at the direction of the insured;
- (c) to bodily injury, property damage or loss which occurs after notification to the named insured of the acceptance of the work by the governmental authority, other than bodily injury, property damage or loss resulting from the existence or removal of tools, uninstalled equipment and abandoned or unused materials;
- (d) Under Coverages A(I), B and C, to bodily injury, property damage or loss, the sole proximate cause of which is an act or omission of any insured other than acts or omissions of any designated employee of any insured;
- (e) under Coverage A, to any obligation for which the insured or any carrier as his insurer may be held liable under any workmen's compensation, unemployment compensation or disability benefits law, or under any similar law; provided that the Federal Employers' Liability Act, U.S. Code (1946) Title 45, Sections 51-60, as amended, shall for the purposes of this insurance be deemed not to be any similar law;
- (f) under Coverage B, to injury to or destruction of property (I) owned by the named insured or (II) leased or entrusted to the named insured under a lease or trust agreement.
- (g) 1. Under any Liability Coverage, to injury, sickness, disease, death or destruction:
  - (a) with respect to which an insured under the policy is also an insured under a nuclear energy liability policy issued by Nuclear Energy Liability Insurance Association, Mutual Atomic Energy Liability Underwriters or Nuclear Insurance Association of Canada, or would be an insured under any such policy but for its termination upon exhaustion of its limit of liability; or
  - (b) resulting from the hazardous properties of nuclear material and with respect to which (1) any person or organization is required to maintain financial protection pursuant to the Atomic Energy Act of 1954, or any law amendatory thereof, or (2) the insured is, or had this policy not been issued would be, entitled to indemnity from the United States of America, or any agency thereof, under any agreement entered into by the United States of America, or any agency thereof, with any person or organization.
2. Under any medical Payments Coverage, or under any Supplementary-Payments provision relating to immediate medical or surgical relief, to expenses incurred with respect to bodily injury, sickness, disease or death resulting from the hazardous properties of nuclear material and arising out of the operation of a nuclear facility by any person or organization.
3. Under any Liability Coverage, to injury, sickness, disease, death or destruction resulting from the hazardous properties of nuclear material, if
  - (a) the nuclear material (1) is at any nuclear facility owned by, or operated by or on behalf of, an insured or (2) has been discharged or dispersed therefrom;
  - (b) the nuclear material is contained in spent fuel or waste any time possessed, handled, used, processed, stored, transported or disposed of by or on behalf of an insured; or
  - (c) the injury, sickness, disease, death or destruction arises out of the furnishing by an insured of services, materials, parts or equipment in connection with the planning, construction, maintenance, operation or use of any nuclear facility, but if such facility is located within the United States of America, its territories or possessions or Canada, this exclusion (c) applies only to injury to or destruction of property at such nuclear facility.
4. As used in this exclusion:

"Hazardous properties" include radioactive, toxic or explosive properties;

"nuclear material" means source material, special nuclear material or byproduct material;

"source material", "Special nuclear material", and "byproduct material" have the meanings given them in the Atomic Energy Act of 1954, or in any law amendatory thereof.

"spent fuel" means any fuel element or fuel component, solid or liquid, which has been used or exposed to radiation in a nuclear reactor;

"waste" means any waste material:

- (1) containing byproduct material and
- (2) resulting from the operation by any person or organization of any nuclear facility included within the definition of nuclear facility under paragraph (a) or (b) thereof;

"nuclear facility" means:

- (a) any nuclear reactor
- (b) any equipment or device designed or used for (1) separating the isotopes of uranium or plutonium, (2) processing or utilizing spent fuel, or (3) handling, processing or packaging waste;
- (c) any equipment or device used for the processing, fabricating or alloying of special nuclear material if at any time the total amount of such material in the custody of the insured at the premises where such equipment or device is located consists of or contains more than 25 grams of plutonium or uranium 233 or any combination thereof, or more than 250 grams of uranium 235.
- (d) any structure, basin, excavation, premises or place prepared or used for the storage or disposal of waste.

and includes the site on which any of the foregoing is located, all operations conducted on such site and all premises used for such operations;

"nuclear reactor" means any apparatus designed or used to sustain nuclear fission in a self-supporting chain reaction or to contain a critical mass of fissionable material;

"injury" or "destruction", with respect to injury to or destruction of property, the word includes all forms of radioactive contamination of property.

- (h) under coverage C, to loss due to nuclear reaction, nuclear radiation or radioactive contamination, or to any act or condition incident to any of the foregoing.

#### CONDITIONS

(The conditions, except conditions 3, 4, 5, 7, 8, 9, 10, 11 and 12, apply to all coverages. Conditions 3, 4, 5, 7, 8, 9, 10, 11 and 12 apply only to the coverage noted thereunder.)

1. Premium The Premium bases and rates for the hazards described in the declarations, are stated therein. Premium bases and rates for hazards not so described are those applicable in accordance with the manuals in use by company. The term "contract cost" means the total cost of all work described in Item 6 of the declarations.

The term "rental cost" means the total cost to the contractor for rental of work trains or other railroad equipment, including the remuneration of all employees of the insured while operating, attached to or engaged thereon.

The advance premium stated in the declaration is an estimated premium only. Upon termination of this policy the earned premium shall be computed in accordance with the company's rules, rates, rating plans, premiums and minimum premiums applicable to this insurance. If the earned premium thus computed exceeds the estimated advance premium paid, the company shall look to the contractor specified in the declarations for any such excess; if less, the company shall return to the said contractor the unearned portion paid.

In no event shall payment of premium be an obligation of the named insured.

2. Inspection The named insured shall make available to the company records of information relating to the subject matter of this insurance.

The company shall be permitted to inspect all operations in connection with the work described in Item 6 of the declarations.

3. Limits of Liability Coverage A The limits of bodily injury liability stated in the declarations as applicable to "each person" is the limit of the company's liability for all damages, including damages for care and loss of services, arising out of bodily injury sustained by one person as the result of any one occurrence; the limit of such liability stated in the declarations as applicable to "each occurrence" is, subject to the above provisions respecting each person, the total limit of the company's liability for all such damage arising out of bodily injury sustained by two or more persons as the result of any one occurrence.
4. Limits of Liability Coverages B&C The limit of liability under Coverages B and C stated in the declarations as applicable to "each occurrence" is the total limit of the company's

arising out of physical injury to, destruction or loss of all property of one or more persons or organizations, including the loss of use of any property due to such injury or destruction under Coverage B, as the result of any one occurrence.

Subject to the above provisions respecting "each occurrence", the limit of liability under Coverages B and C stated in the declaration as "aggregate" is the total limit of the company's liability for all damages and all loss under Coverages B and C combined arising out of physical injury to, destruction or loss of property, including the loss of use of any property due to such injury or destruction under Coverage B.

Under Coverage C, the limit of the company's liability for loss shall not exceed the actual cash value of the property or if the loss is of a part thereof the actual cash value of such part, at time of loss, nor what it would then cost to repair or replace the property or such part thereof with other of like kind and quality.

5. Severality of Interests      The term "the insured" is used severally and not collectively, but Coverages A&B      the including herein of more than one insured shall not operate to increase the limits of the company's liability.
  
6. Notice      In the event of an occurrence or loss, written notice containing particulars sufficient to identify the insured and also reasonably obtainable information with respect to the time, place and circumstances thereof, and the names and addresses of the injured and of available witnesses, shall be given by or for the insured to the company or any of its authorized agents as soon as practicable. If claim is made or suit is brought against the insured, he shall immediately forward to the company every demand, notice, summons or other process received by him or his representative.
  
7. Assistance and Cooperation of the Insured      The insured shall cooperate with the company and, Coverages A&B      upon the company's request, attend hearings and trials and assist in making settlements, securing and giving evidence, obtaining the attendance of witnesses and in the conduct of suits. The insured shall not, except at his own cost, voluntarily make any payment, assume any obligation or incur any expense other than for such immediate medical and surgical relief to others as shall be imperative at the time of accident.
  
8. Action Against Company      No action shall lie against the company unless, as a condition precedent thereto, the insured shall have fully complied with all the Coverages A&B      terms of this policy, nor until the amount of the insured's obligation to pay shall have been finally determined either by judgment against the insured after actual trial or by written agreement of the insured, the claimant and the company.

Any person or organization or the legal representative thereof who has secured such judgment or written agreement shall thereafter be entitled to recover under this policy to the extent of the insurance afforded by this policy. No person or organization shall have any right under this policy to join the company as a party to any action against the insured to determine the insured's liability. Bankruptcy or insolvency of the insured or of the insured's estate shall not relieve the company of any of its obligations hereunder.

Coverage C      No action shall lie against the company unless, as a condition precedent thereto, there shall have been full compliance with all the terms of this policy nor until thirty days after proof of loss is filed and the amount of loss is determined as provided in this policy.

9. Insured's Duties in Event of Loss      In the event of loss the insured shall: Coverage C
  - (a) protect the property, whether or not the loss is covered by this policy, and any further loss due to the insured's failure to protect shall not be recoverable under this policy; reasonable expenses incurred at the company's request;
  - (b) file with the company, as soon as practicable after loss, his sworn proof of loss in such form and including such information as the company may reasonably require and shall, upon the company's request, exhibit the damaged property.
  
10. Appraisal      If the insured and company fail to agree as to the amount of loss, either may, Coverage C      within 60 days after the proof of loss is filed, demand an appraisal of the loss. In such event the insured and the company shall each select a competent appraiser, and the appraisers shall select a competent and disinterested umpire. The appraisers shall state separately the actual cash value and the amount of loss and failing to agree shall submit their differences to the umpire. An award in writing of any two shall determine the amount of loss. The insured and the company shall each pay his chosen appraiser and shall bear equally the other expenses of the appraisal and umpire.

The company shall not be held to have waived any of its rights by any act relating to appraisal.

11. Payment of Loss Coverage C The company may pay for the loss in money but there shall be no abandonment of the damaged property to the company.
12. No Benefit to Bailee Coverage C The insured afforded by this policy shall not inure directly or indirectly to the benefit of any carrier or bailee, other than the named insured, liable for loss to the property.
13. Subrogation In the event of any payment under this policy, the company shall be subrogated to all the insured's right of recovery therefor against any person or organization and the insured shall execute and deliver instruments and papers and do whatever else is necessary to secure such rights. The insured shall do nothing after loss to prejudice such rights.
14. Application of Insurance The insurance afforded by this policy is primary insurance.
15. Three Year Policy A policy period of three years is comprised of three consecutive annual periods. Computation and adjustment of earned premium shall be made at the end of each annual period. Aggregate limits of liability as stated in this policy shall apply separately to each annual period.
16. Changes Notice to any agent or knowledge possessed by any agent or by any other person shall not effect a waiver or a change in any part of this policy or estop the company from asserting any right under the terms of this policy; nor shall the terms of this policy be waived or changed, except by endorsement issued to form a part of this policy.
17. Assignment Assignment of interest under this policy shall not bind the company until its consent is endorsed hereon.
18. Cancellation This policy may be cancelled by the named insured by mailing to the company written notice stating when thereafter the cancellation shall be effective. This policy may be cancelled by the company by mailing to the named insured, contractor and governmental authority at the respective addresses shown in this policy written notice stating when not less than thirty days thereafter such cancellation shall be effective. The mailing of notice as aforesaid shall be sufficient proof of notice. The effective date and hour of cancellation stated in the notice shall become the end of the policy period. Delivery of such written notice either by the named insured or by the company shall be equivalent to mailing.  
  
If the named insured cancels, earned premium shall be computed in accordance with the customary short rate table and procedure. If the company cancels, earned premium shall be computed pro rata. Premium adjustment may be made either at the time cancellation is effected or as soon as practicable after cancellation becomes effective, but payment or tender of unearned premium is not a condition of cancellation.
19. Declarations By acceptance of this policy the named insured agrees that such statements in the declarations as are made by him are his agreements and representations, that this policy is issued in reliance upon the truth of such representations and that this policy embodies all agreements existing between himself and the company or any of its agents relating to this insurance.

IN WITNESS WHEREOF, the \_\_\_\_\_ Indemnity Company has caused this policy to be signed by its president and a secretary at \_\_\_\_\_ and countersigned on the declarations page by a duly authorized agent of the company.

(FACSIMILE OF SIGNATURE)

(FACSIMILE OF SIGNATURE)

Secretary

President

Agreement between  
THE ATCHISON, TOPEKA AND SANTA FE RAILWAY COMPANY  
AND THE CONTRACTOR

The Atchison, Topeka and Santa Fe Railway Company  
One Santa Fe Plaza, 5200 E. Sheila Street  
Los Angeles, CA 90040

Attention: General Manager

Gentlemen:

The undersigned has entered into a contract dated \_\_\_\_\_, 19\_\_\_\_, with the \_\_\_\_\_, for the performance of certain work in connection with \_\_\_\_\_

in the performance of which work the undersigned will necessarily be required to conduct operations within your right of way and property. The Contract provides that no work shall be commenced within your right of way or property until the contractor employed in connection with said work for Government shall have executed and delivered to you a letter agreement in the form hereof and shall have provided insurance of the coverage and limits specified in said contract. If this letter agreement is executed by other than the Owner, General Partner, President or Vice President of the undersigned firm, evidence is furnished to you herewith certifying that the signatory is empowered to execute this agreement for the firm.

Accordingly, as one of the inducements to and as part of the consideration for your granting permission to the undersigned to enter upon your right of way or property for the performance of so much of the work as is necessary to be done within your right of way or property, the undersigned, effective on the date of the contract with the Government \_\_\_\_\_, has agreed and does hereby agree with you as follows:

1. The undersigned shall indemnify and save harmless the Santa Fe, its agents and employees against all liability, claims, demands, damages, or costs for (a) death or bodily injury to persons, including without limitation the employees of the parties hereto, (b) injury to property, including without limitation, the property of the parties hereto, (c) design defects, or (d) any other loss, damage, or expense arising under either (a), (b), or (c), and all fines or penalties imposed upon or assessed against Santa Fe, and all expenses of investigating and defending against same, arising in any manner out of (1) use, occupancy or presence of the undersigned, sub-contractors, employees, or agents in, on, or about the construction site, (2) the performance, or failure to perform, by the undersigned, its subcontractors, employees, or agents, its work or any obligation under this agreement, or (3) the sole or contributing acts or omissions of the undersigned, its subcontractors, employees, or agents in, on, or about the construction site. Nothing contained in this provision is intended to, nor shall be deemed or construed to, indemnify Santa Fe from its sole negligence or willful misconduct, or that of its agents, servants or independent contractors who are directly responsible to it

2. That the undersigned will procure, and maintain in force, insurance meeting all of the requirements outlined in the special provisions for and in contract referred to in the second paragraph above, and there is handed you herewith:

- (1) Original Policy in Railroad Protective Liability Form, favor of The Atchison, Topeka and Santa Fe Railway Company, One Santa Fe Plaza, 5200 East Sheila Street, Los Angeles, CA 90040, and
- (2) Certificate reflecting the existence of Contractor's Public Liability and Property Damage Liability Insurance and Contractor's Protective Public Liability and Property Damage Liability Insurance.

meeting such requirements. It is further distinctly understood and agreed by the undersigned that its liability to the Railway Company herein under Paragraph 2, will not in any way be limited to the amount of insurance obtained and carried by the undersigned in connection with said contract.

3. That the undersigned will observe and comply with all the provisions, obligations and limitations to be observed by Contractor which are contained in the sub-division of the specifications of the contract referred to in the second paragraph hereof, entitled "Relations with Railway Company", which shall include, but not be limited to, payment of all costs incurred for any damages to Railroad roadbed, tracks, and/or appurtenances thereto, resulting from use, occupancy, presence of its employees or agents on or about the construction site.

AT&SF Railway Co.

Date: \_\_\_\_\_

Kindly acknowledge receipt of this letter and of the insurance policies herein provided to be furnished to you by signing and returning to the undersigned a copy of this letter, which shall thereupon constitute an agreement between us.

Yours truly,

\_\_\_\_\_  
By \_\_\_\_\_

Receipt of the foregoing letter and of the policies and certificates of insurance herein provided to be furnished is hereby acknowledged this

\_\_\_\_\_ day of \_\_\_\_\_, 19\_\_\_\_,  
THE ATCHISON, TOPEKA AND SANTA FE RAILWAY COMPANY

By \_\_\_\_\_

Its \_\_\_\_\_

RELATIONS WITH RAILWAY COMPANY

-1.01 General.--The Contractor, as a prerequisite for award, shall be satisfactory as to his responsibility and ability to perform the work over and across the property and over or under the tracks of The Atchison, Topeka and Santa Fe Railway Company.

It is expected that The Atchison, Topeka and Santa Fe Railway Company will cooperate with the Contractor to the end that the work may be handled in an efficient manner, but the Contractor shall have no claim for damages or extra compensation in the event his work is held up by the work of the Railway Company forces.

-1.02 Agreement.--Before doing any work on Railway right of way, or property, the Contractor will be required to execute and deliver to The Atchison, Topeka and Santa Fe Railway Company a letter agreement, in the form attached hereto, obligating the Contractor to provide and keep in full force and effect the insurance called for under "insurance" of these special provisions.

-1.03 Railway Requirements.--The Contractor shall cooperate with The Atchison, Topeka and Santa Fe Railway Company where work is over or under the tracks, or within the limits of Railway property in order to expedite the work and to avoid interference with the operation of Railway equipment.

The Contractor shall comply with the rules and regulations of Railway or the instructions of its representatives in relation to the proper manner of protecting the tracks and property of Railway and the traffic moving on such tracks, as well as the wires, signals and other property of Railway, its tenants or licensees, at and in the vicinity of the work during the period of construction.

The Contractor shall perform his work in such manner and at such times as shall not endanger or interfere with the safe and timely operation of the tracks and property of Railway and the traffic moving on such tracks, as well as wires, signals and other property of Railway, its tenants or licensees, at or in the vicinity of the work.

The Contractor shall take protective measures necessary to keep Railroad facilities, including track ballast, free of sand or debris resulting from his operations. Any damage to Railroad facilities resulting from contractor's operations will be repaired or replaced by Railroad and the cost of such repairs or replacement shall be deducted from the contractor's progress and final pay estimates.

The Contractor shall not pile or store any materials, park or use his equipment closer to the center of the nearest Railway track, or overhead lines, than permitted by the following clearances:

- 10'-0"      Horizontally from center line of track.
- 22'-6"      Vertically above top of rail
- 27'-0"      Vertically above top of rail for electric wires carrying less than 750 volts.
- 28'-0"      Vertically above top of rail for electric wires carrying 750 volts to 15,000 volts.
- 30'-0"      Vertically above top of rail for electric wires carrying 15,000 volts to 20,000 volts.
- 34'-0"      Vertically above top of rail for electric wires carrying more than 20,000 volts.

Any infringement on the above clearances or walkways due to the Contractor's operations shall be submitted to the Railway and to the Engineer and shall not be undertaken until approved by the Railway, and until the Engineer has obtained any necessary authorization from the Public Utilities Commission for the infringement. No extra compensation will be allowed in the event the Contractor's work is delayed pending Railway approval, and Public Utilities Commission authorization.

In the case of impaired vertical clearance above top of rail, Railway shall have the option of installing tall-tales or other protective devices railway deems necessary for protection of railway trainmen or rail traffic.

The details of construction affecting the Railway tracks and property not included in the contract plans shall be submitted to the Railway for approval before such work is undertaken.

If the Contractor desires to move his equipment or materials across Railway's tracks he shall obtain permission from Railway and, should it be required, the Contractor shall obtain a private crossing agreement. The crossing installation for the use of the Contractor, if required, shall be at the expense of the Contractor.

The Contractor shall, upon completion of the work covered by this contract to be performed by the Contractor upon the premises or over or beneath the tracks of Railway, promptly remove from the premises of Railway all of Contractor's tools, implements and other materials, whether brought upon said premises by said Contractor or any Sub-contractor, employee or agent of Contractor or of any Sub-contractor, and cause said premises to be left in a clean and presentable condition.

**-1.04 Protection of Railroad Facilities:-**

- (1) Upon advance notification of not less than 24 hours by contractor, Railroad representatives, conductors, flagmen or watchmen will be provided by railroad to protect its facilities, property and movements of its trains or engines. In general, Railroad will furnish such personnel or other protective services:
  - (a) When any part of any equipment is standing or being operated within 10 feet, measured horizontally, from centerline of any track on which trains may operate, or when any erection or construction activities are in progress within such limits, regardless of elevation above or below track.
  - (b) For any excavation below elevation of track subgrade if, in the opinion of Railroad's representative, track or other railroad facilities may be subject to settlement or movement.
  - (c) For any clearing, grubbing, grading, or blasting in proximity to Railroad facilities which, in the opinion of Railroad's representative, may endanger Railroad facilities or operations.
- (2) Railroad will furnish such personnel or other protective services when, in the opinion of Railroad's representative, Railroad facilities, including, but not limited to, tracks, buildings, signals, wire lines or pipe lines, may be endangered.
- (3) Information as to the Railroad employees which may be required to provide protection to Railroad facilities is as follows:
  - (a) Inspector                    \$250.00 per day plus expenses
  - (b) Flagman                      \$200.00 per day plus expenses

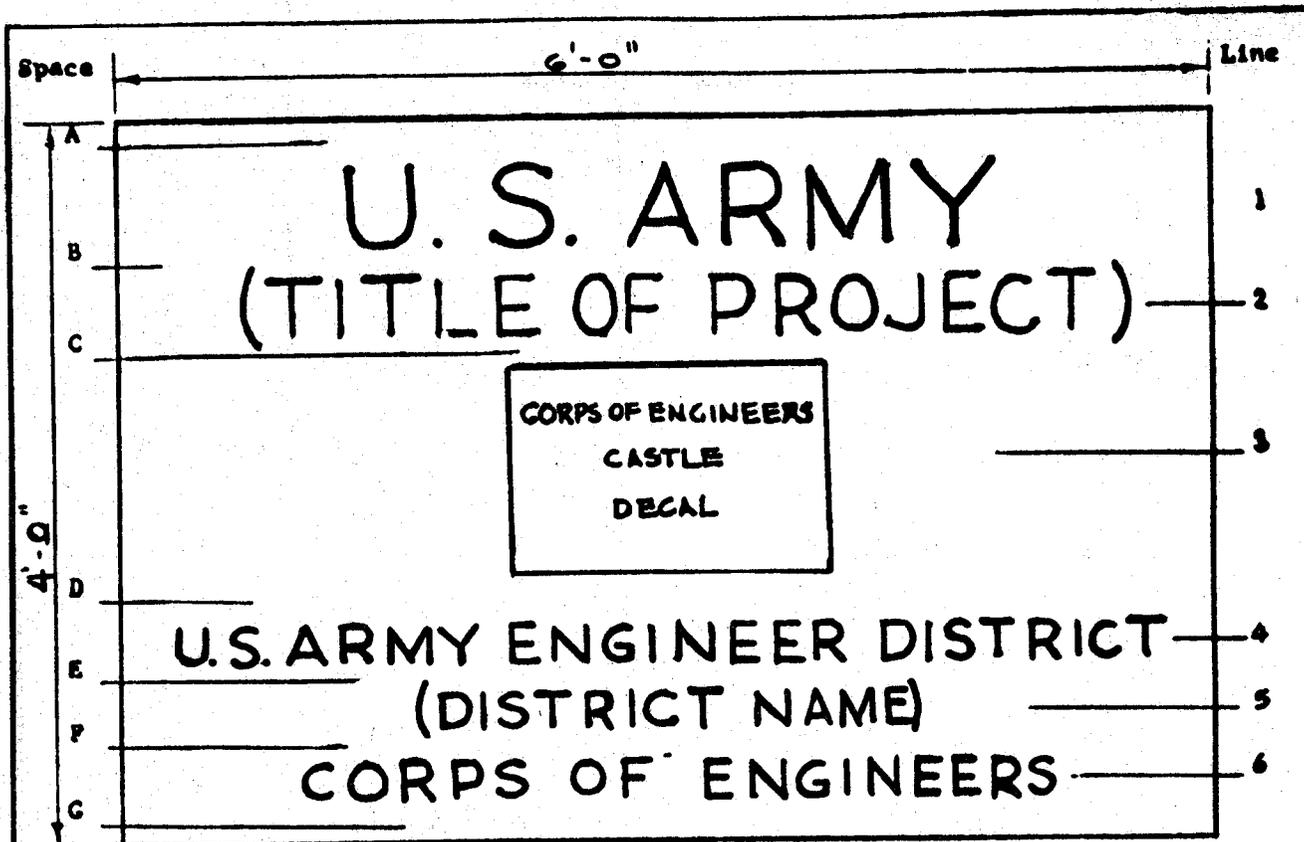
The above rates are for estimating only, and rates in effect at the time of construction will be used for overtime, number of hours to be paid for, and travel, meal and lodging allowances will be in accordance with labor union agreements in effect at the time the work is performed.

To all direct labor costs, there shall be added additional charges for Vacation Allowance; Holiday Pay; Health and Welfare; Railroad Retirement and Unemployment Taxes; Public Liability, Property Damage, and Workman's Compensation Insurance; and Accounting and Billing.

The cost of all Railroad personnel, equipment, and facilities deemed necessary by the Railway and provided by the Railway for the protection of Railroad facilities and trains during the period of construction within Railway right-of-way and the cost of installing protective devices in the case of impaired clearance shall be borne by the Government. The Contractor shall be responsible for payment of all costs incurred for any damages to Railroad roadbed, track and/or appurtenances thereto, resulting from use, occupancy, presence of its employees or agents on or about the construction site.

- (4) Railroad will submit its final bills for flagging and related services to Government after completion of the project. Government will pay all flagging charges.

**-1.05 Work by Railway Company. -** Railroad will rearrange its tracks, telephons, telegraph, and signal lines and appurtenances, and will perform any other work in connection therewith, except grading to be done by others.



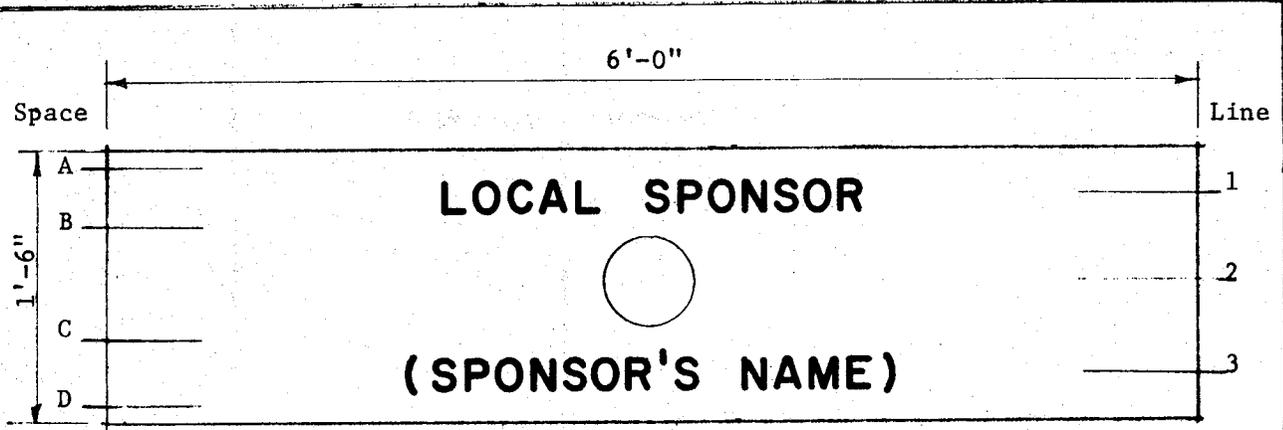
SCHEDULE

<u>Space</u>	<u>Height</u>	<u>Line</u>	<u>Description</u>	<u>Letter Height</u>	<u>Stroke</u>
A	3"	1	U. S. ARMY	5 1/2"	7/8"
B	2"	2	PROJECT NOMENCLATURE	4"	5/8"
C	2"	3	CORPS OF ENGINEERS CASTLE (DECAL)	1 1/4"	--
D	3"	4	U. S. ARMY ENGINEER DISTRICT	2 3/4"	3/8"
E	2"	5	DISTRICT NAME	2 1/4"	1/4"
F	2"	6	CORPS OF ENGINEERS	2 1/2"	3/8"
G	3"				

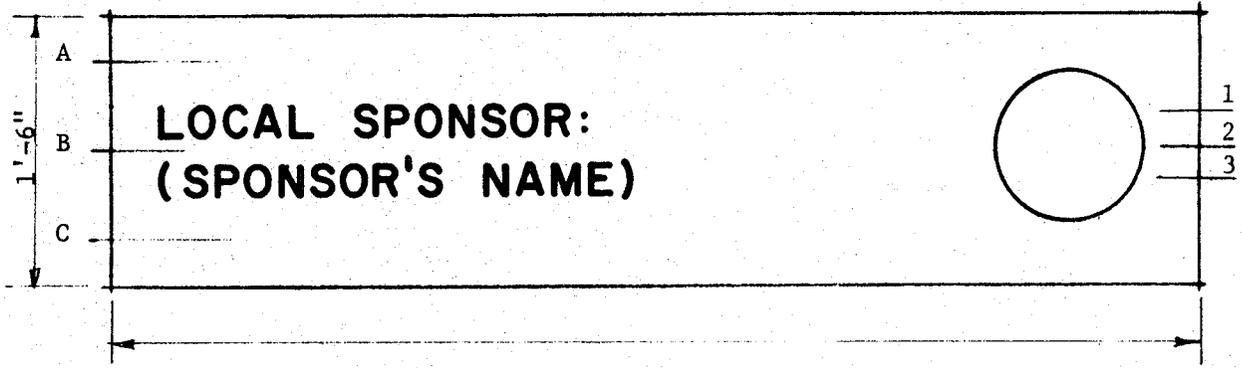
Lettering Color -- Black

PROJECT SIGN  
(Army-Civil Works)

Figure 1  
14 August 1972



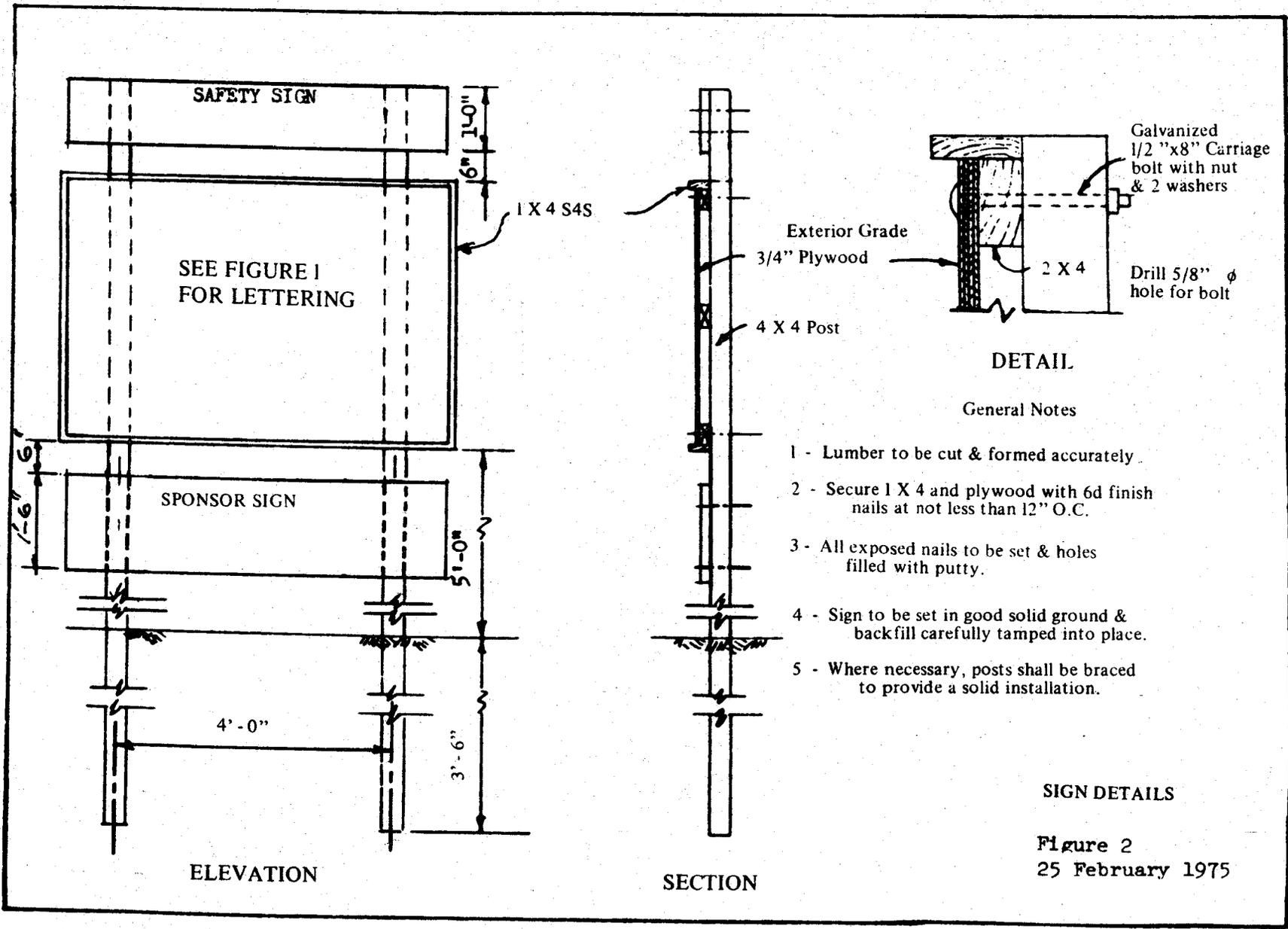
<u>Space</u>	<u>Height</u>	<u>Line</u>	<u>Description</u>	<u>Letter Height</u>	<u>Stroke</u>
A	2"	1	LOCAL SPONSOR	2"	3/8"
B	2" Min.	2	SPONSOR'S EMBLEM (DECAL)		
C	2" Min.	3	SPONSOR'S NAME	2"	3/8"
D	2"				



<u>Space</u>	<u>Height</u>	<u>Line</u>	<u>Description</u>	<u>Letter Height</u>	<u>Stroke</u>
A	6"	1	LOCAL SPONSOR	2"	3/8"
B	2"	2	SPONSOR'S EMBLEM (DECAL)		
C	6"	3	SPONSOR'S NAME	2"	3/8"

Lettering Color -- Black

Figure 1A  
21 February 1975



**DETAIL**

**General Notes**

- 1 - Lumber to be cut & formed accurately.
- 2 - Secure 1 X 4 and plywood with 6d finish nails at not less than 12" O.C.
- 3 - All exposed nails to be set & holes filled with putty.
- 4 - Sign to be set in good solid ground & backfill carefully tamped into place.
- 5 - Where necessary, posts shall be braced to provide a solid installation.

**SIGN DETAILS**

**Figure 2**  
25 February 1975

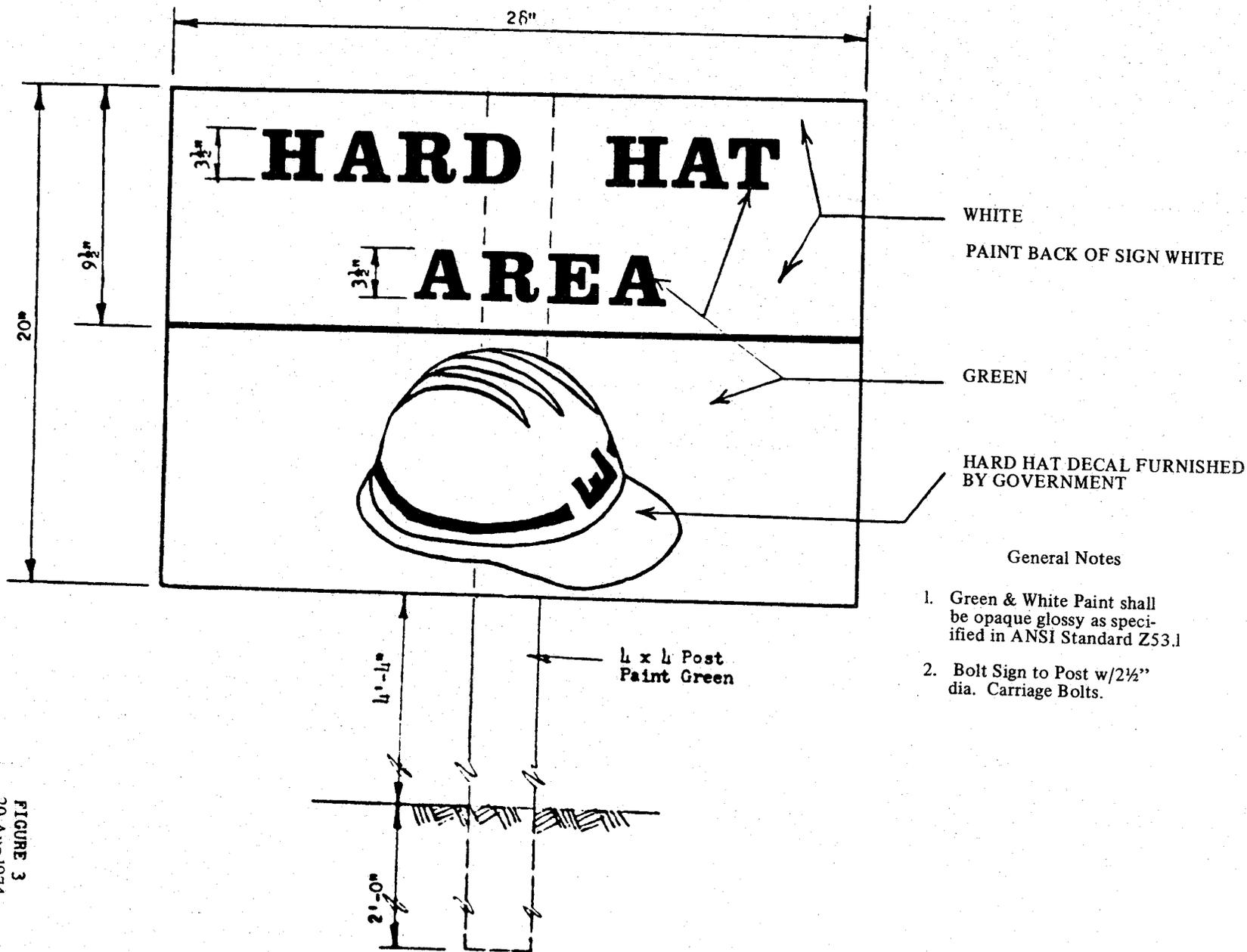


FIGURE 3  
20 Aug 1974

## SECTION 1B

### MEASUREMENT AND PAYMENT

#### Index

- |   |   |
|---|---|
| 1. Diversion and Control of Water                 | 14. Inlet Channel, Sta. 348+44                  |
| 2. Clearing Site and Removing Obstructions        | 15. Storm Drain Channel, Sta. 322+00            |
| 3. Excavation                                     | 16. Side Drains, Catch Basins, and<br>Spillways |
| 4. Landfill Excavation and Disposal               | 17. Bridge Protection                           |
| 5. Compacted Fill                                 | 18. Aggregate Base Course                       |
| 6. Backfill, Toe                                  | 19. Invert Stabilizer at Sta. 302+00            |
| 7. Miscellaneous Fill                             | 20. Safety Rail                                 |
| 8. Cement for Soil Cement                         | 21. Pipe Gates                                  |
| 9. Soil Cement                                    | 22. Landscaping                                 |
| 10. Modification at Olive Avenue                  | 23. Scour Gages and Monuments                   |
| 11. Modification of Lucky's Parking Lot           | 24. Fence Installation                          |
| 12. Road Modification at Peoria Avenue            |   |
| 13. Retaining Wall, Sta. 306+00 to<br>Sta. 307+26 |   |

1. DIVERSION AND CONTROL OF WATER. Payment will be made at the applicable contract price, which payment shall constitute full compensation for the diversion and control of water, complete.

