

2. AMENDMENT/MODIFICATION NO. AM-0008	3. EFFECTIVE DATE 02/26/02	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. <i>(If applicable)</i>
---	--------------------------------------	----------------------------------	---------------------------------------

6. ISSUED BY CODE US ARMY ENGINEER DISTRICT, HONOLULU CORPS OF ENGINEERS, BUILDING S-200 FORT SHAFTER, HAWAII 96858-5440 CONTRACT SPECIALIST: RENEE M. HICKS	7. ADMINISTERED BY <i>(If other than Item 6)</i> CODE
--	---

8. NAME AND ADDRESS OF CONTRACTOR <i>(No., street, county, State and ZIP Code)</i>	(X)	9A. AMENDMENT OF SOLICITATION NO. DACA83-02-R-0003
	X	9B. DATED <i>(SEE ITEM 11)</i> 12/07/01
		10A. MODIFICATION OF CONTRACT/ORDER NO.
		10B. DATED <i>(SEE ITEM 13)</i>

CODE	FACILITY CODE	11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS
------	---------------	--

The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers is extended, is not extended.

Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a) By completing Items 8 and 15, and returning _____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. Accounting and Appropriation Data *(If required)*

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

- | | |
|-----|--|
| (X) | A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: <i>(Specify authority)</i> THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A. |
| | B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES <i>(such as changes in paying office, appropriation date, etc.)</i> SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b). |
| | C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF: |
| | D. OTHER <i>(Specify type of modification and authority)</i> |

E. IMPORTANT: Contractor is not, is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION *(Organized by UCF section headings, including solicitation/contract subject matter where feasible.)*
FY02 MCA PN 50846 COLD STORAGE FACILITY, AND FY01 RDT&E REPAIR WATER TANKS, U.S. ARMY KWAJALEIN ATOLL

(See Page 2 of 2 Pages)

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER <i>(Type or print)</i>	16A. NAME AND TITLE OF SIGNER <i>(Type or print)</i>
15B. CONTRACTOR/OFFEROR <i>(Signature of person authorized to sign)</i>	16B. UNITED STATES OF AMERICA BY _____ <i>(Signature of Contracting Officer)</i>
15C. DATE SIGNED	16C. DATE SIGNED

1. CHANGES TO SPECIFICATIONS. Attached hereto are revised pages and sections to the specifications. The revision mark "(AM-0008)" is shown on each page. Changes are indicated in bold or with asterisk.

Section 00800 - S-36.21 "Availability and Use of Utility Services (APR 1984), S-17.1 "Option for Increased Scope-Separately Priced Line Item (APR 1996), APPENDICES A and B

Section 00900 - Questions and Answers

WATER TANKS - Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE - paragraphs: 1.7.4 and 2.3.2 (Note: This section of the specs is being re-issued because you may not have been able to view it properly, depending on the way Am-0006 was viewed from the CD-ROM (through the executable or the CD-ROM drive)

2. The proposal due date of March 8, 2002, 2:00 P.M. Hawaiian Standard Time (HST) remains unchanged.

7. Failure to follow the procedures outlined above may result in delays in entering Army Installations. The Government is not responsible for any adverse impact on the contractor or its operation as a result of delays due to the failure to register vehicles.

S-36.22 NOTICE OF PARTNERING

The Government intends to encourage the foundation of a cohesive partnering arrangement with the contractor and its subcontractors. This partnering arrangement will be structured to draw on the strengths of each organization to identify and achieve reciprocal goals. The objectives are effective and efficient contract performance intended to achieve completion within budget, on schedule, and in accordance with contract plans and specifications. This partnering arrangement will be bilateral in membership. To implement this partnering initiative, it is anticipated that within 60-days of Notice to Proceed, the contractor and Government management teams to include on-site and off-site management will attend a 2 day partnering development seminar/team building workshop. Any costs associated with the partnering workshop, excluding salaries, travel, lodging, and food for Government personnel, shall be borne by the contractor. The facilitator for the workshop shall be an objective and neutral third party participant, skilled in team building and group dynamics, who has no vested interest in the decisions reached by the group. Up to 20 Government personnel will attend this workshop. The partnering workshop will be held in Kwajalein at a date to be determined later.

[End of Statement]

S-36.21 AVAILABILITY AND USE OF UTILITY SERVICES (APR 1984)

(a) The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. The Contractor shall carefully conserve any utilities furnished without charge.

(b) The Contractor, at its expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of each utility used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.

***(c) Schedule of utilities available from the Government without charge: connections to water and electricity lines can be made, however, metering is required for the Cold Storage project only. Metering for the Water Tanks is not required. ***

[End of Statement]

S-36.20 PERFORMANCE OF WORK BY THE CONTRACTOR - DEFINED (NOV 1998)

(a) "Work," means physical work activities, involving any of the trades required to directly place the construction required by the contract. It also includes physical activities that directly support the work, such as: (1) warehousing; (2) maintenance of equipment; (3) procurement and transportation of supplies or construction materials to the site for use by the contractor; (4)
(AM-0008)

(a) Arrangements may be made through the Contracting Officer or his authorized representative for the installation of a limited number of telephones at desired locations on Kwajalein. There will be an installation charge and monthly service charge for each telephone instrument, based on prevailing rates, and the Contractor shall make payment for such services in a manner as determined and approved by the Contracting Officer.

(b) Approved communication facilities for safety purposes will be provided by the Contractor with work parties at isolated locations.

[End of Statement]

*

*S-17.1 OPTION FOR INCREASED SCOPE -- SEPARATELY PRICED LINE ITEM (APR 1996)

The Government may require the construction of the numbered line item(s), identified in the bidding schedule as (an) option item(s), in the quantity and at the price stated. The Contracting Officer may exercise the option(s) at time of award or by written notice to the Contractor within 90 calendar days from time of award. Performance period(s) for the option(s) will be identified in the FAR clause entitled COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK, in Section 00800.

[End of Statement]

*

(AM-0008)

RESPONSES TO QUESTIONS
SUBMITTED BY VARIOUS PLANHOLDERS
FOR
RFP DACA83-02-R-0003

NOTES:

A. QUESTIONS ARE NOT LISTED IN ANY SPECIFIC ORDER. THE PLANHOLDERS WHO SUBMITTED THE QUESTIONS ARE INDICATED.

B. QUESTIONS RECEIVED MAY OR MAY NOT RECEIVE RESPONSES PRIOR TO THE PROPOSAL DUE DATE. THEREFORE, OFFERORS SHOULD DEVELOP THEIR PROPOSALS AS THEY INTERPRET THE SITUATION DESCRIBED IN THE DOCUMENTS AVAILABLE.

J.A. JONES CONSTRUCTION QUESTIONS:

1. Drawing S-4, Tank Structural Notes under item C., note # 5 states that the Contractor shall include costs for monitoring cultural resources. Please clarify this statement regarding the inclusion of cost and advise if any particular requirements are different under this contract from the previous customary practices in Kwajalein. **RESPONSE:** *This drawing note has been deleted by amendment. Refer to contract specifications regarding cultural resources.*

2. Note # 6 under the same drawing noted in 1. above states Contractor is to include costs for asbestos coated underground pipe. Can the Government provide an approximate quantity of hazardous pipe expected underground?
RESPONSE: *This drawing note has been revised by amendment. No asbestos-containing materials are anticipated for the underground pipe.*

3. Drawing S-1 indicates that only 6 panels can be removed from the existing tank covers for access to execute construction work. If the Contractor can obtain approval from TEMCOR, would it be acceptable to remove more than 6 panels for improved access purposes?
RESPONSE: *Yes, more panels can be removed, if approved by tank dome cover manufacturer, TEMCOR.*

4. Drawing S-4, item H for tank testing requires the following. Fill the tank to complete capacity and monitor water level drop until ½ inch develops or three days elapse, whichever occurs first. This note and related testing criteria further states that adjustments will be made for evaporation and temperature during testing. What will the evaporation and temperature formula basis be to measure against the tank water loss? The climate varies little in Kwajalein. What is the allowable evaporation loss if calculated today?
RESPONSE: *Refer to ACI 350 1.R (to be added as a reference by amendment).*

5. Drawing S-7 (As Built) and Plans Sections. Details and Notes contain the following information, which is confusing and conflicting with the other documents. This drawing shows a “SCHEDULE OF WORK” and TYP PLAN FOR TANKS. In this table, 15 tanks

are listed with conflicting information. For example, it states that all tanks are to get a new FML floor system. We believe this drawing has many other notes and requirements which do not apply. Please advise what portions of Drawing S-7 and other "As Built" Drawings are applicable for this RFP.

RESPONSE: *Sheets S-5 through S-9 are reference asbuilt drawings, and are provided in the contract for general reference (informational) purposes only. These are provided to assist the contractor with planning demolition and new work. New contract actual physical work requirements are not shown on the reference asbuilt drawings but are indicated on Sheets S-1 through S-4.*

6. Drawing S4, note F -3 states that the Contractor will assume 150 gallons of epoxy for 500 If of shrinkage cracks per tank for 500 if of cracks. A similar note exists under item 4. for the floor slab, i.e., 500 gallons of epoxy for 3480 If of shrinkage cracks. Will the contract be modified if the quantities vary? If so, what will be the basis of measurement and payment?

RESPONSE: *These notes regarding quantities of epoxy will be deleted by amendment. Contract requires extraordinary procedures to eliminate concrete shrinkage cracks. Any shrinkage cracks that develop after the new concrete floor slab has been cured will be considered the responsibility of the contractor to repair by epoxy injection. The contractor will be required to determine the amount of epoxy required to repair shrinkage cracks. Existing walls are not expected to have shrinkage cracks that cause water leaks.*

7. Section 03300, 1.7.3 mentions that Air Entrainment shall be required. Section 03300, 2.3.1 mentions that Air-Entrainment Admixture shall not be used. Section 03300, 3.14.4 and 3.14.5 mention the use of Air-Entrainment agents or admixture. Please indicate which spec is the required.

RESPONSE: *The following paragraph is being added to Section 03300: "1.8.3 Air Entrainment. All normal weight concrete shall be air entrained to contain between 4 and 7 percent total air, except that when the nominal maximum size coarse aggregate is 3/4 inch or smaller it shall be between 3.5 and 5.5 percent. Concrete with specified strength over 5000 psi may have 1.0 percent less air than specified above. Specified air content for normal weight concrete shall be determined in accordance with ASTM C 231." Also, the following will replace the text in Contract Specification 3300, paragraph 2.3.1, Air Entrainment Admixture: "ASTM C 260 and shall consistently entrain the air content in the specified ranges under field conditions."*

8. It is our understanding that there are no items required for handover as Government salvage at the existing Cold Storage Warehouse. Is our understanding correct?

RESPONSE: *Correct.*

9. Detail 1 of Drawing A-9 indicates a double layer of 6 mil Polyethylene sheets with taped or folded staggered joints under the 89 mm thick cement grout layer with the radiant tubing of the Freezer Slab system. On the other hand, the typical slab details shown on Drawing S-2 do not show these sheets. Only a 15 mil Polyolefin Geomembrane is shown as a vapor barrier for the Office, Mechanical and Electrical Rooms. Spec

Section 07225 – REFRIGERATED FLOOR INSULATION, Paragraph 3.2.1 indicates to provide Vapor Barrier (Black polyvinyl chloride, 0.75 mm thick) and Slip Sheet beneath the entire concrete floor slab and floor insulation as indicated. Please clarify if the Polyethylene sheets are to be installed according to Drawing A-9 or beneath the insulation as indicated in Section 07225. Please send a detail for a better understanding.

RESPONSE: *For Office, Mechanical & Electrical Rooms: Follow note “15 mil polyolefin geomembrane” on structural sheet S-2 for vapor barrier requirements. For vapor barrier & slip sheet requirements for freezer, chill, ice storage, receiving/issue, freezer staging rooms, see Amendment #6.*

10. Section 03300, 1.6.2.1 - Strength Requirements - indicates a compressive strength of 27.5 Mpa for the Concrete Topping over Refrigeration and Freezer Floors. Section 03300, 1.7.3 – Mix Design for Topping for Refrigeration and Freezer Floors asks for a 28-day strength of at least 34.5 Mpa. Please define which strength is correct.

RESPONSE: *Refrigerator and Freezer floors shall have a minimum compressive strength of 34.5 Mpa. Section 03300, 1.6.4, regarding slump increase, please refer to slump table in specs which allow the maximum slumps as shown.*

11. Section 02754, 2.2.1. Can Round Concrete Aggregate be used in the pavement construction?

RESPONSE: *Round concrete aggregate should not be used for the pavement. The use of round aggregates will decrease the strength and bonding of the concrete pavement. The overall integrity of the pavement section may be difficult to control.*

12. On sheet M-18 the schedule of unit coolers served by rack "A" is a total 92 tons of refrigeration and for rack "B" a total 50 tons. Then on sheet M-19 the schedule of compressor racks calls out rack A at 50 ton and rack B at 92 ton. Please clarify which is correct and verify the compressor sizing called out in the rack schedule.

