

CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION

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**Invitation for Bid
Notice to Prospective Bidders**

3CA08018 Ramona Air Attack Base (AAB) - Helitack Site Improvements

October 7, 2026

You are invited to review and respond to this Invitation for Bid (IFB). In submitting your bid, you must comply with these instructions. In addition to those programs and preferences that are specified in this solicitation, Prospective Contractors are encouraged to consider programs and preferences that are available, such as those for the use of small businesses, disadvantaged businesses, disabled veteran businesses, and other businesses covered by State and Federal programs and preferences.

On March 04, 2022, Governor Gavin Newsom issued Executive Order N-6-22 (the EO) regarding Economic Sanctions against Russia and Russian entities and individuals. "Economic Sanctions" refers to sanctions imposed by the U.S. government in response to Russia's actions in Ukraine, as well as any sanctions imposed under state law. By submitting a bid or proposal, Contractor represents that it is not a target of Economic Sanctions. Should the State determine Contractor is a target of Economic Sanctions or is conducting prohibited transactions with sanctioned individuals or entities, that shall be grounds for rejection of the Contractor's bid/proposal any time prior to contract execution, or, if determined after contract execution, shall be grounds for termination by the State.

The DVBE Participation Program applies, and a **three percent (3%)** goal is required for this IFB. The DVBE Incentive Program may also apply to this IFB. See **Section D, Special Programs, Item 1**, in this IFB for requirements.

As required by Executive Order S-02-06, the California Department of Forestry and Fire Protection (CAL FIRE) is committed to meeting the State's 25 percent (25%) Small Business (SB) participation goal. Certified SBs, Micro Businesses (MB), and contractors willing to commit to subcontracting a minimum of 25 percent (25%) of their net bid price to certified SBs or MBs (if applicable), are encouraged to submit bids. See **Section D, Special Programs, Item 2**, in this IFB for requirements.

Note that all agreements entered into with the State of California will include by reference General Terms and Conditions (GTC 02/2025) and Contractor Certification Clauses that may be viewed and downloaded at Internet site <https://www.dgs.ca.gov/OLS/Resources/Page-Content/Office-of-Legal-Services-Resources-List-Folder/Standard-Contract-Language>. If you do not have Internet access, a hard copy can be provided by contacting the person listed below.

This contract requires Prevailing Wages if the total bid amount exceeds **\$1,000.00**. If the total bid amount is under **\$1,000.00**, then Prevailing Wage language will be removed prior to award. Refer to **Sample Standard Agreement**, for requirement details.

In the opinion of California Department of Forestry and Fire Protection (CAL FIRE), this IFB is complete and without need of explanation. However, if you have questions, or should you need any clarifying information, the contact person for this IFB is:

Antwanette Page

California Department of Forestry and Fire Protection

Please note that no *verbal* information given will be binding upon the State unless such information is issued in writing as an official addendum.

Technical questions regarding this solicitation will be addressed, in writing, and in accordance with the Questions and Answers portion of this IFB. See **Section C, Item 1, Key Action Dates** for more details.

Antwanette Page

Contract Analyst

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A) Purpose and Description of Services

Contractor agrees to provide to the California Department of Forestry and Fire Protection (CAL FIRE) Ramona Air Attack Base (AAB) - Helitack Site Improvements, as described herein:

Contractor shall provide all materials, labor, equipment, tools, permits, taxes, transportation, and fees to provide demolition services and flat work including, but not limited to, updates to landscape and concrete driveway at the CAL FIRE Ramona Air Attack Base (AAB).

Services are necessary to comply with safety requirements and maintain operational capabilities. Ramona AAB serves as a critical hub providing essential services that strengthen wildfire response efforts across the county and regionally.