2. CLEARING SITE AND REMOVING OBSTRUCTIONS. Payment will be made at the applicable contract price, which payment shall constitute full compensation for clearing the site and removing obstructions, including clearing and grubbing, complete.

#### 3. EXCAVATION.

3.1 Measurement. A survey of the site shall be made prior to commencement of work, and all measurements will be based on this survey without regard to any changes in the site that may be made between the excavation lines and grades indicated on the drawings or staked in the field and ground surfaces as indicated by the above mentioned surveys. The actual slopes as excavated may be greater or less than those indicated or staked depending on the materials excavated and methods used in performing the work, but such alterations shall not change the measurement for payment from the original lines as specified herein. The quantity of directed excavation necessary for the removal of unsuitable foundation material as specified shall be included in the measurement of the excavation where the unsuitable soils are encountered. Quantities will be computed in cubic yards by the average end area method and the planimeter will be considered a precise instrument for measurement of plotted cross sections. All excavation outside of excavation lines shown on the drawings or staked in the field will be considered as being for the convenience of the Contractor. Measurement for the payment will not include voids larger than 5 cubic feet in structures to be removed.

3.2 Payment for Excavation will be made at the applicable contract price, which payment shall constitute full compensation for excavation (including toe excavation), stockpiling, hauling and disposal of the excavated materials, complete, but shall not include excavation from borrow areas landfill excavation and disposal.

#### 4. LANDFILL EXCAVATION AND DISPOSAL.

4.1 Payment for landfill excavation and disposal will be made at the applicable contract price, which payment shall constitute full compensation for excavation and disposal of landfill material, including monitoring of excavation, complete.

#### 5. COMPACTED FILL.

5.1 Measurement of Compacted Fill will be made between the excavation and structure lines and the fill limit lines, or between the ground lines and fill lines, as indicated or staked in the field. Quantities will be computed in cubic yards by the average end area method and the planimeter will be considered a precise instrument for measuring plotted cross sections.

5.2 Payment will be made at the applicable contract price, which payment shall constitute full compensation for placing and compacting the fill, complete.

#### 6. BACKFILL, TOE.

6.1 Measurement for payment of the Backfill, Toe will be made between the toe excavation line and soil cement structure line and the excavation channel lines (invert line) as indicated. Quantities will be computed in cubic yards by the average end area method and the planimeter will be considered a precise instrument for measuring plotted cross sections.

6.2 Payment for Backfill, Toe will be made at the applicable contract price, which payment shall constitute full compensation for placing and compacting the backfill, complete.

#### 7. MISCELLANEOUS FILL.

7.1 Measurement for payment of Miscellaneous Fill will be measured to the nearest cubic yard. Quantities will be computed by the average end area method and the planimeter will be considered a precise instrument for measuring plotted cross sections.

7.2 Payment for Miscellaneous Fill will be made at the applicable contract price, which payment shall constitute full compensation for placing and final grading of the miscellaneous fill, complete.

#### 8. CEMENT FOR SOIL CEMENT.

8.1 Measurement. The quantity of Cement to be paid for will be the number of hundred-weight (100 pounds) of cement used for soil cement on a cubic yard basis unless specifically excepted, wasted or used for the convenience of the Contractor. The quantity to be paid for will be determined by multiplying the approved weight in pounds of cement per cubic yard by the number of cubic yards of grout or soil cement within the paylines of the structures and dividing by 100.

8.2 Payment for Cement will be made at the applicable contract price, which payment shall constitute full compensation for the cement used.

9. SOIL CEMENT.

9.1 Measurement of the Soil Cement to be paid for will be in cubic yards acceptably placed between the excavation and pay lines as indicated. Quantities will be computed by the end area method and the planimeter will be considered a precise instrument for measuring plotted cross sections.

9.2 Payment for Soil Cement will be at the applicable contract price, which payment shall constitute full compensation for the soil cement including materials (except cement), batching, hauling, placing, curing, and trimming, complete in place.

10. MODIFICATION AT OLIVE AVENUE. Payment will be made at the applicable contract price, which payment shall constitute full compensation for labor, materials, and construction for the modification of the safety barrier at Olive Avenue and shotcreting of the side slope. Included in this item are the shotcrete, aggregate base course, asphalt concrete pavement including tack and prime coats, sawcutting and joining to existing pavement, removal of existing safety barrier, and construction of the safety barrier.

11. MODIFICATION OF LUCKY'S PARKING LOT. Payment will be made at the applicable contract price, which payment shall constitute full compensation for labor, materials and construction for the modification of Lucky's Parking Lot. Included in this item are the aggregate base course, asphalt concrete pavement including tack and prime coats, sawcutting and joining the existing pavement, and removal of the existing asphalt curb.

12. ROAD MODIFICATOIN AT PEORIA AVENUE. Payment will be made at the applicable contract price, which payment shall constitute full compensation for labor, materials and construction for the modification of Peoria Avenue. Included in this item are the aggregate base course, sawcutting and removal of the existing asphalt curb.

13. RETAINING WALL, STA. 306+00 TO STA. 307+26. Payment will be made at the applicable contract price, which payment shall constitute full compensation for the retaining wall, including all materials and labor, complete.

14. INLET CHANNEL, STA. 348+44. Payment will be made at the applicable contract price, which payment shall constitute full compensation of the shotcrete lined portion of the inlet channel at Sta. 348+44, including all materials and labor, complete. Included in this item are sawcutting and removing of the existing channel, placing compacted fill, reinforcement and shotcrete.

15. STORM DRAIN CHANNEL, STA. 322+00. Payment will be made at the applicable contract price, which payment shall constitute full compensation for the construction of the storm drain channel at Station 322+00, including all materials and labor, complete.

16. SIDE DRAINS AND SPILLWAYS. Payment will be made at the applicable contract price, which payment shall constitute full compensation for the side drains (except at Sta. 348+44 and Sta. 322+00) and spillways, including all materials and labor, complete.

17. BRIDGE PROTECTION. Payments will be made at the applicable contract price, which payments shall constitute full compensation for the construction of the bridge protections at Grand Avenue (including the AT&SF Railway bridge), Peoria Avenue, Glendale Avenue, and Thunderbird Road bridges including all materials and labor, complete. The bridge protection at Grand Avenue shall include the construction of the retaining walls, reinforced concrete beneath Grand Avenue and the grouted stone.

18. AGGREGATE BASE COURSE.

18.1 Measurement for Payment of Aggregate Base Course will be in cubic yards acceptably placed as indicated on the drawings.

18.2 Payment for Aggregate Base Course will be made at the applicable contract price, which payment shall constitute full compensation for furnishing and placing of the aggregate base course.

19. INVERT STABILIZER AT STA. 302+00. Payment will be made at the applicable contract price, which payment shall constitute full compensation for the construction of the invert stabilizer at Station 302+00, including all labor and materials, complete.

20. SAFETY RAIL.

20.1 Measurement of Safety Rail will be the actual number of linear feet of safety rail, measured end to end, acceptably installed.

20.2 Payment for Safety Rail will be made at the applicable contract price, which payment shall constitute full compensation for furnishing and installing the safety rail, complete in place.

21. PIPE GATES.

21.1 Measurement of the Pipe Gate will be the actual number of pipe gates acceptably installed.

21.2 Payment for the Pipe Gate will be made at the applicable contract price, which payment shall constitute full compensation for furnishing and installing the pipe gate, complete in place.

22. LANDSCAPING. Payment will be made at the applicable contract price, which payment shall constitute full compensation for furnishing and installing the irrigation system and all trees, hydroseeding, groundcover and shrubs, picket fence, including electrical equipment for the irrigation system, materials, installation, and maintaining, complete.

23. SCOUR GAGES AND MONUMENTS. Payment for the scour gages will be made at the applicable contract price, which payment shall constitute full compensation for construction of the scour gages and monuments at locations indicated on the drawings including all materials and labor, complete. Contracting Officer to furnish Bronze Disk Monuments.

24. FENCE INSTALLATION. Payment for fence installation will be made at the applicable contract price, which payment shall constitute full compensation for removing the existing fence, furnishing and installing fence, complete in place.

\* \* \* \* \*

## SECTION 1C

### CONTRACTOR'S QUALITY CONTROL

#### Index

- |                                 |                                  |
|---------------------------------|----------------------------------|
| 1. General                      | 6. Tests                         |
| 2. Quality Control Plan         | 7. Completion Inspection         |
| 3. Quality Control Organization | 8. Documentation                 |
| 4. Submittals                   | 9. Notification of Noncompliance |
| 5. Control                      |                                  |

1. GENERAL. The Contractor shall establish and maintain an effective quality control system in compliance with CONTRACT CLAUSE: INSPECTION OF CONSTRUCTION. The quality control system consist of plans, procedures, and organization necessary to provide materials, equipment, workmanship, fabrication, construction and operations which comply with contract requirements. The system shall cover construction operations, both onsite and offsite, and shall be keyed to the proposed construction sequence.

#### 2. QUALITY CONTROL PLAN.

2.1 General. The Government will consider an interim plan for the first 15 days of operation. However, the Contractor shall furnish for approval by the Government, not later than 30 days after receipt of Notice to Proceed the Contractor Quality Control (CQC) Plan with which he proposes to implement the requirements of CONTRACT CLAUSE: INSPECTION OF CONSTRUCTION. The plan shall identify personnel, procedures, instructions, records, and forms to be used. If the Contractor fails to submit an acceptable QC plan within the time prescribed, the Contracting Officer (CO) may refuse to allow construction to start if an acceptable interim plan is not furnished or withhold funds from progress payments in accordance with the CONTRACT CLAUSE: PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS until such time as the Contractor submits an acceptable final plan.

2.2 Coordination Meeting. Before start of construction, the Contractor shall meet with the CO and discuss the Contractor's quality control system. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's inspection and control with the Government's inspection. Minutes of the meeting shall be prepared and signed by both the Contractor and the CO. The minutes shall become a part of the contract file. There may also be occasions when subsequent conferences will be called to reconfirm mutual understandings.

2.3 The Quality Control Plan. This plan shall include as a minimum, the following:

2.3.1 A description of the quality control organization including chart showing lines of authority and acknowledgement that the CQC staff shall conduct the phase inspections for all aspects of the work specified and shall report to the project manager or someone higher in the Contractor's organization.

2.3.2 The name, qualifications, duties, responsibilities and authorities of each person assigned a QC functions.

2.3.3 A copy of the letter to the QC manager signed by an authorized official of the firm, which describes the responsibilities and delegates the authorities of the QC manager shall be furnished.

2.3.4 Procedures for scheduling and managing submittals, including those of subcontractors, offsite fabricators, suppliers and purchasing agents.

2.3.5 Control testing procedures for each specific test. (Laboratory facilities will be approved by the Contracting Officer).

2.3.6 Reporting procedures including proposed reporting formats.

2.4 Acceptance of Plan. Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC plan and operations as necessary to obtain the quality specified.

2.5 Notification of Changes. After acceptance of the QC plan, the Contractor shall notify the CO in writing of any proposed change. Proposed changes are subject to acceptance by CO.

### 3. QUALITY CONTROL ORGANIZATION.

3.1 System Manager. The Contractor shall identify an individual, within his organization at the site of the work, who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. This CQC System Manager shall be approved by the CO.

3.2 Personnel. A staff shall be maintained under the direction of the system manager to perform all QC activities. The actual strength of the staff during any specific work period may vary to cover work phase needs, shifts, and rates of placement. The personnel of this staff shall be fully qualified by experience and technical training to perform their assigned responsibilities and shall be directly hired by and work for the Prime Contractor.

4. SUBMITTALS. Submittals shall be as specified in the SPECIAL CLAUSE: SUBMITTALS. The CQC Organization shall be responsible for certifying that all submittals are in compliance with the contract requirements.

5. CONTROL. Contractor Quality Control is the means by which the Contractor assures himself that his construction complies with the requirements of the contract plans and specifications. The controls shall be adequate to cover all construction operations, including both onsite and offsite fabrication, and will be keyed to the proposed construction sequence. The controls shall include at least three phases of inspection for all definitive features of work as follows:

5.1 Preparatory Inspection. This shall be performed prior to beginning any work on any definable feature of work. It shall include a review of contract requirements; a check to assure that all materials and/or equipment have been tested, submitted and approved; a check to assure that provisions have been made

to provide required control testing; examination of the work area to ascertain that all preliminary work has been completed; and a physical examination of materials, equipment and sample work to assure that they conform to approved shop drawings or submittal data and that all materials and/or equipment are on hand. The Contracting Officer's Representative (COR) shall be notified at least 24 hours in advance of the preparatory inspection and such inspection shall be made a matter of record in the Contractor's Quality Control documentation as required below. Subsequent to the preparatory inspection and prior to commencement of work, the Contractor shall instruct each applicable worker as to the acceptable level of workmanship required in his CQC plan in order to meet contract specifications.

5.2 Initial Inspection. This shall be performed as soon as a representative portion of the particular feature of work has been accomplished and shall include examination of the quality of workmanship and a review of control testing for compliance with contract requirements, use of defective or damaged materials, omissions, and dimensional requirements. The Contracting Officer's Representative shall be notified at least 24 hours in advance of the initial inspection and such inspection shall be made a matter of record in the CQC documentation as required below.

5.3 Follow-up Inspections. These shall be performed daily to assure continuing compliance with contract requirements, including control testing, until completion of the particular feature of work. Such inspections shall be made a matter of record in the CQC documentation as required below. Final follow up inspections shall be conducted and test deficiencies corrected prior to the addition of new features of work.

## 6. TESTS.

6.1 Testing Procedure. The Contractor shall perform tests specified or required to verify that control measures are adequate to provide a product which conforms to contract requirements. The Contractor shall procure the services of an industry recognized testing laboratory or he may establish an approved testing laboratory at the project site. A list of tests which the Contractor understands he is to perform shall be furnished as a part of the CQC plan to the Contracting Officer. The list shall give the test name, specification paragraph containing the test requirements, and the personnel and laboratory responsible for each type of test. The Contractor shall perform the following activities and record and provide the following data.

6.1.1 Verify that testing procedures comply with contract requirements.

6.1.2 Verify that facilities and testing equipment are available and comply with testing standards.

6.1.3 Check test instrument calibration data against certified standards.

6.1.4 Verify that recording forms, including all of the test documentation requirements, have been prepared.

## 6.2 Testing.

6.2.1 Capability Check. The COR will have the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check laboratory technician's testing procedures and techniques.

6.2.2 Capability Re-Check. If the selected laboratory fails the capability check, the Contractor will be assessed a charge of \$675.00 to reimburse the Government for each succeeding re-check of the laboratory or the checking of a subsequently-selected laboratory. Such costs will be deducted from the contract amount due the Contractor.

6.2.3 Project Laboratory. The COR will have the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

6.2.4 Transportation of Samples for Testing. Costs incidental to the transportation of samples or materials will be borne by the Contractor. Samples of materials for test verification and acceptance testing by the Government shall be delivered to the Corps of Engineers Division Laboratory, f.o.b., at the following address:

For delivery by mail: Director  
South Pacific Division Laboratory  
U.S. Army Corps of Engineers  
P.O. Box 37  
Sausalito, CA 94966

For other deliveries: Director  
South Pacific Division Laboratory  
U.S. Army Corps of Engineers  
Bridgeway, Foot of Spring St.  
(bldg. directly east of 2000 Bridgeway)  
Sausalito, CA 94965

7. COMPLETION INSPECTION. At the completion of all work or any increment thereof established by a completion time stated in the paragraph: COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK or stated elsewhere in the specifications, the CQC System Manager shall conduct a completion inspection of the work and develop a punch list of items which do not conform to the approved plans and specifications. Such a list shall be included in the CQC documentation, as required by paragraph: DOCUMENTATION below, and shall include the estimated date by which the deficiencies will be corrected. The CQC System Manager or his staff shall make a second completion inspection to ascertain that all deficiencies have been corrected and so notify the Contracting Officer's Representative. The completion inspection and any deficiency corrections required by this paragraph will be accomplished within the time stated for completion of the entire work or any particular increment thereof if the project is divided into increments by separate completion dates.

8. DOCUMENTATION.

8.1 The Contractor shall maintain correct records of quality control operations, activities, and tests performed including the work of suppliers and subcontractors. In addition, these records shall include factual evidence that the required activities or tests have been performed, including but not limited to the following:

8.1.1 Type and number of control activities and tests involved.

8.1.2 Results of control activities or tests.

8.1.3 Nature of defects, causes for rejection, etc.

8.1.4 Proposed remedial action.

8.1.5 Corrective actions taken.

8.2 These records shall cover both conforming and defective or deficient features and shall include a statement that supplies and materials incorporated in the work comply with the contract. Legible copies of these records shall be furnished to the CO daily.

9. NOTIFICATION OF NONCOMPLIANCE. The Contracting Officer will notify the Contractor of any noncompliance with the foregoing requirements. The Contractor shall, after receipt of such notice immediately take corrective action. Such notice, when delivered to the Contractor or his representative at the site of the work, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of claim for extension of time or for excess costs or damage by the Contractor.

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## SECTION 1D

### ENVIRONMENTAL PROTECTION

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| 6. Protection of Environmental Resources |  |

1. SCOPE. This section covers prevention of environmental pollution and damage as the result of construction operations under this contract and for those measures set forth in other Technical Provisions of these specifications. For the purpose of this specification, environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environment for aesthetic, cultural and/or historical purposes. The control of environmental pollution and damage requires consideration of air, water, and land, and includes management of visual aesthetics, noise, solid waste, radiant energy and radioactive materials, as well as other pollutants.

2. QUALITY CONTROL. The Contractor shall establish and maintain quality control for environmental protection of all items set forth herein. The Contractor shall record on daily reports any problems in complying with laws, regulations and ordinances and corrective action taken.

3. SUBMITTALS. The Contractor shall submit an environmental protection plan in accordance with provisions as herein specified and in the SPECIAL CLAUSES.

3.1 Environmental Protection Plan shall include but not be limited to the following:

(1) A list of Federal, State and local laws, regulations, and permits concerning environmental protection, pollution control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations and permits.

(2) Methods for protection of features to be preserved within authorized work areas. The Contractor shall prepare a listing of methods to protect resources needing protection, i.e., trees, shrubs, vines, grasses and ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, archeological and cultural resources.

(3) Procedures to be implemented to provide the required environmental protection and to comply with the applicable laws and regulations. The Contractor shall set out the procedures to be followed to correct pollution of the environment due to accident, natural causes or failure to follow the procedures set out in accordance with the environmental protection plan.

(4) Permit or license and the location of the solid waste disposal area.

(5) Drawings showing locations of any proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials.

(6) Environmental monitoring plans for the jobsite, including land, water, air, and noise monitoring.

(7) Methods of protecting surface and groundwater during construction activities.

(8) Work area plan showing the proposed activity in each portion of the area and identifying the areas of limited use or non-use. Plan should include measures for marking the limits of use areas.

3.2 Implementation. After receipt of Notice to Proceed, the Contractor shall submit in writing the above Environmental Protection Plan within 14 days. If the Contractor fails to submit an acceptable Environmental Protection Plan within the time herein prescribed, the Contracting Officer may refuse to allow construction to start or may withhold funds from progress payments in accordance with the CONTRACT CLAUSE: PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS until such time as the Contractor submits an acceptable final plan. Approval of the Contractor's plan will not relieve the Contractor of his responsibility for adequate and continuing control of pollutants and other environmental protection measures.

4. SUBCONTRACTORS. Assurance of compliance with this section by subcontractors will be the responsibility of the Contractor.

5. NOTIFICATION. The Contracting Officer will notify the Contractor in writing of any observed noncompliance with the aforementioned Federal, State or local laws or regulations, permits and other elements of the Contractor's environmental protection plan. The Contractor shall, after receipt of such notice, inform the Contracting Officer of proposed corrective action and take such action as may be approved. If the Contractor fails to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions shall be granted or costs or damages allowed to the Contractor for any such suspension.

6. PROTECTION OF ENVIRONMENTAL RESOURCES. The environmental resources within the project boundaries and those affected outside the limits of permanent work under this contract shall be protected during the entire period of this contract. The Contractor shall confine his activities to areas defined by the drawings and specifications. Environmental protection shall be as stated in the following subparagraphs.

6.1 Protection of Land Resources. Prior to the beginning of any construction, the Contractor shall identify all land resources to be preserved within the Contractor's work area. The Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, cacti, shrubs, vines, grasses, top soil, and land forms without special permission from the Contracting Officer. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage

unless specifically authorized. Where such special emergency use is permitted, the Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs.

6.1.1 Work Area Limits. Prior to any construction the Contractor shall mark the areas within the construction work limits that are not required to accomplish all work to be performed under this contract. Isolated areas within the general work area which are to be saved and protected shall also be fenced or flagged. Monuments and markers shall be protected before construction operations commence. Where construction operations are to be conducted during darkness, the markers shall be visible. The Contractor shall convey to his personnel the purpose of marking and/or protection of all necessary objects.

6.1.2 Protection of Landscape. Trees, cacti, shrubs, vines, grasses, land forms and other landscape features indicated and defined on the drawings to be preserved shall be clearly identified by fencing, flagging, or any other approved techniques.

6.1.3 Reduction of Exposure of Unprotected Erodible Soils. Earthwork brought to final grade shall be finished as indicated and specified. Side slopes and back slopes shall be protected as soon as practicable upon completion of rough grading. All earthwork shall be planned and conducted to minimize the duration of exposure of unprotected soils.

6.1.4 Temporary Protection of Disturbed Areas. Such methods as necessary shall be utilized to effectively prevent erosion and control sedimentation, including but not limited to the following:

(1) Retardation and control of Runoff. Runoff from the construction site shall be controlled by construction of diversion ditches, benches, and berms to retard and divert runoff to protected drainage courses, and any measures required by area-wide plans approved under paragraph 208 of the Clean Water Act.

6.1.5 Erosion and Sedimentation Control Devices. The Contractor shall construct or install all temporary and permanent erosion and sedimentation control features as necessary. Temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing and mulching shall be maintained until permanent drainage and erosion control facilities are completed and operative.

6.1.6 Location of Field Offices, Storage and Other Contractor Facilities. The Contractors' field offices, staging areas, stockpile storage, and temporary buildings shall be placed in areas designated by the Contracting Officer. Due to the sensitive nature of riparian habitat in the basin, strict adherence to the designated areas is necessary. Temporary movement or relocation of Contractor facilities shall be made only on approval by the Contracting Officer.

6.1.7 Spoil Areas shall be managed and controlled to limit spoil to areas designated and prevent erosion of soil or spoil from entering nearby water courses or lakes.

6.1.8 Temporary Excavations and Embankments for plant and/or work areas shall be controlled to protect adjacent areas from spoils.

6.1.9 Disposal of Solid Wastes. Solid wastes (excluding clearing debris) shall be placed in containers which are emptied on a regular schedule. All handling and disposal shall be conducted to prevent contamination and shall conform to the requirements of applicable local, State and Federal laws and regulations.

6.1.10 Disposal of Chemical Waste. Chemical waste shall be stored in corrosion resistant containers, removed from the work area and disposed of in accordance with Federal, State and local regulations. Crankcase oil and other waste chemicals shall be captured and not drained onto the ground.

6.1.11 Disposal of Discarded Materials. Discarded materials other than those which can be included in the solid waste category will be handled as directed by the Contracting Officer.

6.2 Preservation and Recovery of Historical, Archeological and Cultural Resources. Existing historical, archeological and cultural resources within the Contractor's work area will be so designated by the Contracting Officer and precautions taken to preserve all such resources as they existed at the time they were pointed out to the Contractor. The Contractor shall install all protection for these resources so designated on the drawings and shall be responsible for their preservation during this contract. If during construction activities the Contractor observes unusual items that might have historical or archeological value all work in the immediate area shall be stopped and such observations shall be reported as soon as practicable to the Contracting Officer. Recording and preservation of historical and archeological finds during construction shall conform to the requirements of the SPECIAL CLAUSES.

6.3 Protection of Water Resources. The Contractor shall keep construction activities under surveillance, management and control to avoid pollution of surface and groundwaters. Special management techniques as set out below shall be implemented to control water pollution by the listed construction activities which are included in this contract.

6.3.1 Washing and Curing Water. Waste waters directly derived from construction activities shall not be allowed to enter water areas. These waste waters shall be collected and placed in retention ponds where suspended material can be settled out or the water evaporates so that pollutants are separated from the water.

6.3.2 Cofferdam and Diversion Operations. The Contractor shall plan his operation and perform all work necessary to minimize adverse impact or violation of the water quality standard of Federal, state, or local governments. Construction operations for dewatering, removal of cofferdams shall be controlled at all times to limit the impact of water turbidity on the habitat for wildlife and impacts on water quality for downstream use.

6.3.3 Monitoring of Water Areas Affected by Construction Activities shall be the responsibility of the Contractor. All water areas affected by construction activities shall be monitored by the Contractor.

6.4 Protection of Fish and Wildlife Resources. The Contractor shall keep construction activities under surveillance, management and control to minimize interference with, disturbance to and damage of fish and wildlife. Species that require specific attention along with the measures for their protection will be listed by the Contractor prior to beginning of construction operations.

6.5 Protection of Air Resources. The Contractor shall keep construction activities under surveillance, management and control to minimize pollution of air resources. All activities, equipment, processes, and work operated or performed by the Contractor in accomplishing the specified construction shall be in strict accordance with the State of Arizona and all Federal emission and performance laws and standards. Ambient Air Quality Standards set by the Environmental Protection Agency shall be maintained for those construction operations and activities specified in this section. Special management techniques as set out below shall be implemented to control air pollution by the construction activities which are included in the contract.

6.5.1 Particulates. Dust particles, aerosols, and gaseous by-products from all construction activities, processing and preparation of materials, such as from asphaltic batch plants, shall be controlled at all times, including weekends, holidays and hours when work is not in progress. A permit will be required by Maricopa County that will require particulate suppression control.

6.5.1.1 Particulates Control. The Contractor shall maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause the air pollution standards mentioned in paragraph hereinabove to be exceeded or which would cause a hazard or a nuisance. Sprinkling, treatment with an approved non-toxic dust palliative, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated at such intervals as to keep the disturbed area damp at all times. The Contractor must have sufficient equipment available to accomplish this task. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs.

6.5.2 Hydrocarbons and Carbon Monoxide. Hydrocarbons and carbon monoxide emissions from equipment shall be controlled to Federal and State allowable limits at all times.

6.5.3 Odors. Odors shall be controlled at all times for all construction activities, processing and preparation of materials.

6.5.4 Monitoring of Air Quality shall be the responsibility of the Contractor. All areas affected by the construction activities shall be monitored by the Contractor.

6.6 Protection of Sound Intrusions. The Contractor shall keep construction activities under surveillance, and control to minimize damage to the environment by noise. Construction will not be allowed between the hours of 6:00 PM and 7:00 AM without the prior approval of the Contracting Officer.

7. RESTORATION OF LANDSCAPE DAMAGE. The Contractor shall restore all landscape features damaged or destroyed during construction operations outside the limits of the approved work areas. Such restoration shall be in accordance with the plan submitted for approval by the Contracting Officer. This work will be accomplished at the Contractor's expense.

8. MAINTENANCE OF POLLUTION CONTROL FACILITIES. The Contractor shall maintain all constructed facilities and portable pollution control devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

9. TRAINING OF CONTRACTOR PERSONNEL IN POLLUTION CONTROL. The Contractor shall train his personnel in all phases of environmental protection. The training shall include methods of detecting and avoiding pollution, familiarization with pollution standards, both statutory and contractual familiarization with cultural resource identification, and installation and care of facilities (vegetative covers, and instruments required for monitoring purposes) to ensure adequate and continuous environmental pollution control.

10. POST CONSTRUCTION CLEAN UP. The Contractor shall clean up areas used for construction.

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SECTION 1E

LANDFILL EXCAVATION MONITORING

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1. GENERAL. The Contractor shall establish and maintain an effective landfill excavation monitoring system in compliance with CONTRACT CLAUSE: INSPECTION OF CONSTRUCTION. The landfill excavation monitoring system consist of plans, procedures, and organization necessary to provide monitoring and reporting operations which comply with contract requirements. The system shall cover monitoring of excavation operations in the landfill areas, which will be identified by the Contracting Officer, and shall be keyed to the proposed construction sequence. Requirements for monitoring shall not relieve the Contractor from requirements of CONTRACT CLAUSE: PERMITS AND RESPONSIBILITIES.

2. LANDFILL EXCAVATION MONITORING PLAN.

2.1 General. The Contractor shall furnish for approval by the Government, not later than 30 days after receipt of Notice of Proceed, the Landfill Excavation Monitoring Plan with which he proposes to implement the requirements of CONTRACT CLAUSE entitled "INSPECTION OF CONSTRUCTION". The plan shall identify personnel, procedures, instructions, records, and forms to be used. If the Contractor fails to submit an acceptable Landfill Excavation Monitoring Plan within the time herein prescribed, the Contracting Officer may refuse to allow construction to start in the landfill area if an acceptable plan is not furnished or withhold funds from progress payments in accordance with the CONTRACT CLAUSE entitled "PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS" until such time as the Contractor submits an acceptable final plan.

2.2 Coordination Meeting. Before start of construction, the Contractor shall meet with the Contracting Officer and discuss the Contractor's Landfill Excavation Monitoring system. During the meeting, a mutual understanding of the system details shall be developed, including the requirements for reporting the Landfill Excavation Monitoring operations, control activities, testing, administration of the system for both onsite work and offsite testing, and the interrelationship of Contractor's inspection and control with the Government's inspection. Minutes of the meeting shall be prepared and signed by both the Contractor and the Contracting Officer. The minutes shall become a part of the contract file. There may also be occasions when subsequent conferences will be called to reconfirm mutual understandings.

2.3 The Landfill Excavation Monitoring Plan. This plan shall include as a minimum, the following:

2.3.1 A description of the Landfill Excavation Monitoring organization, including chart showing lines of authority and acknowledgement that the Landfill Excavation Monitoring staff shall conduct the phase inspections for all aspects of the work specified and shall report to the project manager or someone higher in the Contractor's organization.

2.3.2 The name, qualifications, duties, responsibilities and authorities of each person assigned Landfill Excavation Monitoring and/or testing functions.

2.3.3 A copy of the letter to the Landfill Excavation Monitoring manager signed by an authorized official of the firm, which describes the responsibilities and delegates the authorities of the Landfill Excavation Monitoring manager shall be furnished.

2.3.4 Procedures for scheduling and managing submittals, including those of subcontractors.

2.3.5 Procedures for use in the event of emergencies or encounter of hazardous wastes during excavations.

2.3.6 Reporting procedures, including proposed reporting formats.

2.3.7 Data supporting the qualifications of the Hazardous Waste Monitoring manager.

2.4 Acceptance of Plan. Acceptance of the Contractor's plan is required prior to the start of landfill excavation. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his Landfill Excavation Monitoring plan and operations as necessary to obtain the monitoring specified.

2.5 Notification of Changes. After acceptance of the Landfill Excavation Monitoring plan, the contractor shall notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by Contracting Officer.

### 3. LANDFILL EXCAVATION MONITORING ORGANIZATION.

3.1 System Manager. The Contractor shall identify an individual, within his organization at the site of the work, who shall be responsible for overall management of Landfill Excavation Monitoring and have the authority to act in all monitoring matters for the Contractor. The System Manager shall be a certified Industrial Hygienist or Safety and Health Specialist. A Certified Industrial Hygienist shall have working experience in the chemical industry and/or chemical waste industry and will have a sound working knowledge of State and Federal occupational and safety regulations and formal training in occupational safety and health. A Safety and Health specialist will have a minimum of two years working experience in the chemical industry and/or chemical waste industry. The Safety and Health Specialist will have a sound working knowledge of State and Federal occupational safety and health regulations and formal training in occupational safety and health. This System Manager shall be approved by the Contracting Officer.

3.2 Personnel. A staff shall be maintained under the direction of the system manager to perform all Landfill Excavation Monitoring activities. The actual strength of the staff during any specific work period may vary to cover work phase needs, shifts, and rates of placement. The personnel of this staff shall be fully qualified by experienced and technical training to perform their assigned responsibilities and shall be directly hired by and work for the Prime Contractor.

4. SUBMITTALS. Submittals shall be made as specified in the SPECIAL CLAUSE: SUBMITTALS. The Landfill Excavation Monitoring Organization shall be responsible for certifying that all submittals are in compliance with the contract requirements. Within 14 days of the submittal of the reporting required for samples collected, the Contracting Officer will notify the Contractor of the presence of any hazardous wastes in the landfill area.

5. CONTROL. Landfill Excavation Monitoring Control is the means by which the Contractor assures himself that his construction complies with the requirements of the contract plans and specifications. The controls shall be adequate to cover all construction operations, and will be keyed to the proposed construction sequence. Inspections shall be performed daily to assure continuing compliance with contract requirements, including control testing, until completion of the sampling and testing. Such inspections shall be made a matter of record in the Landfill Excavation Monitoring documentation as required below.

#### 6. MONITORING.

6.1 Monitoring Procedure. The Contractor shall perform monitoring specified or required to verify that control measures are adequate to provide monitoring conforming to contract requirements. A list of activities which the Contractor understands he is to perform shall be furnished as a part of the Landfill Excavation Monitoring plan to the Contracting Officer. The list shall give the specification paragraph containing the requirements and the personnel responsible for each activity. The Contractor shall perform the following activities.

6.1.1 Verify that monitoring complies with contract requirements.

6.1.2 Verify that monitoring is adequate to provide immediate notification of the presence of hazardous waste.

6.1.3 Verify that recording forms have been prepared.

#### 7. DOCUMENTATION.

7.1 The Contractor shall maintain correct records of Landfill Excavation Monitoring operations performed, including the work of subcontractors. In addition, these records shall include factual evidence that the required activities have been performed, including but not limited to the following:

7.1.1 Type and number of control activities involved.

7.1.2 Results of control activities.

7.1.3 Proposed remedial action.

7.1.4 Corrective actions taken.

7.1.5 Significant problems and results encountered outside of limits.

7.2 These records shall cover both conforming and defective or deficient. Legible copies of these records shall be furnished to the Contracting Officer daily. The Contractor shall maintain reports and supporting data throughout the duration of the contract.

8. NOTIFICATION OF NONCOMPLIANCE. The Contracting Officer will notify the Contractor of any noncompliance with the foregoing requirements. The Contractor shall, after receipt of such notice immediately take corrective action. Such notice, when delivered to the Contractor or his representative at the site of the work, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of claim for extension of time or for excess costs or damage by the Contractor.

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SECTION 2A

DIVERSION AND CONTROL OF WATER

1. REQUIREMENT.

1.1 General. All permanent construction shall be carried on in areas free from water. Water in varying quantities may be flowing in the river during the entire period of construction as a result of either rainfall or releases from agricultural irrigation ditches. Runoff from the watersheds is rapid, and, during periods of rain, intermittent freshets may be expected. The responsibility of the Contractor for protection of work against water flows is specified in paragraph: DAMAGE TO WORK of the SPECIAL CLAUSES. At all locations where construction work is at a lower elevation than the elevation of the stream or ground water at the time of doing the work, suitable cofferdams or dikes, if necessary, shall be constructed, the construction area shall be dewatered prior to commencement of work, and all subgrades, whether for earth fill, stone, or concrete, shall be kept drained and free of water throughout the working period. Within 10 days after receipt of Notice to Proceed, the Contractor shall submit plans showing the method that he proposes to use to dewater each working area and control the water from rain, sheet flow, stream flow, and any other surface water. The plans shall show the scheme of operations and a complete layout of drainage pipes, pumps, diversion channels, cofferdams, etc. The plans shall also take into consideration the following specific requirements.

1.2 Flood Flows. The Contractor shall provide for diversion of channel flows as hereinafter specified. The channel flows will include water originating from upstream of the work; adjacent drainages; and in addition any and all ground water originating within the work. Flood flows are defined as any flow in excess of 5000 cfs.

1.3 Drainage Ditches. The location and depth of any drainage ditch to be constructed under this contract shall be subject to the approval of the Contracting Officer. Special precautions shall be taken to avoid impairing the permanent subgrade, and any excavation below the existing streambed or invert subgrade shall be refilled with compacted fill in accordance with SECTION: FILLS AND SUBGRADE PREPARATION by and at the expense of the Contractor.

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## SECTION 2B

### CLEARING SITE AND REMOVING OBSTRUCTIONS

#### 1. PROTECTION.

1.1 Environmental Protection. All work and Contractor operations shall comply with the requirements of SECTIONS: ENVIRONMENTAL PROTECTION and EXCAVATION.

2. BURNING. The use of burning at the project site for the disposal of refuse and debris will not be permitted.

#### 3. REQUIREMENTS.

3.1 General. Except as otherwise specified, and/or indicated, areas to be cleared will be limited to actual excavation areas and areas on which fills and/or structures are to be placed. The removal of trees, shrubs, turf, and other vegetation outside of these areas shall be held to a minimum and care shall be exercised not to damage any trees, shrubs, turf, or vegetation which can be left in place.