RESPONSE: *The Mechanical Equipment Schedule and Electrical drawings were revised to resolve this.*

DICK-PACIFIC CONSTRUCTION QUESTIONS:

13. Please clarify if subcontracting plan require to submit as part of bid submittal, if yes, please provide us the requirements and standard forms.

RESPONSE: *No, the small business requirements (i.e., subcontracting plans) does not apply to this project.*

14. Please clarify if the general contractor require to provide full time QC manager and Safety officer for the duration of the project, if yes, what are the qualification.

RESPONSE: *CQC requirements have been added by amendment. Safety Officer must have at least 5 years of safety experience and be first-aid and CPR certified.*

15. On page 00800-24, K-21: Will the government to handle the UXO ordinance survey and clearance prior to contractor site clearing and grading?

RESPONSE: *Yes.*

16. On page 00700-64, 52.236 Permits Responsibility: Please clarify if general contractor require to secure building permit and pay all fees to government of Marshall Island?

RESPONSE: *Only the Marshallese income tax is required.*

17. Please extend the deadline of submission of question for another 4-weeks.

RESPONSE: *As stated at the pre-proposal conference, questions will continue to be accepted; however, there is no assurance that responses will be provided in sufficient time to allow appropriate adjustment of proposals.*

18. Existing buildings to be demolished: Is there a landfill area that we can use to dump materials or do all materials have to be removed from island.

RESPONSE: *The existing landfill will be available for appropriate materials.*

19. Asbestos: Can you please tell us what type and thickness of existing materials. Do these materials have to be removed from Island or again is there a landfill area that we can use.

RESPONSE: *See hazardous materials survey report. The asbestos must be removed from the island.*

20. Please provide specifications for the new FML waterproofing system

RESPONSE: *New FML waterproofing system is not required for the project. Detail 3/S-1/S-1 requires existing FML liner tank liner to be removed. Reference asbuilt drawing sheet S-6 shows the existing asbuilt condition of the FML tank liner.*

21. Will submitted bids for the water tanks be awarded at the same time with the cold storage facility or at a different date?

RESPONSE: *It is currently intended to award both projects at the same time, if funds are available.*

22. Please provide drawings for the three existing buildings to be demolished. (Floor plans, elevations, cross sections, and general mechanical, electrical layout plans)

RESPONSE: *Drawings and notes will be provided by amendment.*

23. Price breakdowns – Parts 1, 2, & 3, Parts 2 & 3 are the same and have no reference to solicitation numbers. Is Part 2 for the cold storage facility and Part 3 for the water tanks?

RESPONSE: *The format for the submission of Cost Breakdown was revised and issued with Amendment 0005.*

24. Drawing S-1 dome cover notes No. 3. Removal and replacement of dome tank cover by TEMCOR or by others: Please clarify who is responsible to the removal & replacement COST to be rendered by Temcor, the government or general contractor.

RESPONSE: *Note 3 reads in part as follows: "Removal and replacement of the tank cover panels for construction purposes shall be performed by the original tank cover*

manufacturer or if by others, shall be in accordance with and approved by the original tank cover manufacturer (TEMCOR)." The general contractor is responsible for cost to remove tank dome cover for construction purposes. The general contractor may perform this work himself, subcontract this work to TEMCOR or another subcontractor of his choice, however, removal of the tank dome cover must be performed in accordance with the original tank dome cover manufacturer procedures.

25. Please confirm if water tanks # 966, 946 and 947 are the only three (3) tanks to be repaired under this contract.

RESPONSE: *Concur, only tanks 966, 946 and 947 are to be repaired under this contract.*

26. Drawing S-7 As-built Drawing, Schedule of works: Again, please re-clarify only tank #966, 946 & 947 are the tanks to be repaired, the other twelve (12) tanks that listed on the schedule are NOT part of the scope of work.

RESPONSE: *To re-clarify, only tanks 966, 946 and 947 are to be repaired under this contract. There seems to be some confusion of what is required by drawing sheet S-7. Please note that drawing sheets S-5 through S-9 are reference asbuilt drawings and only show existing asbuilt conditions. The reference asbuilt drawings are provided in the contract for general reference (informational) purposes only and are provided to assist the contractor with planning demolition and new work. New contract actual physical work requirements are not shown on the reference asbuilt drawings S-5 through S-9. Actual new work for tanks are indicated on Sheets S-1 through S-4.*

27. Drawing detail 2/S-1, what is the size/area of roof dome opening for construction access. Is the area of opening accessible to bring-in backhoe w/ breaker?

RESPONSE: *Actual construction access dimensions should be coordinated with the original tank dome cover manufacturer, TEMCOR representative, (Mike Weitzenhoff, M & M tank, 808 845 7556).*

28. Please clarify if the water tank need to install new FML liner system after removal of existing, if yes please provide materials specification.

RESPONSE: *New FML waterproofing system is not required for the project. Detail 3/S-1/S-1 requires existing FML liner tank liner to be removed. Reference asbuilt drawing sheet S-6 shows the existing asbuilt condition of the FML tank liner.*

29. Please clarify all information shown in "AS BUILT/ FOR REFERENCE ONLY" are not part of the scope of work under this contract.

RESPONSE: *Drawing sheets S-5 through S-9 are reference asbuilt drawings and only show existing asbuilt conditions. The reference asbuilt drawings are provided in the contract for general reference (informational) purposes only and are provided to assist the contractor with planning demolition and new work. New contract actual physical work requirements are not shown on the reference asbuilt drawings S-5 through S-9. Actual new work for tanks are indicated on Sheets S-1 through S-4.*

30. Drawing S-4, Note "I" Water Tank Disinfections: Please clarify where to dispose or drain approximately 18,000 Gallons of water during disinfection.

RESPONSE: *An amendment will be made to require disinfection by spraying with 500 ppm chlorine solution. After tank is sprayed with the disinfection solution, the tank would be filled with water to dilute the solution to 10 ppm concentration and then the solution would be used for potable water.*

31. Drawing S-1, Plastic Liner Removal Notes, Item 2. The liner shall be removed by method approved by the government to minimize damage to existing liners: Please provide information what is the acceptable removal method of the government.

RESPONSE: *Tank liner is loosely laid on tank floor, draped on the tank walls and held in place with embedded wall anchor bolts. Refer to reference asbuilt drawings sheet S-6. Method to remove tank liner work should be provided to the contracting officer representative for approval once project has been awarded.*

32. On drawing sheet C-3 Legend, indicated the 508mm and 205mm new un-reinforce concrete pavement, however on drawing sheet C-8 detail 20 & 21 indicated with reinforced concrete pavement. Please clarify which to follow.

RESPONSE: *Reinforced detail to be used for odd-shaped slabs ($L > 1.25W$) and mismatched joints.*

BLACK CONSTRUCTION QUESTIONS:

33. Light Fixture Type 'D' - Luminaire Details on Dwg. E-18 shows a surface mounted fixture (WideLite - FreezerLyte Model), which requires wiring and raceway below the insulated ceiling panel while mounting Det 5/E-3/E-10 shows pendant mounted (Widelite WarehouseLyte Model) with wiring and raceways above the insulated panels. Please clarify correct fixture model or mounting scheme.

RESPONSE: *The Type D Fixtures are installed inside of the refrigerated compartments, and must be supported independent of the freezer panels. The wiring between light fixtures should be run outside of the refrigerated box, and should not be attached to the freezer panels. Widelite WL Series (FreezerLyte) is correctly specified for light located inside refrigerated compartment. WideLite's "WarehouseLyte" series is not suitable for this application, and should not be used.*

34. Refrigerated Container Receptacles - Det 4/E-1/E-10 shows T&B MIPCO #333FC. Current T&B Catalogs show this item as obsolete. Suggested replacement is AMERACE #333FCV. Please check if acceptable. Also, Electrical Symbols on Dwg. E-7 and Diagram on Dwg. E-7 call for 60-Ampere while the above-specified model is a 32-Ampere Receptacle. Please Clarify.

RESPONSE: *Verified the part number with Matson in Honolulu. Verified with Wesco Hawaii (808 839-7261), that the part was listed in the current Mipco product catalog. The item is difficult to find, so the contractor should contact equipment*

supplier like Wesco to locate the item. Substitutions should be requested following the award.

35. Transient Suppression Protection Unit - No specifications. Please provide.

RESPONSE: An addition to the specifications for the Transient Voltage Surge Suppression (TVSS) Unit has been added by amendment.

36. Disconnect, Switches - No specifications. Please provide.

RESPONSE: An addition to the specifications for disconnect switches has been added by amendment.

37. Is there any existing concrete batch plant facility in the island that a contractor can use? What is the production capacity?

RESPONSE: The existing concrete batch plant will not be available.

38. Is there any US Army owned heavy equipment available for contractor use? (I.e. crane, trucks/trailer, forklifts, backhoes, pumps, etc). Please provide list including rental rates if available.

RESPONSE: The on-island Army-owned equipment will not be available.

39. Can contractor buy gas/fuel for their equipment from U5 Army? Please provide cost of gas/fuel per gallon?

RESPONSE: Gas and diesel fuel will be available for purchase by the contractor. The 2002 rate for gas is \$1.07 per gallon, and the price of diesel is \$0.96 per gallon. There is also \$0.16 per gallon handling fee.

CLOSE CONSTRUCTION QUESTIONS:

40. Environmental Report: Please advise how we can obtain a copy of the hazmat survey prepared by Brewer Environmental. This report is referenced in SPEC Sections 13281 (Asbestos), 13282 (Lead Containing Paint), and 13286 (PCB). Please refer to SPEC Section 13281, par 1.3, page 6 and 13286, para 1.2(a), page 3 for specific reference to this report by BES.

RESPONSE: The survey report has been included in Amendment 0004.

NELSON REFRIGERATION QUESTIONS:

41. We are in receipt of Amend #4 on the above referenced project. We would like to clarify the requirements. The specification calls for all metals to be stainless steel if constructed in "exterior and non air conditioned space". Are the Cold-Storage Rooms (Prefabricated Panel Type) classified to be in a "non air conditioned space" requiring the metal clad skin to be stainless steel? Technically, the exterior side of the panels will not be in an air conditioned space.

RESPONSE: Please refer to Section 13038, para. 2.1 "The cold storage room shall conform to NSF 7 and to MIL-R-43900..." MIL-R-43900 refers to aluminum cladding.

42. Reference Specs: 15652 - 2.11 Ice Maker and Plans: Sht M-19 Ice Maker Schedule. The plans and specs call for (2) new ice makers. Although required capacities and accessories are provided a specific manufacturer "or equal" was not provided. Is there anyway the government can provide us with the manufacturer that the plans & specs where pattern on?

RESPONSE: *The specs were designed around Mannhardt and Vogt.*

PACIFIC INTERNATIONAL INC.

43. Section K- 10, (a), notes: "However, the contractor is advised that there may be limited numbers of skilled Marshallese available for hire for this Contract." We agree that this is the case for Marshallese who are residents of Ebeye in the Kwajalein Atoll Our workforce includes skilled Marshallese who are not residents of Ebeye, and if we were to utilize them for this Contract, they would have to be housed. In reference to Section K-10, (d), please advise if Marshallese will be granted the necessary permission from the Commander USAKA to reside in Contractors camp on Kwajalein Island.

RESPONSE: *The housing of Marshallese workers on USAKA controlled islands, in this case Kwajalein Island, is not allowed in accordance with USAKA Regulation 190-10. An exception to policy would need to be submitted through the Corps of Engineers, Kwajalein Resident Office to USAKA Public Works. This request must be staffed through the Provost Marshal and Security offices to the Commander, USAKA, for approval. Each exception request is evaluated on a case-by-case basis and approved or disapproved. In the event that the contractor is asking for a group of Marshallese to live in his mancamp facilities, the exception can be processed for the group of Marshallese citizens/workers. Each individual does not have to be a separate request for exception.*

J.A. JONES CONSTRUCTION QUESTIONS:

44. Cold Storage Facilities:

a. Referring to the Concrete topping slab for the refrigerated and Freezer rooms, Section 03300, 1.7.3 at the end of the paragraph says that "in no case shall the slump exceed 25 mm as determined by ASTM C 143". For workability purposes, could the slump be increased to 75 mm as required for other slabs in section 03300, 1.6.4 – Slump.

RESPONSE: *Per Section 03300, 1.7.3, slump for refrigerator and freezer slabs shall have a maximum slump of 25mm.*

b. What is the interior finish of the insulated panels of the refrigerated and freezer rooms? The drawings show them as metal clad insulated panels. Please indicate the desired finish.

RESPONSE: *Per MIL-R-43900B, interior finish of the insulated panels shall be patterned aluminum, 0.040 inch thick, per manufacturer's standard finish.*

c. Please Define Hardware Set # 2. Refrigerated Room Manufacturers are requesting this information.

RESPONSE: *Per MIL-R-43900B, door hardware shall be of stainless steel. Standard cold storage door hinges shall be furnished on all refrigerated or freezer doors and shall be self-closing type with stainless steel pins and nylon cam type bearings. For sliding doors, ball bearing trolley rollers shall be provided on the overhead track. Hardware, overhead track and floor guides shall be stainless steel. The door latch and striker shall be of the adjustable type and shall be provisions for a padlock. The latch shall have provisions for being opened from the inside, when locked from outside, without damage to the door latch assembly. Safety release is required for both swing and slide type doors.*

45. Water Tanks: Will the government provide at no cost all the water required for testing the tanks and for the construction as well?