B) Bidder Minimum Qualifications

1. The Prime Bidder must be either an individual or firm currently licensed to do business in California and provide proof of such as required in **Required Attachment Checklist, Attachment 1**.
2. The Prime Bidder must have a business license or incorporation papers for their respective State showing that their company is in good standing in that state, if the Prime Bidder's base of operation is located outside the State of California and provide proof of such as required in **Required Attachment Checklist, Attachment 1**.
3. **(If applicable)** Pursuant to Public Contract Code section 2010, a person that submits a bid or proposal to [...] a state agency with respect to any contract in the amount of \$100,000.00 shall complete the **California Civil Rights Laws, Attachment 10**.
4. Contractor shall possess and provide proof of such as required in **Required Attachment Checklist, Attachment 1**:
 - A. **A – General Engineering** Contractor license issued by the California Contractors State Licensing Board (CSLB).
 - B. Proof of valid Department of Industrial Relations (DIR) registration as a Public Works Contractor.
 - C. Bidder's Bond executed by an admitted surety insurer and made payable to the State of California if bid price exceeds \$484,000.00. The bidder's bid bond shall be no less than 10 percent (10%) of bidder's total bid.
5. By submitting its bid, Bidder certifies, under penalty of perjury, that its Contractors State License Board (CSLB) license is in a classification appropriate to the work to be undertaken as identified in the **Sample Standard Agreement, Exhibit A, Scope of Work, Section 1**. This requirement has also been added in the **Sample Standard Agreement, Exhibit E, Section 5**. Refer to **Section C, Bid Requirements and Information, Contractor License**, for submittal requirements.
6. Failure of Bidder to sufficiently provide any or all of the minimum qualifications, in the opinion of CAL FIRE, will result in the Bidder's bid deemed non-responsive.

C) Bid Requirements and Information

1. Key Action Dates

It is recognized that time is of the essence. All bidders are hereby advised of the following schedule and will be expected to adhere to the required dates and times.

Event	Date	Time (Pacific Time)
IFB available to prospective bidders	October 07, 2026	
Mandatory Pre-bid Conference	October 22, 2026	2:00 p.m.
Written Question Submittal	October 26, 2026	
Final Date and Time for Bid Submission	November 02, 2026	05:00 p.m.
Bid Opening	November 03, 2026	02:00 p.m.

2. Mandatory Pre-Bid Walk-Through

- A. A mandatory pre-bid walk-through is scheduled at 2:00 p.m. on October 22, 2026, for the purpose of viewing the site and discussing concerns regarding this IFB.

The meeting site is CAL FIRE Ramona Air Attack Base (AAB) - 2498 Montecito Road, Ramona, CA 92065.

- B. In the event a potential prime contractor is unable to attend the mandatory pre-bid walk-through, an authorized representative may attend on their behalf. The representative may only sign-in for one (1) company. Subcontractors may not represent a potential prime contractor at a mandatory pre-bid walk-through. No bid will be accepted unless the bidder or his authorized representative was in attendance.

3. Written Question and Answer Period

- A. Potential Bidders who attended the mandatory pre-bid walk-through may submit written questions regarding the bid by October 26, 2026. All questions should be emailed in writing to antwanette.page@fire.ca.gov. NO QUESTIONS will be accepted after October 26, 2026.
- B. Written questions must include: the individual's name, firm name, complete address and must reference IFB No. **3CA08018**.
- C. Written responses to all questions will be collectively compiled and posted, as an Addendum, to the Cal eProcure website (<https://caleprocure.com/pages/index.aspx>). It is the responsibility of the Bidder to access the website for any changes or addenda that may be posted. Refer to this **IFB, Section C1, Key Action Dates**, for the schedule of events and dates/times. It is the responsibility of the bidder to check Cal eProcure for all addenda. Bidder can contact the Contract Analyst named above.

4. Costs Included in Bid Rates

Bid prices/rates shall include the cost of employer payments to or on behalf of employees, subsistence, travel, compensation insurance premiums, unemployment contributions, social security taxes, contract bond premiums, and any other taxes or assessments, **including but not limited to, sales and use taxes** required by law or otherwise and no additional allowance will be paid unless separate payment provisions in the Agreement should specifically provide otherwise.

5. Employment of undocumented Workers

No State agency or department, as defined in California Public Contract Code Section 10335.7, that is subject to this code, shall award a public works contract to a bidder or contractor, nor shall a bidder or contractor be eligible to bid for or receive a Public Works Agreement, who has, in the preceding five (5) years, been convicted of violating a State or Federal law regarding the employment of undocumented workers (Pub. Cont. Code Section 6101).