3.2 Existing Structures and Obstructions. The Contractor shall clear and grub the site, including all fill, borrow, and excavation areas, and remove and dispose of all existing structures and obstructions for project construction, except as otherwise noted on the drawings. Obstructions which are designated or specified to be removed but which are not designated or specified to be removed by others shall be removed by the Contractor. Except as otherwise specified, obstructions designated to be removed by others will be removed in sufficient time to preclude interference with the Contractor's operations. Utility relocations are not considered to be obstructions.

3.2.1 Clearing. Trees smaller than 1-1/2 inches in diameter and other vegetation, except as specified, shall be cut off at least 6 inches below the indicated channel subgrade or ground level whichever is lower. Other vegetation shall be cut off flush or slightly below the original ground surface. Clearing operations shall be conducted so as to prevent damage to trees, structures, and installations under construction, or to remain in place, and to provide for the safety of employees and others. All rubbish, waste dumps, and debris areas shall be cleared.

3.2.2 Grubbing shall consist of removing all trees, stumps, roots, logs, and other objectionable vegetable matter in the required fills, foundation areas, and all excavation areas. In grubbing out stumps and roots, all roots or other timber more than 1-1/2 inches in diameter shall be removed to at least 3 feet below the depth of the required excavation or existing ground level, whichever is lower. Trees and stumps shall be pulled, not cut off.

3.3 Utilities. Prior to removing an obstruction, all applicable utility relocations shall have been coordinated in accordance with SECTION: GENERAL REQUIREMENTS paragraph: Public Utilities, Notices, and Restrictions. Pipes designated by owners as "abandoned" shall be removed within the limits of the project as necessary for clearing. All pipe shall be plugged at the cut ends.

4. DISPOSAL OF CLEARED, GRUBBED, AND REMOVED MATERIAL. All material removed, except material specified and/or indicated to be salvaged, is designated as scrap, shall become the property of the Contractor, and shall be removed from the site. Materials removed during clearing operations may be temporarily used for diversion and control of water. Disposal shall be in accordance with the requirements of SECTION: ENVIRONMENTAL PROTECTION.

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## SECTION 2C

### EXCAVATION

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1. **APPLICABLE PUBLICATIONS.** The American Society for Testing and Materials (ASTM) standard listed below form a part of this specification to the extent referenced. The publication is referred to in the text by the basic designation only.

D 2487-83

Classification of Soils for  
Engineering Purposes

2. **GENERAL.** Excavation shall consist of the removal of every type of material encountered (except materials covered by the provisions of the SECTION: CLEARING SITE AND REMOVING OBSTRUCTIONS) in the designated areas or from areas directed. The material to be removed may include, but is not limited to earth, hardpan, silt, clay, gravel, cemented sand and gravel, cobbles and boulders, adobe, detached pieces of stone and concrete, rock fills, existing fills of miscellaneous debris and rubbish, and other unsuitable materials. Slope lines indicated on the drawings for temporary cuts do not necessarily represent the actual slope to which the excavation must be made to safely perform the work. The stability of the temporary cut slopes and the safety of personnel shall be the responsibility of the Contractor. Stability of temporary cut slopes may require flatter slopes, in some instances, than that indicated on the drawings. Excavation for permanent cuts shall be made to the slope lines indicated. Excavation shall be performed in a manner which will not impair the subgrade. Except as otherwise specified, the finish surface of subgrades shall be smooth and shall not vary more than one inch from indicated grade.

3. **BLASTING.** Blasting will not be permitted.

4. **PRESERVATION OF PROPERTY.** All excavation operations shall be conducted in such a manner that street pavements, sidewalks, curbs, utilities, or other facilities and improvements which are to remain in place permanently will not be subjected to settlement or horizontal movement.

5. **EXCAVATION IN VICINITY OF STRUCTURES.** Excavation within the vicinity of existing structures, utilities, and drainage pipes to remain in place shall be performed in a manner to prevent damage to the structure. Earth banks and facilities to remain in place shall be supported as necessary during excavation. In general, unless otherwise shown or specified, the actual side slopes will be at the Contractor's option.

6. **EXCAVATION FOR DRAINS.** All excavations shall be made by open cut unless otherwise specified. The banks of trenches shall be kept as nearly vertical as practicable. Unless otherwise indicated, trenches shall not exceed 24 inches plus

pipe outside diameter (O.D.) for pipes of less than 24 inches inside diameter, and shall not exceed 36 inches plus pipe outside diameter for larger sizes. The maximum width of trench specified applies to the width at or below the level of the top of the pipe; the width of the trench above the level may be made as wide as necessary for sheathing and bracing and the proper installation of the work. The bottom of trenches shall be accurately graded to provide uniform bearing and support for each section of the pipe at every point along its entire length, except for portions of the pipe sections where it is necessary to excavate for the proper sealing of pipe joints. Except as otherwise indicated, the bottom of all trenches excavated shall be shaped and rounded to conform to the lowest one-fourth of the outside portion of circular pipe or to the lower curved portion of pipe arch for the entire length of the pipe or arch. If soft, spongy, unsatisfactory material as defined in the following paragraph, or material which by reason of its nature cannot be properly shaped or finished to a true pipe subgrade is encountered, it shall be removed and replaced with compacted fill.

7. REMOVAL OF UNSATISFACTORY SOILS. The removal of soils which are unsatisfactory for foundation for the channel, structures, embankments, and drains, may be required in certain areas. Unsatisfactory materials shall consist of any material classified by ASTM 2487 as PT, CH, OH, MH, and OL. Unsatisfactory materials include, but are not limited to those materials containing roots and other organic matter, trash, debris, and stones larger than 4 inches. Unsatisfactory materials also include man-made fills, refuse, or backfills from previous construction. Satisfactory materials consist of those materials not designated as unsatisfactory. The Contractor will be required to excavate any such areas to the depth directed by the Contracting Officer and backfill the areas with compacted fill conforming to the requirements of the SECTION: FILLS AND SUBGRADE PREPARATION.

#### 8. DISPOSAL OF EXCAVATED MATERIALS.

8.1 General. Excavated materials suitable for required fills shall be placed in temporary stockpiles or used directly in the work. All excess materials suitable for fills under the various specifications of this contract shall be placed in miscellaneous fill areas. Excavated material not suitable for compacted fills or back fills and unsatisfactory materials shall become the property of the Contractor and shall be removed from the site, except that unsuitable soils and broken concrete may be placed in miscellaneous fill areas as indicated on the drawings. No excavated materials or waste of any kind shall be disposed of at any place beyond the limits of the work under this contract without the approval of the Contracting Officer. Prior to placing material, the disposal areas and stockpile area(s) shall be cleared of trash and vegetation. Clearing shall conform to the applicable requirements of the SECTION: CLEARING SITE AND REMOVING OBSTRUCTIONS. The stockpiles and disposal fills shall be placed in a manner to preclude ponding of water.

8.2 All required fills shall be completed prior to disposal of any materials in disposal area(s) selected by the Contractor unless approved in writing by the Contracting Officer.

8.3 Additional requirements for disposal of excess excavated material can be found in the SPECIAL CLAUSES; and TECHNICAL PROVISIONS SECTIONS: GENERAL REQUIREMENTS; ENVIRONMENTAL PROTECTION; and CLEARING SITE AND REMOVING OBSTRUCTIONS.

9. OVERCUT. Except as otherwise specified or as may be ordered in writing by the Contracting Officer, any overcut or excavation made outside the lines indicated on the drawings or directed shall be backfilled with compacted fill, or concrete, and all excavating, backfilling, compacting of backfill, and concreting occasioned thereby shall be by the Contractor at no additional cost to the Government. Any overcut under bridge footings shall be backfilled with concrete.

10. EXCAVATION OF LANDFILL. Required excavation of areas designated as "landfill," by the Contracting Officer, shall be classified as excavation of landfill and shall conform to the following requirements. Material from required excavation of landfill shall become the property of the Contractor. Material from required excavation of landfill shall be removed from the site and disposed of by the Contractor in conformance with applicable local, State, and Federal laws and regulations except that soils and broken concrete may be disposed of in miscellaneous fill areas as shown on the drawings. Excavation of landfill shall be carefully monitored by the Contractor in accordance with Section: LANDFILL EXCAVATION MONITORING. Disposal of material from required excavation of landfill shall be in accordance with the requirements of SECTION: ENVIRONMENTAL PROTECTION.

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## SECTION 2D

### FILLS AND SUBGRADE PREPARATION

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|--|---|
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1. APPLICABLE PUBLICATIONS. The American Society for Testing and Materials (ASTM) standards listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

D 1556-82	Density of Soil In-Place by the Sand-Cone Method
D 1557-78	Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using a 10-Lb. (4.54-kg) Rammer and an 18-In. (457 mm) Drop
D 2487-83	Classification of Soils for Engineering Purposes
D 2922-81	Density of Soil and Soil-Aggregate In-Place By Nuclear Methods (Shallow Depth)

#### 2. COMPACTION EQUIPMENT.

2.1 General. All equipment, tools, and machines shall be maintained in satisfactory working condition at all times.

##### 2.2 Tamping Rollers.

2.2.1 Towed. Tamping rollers shall consist of two or more non-vibratory roller drums mounted side by side in a suitable frame and towed by either a crawler-type or rubber tired tractor having sufficient power to pull the roller satisfactorily when the drums are fully ballasted. Each drum shall be free to pivot about an axis parallel to the direction of travel. Rollers operated in tandem sets shall be controlled in a manner such that the prints produced by the tamping feet of the tandem units are staggered. Each drum of a roller shall have an outside diameter of not less than 5 feet and shall be not less than 5 feet in length. The space between two adjacent drums, when on a level surface, shall be not less than 12 inches nor more than 15 inches. Each drum ballasted with fluid shall be equipped with at least one pressure-relief valve and with at least one safety head. The safety head shall be equal to union-type safety heads equipped with rupture discs suitable for rupturing pressures between 50 and 75 psi as manufactured by Fike Metal Products Corporation, Blue Springs, Missouri. The pressure-relief valve is

a manually operated valve and shall be opened periodically. Personnel responsible for opening pressure-relief valves shall be periodically instructed to ascertain that valve openings are free from plugging to assure that any pressure developed in roller drums is released at each inspection. At least one tamping foot shall be provided for each 100 square inches of drum surface. The length of each tamping foot from the outside surface of the drum shall be not more than 10 inches and shall be maintained at not less than 7 inches. The bearing surface of each tamping foot shall be flat with a surface area not less than 5 square inches nor more than 10 square inches. During the operation of rolling, the spaces between the tamping feet shall be maintained clear of materials which would impair the effectiveness of the tamping rollers. The weight of a roller when fully loaded shall be not less than 4,000 pounds per foot of length of drum. The weight of a roller empty shall be not more than 2,500 pounds per foot of drum length. The bearing surface, tamping foot size, the drum loading, and operation of the rollers shall be as required to obtain the desired compaction. If more than one roller is used on any one layer of fill, all rollers so used shall be of the same type and essentially of the same dimensions. Rollers shall be drawn by crawler-type or rubber-tired towing tractors at a speed not to exceed 5.0 miles per hour. The use of rubber-tired towing equipment shall be discontinued if the tires leave ruts that prevent uniform compaction by the tamping roller, and the substitution of crawler type towing equipment may be directed by the Contracting Officer.

2.2.2 Self-propelled. The use of self-propelled non-vibratory rollers conforming to the following specifications will be permitted, and their design and operation shall be subject to the approval of the Contracting Officer who shall have the right at any time during the prosecution of the work, to direct such modifications to the tamping feet or variations in roller drum weight where applicable, as may be found necessary to secure optimum compaction of the earthfill materials. If use of self-propelled rollers causes shearing of the fill or laminations in the fill, or results in inadequate compaction, the Contracting Officer may direct that the rollers be removed from the fill and that appropriate towed tamping rollers be used. Two- or three-drum side-by-side units that are either in drive position or drawn by separate power equipment shall have a clearance between adjacent drums not less than 12 inches nor more than 15 inches. Two-drum or four-drum equipment separated by cab and differential and arranged in tandem must have its static weight equally distributed to all compaction drums and must have the tandem drums positions such that the prints of the tamping feet produced by the tandem drums are staggered. The surface on which the tamping feet are mounted shall have a minimum outside diameter of 4 feet and at least one tamping foot for each 100 square inches of drum surface. The distance between the centers of any two adjacent tamping feet shall be not less than 9 inches. The length of each tamping foot from the outside mounting surface of the drum shall be not more than 11 inches and shall be maintained at not less than 9 inches. The bearing surface of each tamping foot shall be flat and have a surface area not less than 7 square inches nor more than 14 square inches. Cupped recesses within the bearing surface of each tamping foot will be permitted, but shall not exceed 0.5 inches in depth. During rolling operations, the spaces between the tamping feet shall be maintained clear of materials which would impair the effectiveness of the tamping roller. The weight of all roller drums during compaction of fill materials shall be maintained uniform and with the weight per foot of drum length not less than 4,300 pounds. For self-propelled rollers with drums capable of being ballasted with fluid, each drum shall be equipped with at least one pressure-relief valve and with at least one safety head. The safety head shall be equal to union type safety heads equipped with rupture discs suitable for rupturing pressures between

50 and 75 psi as manufactured by the Fike Metal Products Corporation, Blue Springs, Missouri. The pressure relief valve is a manually operated valve and shall be opened periodically. Personnel responsible for opening pressure-relief valves shall be periodically instructed to ascertain that valve openings are free from plugging to assure that any pressure developed in roller drums is released at each inspection. For self-propelled rollers in which steering is accomplished through the use of rubber-tired wheels, the tire pressure shall not exceed 40 psi. The use of the compactor shall be discontinued if the tires leave ruts that prevent uniform compaction by the tamping roller and the substitution of appropriate towed tamping rollers may be directed by the Contracting Officer. When self-propelled roller is provided with a dozer blade, coverages made with the blade in operation shall not be counted as compaction coverages. Self-propelled rollers shall be operated at a speed not to exceed 5.0 mph.

2.2.3 Vibratory Rollers. Vibratory rollers shall be equipped with smooth steel compaction drum and shall be operated at a frequency of vibration during compaction operations between 1100 and 1500 vpm. Vibratory rollers may be either towed or self-propelled and shall have an unsprung drum weight that is a minimum of 60 percent of the rollers' static weight. Towed rollers shall have at least 90 percent of their weight transmitted to the ground through the compaction drum when the roller is standing in a level position hitched to the towing vehicle. Rollers shall have a minimum static weight of 20,000 pounds, a minimum dynamic force of 40,000 pounds when operating at 1400 vpm, and an applied force not less than 9,000 pounds per foot of compaction drum length. The level of amplitude and vibration frequency during compaction will be maintained uniform throughout the zone within which it is operating. Rollers shall be operated at speeds not to exceed 1.5 miles per hour. The equipment manufacturer shall furnish sufficient data, drawings, and computation for verification of the above specifications, and the character and efficiency of this equipment shall be subject to the approval of the Contracting Officer.

2.2.4 Rubber-Tired Rollers shall have a minimum of 4 wheels equipped with pneumatic tires. The tires shall be of such size and ply as to be capable of being operated at tire pressures between 80 and 100 pounds per square inch at a 25,000-pound wheel load. The roller wheels shall be located abreast and be so designed that each wheel will carry approximately equal load in traversing uneven ground. The spacing of the wheels will be such that the distance between the nearest edges of adjacent tires will not be greater than 50 percent of the rated tire width of a single tire at the operating pressure for a 25,000-pound wheel load. The roller shall be provided with a body suitable for such ballast loading that the load per wheel may be varied as directed by the Contracting Officer from 18,000 to 25,000 pounds. The roller shall be towed at speeds not to exceed 5 miles per hour. The character and efficiency of this equipment shall be subject to the approval of the Contracting Officer. If the rubber-tired rollers cause shearing of the fill or laminations in the fill, the Contracting Officer may direct that the rollers be removed from the fill and that tractor-drawn tamping rollers be used.

2.2.5 Mechanical Tampers. Compaction of material, in areas where it is impracticable to use a roller, shall be performed by the use of approved mechanical tampers.

### 3. GENERAL REQUIREMENTS FOR FILLS AND COMPACTED BACKFILLS.

3.1 Control. Moisture-density relations shall be established by the Contractor. Field density tests shall be performed by the Contractor in sufficient number and in such locations to insure that the specified density is being obtained. Moisture-density relations and field densities shall be reported on approved forms. One copy of density data less dry weight determinations shall be provided on the day each test is taken. The completed test reports shall be provided to the Contracting Officer on the work day following the test.

3.1.1 Laboratory Control. One moisture-density relation shall be made for each classification, blend or change in classification of soil material encountered. Approval of moisture-density relations shall be obtained prior to the compacting of any material in the work. The moisture-density relations shall be determined in a laboratory in accordance with ASTM D 1557, modified as specified hereafter. Each sample tested for moisture-density relation shall also be classified in accordance with ASTM D 2487.

3.1.1.1 A separate batch of materials will be used for each compaction test specimen. No materials will be re-used.

3.1.1.2 The desired amount of mixing water will be added for each compaction test specimen, mixed well, and the mixture will be placed in a container with an airtight cover and allowed to cure for 24 hours. A shorter curing time may be allowed where tests show that shortening the curing time will not affect the results. Specimens shall be prepared for at least two moisture contents wet of the optimum moisture content and at least two moisture contents dry of optimum.

3.1.2 Field Control. Field in-place density shall be determined in accordance with ASTM Specifications D 1556, except that in each test, the weight of the disturbed sample representing the full depth of layer shall be not less than 10 pounds for fine grain material and 12 pounds for coarse grain material using a scale for weighing of sufficient capacity and sensitive to .01 pounds. The density tests shall be well distributed and shall average not less than one test for each 2000 cubic yards of compacted fill or backfill material, and not less than one test per 5,000 square feet of subgrade area. At least one test shall be made for each 2 feet of elevation of compacted material processed as a unit and at least one test shall be made in each area compacted. Determination of in-place densities using the nuclear method (ASTM D 2922) may be used to supplement the sand-cone density tests, but will not be permitted as the primary control. In using a nuclear density device the results obtained using factory supplied curves must be compared with density and water contents determined by the sand-cone method. If field density tests determined by the nuclear method vary by more than 3 pounds per cubic foot from comparison sand-cone tests, and are consistently high or low, then adjustment of the calibration curve is necessary.

3.1.3 Moisture-Density Curves for Cohesionless and Cohesive Material. Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravels, gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, clays, silts, and very fine sands. When results of compaction tests for moisture-density relations are recorded on graphs, cohesionless soils typically show straight lines or reverse-shaped moisture-density curves, and cohesive soils will show normal moisture-density curves.

3.2 Settling of Fills or Backfills with Water will not be permitted, except as specified for sand backfill of pipe trenches in accordance with SECTION: CULVERTS.

3.3 Fill material shall be obtained from the required excavations; shall be free from sod, roots, brush, debris, trash or other objectionable material, and shall contain no stone whose greatest dimension is more than 3/4 of the layer thickness after compaction nor any unsatisfactory soils as defined in SECTION: EXCAVATION.

3.4 Placement. Fill material shall not be placed against concrete which has not been in place at least 14 days or until the concrete has attained a strength of 2,500 p.s.i. when tested in accordance with the SECTION: CONCRETE. Fill material shall not be placed against soil cement or grouted stone which has not been in place at least 7 days. Heavy equipment shall not be operated over pipes and buried structures until at least 2 feet of fill material has been placed and compacted over them in conformance with the requirements of SECTION: CULVERTS. Compacted fill and backfill shall be placed with suitable equipment in horizontal layers which after compaction, shall not exceed 12 inches in depth for rubber-tired or vibratory rollers, 6 inches in depth for tamping rollers, and 4 inches in depth when mechanical tampers are used. The Contractor may vary the layer thickness within these limits for most efficient operations. Material containing stones shall be placed in a manner to prevent the stones from striking the concrete structures and to prevent the formation of voids.

3.5 Moisture Content. Material shall have a uniform moisture content while being placed and compacted. Water shall be added at the source, if required, or by sprinkling each layer of material during placement. Uniform distribution of moisture shall be obtained by disking, harrowing, or otherwise manipulating the soil during and after the time water is added. Material containing an excess of moisture shall be manipulated with suitable implements to facilitate maximum aeration and shall be permitted to dry to the proper consistency before being compacted. Fill shall have a maximum moisture content of not more than 2 percent above optimum and a minimum moisture content of not less than 2 percent below optimum.

3.6 Compaction. No layer of fill shall be compacted before the appropriate uniform moisture content has been obtained. If the compacted surface of any layer of material is determined to be too smooth to bond properly with the succeeding layers, it shall be scarified by an approved method. Scarified areas shall be compacted as specified for the fill placed thereon. Rollers will not be permitted to be operated within one foot of channel or structure walls or over buried structures until the compacted fill over the top of the structures has reached a depth of 2 feet. Compaction equipment shall be so operated that structures are not damaged nor overstressed during compaction operations. Mechanical tampers shall be used for compaction of fill material adjacent to structures where rolling equipment is impracticable for use in compaction.

4. COMPACTED FILL, CULVERTS. Bedding and backfill for culverts shall conform to the requirements of SECTION: CULVERTS.

5. COMPACTED FILL.

5.1 Preparation for Placing. Before placing material for compacted fill, the foundation surface shall be cleared of all existing obstructions, vegetation, and debris. Unsuitable material not meeting the requirements for fill material shall

be removed where directed, and the existing surfaces scarified to a depth of 6 inches before placing the fill. Sloped ground surfaces steeper than one vertical to 4 horizontal, on which fill or compacted backfill is to be placed, shall be stepped in such a manner that the compaction equipment will bear on the full depth of the fill layer.

5.2 Compaction. Each layer of compacted fill shall be compacted to not less than 90 percent of maximum density as determined by ASTM D 1557 prior to placement of any adjacent miscellaneous fill.

5.3 Trimming. The river side and top of banks shall be trimmed to the lines indicated on the drawing with a tolerance of plus or minus one inch as measured perpendicular to the slope. Any material loosened by trimming shall be recompacted. The land side of banks shall be trimmed to a uniform alinement at top of banks and to a reasonably uniform slope at, or outside the lines on the drawings. The ramps shall be trimmed to a uniform alinement and reasonably uniform slopes.

## 6. BACKFILLS.

### 6.1 Backfill and Fill About Structures.

6.1.1 Location. Backfill shall consist of all fill against and/or around structures, except backfill for culvert trenches.

6.1.2 Material. Backfill and fill material shall be obtained from the required excavation and borrow source(s) as approved by the Contracting Officer. In general, the best material available will be designated as backfill and fill about structures. Backfill may consist of sand, gravelly sand, silty sands, and clayey sands. Organic material, silt, clay, broken concrete or pavement, boulders and other objectionable material shall not be used.

6.1.3 Placing. Fill material shall not be placed against concrete which has not been in place at least 14 days or until the concrete has attained a strength of 2,500 p.s.i. when tested in accordance with SECTION: CONCRETE. Fill material shall not be placed against soil cement or grouted stone which has not been in place at least 7 days. Fill shall be placed in layers no greater than 4 inches after compaction.

6.1.4 Compaction shall be not less than 90 percent of maximum density as determined by ASTM D 1557.

6.2 Backfill, Culvert Trenches. Backfill for culverts shall conform to SECTION: CULVERTS.

6.3 Backfill, Toe shall consist of material placed over the toe of the soil cement protection. In general, the fill shall consist of material suitable for compacted fill placed in horizontal layers not more than 9 inches in thickness after compaction, smoothed and dressed to the lines and grades indicated, and compacted to not less than 90 percent maximum density as determined by ASTM D 1557. No depressions shall be left in toe backfill areas.

7. MISCELLANEOUS FILL shall consist of material placed in the areas indicated and shall be placed only after any adjacent compacted fill has been completed. Miscellaneous fill material shall be placed in layers not exceeding 24 inches in

depth before consolidation. Miscellaneous fill shall be free of trash, debris, and bituminous paving. No depressions in which water might pond shall be left in fill areas. The finished areas shall be sloped to drain. Compaction other than that obtained by the controlled movement of the construction equipment will not be required.

#### 8. SUBGRADE PREPARATION FOR SOIL-CEMENT.

8.1 All areas which shall receive soil-cement shall be cleaned of debris, trash, organics, and unsuitable materials, and excavated to the lines and grades as shown on the drawings without damage to the subgrade. The subgrade for soil-cement shall be defined as the area beneath the bottom layer of soil-cement which bears the weight of the soil-cement and compaction equipment. The subgrade for the soil-cement fill shall be compacted to at least 95 percent maximum density as determined by ASTM D 1557 to a depth of at least 12 inches and shall be capable of withstanding, without displacement, the compaction specified for the soil-cement mixture. Unsatisfactory subgrade material shall be removed and replaced with acceptable material in accordance with paragraph: REMOVAL OF UNSATISFACTORY SOILS of SECTION: EXCAVATION. Testing requirements and frequencies shall be as described in SECTION: SOIL CEMENT.

#### 9. SUBGRADE PREPARATION FOR AGGREGATE BASE.

9.1 All areas which shall receive aggregate base shall be cleaned of debris, trash, organics, and unsuitable materials and trimmed to the lines and grades shown on the drawings without damage to the subgrade. The subgrade for the aggregate base course shall be compacted to at least 95 percent of maximum density as determined by the ASTM D 1557 to a depth of at least 6 inches and shall be capable of withstanding, without displacement, the compaction specified for the aggregate base. Unsatisfied subgrade material shall be removed and replaced with acceptable material in accordance with paragraph: REMOVAL OF UNSATISFACTORY SOILS of SECTION: EXCAVATION. Testing and inspection requirements and frequencies shall be as described in SECTION: AGGREGATE BASE.

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SECTION 2E

CULVERTS

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1. APPLICABLE PUBLICATIONS. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1 Federal Specification (Fed. Spec.).

HH-P-117

Packing; Jute, Twisted

SS-S-210A

Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints

1.2 Federal Standards (Fed. Std.).

No. 601

Rubber: Sampling and Testing

1.3 American Association of State Highway and Transportation Officials (AASHTO), Standards.

M 65-80

Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated

M 170-84

Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

M 198-75 (1982)

Joint for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets

1.4 American Society for Testing and Materials (ASTM) Standards.

C 76-84a

Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

C 231-82

Air Content of Freshly Mixed Concrete by the Pressure Method

C 270-84

Mortar for Unit Masonry

C 425-77 (R 1982)	Compression Joints for Vitrified Clay Pipe and Fittings
C 443-79	Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
C 700-78a (R1983)	Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
D 558-82	Moisture-Density Relations of Soil Cement Mixtures
D 1556-82	Density of Soil in Place by the Sand-Cone Method
D 1557-78	Moisture-Density Relations of Soils, and Soils-Aggregate Mixtures Using 10-lb. (4.5-Kg) Rammer and 18-in. (457-mm) Drop
D 1751-83	Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
D 1752-84	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

## 2. DELIVERY, STORAGE, AND HANDLING OF MATERIALS.

2.1 Delivery and Storage. Materials delivered to the site shall be inspected for damage, unloaded, and stored with the minimum of handling. Do not store materials directly on the ground. Inside of pipes and fittings shall be kept free of dirt and debris.

2.2 Handling. Materials shall be handled in such a manner as to insure delivery to the trench in sound undamaged condition. Pipe shall be carried to the trench not dragged. Gasket materials and plastic materials that are not to be installed immediately shall not be stored in the direct sunlight.

3. MANUFACTURER'S RECOMMENDATIONS. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Contracting Officer prior to installation. Installation of the item will not be allowed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

4. TESTS FOR PIPE. Certified copies of test reports demonstrating conformance to applicable pipe specifications shall be delivered to the Contracting Officer before pipe is installed. Strength tests for concrete and clay pipe as required in applicable specifications shall be the three-edge bearing tests.

5. PIPE FOR CULVERTS shall be as indicated and shall conform to requirements for the following pertinent types.

5.1 Reinforced Concrete Pipe. ASTM C 76 or AASHTO M 170, type as shown on the drawings.

5.2 Mortar. Type M, conforming to ASTM C 270 except the maximum placement time shall be 30 minutes after the ingredients are mixed with water.

5.3 Vitriified Clay Pipe. ASTM C 700 or AASHTO M 65, extra strength type.

## 6. MATERIALS FOR DRAINAGE STRUCTURES.

6.1 Concrete. Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements of the SECTION: CONCRETE, 4,000 psi compressive strength at 28 days. The concrete mixture shall have air content by volume of concrete, based on measurements made at point of delivery to the forms, of 5 to 7 percent when maximum size of coarse aggregate exceeds 1-1/2 inches. Air content shall be determined in accordance with ASTM C 231. The concrete covering over steel reinforcing shall be not less than 1-1/2 inches thick for walls and flooring. Concrete covering deposited directly against the ground shall have a thickness of at least three inches between steel and ground. Expansion-joint filler material shall conform to ASTM D 1751 and D 1752, or shall be resin impregnated fiberboard conforming to the physical requirements of ASTM D 1752.

6.2 Mortar. Mortar for pipe joints and connections to other drainage structures shall conform to ASTM C 270, Type M, except the maximum placement time shall be 30 minutes after the ingredients are mixed with water.

6.2.1 The inside of the joint shall be wiped clean and finished smooth. In pipe too small for a man to work inside, wiping may be done by dragging a suitable swab or long-handled brush through the pipe as work progresses. The mortar bead on the outside shall be protected from air and sun with a proper covering until satisfactorily cured.

7. CONCRETE AND VITRIFIED CLAY PIPE JOINTS. Unless otherwise specified, one of the following methods of jointing for bell-and-spigot and tongue-and-groove pipe shall be used:

7.1 Cement-Mortar Bell-And-Spigot Joint. The first pipe shall be bedded to the established gradeline, with the bell end placed upstream. The interior surface of the bell shall be carefully cleaned with a wet brush and the lower portion of the bell filled with mortar to such depth as to bring inner surfaces of abutting pipes flush and even. The spigot end of each subsequent pipe shall be cleaned with a wet brush and uniformly matched into the bell so that sections are closely fitted. After each section is laid, remainder of the joint shall be filled with mortar, and a bead shall be formed around the outside of the joint with sufficient additional mortar. Cement mortar, finish, and protection of joints shall be as specified in paragraph: MATERIALS FOR DRAINAGE STRUCTURES: Mortar. If the mortar is not sufficiently stiff to prevent appreciable slump before setting, the outside of the joint shall be wrapped or bandaged with cheesecloth to hold the mortar in place.

7.2 Cement-Mortar Oakum Joint for Bell-And-Spigot Pipe. A closely twisted gasket shall be made of joint packing, conforming to Fed. Spec. HH-P-117, of diameter required to support the spigot end of the pipe at the proper grade and to make the joint concentric. Joint packing shall be in one piece of sufficient length to pass around the pipe and lap at the top. This gasket shall be thoroughly saturated with neat cement grout. The bell of the pipe shall be thoroughly cleaned with a wet brush, and the gasket shall be laid in the bell for the lower third of the circumference and covered with mortar. The spigot of pipe shall be thoroughly cleaned with a wet brush, inserted in the bell, and carefully driven home. A small amount of mortar shall be inserted in the annular space for the upper two-thirds of the circumference. The gasket then shall be lapped at the top of the pipe and driven home in the annular space with a calking tool. The remainder of annular space then shall be filled completely with mortar and beveled at an angle of approximately 45 degrees with the outside of the bell. If the mortar is not sufficiently stiff to prevent appreciable slump before setting, the outside of the joint thus made shall be wrapped with cheesecloth. Placing of this type of joint shall be kept at least five joints behind laying operations.

7.3 Cement-Mortar Diaper Joint for Bell-And-Spigot Pipe. The pipe shall be centered so that annular space is uniform. The annular space shall be calked with joint packing conforming to Fed. Spec. HH-P-117. Before calking, the inside of bell and outside of spigot shall be clean.

7.3.1 Diaper bands shall consist of heavy cloth fabric to hold the grout in place at the joints and shall be cut into such lengths that they will extend one-eighth of the circumference of pipe above the spring line on one side of the pipe and up to the spring line on the other side of the pipe. Longitudinal edges of fabric bands shall be rolled and stitched around two pieces of wire. Width of fabric bands shall be such that after the fabric has been securely stitched at both edges with wires, the wires will be uniformly spaced not less than 8 inches apart. Wires shall be cut into lengths to pass around the pipe with sufficient extra length for the ends to be twisted at the top of pipe to hold the band securely in place; bands shall be accurately centered around the lower portion of joint.

7.3.2 Grout shall be poured between band and pipe from only the high side of band, until grout rises to the top of the band at the spring line of the pipe, or as nearly as possible, on the opposite side of pipe, to insure a thorough sealing of joint around the portion of pipe covered by the band. Silt, slush, water, or polluted mortar grout forced up on the lower side shall be carefully forced out by the pouring and removed.

7.3.3 The remaining unfilled upper portion of the joint shall then be filled with mortar and a bead formed around the outside of this upper portion of the joint with sufficient amount of additional mortar. The diaper shall be left in place. Placing of this type joint shall be kept at least five joints behind actual laying of pipe. No backfilling around joints shall be done until joints have been fully inspected by Contractor's Quality Control and approval by the Contracting Officer.

7.4 Cement-Mortar Tongue-And-Groove Joint. The first pipe shall be bedded carefully to the established gradeline with the groove upstream. A shallow excavation shall be made underneath the pipe at the joint and filled with mortar to provide a bed for the pipe. The grooved end of the first pipe shall be carefully cleaned with a wet brush, and a layer of soft mortar applied to the lower half of the groove. The tongue of the second pipe shall be cleaned

carefully with a wet brush; while in horizontal position, a layer of soft mortar shall be applied to the upper half of the tongue. The tongue end of the second pipe then shall be inserted in the grooved end of the first pipe until mortar is squeezed out on interior and exterior surfaces. Sufficient mortar shall be used to fill the joint completely and to form a bead on the outside.

7.5 Cement-Mortar Diaper Joint for Tongue-And-Groove Pipe. The joint shall be of the type described in paragraph: Cement-Mortar Tongue-And-Groove Joint above, except that the shallow excavation directly beneath the joint shall not be filled with mortar until after a gauze or cheesecloth band dipped in cement mortar has been wrapped around the outside of the joint. The cement-mortar bead at the joint shall be at least 1/2-inch thick, and the width of the diaper band shall be at least eight inches. The diaper shall be left in place. Placing of this type joint shall be kept at least five joints behind the actual laying of the pipe. No backfilling around the joints shall be done until joints have been fully inspected by the Contractor's Quality Control and approved by the Contracting Officer.

7.6 Rubber Gasket Joint. Design of joints and physical requirements for rubber-type gaskets shall conform to ASTM C 443 or AASHTO M 198. Gaskets shall have not more than one factory-fabricated splice, except that two factory-fabricated splices of the rubber gasket type are permitted if nominal diameter of pipe being gasketed exceeds 54 inches. Material conforming to Fed. Spec. SS-S-210 is acceptable as an alternate to ASTM C 443 provided the necessary installation instructions are furnished. Gaskets or jointing materials shall not swell more than 100 percent by volume when immersed in accordance with Method 6211 of Fed. Std. 601, in immersion medium No. 3 for 70 hours at 212 degrees F. Certified copies of test results shall be delivered to the Contracting Officer before gaskets or jointing materials are installed. Alternate types of watertight joint may be furnished if specifically approved. Gaskets and joining materials shall be as recommended by the particular manufacturer in regard to use of lubricants, cements, adhesives, and other special installation requirements. Surfaces to receive lubricants, cements, or adhesives shall be clean and dry. Gaskets and jointing materials shall be affixed to the pipe not more than 24 hours prior to the installation of the pipe, and shall be protected from the sun, blowing dust, and other deleterious agents at all times. Gaskets and jointing materials shall be inspected before installing the pipe; any loose or improperly affixed gaskets, and jointing materials shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pulled together. If, while making the joint, the gasket or jointing material becomes loose and can be seen through the exterior joint recess when joint is pulled up to within one inch of closure, the pipe shall be removed and the joint remade.

7.7 Plastic conforming to ASTM C 425 may be used with clay pipe. Plastic shall be molded in the annular space or on the spigot of the pipe, or both, in a plant especially equipped for the purpose.

8. EXCAVATION AND TRENCHING FOR PIPE CULVERTS. Excavation of trenches shall be in accordance with the applicable portions of SECTION: EXCAVATION and the following requirements.

8.1 Trenching. Sheet piling and bracing where required shall be placed within the trench width as specified in SECTION: EXCAVATION. Care shall be taken not to over excavate. Where trench widths are exceeded, redesign with a resultant

increase in cost of stronger pipe or special installation procedures shall be necessary. Cost of this redesign and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the Government.

8.2 Removal of Rock. Rock encountered during excavation in either ledge or boulder formation shall be replaced with satisfactory materials containing no stone larger than recommended by the pipe manufacturer to provide a compacted earth cushion having a thickness between unremoved rock and the pipe of at least 8 inches or 1/2-inch for each foot of fill over the top of the pipe, whichever is greater, but not more than three-fourths the nominal diameter of the pipe. Where bell-and-spigot pipe is used, the cushion shall be maintained under the bell as well as under the straight portion of the pipe. Satisfactory materials are defined in accordance with paragraph: REMOVAL OF UNSATISFACTORY SOILS of SECTION: EXCAVATION.

8.3 Removal of Unstable Material. Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the Contracting Officer, is encountered in the bottom of the trench, such material shall be removed to the depth required and replaced to the proper grade with satisfactory material, compacted as provided in paragraph: BACKFILLING. When removal of unstable material is due to the fault or neglect of the Contractor in his performance of shoring and sheeting, water removal, or other specified requirements, resulting material shall be excavated and replaced.

## 9. MATERIALS FOR BEDDING AND BACKFILLING.

9.1 General. Bedding sand fill for culverts or water line shall consist of sand fill placed around the pipe in accordance with paragraph: BACKFILLING. Compacted fill above the springing line shall be placed in accordance with paragraph: BACKFILLING.

9.1.1 Material for the bedding and sand fill for the culvert shall be clean sand, free of trash, organic materials, debris, and with 100 percent passing the No. 4 sieve and not more than 10 percent passing the No. 100 sieve. The Contractor shall submit a copy of the gradation of the bedding material prior to delivery of material to the site.

9.1.2 Material for the compacted fill above the springing line shall not contain any stone larger than 3/4 inch and may consist of sand, gravelly sand, silty sands, and clayey sands. Organic material, silt, clay, broken concrete or pavement, boulders and other objectionable material shall not be used.

## 10. PLACING PIPE.

10.1 Bedding. The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe. The pipe shall be bedded carefully in a soil foundation accurately shaped and rounded to conform to the lowest one-fourth of the outside portion of circular pipe, or to the lower curved portion of pipe arch for the entire length of pipe or arch. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall be only of such length, depth, and width as required for properly making the particular type joint.