RESPONSE:

46. Cold Storage Ice makers:

a. Type = cubes, crushed, or tube?

RESPONSE: *Tube Ice.*

b. Is the bagger to be part of the storage bin or a separate piece of equipment?

RESPONSE: *Bagger is attached to the ice storage bin.*

c. Capacity of bagger?

RESPONSE: *Bagger should be setup to fill 20 lb bags of ice, but should be capable of filling 10 to 50 lb bags.*

d. Are there any physical size requirements/restrictions for this equipment?

RESPONSE: *Ice making capacities and storage are included in the Mechanical Equipment Schedules on the drawings. Equipment furnished must fit in the allotted space.*

e. Any more information available i.e. similar make & model?

RESPONSE: *Equipment used for the design was Vogt and Mannhardt.*

47. Cold Storage rooms:

a. Finish/color (insulated panels)?

RESPONSE: *See Specs. Reference to MIL-R-43900B. Patterned .04 inch thick aluminum.*

b. Hardware requirements for all doors?

RESPONSE: *For non-clad storage room doors see spec section 8700 paragraph 3.2 hardware sets. For cold storage room doors see attachment (from Specs-Intact) MIL-R-43900B.*

c. Please verify the details and requirements for door D-17 (that type of door is not available as fire rated)?

RESPONSE: *Details and requirements per attached MIL-R-43900B. Fire rated cold storage room doors are available. See attached catalog as example.*

DICK-PACIFIC CONSTRUCTION QUESTION:

48. The Loads given on S-1 Design Criteria D. Design load a. Roof Dead Load of 1.6kpa (32psf) does this include the mechanical load given on S-9 Detail 2 max. Total Service Weight 8.8kn (2,000 lbs)? If to use the max. weight at all locations this would add 3.05kpa (61.5psf) over and above the given Roof Dead Load.

RESPONSE: *The Roof Dead Load on Sheet S-1 includes the roof dead loads except the double tee self weight and topping weight. The intent of the maximum concentrated load given on Sheet S-9, Detail 2, is to provide a maximum limit on the amount of concentrated load at a typical anchor.*

NELSON REFRIGERATION QUESTION:

49. Reference Shts M-18 & M-19. On Sht M18, the capacity requirement for all the unit coolers calculate out to be 1,104,171 btu (medium temp racks) and 605,202 btu (low temp racks). On Sht M19, the compressor rack schedule show the medium temp racks @ 176 kw or 600,688 btu and the low temp rack has a requirement of 324 kw or 1,105,812 btu. The loads been switched from page M18 to page M19. Which one is correct?

RESPONSE: *The equipment schedule on sheet M-19 was revised and will be provided in PC-AM-0001, following the proposal due date, to reflect capacities comparable with sheet M-18.*

BLACK CONSTRUCTION QUESTIONS:

50. Must materials be made to the exact metric dimensions given or can material be supplied in closest U. S. inches/feet?

RESPONSE: *Where particular building materials in hard metric units are not manufactured, same materials of inch-pound measurements may be converted to soft metrics.*

51. Who is responsible for the installation? That is, is the bidder supplying the material with others being responsible for its installation?

RESPONSE: *Contractor is ultimately responsible for the installation of pallet storage racks. The Contractor may use bidder supplying the materials or others.*

52. Re: 1.3.1 - The 1997 RMI spec is the latest with some manufacturers producing rack to the previous 1964 spec. Which spec are you requiring?

RESPONSE: RMI Specification should be the latest date of publication, 1997.

53. Re: 1.3.1.2 - Is material to conform to Seismic Zone 1 standards? 3.4, 3.4.1 and 3.4.2 indicate requirements far beyond Seismic Zone 1.

RESPONSE: Minimum seismic Zone 1 standards; entire structure was designed on Seismic Zone 1.

54. Re: 1.3.2 - Says flue spacing is to be 300 mm but drawing A15 shows 305mm.

RESPONSE: Flue spacing 300 mm, plus or minus 5 mm, unless indicated otherwise.

55. Re: 2.1.1a - It is not clear whether requirements is for structural steel frames and beams, roll-formed frames and beams, or some combination of both.

RESPONSE: Some combination of both with yield strength of not less than 310 MPa.

56. Re: 2.1.1b - Does this mean the aisle-side post is to be fitted with an additional thickness of steel for impact resistance?

RESPONSE: Yes, to resist forklift impact resistance.

57. Re: 2.1.1e - Says frame height is to be 5842 mm (19') but drawing A15 shows some frames to be 5487 mm (18') and some 4876 mm (16'). Also, says frame depth is to be 1016 mm but drawing A15 shows 1067 mm (42'). Which size(s) are required and quantity of each.

RESPONSE: Use dimensions shown on the drawings. Revised specifications will be provide to planholders in a future amendment.

58. Re: 2.1.2b - Says beams are 1422 m (56") and 2743 mm (108") but drawing A15 shows beams re 7' 6". Which size(s) are required and quantity of each.

RESPONSE: Use beam length shown on the drawings. Revised specifications will be provided to planholders in a future amendment.

59. Re: 2.2.1 and 2.2.2 - One of these says finish is to be galvanized and the other says finish is paint. Which one?

RESPONSE: All ferrous metal shall be thoroughly cleaned and hot dipped galvanized after fabrication. After galvanizing all ferrous metal surfaces shall be factory finished.

60. Re: 2.2.3 - Who is responsible for applying these safety stripes? Is the bidder to ship materials with stripes factory applied or is this work to be done by installers or others?

RESPONSE: Contractor is responsible for safety stripes.

61. Re: 3.2 - Talks about sway braces. It is unclear how these are to be used or where they are to be installed. The frames are manufactured with bracing welded in. This spec calls for bolts. Are you requiring bolt-together frames? Or is this spec calling for a lateral back brace?

RESPONSE: *Sway braces to resist horizontal forces to prevent racks from toppling due to domino effects. Racks may be welded or bolted.*

CLOSE CONSTRUCTION QUESTIONS:

62. Reference spec 02120 para 3.2, Transportation and disposal of hazardous materials. Our interpretation is that disposal can be any approved site. Asbestos to PVT at Nanakuli, Oahu, and Lead & PCB to a U.S. mainland site. However on a recent project on Roi-Namur reference was made to a current USAKA spec that allowed disposal only on mainland. Please advise which is correct.

RESPONSE: *Any site outside of Kwajalein, conforming to that specification, is acceptable, including approved site(s) in Hawaii.*

63. Comparison of Brewer's Environmental report and drawing C-2 indicates an error in "dimension table" on HR-1. We know that Bldg 612 is approximately 4,500 SF, but table on HR-1 indicates #612 is 1,259 sq meters or approximately $1259 \times 10.76 = 13,547$ SF or 3 times actual.

RESPONSE: *Conflicting information is presented between the Dimension Note Table listed on HR-1 and in the report. Upon review of the data, adjustments will be made to the Table and will be reflected in the revised drawing submitted in a future amendment. The planholder should be note that the HR drawings are provided for reference only and the planholder is responsible for verifying all material quantities and locations.*

DICK-PACIFIC CONSTRUCTION QUESTION:

64. Each water tank has 1 million gallons capacity and require to have leakage test after repair, will the government provide a free of charge of water during testing?

RESPONSE: *A future amendment will state that utilities metering for the Repair Water Tanks project is not required. Water for the testing of the tanks will not be charged to the contractor.*

SECTION TABLE OF CONTENTS

DIVISION 03 - CONCRETE

SECTION 03300

CAST-IN-PLACE STRUCTURAL CONCRETE

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 LUMP SUM CONTRACT
- 1.3 SUBMITTALS
- 1.4 QUALIFICATIONS
- 1.5 FIELD TEST FLOOR SLAB
 - 1.5.1 Test Floor Slab
- 1.6 SPECIAL REQUIREMENTS
- 1.7 GENERAL REQUIREMENTS
 - 1.7.1 Tolerances
 - 1.7.1.1 Floors
 - 1.7.1.2 Floors by the Straightedge System
 - 1.7.2 Strength Requirements and w/c Ratio
 - 1.7.2.1 Strength Requirements
 - 1.7.2.2 Water-Cement Ratio
 - 1.7.3 Air Entrainment
 - 1.7.4 Slump
 - 1.7.5 Concrete Temperature
 - 1.7.6 Size of Coarse Aggregate
 - 1.7.7 Special Properties and Products
 - 1.7.8 Technical Service for Specialized Concrete
- 1.8 MIXTURE PROPORTIONS
 - 1.8.1 Proportioning Studies for Normal Weight Concrete
 - 1.8.2 Average Compressive Strength Required for Mixtures
 - 1.8.2.1 Computations from Test Records
 - 1.8.2.2 Computations without Previous Test Records
- 1.9 STORAGE OF MATERIALS
- 1.10 GOVERNMENT ASSURANCE INSPECTION AND TESTING
 - 1.10.1 Materials
 - 1.10.2 Fresh Concrete
 - 1.10.3 Hardened Concrete
 - 1.10.4 Inspection

PART 2 PRODUCTS

- 2.1 CEMENTITIOUS MATERIALS
 - 2.1.1 Portland Cement
- 2.2 AGGREGATES
 - 2.2.1 Fine Aggregate
 - 2.2.2 Coarse Aggregate
- 2.3 CHEMICAL ADMIXTURES
 - 2.3.1 Air-Entraining Admixture
 - 2.3.2 Water-Reducing or Retarding Admixture
 - 2.3.3 High-Range Water Reducer (HRWR)
 - 2.3.4 Evaporation Retarder

- 2.3.5 Delete
- 2.3.6 Shrinkage Reducing Admixture
- 2.4 CURING MATERIALS
 - 2.4.1 Impervious-Sheet
 - 2.4.2 Membrane-Forming Compound
 - 2.4.3 Burlap and Cotton Mat
- 2.5 WATER
- 2.6 NONSHRINK GROUT
- 2.7 LATEX MODIFIED NONSAG MORTAR
- 2.8 LATEX BONDING AGENT
- 2.9 EPOXY RESIN
- 2.10 VAPOR BARRIER
- 2.11 JOINT MATERIALS
 - 2.11.1 Joint Fillers, Sealers, and Waterstops
- 2.12 SYNTHETIC FIBERS FOR REINFORCING
- 2.13 Evaporative Retarder

PART 3 EXECUTION

- 3.1 PREPARATION FOR PLACING
 - 3.1.1 Foundations
 - 3.1.1.1 Concrete on Earth Foundations
 - 3.1.2 Preparation of Previously Placed Concrete
- 3.2 CONCRETE PRODUCTION
 - 3.2.1 Portable, Batching, Mixing, and Transporting Concrete
 - 3.2.1.1 General
 - 3.2.1.2 Batching Equipment
 - 3.2.1.3 Scales
 - 3.2.1.4 Portable Batching Tolerances
 - 3.2.1.5 Moisture Control
 - 3.2.1.6 Concrete Mixers
 - 3.2.1.7 Stationary Mixers
- 3.3 CONCRETE PRODUCTION, SMALL PROJECTS
- 3.4 FIBER REINFORCED CONCRETE
- 3.5 TRANSPORTING CONCRETE TO PROJECT SITE
- 3.6 CONVEYING CONCRETE ON SITE
 - 3.6.1 Buckets
 - 3.6.2 Transfer Hoppers
 - 3.6.3 Chutes
 - 3.6.4 Belt Conveyors
 - 3.6.5 Concrete Pumps
- 3.7 PLACING CONCRETE
 - 3.7.1 Depositing Concrete
 - 3.7.2 Consolidation
 - 3.7.3 Hot Weather Requirements
 - 3.7.4 Prevention of Plastic Shrinkage Cracking
- 3.8 JOINTS
 - 3.8.1 Construction Joints
 - 3.8.2 Contraction Joints in Slabs on Grade
 - 3.8.3 Expansion Joints
 - 3.8.4 Dowels and Tie Bars
- 3.9 FINISHING FORMED SURFACES
 - 3.9.1 Class B Finish
 - 3.9.2 Smooth Finish
- 3.10 REPAIRS
 - 3.10.1 Damp-Pack Mortar Repair
 - 3.10.2 Repair of Major Defects
 - 3.10.2.1 Surface Application of Mortar Repair
 - 3.10.2.2 Repair of Deep and Large Defects

- 3.11 FINISHING UNFORMED SURFACES
 - 3.11.1 General
 - 3.11.2 Rough Slab Finish
 - 3.11.3 Floated Finish
 - 3.11.4 Troweled Finish
- 3.12 CURING AND PROTECTION
 - 3.12.1 General
 - 3.12.2 Immersion Curing
- 3.13 SETTING BASE PLATES AND BEARING PLATES
 - 3.13.1 Nonshrink Grout
 - 3.13.1.1 Mixing and Placing of Nonshrink Grout
 - 3.13.1.2 Treatment of Exposed Surfaces
- 3.14 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL
 - 3.14.1 Grading and Corrective Action
 - 3.14.1.1 Fine Aggregate
 - 3.14.1.2 Coarse Aggregate
 - 3.14.2 Quality of Aggregates
 - 3.14.3 Scales, Batching and Recording
 - 3.14.4 Batch-Plant Control
 - 3.14.5 Concrete Mixture
 - 3.14.6 Inspection Before Placing
 - 3.14.7 Placing
 - 3.14.8 Vibrators
 - 3.14.9 Curing Inspection
 - 3.14.10 Mixer Uniformity
 - 3.14.11 Reports