6. State General Prevailing Wage Rates

State General Prevailing Wage Rates will apply for the County(ies) of San Diego as described in the attached **Sample Standard Agreement, Section E**. The predetermined general prevailing wage rates published by the Director of Industrial Relations may be obtained via the Internet: <https://www.dir.ca.gov/OPRL/DPreWageDetermination.htm>. It is the bidder's responsibility to use the correct classification determination published by the Department of Industrial Relations.

7. Postconsumer Content Certification

Your signature affixed hereon and dated on the **Bid/Bidder Certification Sheet, Attachment 2** shall signify that you are aware of the recycle materials, goods, and supplies program requirements of Public Contract Code Sections 12200 and 12205, and that the Recycled-Content Certification will be required for the successful contractor. The awarded bidder will be required to complete a Postconsumer-Content Certification (CalRecycle 74) and provide the form with the signed Agreement. An incomplete form or failure to provide a completed form will result in cancellation of the Agreement. The Postconsumer-Content Certification can be downloaded at <https://calrecycle.ca.gov/buyrecycled/>.

8. Mandatory Organic Waste Recycling

The Contractor generating organic waste or commercial solid waste shall arrange for the recycling services required by this section in a manner that is consistent with State and local laws and requirements, including a

local ordinance or local jurisdiction's franchise agreement, applicable to the collection, handling, or recycling of organic waste and commercial solid waste. This requirement does not modify, limit or abrogate the Contractors right to sell or donate its recyclable organic waste materials consistent with the requirements of Public Resources Code Sections 42649.8 et seq

9. Motor Carrier Permit Requirements

- A. Contractor is responsible for determining whether California Vehicle Code Sections 34601 and 34620 require Contractor to have a valid Motor Carrier Permit (MCP) issued by the Department of Motor Vehicles (DMV) in order for Contractor to lawfully perform any part or aspect of the work described in **Exhibit A, Scope of Work**, and, if California Vehicle Code Sections 34601 and 34620 do require same for any part or aspect of such work, Contractor must have a valid MCP(s) issued from the DMV for its services as a Motor Carrier of Property under this Agreement. Contractor shall pay any required fees necessary to obtain and maintain in good standing during the entire term of this Agreement the any such required MCP(s).
- B. The MCP(s), if any, required for the Contractor's Motor Carriers of Property under California Vehicle Code Sections 34601 and 34620 shall be on file with the Contractor for the duration of this Agreement. Upon request of CAL FIRE, the Contractor must immediately provide to CAL FIRE a copy of the required MCP(s), if any.

10. Contractor Registration Program

- A. No Contractor or Subcontractor may be listed on a bid proposal for a public works contract unless registered with the Department of Industrial Relations (DIR), pursuant to Labor Code Section 1725.5 with limited exceptions from this requirement for bid purposes only under LC Section 1771.1(a)).
- B. No Contractor or Subcontractor may be awarded a public works contract or commercial service contract requiring prevailing wages, unless registered with DIR pursuant to Labor Code Section 1725.5.
- C. CAL FIRE will verify each of the registration numbers prior to contract award. Bidders that do not possess the required DIR registration will be deemed non-responsive and rejected from further consideration in the solicitation process.

11. Contractor's License

Bidder must have, at time of bid submittal and for the duration of the contract, a valid, current **A - General Engineering** license issued by the Contractors State License Board (CSLB), for the type of work to be performed. Bidder shall obtain, pay for and maintain, in good standing, all necessary licenses and permits to accomplish the work. Bidders will be considered non-responsive unless proper licensing requirements are met. An invalid license will result in rejection of the bid. Positive verification of a valid license issued by the CSLB will be performed by CAL FIRE (reference Business and Professions Code Section 7028.15).

12. Subcontractors

Bidder may subcontract portions of the work as defined in the attached **Sample Standard Agreement**. If subcontractors are used, complete the **Bidder Declaration (GSPD-05-105)**, **Attachment 5**. Bidder must ensure that the subcontractor(s) will have all necessary licenses, permits, and/or certifications to accomplish its portion of the work. Failure of a subcontractor(s) to have the proper licenses, permits, and/or certifications, shall be cause for rejection of bid. The Bidder Declaration can also be downloaded at which can be downloaded at <https://www.documents.dgs.ca.gov/dgs/fmc/gspd/gspd05-105.pdf>.