10.2 Pipe. Each pipe shall be carefully examined before being laid, and defective or damaged pipe shall not be used. Pipelines shall be laid to the grades and alinement indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Lifting lugs in vertically elongated metal pipe shall be placed in the same vertical plane as the major axis of the pipe. Under no circumstances shall pipe be laid in water, and no pipe shall be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. All pipe in place shall be inspected before backfilling, and those damaged during placement shall be removed and replaced at no additional cost to the Government. Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.

## 11. BACKFILLING.

11.1 Backfilling Pipe Trenches. After the bedding has been prepared and the pipe installed, sand fill material, shall be placed along both sides of pipe in a single lift to the springing line (maximum horizontal dimension of a pipe). The sand fill shall be brought up evenly on both sides of pipe for the full length of pipe. Water shall be applied to the sand fill by jetting in a manner, quantity, and at a rate sufficient to thoroughly saturate the entire lift. Vibrating compacting equipment shall be used to obtain not less than 85 percent of maximum density. Care shall be taken to insure thorough compaction of the sand fill under the haunches of the pipe. Above the springing line, the trench shall be filled with material conforming to paragraph: MATERIALS FOR BEDDING AND BACKFILLING. The compacted fill material shall be placed along both sides of pipe in layers not exceeding 4 inches in compacted depth at a moisture content that will facilitate compaction. The compacted fill shall be brought up evenly on both sides of pipe for the full length of pipe. Each layer shall be thoroughly compacted with mechanical tampers or vibrators to not less than 85 percent of maximum density. This method of filling and compacting shall continue until the fill has reached an elevation of at least 24 inches above the top of the pipe. The remainder of the trench shall be backfilled and compacted by the spreading and rolling or compacted by mechanical tampers or vibrators in layers not exceeding 6 inches compacted to 90 percent of maximum density. Where it is necessary in the opinion of the Contracting Officer, any sheeting and/or portions of bracing used shall be left in place, and the contract will be adjusted accordingly. Untreated sheeting shall not be left in place beneath structures or pavements.

11.2 Backfilling Pipe Trenches in Fill Sections. For pipe placed in fill sections, backfill material and the placement and compaction procedures shall be as specified above. The fill material above the springing line shall be uniformly spread in layers longitudinally on both sides of pipe, not exceeding 4 inches in compacted depth, and shall be compacted by rolling parallel with pipe or by mechanical tamping or vibrating to obtain not less than 85 percent of maximum density. Prior to commencing normal filling operations, the crown width of the fill at a height of 24 inches above the top of the pipe shall extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 12 feet, whichever is less. After the backfill has reached at least 24 inches above the top of the pipe, the remainder of the fill shall be placed and thoroughly compacted to 90 percent of maximum density in layers not exceeding 6 inches.

11.3 Backfilling Pipe Trenches in Soil-Cement Sections. For pipe placed in soil-cement fill sections, after the pipe bedding has been prepared and the pipe installed, soil-cement material shall be placed along both sides of the pipe and

made to ramp over the pipe in compacted lifts not to exceed 4-inches until the pipe is covered with a minimum of 24-inches of soil-cement. The gradient of the ramp shall be limited to a maximum of 10 percent. The soil-cement fill shall be brought up evenly on both sides and for the full length of the pipe along the soil-cement facing. Vibratory compacting equipment shall be used to obtain not less than 98 percent of maximum density as determined by ASTM D 558. Care shall be taken to insure thorough compaction of the soil-cement fill under the haunches of and around the pipe to prevent damage to the pipe. Soil cement shall conform to the specifications set forth in SECTION: SOIL-CEMENT.

11.4 Movement of Construction Machinery. In compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert at any stage of the construction shall be at the Contractor's risk. Any pipe damaged thereby shall be repaired or replaced at the expense of the Contractor.

#### 11.5 Compaction.

11.5.1 Laboratory Control. The moisture-density relations shall be determined for each material type in a laboratory in accordance with ASTM D 1557 and ASTM D 558.

11.5.2 Field Control. Tests shall be well distributed and shall average not less than one test for each 200 lineal feet of trench for each 2 feet or less of backfill. At least one test shall be made in each trench. Field in-place density shall be determined in accordance with ASTM D 1556, except that in each test, the weight of the disturbed sample representing the full depth of layer shall be not less than 10 pounds for fine grain material and 12 pounds for coarse grain material using a scale for weighing of sufficient capacity and sensitive to .01 pounds.

12. LEAKAGE TESTS. Lines shall be tested for leakage by either infiltration tests or exfiltration tests, as appropriate. Prior to testing for leakage the trench shall be backfilled up to at least the lower half of the pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection. Visible leaks encountered shall be corrected regardless of leakage test results. When the water table is 2 feet or more above the top of the pipe at the upper end of the pipe line section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Contracting Officer. When the Contracting Officer determines that infiltration cannot be properly tested, an exfiltration test shall be made by filling the line to be tested with water so that a head of at least 2 feet is provided above both the water table and the top of the pipe at the upper end of the pipe line to be tested. The filled line shall be allowed to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be re-established. The amount of water required to maintain this water level during a two-hour test period shall be measured. Leakage as measured by either the infiltration test or exfiltration test shall not exceed .2 gallons per inch diameter per 100 feet of pipe line per hour. When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished. Testing, correction, and retesting shall be made at no additional cost to the Government.

13. SUBMITTALS. Copies of the field density test results and gradation of the bedding material shall be submitted to the Contracting Officer with the Contractor Quality Control Report on the following work day after testing.

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SECTION 2F

AGGREGATE BASE (ARIZONA)

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1. APPLICABLE PUBLICATIONS. The American Society for Testing and Materials (ASTM) publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

C 117-84	Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing
C 131-81	Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine
C 136-84a	Sieve or Screen Analysis of Fine and Coarse Aggregates
D 75-82	Sampling Aggregates
D 422-63 (R 1972)	Particle-Size Analysis of Soils
D 1556-82	Density of Soil in Place by the Sand-Cone Method
D 1557-78	Moisture Unit Weight Relations of Soils and Soil Aggregate Mixtures Using 10-lb. (4.5 Kg) Rammer and 18-in. (457 mm) Drop
D 4318-83	Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
E 11-81	Sieves for Testing Purposes

2. MATERIALS. Aggregates shall consist of crushed stone, crushed gravel, angular sand, soil, or other sound, durable, approved materials processed and blended or naturally combined. Aggregates shall be durable and sound, free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign material. It shall be the responsibility of the Contractor to obtain materials that will meet the requirements specified herein and that can be constructed to meet the grade and smoothness requirements specified herein after all compaction

requirements have been completed. The material retained on a No. 4 sieve shall be known as coarse aggregate, and the material passing the No. 4 sieve shall be known as binder material.

2.1 Coarse Aggregate conforming to the requirements specified above shall have a percentage of wear not to exceed 50 percent after 500 revolutions when tested in accordance with ASTM C 131. Coarse aggregate shall consist of angular fragments reasonably uniform in density and quality. The amount of flat and elongated particles shall not exceed 30 percent. A flat particle is one having a ratio of width to thickness greater than 3, and an elongated particle is one having a ratio of length to width greater than 3.

2.1.1 Coarse aggregate retained on each sieve specified shall contain at least 50 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the piece. When two fractures are adjacent, the angle between the planes of the fractures must be at least 30 degrees to count as fractured faces.

2.2 Binder Material shall consist of screenings, angular sand, soil, or other finely divided mineral matter processed or naturally combined with the coarse aggregate. Liquid-limit and plasticity-index requirements stated herein shall apply to any component that is blended to meet the required gradation and shall also apply to the completed course. The portion of any component or of the completed course passing the No. 40 sieve shall be either nonplastic or shall have a liquid limit not greater than 25 and a plasticity index not greater than 5.

2.3 Gradation requirements specified herein shall apply to the completed base course and it shall be the responsibility of the Contractor to obtain materials that will meet the gradation requirements after mixing, placing, compacting, and other operations. The values are based on aggregates of uniform specific gravity, and the percentages passing the various sieves are subject to appropriate correction by the Contracting Officer when aggregates of varying specific gravities are used.

2.3.1 The Base Course aggregates shall have a maximum size of one inch and shall be continuously graded within the limits specified below:

Sieve Designation	Percentage by Weight Passing Square-Mesh Sieve
1-1/8 Inch	100
No. 4	38-65
No. 8	25-60
No. 30	10-40
No. 200	3-12

3. SAMPLING AND TESTING. Sampling and testing shall be by and at the expense of the Contractor.

3.1 Samples shall be of the size required and shall be taken by the Contractor. Copies of test results shall be submitted for approval 7 days prior to starting the work, and thereafter at regular intervals during production, as specified hereinafter. These samples shall be obtained at the source, from test pits, borings, trucks, stockpiles, or from other designated locations. Samples for material gradation, wear test, liquid-limit determination, and plasticity-index tests shall be taken in conformance with ASTM D 75. After the material has been placed and compacted, samples for density tests shall be taken as specified in ASTM D 1556, and additional samples for gradation, liquid-limit, and plasticity-index tests shall be taken by an appropriate method. Where deemed necessary, the sampling will be supervised by the Contracting Officer. The Contractor shall arrange his work so that sampling and testing may be performed without interruption.

### 3.2 Tests.

3.2.1 Aggregate Gradation. Aggregate gradation shall be determined in accordance with ASTM C 117, C 136, and D 422. Sieves shall conform to ASTM E 11.

3.2.2 Liquid Limit shall be determined in accordance with ASTM D 4318.

3.2.3 Plasticity Index shall be determined in accordance with ASTM D 4318.

3.2.4 Wear Test shall be made in conformance with ASTM C 131.

3.2.5 Field in-place density shall be determined in accordance with ASTM D 1556. Moisture-density relations shall be established in the laboratory in accordance with ASTM D 1557, Method D.

3.3 Testing Frequency. Results of tests to determine particle shape, presence of objectionable coatings and foreign matter, percentage of wear, fracture count, gradation, liquid-limit, plasticity-index, specific gravity, and other specification requirements for determination of the acceptability of the source shall be submitted for approval at least 7 days prior to starting of manufacture of the base course material. Three sets of tests for material gradation, liquid limit, and plasticity index shall be performed at regular intervals with at least one test being made for each 500 cubic yards or fraction thereof, of material produced and results shall be submitted on a daily basis. Deviations from specification requirements shall be corrected immediately upon discovery. After the material has been placed and compacted, one field density test for each 300 square yards or fraction thereof of finished base course and one additional gradation, liquid-limit, and plasticity index test for each 500 square yards of base course or fraction thereof shall be performed. Maximum-density moisture relations shall be established for each 500 square yards of base course material. Field density tests shall be performed on the completed subgrade at a minimum of one per 5,000 square yards of subgrade area. The location of the after-placement tests shall be as directed. One copy of density data (less dry weight determinations) shall be provided on the day each test is taken. The completed test report shall be provided with the Contractor Quality Control Report on the following work day. Results of all tests made shall be submitted for approval on a daily basis and subsequent paving operations shall not commence until final approval has been obtained. Failure of any test shall be reported verbally, by the most expeditious means and followed promptly by written report.

Contractor field operations shall immediately reflect corrective measures. For every failing test, retesting will be required after corrective measures have been taken.

3.4 Approval of Material. The source of the material shall be selected 7 days in advance of the time materials will be required in the work. Tentative approval of the preliminary reports submitted by the Contractor and the source will be based on an inspection by the Contracting Officer. Tentative approval of the materials will be based on test samples as specified herein. Final approval of both the source and the materials will be based on specific tests performed on samples taken from the completed and compacted base course and selected material.

4. EQUIPMENT. All plant, equipment, and tools used in the performance of the work covered by this section will be subject to approval by the Contracting Officer before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein and within the specified time limits.

5. OPERATION OF PITS OR QUARRIES. All work involved in clearing, stripping, and excavating in opening or operation of pits or quarries shall be performed by the Contractor. Pits or quarries shall be opened to expose vertical faces of deposit to depths suitable for working. Materials excavated from pits shall be obtained in successive vertical cuts extending through all exposed strata. All pockets or strata of unsuitable materials overlying or occurring within the deposit shall be wasted as directed. The methods of operating pits or quarries and the processing and blending of the material may be changed or modified by the Contracting Officer when necessary to obtain material conforming to the specified requirements. Quarries shall be conditioned in agreement with the local laws or authorities.

6. WEATHER LIMITATIONS. Aggregate base shall be constructed only when the atmospheric temperature is above 35 degrees F. When the temperature falls below 35 degrees F., the Contractor shall protect all areas of the completed aggregate base course, by approved methods, against any detrimental effects of freezing. Areas of completed aggregate base course damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

7. PREPARATION OF UNDERLYING SURFACE. Prior to constructing the aggregate base course, the previously constructed subgrade shall be cleaned of all foreign substances. Surface of the subgrade shall be inspected by the Contractor for adequate compaction and surface tolerances. The subgrade shall conform to SECTION: FILLS AND SUBGRADE PREPARATION. Ruts or soft, yielding spots that may appear in the subgrade areas having inadequate compaction, and deviations of the surface from the requirements set forth therein shall be corrected to line and grade and to all specification requirements. The finished subgrade shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the base course is placed.

8. GRADE CONTROL. During construction the lines and grades including crown and cross slope indicated for the aggregate base course shall be maintained by means of line and grade stakes placed by the Contractor at the worksite in accordance with SPECIAL CLAUSES of these specifications.

9. MIXING AND PLACING MATERIALS. The material shall be mixed by the stationary-plant, traveling-plant or road-mix method and placed in such a manner as to obtain uniformity of the aggregate base course material and at a uniform optimum moisture content for compaction. The Contractor shall make such adjustments in mixing or placing procedures or in equipment as may be directed to obtain the true grades, to minimize segregation and degradation, to reduce or accelerate loss or increase of water, and to insure a satisfactory aggregate base course meeting all the requirements of this specification.

10. COMPACTION. The aggregate base course shall be compacted with approved compaction equipment. Water content shall be maintained at optimum or at the percentage specified during compaction. In places not accessible to the rollers, the mixture shall be compacted with mechanical tampers. Compaction shall continue until each layer through the full depth is compacted to at least 100 percent of maximum density. The Contractor shall make such adjustments in rolling or finishing procedures as may be required to obtain true grades, to minimize segregation and degradation, to reduce or accelerate loss or gain of water, and to insure a satisfactory aggregate base course. Unsatisfactory materials shall be reworked to produce a satisfactory material.

11. EDGES OF BASE COURSE. Where the base course is not placed between curbs or similar construction, approved material shall be placed along the edges of the aggregate base course in such quantities as will compact to the thickness of the course being considered, or when the course is being constructed in two layers, to the thickness of each layer of the course. Allow in each operation at least a 1-foot width of the shoulder to be rolled and compacted simultaneously with the rolling and compacting of each layer of the base course.

12. SMOOTHNESS TEST. The surface of each layer shall not show any deviations in excess of 3/8 inch when tested with either a 10-foot straightedge applied both parallel with and at right angles to the center line of the paved area. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing material and compacting, as directed.

13. THICKNESS CONTROL. The completed thicknesses of the base course shall be within 1/2 inch, plus or minus, of the thickness indicated. Thickness test shall be made and recorded by the Contractor. The thickness of the base course shall be measured at intervals in such manner that there will be a thickness measurement for at least 1,000 square yards of base course except not less than one test per area paved with asphalt concrete. The thickness measurement shall be made by test holes at least 3 inches in diameter through the base course. Where the measured thickness of the base course is more than 1/2 inch deficient in thickness, the Contractor, at no additional expense to the Government, shall correct such areas by scarifying, adding mixture of proper gradation, reblading, and recompacting, as directed. Where the measured thickness of the base is more than 1/2 inch thicker than that indicated, it shall be considered as conforming with the specified thickness requirements plus 1/2 inch. The average job thickness shall be the average of the job measurements determined as specified above, but shall be within 1/4 inch of the thickness indicated.

14. MAINTENANCE. The Contractor shall maintain the aggregate base course in a satisfactory condition until the completed work is accepted.

15. WAYBILLS AND DELIVERY TICKETS. Copies of waybills or delivery tickets shall be attached to the Daily Contractor Quality Control Report for the day of delivery. Before the final statement is allowed, the Contractor shall file with the Contracting Officer waybills and/or certified delivery tickets for all aggregates actually used in the construction covered by the contract.

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## SECTION 2G

### MISCELLANEOUS AGGREGATES

1. APPLICABLE PUBLICATIONS. The American Society for Testing and Materials (ASTM) Standards listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

C 33-82	Concrete Aggregates
C 131-81	Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
C 144-81	Aggregate for Masonry Mortar

2. GRAVEL PLACEMENT AND MATERIAL. Gravel shall be placed as shown on the drawings in accordance with the following requirements: Gravel shall be clean hard, sound, durable, uniform in quality, and free of any detrimental quantity of soft, friable, thin, elongated, or laminated pieces, disintegrated material, organic matter, oil, alkali, or other deleterious substance.

2.1 Gravel Composition. Gravel shall be composed entirely of particles that are either fully or partially rounded and water-worn. Crushed rock may be combined provided it is uniformly distributed throughout and blended with the gravel. The quality and gradation requirements shall be as follows: ASTM C 33, 1/2-inch maximum size as indicated in Grading Table for coarse aggregates.

3. DESERT GRAVEL. Desert gravel shall be placed on the area as shown on the drawings in accordance with the following requirements.

3.1 Desert gravel (D.G.) or disintegrated granite shall be any granitoid igneous rock which has been weathered in place and which has as principal constituents granular fragments of quartz and feldspar. It may also contain fragments of granite rock not yet broken down into the component minerals. The material shall remain stable when saturated with water.

3.2 Material shall be free from all foreign objects, lumps, irregularities and shall be consistent in color.

3.3 Desert gravel shall have a maximum size of not more than 1/2 inch, have not more than 30 percent of the material passing the No. 200 sieve, and shall have a plasticity index of less than 10 for the material passing the No. 40 sieve.

3.4 Subgrade shall be thoroughly compacted prior to application. Weed barrier fabric shall be laid on the subgrade under all desert gravel.

3.5 Coloration shall conform to the "Munsell" soil chart (1975 edition; published by the Knoll Morgen Corp., 2441 North Calvert Street, Baltimore, Maryland 21218), as follows:

"Amber" hue 7.5 YR, value/chroma 6/4.

3.6 Material shall be obtained from commercial sources.

3.7 Contractor shall submit color samples (minimum of 3) and gradations and abrasion test results of D.G. to the Contracting Officer or his representative for approval prior to installation.

3.8 D.G. shall be spread to a depth of 2 inches thick, raked, dampened, and rolled with a 90# roller.

4. WEED BARRIER FABRIC shall be a permeable polypropylene fabric with a minimum thickness of 2 mil and shall be a product commercially manufactured as weed barrier fabric.

5. LANDSCAPE MOUNDING. Fill material for use in landscape mounding shall be representative of existing site soil and be free of all foreign material, caliche, and all organic material and stones larger than 2 inches in diameter. The source of landscape fill shall be from excavation areas identified by the Contractor and approved by the Contracting Officer.

6. PEA GRAVEL. Aggregate for "pea gravel" material shall be of clean sand, gravel or crushed rock and shall be free from lumps or balls of clay and shall not contain calcareous or clay coatings, caliche, synthetic materials, organic matter of foreign substances. The gradation shall meet the following requirements when tested in accordance with the requirements of Arizona Test Method No. 201.

Sieve Size	Percent Passing
3/8 inch	100
No. 4	0-25
No. 8	0-5
No. 200	0-2.0

\* \* \* \* \*

SECTION 2H

TREES, SHRUBS, AND GROUND COVERS

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- |                                    |                               |
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1. APPLICABLE PUBLICATIONS. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1 Federal Specification (Fed. Spec.).

O-F-241D

Fertilizers, Mixed Commercial

1.2 American National Standards Institute (ANSI) Publication.

Z60.1-1986

American Standard for Nursery Stock

1.3 American Joint Committee on Horticultural Nomenclature (AJCHN) Publication.

Standardized Plant Names  
(Second Edition, 1942)

1.4 American Society for Testing and Materials (ASTM) Standard.

C 136-81

Sieve Analysis of Fine and Course  
Aggregates

2. SOURCE INSPECTIONS.

2.1 Plant Materials. Plant materials will be inspected by the Contracting Officer at the growing site and tagged or otherwise approved for delivery. Such inspection does not preclude right of rejection at the project site.

2.2 Topsoil. The source of topsoil will be inspected by the Contracting Officer to determine the acceptability of the topsoil and the depth to which it is to be stripped.

3. SUBMITTALS.

3.1 Samples. The following samples shall be submitted for approval before work is started.

a. Topsoil - Representative samples shall be taken from several locations on the area under consideration.

b. Soil Amendments - Ten pounds of each type to be used in the project.

3.2 Certified Laboratory Test Reports. Testing shall be performed by an approved independent laboratory within 10 days of submittal of reports. Test reports on a previously tested material shall be accompanied by certificates from the manufacturer certifying that the material is equal in all respects to that proposed for this project. Certified copies of the reports of tests listed below shall be submitted:

a. Offsite topsoil - for pH, salts, potash, and phosphorous.

b. Organic Amendments - for classification of total nitrogen, moisture ash and organic matter, sand content, pH.

3.3 Maintenance Instruction. Written instructions for year-round care of installed plants shall be furnished.

3.4 Identification. All plants shall be identified with durable waterproof labels and weather-resistant ink. Labels shall be securely attached to plants, bundles, or containers of plants and shall state the correct plant name and size.

#### 4. DELIVERY, STORAGE, AND HANDLING.

##### 4.1 Delivery.

4.1.1 The Contractor shall notify the Contracting Officer of the delivery schedule in advance so the plant material may be inspected upon arrival at the jobsite by the Contracting Officer. Unacceptable plant material shall be removed from the jobsite immediately.

4.1.2 Plants shall be protected during delivery to prevent damage to the root balls or desiccation of leaves. Trees shall be protected during transportation by tying in the branches and covering all exposed branches.

4.1.3 Fertilizer shall be delivered to the site in the original, unopened containers bearing the manufacturer's guaranteed chemical analysis, name, trade name or trademark, and in conformance to state and Federal law. In lieu of containers, fertilizer may be furnished in bulk and a certificate indicating the above information shall accompany each delivery.

4.1.4 All pesticide material, including soil fumigants, shall be delivered to the site in the original unopened containers. Containers that do not have a legible label that identifies the Environmental Protection Agency registration number and the manufacturer's registered uses will be rejected.

4.1.5 Soil conditioners and amendments shall be delivered to the site in the original, unopen containers bearing the manufacturer's guaranteed chemical analysis and name. In lieu of containers, soil conditioners and amendments may be furnished in bulk and a certificate from the manufacturer indicating the above information shall accompany each delivery.

##### 4.2 Storage.

4.2.1 Plant Storage. Plants not installed on the day of arrival at the site shall be stored and protected. Outside storage locations shall be continually shaded and protected from the wind. Plants stored on the project shall be

protected from any drying at all times. Plants in containers, shall be kept in a moist condition until planted by routine watering.

4.2.2 Storage of Other Materials. Pesticide material shall be kept in dry storage and shall not contaminate adjacent material, and shall be handled and stored following manufacturer's directions. Storage of materials shall be in areas designated or as approved by the Contracting Officer.

4.3 Handling. Care shall be taken to avoid damaging plants being moved from the nursery or storage area to the planting site. Plants shall be protected from freezing or drying out by covering with burlap, tarpaulin or mulching material during transportation to planting site. Plants shall not be handled by the trunk or stems. Damaged plants will be rejected and shall be removed from the site.

5. ENVIRONMENTAL PROTECTION. All work and Contractor operations shall comply with the requirements of SECTION: ENVIRONMENTAL PROTECTION.

6. MATERIALS.

6.1 Plants.

6.1.1 Plants shall conform to the varieties specified in the plant list and be true to botanical names as listed in AJCHN Standardized Plant Names. Plants shall be in accordance with ANSI Z60.1 except as otherwise stated in the specifications or shown on the plans. Where the drawings or specifications are in conflict with ANSI Z60.1, the drawings and specifications shall prevail.

6.1.2 Planting stock shall be well-branched and well-formed, sound, vigorous, healthy, and free from disease, sun-scald, windburn, abrasion, and harmful insects or insect eggs and shall have healthy, normal and unbroken root systems. Deciduous trees and shrubs shall be symmetrically developed, of uniform habit of growth, and free from objectionable disfigurements. Plants shall have been grown under climatic conditions similar to those in the locality of the project.

6.1.3 The minimum acceptable sizes of all plants, measured before pruning and with branches in normal position, shall conform to the measurements indicated. Plants larger in size than specified may be used with the approval of the Contracting Officer with no change in the contract price. If larger plants are used, the ball of earth or spread of roots shall be increased in accordance with ANSI Z60.1.

6.1.4 The Contractor shall facilitate inspection and identifications by labeling trees and bundles or containers of the same shrub, with a durable waterproof label and weather-resistant ink. Labels shall state the correct plant name and size as specified in the list of required plants. Labels shall be securely attached to plants, bundles, and containers of plants and shall be legible for 60 days after delivery to the planting site.

6.1.5 Plant material shall be nursery grown unless otherwise indicated and shall conform to the requirements and recommendations of ANSI Z60.1. Plants shall be dug and prepared for shipment in a manner that will not cause damage to branches, shape, and future development after planting.

6.1.5.1 Container grown plants shall have sufficient root growth to hold the earth intact when removed from containers but shall not be root bound.

6.1.6 Substitutions shall be made only when a plant (or its alternates as specified) is not obtainable and the Contracting Officer authorizes a change order providing for use of the nearest equivalent obtainable size or variety of plant having the same essential characteristics with an equitable adjustment of the contract price.

## 6.2 Topsoil.

6.2.1 Topsoil shall be the existing surface soil stripped and stockpiled on the site after the project site has been cleared and grubbed.

6.2.2 Additional topsoil, if required, beyond that available from stripping operations, shall be a neutral, friable soil representative of productive soils in the site. It shall be obtained from well-drained areas and shall be free of any admixture of subsoil, foreign matter, objects larger than one inch in any dimension, toxic substances, and any material or substance that may be harmful to plant growth. The pH range shall be 5.3 to 6.0. Topsoil that does not meet this pH range shall be amended by the addition of pH adjusters, at a rate recommended by the County Extension Service agent, based on soil tests.

## 6.3 Soil Conditioners and Amendments.

6.3.1 Rotted sawdust shall have 7.5 pounds of nitrogen added uniformly to each cubic yard and shall be free of chips, stones, sticks, soil, and toxic substances.

6.3.2 Planting Soil Mixture. The planting soil mixture shall be composed of 6 parts topsoil, 4 parts rotted sawdust, and one lb. 12-12-12 fertilizer and 2 lbs. iron sulphate per cubic yard of mix.

## 6.4 Fertilizer. Fertilizer shall be commercial grade and uniform in composition.

6.4.1 Packet, tablet, pellet, or other forms of slow release fertilizers may be used conforming to Fed. Spec. O-F-241, and shall bear the manufacturer's guaranteed statement of analysis. Slow release fertilizers shall contain a minimum percentage by weight of: 20 nitrogen, 10 percent available phosphoric acid, and 5 percent potash.

6.5 Mulch. Mulch shall be 2" D.G. free from deleterious materials and shall be stored so as to prevent inclusion of foreign materials.

6.6 Agrosoke. A stable synthetic anionic polymeric (polyacrylamide) crystal, having neutral pH (7.0), shall be added to the backfill mixture at the rate 2.5 lbs per cubic yard of soil.

## 6.7 Staking Material.

6.7.1 Stakes for tree support shall be lodge pole pine, free from knots, rot, cross grain, or other defects that would impair the strength. Standard stakes shall be a hardwood treated with pentachlorophenol, and 2-1/2 inches in diameter, by 8 feet long and pointed at one end. Ground stakes shall be a minimum of 2 inches by 2 inches and 3 feet long and pointed at one end.

6.7.2 Tie wire shall be 12 gage annealed galvanized steel.

6.7.3 Hose chafing guards shall be new 2-ply reinforced rubber or plastic hose and shall be all the same color on the project. Length shall be one and one-half time the circumference of the plant at its base.

6.4 Water. Water shall not contain elements toxic to plant life.

6.5 Granular fertilizer shall conform to Fed. Spec. O-F-241, Type I, Level B, and shall bear the manufacturer's guaranteed statement of analysis. Granular fertilizer shall contain a minimum percentage by weight of: 14 nitrogen, 14 available phosphoric acid, and 14 potash.

6.5 Tree Wound Dressing. Tree wound dressing shall be a black asphalt-base antiseptic paint, a black paint consisting of Bordeaux Mixture, raw linseed oil, and lamp black, a black paint consisting of zinc oxide, raw linseed oil, and lamp black.

## 7. SITE PREPARATION.

7.1 Clearing and Grading. Clearing shall consist of the satisfactory removal and disposal of brush, snags, and rubbish occurring within the landscape area shown. Clearing shall be accomplished by hand within 5 feet of existing vegetation to be left standing. Grading shall conform to the lines and grades shown.

7.2 Layout. Plant material locations and bed outlines shall be staked on the project site before any plant pits or beds are dug. Plant material locations may be adjusted by the Contracting Officer to meet field conditions.

7.3 Protection of Existing Trees that are to be preserved shall be barricaded in a manner that will effectively protect them during planting operations.

7.4 Underground Obstructions to Planting. If underground utilities, construction, or solid rock ledges are encountered, other locations for planting may be selected by the Contracting Officer.

7.5 Plant Pits. Plant pits shall be dug to produce vertical sides and flat, uncompacted bottoms. When pits are dug with an auger and the sides of the pits become glazed, the glazed surface shall be scarified. The size of plant pits shall be as shown on drawings.

7.6 Herbicide and Pesticide Application. Herbicides, insecticides and fungicides shall be applied as needed and in accordance with the manufacturer's recommendations.

## 8. INSTALLATION.

8.1 Planting Seasons and Conditions. Planting shall not be done when the ground is in an unsuitable condition for planting as determined by the Contracting Officer.

8.2 Container grown stock shall be removed from containers in such a way so as to prevent damage to plant or root system. Planting shall be completed as specified above.

8.2.1 Container stock shall be backfilled with topsoil to approximately half the depth of the ball and then tamped and watered. The remainder of backfill of topsoil shall be tamped and watered. Earth saucers or water basins shall then be formed around isolated plants. Water holding basins shall be ample enough in size and height to hold at least 2-1/2 gallons for shrubs or 5 gallons for trees.

8.4 Watering. Depressed water basins shall be used around all plants. All watering shall be done in a manner which will provide deep penetration, but which will not cause erosion or damage to the finished surface. Sufficient water shall be applied to penetrate the planting bed to a depth of 24 inches. Frequent watering may be necessary during periods of hot weather.

8.5 Inspection. The trunks of the trees shall be inspected for physical damage or insect infestation and required treatment or rejection shall be determined.

## 9. PRUNING.

9.1 New plant material shall be pruned in the following manner. Dead and broken branches shall be removed. Trees and shrubs shall be pruned to reduce total amount of anticipated foliage by one fourth. Typical growth habit of individual plants shall be retained with as much height and spread as is practicable. Cuts shall be made with sharp instruments, and shall be flush with trunk or adjacent branch to insure elimination of stubs. "Headback" cuts at right angles to line of growth shall not be permitted. Trees shall not be poled or the leader removed. Trimmings shall be removed from the site. Cuts 1/2 inch in diameter and larger shall be painted with the specified tree wound dressing.

9.2 Restoration and Clean-Up. Excess and waste material shall be removed daily. When planting in an area has been completed, they shall be cleared of all debris, spoil piles, and containers.

9.3 Maintenance During Installation. Maintenance operations shall begin immediately after each plant is planted and shall continue as required until final acceptance. Plants shall be kept in a healthy, growing condition by watering, pruning, spraying, weeding, and any other necessary operations of maintenance. Plant saucers and beds shall be kept free of weeds, grass, and other undesired vegetation. Plants shall be inspected at least once per week by the Contractor during the installation period and needed maintenance performed promptly.

10. PLANT ESTABLISHMENT PERIOD. Final acceptance of all work and materials under this section shall be at the end of a period of establishment to be determined as follows.

10.1 Beginning of the Plant Establishment Period. The period of establishment shall begin on the date that an inspection by the Contracting Officer shows that all plants are in place and have been installed in accordance with the specifications and plans. Replacement of plants that were not supplied by the Contractor but were relocated under this contract and that die for any reason

other than improper handling during transplanting and/or lack of proper care will not be required. Loss through Contractor negligence, however, shall require replacement in kind and size per specification and shall be at the Contractor's expense.

## 10.2 During the Plant Establishment Period.

10.2.1 During the plant establishment period, the Contractor shall water all plants as necessary to maintain an adequate supply of moisture within the root zone. Water shall not be applied so quickly that it cannot be absorbed by the plants.

10.2.2 Plants shall be pruned as required.

10.2.3 Stakes and eroded plant saucers shall be replaced as required.

10.2.4 Other work, such as spraying with approved insecticides and fungicides to control pests, shall be done (each day if necessary) to ensure plant survival in a healthy growing condition.

10.2.5 Dead plants shall be removed immediately at the Contractor's expense and replacement plant immediately installed. The Contractor will not be responsible for theft or damage to plants by vehicles or vandalism following completion and approval of the installation portion of the planting contract.

## 10.3 Termination of the Plant Establishment Period.

10.3.1 A preliminary inspection by the Contractor and the Contracting Officer will be held 120 days from the date of the beginning of the plant establishment period to determine plant acceptability and the number of replacements. Alternate or substituted varieties of plants shall be used only if approved by the Contracting Officer.

10.3.2 A final inspection of all plants will be held after the replacement planting has been completed. No additional plant establishment period will be required for replacement plants. The establishment period will end on the date of this inspection and said inspection will be considered final acceptance provided the Contractor has complied with the following requirements.

a. Dead, missing, and defective plant material shall have been replaced as directed by the Contracting Officer otherwise, final acceptance will be delayed until such replacements have been satisfactorily accomplished.

b. Plant saucers shall be free of weeds.

c. Stakes and guys shall be in good condition.

d. Remedial measures directed by the Contracting Officer to ensure plant survival shall have been carried out.

e. Plant material shall have been fertilized as required prior to acceptance.

10.4 Replacement. At the end of the guarantee period the Contracting Officer will make another inspection to determine the condition of plants. Plants not in healthy growing condition, as determined by the Contracting Officer will be noted and as soon as seasonal conditions permit shall be removed from the site and replaced with plants of the same species and sizes as originally specified. Such replacements shall be made in the same manner as specified for the original plantings, and at no cost to the Government. The guarantee on plants will be limited to one replacement.

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SECTION 2I

IRRIGATION SYSTEM

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1. APPLICABLE PUBLICATIONS. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1 Federal Specification (Fed. Spec.).

WW-U-531E Unions, Pipe, Steel or Malleable Iron, Threaded Connection, 150 lbs and 250 lbs

WW-V-51F Valve, Angle, Check, and Globe, Bronze, (125, 150 and 200 Pound, Threaded End, Flanged Ends, Solder Ends, and Brazed Ends, for Land Use)

WW-V-54D & Int. Am-3 Valve, Gate, Bronze (125, 150 and 200 Pound, Threaded Ends, Flange Ends, Solder End and Brazed Ends, for Land Use)

1.2 Military Standard (Mil. Std.).

MIL-STD-621A Test Method for Pavement Subgrade, Sub-base, and Base-Course Materials  
Notices 1, 2

1.3 American National Standards Institute, Inc. (ANSI).

B16.3-1977 Malleable Iron Threaded Fittings Class 150 and 300

1.4 American Society for Testing and Materials (ASTM) Standards.

A 120-79 Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses

D 1785-82 Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

D 2241-82 Poly (Vinyl Chloride) (PVC) Plastic Pipe (DDR-PR)

- D 2464-76 Threaded Poly (Vinyl Chloride) (PVC)  
Plastic Pipe Fittings, Schedule 80
- D 2466-78 Poly (Vinyl Chloride) (PVC) Plastic Pipe  
Fittings, Schedule 40
- D 2564-80 Solvent Cements for Poly (Vinyl Chloride)  
(PVC) Plastic Pipe and Fittings
- D 2774-72 Recommended Practice for Underground  
Installation of Thermoplastic Pressure  
Piping

1.5 American Water Works Association (AWWA) Standards.

- C 601-81 Disinfecting Water Mains

1.6 Maricopa Association of Government (M.A.G.).

- Specifications 530 and 790

1.7 Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS) Standards.

- SP-58 Pipe Hangers and Supports-Materials, Design  
and Manufacture (1975)
- SP-69 Pipe Hangers and Supports-Selection and  
Application (1976)

2. GENERAL. This section covers irrigation piping including connection to source of water supply, complete. Excavation, trenching, and backfill are specified in SECTION: EXCAVATION.

2.1 Above ground piping shall be galvanized steel.

2.2 Below Ground Piping. Pipe smaller than 2-inch shall be plastic. Pipe for sleeving shall be plastic. The minimum cover for laterals and branches shall be 12 inches and 4 inches for dripline, unless otherwise indicated on drawings. The minimum cover for pressure lines shall be 2.5 feet except under roadways, parking and paved areas where the minimum cover shall be 3 feet.

2. Electrical Work shall conform to the applicable requirements of SECTION: ELECTRICAL WORK (FOR IRRIGATION LANDSCAPING).

3. EXCAVATION.

3.1 General. All excavation of every description and of whatever substances encountered shall be performed to the depths indicated or as otherwise specified. During excavation, material suitable for backfilling (see SECTION: FILL AND SUBGRADE PREPARATION) shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. All excavated materials not required or suitable for backfill shall be removed and wasted as indicated or as directed. Grading shall be done as may be

necessary to prevent surface water from flowing into trenches or other excavations, and any water accumulating therein shall be removed by pumping or by other approved methods. Sheet piling and shoring shall be done as may be necessary for the protection of the work and for the safety of personnel. Earth excavation shall comprise all materials not classified as rock excavation. Rock excavation shall comprise the following: boulders measuring 1/3 cubic yard or more in volume; rock material in ledges, bedded deposits, unstratified masses, and conglomerate deposits so firmly cemented as to possess the characteristics of solid rock that cannot be removed without systematic drilling and blasting; and concrete or masonry structures except sidewalks and paving.