-- End of Section Table of Contents --

SECTION 03300

CAST-IN-PLACE STRUCTURAL CONCRETE

PART 1 GENERAL

1.1 REFERENCES

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

ACI INTERNATIONAL (ACI)

ACI 117/117R	(1990; Errata) Standard Tolerances for Concrete Construction and Materials
ACI 211.1	(1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 214.3R	(1988) Simplified Version of the Recommended Practice for Evaluation of Strength Test Results of Concrete
ACI 301	(1996) Standard Specifications for Structural Concrete
ACI 305R	(1991) Hot Weather Concreting
ACI 318/318R	(1999) Building Code Requirements for Structural Concrete and Commentary

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 31/C 31M	(1998) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(1999a) Concrete Aggregates
ASTM C 39	(1996) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 42	(1999) Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C 78	(1994) Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading)
ASTM C 94	(1999) Ready-Mixed Concrete
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates

ASTM C 143	(1998) Slump of Hydraulic Cement Concrete
ASTM C 150	(1998a) Portland Cement
ASTM C 171	(1997a) Sheet Materials for Curing Concrete
ASTM C 172	(1999) Sampling Freshly Mixed Concrete
ASTM C 192/C 192M	(1998) Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	(1997e1) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(1998) Air-Entraining Admixtures for Concrete
ASTM C 494	(1999) Chemical Admixtures for Concrete
ASTM C 878	(1995, Rev A) Standard Test Method for Restrained Expansion of Shrinkage - Compressive Concrete
ASTM C 881	(1999) Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C 940	(1998a) Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory
ASTM C 1017	(1998) Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C 1059	(1999) Latex Agents for Bonding Fresh to Hardened Concrete
ASTM C 1064/C 1064M	(1999) Temperature of Freshly Mixed Portland Cement Concrete
ASTM C 1077	(1998) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM C 1107	(1999) Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C 1116	(1995) Fiber-Reinforced Concrete and Shotcrete
ASTM D 75	(1987; R 1997) Sampling Aggregates
ASTM E 96	(1995) Water Vapor Transmission of Materials
ASTM E 1745	(1997) Standard Specification for Plastic Water Vapor Retarders Used in Contract

with Soil or Granular Fill under Concrete
Slabs

CORPS OF ENGINEERS (COE)

COE CRD-C 104 (1980) Method of Calculation of the
Fineness Modulus of Aggregate

COE CRD-C 400 (1963) Requirements for Water for Use in
Mixing or Curing Concrete

COE CRD-C 521 (1981) Standard Test Method for Frequency
and Amplitude of Vibrators for Concrete

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST HB 44 (1997) NIST Handbook 44: Specifications,
Tolerances, and Other Technical
Requirements for Weighing and Measuring
Devices

NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA CPMB 100 (1996) Concrete Plant Standards

NRMCA TMMB 100 (1994) Truck Mixer Agitator and Front
Discharge Concrete Carrier Standards

NRMCA QC 3 (1984) Quality Control Manual: Section 3,
Plant Certifications Checklist:
Certification of Ready Mixed Concrete
Production Facilities

1.2 LUMP SUM CONTRACT

Under this type of contract concrete items will be paid for by lump sum and will not be measured. The work covered by these items consists of furnishing all concrete materials, reinforcement, miscellaneous embedded materials, and equipment, and performing all labor for the forming, manufacture, transporting, placing, finishing, curing, and protection of concrete in these structures.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-08 Statements

Mixture Proportions; GA.

The results of trial mixture design studies along with a statement giving the maximum nominal coarse aggregate size and the proportions of ingredients that will be used in the manufacture of each strength or class of concrete, at least 14 days prior to commencing concrete placing operations. Aggregate weights shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an

approved independent commercial testing laboratory, showing that mixture design studies have been made with materials proposed for the project and that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the mixture design studies without additional tests to show that the quality of the concrete is satisfactory.

SD-09 Reports

Testing and Inspection for Contractor Quality Control; GA.

Certified copies of laboratory test reports, including mill tests and all other test data, for portland cement, blended cement, pozzolan, ground granulated blast furnace slag, silica fume, aggregate, admixtures, and curing compound proposed for use on this project.

SD-13 Certificates

Qualifications; GA.

Written documentation for Contractor Quality Control personnel.

SD-14 Samples

Surface Retarder; FIO.

Surface retarder material with manufacturer's instructions for application in conjunction with air-water cutting.

1.4 QUALIFICATIONS

Contractor Quality Control personnel assigned to concrete construction shall be American Concrete Institute (ACI) Certified Workmen in one of the following grades or shall have written evidence of having completed similar qualification programs:

Concrete Field Testing Technician, Grade I
Concrete Laboratory Testing Technician, Grade I or II
Concrete Construction Inspector, Level II

Concrete Transportation Construction Inspector or
Reinforced Concrete Special Inspector, Jointly certified by American Concrete Institute (ACI), Building Official and Code Administrators International (BOCA), International Conference of Building Officials (ICBO), and Southern Building Code Congress International (SBCCI).

The foreman or lead journeyman of the flatwork finishing crew shall have similar qualification for ACI Concrete Flatwork Technician/Finisher or equal, with written documentation.

1.5 FIELD TEST FLOOR SLAB

Field test slabs shall be constructed 3 months prior to beginning of work using the materials and procedures proposed for use on the job, to demonstrate the results to be attained. The quality and appearance of the test slab shall be subject to the approval of the Contracting Officer, and, if not judged satisfactory, additional test slabs shall be constructed until approval is attained. Formed or finished surfaces in the completed

structure shall match the quality and appearance of the approved field example.

1.5.1 Test Floor Slab

The test floor slab shall be at least 4 feet by 5 feet and 6 inches thick. A full length expansion joint shall be constructed at the center of the test floor slab. All materials used for the actual expansion joint shall be used in the test floor slab. The concrete used for the test floor slab shall contain all admixtures used for the actual concrete. The test floor slab can be constructed in Honolulu or in Kwajalein and shall be available to the Contracting Officer for inspection.

1.6 SPECIAL REQUIREMENTS

A pre-installation meeting with the Contracting Officer will be required at least 10 days prior to start of construction. The Contractor shall be responsible for calling the meeting; the Project Superintendent and active installation personnel shall be present.

1.7 GENERAL REQUIREMENTS

1.7.1 Tolerances

Except as otherwise specified herein, tolerances for concrete batching, mixture properties, and construction as well as definition of terms and application practices shall be in accordance with ACI 117/117R. Level and grade tolerance measurements of slabs shall be made as soon as possible after finishing; when forms or shoring are used, the measurements shall be made prior to removal.

1.7.1.1 Floors

For the purpose of this Section the following terminology correlation between ACI 117/117R and this Section shall apply:

Floor Profile Quality Classification From ACI 117/117R -----	This Section -----
Conventional Bullfloated	Same
Conventional Straightedged	Same
Flat	Float Finish or Trowel Finish
Very Flat	Same. Use only with F-system

Levelness tolerance shall apply where design requires floors to be sloped to drains or sloped for other reasons.

1.7.1.2 Floors by the Straightedge System

The flatness of the floors shall be carefully controlled and the tolerances shall be measured by the straightedge system as specified in paragraph 4.5.7 of ACI 117/117R, using a 5 foot and adjusted for slopes to drain, straightedge and adjusted for slopes to drain, within 72 hours after floor slab installation and before shores and/or forms are removed. The listed tolerances shall be met at any and every location at which the straightedge can be placed.

Bullfloated 1/2 inches

Straightedged 5/16 inches
 Float Finish 1/4 inches
 Trowel Finish 3/16 inches

1.7.2 Strength Requirements and w/c Ratio

1.7.2.1 Strength Requirements

Specified compressive strength (f'c) shall be as follows:

COMPRESSIVE STRENGTH	STRUCTURE OR PORTION OF STRUCTURE
4000 psi at 28 days	All

Compressive strength shall be determined in accordance with ASTM C 39.

- a. Evaluation of Concrete Compressive Strength. Compressive strength specimens (6 by 12 inch cylinders) shall be fabricated by the Contractor and laboratory cured in accordance with ASTM C 31/C 31M and tested in accordance with ASTM C 39. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified compressive strength f'c and no individual test result falls below the specified strength f'c by more than 500 psi. A "test" is defined as the average of two companion cylinders, or if only one cylinder is tested, the results of the single cylinder test. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the structure is considered potentially deficient.
- b. Investigation of Low-Strength Compressive Test Results. When any strength test of standard-cured test cylinders falls below the specified strength requirement by more than 500 psi or if tests of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that the load-carrying capacity of the structure is not jeopardized. When the strength of concrete in place is considered potentially deficient, cores shall be obtained and tested in accordance with ASTM C 42. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores will be determined by the Contracting Officer to least impair the strength of the structure. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified strength requirement. Non-destructive tests (tests other than test cylinders or cores) shall not be used as a basis for acceptance or rejection. The Contractor shall perform the coring and repair the holes. Cores will be tested by the Government.
- c. Load Tests. If the core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of the structure, load tests may be directed by the Contracting Officer in accordance with the requirements of ACI 318/318R. Concrete work evaluated by structural analysis or by results of a load test as being understrength shall be corrected in a manner

satisfactory to the Contracting Officer. All investigations, testing, load tests, and correction of deficiencies shall be performed by and at the expense of the Contractor and must be approved by the Contracting Officer, except that if all concrete is found to be in compliance with the drawings and specifications, the cost of investigations, testing, and load tests will be at the expense of the Government.

1.7.2.2 Water-Cement Ratio

Maximum water-cement ratio (w/c) for normal weight concrete shall be as follows:

WATER-CEMENT RATIO, BY WEIGHT	STRUCTURE OR PORTION OF STRUCTURE
0.45	All

These w/c's may cause higher strengths than that required above for compressive or flexural strength. The maximum w/c required will be the equivalent w/c as determined by conversion from the weight ratio of water to cement plus pozzolan, by the weight equivalency method as described in ACI 211.1.

1.7.3 Air Entrainment

Air Entrainment shall be required.

1.7.4 Slump

Slump of the concrete, as delivered to the point of placement into the forms, shall be within the following limits. Slump shall be determined in accordance with ASTM C 143.

Structural Element	Slump	
_____	Minimum	Maximum
_____	_____	_____
Foundation walls, substructure walls, footings, slabs	5 in.	6 in.

When use of a plasticizing admixture conforming to ASTM C 1017 or when a Type F or G high range water reducing admixture conforming to ASTM C 494 is permitted to increase the slump of concrete, concrete shall have a slump of 2 to 4 inches before the admixture is added and a maximum slump of 8 inches at the point of delivery after the admixture is added.

All normal weight concrete shall be air entrained to contain between 4 and 7 percent total air, except that when the nominal maximum size coarse aggregate is 3/4 inch or smaller it shall be between 3.5 and 5.5 percent. Concrete with specified strength over 5000 psi may have 1.0 percent less air than specified above. Specified air content for normal weight concrete shall be determined in accordance with ASTM C 231.

1.7.5 Concrete Temperature

The temperature of the concrete as delivered shall not exceed 90 degrees F.

Concrete for the main water tank floor shall be placed at night between the hours of 08:00 pm and 06:00 AM.

1.7.6 Size of Coarse Aggregate

The largest feasible nominal maximum size aggregate (NMSA) specified in paragraph AGGREGATES shall be used in each placement. However, nominal maximum size of aggregate shall not exceed any of the following: three-fourths of the minimum cover for reinforcing bars, three-fourths of the minimum clear spacing between reinforcing bars, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

1.7.7 Special Properties and Products

Concrete may contain admixtures other than air entraining agents, such as water reducers, superplasticizers, or set retarding agents to provide special properties to the concrete, if specified or approved. Any of these materials to be used on the project shall be used in the mix design studies. Admixture manufacturer shall provide written document showing compatibility of all materials.

1.7.8 Technical Service for Specialized Concrete

The services of a factory trained technical representative shall be obtained to oversee proportioning, batching, mixing, placing, consolidating, and finishing of concrete with HWWR admixture. A factory trained technical representative shall be present on site for the High-Range Water Reducer (HRWR) admixture. The technical representative shall be on the job full time until the Contracting Officer is satisfied that field controls indicate concrete of specified quality is furnished and that the Contractor's crews are capable of continued satisfactory work. The technical representative shall be available for consultation with, and advice to, Government forces.

1.8 MIXTURE PROPORTIONS

Concrete shall be composed of portland cement, other cementitious and pozzolanic materials as specified, aggregates, water and admixtures as specified.