3.2 Trench Excavation. Trenches shall be of the necessary width for proper laying of pipe. The banks of pipe trenches shall be as nearly vertical as practicable. Care shall be taken not to overexcavate. The bottom of the trenches shall be accurately graded to provide uniform bearing and support for each section of the pipe on undisturbed soil at every point along entire length, except for the portions of the pipe sections where it is necessary to excavate for bell holes and for the proper sealing of pipe joints, and as hereinafter specified. Bell holes and depressions for joint shall be dug after the trench bottom has been graded, and, in order that the pipe rest on the prepared bottom for as nearly its full length as practicable, bell holes and depressions shall be only of such length, depth, and width as required for properly making the particular type of joint. Stones shall be removed as necessary to avoid point bearing. Where rock excavation, as defined hereinbefore, is required in trenches for pipe, the rock shall be excavated to a minimum overdepth of 6 inches below the trench depths indicated or specified. Except as hereinafter specified for wet or otherwise unstable material, overdepth excavation shall be backfilled as and with materials specified for backfilling the lower portion of trenches. Whenever wet or otherwise unstable material that is incapable of properly supporting the pipe is encountered in the bottom of the trench, and overdepth is not indicated on the drawings, such material shall be overexcavated to a depth to allow for construction of a stable pipe bedding. The trench shall be backfilled to the proper grade with approved materials.

4. BACKFILLING. The trenches shall not be backfilled until all required pressure tests are performed and until the irrigation systems as installed conform to the requirements specified. Except as otherwise specified for special conditions, trenches shall be backfilled to the ground surface with selected material that is suitable for the specified compaction and as hereinafter specified. Trenches improperly backfilled shall be reopened to the depth required for proper compaction, then refilled and compacted as specified, or the condition shall be otherwise corrected as approved. The meaning of "density of the adjacent soil" when the adjacent formation is rock shall be interpreted as maximum density in accordance with MIL-STD-621, Method 100, CE 55. The surface shall be restored to its original condition as near as practicable and as hereinafter specified.

#### 4.1 Compaction.

4.1.1 Laboratory Control. The moisture-density relationships shall be determined in a laboratory in accordance with ASTM D 1557.

4.1.2 Field Control. Tests shall be well distributed and shall average not less than one test for each 200 lineal feet of trench for each 2 feet or less of backfill. At least one test shall be made in each trench. Field in-place density shall be determined in accordance with ASTM D 1556.

5. MATERIALS shall conform to the respective specifications and other requirements specified below.

5.1 Pipe.

5.1.1 Galvanized Steel Pipe shall conform to ASTM A 120, standard weight.

5.1.2 Plastic Pipe shall conform to ASTM D 1785, schedule 40 for pipe with solvent welded joints and schedule 80 for pipe with threaded joints, or to ASTM D 2241, Type 1, grade 1, 315 psi for pressure lines and 200 psi for other lines for pipe with solvent welded joints. Pipe and fittings shall bear the seal of approval (nsf mark) of the National Sanitation Foundation's standard for plastic pipe and fittings for potable water service.

5.1.3 Polyethylene pipe shall be 100 percent polyethylene as follows:

1/2" I.D. .574" wall thickness .050"

Melting point- .065 grams per 10 minutes

Plastic Recovery- 30%

Tensile strength at break- 1665 pounds per square inch

Elongation- 65%

Brittleness at 76°C- zero failures from 10 samples

Stress crack in 100% Igepol solution- zero failures from 10 samples

5.1.4 Polyethylene pipe (dripline) shall have a maximum length of 500 feet if the line returns to the PVC lateral, or a maximum length of 300 feet if the line dead ends. Maximum flow (gpm) shall not exceed the manufacturer's recommendations for pipe size indicated.

5.2 Joints.

5.2.1 Plastic Pipe Joints shall be solvent welded or threaded. Solvent for welded joints shall conform to ASTM D 2564. Use of pipe dope or solvents on threaded joints will not be permitted. Polyethylene shall have compression joints.

5.3 Fittings and Specials.

5.3.1 For Galvanized Steel Pipe. Steel fittings shall be galvanized. Threaded fittings shall conform to ANSI B 16.3.

5.3.2 For Plastic Pipe. Fittings shall conform to ASTM D 2464 or D 2466.

5.4 Gate Valves shall be designed for a working pressure of not less than 150 psi. Valve connections shall be as required for the piping in which they are installed. Valves shall have a clear waterway equal to the full nominal diameter of the valve, and shall be opened by turning counterclockwise. The operating nut or wheel shall have an arrow, cast in the metal, indicating the direction of the opening. Valves smaller than 3 inches shall be all bronze and shall conform to Fed. Spec. WW-V-54, type I.

## 5.5 Backflow Prevention Units.

5.5.1 General. Backflow prevention units of the types indicated shall be installed at the locations shown on the drawings. Where union connections are not provided as part of the unit, the Contractor shall provide and install a union or sleeve type coupling between the control valve and the inlet side of the unit. Pipe and fittings for backflow prevention units shall be galvanized steel.

5.5.2 Reduced Prssures Backflow Prevention Unit. The reduced pressure backflow prevention unit shall be a factory assembled unit consisting of two independently acting spring-loaded check valves with a differential pressure relief valve controlled-reduced-pressure zone in between and shall be complete with test cocks and drain. The first check valve shall reduce the supply pressure a predetermined amount so that during normal flow and the cessation of normal flow the pressure between the checks is less than the supply pressure. The pressure differential relief valve shall automatically discharge to atmosphere to maintain the pressure in the reduced pressure zone below the supply pressure. All parts shall be removeable or replaceable without removal of the unit from the line. The unit shall be suitable for a working pressure of 125 pounds per square inch and shall be the product of a manufacturer regularly engaged in the production of backflow prevention units of the reduced pressure type.

5.6 Emitters. Emitter shall be independent pressure compensating plastic in-line emitters, (Drip Line) capable of providing consistent discharge rate of one gallon per hour (gph) at 3 to 60 pounds per square inch (psi). The emitter shall be constructed of heat resistant plastic and have an operating range of 3 to 60 pounds per square inch. Emitters shall be spaced as shown on plans.

5.7 Valve Boxes shall be plastic or concrete except that concrete boxes may be installed only in locations not subjected to vehicular traffic. Concrete boxes shall be the standard product of manufacturer of precast concrete equipment. The words "Irrigate", for gate valves; "PRV", for pressure relief valves; and "RCV" for remote control valves shall be cast in covers of boxes for the irrigation system. Plastic boxes shall be a standard catalog product of a manufacturer regularly engaged in the manufacture of valve boxes. Boxes housing shall have locking or bolttable covers. Plastic shall be rigid combination of polyolefin and fibrous inorganic materials having the following physical properties:

ASTM Test	Method	Value
Tensile Strength (2.0 in. Min.)	D-638	3,400 psi
Impact Strength, Izod	D-256	0.5 ft-lb/in
Shore-D Hardness	D-2240	63
Deflection Temp. @ 66 psi stress	D-648	230 degrees F
Specific Gravity	D-792	1.15

## 5.8 Remote Control Valves and Valve Accessories.

5.8.1 The remote control valves shall be an electrically actuated valve. The valve shall have no moving parts except the diaphragm and the spring. The valve shall have a removable housing cover for easy inline maintenance.

Materials: body - glass reinforced nylon.  
diaphragm - reinforced nylon with O-ring and stainless steel pressure plate.  
spring - stainless steel.

Performance: 1" valve - min. 2 gpm max. 50 gpm  
(FLOW RATES) 1-1/2 valve - min. 10 gpm max. 110 gpm  
2" valve - min. 25 gpm max. 200 gpm

5.8.1 The solenoid actuator shall be 24 volt A.C. 2-way type. Inrush and holding current shall be no more than 300 mA and 200 mA respectively. The solenoid shall require approximately 1/3 the inrush current as standard 24 volt A.C. solenoids.

Materials: Plunder and core - stainless steel.  
housing - glass reinforced nylon, epoxy potted.  
spring - stainless steel

Performance: min. operating voltage at 150 p.s.i. shall be 20 volts.  
Inrush Current (amps) .104  
Holding Current (amps) 104

5.9 Tipping Bucket Rain Gage shall be a high quality accurate instrument used for measuring participation. Rainfall shall enter an 8-inch funnel collector and be directed to the tipping bucket assembly. The bucket shall be made of stainless steel. The funnel shall be anodized aluminum and have two screens to prevent debris from entering the gate. A level shall be provided on the base for correct positioning of unit. The rain gage shall come with .01 inch calibration. The Contractor shall install the unit according to the manufacturers requirements and as shown on the drawings. Contract Rating: 3 watts, 28 VAC, 0.25 amps, 120 VAC.

5.10 Fertilizer Injector shall be a feeder, water operated, positive displacement proportioning chemical metering pump. The pump shall come with plastic tubing, foot valve strainer, suction valve and discharge valve. The pump minimum operating pressure shall be 15 p.s.i. and the maximum operating pressure shall be 125 p.s.i. The fertilizer injectors adjustable feed shall vary from 0 to 1.3 ounce per gallon of water and the ratio of feed can be change while pump is operating. The Contractor shall install the fertilizer injector according to the manufacturers requirements and as shown on the drawings.

5.11 Tensiometer shall be solid state maintenance free units, which will react to changes in soil matric potential and will not be affected by salts, fertilizer, chemical changes in the soils nor damage by freezing. The sensing range shall be factory preset and will require no adjustment or calibration. The tensiometer shall be adaptable for direct input to computer processors. The tensiometer shall be available in a minimum of three ranges to allow irrigation above a preset matric potential. The Contractor shall install the tensiometers according to the manufacturers requirements and as shown on the drawings.

5.12 Irrigation Filter (main line) shall be a centrifugal action filter which forces incoming water through a directional nozzle plate onto the inside of the filter screen. Debris is forced down in rotating motion into a holding basin at the bottom of the filter and by opening a flush valve the particles may be removed. The Contractor shall install the irrigation filter according to the manufacturers requirements and as shown on the drawings.

5.12.1 Filter Housing shall be constructed of ten gauge steel, epoxy coated, and welded into a wye configuration. A threaded 1/2" pressure tap shall be welded into the upstream and downstream piping for connection of pressure gauges.

5.12.2 Filter Screen shall be 150/mesh stainless steel.

5.12.3 Filter Flash Valve shall be a "ball" type made of brass.

5.13 Irrigation Filter (lateral line) shall be a wye type filter with an 80/mesh screen or smaller. The filter shall be constructed of brass, threaded at both ends and come with a blow-off connection.

5.14 Pressure Regulator shall be constructed of brass with double unions. The pressure regulator shall have integral pressure adjustments and an integral pressure gauge reading to 60 p.s.i. The pressure regulator shall be installed according to the manufacturers requirements and as shown on the drawings.

5.15 Automatic Irrigation Controller shall be a computerized radio controlled field satellite system. The irrigation controller shall be a multi wired, stand-along microprocessor base capable of performing up to eight independent irrigation functions simultaneously. The controller shall be connected by communication cable to the transmitter/receiver unit as shown on the drawings. The minimum station capacity shall be as indicated on the project plans. The irrigation controller shall be mounted in a metal enclosure as specified, detailed and as shown on the drawings.

5.16 Automatic Irrigation Controller Components shall be compatible with the irrigation controller and shall be installed according to manufacturers requirements and as shown on the drawings.

5.16.1 Digital Flow Monitor shall be a microprocessor based flow monitor with LCD which will display the flow rate and total flow rate at the push of a button. The flow monitor shall be capable of being calibrated in the field with the use of a front mounted keyboard.

5.16.2 Conduit Box Kit shall be a weatherproof enclosure for stand-along mounting and shall meet NEMA 4x. An opening shall be provided for a standard 1/2" conduit fitting. Mounting brackets shall be welded to the aluminum enclosure allowing surface mounting to the irrigation enclosure.

5.16.3 Keyboard Security Kit shall prevent unauthorized or accidental resetting of total accumulated flow, pipe diameter calibration and pulse output calibration. Special security fasteners and spanner shall be provided.

5.16.4 Relay Output Kit shall provide SPDT relay. The relay shall be available in 12VDC or 24VDC coil voltages. The voltage requirement shall be as shown on the project drawings.

5.16.5 AC Power Adapter (transformer) shall be UL approved 120 VAC outlet plug-in power supply to provide 12VDC to the flow monitor.

5.16.6 Field Satellite Transceiver shall be a trunked radio and be of the same manufacturer as the irrigation controller used in the project. The radio shall be provided with a microprocessor control, audible status tones, and system privacy

for efficient communication on a channel sharing the same trunked radio system. The radio shall be equipped with a durable 5dB gain performance antenna and be of the same manufacturer as the radio. The trunked radio and the antenna shall be installed according to the manufacturers recommendation and as shown on the drawings.

5.17 Flow Sensor (meter) shall be an insertion type with a nonmagnetic, spinning impeller (paddle wheel) as the only moving part. The sensor sleeve will be brass (or 316 stainless steel) with the impeller and sensor housing being glass-filled Ryton. The sensor shall be supplied with a 2" NPT adapter for installation into a weld on fitting or pipe saddle. The sensor will have all electronics epoxy sealed with a 2-conductor, shielded cable extending out through a 1/2" conduit connection on top of the sensor. Insertion of the sensor into the pipe shall be 1-1/2" from the inside wall to the end of the sensor housing. The Contractor shall install the flow sensor according to the manufacturers requirements and as shown on the project drawings.

5.18 Quick Coupling Valves shall be two piece, spring-loaded, compression type, normally closed, opening against line pressure, and actuated by downward thrust against the valve. Body shall be of cast red bronze. Machined parts shall be fabricated from red brass. Valve washers and sealers for key stems shall be of a semi-rigid, non-metallic, material and shall be easily replaceable. Inlets shall be tapped for National Standard pipe thread of the pipe riser size or sizes shown on the drawings. Valves shall be suitable for a maximum operating pressure of 125 psi and shall be the standard product of a reputable manufacturer of quick coupling valves for lawn sprinkling systems. The Contractor shall furnish coupler keys for operating the valves with hose swivels. Rubber sleeves shall be the standard product of the manufacturer of quick coupling valves and when required they shall replace hinged cover as regularly furnished. Each sleeve shall have a cover.

5.19 Gravel shall be crushed or natural materials washed and uniformly graded between 3/8 and one-inch size.

5.20 Pipe Bedding and Backfill Materials. Sand bedding material not less than 2 inches thick shall be placed under pipe where trench excavation is in rock. Where sand bedding is not required, the bottom of trenches shall be accurately graded to provide uniform bearing and support for each section of pipe on undisturbed soil at every point along its entire length. Backfill material shall be suitable for the required compaction and free from stones larger than one-inch in any dimension. Backfill material shall conform to the applicable of SECTION: FILL AND SUBGRADE PREPARATION.

5.21 Pipe straps shall conform to the applicable requirements of MSS SP 58 and SP 69.

5.22 Motorized Ball Valve. The electrical actuator and the ball valve shall be of the same manufacturer. The Contractor shall install the motorized ball valve according to the manufacturers requirements and as shown on the project drawings.

5.22.1 Electric actuator shall be compatible with the irrigation controller. The actuator shall have multi-function capabilities, such as on/off, throttling, variable cycle and analog or digital control. The housing shall be NEMA 1 general purpose, NEMA VII watertight, and NEMA VII & IX Hazardous Environment standards.

5.22.2 Ball Valve shall be of three piece construction for easy installation and inline maintenance. The ball valve shall be a two-way ball valve designed to seal on the downstream side against a resilient seat.

5.23 Enclosure box shall be a NEMA 4, 12 gauge steel, all welded enclosure 36"(W) x 18"(D) x 48"(H) in height, having a full-gasketed hinged door, 3-point dead bolt latch mechanism, padlockable handle, and integral mounting racks compatible with specified controller, power supply and ancillary equipment. The preferred box is manufactured by Cross Brothers, Inc. and is known as a La Max Enclosure, specifically the "Arizona Box" which has additional louvers.

## 6. INSTALLATION.

6.1 General. Unless otherwise specified, installation of emitters, backflow prevention units, control valves, meters and boxes shall conform to the standard details shown on drawing.

6.2 Handling. Pipe and accessories shall be handled so as to insure delivery to the trench in sound, undamaged condition. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material at no additional cost to the Government.

6.3 Cutting of pipe and dripline shall be done in a neat and workmanlike manner without damage to the pipe or dripline. Unless otherwise recommended by the manufacturer and authorized by the Contracting Officer, cutting shall be done with an approved type mechanical cutter. Wheel cutters shall be used when practicable.

6.3.1 Plastic Pipe and dripline shall be cut square and all burrs, particles and curls shall be removed prior to jointing.

6.4 Placing and Laying. Pipe, dripline, and accessories shall be carefully lowered in to the trench. Under no circumstances shall any of the materials be dropped or dumped into the trench. The full length of each section of pipe or dripline shall rest solidly upon the pipe or dripline bed, with recesses excavated to accommodate joints. Pipe or dripline that has the grade or joint disturbed after laying shall be taken up and relaid. Pipe or dripline shall not be laid in water or when trench conditions are unsuitable for the work. Water shall be kept out of the trench until jointing is completed. When work is not in progress or left unattended, open ends of pipe, dripline, fitting, and valves shall be securely closed (water tight) so that no trench water, earth, or other substance will enter the system. Driplines shall not be placed with kinks or sharp bends, that section of dripline shall be replaced at the direction of the Contracting Officer.

6.4.1 Plastic Pipe shall be installed in accordance with the procedures recommended in ASTM D 2774 and as herein specified.

6.4.2 Tracer wire or tracer tape shall follow the main line pipe lines and terminate in the valve box with the gate valve that controls these main irrigation lines. Provide enough length of wire or tape to make a loop and attach a plastic label with the designation "Tracer Wire."

## 6.5 Jointing.

6.5.1 Galvanized Steel Pipe. Threaded joints shall be made tight with a stiff mixture of graphite and oil, inert filler and oil, or with an approved graphite compound, applied with a brush to the male threads only. Compounds shall not contain lead.

6.5.2 Connections between different types of pipe and accessories shall be made with transition fittings approved by the Contracting Officer.

6.6 Pipe Sleeves shall be installed with a minimum of off-set at the joints to permit easy installation and removal of the irrigation lines. All plastic lines (one line per sieve) shall be installed in sleeves under paved areas. Sleeves shall extend at least 12 inches beyond the edges of the pavement. Sizes of sleeves shall be as follows:

Pipe Size (inches)	Minimum Sleeve Size (inches)
1/2	2
3/4	2-1/2
1, 1-1/4 and 1-1/2	3
2 and 2-1/2	4
3 and 4	6

6.7 Setting of Valves, and Boxes. Valves and valve boxes shall be installed where shown or directed, and shall be set plumb. Valve boxes shall be centered on the valves. Valves shall be located outside the area of roads and streets. Earthfill shall be carefully tamped around each valve or meter box to a distance of 4 feet on all sides of the box, or to the undisturbed trench face if less than 4 feet. Valves shall have the interiors cleaned of all foreign matter before installation.

## 6.8 Reaction Backing.

6.8.1 Thrust blocks shall be concrete mixed not leaner than one cement: 2-1/2 sand: 5 gravel. Blocks shall be placed between solid ground and the fitting to be anchored. The area of bearing shall be as indicated or as approved. Contractor shall submit certification of concrete mix in accordance with SECTION: CONCRETE.

## 6.9 Remote Control Valves.

6.9.1 Install remote control valves in locations as shown on the drawings. Install a union on downstream side of all valves not provided with a union type connection. Fit with valve box and locking or bolttable over. Top of valve box shall be 1/2-inch above finish grade.

6.10 Wire for Remote Control Valves and Tensiometers. For wiring connections from remote control valve assemblies (RCV) and tensiometer assemblies to irrigation controller panel using type THWN/THHN dual rated wire. Wiring shall be installed in rigid PVC conduit, Class 125. Pullboxes and junction boxes will be clearly marked as appropriate. All wiring connections exposed to moisture shall be waterproofed using components such as 3M DBY Splice Kit (Scotchlock Y Electrical Spring Connector) or Rain Bird ST-03 Snap-Tite, UL Connectors and PT-S5 Sealer.

6.11 Automatic Controller. Controller shall be mounted on embed. Connect electrical panel as shown on the drawings. Connection to control wiring shall be made within the pedestal or head of the controller. Electrical wiring shall be in a rigid conduit from controllers to panel provided under SECTION: ELECTRICAL WORK (FOR IRRIGATION LANDSCAPING). The work under this section shall include all wiring to the panels or elsewhere as required, in order to complete the installation of the control system.

6.12 Insulation at Irrigation Station. The insulation shall be one (1) inch thick, all service jacket, heavy density glass fiber, sectional pipe insulation with vinyl coated embossed vapor barrier laminate. The jacket shall have a pressure sensitive, self-sealing lap. All insulation shall receive an exterior protective cover of 0.016 aluminum secured with 3/8 inch aluminum straps, 6 inches on center. Insulation shall be installed in a workmanlike manner with no voids or openings which will deter from the effectiveness of the insulation.

6.12.1 The Contractor shall assume full responsibility for the correct installation of the insulation and shall arrange with the insulation manufacturer and/or supplier for services of a qualified instructor to be on hand at the start of the insulation installation and as necessary during installation to assure proper application of all insulation materials.

6.13 Connection to Existing Water Lines. The Contractor shall make all necessary arrangements as specified in SECTION: GENERAL REQUIREMENTS. Water meters and taps to the City of Peoria (COP) water mains shall be provided/installed by the city. Costs shall be paid by the Contractor. The Contractor shall install metal vault as per COP specifications. POC: Mr. Ron West, COP (602) 878-6499.

## 7. TESTS.

7.1 After completion of the piping system and prior to backfilling and the installation of the emitters (dripline), the entire system shall be tested for leaks and thoroughly flushed under pressure to remove any dirt, scale or other material. Lines shall be tested at 200 psi for one hour duration. Cracked or defective pipe, fittings, or accessories disclosed in the pressure tests shall be replaced by the Contractor with sound material at no additional cost to the Government, and the test shall be replaced by the Contractor with sound material at no additional cost to the Government, and the test shall be repeated until results are satisfactory to the Contracting Officer.

7.1.1 No line shall be covered until inspection and approval has been given by the Contracting Officer.

7.1.2 Testing of plastic pipe shall not be done until all joints have had at least 24 hours to set and cure. During cold weather, 48 hours elapsed time shall be allowed for setting prior to testing. No water under pressure shall come in contact with any joint during the specified curing period. In hot weather, water shall not be permitted to stand in pipes until after backfilling is completed. Water used in testing shall be drained from pipes after completion of testing.

7.2 Coverage Test. When the emitters (dripline) system is completed the entire system shall be adjusted and operated to demonstrate the water coverage is complete and adequate and that the system conforms to the manufacturers requirements and according to the plans and specifications. All deficiencies and inadequacies resulting from defective or inadequate materials and/or workmanship

shall be corrected at no additional cost to the Government. In the event any modifications to the system or deviation from the approved plans and specifications are directed, an adjustment in contract price will be made.

8. DISINFECTION. The completed line from the backflow prevention unit to the connection to the existing waterline shall be disinfected by the Contractor as prescribed by AWWA C 601.

9. CLEANUP. Upon completion of the installation of the irrigation system and appurtenances, all debris and surplus materials resulting from the work shall be removed.

10. VARIATION IN ARRANGEMENT OF EMITTERS (dripline) from those shown on drawings will be permitted. If such variation is made, the Contractor shall submit a shop drawing for approval in accordance with the Special Provisions. If any conflicts occur necessitating departures from the contract drawings, details of departures, hydraulic calculation and reasons shall be submitted as soon as practicable for written approval of the Contracting Officer. Hydraulic calculations shall include application rate per hour, maximum triangular spacing of emitters (dripline) for design flow rate and pressure, overlap including wind loss allowance and friction loss through pipe fittings, valves and accessories.

11. GUARANTEE. The following equipment to be furnished under this specification shall be guaranteed for a period of one year from the date of acceptance thereof, either for beneficial use or final acceptance, whichever is earlier, against defective materials, design, and workmanship:

- Hydrovisol
- Backflow prevention units
- Quick coupling valves and keys
- Water meters
- Control valves
- Automatic controller, and components listed herein and on the drawings
- Emitters (drip line)
- Filters
- Pressure regulators
- Motorized ball valves

13. SUBMITTALS. Manufacturer's literature on the following materials shall be submitted for approval:

- Backflow prevnetion units
- Quick copuling valves and keys
- Control valves
- Automatic controller, enclosures and components listed herein and on the drawings
- Pressure regulators
- Filters
- Fertilizer injector
- Motorized ball valves
- PVC
- Flash valves
- Gate valves
- Hydrovisions

\* \* \* \* \*

SECTION 2J

HYDROSEEDING

Index

- |                                    |                             |
|------------------------------------|-----------------------------|
| 1. Applicable Publications         | 4. Environmental Protection |
| 2. Submittals                      | 5. Materials                |
| 3. Delivery, Storage, and Handling | 6. Installation             |

1. APPLICABLE PUBLICATIONS. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1 Federal Specification (Fed. Spec.).

O-F-241D

Fertilizers, Mixed, Commercial

1.2 U.S. Department of Agriculture (USDA) Agricultural Marketing Service, Seed Branch, Grain Division.

53 Stat. 1275

Federal Seed Act (Approved August 9, 1939, Reprinted Sept 1975; Amendment May 1976 Sept 1977)

2. SUBMITTALS.

2.1 Certificates of Conformance or Compliance. Before delivery, notarized certificates attesting that the following materials meet the requirements specified, shall be submitted in triplicate for approval.

a. Seed

b. Fertilizer

2.2 Manufacturer's Literature. Manufacturer's literature on the following materials shall be submitted.

a. Hydro-Mulch

b. Erosion Control Materials

2.3 Maintenance Instructions. Prior to end of the contract maintenance period, 3 copies of written instructions for year-round maintenance and care of installed hydroseeded area shall be furnished to the Contracting Officer.

3. DELIVERY, STORAGE, AND HANDLING.

3.1 Delivery.

3.1.1 The Contractor shall notify the Contracting Officer of the delivery schedule in advance so material may be inspected upon arrival at the jobsite. Unacceptable material shall be removed from the jobsite immediately.

3.1.2 During delivery seed shall be protected from drying out and contamination.

3.1.3 Fertilizer shall be delivered to the site in the original, unopened containers bearing the manufacturer's guaranteed chemical analysis, name, trade name, trade mark, and conformance to state and Federal laws. In lieu of containers, fertilizer may be furnished in bulk and a certificate indicating the above information shall accompany each delivery.

### 3.2 Storage.

3.2.1 Seed and fertilizer shall be kept in dry storage away from contaminants.

3.2.2 Storage of materials shall be in areas designated or as approved.

4. ENVIRONMENTAL PROTECTION. All work and Contractor operations shall comply with the requirements of SECTION: ENVIRONMENTAL PROTECTION.

### 5. MATERIALS.

5.1 Seed. Seed shall be state-certified seed of the latest season's crop and shall be delivered in original sealed packages bearing the producer's guaranteed analysis for percentages of mixtures, pure live seed, germination weedseed content, and inert material. Seed shall be labeled in conformance with U.S. Department of Agriculture rules and regulations under the Federal Seed Act and applicable state seed laws. Seed that has become wet, moldy, or otherwise damaged will not be acceptable. Onsite seed mixing shall be done only in the presence of the Contracting Officer. Seed mixture shall be proportioned by the pounds of pure live seed per acre as follows:

<u>Botanical Name</u>	<u>Common Name</u>	<u>Pure Live Seed</u>
A. <i>Atriplex polycarpa</i>	Desert Saltbush	2.0 Lbs/Acre
B. <i>Cenchrus ciliaris</i>	Buffelgrass	2.5 Lbs/Acre
C. <i>Schismus barbatus</i>	Mediterranean Grass	2.5 Lbs/Acre
D. <i>Encelia farinosa</i>	Brittle Bush	2.0 Lbs/Acre
E. <i>Encelia frutescens</i>	Green Brittlebush	1.5 Lbs/Acre
F. <i>Ambrosia dumosa</i>	White Bursage	2.0 Lbs/Acre
G. <i>Ambrosia deltoides</i>	Triangleleaf Bursage	2.0 Lbs/Acre
H. <i>Plantago insularis</i>	Wooly Indian Wheat	2.5 Lbs/Acre
I. <i>Haplopappus linearifolius</i>	Golden Weed	1.5 Lbs/Acre
H. <i>acradenii</i> (substitution)		
	Total PLS	18.5 Lbs/Acre

Maximum weed seed shall not exceed one percent by weight.

5.2 Fertilizer shall be commercial grade, free flowing, uniform in composition and shall conform to applicable state and Federal regulations. Granular fertilizer shall conform to Fed. Spec. O-F-241, Type I, Level B, and shall bear the manufacturer's guaranteed statement of analysis. Granular inorganic fertilizer shall contain a minimum percentage by weight equaling 16 nitrogen (of which 50 percent shall be organic), 8 available phosphoric acid and 4 potash. Granular slow release fertilizer shall contain a minimum percentage by weight equaling 16 nitrogen, 6 available phosphoric acid, and 8 potash.

### 5.3 Mulch.

5.3.1 Wood cellulose fiber for use with hydraulic application of seed and fertilizer shall consist of specially prepared wood cellulose fiber, processed to contain no growth or germination-inhibiting factors and dyed an appropriate color to facilitate visual metering of the application of materials. On an air-dry weight basis, the wood cellulose fiber shall contain a maximum of 12 percent moisture, plus or minus 3 percent at the time of manufacture. The pH range shall be from 3.5 to 5.0. The wood cellulose fiber shall be manufactured so that:

a. After addition and agitation in slurry tanks with fertilizers, seeds, water, and other approved additives, the fibers in the material will become uniformly suspended to form a homogeneous slurry.

b. When hydraulically sprayed on the ground, the material will form a blotterlike cover impregnated uniformly with seed.

c. The cover will allow the absorption of moisture and allow rainfall or applied water to percolate to the underlying soil.

5.4 Water. Water shall contain no elements toxic to plant life. Water necessary for the maintenance of hydroseeded area shall be obtained by the Contractor and shall be adequate for the intended purpose.

5.5 Erosion Control Material shall be a totally organic substance supplied in dry, powdered form, at least 70 percent of which is 92 percent pure muciloid, derived from *Plantago ovata-insularis* husk. Erosion control material shall be water-soluble, non-toxic, hydrophilic and shall not inhibit germination.

### 5.6 Soil Conditioners.

5.6.1 Rotted manure shall be unleached stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials and containing no chemicals or ingredients harmful to plants.

5.6.2 Topsoil shall be the existing surface soil amended by the application of ferrous sulphate at the rate of 200 lbs/acre, soil sulphur at the rate of 100 lbs/acre and the addition of manure as a soil conditioner at the rate of 1500 lbs per acre.

### 5.7 Erosion Control Netting.

5.7.1 The erosion control netting shall be designed for use over straw mulch. Erosion Control netting shall be an extruded oriented polypropylene net with a mesh opening of approximately 5/8" x 3/4", the strand count approximately 1.5 x 1.3 strands per inch, and weight approximately 3 lbs per 1000 square feet. The color shall be green.

## 6. INSTALLATION.

6.1 Tillage. After the areas required to be seeded have been brought to the grades as specified, they shall be thoroughly tilled to a depth of at least 8 inches by scarifying, disking, harrowing, or other approved methods. Ferrous sulphate, soil sulphur, and manure shall be incorporated into the soil to a depth

of at least 8 inches and shall be incorporated as part of the tillage operation hereinbefore specified. Immediately before seeding, the soil shall be restored to an even condition. All debris remaining on the surface after tillage shall be removed.

6.2 Planting shall not be done when the ground is in an unsatisfactory condition for planting. If special conditions exist that may warrant a variance in plant installation, a written request shall be submitted to the Contracting Officer stating the special conditions and proposed variance.

6.3 Seeding. The seed, mulch, and fertilizer shall be mixed in the required amount of water to produce a homogeneous slurry and then uniformly applied under pressure at the following rates (dry weight) per acre:

- 500 lbs. wood cellulose fiber mulch
- 218 lbs. 16-8-4 inorganic fertilizer
- 18.5 lbs. of seed mix
- 150 lbs. slow release fertilizer 16-6-8

6.3.1 Mulch Application. A second application of 1500 lbs/acre of wood cellulose fiber mulch mix, in the required amount of water to produce a homogeneous slurry, shall be applied immediately after the procedure described in paragraph: SEEDING, above.

6.4 Protection of Seeded Areas. Immediately after seeding, the area shall be covered at a rate of 2000 Lbs/Acre of clean wheat straw mulch through the use of a mulch blower. The straw mulch shall be affixed with a water-soluble erosion control material, crimping will not be allowed. The straw mulch shall be held in place using an open mesh erosion control netting. Protection for seeded area may be provided by the use of S150 or SC150 erosion control blanket manufactured by North American Green or equal in lieu of the straw mulch/open mesh erosion control netting, subject to the submittal of samples, manufacturer's literature, and approval of the Contracting Officer. The netting shall be pinned or stapeled in place per manufacturers' recommendations. The mulch and netting shall be maintained until final acceptance. The seeded area shall be protected against traffic or other use by erecting barricades, as required, and placing approved signs at appropriate intervals until final acceptance.

6.5 Restoration and Clean-Up. Excess and waste material shall be removed daily. When hydroseeding in an area has been completed, the area shall be cleaned of all debris and excess material. Paving shall be cleaned when work in adjacent areas is completed.

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SECTION 2K

SCOUR GAGES AND MONUMENTS

1. GENERAL. The scour gages shall be of the dimensions shown on the drawing and constructed at the locations indicated. Government-furnished Corps of Engineers standard survey monuments shall be installed by the Contractor at the locations indicated on the drawings. After completion of the scour gages and installation of monuments of third order location survey shall be made and all field notes, computations and other records relative to the location of the scour gages and monuments shall be recorded in duplicate and the original pages furnished to the Contracting Officer.

2. DRILLING. The holes shall be drilled with a rotary type aguer drill. Drilling equipment requiring the use of wash water will not be permitted. Casing shall be provided by the Contractor and used to protect the top of the holes from caving and to permit completion of drilling of holes to required depth. The casing shall be removed from the holes and from the site when placing the stone granules is completed. The casing will become the property of the Contractor.

3. MATERIAL. Stone granules shall be a bright red stone or crushed brick, within the following limits.

Sieve Designation	Percent by Weight Passing Square Mesh Sieves
1-1/2"	100
3/8"	0

3.1 The color, quality, gradation and placement method of the stone granules shall be subject to approval by the Contracting Officer.

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## SECTION 3A

### SOIL-CEMENT

#### Index

1. Applicable Publications
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1. APPLICABLE PUBLICATIONS. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

#### 1.1 American Society for Testing and Material (ASTM) Standards.

C 39-83b	Compressive Strength of Cylindrical Concrete Specimens
C 117-84	Materials Finer Than 75um (No. 200) Sieve in Mineral Aggregates by Washing
C 136-84	Sieve or Screen Analysis of Fine and Coarse Aggregates
C 150-84	Specification for Portland Cement
C 171-69 (R 1980)	Sheet Materials for Curing Concrete
C 309-81	Liquid Membrane-Forming Compounds for Curing Concrete
D 75-82	Sampling Aggregates
D 558-82	Moisture Density Relations of Soil Cement Mixtures
D 1556-86	Density of Soil In Place by the Sand-Cone Method
D 1557-70	Moisture-Density Relations of Soils Using 10-lb. Rammer and an 18-in. Drop
D 1633-84	Compressive Strength of Molded Soil-Cement Cylinders

D 2216-80

Laboratory Determination of Water  
(Moisture) Content of Soil, Rock,  
and Soil-Aggregate Mixtures

E 329-77  
(R 1983)

Inspection and Testing Agencies for  
Concrete, Steel, and Bituminous  
Materials as used in Construction

## 2. QUALITY ASSURANCE.

2.1 Preconstruction Testing. The Government will sample and test the cement. The Contractor shall notify the Contracting Officer as soon as practicable, but not less than 45 days in advance of the time when soil-cement placement is expected to begin, of the manufacturer from which each of those materials intended to be used by the Contractor will be obtained together with the sampling location, brand name, type and quantity. The Contractor may submit to the Contracting Officer a request for approval of materials for soil-cement based on certificates of compliance of materials produced at the proposed sources with the requirements of these specifications. Certificates of compliance shall include appropriate manufacturer's test data and results which demonstrate compliance with these specifications. The Contractor shall proceed with required sampling until he receives, in writing from the Contracting Officer, approval for use of the proposed materials. Facilities and labor necessary for sampling will be provided by the Contractor and testing will be performed by and at the expense of the Government except as otherwise specified. No material shall be used until notice has been given by the Contracting Officer that test results are satisfactory and all movement of materials after sampling shall be as directed.

2.1.1 Cement. If cement is to be obtained from more than one source, the initial notification shall state the estimated amount to be obtained from each source and proposed schedule of shipments. Cement will be sampled at the mill or shipping point and/or at the soil-cement mixing plant. If tests prove that a cement which has been delivered is unsatisfactory, it shall be promptly removed from the site of the work. Cement which has not been used within 6 months after compliance testing will be retested at the expense of the Contractor when directed by the Contracting Officer and shall be rejected if test results are not satisfactory. The cost of testing cement in excess of the project requirements will also be at the expense of the Contractor. The charges for testing cement at the expense of the Contractor will be deducted from payments due to the Contractor at a rate of 7 cents per hundred weight of cement represented by the tests.

2.1.1.1 Prequalified Cement Sources. Cement shall be delivered and used directly from a mill of a producer designated as a qualified source. Samples of cement for compliance testing will be taken at the project site or soil-cement mixing plant by a representative of the Contracting Officer for testing at the expense of the Government. A list of prequalified cement sources is available from Commander and Director, U.S. Army Engineer Waterways Experiment Station, P.O. Box 631, Vicksburg, Mississippi 39180.

2.1.1.2 Other Cement Sources. Sampling, testing and shipping inspection from the point of sampling, when the point is other than at the site of work, will be made by or under the supervision of the Government and at the Contractor's expense. No cement shall be used until notice has been given, in writing, by the Contracting Officer that test results are satisfactory. In the event of failure of compliance

tests, the cement may be resampled and tested at the request of the Contractor, and at the Contractor's expense. When the point of sampling is other than at the site of work, the fill gate or gates of the sampled bin will be sealed and kept sealed until shipment from the bin has been completed. Sealing of the fill gate or gates and of conveyances used in shipment will be done by or under the supervision of the Government. Conveyances will not be accepted at the site of work unless received with all seals intact. If tested cement is rehandled at transfer points, the extra cost of inspection will be at the Contractor's expense.