1.8.1 Proportioning Studies for Normal Weight Concrete

Trial design batches, mixture proportioning studies, and testing requirements for various classes and types of concrete specified shall be the responsibility of the Contractor. Except as specified for flexural strength concrete, mixture proportions shall be based on compressive strength as determined by test specimens fabricated in accordance with ASTM C 192/C 192M and tested in accordance with ASTM C 39. Samples of all materials used in mixture proportioning studies shall be representative of those proposed for use in the project and shall be accompanied by the manufacturer's or producer's test reports indicating compliance with these specifications. Trial mixtures having proportions, consistencies, and air content suitable for the work shall be made based on methodology described in ACI 211.1, using at least three different water-cement ratios for each type of mixture, which will produce a range of strength encompassing those required for each class and type of concrete required on the project. The maximum water-cement ratios required in subparagraph Water-Cement Ratio. Laboratory trial mixtures shall be designed for maximum permitted slump and

air content. Separate sets of trial mixture studies shall be made for each combination of cementitious materials and each combination of admixtures proposed for use. No combination of either shall be used until proven by such studies, except that, if approved in writing and otherwise permitted by these specifications, an accelerator or a retarder may be used without separate trial mixture study. Separate trial mixture studies shall also be made for concrete for any conveying or placing method proposed which requires special properties and for concrete to be placed in unusually difficult placing locations. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio, at least three test cylinders for each test age shall be made and cured in accordance with ASTM C 192/C 192M. They shall be tested at 7 and 28 days in accordance with ASTM C 39. From these test results, a curve shall be plotted showing the relationship between water-cement ratio and strength for each set of trial mix studies. In addition, a curve shall be plotted showing the relationship between 7 day and 28 day strengths. Each mixture shall be designed to promote easy and suitable concrete placement, consolidation and finishing, and to prevent segregation and excessive bleeding.

1.8.2 Average Compressive Strength Required for Mixtures

The mixture proportions selected during mixture design studies shall produce a required average compressive strength (f'_{cr}) exceeding the specified compressive strength (f'_c) by the amount indicated below. This required average compressive strength, f'_{cr} , will not be a required acceptance criteria during concrete production. However, whenever the daily average compressive strength at 28 days drops below f'_{cr} during concrete production, or daily average 7-day strength drops below a strength correlated with the 28-day f'_{cr} , the mixture shall be adjusted, as approved, to bring the daily average back up to f'_{cr} . During production, the required f'_{cr} shall be adjusted, as appropriate, based on the standard deviation being attained on the job.

1.8.2.1 Computations from Test Records

Where a concrete production facility has test records, a standard deviation shall be established in accordance with the applicable provisions of ACI 214.3R. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected; shall represent concrete produced to meet a specified strength or strengths (f'_c) within 1,000 psi of that specified for proposed work; and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. Required average compressive strength f'_{cr} used as the basis for selection of concrete proportions shall be the larger of the equations that follow using the standard deviation as determined above:

$$f'_{cr} = f'_c + 1.34S \text{ where units are in psi}$$

$$f'_{cr} = f'_c + 2.33S - 500 \text{ where units are in psi}$$

Where S = standard deviation

Where a concrete production facility does not have test records meeting the requirements above but does have a record based on 15 to 29 consecutive tests, a standard deviation shall be established as the product of the calculated standard deviation and a modification factor from the following table:

NUMBER OF TESTS	MODIFICATION FACTOR FOR STANDARD DEVIATION
15	1.16
20	1.08
25	1.03
30 or more	1.00

1.8.2.2 Computations without Previous Test Records

When a concrete production facility does not have sufficient field strength test records for calculation of the standard deviation, the required average strength f'_{cr} shall be determined as follows:

- a. If the specified compressive strength f'_c is less than 3,000 psi,
 $f'_{cr} = f'_c + 1000$ psi
- b. If the specified compressive strength f'_c is 3,000 to 5,000 psi,
 $f'_{cr} = f'_c + 1,200$ psi
- c. If the specified compressive strength f'_c is over 5,000 psi,
 $f'_{cr} = f'_c + 1,400$ psi

1.9 STORAGE OF MATERIALS

Cement and other cementitious materials shall be stored in weathertight buildings, bins, or silos which will exclude moisture and contaminants and keep each material completely separated. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of aggregates. Aggregate shall not be stored directly on ground unless a sacrificial layer is left undisturbed. Reinforcing bars and accessories shall be stored above the ground on platforms, skids or other supports. Other materials shall be stored in such a manner as to avoid contamination and deterioration. Admixtures which have been in storage at the project site for longer than 6 months or which have been subjected to freezing shall not be used unless retested and proven to meet the specified requirements. Materials shall be capable of being accurately identified after bundles or containers are opened.

1.10 GOVERNMENT ASSURANCE INSPECTION AND TESTING

Day-to day inspection and testing shall be the responsibility of the Contractor Quality Control (CQC) staff. However, representatives of the Contracting Officer can and will inspect construction as considered appropriate and will monitor operations of the Contractor's CQC staff. Government inspection or testing will not relieve the Contractor of any of his CQC responsibilities.

1.10.1 Materials

The Government will sample and test aggregates, cementitious materials, other materials, and concrete to determine compliance with the specifications as considered appropriate. The Contractor shall provide facilities and labor as may be necessary for procurement of representative

test samples. Samples of aggregates will be obtained at the point of batching in accordance with ASTM D 75. Other materials will be sampled from storage at the jobsite or from other locations as considered appropriate. Samples may be placed in storage for later testing when appropriate.

1.10.2 Fresh Concrete

Fresh concrete will be sampled as delivered in accordance with ASTM C 172 and tested in accordance with these specifications, as considered necessary.

1.10.3 Hardened Concrete

Tests on hardened concrete will be performed by the Government when such tests are considered necessary.

1.10.4 Inspection

Concrete operations may be tested and inspected by the Government as the project progresses. Failure to detect defective work or material will not prevent rejection later when a defect is discovered nor will it obligate the Government for final acceptance.

PART 2 PRODUCTS

2.1 CEMENTITIOUS MATERIALS

Cementitious Materials shall be portland cement or portland-pozzolan and shall conform to appropriate specifications listed below.

2.1.1 Portland Cement

ASTM C 150, type II including false set requirements.

2.2 AGGREGATES

Aggregates shall conform to the following.

2.2.1 Fine Aggregate

Fine aggregate shall conform to the quality and gradation requirements of ASTM C 33.

2.2.2 Coarse Aggregate

Coarse aggregate shall conform to ASTM C 33, Class 5S, size designation 67.

2.3 CHEMICAL ADMIXTURES

Chemical admixtures, when required or permitted, shall conform to the appropriate specification listed. Admixtures shall be furnished in liquid form and of suitable concentration for easy, accurate control of dispensing.

2.3.1 Air-Entraining Admixture

Air-Entraining Admixture shall not be used.

2.3.2 Water-Reducing or Retarding Admixture

ASTM C 260 and shall consistently entrain the air content in the specified ranges under field conditions.

2.3.3 High-Range Water Reducer (HRWR)

Eucon 37, Euclid chemical company or approved equal IAW ASTM C 494, Type F or G, except that the 6-month and 1-year strength requirements are waived.

2.3.4 Evaporation Retarder

Eucobar , Euclid Chemical Company, or approved equal.

2.3.5 Delete

2.3.6 Shrinkage Reducing Admixture

Shrinkage Reducing Admixture shall be Eclipse Shrinkage Reducing Admixture, by Grace Construction Products, or approved equal. Approved equal product shall be capable of 25% minimum reduction of ultimate drying shrinkage and shall be NSF approved for potable water tanks. Maximum reduction of specified 28 day concrete compressive strength shall be 15% (600 psi) to 3400 psi. The admixture shall be formulated and applied in accordance with the manufacturer's recommendations.

2.4 CURING MATERIALS

2.4.1 Impervious-Sheet

Impervious-sheet materials shall conform to ASTM C 171, type optional, except, that polyethylene sheet shall not be used.

2.4.2 Membrane-Forming Compound

Membrane-Forming curing compound shall not be used.

2.4.3 Burlap and Cotton Mat

Burlap and cotton mat shall not be used.

2.5 WATER

Water for mixing and curing shall be fresh, clean, potable, and free of injurious amounts of oil, acid, salt, or alkali, except that non-potable water may be used if it meets the requirements of COE CRD-C 400.

2.6 NONSHRINK GROUT

Nonshrink grout shall conform to ASTM C 1107, and shall be a commercial formulation suitable for the proposed application.

2.7 LATEX MODIFIED NONSAG MORTAR

Latex Modified Nonsag Mortar for Vertical Concrete Surface Repairs shall be one of the following materials (or approved equal)

Vertical Supreme, Euclid Chemical Company
Thorite Rapid Vertical, Bonded Manufacturing Company
Polyfast, Dayton Superior Company
Tamms Speed Crete

Approved equal material shall be latex modified nonsag cement based mortar suitable for vertical application without forming, having a 7 day compressive strength of 5000 psi and flexural strength of 650 psi. Surface preparation shall consist of sandblasting, and mechanical scarifying of the entire surface on which material is to be placed.

2.8 LATEX BONDING AGENT

Latex agents for bonding fresh to hardened concrete shall conform to ASTM C 1059.

2.9 EPOXY RESIN

Epoxy resins for use in repairs shall conform to ASTM C 881, Type V. Grade and Class as appropriate for application.

2.10 VAPOR BARRIER

Vapor barrier material shall have the following properties:

Minimum 15-mil tick polyolefin geomembrane
Manufactured with ISO certified virgin resins.
Water Vapor Retarder ASTM E 1745 meets or exceeds Class B requirements with following modification;
Permeance Rating ASTM E 96 not exceeding 0.02 Perms

2.11 JOINT MATERIALS

2.11.1 Joint Fillers, Sealers, and Waterstops

Materials for expansion joints and waterstops shall be in accordance with Section 03150 EXPANSION JOINTS, CONTRACTION JOINTS and joint sealants for expansion joints.

2.12 SYNTHETIC FIBERS FOR REINFORCING

Concrete shall contain synthetic fibers conforming to ASTM C 1116, Type III, Synthetic Fiber 7.5 lbs per cy. Fibers shall be 100 percent virgin polypropylene fibrillated fibers containing no reprocessed olefin materials. Fibers shall have a specific gravity of 0.9, a minimum tensile strength of 70 ksi graded per manufacturer, and specifically manufactured to an optimum gradation for use as concrete secondary reinforcement.

2.13 Evaporative Retarder

Evaporative Retarder shall be sprayed over the fresh concrete surface immediately after bullfloating of the concrete floor slab. The evaporative retarder shall be Eucobar, by Euclid Chemical Company or approved equal. Spray equipment, mixing and application rate, installation shall be per manufacturers instructions. The evaporative retarder shall be used only to prevent rapid evaporation of the concrete slab moisture and shall not be used as a finishing aid.

PART 3 EXECUTION

3.1 PREPARATION FOR PLACING

Before commencing concrete placement, the following shall be performed.

Surfaces to receive concrete shall be clean and free from mastic. Forms shall be in place, cleaned, coated, and adequately supported. Reinforcing steel shall be in place, cleaned, tied, and adequately supported, in accordance with Section 03200 CONCRETE REINFORCEMENT. Transporting and conveying equipment shall be in-place, ready for use, clean, and free of hardened concrete and foreign material. Equipment for consolidating concrete shall be at the placing site and in proper working order. Equipment and material for curing and for protecting concrete from weather or mechanical damage shall be at the placing site, in proper working condition and in sufficient amount for the entire placement. When hot, windy conditions during concreting appear probable, equipment and material shall be at the placing site to provide windbreaks, shading, fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete.

3.1.1 Foundations

3.1.1.1 Concrete on Earth Foundations

Earth (subgrade, base, or subbase courses) surfaces upon which concrete is to be placed shall be clean, damp, and free from debris, and standing or running water. Prior to placement of concrete, the foundation shall be well drained and shall be satisfactorily graded and uniformly compacted.

3.1.2 Preparation of Previously Placed Concrete

Concrete surfaces to which other concrete is to be bonded shall be abraded in an approved manner that will expose sound aggregate uniformly without damaging the concrete. Laitance and loose particles shall be removed. Apply epoxy bonding agent immediately prior to placing new concrete.

3.2 CONCRETE PRODUCTION

3.2.1 Portable, Batching, Mixing, and Transporting Concrete

All concrete shall be batched after sunset and before sunrise. Concrete shall either be batched and mixed onsite by on-site batch plant and transpoiled accordance with ASTM C 94. Concrete truck mixers shall not be used. Concrete shall be batched and mixed onsite, or close to onsite, and shall conform to the following subparagraphs.

3.2.1.1 General

The batching plant shall be located on site in the general area approved by the Contracting Officer. The batching, mixing and placing system shall have a capacity of at least 75 cubic yards per hour. The batching plant shall conform to the requirements of NRMCA CPMB 100 and as specified; however, rating plates attached to batch plant equipment are not required.

3.2.1.2 Batching Equipment

The batching controls shall be semiautomatic or automatic, as defined in NRMCA CPMB 100. A semiautomatic batching system shall be provided with interlocks such that the discharge device cannot be actuated until the indicated material is within the applicable tolerance. The batching system shall be equipped with accurate recorder or recorders that meet the requirements of NRMCA CPMB 100. The weight of water and admixtures shall be recorded if batched by weight. Separate bins or compartments shall be provided for each size group of aggregate and type of cementitious

material, to prevent intermingling at any time. Aggregates shall be weighed either in separate weigh batchers with individual scales or, provided the smallest size is batched first, cumulatively in one weigh batcher on one scale. Aggregate shall not be weighed in the same batcher with cementitious material. If both portland cement and other cementitious material are used, they may be batched cumulatively, provided that the portland cement is batched first, except that silica fume shall always be batched separately. Water may be measured by weight or volume. Water shall not be weighed or measured cumulatively with another ingredient. Filling and discharging valves for the water metering or batching system shall be so interlocked that the discharge valve cannot be opened before the filling valve is fully closed. Piping for water and for admixtures shall be free from leaks and shall be properly valved to prevent backflow or siphoning. Admixtures shall be furnished as a liquid of suitable concentration for easy control of dispensing. An adjustable, accurate, mechanical device for measuring and dispensing each admixture shall be provided. Each admixture dispenser shall be interlocked with the batching and discharging operation of the water so that each admixture is separately batched and individually discharged automatically in a manner to obtain uniform distribution throughout the water as it is added to the batch in the specified mixing period. When use of truck mixers makes this requirement impractical, the admixture dispensers shall be interlocked with the sand batchers. Different admixtures shall not be combined prior to introduction in water and shall not be allowed to intermingle until in contact with the cement. Admixture dispensers shall have suitable devices to detect and indicate flow during dispensing or have a means for visual observation. The plant shall be arranged so as to facilitate the inspection of all operations at all times. Suitable facilities shall be provided for obtaining representative samples of aggregates from each bin or compartment, and for sampling and calibrating the dispensing of cementitious material, water, and admixtures. Filling ports for cementitious materials bins or silos shall be clearly marked with a permanent sign stating the contents.

3.2.1.3 Scales

The weighing equipment shall conform to the applicable requirements of CPMB Concrete Plant Standard, and of NIST HB 44, except that the accuracy shall be plus or minus 0.2 percent of scale capacity. The Contractor shall provide standard test weights and any other auxiliary equipment required for checking the operating performance of each scale or other measuring devices. The tests shall be made at the specified frequency in the presence of a Government inspector. The weighing equipment shall be arranged so that the plant operator can conveniently observe all dials or indicators.

3.2.1.4 Portable Batching Tolerances

(A) Tolerances with Weighing Equipment

MATERIAL	PERCENT OF REQUIRED WEIGHT
Cementitious materials	0 to plus 2
Aggregate	plus or minus 2
Water	plus or minus 1
Chemical admixture	0 to plus 6

MATERIAL	PERCENT OF REQUIRED WEIGHT
----------	-------------------------------

(B) Tolerances with Volumetric Equipment

For volumetric batching equipment used for water and admixtures, the following tolerances shall apply to the required volume of material being batched:

MATERIAL	PERCENT OF REQUIRED MATERIAL
Water:	plus or minus 1 percent
Chemical admixtures:	0 to plus 6 percent

3.2.1.5 Moisture Control

The plant shall be capable of ready adjustment to compensate for the varying moisture content of the aggregates and to change the weights of the materials being batched.

3.2.1.6 Concrete Mixers

Mixers shall be stationary mixers. Mixers shall be capable of combining the materials into a uniform mixture and of discharging this mixture without segregation. The mixers shall not be charged in excess of the capacity recommended by the manufacturer. The mixers shall be operated at the drum or mixing blade speed designated by the manufacturer. The mixers shall be maintained in satisfactory operating condition, and the mixer drums shall be kept free of hardened concrete. Should any mixer at any time produce unsatisfactory results, its use shall be promptly discontinued until it is repaired.

3.2.1.7 Stationary Mixers

Concrete plant mixers shall be drum-type mixers of tilting, nontilting, horizontal-shaft, or vertical-shaft type, or shall be pug mill type and shall be provided with an acceptable device to lock the discharge mechanism until the required mixing time has elapsed. The mixing time and uniformity shall conform to all the requirements in ASTM C 94 applicable to central-mixed concrete.

3.3 CONCRETE PRODUCTION, SMALL PROJECTS

Batch-type equipment shall be used for producing concrete. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C 94, except as otherwise specified. Agitators, and nonagitating transporting units shall comply with NRMCA TMMB 100. Ready-mix plant equipment and facilities shall be certified in accordance with NRMCA QC 3. Approved batch tickets shall be furnished for each load of ready-mixed concrete. Site-mixed concrete shall be produced in accordance with ACI 301, and plant shall conform to NRMCA CPMB 100.

3.4 FIBER REINFORCED CONCRETE

Fiber reinforced concrete shall conform to ASTM C 1116 and as follows, using the fibers specified in PART 2. A minimum of 1.5 pounds of fibers per cubic yard of concrete shall be used. Fibers shall be added at the

batch plant. Toughness indices shall meet requirements for performance level I of ASTM C 1116. The services of a qualified technical representative shall be provided to instruct the concrete supplier in proper batching and mixing of materials to be provided.

3.5 TRANSPORTING CONCRETE TO PROJECT SITE

Concrete shall be transported to the placing site in agitators, nonagitating transporting equipment conforming to NRMCA TMMB 100 or by approved pumping equipment or conveyors.

3.6 CONVEYING CONCRETE ON SITE

Concrete shall be conveyed from mixer or transporting unit to forms as rapidly as possible and within the time interval specified by methods which will prevent segregation or loss of ingredients using following equipment. Conveying equipment shall be cleaned before each placement.

3.6.1 Buckets

The interior hopper slope shall be not less than 58 degrees from the horizontal, the minimum dimension of the clear gate opening shall be at least 5 times the nominal maximum-size aggregate, and the area of the gate opening shall not be less than 2 square feet. The maximum dimension of the gate opening shall not be greater than twice the minimum dimension. The bucket gates shall be essentially grout tight when closed and may be manually, pneumatically, or hydraulically operated except that buckets larger than 2 cubic yards shall not be manually operated. The design of the bucket shall provide means for positive regulation of the amount and rate of deposit of concrete in each dumping position.

3.6.2 Transfer Hoppers

Concrete may be charged into nonagitating hoppers for transfer to other conveying devices. Transfer hoppers shall be capable of receiving concrete directly from delivery vehicles and shall have conical-shaped discharge features. The transfer hopper shall be equipped with a hydraulically operated gate and with a means of external vibration to effect complete discharge. Concrete shall not be held in nonagitating transfer hoppers more than 30 minutes.

3.6.3 Chutes

When concrete can be placed directly from a truck mixer, agitator, or nonagitating equipment, the chutes normally attached to this equipment by the manufacturer may be used. A discharge deflector shall be used when required by the Contracting Officer. Separate chutes and other similar equipment will not be permitted for conveying concrete.

3.6.4 Belt Conveyors

Belt conveyors shall be designed and operated to assure a uniform flow of concrete from mixer to final place of deposit without segregation of ingredients or loss of mortar and shall be provided with positive means, such as discharge baffle or hopper, for preventing segregation of the concrete at the transfer points and the point of placing. Belt conveyors shall be constructed such that the idler spacing shall not exceed 36 inches.

The belt speed shall be a minimum of 300 feet per minute and a maximum of 750 feet per minute. If concrete is to be placed through installed

horizontal or sloping reinforcing bars, the conveyor shall discharge concrete into a pipe or elephant truck that is long enough to extend through the reinforcing bars.

3.6.5 Concrete Pumps

Concrete may be conveyed by positive displacement pump when approved. The pumping equipment shall be piston or squeeze pressure type; pneumatic placing equipment shall not be used. The pipeline shall be rigid steel pipe or heavy-duty flexible hose. The inside diameter of the pipe shall be at least 3 times the nominal maximum-size coarse aggregate in the concrete mixture to be pumped but not less than 4 inches. Aluminum pipe shall not be used.

3.7 PLACING CONCRETE

Mixed concrete shall be discharged within 1-1/2 hours or before the mixer drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates. When the concrete temperature exceeds 85 degrees F, the time shall be reduced to 45 minutes. Concrete shall be placed within 15 minutes after it has been discharged from the transporting unit. Concrete shall be handled from mixer or transporting unit to forms in a continuous manner until the approved unit of operation is completed. Adequate scaffolding, ramps and walkways shall be provided so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities furnished by the Contractor prevent proper consolidation, finishing and curing. Sufficient placing capacity shall be provided so that concrete can be kept free of cold joints.

3.7.1 Depositing Concrete

Concrete shall be deposited as close as possible to its final position in the forms, and there shall be no vertical drop greater than 5 feet except where suitable equipment is provided to prevent segregation and where specifically authorized. Depositing of the concrete shall be so regulated that it will be effectively consolidated in horizontal layers not more than 12 inches thick, except that all slabs shall be placed in a single layer. Concrete to receive other construction shall be screeded to the proper level. Concrete shall be deposited continuously in one layer or in layers so that fresh concrete is deposited on in-place concrete that is still plastic. Fresh concrete shall not be deposited on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within the section. Concrete that has surface dried, partially hardened, or contains foreign material shall not be used. When temporary spreaders are used in the forms, the spreaders shall be removed as their service becomes unnecessary. Concrete shall not be placed in slabs over columns and walls until concrete in columns and walls has been in-place at least two hours or until the concrete begins to lose its plasticity. Concrete for beams, girders, brackets, column capitals, haunches, and drop panels shall be placed at the same time as concrete for adjoining slabs.

3.7.2 Consolidation

Immediately after placing, each layer of concrete shall be consolidated by internal vibrators, except for slabs 4 inches thick or less. The vibrators shall at all times be adequate in effectiveness and number to properly consolidate the concrete; a spare vibrator shall be kept at the jobsite

during all concrete placing operations. The vibrators shall have a frequency of not less than 10,000 vibrations per minute, an amplitude of at least 0.025 inch, and the head diameter shall be appropriate for the structural member and the concrete mixture being placed. Vibrators shall be inserted vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator so that the area being vibrated will overlap the adjacent just-vibrated area by a reasonable amount. The vibrator shall penetrate rapidly to the bottom of the layer and at least 6 inches into the preceding layer if there is such. Vibrator shall be held stationary until the concrete is consolidated and then vertically withdrawn slowly while operating. Form vibrators shall not be used unless specifically approved and unless forms are constructed to withstand their use. Vibrators shall not be used to move concrete within the forms. Slabs 4 inches and less in thickness shall be consolidated by properly designed vibrating screeds or other approved technique. Excessive vibration of lightweight concrete resulting in segregation or flotation of coarse aggregate shall be prevented. Frequency and amplitude of vibrators shall be determined in accordance with COE CRD-C 521. Grate tampers ("jitterbugs") shall not be used.

3.7.3 Hot Weather Requirements

Concrete shall be placed at night. When the ambient temperature during concrete placing is expected to exceed 85 degrees F, the concrete shall be placed and finished with procedures previously submitted and as specified herein. The concrete temperature at time of delivery to the forms shall not exceed the temperature shown in the table below when measured in accordance with ASTM C 1064/C 1064M. Cooling of the mixing water or aggregates or placing concrete in the cooler part of the day may be required to obtain an adequate placing temperature. A retarder may be used, as approved, to facilitate placing and finishing. Steel forms and reinforcements shall be cooled as approved prior to concrete placement when steel temperatures are greater than 120 degrees F. Conveying and placing equipment shall be cooled if necessary to maintain proper concrete-placing temperature.

Maximum Allowable Concrete Placing Temperature

Relative Humidity, Percent, During Time of Concrete Placement	Maximum Allowable Concrete Temperature Degrees
Greater than 60	90 F
40-60	85 F
Less than 40	80 F

3.7.4 Prevention of Plastic Shrinkage Cracking

During hot weather with low humidity, and particularly with appreciable wind, the Contractor shall be alert to the tendency for plastic shrinkage cracks to develop and shall institute measures to prevent this. Particular care shall be taken if plastic shrinkage cracking is potentially imminent and especially if it has developed during a previous placement. Periods of high potential for plastic shrinkage cracking can be anticipated by use of Fig. 2.1.5 of ACI 305R. In addition the concrete placement shall be further protected by erecting shades and windbreaks and by applying fog sprays of water, sprinkling, ponding or wet covering. Plastic shrinkage

cracks that occur shall be filled by injection of epoxy resin as directed, after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry.

3.8 JOINTS

Joints shall be located and constructed only as indicated or approved.

3.8.1 Construction Joints

Construction joints are not permitted.

3.8.2 Contraction Joints in Slabs on Grade

There are no contraction joints for the tank slab.

3.8.3 Expansion Joints

Installation of expansion joints and sealing of these joints shall conform to the requirements of Section 03150 EXPANSION JOINTS.

3.8.4 Dowels and Tie Bars

Dowels and tie bars shall be installed at the locations shown on the drawings and to the details shown, using materials and procedures specified in Section 03200 CONCRETE REINFORCEMENT and herein. Conventional smooth "paving" dowels shall be installed in slabs using approved methods to hold the dowel in place during concreting within a maximum alignment tolerance of 1/8 inch in 12 inches. "Structural" type deformed bar dowels, or tie bars, shall be installed to meet the specified tolerances. Care shall be taken during placing adjacent to and around dowels and tie bars to ensure there is no displacement of the dowel or tie bar and that the concrete completely embeds the dowel or tie bar and is thoroughly consolidated.