2.2 Construction Testing by Government. The Government will sample and test cement, soil and soil-cement to determine compliance with the specifications. The Contractor shall provide facilities and labor as may be necessary for procurement of representative test samples. Samples of soil will be obtained from stockpiles and at the point of batching in accordance with ASTM D 75.

2.3 Submittals. The Contractor shall submit, in writing to the Contracting Officer, for approval a plan for the batching, conveyance, placement, compaction, finishing and curing of the soil-cement mixture. The Contractor's plan shall also include the following items: the approximate length of soil-cement to be placed prior to the start of compaction operations; the number and type of watering equipment to be used; the method used to keep soil-cement surfaces continually moist until subsequent layers of soil-cement are placed; the method used to cure permanently exposed soil-cement surfaces; proposed sources of soil to be used in soil-cement if other than designated sources; proposed size and number of stockpiles; and mix designs for the soil-cement.

3. EVALUATION AND ACCEPTANCE. The compaction of the soil-cement will be considered satisfactory so long as the results equal or exceed the specified density requirements as described in paragraph: PLACEMENT OF SOIL-CEMENT. Soil cement work judged inadequate shall be replaced at the Contractor's expense as directed by the Contracting Officer.

#### 4. MATERIALS.

4.1 Cement shall conform to the requirements of ASTM C 150, Type II. Cement shall be stored in a manner to prevent the absorption of moisture.

4.2 Water shall be clean, fresh, and free from injurious amounts of oil, acid, salt, alkali, organic matter, and other substances deleterious to the hardening of soil-cement and shall be subject to the approval of the Contracting Officer.

#### 4.3 Aggregate.

4.3.1 Soil aggregate for use in soil-cement construction, when tested in accordance with ASTM C 136 and ASTM C 117, shall conform to the following gradation and be free of any deleterious material:

Standard Sieve Size	Percent passing
1-1/2 in.	100
No. 4	60-90
No. 200	5-20

4.3.2 Soil aggregate for soil cement construction may be obtained from the required project excavation or from commercial sources. Commercial sources of suitable soil aggregate are available within a 5-mile radius of the project site. The Contractor shall make all arrangements, and secure all permits for the procurement, furnishing and transporting the soil aggregate. It is the responsibility of the Contractor to blend and/or process available materials (or import additional suitable materials from other sources approved by the Contracting Officer) so that soil used in construction of soil-cement conforms to the above requirements. (Supplemental exploration data presenting the laboratory test results of soils in the project area are available for informational purposes as stated in paragraph: PHYSICAL DATA of the SPECIAL CLAUSES).

#### 4.4 Curing Materials.

4.4.1 Waterproof sheeting shall be white waterproof paper or white opaque polyethylene film conforming to ASTM C 171.

4.4.2 Curing Compounds shall conform to ASTM C 309, Type 2.

#### 5. PROPORTIONING AND MIXING.

5.1 General. The Contracting Officer shall provide the required proportions of cement, aggregate, and water to be used in the soil-cement based on test results provided by the Contractor for each approved stockpile. The proportions will vary depending on the aggregate used and will be based from test results conducted in accordance with paragraphs: MOISTURE-DENSITY TESTS, COMPRESSIVE STRENGTH TESTS AND STOCKPILING OF MATERIAL. These moisture-density and compressive strength tests shall be conducted in the presence of the Contracting Officer's representative. The soil, cement, and water shall be accurately measured and conveyed into the mixer in the proportionate amounts necessary to meet the specified requirements. All ingredients shall be mixed for at least 30 seconds per cubic yard of mixture, or longer as may be necessary to insure a thorough and uniform mix on the soil, cement, and water, and until the resulting mixture is homogeneous and uniform in appearance. When mixing is completed, the percentage of moisture in the mixture, on a basis of oven-dry weight as determined by ASTM D 2216, shall be such that at the time of compaction, it will be between optimum moisture and 2 percentage points wet of the optimum moisture cement.

5.2 Moisture-Density Tests. The Contractor shall determine four series of optimum moisture-maximum density relationships of soil and cement mixtures in accordance with ASTM D 558, Method A. Moisture-density relationships shall be conducted for cement contents of 6, 8, 10 and 12 percent.

5.3 Compressive Strength Tests. The Contractor shall prepare four series of compression test specimens of soil cement (laboratory cured) and test them in accordance with ASTM D 1633, Method A, at seven (7) days. Each series shall consist four compaction points, uniformly spaced and representing a moisture range beginning at optimum moisture and extending to 6 percent wet of optimum moisture. Each data point shall be the result of the average compressive strength from three breaks. For the testing, cement contents used shall be 6, 8, 10 and 12 percent. Cement content is defined as the percentage of cement, by weight, of total dry aggregate or soil.

## 6. PLANT AND EQUIPMENT.

6.1 Mixing Plant. Mixing of the soil, cement, and water to be used in the soil-cement mixture shall be accomplished in a stationary mixing plant. The mixer shall be an approved twin-pugmill type or a continuous-mixing type designed for either weight or volume proportioning. The plant shall be designed and operated so as to produce a uniform mixture within the limits required by these specifications. The plant shall be equipped with a hydraulically or mechanically operated holding bin having a minimum capacity of 20 tons.

6.1.1 Satisfactory means shall be provided to obtain the proper amount of cement, soil, and water. Measuring devices for soil and water shall be sensitive to a 2 percent variation above or below the actual weight required. Measuring devices for cement shall be sensitive to within plus or minus 0.5 percent of the actual weight in pounds. Proportioning may be on a volume basis, provided that the sensitivity specified for the weight basis is maintained.

6.1.2 The plant shall be equipped with a positive, adjustable governor for controlling the mixing time of each batch. The mixing time shall be considered as the interval between the time the cement contacts the soil and water and time the mixture leaves the mixing unit.

6.1.3 Batching plants designed for weight proportioning shall include means for accurately weighing soil and cement in a weight box or hopper suspended on scales, ample in size to hold a full batch without hand raking or running over. The weight box or hopper shall be supported on fulcrums and knife edge so constructed that they will not be easily thrown out of alignment or adjustment. Scales may be either of the beam type with over-and-under indicator or springless-dial type and shall be of a standard make and design, sensitive to 1/2 of 1 percent of the maximum load that may be required. If the beam-type scale is used, there shall be included a separate beam for soil and for cement, each beam being connected so as to actuate the over-and-under indicator, and a tare beam for balancing the hopper.

6.1.4 Plants designed for continuous mixing shall include a means for accurately proportioning soil and cement and shall be equipped to insure positive interlocking control of the flow of soil and cement from bins.

6.1.5 Recorders. An accurate recorder shall be provided for the aggregates and cement. The weights or volumes of water shall also be recorded including the weight of free moisture tested in the aggregate. The recorders shall conform to the following requirements:

(1) The recorders shall produce a digital record on a single tape of the weight of each material in the batch at the conclusion of the batching cycle. All materials that are weighed and those measured by volume shall be recorded on a single tape. The record shall be produced prior to delivery of the materials to the mixer. After the batches have been discharged, the recorder shall show the return to empty condition.

(2) The recording unit shall be completely housed in a single cabinet which shall be capable of being locked.

(3) The tapes shall be so marked that each batch may be permanently identified and so that variations in weights of each batch can be readily observed.

(4) The tapes shall show time of day at intervals of not more than 15 minutes.

(5) The recorded tape shall become the property of the Government.

6.2 Transportation Equipment. Equipment for transporting the soil-cement mixture shall have clean, smooth beds and protective covers for use in unfavorable weather (as described in paragraph: WEATHER LIMITATIONS).

6.3 Spreader. The equipment for spreading the soil-cement mixture shall be suitable for the purpose and shall be capable of discharging the mixture in layers to produce reasonably smooth uniform surfaces. The equipment shall be controllable so as to produce layers, which when compacted, will each be approximately of the specified thickness and will meet all of the requirements of these specifications.

6.4 Compaction Equipment. Compaction shall be accomplished by tamping rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment well-suited to the material being compacted. The equipment shall provide uniform compaction across the width of the equipment for each pass. The use of trucks, tractors, or other hauling equipment shall not be allowed for compaction of soil-cement mixtures.

6.5 Water Curing Equipment. Water Curing Equipment consisting of pumps, water tanks, sprinklers, or other approved equipment shall be furnished by the Contractor. Adequate equipment, subject to the approval of the Contracting Officer, shall be available at all times to provide water as required for curing and protection of permanently exposed slopes and for moistening compacted surfaces that are to receive an overlying layer of soil-cement. Water trucks or sprinklers for applying water to in-place layers of soil-cement shall be equipped with fog-type sprayers.

7. STOCKPILING OF MATERIAL. Soil aggregate shall be stockpiled on firm ground drained and leveled, free of debris, trash, organics, and other objectionable or deleterious material. Stockpiles shall be constructed in layers not exceeding 2 feet in thickness. Ramps formed for the construction of stockpiles shall be of the same material as that being stockpiled, and will be considered a part of the stockpile. Material taken from the stockpile for soil-cement production shall be scooped from the stockpile in such a manner that material from several layers of the stockpile are combined in each scoop and the gradation of the material obtained is representative of that used in the mix design tests. For each stockpile, the Contractor shall allow the Contracting Officer at least seven (7) days following the submittal of moisture-density relationships and soil-cement mix compressive test results to allow the Government time to provide a mix design. Soil aggregate for use in soil-cement shall not be used from any stockpile without completion of the mix design. A minimum of one series of tests and a mix design shall be conducted for each stockpile. For stockpiles exceeding 15,000 cubic yards of material, a series of tests and mix design shall be conducted for each 15,000 cubic yards or fraction thereof.

8. DRAINAGE. Adequate drainage shall be provided during the entire construction period to prevent water from collecting or standing on the area to be stabilized or on the mixed, or partially-mixed material.

9. SUBGRADE PREPARATION. The subgrade for soil-cement shall be defined as the area beneath the bottom layer of soil-cement which bears the weight of the soil-cement and compaction equipment. The subgrade shall be cleaned of debris, trash, and organics. The subgrade shall be adequately compacted to 95 percent of maximum density in accordance with ASTM D 1557 and shall be capable of withstanding, without displacement, the compaction specified for the soil-cement mixture. Debris and removed in-place material designated as unsuitable shall become the property of the Contractor and be disposed of. The subgrade for the soil-cement fill shall be compacted in accordance with SECTION: FILLS AND SUBGRADE PREPARATION.

10. TRANSPORTING SOIL-CEMENT MIXTURE. The soil-cement mixture shall be transported from the mixing plant to the site of the work in clean equipment provided with protective covers for use in unfavorable weather (as described in paragraph: WEATHER LIMITATIONS). The total elapsed time between the addition of water to the soil-cement mixture and the start of compaction shall not exceed thirty (30) minutes. Any load excessively wetted by rain or excessively dried (dry of optimum moisture content) for any reason will be subject to rejection. Equipment shall not be operated on a finished compacted layer of soil-cement except where specifically permitted, and any damage resulting to the soil-cement from such operation shall be repaired at the expense of and by the Contractor.

11. PLACEMENT OF SOIL-CEMENT.

11.1 Spreading. The soil-cement mixture shall be placed and distributed in such a manner as to produce a reasonably smooth, uniform surface in layers of such uncompacted thickness that when compacted each layer shall not exceed 8 inches nor be less than 4 inches in thickness. In general, soil-cement shall be placed in horizontal layers. The Contractor will be permitted to place the material in sloping layers to accommodate hauling and compacting equipment if such sloping layers are not steeper than 8:1.

11.2 Compaction. Compaction shall commence as soon as practical after spreading. Compaction shall be completed within one hour from the time the soil-cement mixture is discharged from the mixer. Each layer shall be compacted to a density of at least 98 percent maximum density in accordance with ASTM D 558, Method A. The blade of the self-propelled roller or the tractor towing the roller shall not be used for spreading.

11.3 The specified moisture content shall be maintained uniformly throughout the layer of material being compacted. At no time shall water be added during compaction operations to the uncompacted soil cement mixture. If in the opinion of the Contracting Officer, the surface of a layer of soil-cement has been rutted or compacted unduly by hauling equipment to reduce the effectiveness of compaction by the specified rollers, the Contractor will be required to scarify such surfaces as directed prior to compacting with the specified rollers. At the start of compaction, the mixture shall be in a uniform, loose condition throughout its full depth. No section shall be left undisturbed for longer than thirty minutes during compaction operations. Compaction of each layer shall be done in such a manner as to produce a dense surface, free from compaction planes.

11.4 Where compaction of the soil-cement adjacent to concrete structures or elsewhere by means of the above specified roller is impracticable or undesirable as determined by the Contracting Officer, the soil-cement shall be compacted by mechanical tampers or by other approved methods to obtain the compaction equivalent to the soil-cement compacted with the above rollers.

#### 11.5 Construction Joints.

11.5.1 Compacted surfaces of soil-cement that are to receive an overlying layer of soil-cement shall be kept moist continuously until placement of the overlying or adjacent layer of soil-cement; provided that the Contractor will not be required to keep such surfaces moistened for a period longer than 7 days. Whenever the Contractor's operation is interrupted for more than two (2) hours, the top surface of the completed soil-cement layer, if smooth, shall be scarified to a depth of at least one (1) inch with a spike tooth instrument prior to placement of the next layer. The scarified surface shall then be swept using a power broom or other method approved by the Contracting Officer to completely free the surface of all loose material prior to the placement of the soil-cement for the next layer.

11.5.2 The Contractor shall clean off bonding surfaces thoroughly by power brooming prior to placing the next layer of soil-cement. Equipment operating on soil-cement layers shall be routed so as not to disrupt or damage the layers, and no equipment shall be operated over the finished edges of the soil-cement on the slope unless proper protection is provided. Transverse joints at stoppages of work shall be trimmed to form straight, vertical joints. When lanes of soil-cement are placed in adjacent layers, the longitudinal joints, if placement is discontinued, shall be trimmed within 3 hours of compaction to form straight, vertical joints prior to the placement of the adjacent lane. Soil-cement materials removed in brooming, smoothing, or trimming the layers after the time limits specified for transporting and compacting the layers shall be wasted.

#### 11.6 Protection.

11.6.1 Protection from Construction Traffic. The Contractor shall take all necessary precautions to avoid damage to completed soil-cement by the movement of equipment, and shall avoid the deposition of soil or foreign materials between layers of soil-cement. Earthen ramps crossing completed soil-cement shall have a minimum compacted thickness of two feet. Where ramps are constructed over soil-cement that is not to grade, all foreign materials and the uppermost 1-inch of the previously placed soil-cement mixture shall be removed prior to continuation of the soil-cement construction.

11.6.2 Protection from Rain or Waterflow. If, prior to completion of compaction, the soil-cement mixture is wetted by rain so that the average moisture content exceeds the tolerance given in subparagraph: WATER CONTENT, at the time of final compaction, the entire layer affected, as determined by the Contracting Officer, shall be removed and shall be replaced in accordance with these specifications at the expense of the Contractor.

11.7 Finishing. After compaction, the soil-cement shall be cut to the required lines, grades, and cross-sections and rolled to a reasonably smooth surface. Trimming and shaping of the soil-cement shall be conducted at the completion of each day's production utilizing a smooth blade.

12. WEATHER LIMITATIONS. No soil-cement shall be prepared except when the air temperature is at least 40 degrees F. in the shade and rising. No cement shall be applied to soils that are frozen or contain frost. When the air temperature does not exceed 90 degrees F, the moisture content shall not be below optimum nor be more than 2 percent above optimum at the time of compaction. When the air temperature exceeds 90 degrees F, or there is a breeze or wind which promotes the rapid drying of the soil-cement mixture, protective covers on transporting equipment shall be used and the moisture content of the mix shall be increased as needed at the direction of the Contracting Officer, but shall be less than that quantity that will cause the soil-cement to become unstable during compaction and finishing operations. Protective covers on transportation equipment will also be required to protect the soil-cement mixture from extra moisture caused by rain.

### 13. CURING AND PROTECTION.

13.1 General. Temporarily exposed surfaces of soil-cement that will be in contact with succeeding layers of soil-cement shall be kept continuously moist by moist curing or impervious-sheet curing methods described hereinafter until placement of the subsequent layer, provided that the Contractor will not be required to keep such surfaces continuously moist for a period longer than seven (7) days. Curing of permanently exposed surfaces shall begin immediately after compaction, or immediately after trimming if the surface is to be trimmed, and shall continue for at least seven (7) days. The soil-cement shall be cured and protected from premature drying, extremes in temperature, rapid temperature change, freezing, mechanical damage and exposure to rain or flowing water. The Contractor shall have all equipment needed for adequate curing and protection of the soil-cement on hand and ready to install before actual soil-cement placement begins. The curing medium and method, or the combination of mediums and methods used, shall be approved by the Contracting Officer. Soil-cement shall be protected from the damaging effects of rain for 12 hours and flowing water for 14 days.

13.2 Moist Curing. Soil-cement may be moist cured by maintaining all surfaces continuously (not periodically) wet for the duration of the entire curing period with the exceptions listed below. Water for curing shall comply with the requirements of paragraph: WATER. If water is used which stains or discolors soil-cement surfaces which are to be permanently exposed, the surfaces shall be cleaned to the satisfaction of the Contracting Officer. Horizontal surfaces shall be cured by covering with a minimum uniform thickness of 2 inches of continuously saturated sand, or by covering with saturated non-staining burlap or cotton mats. Horizontal construction joints may be allowed to dry for twelve hours immediately prior to the placing of the following lift.

13.3 Curing Compound. A curing compound conforming to ASTM C 309 may be used on permanently exposed surfaces which will not be in contact with succeeding layers of soil-cement. The curing compound shall be applied to surfaces as soon as final compaction has been completed. The curing compound shall be applied in a 2-coat continuous operation by approved motorized power-spraying equipment and pressure tank type equipment with provisions for continuous agitation. The compound shall be applied at a uniform coverage of not more than 400 square feet per gallon for each coat. Soil-cement surfaces which have been subjected to rainfall within 3 hours after curing compound has been applied shall be resprayed by the method and at the coverage herein specified. All soil cement surfaces on which the

curing compound has been applied shall be adequately protected for the duration of the entire curing period from pedestrian and vehicular traffic and from any other cause which will disrupt the continuity of the curing membrane.

13.4 Impervious-sheet Curing. The sheets shall comply with the requirements of ASTM C 171, except that the polyethylene film, if used, shall be white opaque. All surfaces shall be thoroughly wetted and be completely covered with waterproof paper or polyethylene film. Covering shall be laid with light-colored side up. Covering shall be taped to form a continuous cover with completely closed joints. The sheet shall be weighted to prevent displacement so that it remains in contact with soil-cement during the specified length of curing. Coverings shall be folded down over exposed edges of slabs and secured by approved means. Sheets shall be immediately repaired or replaced if tears or holes appear during the curing period.

14. GRADE CONTROL. The finished and completed soil-cement slope protection shall conform to the lines, grades, cross section, and dimensions indicated. All points of the finished soil-cement surfaces shall be within 1 inch of the construction lines shown on the contract drawings. The lines and grades indicated shall be maintained by means of line and grade stakes placed by the Contractor at the site of the work in accordance with the SPECIAL CLAUSES.

#### 15. CONTRACTOR QUALITY CONTROL.

15.1 General. The Contractor shall perform the inspection and tests described in paragraph: INSPECTION DETAILS AND FREQUENCY OF TESTING, and based upon the results of these inspections and tests, he shall take the action required in paragraph: ACTION REQUIRED, and submit reports as required in paragraphs: ACTION REQUIRED and REPORTS. The laboratory performing the tests shall conform to ASTM E 329. The individuals who sample and test soil-cement or the constituents of soil-cement shall have demonstrated a knowledge and ability to perform the necessary test procedures. The results of all laboratory and field tests shall be reported to the Contracting Officer within 24 hours.

#### 15.2 Inspection Details and Frequency of Testing.

15.2.1 Stockpiled Aggregate. Samples from stockpiles for moisture-density tests and mix designs shall be obtained by taking a minimum of six (6) face cuts at different locations on a stockpile and blending the sampled material. A minimum of one moisture-density relation shall be determined in accordance with ASTM D 1557 for each 15,000 cubic yards of stockpiled soil aggregate or one per stockpile, whichever is less. In addition, one sieve analysis shall be performed in accordance with ASTM C 136 and ASTM C 117 for each of the six face cuts of stockpiled aggregate and one for the blend of the six face cuts.

15.2.2 Batched Aggregate. At least once during each shift in which soil-cement is being delivered, there shall be one sieve analysis performed on soil aggregate from the batching plant in accordance with ASTM C 136 for aggregates. The location at which samples are taken from within the batching plant may be selected by the Contractor as the most advantageous for control. However, the Contractor is responsible for delivering aggregate to the mixer within the specification limits. Each time the Contractor performs a moisture-density relation, an additional gradation analysis in conformance with ASTM C 136 shall be performed, corresponding to the material used in the moisture-density relation.

15.2.3 Scales. The accuracy of scales used shall be checked by test weights at least once a month for conformance with the applicable requirement of paragraph: PLANT AND EQUIPMENT. Such tests shall also be made whenever there are variations in properties of the soil-cement which could result from batching errors.

15.2.4 Preparation for Placing. Foundation or construction joints shall be inspected in sufficient time prior to each soil-cement placement by the Contractor in order to certify to the Contracting Officer that it is ready to receive soil-cement. The results of each inspection shall be reported in writing. Density tests for subgrade shall be taken for every 5000 square feet.

15.2.5 Placing. The placing foreman shall supervise all placing operations and shall be responsible for measuring and recording ambient temperature, weather conditions, time of placement, yardage placed, and method of placement.

15.2.6 Density Tests. One density test conforming to ASTM D 1556 shall be taken for every 500 cubic yards of soil-cement placed. The locations of tests shall be randomly distributed throughout the soil-cement which has been placed.

15.2.7 Compressive strengths. At least one compressive strength test (two cylinders each) shall be conducted for each 1500 cubic yards of soil cement placed. Samples shall be taken from the wet batched mix. Tests shall determine the seven (7) day compressive strength in accordance with ASTM D 1633, Method A except that curing of specimens in the mold will be required only for the length of time necessary to satisfactorily remove the specimens from the mold without damage to the specimens.

15.2.8 Curing.

15.2.8.1 Moist curing. At least once each shift, an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded.

15.2.8.2 Curing Compound. No curing compound shall be applied until it has been verified that the compound is properly mixed and ready for spraying. At the end of each operation, the quantity of compound used and the area of soil-cement covered shall be reported and the rate of coverage in square feet per gallon shall be computed. The report shall state whether coverage is uniform.

15.2.8.3 Impervious Sheet Curing. At least once each shift, an inspection shall be made of all areas being cured using impervious sheets. The condition of the covering and the tightness of the laps and tapes shall be noted and recorded.

15.2.9 Protection. At least once each shift, an inspection shall be made of all areas subject to protection from adverse weather or flows. Deficiencies shall be noted.

15.3 Action Required.

15.3.1 Aggregates. When the amount passing any sieve is outside the specified limits, the aggregate shall immediately be resampled and retested. If there is another failure on any sieve, the fact shall immediately be reported to the Contracting Officer, and immediate steps shall be taken to rectify the situation.

15.3.2 Scales. Whenever the weighing accuracy or batching accuracy is found not to comply with specification requirements, the plant shall not be operated until necessary adjustments or repairs have been made.

15.3.3 Placing. The placing foreman shall not permit placing to begin until he has verified that adequate equipment manned with competent operators are available for compacting the soil-cement mixture. Placing shall be temporarily discontinued if any lift is inadequately compacted until such time as that lift has been reworked, retested, and meets the density requirements.

15.3.4 Density. Whenever the results of a density test indicate that the soil-cement has not been adequately compacted, the Contracting Officer shall be immediately notified. The extent of unsuitably compacted material will be determined and, if the time periods specified in paragraph: PLACEMENT OF SOIL-CEMENT have not expired, the Contractor may be allowed to apply additional rolling. If the time period has expired, the material will be removed, disposed of, and replaced with soil-cement meeting these specifications at no additional cost to the Government.

15.3.5 Curing.

15.3.5.1 Moist Curing. When a daily inspection report lists an area of inadequate curing, the required curing period for that area shall be extended by one day.

15.3.5.2 Curing Compound. When the coverage rate of curing compound is less than that specified or when the coverage is not uniform, the entire surface shall be sprayed again.

15.3.5.3 Impervious Sheet Curing. When a daily inspection report lists any tears, holes, or laps of joints that are not completely closed, the tears and holes shall promptly be repaired or the sheets replaced, the joints closed, and the required curing period for those areas shall be extended by one day.

15.4 Reports. All results of tests conducted at the project site shall be reported as required. During periods requiring protection from weather, reports of pertinent temperatures or flows shall be made daily. These requirements do not relieve the Contractor of the obligation to report certain failures immediately as required in preceding paragraphs. Such reports of failures and the action taken shall be confirmed in writing in the routine reports. The Contracting Officer has the right to examine all Contractor Quality Control records.

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SECTION 3B

CONCRETE

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1. APPLICABLE PUBLICATIONS. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1 American Concrete Institute (ACI) Standards.

318-83	Building Code Requirements for Reinforced Concrete
SP-66	ACI Detailing Manual - 1980

1.2 American Society for Testing and Materials (ASTM) Standard.

C 94-86a	Ready-Mixed Concrete
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2. GENERAL. The work shall be in conformance with ACI 318, part entitled "Construction Requirements", except as specified herein. Concrete shall conform to ASTM C 94.

3. STORAGE. Materials shall be stored so as not to deteriorate or become contaminated.

4. MATERIALS.

4.1 Anchorage Items. Anchorage items for anchoring work of other trades to concrete shall be of standard manufacture and of types to engage with anchors provided and installed under other sections.

4.2 Concrete Materials. Concrete materials shall conform to ASTM C 94, cement type optional. Only one brand of any one type of cement shall be used for exposed concrete surfaces of any individual structure.

4.3 Curing Materials. Curing materials shall be impervious sheet or membrane-forming curing compound. Impervious sheet shall be white opaque polyethylene 4 mil thick, waterproof kraft paper, or polyethylene-coated burlap. Membrane-forming curing compound shall be of commercial formulation, sprayable, nontoxic, and will form a film highly resistant to moisture loss from concrete while curing and will dry within 4 hours. Compound shall be clear with fugitive dye, resin-base or chlorinated-rubber-base-type.

4.4 Dowels. Dowels shall be plain carbon steel bars, minimum yield point of 40,000 psi for use in slabs on grade.

4.5 Expansion Joint Filler Strips, Premolded. Expansion joint strips shall be nonextruding, resilient bituminous or nonbituminous type commercially used in concrete paving or construction, 3/8-inch thick.

4.6 Form Coating. Form coating shall be nonstaining form oil or form release agent that will not deleteriously affect concrete surfaces nor impair subsequent applications.

4.7 Form Materials. Form materials shall be plywood or hardboard especially made for concrete form use or other materials that will produce the specified finishes without adversely affecting the concrete surfaces.

4.8 Form Ties. Form ties shall be metal, factory-fabricated removable or snap-off, that will leave holes not less than 1/4 inch nor more than one inch in diameter and not more than one inch deep. That portion of the tie remaining permanently in the concrete shall not project beyond the surface of the concrete and shall be recessed at least one inch from any concrete surface that will be exposed, painted, damproofed, or will receive direct applications of plaster.

4.9 Joint Sealant. Joint sealant shall be hot- or cold-applied, made specifically for sealing joints in concrete against moisture infiltration.

4.10 Reinforcement. Reinforcement bars shall be deformed, Grade 40 or Grade 60 billet or axle steel, or Grade 50 or Grade 60 rail steel. Mesh shall be welded steel wire fabric with wires at right angles to each other.

5. CONCRETE QUALITY. Proportioning of concrete mixes to meet the requirements specified below shall be the Contractor's responsibility.

5.1 Compressive Strength. Compressive strength in 28 days shall be 4,000 psi for all concrete. The maximum water-cement ratio shall not exceed 0.45 by weight, except for sidewalks and curbs and gutters. The compressive strengths shall be reached in 7 days when high-early-strength cement is used.

5.2 Entrained-Air Content. Entrained-air content of exterior concrete shall be maintained at 5 to 7 percent by volume of concrete.

5.3 Slump. Slump shall be 3 to 4 inches for walls and 2 to 3 inches for other work.

6. FORMWORK. Formwork shall provide for concrete conforming accurately to the indicated shapes, lines, dimensions, and with surfaces free of offset, waviness, or bulges. Where surfaces are to be exposed or painted, panels shall be manufacturer's stock size material, using smaller panels cut to required dimensions only where required by openings and joints. Panel joints in exposed or painted work shall occur at control joints, including alinement with masonry control joints and construction joints. Exposed corners shall be chamfered, beveled, or rounded by moldings placed in the forms. Surfaces shall be thoroughly cleaned and coated before each use. Forms shall be removed at a time and in a manner that will not injure the concrete.

7. REINFORCEMENT. Reinforcement detailing and placement shall conform to ACI SP-66 and ACI 318. Reinforcement shall be interrupted 2 inches clear on each side of joints in slabs on grade and perimeter joints. Wire-mesh reinforcement shall be continuous between joints in slabs on grade. Laps shall be at least one full mesh plus 2 inches; staggered to avoid continuous lap in either direction; and securely wired or clipped with the standard clips. Mesh shall be supported on precast concrete units in a manner that will support the mesh at the minimum height indicated. Dowels and tie bars in slabs on grade shall be installed at right angles to joints; accurately aligned parallel to the finished surface; and rigidly held in place and supported during concrete placement. One end of dowels shall be oiled or greased.

8. INSTALLATION OF ANCHORAGE ITEMS. Anchorage items shall be of number, size, and location to insure sufficient anchorage for purpose intended.

9. PLACING. Concrete footings and slabs and walls shall be placed upon clean undisturbed surfaces free from frost, ice, and water. Dry or pervious surfaces receiving concrete shall be covered with impervious sheet materials. Concrete may be placed directly on impervious surfaces that are thoroughly moistened but not muddy. Concrete shall be placed in layers not over 12 inches deep. Concrete to receive other construction shall be screeded to the proper level.

10. CONSOLIDATION OF CONCRETE. Consolidation of concrete shall be with internal concrete vibrators supplemented by handspading, rodding, and tamping. Vibrating equipment shall be adequate to thoroughly consolidate the concrete.

11. FINISHES OF CONCRETE. Fins and loose material shall be removed. Unsound concrete, voids over 1/2 inch in diameter, and tie-rod and bolt holes shall be cut back to solid concrete, reamed, brush-coated with cement grout, and filled solid with a stiff Portland-cement-sand mortar mix. Patchwork shall finish flush with adjoining concrete surfaces and where exposed, shall match adjoining surfaces in texture and color. Patchwork shall be cured for 72 hours. White Portland cement shall be used as needed to attain color match.

11.1 Smooth Finish. Surfaces to be painted or exposed to view shall be thoroughly wetted and then brush-coated with Portland-cement-sand grout of thick consistency and of mixture so that final color will approximately match the concrete. White Portland cement shall be used as needed to attain color match. Grout shall be cork- or wood-floated to fill voids, excess scraped off with a trowel, and visible grout film removed by rubbing with burlap. Grout shall be kept damp until set.

11.2 Forms shall be fabricated with facing materials that produce the following specified construction tolerance requirements:

11.2.1 This class of finish shall apply to all surfaces unless otherwise noted. The sheathing shall be composed of tongue-and-groove or shiplap lumber, plywood conforming to NBS Product Standards PS-1 Grade B-B Concrete Form, Tempered concrete from hardboard, or steel. Steel lining on wood sheathing will not be permitted.

11.3 Surface Requirements. Allowable irregularities are designated "abrupt" or "gradual" for purposes of providing for surface variations. Offsets resulting from displaced, misplaced, or mismatched forms, or sheathing, or by loose knots in

sheathing, or other similar form defects, shall be considered "Abrupt" irregularities. Irregularities resulting from warping, unplaneness or similar uniform variations from planeness, or true curvature, shall be considered "Gradual" irregularities. "Gradual" irregularities will be checked for compliance with the prescribed limits with a 5-ft. template, consisting of a straightedge for plane surfaces and a shaped template for curved or warped surfaces. In measuring irregularities, the straightedge or template may be placed anywhere on the surface in any direction, with the testing edge held parallel to the intended surface.

Irregularities

Abrupt, inches	1/4
Gradual, inches	1/2

12. CURING shall start as soon as free water has disappeared from concrete surfaces after placing and finishing. Curing materials shall be applied and maintained so as to protect the concrete from moisture loss for 7 days. Curing shall be accomplished by impervious sheet or membrane-forming curing compound. Concrete surfaces shall be thoroughly wetted before covering with impervious-sheet materials. Membrane-forming curing compound shall be applied with mechanical spraying equipment at a coverage of not more than 300 square feet per gallon. Surfaces damaged during curing shall be resprayed.

13. SIDEWALKS AND CURBS AND GUTTERS.

13.1 Concrete. Concrete for use in sidewalks, curbs, and gutters shall have a compressive strength of 3000 psi at 28 days.

13.2 Forms.

13.2.1 Sidewalks. Construct forms to conform to line and grade. Do not remove side forms until at least 12 hours after finishing.

13.2.2 Curbs and Gutters. Construct forms to conform to the dimensions of the curb. Hold forms rigidly in place by the use of stakes placed at intervals not to exceed 4 feet. Remove the forms on the front of the curb not less than 2 hours nor more than 6 hours after the concrete has been placed. Remove the remainder of the forms not less than 12 hours after the concrete placement.

13.2.3 Curb Forming Machines. Curb-forming machines for constructing curb and gutter may be used provided satisfactory results are obtained.

13.3 Finishing. Concrete for the sidewalks shall have a broom finish. Concrete for curb and gutter shall be finished as specified above. Broom finish shall be applied in a direction perpendicular to the direction of travel.

13.3.1 Edges for sidewalks including those at formed joints, shall be finished with an edger having a radius of 1/8 inch. Edges for curb and gutter shall be rounded with a 1/2 inch edging tool.

13.4 Joints.

13.4.1 Sidewalks.

13.4.1.1 Construction joints in sidewalks shall be placed so that the surface is divided into rectangular areas not more than 5 feet on center.

13.4.1.2 Expansion joints shall be installed at sidewalk returns.

13.4.2 Curbs and Gutters.

13.4.2.1 Contraction joints will be placed so the monolithic sections between curb returns will not be less than 5 feet nor greater than 15 feet.

13.4.2.2 Expansion joints will be placed in curb and gutter at intervals not exceeding 15 feet.

14. WAYBILLS AND DELIVERY TICKETS. Copies of waybills or delivery tickets shall be attached to the Daily Contractor Quality Control Report for the day of delivery. Before the final statement is allowed, the Contractor shall file with the Contracting Officer waybills and/or certified delivery tickets for all concrete actually used in the construction covered by this contract.

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SECTION 3C

SHOTCRETE (PNEUMATICALLY PLACED CONCRETE)

Index

- |                             |                                |
|-----------------------------|--------------------------------|
| 1. Applicable Publications  | 6. Preparation of Surfaces     |
| 2. Usage                    | 7. Placing                     |
| 3. Description              | 8. Finishing                   |
| 4. Materials                | 9. Curing and Protection       |
| 5. Proportioning and Mixing | 10. Contractor Quality Control |

1. APPLICABLE PUBLICATIONS. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1 American Society for Testing and Materials (ASTM) Publications.

- |          |   |
|----------|---|
| A 185-85 | Welded Steel Wire Fabric for Concrete Reinforcement   |
| C 33-86  | Concrete Aggregates                                   |
| C 150-85 | Portland Cement                                       |
| C 309-81 | Liquid Membrane-Forming Compounds For Curing Concrete |

1.2 U.S. Army Corps of Engineers Handbook for Concrete and Cement (CRD).

- |              |  |
|--------------|--|
| CRD-C 400-63 | Water for Use in Mixing or Curing Concrete |
|--------------|--|

1.3 American Concrete Institute (ACI) Standard.

- |                        |  |
|------------------------|--|
| ACI 304-73<br>(R 1978) | Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete |
|------------------------|--|

2. USAGE. Pnuematically placed concrete shall be placed where indicated.

3. DESCRIPTION. Pnuematically placed concrete shall be produced by either the dry mixed process in which most of the mixing water is added to the dry materials immediately prior to its expulsion from the nozzle, or the wet mix process in which all of the materials (including water) are premixed before entering the delivery hose.

4. MATERIALS.

4.1 Portland Cement shall conform to the requirements of ASTM C 150, Type II, low alkali. Cement shall meet requirements for false set.

4.2 Fine Aggregate shall conform to the requirements of ASTM C 33. Fine aggregate shall contain not less than 3 percent nor more than 6 percent moisture by weight. The proportions of fine aggregate and cement shall be corrected to allow for bulking due to sand moisture content.

4.3 Water for mixing and curing shall be clean, fresh and free from injurious amounts of mineral and organic substances as determined by CRD-C 400.

4.4 Reinforcement. Reinforcement shall be welded-steel-wire fabric conforming to ASTM A 185, size(s) as indicated.

4.5 Sample Panels. Five sample panels representative of the pneumatically placed concrete after curing shall be constructed and submitted to the Contracting Officer. The panels shall be not less than 2 feet long and one foot wide. Concrete shall be of the approved design mix.

## 5. PROPORTIONING AND MIXING.

5.1 Dry Mix Process. The dry mixture shall consist of one part Portland cement to not more than 4-1/2 parts of fine aggregate. Measurement may be either by volume or weight. The material shall be mixed dry in an approved power batch mixer equipped with accurate measuring and timing devices and capable of thoroughly mixing the fine aggregate and sand in sufficient quantity to maintain placing continuity. The mixing time shall be as recommended by the manufacturer of the mixer except that the mixing time shall be not less than one minute in drum-type mixers. Mixers shall be capable of discharging all mixed material without any carryover between batches. Materials that have been mixed for more than 45 minutes and have not been incorporated into the work shall not be used.

5.2 Wet Mix Process. The premixed concrete shall contain not less than 6-1/2 sacks of Portland cement per cubic yard of fine aggregate and water. A maximum of 30 percent pea gravel may be substituted for an equal amount of fine aggregate. The maximum size of pea gravel shall be such that 100 percent passes the 1/2 inch screen and at least 90 percent passes the 3/8 inch screen. Measurement may be either by volume or weight. The mixing equipment shall be capable of thoroughly mixing the materials in sufficient quantity to maintain continuous placing. The required mixing time shall depend on the mix being used and the efficiency of the mixer. Mixing shall conform to ACI 304. Non-agitating hauling equipment may be used subject to the approval of the Contracting Officer.

5.3 Strength. Pneumatically placed concrete shall have a minimum compressive strength of not less than 3,000 pounds per square inch at 28 days.