3.9 FINISHING FORMED SURFACES

Finishing of formed surfaces shall be as specified herein. Unless another type of architectural or special finish is specified, surfaces shall be left with the texture imparted by the forms except that defective surfaces shall be repaired. Unless painting of surfaces is required, uniform color of the concrete shall be maintained by use of only one mixture without changes in materials or proportions for any structure or portion of structure that requires a Class A or B finish. Except for major defects, as defined hereinafter, surface defects shall be repaired as specified herein within 24 hours after forms are removed. Repairs of the so-called "plaster-type" will not be permitted in any location. Tolerances of formed surfaces shall conform to the requirements of ACI 117/117R. These tolerances apply to the finished concrete surface, not to the forms themselves; forms shall be set true to line and grade. Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter shall be repaired as specified in paragraph Damp-Pack Mortar Repair. Defects whose surface diameter is greater than their depth shall be repaired as specified in paragraph Repair of Major Defects. Repairs shall be finished flush with adjacent surfaces and with the same surface texture. The cement used for all repairs shall be a blend of job cement with white cement proportioned so that the final color after curing and aging will be the same as the adjacent concrete. Concrete with excessive honeycomb, or other defects which affect the strength of the member, will be rejected. Repairs shall be demonstrated to be acceptable

and free from cracks or loose or drummy areas at the completion of the contract and, for Class A and B Finishes, shall be inconspicuous. Repairs not meeting these requirements will be rejected and shall be replaced.

3.9.1 Class B Finish

Class B finish is required to all formed concrete surfaces. Fins, ravelings, and loose material shall be removed, all surface defects over 1/2 inch in diameter or more than 1/2 inch deep, shall be repaired and, except as otherwise indicated. Defects more than 1/2 inch in diameter shall be cut back to sound concrete, but in all cases at least 1 inch deep.

The Contractor shall prepare a sample panel for approval (as specified in PART 1) before commencing repair, showing that the surface texture and color match will be attained.

3.9.2 Smooth Finish

After other concrete construction is complete in each overall separate contiguous area of the structure, smooth finish shall be applied to the areas indicated on the drawings. A mortar mix consisting of one part portland cement and two parts well-graded sand passing a No. 30 sieve, with water added to give the consistency of thick paint, shall be used. Where the finished surface will not receive other applied surface, white cement shall be used to replace part of the job cement to produce an approved color, which shall be uniform throughout the surfaces of the structure. After the surface has been thoroughly wetted and allowed to approach surface dryness, the mortar shall be vigorously applied to the area by clean burlap pads or by cork or wood-floating, to completely fill all surface voids. Excess grout shall be scraped off with a trowel. As soon as it can be accomplished without pulling the mortar from the voids, the area shall be rubbed with burlap pads having on their surface the same sand-cement mix specified above but without any mixing water, until all of the visible grout film is removed. The burlap pads used for this operation shall be stretched tightly around a board to prevent dishing the mortar in the voids. The finish of any area shall be completed in the same day, and the limits of a finished area shall be made at natural breaks in the surface. The surface shall be continuously moist cured for 48 hours commencing immediately after finishing operations in each area. The temperature of the air adjacent to the surface shall be not less than 50 degrees F for 24 hours prior to, and 48 hours after, the application. In hot, dry weather the smooth finish shall be applied in shaded areas or at night, and shall never be applied when there is significant hot, dry wind.

3.10 REPAIRS

3.10.1 Damp-Pack Mortar Repair

Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter but not over 4 inches shall be repaired by the damp-pack mortar method. Form tie holes shall be reamed and other similar defects shall be cut out to sound concrete. The void shall then be thoroughly cleaned, thoroughly wetted, brush-coated with a thin coat of neat cement grout and filled with mortar. Mortar shall be a stiff mix of 1 part portland cement to 2 parts fine aggregate passing the No. 16 mesh sieve, and minimum amount of water. Only sufficient water shall be used to produce a mortar which, when used, will stick together on being molded into a ball by a slight pressure of the hands and will not exude water but will leave the hands damp. Mortar shall be mixed and allowed to stand for 30 to 45 minutes before use with remixing performed immediately prior to use.

Mortar shall be thoroughly tamped in place in thin layers using a hammer and hardwood block. Holes passing entirely through walls shall be completely filled from the inside face by forcing mortar through to the outside face. All holes shall be packed full. Damp-pack repairs shall be moist cured for at least 48 hours.

3.10.2 Repair of Major Defects

Major defects will be considered to be those more than 1/2 inch deep or, for Class A and B finishes, more than 1/2 inch in diameter and, for Class C and D finishes, more than 2 inches in diameter. Also included are any defects of any kind whose depth is over 4 inches or whose surface diameter is greater than their depth. Major defects shall be repaired as specified below.

3.10.2.1 Surface Application of Mortar Repair

Defective concrete shall be removed, and removal shall extend into completely sound concrete. Approved equipment and procedures which will not cause cracking or microcracking of the sound concrete shall be used. If reinforcement is encountered, concrete shall be removed so as to expose the reinforcement for at least 2 inches on all sides. All such defective areas greater than 12 square inches shall be outlined by saw cuts at least 1 inch deep. Defective areas less than 12 square inches shall be outlined by a 1 inch deep cut with a core drill in lieu of sawing. All saw cuts shall be straight lines in a rectangular pattern in line with the formwork panels. After concrete removal, the surface shall be thoroughly cleaned by high pressure washing to remove all loose material. Surfaces shall be kept continually saturated for the first 12 of the 24 hours immediately before placing mortar and shall be damp but not wet at the time of commencing mortar placement. The Contractor, at his option, may use either hand-placed mortar or mortar placed with a mortar gun. If hand-placed mortar is used, the edges of the cut shall be perpendicular to the surface of the concrete. The prepared area shall be brush-coated with a thin coat of neat cement grout. The repair shall then be made using a stiff mortar, preshrunk by allowing the mixed mortar to stand for 30 to 45 minutes and then remixed, thoroughly tamped into place in thin layers. If hand-placed mortar is used, the Contractor shall test each repair area for drumminess by firm tapping with a hammer and shall inspect for cracks, both in the presence of the Contracting Officer's representative, immediately before completion of the contract, and shall replace any showing drumminess or cracking. If mortar placed with a mortar gun is used, the gun shall be a small compressed air-operated gun to which the mortar is slowly hand fed and which applies the mortar to the surface as a high-pressure stream, as approved. Repairs made using shotcrete equipment will not be accepted. The mortar used shall be the same mortar as specified for damp-pack mortar repair. If gun-placed mortar is used, the edges of the cut shall be beveled toward the center at a slope of 1:1. All surface applied mortar repairs shall be continuously moist cured for at least 7 days. Moist curing shall consist of several layers of saturated burlap applied to the surface immediately after placement is complete and covered with polyethylene sheeting, all held closely in place by a sheet of plywood or similar material rigidly braced against it. Burlap shall be kept continually wet.

3.10.2.2 Repair of Deep and Large Defects

Deep and large defects will be those that are more than 6 inches deep and also have an average diameter at the surface more than 18 inches or that

are otherwise so identified by the Project Office. Such defects shall be repaired as specified herein or directed, except that defects which affect the strength of the structure shall not be repaired and that portion of the structure shall be completely removed and replaced. Deep and large defects shall be repaired by procedures approved in advance including forming and placing special concrete using applied pressure during hardening. Preparation of the repair area shall be as specified for surface application of mortar. In addition, the top edge (surface) of the repair area shall be sloped at approximately 20 degrees from the horizontal, upward toward the side from which concrete will be placed. The special concrete shall be a concrete mixture with low water content and low slump, and shall be allowed to age 30 to 60 minutes before use. Concrete containing a specified expanding admixture may be used in lieu of the above mixture; the paste portion of such concrete mixture shall be designed to have an expansion between 2.0 and 4.0 percent when tested in accordance with ASTM C 940. A full width "chimney" shall be provided at the top of the form on the placing side to ensure filling to the top of the opening. A pressure cap shall be used on the concrete in the chimney with simultaneous tightening and revibrating the form during hardening to ensure a tight fit for the repair. The form shall be removed after 24 hours and immediately the chimney shall be carefully chipped away to avoid breaking concrete out of the repair; the surface of the repair concrete shall be dressed as required.

3.11 FINISHING UNFORMED SURFACES

The finish of all unformed surfaces shall meet the requirements of paragraph Tolerances in PART 1, when tested as specified herein.

3.11.1 General

In hot weather all requirements of paragraphs Hot Weather Requirements and Prevention of Plastic Shrinkage Cracking shall be met. Unformed surfaces that are not to be covered by additional concrete or backfill shall have a float finish, with additional finishing as specified below, and shall be true to the elevation shown on the drawings. Surfaces to receive additional concrete or backfill shall be brought to the elevation shown on the drawings, properly consolidated, and left true and regular. Unless otherwise shown on the drawings, exterior surfaces shall be sloped for drainage, as directed. Where drains are provided, interior floors shall be evenly sloped to the drains. Joints shall be carefully made with a jointing or edging tool. The finished surfaces shall be protected from stains or abrasions. Grate tampers or "jitterbugs" shall not be used for any surfaces. The dusting of surfaces with dry cement or other materials or the addition of any water during finishing shall not be permitted. If bleedwater is present prior to finishing, the excess water shall be carefully dragged off or removed by absorption with porous materials such as burlap. During finishing operations, extreme care shall be taken to prevent over finishing or working water into the surface; this can cause "crazing" (surface shrinkage cracks which appear after hardening) of the surface. Any slabs with surfaces which exhibit significant crazing shall be removed and replaced. During finishing operations, surfaces shall be checked with a 10 foot straightedge, applied in both directions at regular intervals while the concrete is still plastic, to detect high or low areas.

3.11.2 Rough Slab Finish

As a first finishing operation for unformed surfaces and as final finish for slabs to receive mortar setting beds, the surface shall receive a rough

slab finish prepared as follows. The concrete shall be uniformly placed across the slab area, consolidated as previously specified, and then screeded with straightedge strikeoffs immediately after consolidation to bring the surface to the required finish level with no coarse aggregate visible. Side forms and screed rails shall be provided, rigidly supported, and set to exact line and grade. Allowable tolerances for finished surfaces apply only to the hardened concrete, not to forms or screed rails. Forms and screed rails shall be set true to line and grade. "Wet screeds" shall not be used.

3.11.3 Floated Finish

Slabs to receive more than a rough slab finish shall next be given a wood float finish. The screeding shall be followed immediately by darbying or bull floating before bleeding water is present, to bring the surface to a true, even plane. Then, after the concrete has stiffened so that it will withstand a man's weight without imprint of more than 1/4 inch and the water sheen has disappeared, it shall be floated to a true and even plane free of ridges. Floating shall be performed by use of suitable hand floats or power driven equipment. Sufficient pressure shall be used on the floats to bring a film of moisture to the surface. Hand floats shall be made of wood, magnesium, or aluminum. Lightweight concrete or concrete that exhibits stickiness shall be floated with a magnesium float. Care shall be taken to prevent over-finishing or incorporating water into the surface.

3.11.4 Troweled Finish

All tank floor slabs shall be given a trowel finish. After floating is complete and after the surface moisture has disappeared, unformed surfaces shall be steel-troweled to a smooth, even, dense finish, free from blemishes including trowel marks. In lieu of hand finishing, an approved power finishing machine may be used in accordance with the directions of the machine manufacturer. Additional trowelings shall be performed, either by hand or machine until the surface has been troweled 4 times, with waiting period between each. Care shall be taken to prevent blistering and if such occurs, troweling shall immediately be stopped and operations and surfaces corrected. A final hard steel troweling shall be done by hand, with the trowel tipped, and using hard pressure, when the surface is at a point that the trowel will produce a ringing sound. The finished surface shall be thoroughly consolidated and shall be essentially free of trowel marks and be uniform in texture and appearance. The concrete mixture used for troweled finished areas shall be adjusted, if necessary, in order to provide sufficient fines (cementitious material and fine sand) to finish properly.

3.12 CURING AND PROTECTION

3.12.1 General

Concrete shall be cured by total immersion of water 60 days after concrete finishing.

3.12.2 Immersion Curing

Concrete slab for sump pit area slab shall be used with impetuous sheeting and continuous mist spraying. The main concrete slab shall be cured by continuous immersed with 1 inches to 2 inches of potable water immediately after finishing the concrete slab for a period of 60 days.

3.13 SETTING BASE PLATES AND BEARING PLATES

3.13.1 Nonshrink Grout

Nonshrink grout shall be a ready-mixed material requiring only the addition of water. Water content shall be the minimum that will provide a flowable mixture and completely fill the space to be grouted without segregation, bleeding, or reduction of strength.

3.13.1.1 Mixing and Placing of Nonshrink Grout

Mixing and placing shall be in conformance with the material manufacturer's instructions and as specified therein. Ingredients shall be thoroughly dry-mixed before adding water. After adding water, the batch shall be mixed for 3 minutes. Batches shall be of size to allow continuous placement of freshly mixed grout. Grout not used within 30 minutes after mixing shall be discarded. The space between the top of the concrete or machinery-bearing surface and the plate shall be filled solid with the grout. Forms shall be of wood or other equally suitable material for completely retaining the grout on all sides and on top and shall be removed after the grout has set. The placed grout shall be carefully worked by rodding or other means to eliminate voids; however, overworking and breakdown of the initial set shall be avoided. Grout shall not be retempered or subjected to vibration from any source. Where clearances are unusually small, placement shall be under pressure with a grout pump. Temperature of the grout, and of surfaces receiving the grout, shall be maintained at 65 to 85 degrees F until after setting.

3.13.1.2 Treatment of Exposed Surfaces

For metal-oxidizing nonshrink grout, exposed surfaces shall be cut back 1 inch and immediately covered with a parge coat of mortar consisting of 1 part portland cement and 2-1/2 parts fine aggregate by weight, with sufficient water to make a plastic mixture. The parge coat shall have a smooth finish. For other mortars or grouts, exposed surfaces shall have a smooth-dense finish and be left untreated. Curing shall comply with paragraph CURING AND PROTECTION.

3.14 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL

The Contractor shall perform the inspection and tests described below and, based upon the results of these inspections and tests, shall take the action required and shall submit specified reports. When, in the opinion of the Contracting Officer, the concreting operation is out of control, concrete placement shall cease and the operation shall be corrected. The laboratory performing the tests shall be onsite and shall conform with ASTM C 1077. Materials may be subjected to check testing by the Government from samples obtained at the manufacturer, at transfer points, or at the project site. The Government will inspect the laboratory, equipment, and test procedures prior to start of concreting operations for conformance with ASTM C 1077.

3.14.1 Grading and Corrective Action

3.14.1.1 Fine Aggregate

At least once during each shift when the concrete plant is operating, there shall be one sieve analysis and fineness modulus determination in accordance with ASTM C 136 and COE CRD-C 104 for the fine aggregate or for

each fine aggregate if it is batched in more than one size or classification. The location at which samples are taken may be selected by the Contractor as the most advantageous for control. However, the Contractor is responsible for delivering fine aggregate to the mixer within specification limits. When the amount passing on any sieve is outside the specification limits, the fine aggregate shall be immediately resampled and retested. If there is another failure on any sieve, the fact shall immediately reported to the Contracting Officer, concreting shall be stopped, and immediate steps taken to correct the grading.

3.14.1.2 Coarse Aggregate

At least once during each shift in which the concrete plant is operating, there shall be a sieve analysis in accordance with ASTM C 136 for each size of coarse aggregate. The location at which samples are taken may be selected by the Contractor as the most advantageous for production control. However, the Contractor shall be responsible for delivering the aggregate to the mixer within specification limits. A test record of samples of aggregate taken at the same locations shall show the results of the current test as well as the average results of the five most recent tests including the current test. The Contractor may adopt limits for control coarser than the specification limits for samples taken other than as delivered to the mixer to allow for degradation during handling. When the amount passing any sieve is outside the specification limits, the coarse aggregate shall be immediately resampled and retested. If the second sample fails on any sieve, that fact shall be reported to the Contracting Officer. Where two consecutive averages of 5 tests are outside specification limits, the operation shall be considered out of control and shall be reported to the Contracting Officer. Concreting shall be stopped and immediate steps shall be taken to correct the grading.

3.14.2 Quality of Aggregates

Thirty days prior to the start of concrete placement, the Contractor shall perform all tests for aggregate quality required by ASTM C 33. In addition, after the start of concrete placement, the Contractor shall perform tests for aggregate quality at least every three months, and when the source of aggregate or aggregate quality changes. Samples tested after the start of concrete placement shall be taken immediately prior to entering the concrete mixer.

3.14.3 Scales, Batching and Recording

The accuracy of the scales shall be checked by test weights prior to start of concrete operations and at least once every three months. Such tests shall also be made as directed whenever there are variations in properties of the fresh concrete that could result from batching errors. Once a week the accuracy of each batching and recording device shall be checked during a weighing operation by noting and recording the required weight, recorded weight, and the actual weight batched. At the same time, the Contractor shall test and ensure that the devices for dispensing admixtures are operating properly and accurately. When either the weighing accuracy or batching accuracy does not comply with specification requirements, the plant shall not be operated until necessary adjustments or repairs have been made. Discrepancies in recording accuracies shall be corrected immediately.

3.14.4 Batch-Plant Control

The measurement of concrete materials including cementitious materials, each size of aggregate, water, and admixtures shall be continuously controlled. The aggregate weights and amount of added water shall be adjusted as necessary to compensate for free moisture in the aggregates. The amount of air-entraining agent shall be adjusted to control air content within specified limits. A report shall be prepared indicating type and source of cement used, type and source of pozzolan or slag used, amount and source of admixtures used, aggregate source, the required aggregate and water weights per cubic yard, amount of water as free moisture in each size of aggregate, and the batch aggregate and water weights per cubic yard for each class of concrete batched during each day's plant operation.

3.14.5 Concrete Mixture

- a. Air Content Testing. Air content tests shall be made when test specimens are fabricated. In addition, at least two tests for air content shall be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of concrete production. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Tests shall be made in accordance with ASTM C 878. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single test result reaches either the upper or lower action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the air content of the batch to plot on both the air content and the control chart for range, and for determining need for any remedial action. The result of each test, or average as noted in the previous sentence, shall be plotted on a separate control chart for each mixture on which an "average line" is set at the midpoint of the specified air content range from paragraph Air Entrainment. An upper warning limit and a lower warning limit line shall be set 1.0 percentage point above and below the average line, respectively. An upper action limit and a lower action limit line shall be set 1.5 percentage points above and below the average line, respectively. The range between each two consecutive tests shall be plotted on a secondary control chart for range where an upper warning limit is set at 2.0 percentage points and an upper action limit is set at 3.0 percentage points. Samples for air content may be taken at the mixer, however, the Contractor is responsible for delivering the concrete to the placement site at the stipulated air content. If the Contractor's materials or transportation methods cause air content loss between the mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer, and the air content at the mixer controlled as directed.
- b. Air Content Corrective Action. Whenever points on the control chart for percent air reach either warning limit, an adjustment shall immediately be made in the amount of air-entraining admixture batched. As soon as practical after each adjustment, another test shall be made to verify the result of the adjustment. Whenever a point on the secondary control chart for range reaches the warning limit, the admixture dispenser shall be recalibrated to ensure that it is operating accurately and with good

reproducibility. Whenever a point on either control chart reaches an action limit line, the air content shall be considered out of control and the concreting operation shall immediately be halted until the air content is under control. Additional air content tests shall be made when concreting is restarted.

- c. Slump Testing. In addition to slump tests which shall be made when test specimens are fabricated, at least four slump tests shall be made on randomly selected batches in accordance with ASTM C 143 for each separate concrete mixture produced during each 8-hour or less period of concrete production each day. Also, additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single slump test reaches or goes beyond either the upper or lower action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the slump of the batch to plot on both the control charts for slump and the chart for range, and for determining need for any remedial action. Limits shall be set on separate control charts for slump for each type of mixture. The upper warning limit shall be set at 1/2 inch below the maximum allowable slump specified in paragraph Slump in PART 1 for each type of concrete and an upper action limit line and lower action limit line shall be set at the maximum and minimum allowable slumps, respectively, as specified in the same paragraph. The range between each consecutive slump test for each type of mixture shall be plotted on a single control chart for range on which an upper action limit is set at 2 inches. Samples for slump shall be taken at the mixer. However, the Contractor is responsible for delivering the concrete to the placement site at the stipulated slump. If the Contractor's materials or transportation methods cause slump loss between the mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer, and the slump at the mixer controlled as directed.
- d. Slump Corrective Action. Whenever points on the control charts for slump reach the upper warning limit, an adjustment shall immediately be made in the batch weights of water and fine aggregate. The adjustments are to be made so that the total water content does not exceed that amount allowed by the maximum w/c ratio specified, based on aggregates which are in a saturated surface dry condition. When a single slump reaches the upper or lower action limit, no further concrete shall be delivered to the placing site until proper adjustments have been made. Immediately after each adjustment, another test shall be made to verify the correctness of the adjustment. Whenever two consecutive individual slump tests, made during a period when there was no adjustment of batch weights, produce a point on the control chart for range at or above the upper action limit, the concreting operation shall immediately be halted, and the Contractor shall take appropriate steps to bring the slump under control. Additional slump tests shall be made as directed.
- e. Temperature. The temperature of the concrete shall be measured

when compressive strength specimens are fabricated. Measurement shall be in accordance with ASTM C 1064/C 1064M. The temperature shall be reported along with the compressive strength data.

- f. Strength Specimens. At least one set of test specimens shall be made, for compressive or flexural strength as appropriate, on each different concrete mixture placed during the day for each 500 cubic yards or portion thereof of that concrete mixture placed each day. Additional sets of test specimens shall be made, as directed by the Contracting Officer, when the mixture proportions are changed or when low strengths have been detected. A truly random (not haphazard) sampling plan shall be developed by the Contractor and approved by the Contracting Officer prior to the start of construction. The plan shall assure that sampling is done in a completely random and unbiased manner. A set of test specimens for concrete with a 28-day specified strength per paragraph Strength Requirements in PART 1 shall consist of four specimens, two to be tested at 7 days and two at 28 days. Test specimens shall be molded and cured in accordance with ASTM C 31/C 31M and tested in accordance with ASTM C 39 for test cylinders and ASTM C 78 for test beams. Results of all strength tests shall be reported immediately to the Contracting Officer. Quality control charts shall be kept for individual strength "tests", ("test" as defined in paragraph Strength Requirements in PART 1) moving average of last 3 "tests" for strength, and moving average for range for the last 3 "tests" for each mixture. The charts shall be similar to those found in ACI 214.3R.

3.14.6 Inspection Before Placing

Foundations, construction joints, forms, and embedded items shall be inspected by the Contractor in sufficient time prior to each concrete placement in order to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing.

3.14.7 Placing

The placing foreman shall supervise placing operations, shall determine that the correct quality of concrete or grout is placed in each location as specified and as directed by the Contracting Officer, and shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume placed, and method of placement. The placing foreman shall not permit batching and placing to begin until it has been verified that an adequate number of vibrators in working order and with competent operators are available. Placing shall not be continued if any pile of concrete is inadequately consolidated. If any batch of concrete fails to meet the temperature requirements, immediate steps shall be taken to improve temperature controls.

3.14.8 Vibrators

The frequency and amplitude of each vibrator shall be determined in accordance with COE CRD-C 521 prior to initial use and at least once a month when concrete is being placed. Additional tests shall be made as directed when a vibrator does not appear to be adequately consolidating the concrete. The frequency shall be determined while the vibrator is operating in concrete with the tachometer being held against the upper end

of the vibrator head while almost submerged and just before the vibrator is withdrawn from the concrete. The amplitude shall be determined with the head vibrating in air. Two measurements shall be taken, one near the tip and another near the upper end of the vibrator head, and these results averaged. The make, model, type, and size of the vibrator and frequency and amplitude results shall be reported in writing. Any vibrator not meeting the requirements of paragraph Consolidation, shall be immediately removed from service and repaired or replaced.

3.14.9 Curing Inspection

- a. Moist Curing Inspections. At least once each shift, and not less than twice per day on both work and non-work days, an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded.
- b. Moist Curing Corrective Action. When a daily inspection report lists an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for those areas shall be extended by 1 day.
- c. Membrane Curing Inspection. No curing compound shall be applied until the Contractor has verified that the compound is properly mixed and ready for spraying. At the end of each operation, the Contractor shall estimate the quantity of compound used by measurement of the container and the area of concrete surface covered, shall compute the rate of coverage in square feet per gallon, and shall note whether or not coverage is uniform.
- d. Membrane Curing Corrective Action. When the coverage rate of the curing compound is less than that specified or when the coverage is not uniform, the entire surface shall be sprayed again.
- e. Sheet Curing Inspection. At least once each shift and once per day on non-work days, 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.
- f. Sheet Curing Corrective Action. When a daily inspection report lists any tears, holes, or laps or 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 1 day.

3.14.10 Mixer Uniformity

- a. Stationary Mixers. Prior to the start of concrete placing and once every 6 months when concrete is being placed, or once for every 75,000 cubic yards of concrete placed, whichever results in the shortest time interval, uniformity of concrete mixing shall be determined in accordance with ASTM C 94.
- b. Truck Mixers. Prior to the start of concrete placing and at least once every 6 months when concrete is being placed, uniformity of concrete mixing shall be determined in accordance with ASTM C 94. The truck mixers shall be selected randomly for testing. When satisfactory performance is found in one truck mixer, the performance of mixers of substantially the same design and

condition of the blades may be regarded as satisfactory.

- c. Mixer Uniformity Corrective Action. When a mixer fails to meet mixer uniformity requirements, either the mixing time shall be increased, batching sequence changed, batch size reduced, or adjustments shall be made to the mixer until compliance is achieved.

3.14.11 Reports

All results of tests or inspections conducted shall be reported informally as they are completed and in writing daily. A weekly report shall be prepared for 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.

-- End of Section --