## 6. PREPARATION OF SURFACES.

6.1 Preparation of Foundation. Areas to receive pneumatically placed concrete shall be thoroughly compacted and trimmed to line and grade with sufficient moisture to provide a firm foundation and prevent absorption of water from the concrete. No free water shall be present on the surface. Ground or gaging wires shall be used where necessary to establish thicknesses, surface planes and finish lines.

6.2 Preparation of Existing Concrete Surfaces. Loose concrete shall be removed by making a saw cut at least 6 inches outside the spalled area and to such a depth as required. If steel reinforcement is exposed, the concrete shall be removed to such depth as required to provide a minimum distance of one inch between the bottom of the cavity and backside of the steel. If steel reinforcement is not exposed the concrete shall be removed so as not to damage the steel. Concrete removal shall have no offsets in the cavity that will cause abrupt changes in the thickness of the repair. Square shoulders shall not be left in the perimeter of the cavity and all edges shall be tapered. After removal of loose concrete, the cavity shall be thoroughly cleaned by sandblasting. Just prior to placing concrete all surfaces shall be cleaned with an air-water jet and left damp.

## 7. PLACING.

7.1 Workmen. Only experienced foremen, gunmen, nozzle men, and rodmen shall be employed and satisfactory written evidence of such experience shall be furnished the Contracting Officer or his representative upon demand.

7.2 Equipment. The Contractor shall provide delivery equipment of approved design which will apply the material by means of pneumatic pressure. Air shall be supplied in sufficient volume and under such pressure as may be necessary for the best operating conditions. Air pressure at the nozzle shall be steady and without pulsation. A constant pressure of not less than 45 pounds per square inch shall be maintained in the placing machine where the hose length is 100 feet or less and the pressure shall be increased at least 5 pounds for each additional 50 feet of hose or fraction thereof. Water used for hydration at the nozzle shall be maintained at a uniform pressure not less than 15 pounds per square inch greater than the air pressure at the machine.

7.3 Applying. The nozzle shall be held as nearly perpendicular as possible to the surface to which the mortar is applied, at such distance and narrow range of movement as will produce a spreading effect over a small area. The velocity of discharge from the nozzle, the distance of the nozzle from the face, and the amount of water used shall be regulated by the nozzle men in such a way as will produce a dense coating resulting in a minimum rebound of materials and no sloughing. Rebound material shall not be used again but shall be removed from the work. The maximum thickness of each layer will be limited to the thickness which can be placed without the material sagging. Time between application of layers shall be only sufficient to insure against sloughing. In case a portion of the previous layer has set to such hardness or has become coated in a manner preventing adequate bonding, the surface of that layer shall be cleaned by air and water jets before starting the next layer. Construction joints shall be avoided. Where necessary, at the end of the day's work or similar stopping periods, the concrete shall be tapered to a thin edge. Before applying the adjacent section, this tapered portion shall be thoroughly cleaned and wetted.

7.4 Clean-up. At the completion of each day's work, or as otherwise directed, all accumulations of pneumatically placed concrete on adjacent surfaces shall be removed.

8. FINISHING. After the concrete has been placed to the required thickness the surface shall be checked with a straightedge and any low spots or depressions shall be filled. Except as otherwise specified, surfaces shall be left in a natural finish as left by the nozzle.

8.1 Steel Trowel Finish. Surfaces to be exposed to flowing water shall receive a steel trowel finish. After the concrete has taken an initial set crumbling slightly when cut the surfaces shall be screeded with straightedges and wood-floated to a true even plane. After surface moisture has disappeared, the surfaces shall be finished to a smooth, even surface, with a steel trowel. The finished surface shall be free from blemishes and trowel marks.

8.2 Surface Requirements. Surfaces will be checked for compliance with the prescribed limits with a 5-foot template, consisting of a straightedge for plane surfaces and a shaped template for curved or warped surfaces. In measuring irregularities, the straightedge or template may be placed anywhere on the surface in any direction, with the testing edge held parallel to the intended surface. Allowable tolerance for surface irregularities is 1/4 inch. Surfaces with irregularities greater than 1/4 inch will be resurfaced after the surface has been prepared.

8.3 Edges at joints shall be finished with an edger having a radius of 1/8 inch.

## 9. CURING AND PROTECTION.

9.1 General. Concrete shall be cured for the period of time given below.

Type II Portland cement

14 days

The Contractor shall have all equipment needed for adequate curing and protection of the concrete on hand and ready to install before actual concrete placement begins. The curing medium and method, or the combination of mediums and methods used, shall be approved in writing. The curing medium shall be applied so as to prevent loss of moisture from the concrete. Concrete shall be protected from the damaging effects of rain for 12 hours, flowing water for 14 days and direct rays of sun for 3 days. All concrete shall be adequately protected from damage. No fire or excessive heat shall be permitted near or in direct contact with concrete at any time. Formed openings through the concrete shall be closed during the entire construction period.

9.2 Moist Curing. Concrete shall be moist-cured by maintaining all surfaces continuously (not periodically) wet for the duration of the entire curing period. Surfaces of concrete which are to be permanently exposed, shall be cleaned if water used which stains or discolors the surfaces, if staining occurs from rusting of the reinforcement, or if staining occurs from any other cause. All moist cured concrete shall be protected from the direct rays of the sun for the first 7 days of the curing period.

9.3 Membrane Curing. At the option of the Contractor, concrete in all structures or portions of structures may be cured with an approved pigmented curing compound of the surface membrane type in lieu of moist curing with water. The pigmented curing compound shall conform to ASTM C-309, Type 2. The curing-compound shall be applied to formed surfaces immediately after the forms are removed and prior to any patching or other surface treatment except the cleaning of loose sand, mortar, and debris from the surface. The surfaces shall be thoroughly moistened with water and the curing compound applied as soon as free water disappears. The curing compound shall be applied to unformed surfaces as soon as free water has disappeared. The curing compound shall be applied with an overlapping coverage that will give a two-coat application at a coverage of not more than 400 square

feet per gallon for each coat. The application of curing compound by hand-operated pressure sprayers will be permitted only on odd widths or shapes of slabs where indicated, and on concrete surfaces exposed by the removal of forms. When application is made by hand-operated sprayers, the second coat shall be applied in a direction approximately at right angles to the direction of the first coat. The compound shall form a uniform, continuous, cohesive film that will not check, crack, or peel, and that will be free from pinholes and other discontinuities. If pinholes, abrasions, or other discontinuities exist, an additional coat shall be applied to the affected areas within 30 minutes. Concrete surfaces which have been subjected to rainfall within 3 hours after curing compound has been applied shall be resprayed by the method and at the coverage herein specified. All concrete surfaces on which the curing compound has been applied shall be adequately protected for the duration of the entire curing period from pedestrian and vehicular traffic and from any other cause which will disrupt the continuity of the curing membrane.

9.4 Cold Weather. The air and forms in contact with concrete sections having a minimum dimension less than 12 inches shall be maintained at a temperature above 50 degrees F. for at least the first 3 days and at a temperature above 32 degrees F. for the remainder of the specified curing period. Concrete in more massive sections shall be maintained at a temperature above 40 degrees F. for at least 3 days and at a temperature above 32 degrees F. for the remainder of the specified curing period. The temperature protection equipment, the curing water and removal of forms shall be handled in such manner that the surface concrete will not be subjected to a temperature differential of more than 25 degrees F. as determined by observation of ambient and concrete temperatures indicated by suitable thermometers furnished by the Government as required and installed adjacent to the concrete surface and 2 inches inside the surface of the concrete. The installation of the thermometers shall be made by the Contractor at such locations as may be directed. Curing compounds shall not be used on concrete surfaces which are maintained at curing temperature by use of free steam.

9.5. Protective Wet Curing shall be accomplished by one of the following methods or combination thereof, as approved.

9.5.1 Burlap of Mats. The surface shall be covered with burlap or cotton mats, wetted before placing, and overlapped at least 6 inches. Burlap or mats shall be kept continually wet and in intimate contact with the surface for a period of 24 hours. Following the 24 hour moist curing period, burlap or mats shall be removed and clear membrane curing shall be applied to the concrete surface. During the change in curing medium, the concrete shall not remain exposed for more than one hour. Materials used in the moist curing shall be approved.

9.5.2 Fog Spray. The entire exposed surfaces of the concrete shall be kept continually wet for a period of 24 hours by means of approved fog spraying equipment. Following the 24 hour fog spraying curing period clear membrane curing shall be applied to the concrete surfaces. During the change in curing medium, the concrete shall not remain exposed for more than one hour.

9.5.3 Application of membrane curing compound shall conform to the requirements specified hereinbefore.

## 10. CONTRACTOR QUALITY CONTROL.

10.1 General. The Contractor shall perform the following inspections and tests, and based upon the results of these inspections and tests, he shall take such action and submit reports as hereinafter specified.

### 10.2 Inspection Details and Frequency of Testing.

10.2.1 Preparation for Placing. Foundation, forms and embedded items shall be inspected in sufficient time prior to each concrete placement by the Contractor in order to certify to the Contracting Officer it is ready to receive concrete. The results of each inspection shall be reported in writing.

10.2.2 Placing. The placing foreman shall supervise all placing operations and shall be responsible for measuring and recording ambient temperature, weather conditions, time of placement, yardage placed, and method of placement.

10.2.3 Compressive Strength. The Contractor shall provide for test purposes 2 test panels from each 8-hour shift. Each panel shall be not less than 12 inches square and 3 inches in thickness. Cubes, 3 x 3 x 3 inches in size shall be sawed from the panels for testing. One half of the cubes shall be tested at 7 days and one half at 28 days. Panels shall be cured, stored and tested by and at the expense of the Contractor. Cube strengths may be reported as determined or converted to cylinder strengths by multiplying by the factor 0.85. Test results shall be reported in writing.

### 10.2.4 Curing.

10.2.4.1 Moist Curing. At least once each shift an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded.

10.2.4.2 Curing Compound. No curing compound shall be applied until the Contractor's authorized representative has verified that the compound is properly mixed and ready for spraying. At the end of each operation he shall estimate the quality of compound used and the area of concrete surface covered and compute the rate of coverage in square feet per gallon. He shall note whether coverage is uniform.

10.2.5 Protection. At least once each shift an inspection shall be made of all areas subject to cold weather protection. Deficiencies shall be noted. During removal of protection, measurement of concrete and ambient temperature shall be made at least hourly.

### 10.3 Action Required.

10.3.1 The placing foreman shall not permit placing to continue when material is not uniform at the nozzle or the material is not being applied at proper velocity for good compaction. Immediate steps shall be taken to correct these conditions.

### 10.3.2 Curing.

10.3.2.1 Moist Curing. When a daily inspection report lists an area of inadequate curing, the required curing period for that area shall be extended by one day.

10.3.2.2 Curing Compound. When the coverage rate of curing compound is less than that specified or when the coverage is not uniform, the entire surface shall be sprayed again.

10.3.3 Compressive Strength. When laboratory-cured specimens fail to conform to the requirements for strength, the Contractor shall change the proportions or the water contents, or both, for the remaining portions of the work.

10.3.4 Protection. Whenever any concrete temperature during the period of protection or protection removal fails to comply with the specifications, that fact shall be reported to the Contracting Officer and immediate steps should be taken to correct the situation.

10.4 Reports. All results of tests conducted at the project site shall be reported weekly and shall be delivered to the Contracting Officer's Representative within 3 days after the end of each weekly report period. Each weekly report shall include the updating of control charts covering the entire period from the start of the construction season through the current week. During periods of cold weather protection, reports of pertinent temperatures shall be made daily. These requirements do not relieve the Contractor of the obligation to report certain failures immediately as required in preceding paragraphs. Such reports of failures and the action taken shall be confirmed in writing in the routine reports. The Contracting Officer has the right to examine all Contractor quality control records.

\* \* \* \* \*

## SECTION 4A

### STONE PROTECTION

#### Index

1. Applicable Publications
2. Materials
3. Foundation Preparation
4. Placement
5. Scales
6. Waybills and Delivery Tickets

1. **APPLICABLE PUBLICATIONS.** The American Society for Testing and Materials (ASTM) Standards listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

C 88-83	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
C 127-84	Specific Gravity and Absorption of Coarse Aggregate
C 295-85	Petrographic Examination of Aggregates for Concrete
C 535-81	Resistance to Abrasion of Large Size Coarse Aggregate by Use of the Los Angeles Machine
D 1141-75 (R 1980)	Substitute Ocean Water

#### 2. MATERIALS.

##### 2.1 Definitions.

a. **Cobblestone.** Stone which is obtained from alluvial deposits and is nearly spherical and well rounded, ranging from 4 to 12 inches in size.

b. **Quarry Stone.** Stone which is obtained from a rock quarry and is angular in shape.

c. **Stone.** Sound, durable, weather-resistant rock over 4 inches in diameter resulting from quarrying of rock or from alluvial deposits.

2.2 **Source and Material Approval.** No stone shall be placed without prior written acceptance of stone source by the Contracting Officer. The contractor shall make all arrangements, pay all royalties, and secure all permits for the procurement, furnishing and transporting of stone. The source(s) from which the Contractor proposes to obtain the material shall be selected and a sample submitted a minimum of 45 days in advance of the time when the material will be required in the work. Stone from a proposed source or sources will be tested by the Government for quality compliance. The Government will test one sample each from a maximum of 3 sources at its expense. If a stone sample fails the tests, or if the Contractor desires to utilize more than three sources, additional testing will be

accomplished by the Government for the sum of \$1600 for each additional sample tested. The costs of such additional tests will be deducted from payment due the Contractor. All test samples (500 pounds minimum) shall be representative of the stone source and shall be obtained by the Contractor under the supervision of the Contracting Officer and delivered at the Contractor's expense to the South Pacific Division Laboratory, U.S. Army Engineer Division, South Pacific, Sausalito, California. The Contractor shall vary the quarrying, processing, loading and placing operations to secure the type and quality of stone protection specified. If the stone being furnished by the Contractor does not fully meet all the requirements of these specifications, the Contractor shall furnish, at no additional cost to the Government, other stone meeting the requirements of these specifications. Approval of a source shall not be construed as a waiver of the right of the Government to require the Contractor to furnish stone which complies with these specifications. Materials produced from localized areas, zones or strata will be rejected when such stone does not comply with the specifications.

2.2.1 Potential Stone Sources. The Contractor may elect to obtain materials from the following potential cobblestone sources in the Phoenix metropolitan area, which have either undergone recent quality compliance testing for use on Corps of Engineers projects or have acceptable service records:

Arizona Crushers, Inc., POC: Damon DeFriates (602) 242-5143

Johnson-Stewart-Johnson, POC: Dan James (602) 834-1044

Kilauea Crushers, POC: Bill Nichols (602) 843-1888

Sunstate Rock and Materials, POC: Larry Walker (602) 848-8911

Union Rock and Materials Corp., POC: Chuck Peters (602) 276-4211

Stone may be furnished from the sources listed above, or at the option of the Contractor, may be furnished from other cobblestone sources designated by the Contractor and approved by the Contracting Officer, subject to the conditions stated herein. Listing of a stone source is not to be construed as approval of all materials from the source, nor as a waiver of inspection and testing of a designated source. Stone produced from listed potential source must meet all the requirements set forth in this section. Listing of a source is also not to be construed as an indication that an individual potential source can produce the total quantity of stone required for the project.

2.2.2 It is anticipated that significant amounts of acceptable stone will not be available from the required excavation. The required stone will need to be obtained from offsite commercial sources. It is also anticipated that acceptable stone from more than one source will need to be utilized to obtain the required quantity for the project. If sufficient amounts of stone conforming to these specifications are not available from a source or sources used in the work, the Contractor shall submit stone from another source for approval.

2.3 Quality Compliance. Test results and/or service records will be used by the Contracting Officer to determine the acceptability of the stone protection materials. In the event complete or current compliance test reports and/or service records are not available, the material shall be subjected to the tests outlined in these specifications to determine its acceptability for use in the

work. In the event stone is accepted based on service records, samples of the actual stone to be used for construction shall be taken and shall be subjected to the tests outlined in these specifications. Before a proposed source or sources of cobblestone will be considered for sampling and testing the Contractor must demonstrate that the gravel plant(s) has sufficiently stockpiled cobblestone and results of sufficient explorations must be made available to the Government to demonstrate that an adequate quantity of cobblestone is available to fulfill the contract requirements. Before a proposed source or sources of quarry stone will be considered for sampling and testing, one of the following conditions must be met:

a. The quarry or quarries must be sufficiently developed to demonstrate that an adequate quantity of stone is available to fulfill the contract requirements; or,

b. A sufficiently exposed face or faces must be present and results of sufficient explorations must be made available to the Government to demonstrate that an adequate quantity of quarry stone is available to fulfill the contract requirements.

2.3.1 Service records are considered to be acceptable if stone from a proposed source has remained sound with no significant deterioration after 10 or more years of exposure.

2.4 Quality Compliance Tests for Stone Protection. Stone shall meet the following test requirements.

Test	Test Method	Requirement
Specific Gravity (Bulk SSD)	ASTM C 127	2.50 minimum
Absorption	ASTM C 127	2.0% maximum
Wetting & Drying	SPD Test Procedure <sup>(1)</sup>	No fracturing <sup>(3)</sup>
Magnesium Sulfate	ASTM C 88 <sup>(2)</sup>	10% max. loss <sup>(4)</sup>
Abrasion Loss	ASTM C 535	50% max. loss

In addition to the above tests, the stone shall be subjected to a petrographic and X-ray diffraction analysis in accordance with ASTM C 295. The stone must not contain any swelling type clay (illite or montmorillonite).

NOTE: (1): Test procedure wetting-and-drying tests. The initial step of the test is the careful examination of the entire sample and the selection of representative test specimens. The piece should be large enough to produce two cut slabs, one inch thick ( $\pm 1/4$  inch) with a minimum surface area of 30 square inches on one side. Two chunks approximately three by four inches are also chosen. The slabs and chunks are carefully examined under a low-power microscope and all visible surface features are noted and recorded. The specimens are then oven dried at 140 degrees F., for eight hours, cooled and weighed to the nearest tenth of a gram. The test specimens are photographed to show all surface features before the test. The chunks and slabs are then subjected to fifteen cycles of wetting and drying. One slab and one chunk are soaked in fresh tap water, the other slab and chunk are soaked in salt water prepared in accordance with ASTM D 1141. Each cycle consists of soaking for sixteen hours at room temperature and then drying in an oven for eight hours at 140 degrees F. After each cycle the specimens are examined with the low-power microscope to check for opening or

movement of fractures, flaking along edges, swelling of clays, softening of rock surfaces, heaving of micaceous minerals, breakdown of matrix material and any other evidence of weakness developing in the rock. The cycle in which any of these action occurs is recorded. After fifteen cycles, the slabs and chunks are again carefully examined and all changes in the rocks are noted and recorded. The test specimens together with all flakes or particles which come off during the test are oven dried, weighed and photographed.

NOTE: (2): The test shall be made on 50 particles each weighing 100 grams,  $\pm 25$  grams, in lieu of the gradation given in C 88.

NOTE: (3): Weakening and loss of individual surface particles is permissible unless bond of the surface grains softens and causes general disintegration of the surface material.

NOTE: (4): Sandstones which have a loss greater than the specified limit will be accepted if the Contractor demonstrates that the rock has a satisfactory service record.

2.4.1 Stone to be used in the work shall be of the same lithology as the stone sampled for testing and for which service records are provided as a basis for approval. All stone shall be sound, durable, hard, and free from laminations, weak cleavages or undesirable weathering. Stone shall be of such character that it will not disintegrate from the action of air, water, or the conditions of handling and placing. All stone shall be clean and free from earth, clay, refuse, and adherent coatings.

2.5 Gradation Sampling and Testing for Stone Protection performed by an approved testing laboratory on samples selected by the Contracting Officer. The Government reserves the right to perform check tests and to use the Contractor's sampling and testing facilities to make the tests. Each sample shall consist of not less than five tons of materials and shall be selected at random from the production run. One gradation test is required at the beginning of production prior to delivery of stone to the project and a minimum of one additional test for each 10,000 tons of material placed. All sampling and gradation tests performed by the Contractor shall be under the supervision of the Contracting Officer.

## 2.6 Gradation.

2.6.1 General. All points on individual grading curves shall be between the boundary limits as defined by smooth curves drawn through specified grading limits plotted on a mechanical analysis diagram. The individual grading curves shall not exhibit abrupt changes in slope denoting skip grading or scalping of certain sizes. Specified grading of all material shall be met both at the source and as delivered to the project. In addition, material not meeting the required grading due to segregation or degradation during placement shall be rejected. If test results show that stone does not meet the required grading, the hauling operation will be stopped immediately and will not resume until processing procedures are adjusted and a gradation test is completed showing gradation requirements are met. All gradation tests shall be at the expense of the Contractor.

2.6.2 Stone may be obtained from any source approved by the Contracting Officer and shall be reasonably well graded between 4 and 12 inches with not less than 25 nor more than 50 percent passing a 6-inch sieve.

2.6.3 Stone to be grouted may vary from the above gradation by the following allowance. For grouted stone thicknesses of 15 inches, ten (10) percent of the stone may be larger than 12 inches to a maximum size of 18 inches.

3. FOUNDATION PREPARATION. Areas on which filter material or stone is to be placed shall be trimmed and dressed to conform to cross sections indicated or directed, within an allowable tolerance of plus or minus one-half inch from the theoretical slope lines and grades. Where such areas are below the allowable minus tolerance limit they shall be brought to grade by filling with earth similar to the adjacent material and well compacted, or by filling with approved material, and no additional payment will be made for any material thus required. Immediately prior to placing the filter material or stone, the prepared base shall be inspected by the Contracting Officer and no material shall be placed thereon until that area has been approved.

4. PLACEMENT. Stone shall be placed to produce a surface in which the tops of the individual stones do not vary more than plus 2 inches from true grade. Stones larger than the 15-inch layer thickness will be allowed to project more than 2 inches above finish grade for the 15-inch stone layer. The stones larger than 15 inches must be placed such that they rest on the foundation. Double decking of thin flat stones to bring the surface up to the required grade will not be permitted.

5. SCALES shall be standard truck scales of the beam type. The scales shall be of sufficient size and capacity to accommodate all trucks used in hauling the material. Scales shall be tested, approved, and sealed by an inspector of the State Inspection Bureau charged with scales inspection within the state in which the project is located. Scales shall be calibrated and resealed as often as necessary to insure continuous accuracy.

6. WAYBILLS AND DELIVERY TICKETS. Copies of waybills or delivery tickets shall be submitted to the Contracting Officer within 24 hours of delivery of stone. Before the final statement is allowed, the Contractor shall file with the Contracting Officer certified waybills and/or certified delivery tickets for all stone actually used in the construction covered by the contract.

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SECTION 4B

GROUTING STONE PROTECTION

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- |                            |                          |
|----------------------------|--------------------------|
| 1. Applicable Publications | 4. Placing               |
| 2. Materials               | 5. Curing and Protection |
| 3. Mixing                  |                          |

1. APPLICABLE PUBLICATIONS. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1 American Society for Testing and Materials (ASTM) Standards.

- |          |                     |
|----------|---------------------|
| C 33-85  | Concrete Aggregates |
| C 150-85 | Portland Cement     |

1.2 U.S. Department of the Army, Corps of Engineers, Handbook for Concrete and Cement.

- |              |  |
|--------------|--|
| CRD-C 300-77 | Membrane-Forming Compounds for Curing Concrete |
|--------------|--|

2. MATERIALS.

2.1 Aggregate. Aggregate shall conform to the requirements of the SECTION: CONCRETE.

2.2 Portland Cement shall conform to the requirements of ASTM C 150, Type II. The alkali content of the cement shall not exceed 0.6 percent.

2.3 Water shall be fresh, clean, and potable.

3. MIXING. Grout shall be composed of cement, sand, and water mixed in the proportions as directed. The estimated cement content requirement per cubic yard of grout shall be 7-1/2 sacks. The water content of the mix shall not exceed 8-1/2 gallons per sack of cement. In calculating total water content of the mix, the amount of moisture carried on the surfaces of aggregate particles shall be included. Slump of grout mix shall be between 9 and 10 inches for the first course and between 7 and 8 inches for the second course. The grout shall be mixed in a concrete mixer in the manner specified for concrete, except that time of mixing shall be as long as is required to produce a satisfactory mixture, and the grout shall be used in the work within a period of 30 minutes after mixing. Retempering of grout will not be permitted. The consistency of the grout shall be such as to permit gravity flow into the interstices of the stones with the help of spading, rodding, and brooming. Grout batches in the same course shall be uniform in mix, size, and consistency.

#### 4. PLACING.

4.1 Prior to grouting, the stone shall be thoroughly washed with water to wash down the fines and to prevent absorption of water from the grout. The stone shall be kept wet just ahead of the actual placing of grout.

4.2 The grout shall be placed in two courses in side slopes. Each course shall be placed full width or in successive lateral strips approximately 10 feet in width, as applicable, extending from toe of slope to top of side slopes. The grout shall be brought to the place of final deposit pneumatically by approved means and discharged directly on the stone. A splash plate of metal or wood shall be used where necessary to prevent displacement of stone directly under discharge. The flow of grout shall be directed with brooms or other approved baffles to cover the entire area and to assure that all crevices are filled. Sufficient barring shall be done to loosen tight pockets of stone and otherwise aid the penetration of grout. The first course shall fully penetrate the stone blanket. The second course shall be placed as soon as the first course has sufficiently stiffened so that it will not flow when additional grout is added. On side slopes, all brooming shall be uphill. The grouted stone shall be formed to provide a 6-inch minimum vertical surface adjacent to the service road.

4.3 Placement and brooming of the grouted surface shall be such that the outer layer of rock projects  $1/3$  to  $1/4$  their diameter above the grouted surface. After the top course has stiffened the entire surface shall be rebroomed to eliminate runs in the top course and to fill voids caused by sloughing of the layers of grout.

4.4 The exposed surfaces of the stone shall be cleaned by air-water blasting or other approved method.

4.4.1 The air-water blasting shall be capable of producing a minimum pressure of 100 psi and shall be of such nature as to adequately perform the work required.

4.4.2 The grout will be allowed to set for a minimum of one hour, or other length of time as directed by the Contracting Officer before air-water blasting is commenced. The air-water blasting shall be at right angles to the surface of the grout.

4.5 After completion of any strip or panel, no workmen or other load shall be permitted on the grouted surface for a period of 24 hours. The grouted surface shall be protected from injurious action of the sun; shall be protected from rain, flowing water, and mechanical injury; and shall be moist cured or membrane cured at the Contractor's option.

#### 5. CURING AND PROTECTION.

5.1 Moist curing shall consist of covering the grout with a uniform thickness of 2 inches of sand which shall be kept continuously saturated for a period of 14 days.

5.2 Curing compounds shall be applied as soon as the free water disappears and shall be applied in a 2-coat continuous operation by approved power-spraying equipment at a rate of not to exceed 200 square feet per gallon for the combined coats. The second coat shall be applied to overlap the first coat in a direction approximately at right angles to the direction of the first application.

5.2.1 Membrane curing compound shall be resin-base dissipating membrane-type conforming to CRD-C 300.

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SECTION 4C

REINFORCED MASONRY

Index

- |                                    |                                      |
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| 5. Delivery, Storage, and Handling | 11. Protection                       |
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1. APPLICABLE PUBLICATIONS. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1 U. S. Army Corps of Engineers Publication.

CRD-C 619-81	Grout Fluidifier
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1.2 American Concrete Institute (ACI) Standard.

SP-66	ACI Detailing Manual - 1980
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1.3 American Society for Testing and Materials (ASTM) Publications.

A 82-85	Steel Wire, Plain, for Concrete Reinforcement
A 116-81	Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric
A 615-85	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
C 5-79 (R 1984)	Quicklime for Structural Purposes
C 33-86	Concrete Aggregates
C 39-86	Compressive Strength of Cylindrical Concrete Specimens
C 90-85	Hollow Load-Bearing Concrete Masonry Units
C 91-83a	Masonry Cement
C 94-86a	Ready-Mixed Concrete
C 140-75 (R 1980)	Sampling and Testing Concrete Masonry Units

C 144-84	Aggregate for Masonry Mortar
C 150-85a	Portland Cement
C 207-79 (R 1984)	Hydrated Lime for Masonry Purposes
C 270-86	Mortar for Unit Masonry
C 331-81	Lightweight Aggregates for Concrete Masonry Units
C 404-85	Aggregates for Masonry Grout
C 426-70 (R 1982)	Drying Shrinkage of Concrete Block

2. QUALIFICATIONS OF TESTING AGENCY. The Contractor shall retain at his expense a testing laboratory to perform the laboratory and field testing and sampling specified herein. The laboratory shall have all facilities required to perform the specified sampling and testing. Personnel employed in the testing shall have had previous experience in sampling and testing the materials involved. Information regarding testing laboratories and qualifications of testing personnel shall be submitted to the Contracting Officer for approval.

### 3. DEFINITIONS.

3.1 Concealed masonry surfaces are defined surfaces of foundation walls against which backfill is placed.

3.2 Exposed masonry surfaces are defined as all other masonry surfaces.

3.3 Grout Lift and Grout Pour. A grout lift is defined as the layer of grout placed in a single continuous operation. A grout pour is defined as the entire height of grout fill placed in 1 day and is composed of a number of successively placed grout lifts.

### 4. SUBMITTALS.

4.1 Samples. The following samples shall be submitted for approval before work is started.

a. Anchors and Ties - Two of each type proposed for use.

b. Concrete Masonry Units - Shapes, sizes, and kinds in sufficient numbers to show full range of color and texture.

c. Aggregates - One sample shall be taken at the source from each stockpile for each type aggregate specified herein. Each sample shall be collected by taking three incremental samples at random from the source material to make a composite sample of not less than 10 pounds.

4.2 Certificates of Conformance or Compliance. Before delivery of the following materials, notarized certificates attesting that materials meet the requirements specified shall be submitted in accordance with the SPECIAL PROVISIONS.

- a. Concrete Masonry Units
- b. Lime
- c. Reinforcing Bars

4.3 Certified Laboratory Test Reports. In addition to the submittal of certificates specified herein, certified copies of the reports of all tests listed below and required in referenced publications for the following materials shall be submitted. The testing shall have been performed by an approved independent laboratory acceptable to the Contracting Officer within 6 months of submittal of reports for approval. Test reports on a previously tested material shall be accompanied by notarized certificates from the manufacturer certifying that the previously tested material is of the same type, quality, manufacturer, and make as that proposed for this project.

- a. Concrete Masonry Units - linear drying shrinkage, compressive strength and absorption of each type of unit and popout and staining properties of lightweight aggregates used in the units.

- b. Cement - Certified mill test reports of each mill lot.

5. DELIVERY, STORAGE, AND HANDLING. Handle, store, and protect masonry units in a manner to avoid chipping, breakage, or contact with the soil or contaminating materials and exposure to the elements. Concrete masonry units delivered to the job site shall have a moisture content specified in ASTM C 90. Keep anchors, ties, and joint reinforcement free of rust. Steel reinforcing bars shall be free of loose scale and rust. Deliver cement and lime in unbroken bags, barrels, or other approved containers, plainly marked and labeled with the manufacturers' names and brands. Store cementitious materials in dry, weathertight sheds or enclosures or under watertight tarpaulins. Store and handle cement in a manner which will prevent the inclusion of foreign materials and damage by water or dampness.

6. ENVIRONMENTAL CONDITIONS.

6.1 Hot Weather Installation. Masonry erected when the ambient air temperature is more than 99 degrees F. in the shade and the relative humidity is less than 50 percent shall be protected from direct exposure to wind and sun for 48 hours after installation.

6.2 Cold Weather Installation. Materials to be used and built upon shall be free from ice and snow, and shall not be in a frozen condition. Do not lay masonry during temperatures below minus 10 degrees F. unless authorized in writing. Before erecting masonry during temperatures below 40 degrees F., submit for approval a written statement giving the methods proposed to heat the masonry materials and to protect the masonry from freezing. Keep masonry units completely covered and free from frost, ice, and snow at all times and maintain them at a

minimum temperature of 20 degrees F. when laid. Maintain temperature of mortar and grout between 40 degrees F. and 120 degrees F. by heating mixing water and/or sand. Temperature of mixing water or of water and sand introduced to cement shall not exceed 160 degrees F.

## 7. MATERIALS.

7.1 General. The source of materials which will affect the appearance of the finished work shall not be changed after the work has started. Wiregages specified herein are American Steel Wire Gages. Materials shall conform to the respective specifications and other requirements specified below.

7.2 Admixtures. The high-lift grout admixture shall conform to CRD-C 619 and in addition shall produce an expansive action in the plastic grout sufficient to offset initial water loss shrinkage and promote bonding of the grout to all interior faces of the masonry units. Other admixtures may be used in mortar or grout provided that the admixture does not affect bond or compressive strength of mortar or grout designed without the use of the admixture. Anti-freeze compounds shall not be used. The admixtures shall not contain calcium chloride salts or any other chemical that will adversely affect metals or the coatings of metals embedded in the mortar or grout.

7.3 Aggregate for Mortar. ASTM C 144, except that not less than 3 percent nor more than 15 percent shall pass the No. 100 sieve. Aggregate used in mortar for joints 1/4-inch or less shall have 100 percent passing the No. 8 sieve with 10 percent being retained on the No. 16 sieve.

### 7.4 Aggregate for Grout.

7.4.1 Fine Aggregate. ASTM C 404 or C 144.

7.4.2 Pea Gravel. Clean or washed gravel conforming to ASTM C 404, except that 100 percent shall pass the 3/8-inch screen and not more than 5 percent shall pass the No. 8 sieve.

7.4.3 Coarse Aggregate. ASTM C 404, size No. 8 or ASTM C 33, 3/4-inch maximum size as indicated in Grading Table for coarse aggregates.

7.4.4 Lightweight Aggregate. ASTM C 331 except gradation shall conform to ASTM C 33 or C 404 as indicated in Grading Table.

### 7.5 Centering Devices.

7.5.1 Wire Devices. Factory fabricated from steel wire conforming to ASTM A 82. Wire devices in walls shall be formed from wire that has been zinc coated in accordance with ASTM A 116, Class 3.

7.5.1.2 Centering clips shall be formed from not lighter than 9 gage wire. Clips shall be of a design that will prevent displacement of the reinforcing bars during the course of construction.

## 7.6 Cement.

7.6.1 Portland Cement. ASTM C 150, Type II or III, including the requirements for low alkali content.

## 7.7 Concrete Masonry Units.

7.7.1 Aggregates. ASTM C 33 or C 331 except as follows.

7.7.1.1 Grading of aggregates as stipulated in ASTM C 33 and testing of lightweight aggregates for drying shrinkage as stipulated in ASTM C 331 will not be required.

7.7.1.2 Lightweight aggregates and blends of lightweight and heavier aggregates in proportions used in producing the units shall comply with the following requirements when tested for stain-producing iron compounds in accordance with ASTM C 641. by visual classification method, the iron stain deposited on the filter paper shall not exceed the "light stain" classification; by chemical analysis method and reported as ferric oxide, the iron stain deposited on the filter paper from 200-gram sample shall not exceed 1.2 milligrams of ferric oxide.

7.7.2 The linear drying shrinkage of concrete masonry units shall not exceed 0.065 percent when tested in accordance with ASTM C 426. Maximum moisture content percentage of the total absorption will be in accordance with ASTM C 90.

7.7.3 Hollow Concrete Masonry Units. ASTM C 90, Type I, grade N-I having an oven-dry weight of 125 to 105 pcf, and maximum moisture absorption of 15 pcf.

7.8 Lime Paste. Lime paste shall be made with pulverized quicklime or hydrated lime. Hydrated lime processed by the steam method shall be allowed to soak not less than 24 hours. Quicklime and other hydrated lime shall be allowed to soak not less than 72 hours. In lieu of hydrated-lime paste for use in mortar, the hydrated lime may be added in the dry form.

7.8.1 Hydrated Lime. ASTM C 207, Type S.

7.8.2 Pulverized Quicklime. ASTM C 5, except 100 percent shall pass the No. 20 sieve and 90 percent shall pass the No. 50 sieve.

7.9 Reinforcing Bars. ASTM A 615, Grade 40

7.10 Water. Water used in mortar and grout shall be taken from a supply distributed for domestic purposes and at the time of mixing shall be clean and free of acids, alkalies, or other organic materials.

## 8. MORTAR MIXES.

8.1 Proportions. Mortar shall be Type S in accordance with the proportion specifications of ASTM C 270 as modified below. Materials shall be portland cement, hydrated lime or lime paste, aggregate, and water as specified herein. The mortar shall have a flow, after suction, of 70 percent or more when tested for water retention in accordance with ASTM C 91, except mortar shall be mixed to an initial flow of 125 to 135 percent.

## 9. GROUT MIXTURES.

9.1 Proportions. Grouts shall be mixed in laboratory established proportions to attain a compressive strength at 28 days of not less than 2000 psi when tested in accordance with ASTM C 91 for fine aggregate and ASTM C 39 for grout containing coarse aggregate. Grout shall be used subject to the limitations of Table I.

9.1.1 Fine Grout. Fine grout shall consist of portland cement, lime paste or hydrated lime, and fine aggregate mixed with sufficient water to obtain a pouring consistency without segregation of the constituents. Slump shall be between 9 and 11 inches.

9.1.2 Low-Lift Grout. Low-lift grout shall consist of portland cement, lime paste or hydrated lime, fine aggregate and lightweight coarse aggregate mixed with sufficient water to obtain a pouring consistency without segregation of the constituents. Slump shall be between 9 and 11 inches. Maximum size of coarse aggregate for grout shall be in accordance with Table I.

9.1.3 High-Lift Grout. High-lift grout shall consist of portland cement, grout admixture, fine aggregate, and pea gravel or lightweight coarse aggregate mixed with sufficient water to obtain a consistency suitable for pumping without segregation of the constituents. Slump shall be between 9 and 11 inches. The maximum size of coarse aggregate shall be in accordance with Table III.

9.2 Mixing. Batching and mixing of high-lift grout, including equipment used therein, shall conform to the applicable requirements of ASTM C 94.

10. PREPARATION OF CONCRETE SURFACES. Clean laitance, dust, dirt, oil, organic matter or other foreign materials from concrete surface upon which reinforced masonry is to be placed. Use sand blasting, if necessary, to remove laitance from pores and to expose the aggregate.

11. PROTECTION. Top of walls shall be covered with nonstaining waterproof covering or membrane when work is not in process. Covering shall extend a minimum of 2 feet down on each side of the wall and be held securely in place. Before starting or resuming, top surface of masonry in place shall be cleaned of loose mortar and foreign material.

## 12. INSTALLATION.

12.1 Laying Masonry Units. Adjust each unit to its final position while mortar is still soft and plastic. Remove and relay in fresh mortar, any unit that is disturbed after mortar has stiffened. Keep, raked-out joints, and spaces to be grouted free from mortar and other debris. Units used in exposed masonry surfaces shall be free from chipped edges or other imperfections detracting from the appearance of the finished work.

12.1.1 Tolerances. Lay masonry plumb, true to line, with courses level. Bond pattern shall be kept plumb throughout. Lay masonry within the following tolerances.

12.1.1.1 Variation from the plumb in the lines and surfaces of columns, walls and arrises.

- a. In adjacent masonry units - 1/8-inch.
- b. In 10 feet - 1/4-inch.

12.1.1.2 Variations from the plumb for external corners, expansion joints, and other conspicuous lines.

- a. In 20 feet - 1/4-inch.

12.1.1.3 Variations from the level or grades indicated on the drawings for horizontal grooves, and other conspicuous lines.

- a. In 20 feet - 1/4-inch.
- b. In 40 feet or more - 1/2-inch.

12.1.2 Cutting and Fitting. Wherever possible, use full units of the proper size in lieu of cut units. Cutting and fitting, including that required to accommodate the work of others, shall be done by masonry mechanics using power masonry saws. Concrete masonry units shall be wet cut. Wet cut units, before being placed in the work, shall be dried to the same surface-dry appearance as uncut units being laid in the wall. Cut edges shall be clean, true and sharp.

12.1.3 Unfinished Work. Step back unfinished work for joining with new work. Tothing may be resorted to only when specifically approved. Remove loose mortar and thoroughly clean the exposed joints before laying new work.

12.1.4 Wetting Masonry Units. Do not wet concrete masonry units. Do not lay units having a film of water or frost on the surface.

12.1.5 Jointing. Tool joints when the mortar is thumbprint hard. Tool horizontal joints first. Brush joints to remove all loose and excess mortar. Mortar joints shall be finished as follows.

12.1.5.1 Tooled Joints. Joints shall be tooled slightly concave. Tool joints with a jointer slightly larger than the joint width so that complete contact is made along the edges of the unit. Perform tooling so that the mortar is compressed and the joint surface is sealed. Use a jointer of sufficient length to obtain a straight and true mortar joint.

12.1.5.2 Raked Joints. Rake control joints to a depth of 1/2-inch.

12.1.6 Joint Widths. Joint widths shall be approximately as follows.

12.1.6.1 Concrete Masonry Units. 3/8-inch wide.

12.2 Reinforced Hollow Unit Masonry. Reinforced hollow unit masonry shall consist of hollow concrete masonry units reinforced vertically and horizontally with steel bars located within cells or kerfs in the units and with all cells filled solidly with grout. Lay hollow masonry units so as to preserve the vertical continuity of cells filled with grout. The minimum clear horizontal dimensions of vertical cores shall be 2 inches by 3 inches.

12.2.1 Cleanouts. Provide cleanout holes at the bottom of every pour in core containing vertical reinforcement when the height of the grout pour exceeds 48 inches. Where all cells are to be grouted, construct cleanout courses with open-bottom bond beam units inverted to permit cleaning of all cells by flushing. Establish a new series of cleanouts if grouting operations are stopped for more than 4 hours. Cleanouts shall be not less than 3- by 4-inch openings cut from one face shell. Manufacturers' standard cut-out units may be used at the Contractor's option. Do not plug cleanout holes until masonry work, reinforcement, and final cleaning of the grout spaces have been completed.

12.2.2 Bond Pattern. Lay hollow masonry units in running bond.

12.2.3 Mortar Joints. Fill bed joints with mortar for the full thickness of the face shell. Where all cells are to be grouted, spread cross webs with mortar at grout barriers only. Provide grout barriers not more than 25 feet apart as required to limit the horizontal flow of grout for each grout pour. Butter head joints for the full thickness of the face shell and shove the units into place. Avoid fins of mortar that protrude into cells to be grouted.

12.2.4 Bond Beams. Bond beams lintels shall consist of bond beam units, reinforced as indicated and filled with grout. Use open bottom type bond beam units over cells to be filled. All bond beams shall be discontinuous at control joints.

12.2.5 Control Joints. Provide control joints in reinforced hollow concrete masonry walls at every 40 feet. Construct control joints in accordance with the details, using special control joint units.

12.3 Placing Reinforcing Steel. Prior to placing grout, clean all reinforcement of loose, flaky rust, scale, grease, mortar, grout, or other coating which might destroy or reduce its bond with the grout. Unless otherwise indicated, the details of reinforcement shall conform to ACI SP-66. Do not bend or straighten reinforcing in a manner injurious to the steel. Do not use bars with kinks or bends not shown on the drawings. Placement of reinforcement shall be inspected and approved prior to placing grout. Vertical bars shall be spliced only where indicated.

12.3.1 Positioning Bars. Position vertical bars accurately at the lateral position indicated. Maintain a minimum clearance between the bars and masonry units of 1/2-inch and between parallel bars of one diameter of the reinforcement. Hold vertical reinforcing in place using metal supports, centering clips, spacers, ties, or caging-devices located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement.

12.3.2 Splices. Locate splices only where shown on the drawings. Stagger splices in adjacent bars. Lap bars a minimum of 40 diameters of the reinforcement or 2 feet whichever is greater.

12.4 Placing Grout. Place grout using a hand bucket, concrete hopper, or grout pump. Place grout so as to completely fill the grout spaces without segregation of the aggregates. Where grouting is discontinued for more than 1 hour, stop the grout 1-1/2 inches below the top of a course to form a key at pour joints. The height of grout pours and type of grout used shall be limited by the dimensions of grout spaces as indicated in Table I.

#### 12.4.1 Grouting Equipment.

12.4.1.1 Grout Pumps. Pumping through aluminum tubes will not be permitted. Operate pumps to produce a continuous stream of grout without air pockets. Upon completion of each day's pumping, eject grout from pipeline without contamination or segregation of the grout. Remove waste materials and debris from the equipment. Dispose of waste materials, debris, and all flushing water outside the masonry.

12.4.1.2 Vibrators. Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout. Maintain at least one spare vibrator, or sufficient parts for repairing vibrators, at the site at all times. Apply vibrators at uniformly spaced points not further apart than the visible effectiveness of the machine. Limit duration of vibration to time necessary to produce satisfactory consolidation without causing segregation.

12.4.2 Low-Lift Method. Place grout as masonry is erected at a rate that will not cause displacement of the masonry due to hydrostatic pressure of the grout. If mortar has been allowed to set prior to grouting, remove all fins protruding more than 1/2-inch into the grout space. Place grout in final position within 2-1/2 hours after mixing when air temperature is 80 degrees F. or higher and 3-1/2 hours after mixing when the air temperature is less than 80 degrees F. Rod or puddle grout during placement using a 1 inch by 2 inch wood stick or a mechanical vibrator to insure complete filling of the grout space. Do not insert the vibrators into lower pours that are in a semi-solidified state.

12.4.3 High-Lift Method. Lay masonry to the top of a pour before placing grout. Do not pour grout in hollow unit masonry until mortar joints have set for at least 24 hours. Clean mortar droppings from the bottom of the grout space and from reinforcing steel. Remove mortar fins protruding more than 1/2-inch into the grout space by dislodging the projections with a rod or stick as the work progresses or by washing the grout space at least twice a day during erection using a high pressure stream of water. Place grout in final position within 1-1/2 hours after mixing when air temperature is 80 degrees F. or higher and 2-1/2 hours after mixing when the air temperature is less than 80 degrees F. Place grout in lifts not to exceed 4 feet in height, with a waiting period between lifts, dependent on weather and absorption rate of the masonry, in order to place the succeeding lift after the preceding lift becomes plastic but prior to initial set. The first lift shall be consolidated using mechanical vibrators. After the required waiting period, place the second lift and consolidate with the vibrator extending 12 to 18 inches into the previous lift. Do not insert vibrators into lower pours that are in a semi-solidified state. Repeat the waiting, pouring, and consolidating process until the top of the grout pour is reached. Reconsolidate the top pour after the required waiting period. The high-lift grouting of any section of wall between lateral flow barriers shall be completed to the top of a pour in 1 working day unless a new series of cleanout holes is established and the resulting horizontal construction joint cleaned.

12.4.4 Blowouts. Brace walls against wind and other forces during construction. Allow sufficient time between lifts to preclude displacement of solid masonry units or cracking of face shells of hollow masonry units. If blowouts, misalignment, or cracking of face-shells should occur during construction, tear down and re-build the wall at no additional cost to the Government.

12.5 Pointing and Cleaning. After mortar joints have attained their initial set but prior to hardening, completely remove mortar and grout daubs or splashings from exposed masonry surfaces. Before completion of the work, rake out all defects in joints in exposed masonry surfaces, fill with mortar and tool to match existing joints. Immediately after grout work is completed remove scum and stains which have percolated through the masonry using a high pressure stream of water. Do not use metal tools or metal brushes for cleaning.

12.5.1 Concrete Masonry Units. Dry brush exposed concrete masonry unit surfaces at the end of work each day and after any required pointing. Use stiff-fiber bristled brushes only.

## 12.6 Field Tests.

12.6.1 Moisture Content. Sampling and testing of concrete masonry units for moisture content will be performed by a Contractor. Upon delivery of units to the project site and periodically thereafter, samples shall be selected at random from stockpiles and tested in accordance with ASTM C 140. If the moisture content requirements in ASTM C 90 are not met additional protection for stockpiles will be provided immediately. If the moisture content is over 5 percent the maximum, the units will be rejected for use until they are made to conform to the moisture content requirements.

12.6.2 Mortar and Grout. Mortar and grout shall be laboratory-proportioned and tested by a qualified testing laboratory. Certified copies of laboratory-established proportions shall be submitted with the required test reports and test data. Laboratory-established proportions shall not be changed and materials with different physical or chemical characteristics shall not be used in mortar for the work unless additional evidence is furnished that the mortar meets the specified requirements.

12.6.3 Mortar and Grout Admixtures. When it is proposed to use a mortar admixture, test reports indicating the advantages to result shall be submitted. Testing shall be performed by the laboratory that designed the mortar mix. Six test specimens shall be made from mortar without admixture, as control specimens, and six test specimens shall be made from the mortar containing admixture. The mortar used in this testing shall be identical except for the admixture and shall be designed and mixed from identically graded aggregates and from the same brand and type of cement, in strict conformance to the properties specified hereinbefore for mortar. The mortar with and without the admixture shall have the same aggregate ratio, water retention, and compressive strength as stipulated. Admixture shall be used in conformance with manufacturer's recommendations. Each of the mortars shall be tested for bond strength in conformance with ASTM C 952, and shall be tested for water retention and compressive strength in conformance with ASTM C 270.

12.6.4 Field Tests for Strength of Grout. The strengths specified for grout shall be verified during the progress of the work by testing samples taken at the jobsite as follows. The testing will be limited to a set of specimens for the approved laboratory mixed and tested grout. Any changes to the mix or materials will require the following testing of samples. All sampling shall be performed by the Contractor.

12.6.4.1 Grout. Take at least three specimens each day of grout placed that day. On a flat non-absorbent base, form a space approximately 3 inches by 3 inches by 6 inches using masonry units having the same moisture condition as those being laid. Line the space with a permeable paper or porous separator so that water may pass through the liner into the masonry units. Thoroughly mix or agitate grout to obtain a fully representative mix and place into molds in two layers. Puddle each layer with a 1-inch by 2-inch puddling stick to eliminate air bubbles. Level off and immediately cover molds and keep them damp until taken to the laboratory. After 48 hours, remove molds and place specimens in a fog room until tested in the damp condition. Samples shall be tested in accordance with the applicable portions of ASTM C 39 and shall exhibit a minimum ultimate compressive strength of 2000 psi.

Table I. Pour Height and Type Of Grout for Various Grout Space Dimensions.

<u>Minimum Horizontal Dimensions of Core (inches)</u>	<u>Grout Type (See paragraph Grout)</u>	<u>Coarse Aggregate</u>	<u>Maximum Height of Grout Pour (inches)</u>
2 by 3	Fine	None	8
2 by 4	Fine	None	16
2-1/2 by 4	Fine or low lift	ASTM C 404, Size 8	48
3 by 4	High lift	3/8-inch pea gravel	72 (1)
3-1/2 by 4	High lift	3/8-inch pea gravel	180 (1)
5 by 6	High lift Max.	ASTM C 33, 3/4-inch	180 (1)

(1) Where only cells of hollow masonry units containing reinforcement are grouted, the maximum height of the pour shall not exceed the distance between bond beams.

\* \* \* \* \*

SECTION 5A

FLAPGATES AND MISCELLANEOUS METALS

Index

- |                            |                                |
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| 1. Applicable Publications | 5. Flapgates                   |
| 2. Materials               | 6. Painting New Flapgates      |
| 3. Finishes                | 7. Safety Rails and Pipe Gates |
| 4. Anchorage               |                                |

1. APPLICABLE PUBLICATIONS. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1 Federal Specification (Fed. Specs.).

- |                         |   |
|-------------------------|---|
| FF-B-575C               | Bolts, Hexagon and Square   |
| FF-N-836D<br>& Am-1     | Nut: Square, Hexagon, Cap, Slotted,<br>Castle, Knurled, Welding and Single<br>Ball Seat                                       |
| QQ-B-750<br>& Am-2      | Bronze, Phosphor; Bar, Plate, Rod<br>Sheet Strip, Flat Wire, and<br>Structural and Special Shaped<br>Sections                 |
| QQ-S-763d<br>& Notice 1 | Steel Bars, Shapes, and Forgings,<br>Corrosion-Resisting  |
| WW-P-401E               | Pipe Fittings: Bushings, Locknuts,<br>and Plugs; Brass or Bronze, Iron or<br>Steel, and Aluminum; (Screwed);<br>125-150-Pound |

1.2 Military Specification (Mil. Spec.).

- |                   |   |
|-------------------|---|
| Mil-C-18480A Am-3 | Coating Compound, Bituminous, Solvent,<br>Coal Tar Base |
|-------------------|---|

1.3 American Society for Testing and Materials (ASTM) Standards.

- |           |  |
|-----------|--|
| A 36-81a  | Structural Steel   |
| A 53-84a  | Pipe, Steel, Black and Hot Dipped,<br>Zinc Coated, Welded and Seamless |
| A 126-84  | Gray Iron Castings for Valves, Flanges<br>and Pipe Fittings            |
| A 320-84a | Alloy-Steel Bolting Materials for Low-<br>Temperature Service          |

## 2. MATERIALS.

2.1 General. Materials indicated on the drawing or required in the work and not covered elsewhere by detailed requirements shall conform to the requirements of this section. In all cases not specifically covered in these specifications, the Contractor shall furnish approved highest grade commercial materials or products.

2.2 Structural Steel shall conform to ASTM A 36.

2.3 Corrosion-Resisting Steel Bolts and Anchor Bolts shall conform to Fed. Spec. QQ-S-763, Class 304, Condition A, or the applicable requirements of ASTM A 320, Grade BB.

2.4 Bronze shall conform to Federal Specification QQ-B-750, hard temper of either composition.

2.5 Bolts shall conform to Fed. Spec. FF-B-575.

2.6 Nuts shall conform to Fed. Spec. FF-N-836.

2.7 Cast Iron for Drainage Gates shall conform to ASTM A 126, Class B.

2.8 Cast Iron Pipe and Fittings shall conform to the applicable requirements of Fed. Spec. WW-P-401.

2.9 Coal Tar Base Paint shall conform to Mil. Spec. MIL-C-18480. A special primer shall be used only if as recommended by the manufacturer of the coating.

2.10 Grease shall be water-resistant and shall be similar or equal to one of the following.

2.10.1 "All Purpose Superlube" as manufactured by Conoco.

2.10.2 "Multi-Fax Heavy Duty No. 2" as manufactured by Texaco.

2.10.3 "Lubriplate No. 630 AAA" or Alvania No. 1" as manufactured by Shell Oil Company.

3. FINISHES. In general, new flapgate tolerances for machine-finished surfaces designated by nondecimal dimensions shall be within 1/64 inch. Sufficient machining stock shall be allowed on placing pads to insure true surfaces of solid material. Finished contact or bearing surfaces shall be true and exact to secure full contact. All drilled holes for bolts shall be accurately located and drilled from templates. Bolt holes shall be reamed normal to the member and shall be truly cylindrical throughout. Unless otherwise specified, holes for bolts shall not be more than 0.2 inch larger than the diameter of the bolt.

4. ANCHORAGE. Anchorage shall be provided where necessary for fastening miscellaneous metal items securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts, expansion shields, and powder-driven fasteners when approved for concrete. Slotted inserts shall be of types required to engage with the anchors and shall be approved.

5. FLAPGATES. Side drain flapgates shall be of the sizes indicated and constructed for a minimum 10-foot seating head. Frames and covers shall be cast iron or cast steel. Seating surfaces shall be bronze or ductile iron. Links may be cast iron, steel, or high strength malleable iron. Bushings shall be bronze. Fasteners shall be galvanized steel, bronze, or corrosion-resistant steel. Gates shall have fully adjustable linkage. Each gate shall be rigidly secured in place with seating faces inclined from the vertical by approximately 3 degrees. Installation of gates shall be as recommended by the gate manufacturers. Fasteners of the size recommended by the gate manufacturer shall be utilized in assembly of gate and to secure the gates to the frame. The gates shall be so constructed as to prevent locking in any partially open position.

#### 6. PAINTING NEW FLAPGATES.

6.1 Cleaning. All oil and grease shall be removed. When required, welds shall be neutralized by the use of ammonia or other suitable agent. All surfaces to be painted shall be cleaned in the shop to remove all rust, scale, dirt, and other foreign matter. "Tight" mill scale, that cannot be lifted by applying a sharp knife to any edge, will be permitted. The cleaning shall be accomplished by scraping, wire brushing, and wiping or other approved methods. The cleaning and painting operations shall be carried on in such a manner that the time between cleaning and the application of the paint will not exceed 24 hours.

#### 6.2 Painting.

6.2.1 Flapgates shall be given 3 coats of cold applied coal tar base paint. The paint shall be applied heavily by brush, at a coverage rate of approximately 100 square feet per gallon to give a total film thickness of 3 coats of 1/32 of an inch. Each additional coat shall be brushed perpendicularly to strokes of preceding coat. Drying time between coats shall be as recommended by manufacturer of coatings.

#### 7. SAFETY RAILS AND PIPE GATES.

7.1 Safety Rails and Pipe Gates. Safety railings shall be made of galvanized steel pipe conforming to ASTM A 53. Pipe Gates shall be made of galvanized steel pipe of sizes and weights as shown on the drawings. Pipe post for safety rails shall be of galvanized extra strong steel pipe of nominal 2-1/2 inch size conforming to ASTM A 53.

7.1.1 Jointing shall be by one of the following:

a. Flush-type rail fittings, welded and ground smooth with railing splice locks secured with 3/8-inch hexagonal-recessed-head setscrews.

b. Mitered and welded joints made by fitting post to top rail and intermediate rail to post, mitering corners groove welding joints and grinding smooth. Railing splices shall be butted and reinforced by tight-fitting interior sleeve not less than 6 inches long.

7.1.2 Installation shall be by grouting pipe post into performed or drilled holes in the concrete or soil cement. Grout mixture for grouting pipe post into concrete or soil cement shall be as determined in SECTION: REINFORCED MASONRY.

7.2 Workmanship. Miscellaneous metalwork shall be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean, true lines, and surfaces. Welding shall be continuous along the entire area of contact, except where tack welding is permitted. Exposed connection of work in place shall not be tack welded. Exposed welds shall be ground smooth. Exposed surfaces of work in place shall have a smooth finish, and unless otherwise approved, exposed riveting shall be flush. Where tight fits are required, joints shall be milled. Corner joints shall be coped or mitered, well formed, and in true alinement. Work shall be accurately set to established lines and elevations and securely fastened in place. Installation shall be in accordance with manufacturer's installation instructions and approved drawing, cuts, and details.

7.3 Shop Painting. Unless otherwise specified, surfaces of ferrous metal, except galvanized surfaces, shall be cleaned and shop coated with the manufacturer's standard protective coating. Items to be finish painted shall not be given a bituminous protective coating. Surface shall be cleaned with solvents to remove grease and oil and with power wire-brushing or sandblasting to remove loose rust, loose mill scale, and other foreign substances. Surfaces of items embedded in concrete shall not be painted.

\* \* \* \* \*

SECTION 16A

ELECTRICAL WORK (FOR IRRIGATION LANDSCAPING)

Index

- |                                     |                             |
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| 1. Controller to Control Valve Work | 7. Workmanship              |
| 2. Applicable Publications          | 8. Duct System              |
| 3. General                          | 9. Secondary Junction Boxes |
| 4. Materials and Equipment          | 10. Grounding               |
| 5. List of Materials and Equipment  | 11. Tests                   |
| 6. Shop Drawings                    | 12. Guarantee               |

1. CONTROLLER TO CONTROL VALVE WORK. Electrical work from controller to control valves are specified in SECTION: IRRIGATION SYSTEM.

2. APPLICABLE PUBLICATIONS. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

2.1 Federal Specifications (Fed. Spec.).

J-C-30A & Am-1	Cable and Wire, Electrical (Power, Fixed Installation)
W-C-586C	Conduit Outlet Boxes, Bodies and Entrance Caps, Electrical: Cast Metal
W-F-406B & Int. Am-1 (GSA-FSS)	Fittings for Cable, Power, Electrical and Conduit, Metal, Flexible
W-F-408C & Am-1	Fittings for Conduit, Metal Rigid, (Thick-Wall and Thin-Wall (EMT) Type)
W-P-115A & Am-3	Panel, Power Distribution
W-S-610C & Am-1	Splice Conductor
FF-P-101E & Am-2	Padlocks
HH-I-553C & Am-1	Insulation Tape, Electrical (Rubber, Natural and Synthetic)
HH-I-595C	Insulation Tape, Electrical, Pressure- Sensitive Adhesive, Plastic
SS-A-281b & Am-1	Aggregate; (For) Portland-Cement- Concrete

2.2 American Society for Testing and Materials (ASTM) Standards.

A 48-83	Grey Iron Castings
A 123-78	Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip
A 153-80	Zinc Coating (Hot Dip) on Iron and Steel Hardware
C 94-86a	Ready-Mixed Concrete
C 150-85	Portland Cement
D 69-85	Friction Tapes

2.3 National Electrical Manufacturers Association (NEMA) Standards.

No. SG 3-1975 Incl Rev 1	Low-Voltage Power Circuit Breakers
TC 2-1978 Incl Rev 1 thru 4	Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80)

2.4 National Fire Protection Association (NFPA) Publication.

No. 70-1981 (Vol. 6)	National Electrical Code
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2.5 Institute of Electrical and Electronics Engineers (IEEE) Standards.

National Electrical Safety Code (ANSI C2) (1981 Edition)

No. 142-1972	Recommended Practice for Grounding of Industrial and Commercial Power Systems
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2.6 Underwriters' Laboratories, Inc. (UL) Standards.

UL 6	Rigid Metal Conduit (Oct 23, 1981; 9th Ed.)
UL 467	Grounding and Bonding Equipment (Nov 7, 1972, 5th Ed.; Rev. thru 26 Mar 1982)
UL 651	Schedule 40 and 80 Rigid PVC Conduit (May 8, 1981; 4th Ed.)
UL 651A	Type EB and A Rigid PVC Conduit and HDPE Conduit (May 11, 1981; 1st Ed.)

3. GENERAL. The contract drawings indicate the extent and general arrangement of the underground electrical distribution systems.

3.1 Capacities for all equipment and materials shall be not less than those indicated.

3.2 Codes. The installation shall comply with the applicable requirements and recommendations of the National Electrical Code and the National Electrical Safety Code.

3.3 Conformance With Agency Requirements. Where materials or equipment are specified to conform to the standards of the Underwriters' Laboratories, Inc., or to be constructed or tested, or both, in accordance with the standards of the National Electrical Manufacturers Association or the American National Standards Institute, Inc., the Contractor shall submit proof that the items furnished under this section of the specifications conform to such requirements. The label of, or listing by the Underwriter's Laboratories, Inc., will be acceptable as sufficient evidence that the items conform to Underwriters' Laboratories, Inc., requirements. A certification or published catalog specification data statement to the effect that the item is in accordance with the referenced NEMA standard by a company listed as a member company of NEMA for the section whose standards cover the item under consideration, will be acceptable as sufficient evidence that the item conforms to the requirements of the National Electrical Manufacturers Association. In lieu of such stamp, certification, label or listing, the Contractor may submit a written certificate from any nationally recognized testing agency adequately equipped and competent to perform such services, stating that the items have been tested and that the units conform to the requirements listed hereinbefore, including methods of testing of the specified agencies. Conformance with the agency requirements does not relieve the item from complying with any other requirements of the specifications.

3.4 Nameplates. Each major component of equipment shall have as a minimum the manufacturer's name, address, and catalog number, model, style, or type on a plate securely and conspicuously attached to the item of equipment. Nameplates for electrical apparatus shall conform to the referenced standards.

3.5 Prevention of Corrosion. All metallic materials shall be protected against corrosion. Exposed metallic parts of outdoor apparatus shall be given a rust-inhibiting treatment and standard finish by the manufacturer. Aluminum shall not be used in contact with the earth, and where connected to dissimilar metal shall be protected by approved fittings and treatment. All parts such as boxes, bodies, fittings, guards, and miscellaneous parts made of ferrous metals but not of corrosion-resistant steel, shall be zinc-coated in accordance with ASTM A 123, or A 153, except where other equivalent protective treatment is specifically approved in writing by the Contracting Officer. Steel conduits installed underground or under slabs on grade shall be coated with an approved asphaltic paint, plastic coating or shall be wrapped with a single layer of a pressure-sensitive plastic tape, half-lapped. Where pressure-sensitive plastic tape is used, the conduit shall be coated with a primer recommended by the tape manufacturer before applying the tape.

3.6 Spare-Parts Data. As soon as practicable after approval of materials and equipment and, if possible, not later than one month prior to the date of beneficial use, the Contractor shall furnish spare-parts data for each different

item of equipment listed. The data shall include a complete list of parts and supplies, with current unit prices and source of supply; a list of parts and supplies that are either normally furnished at no extra cost with the purchase of the equipment, or specified hereinafter to be furnished as part of the contract; and a list of additional items recommended by the manufacturer to assure efficient operation for a period of 120 days at the particular installation. The foregoing shall not relieve the Contractor of any responsibilities under the guarantee specified hereinafter.

3.7 Standard Products. Materials and equipment shall be essentially the standard products of a manufacturer regularly engaged in the manufacture of the product, shall meet the requirements of the specification, and essentially duplicate materials and equipment that have been in satisfactory use at least 2 years.

3.8 Verification of Dimensions. The Contractor shall be specifically responsible for the coordination and proper relation of this work to the site and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the work and working conditions, shall verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

4. MATERIALS AND EQUIPMENT shall conform to the respective specifications and other requirements specified herein.

4.1 Cable shall have copper conductors unless otherwise indicated.

4.1.1 Conductors, Insulated. Fed. Spec. J-C-30, types as indicated.

4.2 Conduit, Steel. UL 6.

4.3 Plastic Conduit shall be single bore, and shall be polyvinyl-chloride (UL 651), conduit for underground use without concrete encasement or polyvinyl-chloride tubing (UL 651A, Type A PVC) for underground use with concrete encasement conforming to NEMA TC 2 and applicable UL. Conduit fittings shall conform to the applicable NEMA standards, except that where NEMA standards for conduit fittings do not exist for the type of plastic installed, fittings shall be as recommended by the conduit manufacturer. Conduit and fittings shall be free, within commercial tolerances, of objectionable lines, striations, bubbles, welds, and other manufacturing defects that would impair the service of the conduit. The bore of the conduit shall be straight and circular in cross section with smooth interior surfaces free from obstructions and rough and flaky areas. The conduit and fittings shall be free from all substances that injuriously affect any wire or cable covering such as is used on rubber-covered wire, polychloroprene-sheathed cable, weatherproof wire, and lead- or lead-alloy-covered cable. The conduit and fittings shall be corrosion-resistant and not adversely affected by chewing insects, gnawing rodents, acids, alkalies, salts, bacteria, and other organic matter that would normally be encountered in the ground. The conduit length for each size shall be the length that is standard with the manufacturer with a permissible tolerance of 1/4 inch per 10-foot length. Bends, elbows, and other fittings shall be capable of freely passing a ball that is 1/4 inch less in diameter than the nominal bore of the conduit. Fittings shall be of a type especially made for use with plastic conduits for electrical service. Conduit and fittings shall be capable of being joined, by means of a solvent welding cement, so as to provide a watertight and rootproof joint. Electrical plastic tubing,

EPT-PVC, for use with concrete encasement, and electrical plastic conduit, EPC-40-PE or EPC-40-PVC for use without concrete encasement shall have dimensions for the corresponding size in accordance with Table 2-1 of NEMA TC-2. Sections cut from the conduit shall be calipered for wall thickness.

4.4 Connectors. Fed. Spec. W-S-610.

4.5 Fittings, cable and conduit. Fed. Spec. W-F-406 or W-F-408. Insulating material in bushing shall be of the thermosetting type and shall not support combustion.

4.6 Mortar shall be composed of the following materials.

4.6.1 Aggregate. Fed. Spec. SS-A-281.

4.6.2 Portland Cement. ASTM Standard C 150.

4.6.3 Water shall be clean, fresh, and free from injurious amounts of mineral and organic substances.

4.6.4 Mixture shall be in the proportions of one part portland cement to one part sand with sufficient water added to produce a pliable and workable mortar.

4.7 Outlets, metal, for conduit. Fed. Spec. W-C-586.

4.8 Padlocks. Fed. Spec. FF-P-101.

4.9 Paint. As specified.

4.10 Panelboards. Fed. Spec. W-P-115, type and class as indicated. Panelboards installed exposed to the weather shall be raintight except as otherwise indicated.

4.11 Service Entrance Equipment shall be U.L. listed, and approved for use by the Arizona Public Service. Equipment outdoors shall be in NEMA 3R enclosures.

4.12 Tape.

4.12.1 Friction Tape. ASTM D 69.

4.12.2 Plastic Tape. Fed. Spec. HH-I-595.

4.12.3 Rubber Tape. Fed. Spec. HH-I-553.

4.13 Circuit Breakers.

4.13.1 Low-voltage power circuit breakers. NEMA SG 3.

4.13.2 Molded-case circuit breakers. Fed. Spec. W-C-375.

4.14 Grounding and Bonding. UL 467.

4.15 Concrete shall conform to the applicable requirements of ASTM C 94.

5. LIST OF MATERIALS AND EQUIPMENT. Before starting installation of any materials or equipment the Contractor shall submit to the Contracting Officer for approval a complete list, in accordance with the SPECIAL CLAUSES, of materials and equipment to be incorporated in the work. This list shall include manufacturer's style or catalog numbers. Cuts or other descriptive data shall be furnished when required by the Contracting Officer. No consideration will be given to partial lists submitted from time to time. Approval of materials will be based on manufacturer's published data, approval of materials and equipment will be tentative subject to submission of complete shop drawings indicating compliance with the contract documents.

6. SHOP DRAWINGS. After receiving tentative approval of the equipment on the material lists and before installation of any of these items, the Contractor shall submit complete shop drawings and such other descriptive data as the Contracting Officer may require to demonstrate compliance with the contract documents. Shop drawings shall be submitted for the following item and such other items as the Contracting Officer may direct.

a. Meter Pedestal.

If departures from the contract drawings are deemed necessary by the Contractor, details of such departures, including changes in related portions of the project and the reasons therefore, shall be submitted with the shop drawings. Approved departures shall be made at no additional cost to the Government.

7. WORKMANSHIP.

7.1 General. All materials and equipment shall be installed in accordance with the recommendations of the manufacturer as approved by the Contracting Officer to conform with the contract documents. The installation shall be accomplished by workmen skilled in this type of work.

8. DUCT SYSTEM.

8.1 General. The duct system shall consist of single round-bore conduit. The number and size of the duct shall be as indicated. Duct lines shall be laid to a minimum grade of 4 inches per 200 feet. Grade may be from one pullbox to the next or both ways from high point between pullboxes, depending on the contour of the finished grade. Duct lines shall be installed so that the top of concrete in encased duct lines is not less than 18 inches below, or duct in non-encased duct lines is not less than 24 inches below finished grade or finished paving at any point. Changes in direction of runs exceeding the total of 10 degrees, either vertical or horizontal, shall be accomplished by long sweep bends having a minimum radius of curvature of 25 feet, except that manufactured bends may be used at the ends of the run. The long sweep bends may be made up of one or more curved or straight sections and/or combinations thereof. Manufactured bends shall have a minimum radius of 18 inches for use with ducts of less than 3 inches in diameter and a minimum radius of 36 inches for ducts of 3 inches in diameter and larger. Conduits shall terminate in water proof end bells where duct lines enter pullboxes. Conduit shall be thoroughly cleaned before using or laying. During construction and after the duct line is completed, the end of the conduits shall be plugged to prevent water washing mud into the conduits or pullboxes. Particular care shall be taken to keep the conduit clean of concrete, dirt, and any other substance during the course of construction. Where it is necessary to cut a

tapered end on a piece of conduit at the site, the cut shall be made with a tool or lathe designed to cut a taper to match the taper to the particular conduit being used. After the duct line has been completed, a standard flexible mandrel not less than 12 inches long, having a diameter approximately 1/4 inches less than the inside diameter of the conduit, shall be pulled through each conduit, after which a brush with stiff bristles shall be pulled through each conduit to make certain that no particles of earth, sand, or gravel, have been left in the line. Pneumatic rodding may be used to draw in the lead wire. Where connection is made to an existing duct that is of different material and shape than the duct line being installed, a suitable coupling of a type recommended by the duct manufacturer shall be used. Conduits shall be stored to avoid warping or deterioration. Conduit joints in concrete encasement may be placed side by side horizontally but shall be staggered at least 6 inches vertically.

## 8.2 Materials.

8.2.1 Ducts for Secondary Electrical, Feeders and Branch Circuit Conductors shall be rigid steel or plastic conduits without concrete encasement, except conduits shall be concrete encased under all roads, and paved or traffic areas.

## 8.3 Installation of Ducts.

8.3.1 Conduits. Conduits shall be buried directly in the earth, except as specified hereinbefore. The width of the trench shall be approximately the width of the conduit plus 6 inches, with depth of cover over the top of the conduit not less than 24 inches. The bottom of the trench shall be graded toward pullboxes, and shall be smooth and free of stones, soft spots, and sharp objects. Where bottom of trench comprise materials other than sand or stone-free earth, a 3-inch layer of sand, or stone-free earth shall be laid on the bottom of the trench and compacted to the approximate density of the surrounding firm soil before installing the conduits. The first layer of backfill cover shall be sand or stone-free earth, compacted as specified. Conduits may be held in alinement with a few shovelfuls of dirt. The selected earth at the sides of the conduit shall be thoroughly tamped in 4- to 6-inch layers. Backfill and compaction in trenches shall conform to the requirements of paragraph: BACKFILLING of SECTION: IRRIGATION SYSTEM.

## 8.4 Installation of Couplings.

8.4.1 General. Joints in all types of conduit shall be made up in accordance with the manufacturer's recommendations for the particular conduit and coupling selected and as approved by the Contracting Officer. In the absence of specific recommendations, the various types of conduit joint couplings shall be made watertight by the following method.

8.4.1.1 Plastic Conduit Joints shall be made up by brushing a plastic solvent cement on the inside of the plastic coupling fitting and on the outside of the conduit ends. The conduit and fitting shall then be slipped together, until seated, with a slight twist to set the joint tightly, and the conduit then rotated one-half turn to distribute the cement evenly. Excess cement built up on the inside surface of the conduit shall then be removed.

8.5 Concrete shall be 2,500 psi at 28 days. Duct lines shall be of monolithic construction. Where a connection is made to an existing duct line, the concrete encasement shall be well bonded or doweled to the existing encasement.

9. SECONDARY JUNCTION BOXES shall be installed where indicated, for the purpose of splicing or connecting secondary cables. Boxes and covers shall be made of cast iron with zinc-coated or aluminized finish, and of the sizes indicated. A suitable gasket shall be installed between the box and cover, for watertightness. A sufficient number of cover screws shall be installed to hold the cover firmly in place along its entire contact surface. Unless otherwise indicated, the approximate inside dimensions of these boxes shall be 12 inches square and 6 inches deep.

#### 10. GROUNDING.

10.1 General. Grounding shall conform to applicable requirements in the National Electrical Code, the National Electrical Safety Code, and to requirements herein. Neutral conductors, cable shields, metallic cable sheaths, metallic conduits, pothead bodies, junction boxes, and all non-current-carrying metallic parts of equipment, shall be grounded. Ground rods except those installed in pullboxes shall be made of copper, or copper-clad steel, not less than 3/4 inch by 10 feet long, and shall be driven into the earth at least 10 feet unless otherwise indicated.

10.2 Meter Pedestal. Each meter pedestal shall have one ground rod. A bare copper cable not smaller than No. 8 AWG shall be connected to the ground rod. Connection to the ground rod shall be by means of approved fusion-weld process.

#### 11. TESTS.

11.1 Operating Test. After the installation has been completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements of this section of the specifications. The tests shall be performed in the presence of the Contracting Officer. The Contractor shall furnish the necessary instruments and personnel required for the test.

11.2 Ground Resistance Measurements. Ground resistance shall be measured in accordance with and shall meet the requirements of the National Electric Code.

11.3 The maximum resistance measured in accordance with IEEE No. 142 of a driven ground shall not exceed 25 ohms under normally dry conditions. If this resistance cannot be obtained with a single rod, 2 additional rods not less than 6 feet on centers, or if sectional type rods are used, 4 additional sections may be coupled and driven with the first rod. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately.

11.4 Factory Test Reports on equipment, including the impulse tests specified for transformers, shall be certified by the manufacturer or testing laboratory and furnished by the Contractor to the Contracting Officer.

12. GUARANTEE. The following equipment furnished under this section of the specifications shall be guaranteed for a period of one year from the date of acceptance thereof, either for beneficial use or final acceptance, whichever is earlier, against defective materials, design, and workmanship.

Meter Pedestals

Upon receipt of notice from the Government of failure of any part of the guaranteed equipment during the guarantee period, new replacement parts shall be furnished and installed promptly by the Contractor at no additional cost to the Government.

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