13. Non-Collusion Declaration for Public Works

Bidder must submit, as described herein, a non-collusion declaration for Public Works. The non-collusion declaration is attached to this IFB as **Attachment 12**. Failure to submit a complete declaration shall result in rejection of the bid.

14. Bonds

- A. Bidder's Bond is required for Bids \$484,000 and greater: Bidder shall submit a *bid bond (executed by an admitted surety insurer) with bid as described herein. The bidder's bid bond shall be no less than 10 percent (10%) of bidder's total bid, must be notarized and include the embossed surety seal and must include a Power of Attorney if the signee is not an officer of the surety. Submittal of a bid bond that is not in the appropriate amount, signed and stamped with the surety seal, or failure to submit a bid bond shall be

cause for rejection of bid. *The bidder may also submit, in lieu of a Bidder's Bond, one of the following forms of bidder's security: cash, cashier's check, or certified check made payable to CAL FIRE.

- B. Payment Bond (STD 807) Requirement: If the successful bidder's bid exceeds \$25,000, the successful bidder shall furnish a Payment Bond for not less than 100 percent (100%) of the total amount payable by the terms of this Agreement. The Payment Bond is due prior to the start date of work. No work may commence without receipt of a valid Payment Bond. The Payment Bond must be in effect at all times for the duration of the Agreement. If the Payment Bond expires during the term of the Agreement, a new Payment Bond must be provided to the CAL FIRE representative not less than 10 business days prior to its expiration. Failure to maintain a Payment Bond for the full term of this Agreement will be grounds for termination for default in addition to other legal remedies CAL FIRE may have. Inadequate or lack of a Payment Bond does not negate the Contractor's obligations under this Agreement.

15. Insurance

- A. The bidder, who receives the Agreement award, must provide a Certificate of Insurance providing proof of insurance to the Business Service Office (BSO) within ten (10) working days from the date of notification of award. The State's Office of Risk and Insurance Management will review insurance certificates and/or proof of self-insurance documentation before execution of the Agreement. Refer to the **Sample Standard Agreement Exhibit E, Section 1** for the applicable and specific Insurance requirements and coverage limits.
- B. The insurance carrier shall provide an endorsement for the additional insured statement as follows:
The State of California, its officers, agents and employees are included as additional insured, but only with respect to work performed for the State of California under the contract.
- C. The additional insured endorsement must accompany the certificate of insurance.
- D. Available Coverages/Limits
In the event the insurance coverages obtained by the Contractor is broader in scope than, and/or the limits are higher than, those required under the contract, all such broader coverage and/or higher limits available to the Contractor shall also be available and applicable to the State.
- E. In the case of Contractor and/or Permittee's utilization of subcontractors to complete the contracted scope of work, contractor and/or Permittee shall include all subcontractors as insured under Contractor and/or Permittee's insurance or supply evidence of insurance to The State equal to policies, coverages and limits required of Contractor and/or Permittee.

16. California Civil Rights Laws

Any person that submits a bid or proposal to, or otherwise proposes to enter into or renew a contract with, a state agency with respect to any contract in the amount of one hundred thousand dollars (\$100,000.00) or more shall certify, under penalty of perjury, at the time the bid or proposal is submitted or the contract is renewed, that they satisfy all of the conditions set forth in California Public Contract Code Section 2010 and they shall execute the **California Civil Rights Laws Certification**, as **Attachment 10**, completed, signed, and returned with its bid or proposal.

17. Darfur Contracting Act

- A. The Darfur Contracting Act, Public Contract Code Section 10475-10481, applies to any company that currently or within the previous three (3) years has had business activities or other operations outside of the United States. The Act was passed by the California Legislature and signed into law by the Governor to preclude State agencies generally from contracting with "scrutinized" companies that do business in the African nation of Sudan (of which the Darfur region is a part), for the reasons described in Public Contract Code Section 10475. All bidders shall complete the **Darfur Contracting Act Certification, CAL FIRE-720, Attachment 6**, and submit with the proposal.
- B. If your company has not, within the previous three (3) years, had any business activities or other operations outside of the United States, complete **Option 1** on the **CAL FIRE-720**.

- C. A scrutinized company is a company doing business in Sudan as defined in Public Contract Code Section 10476. Scrutinized companies are ineligible to, and cannot bid on, or submit a bid or proposal for an Agreement with a State agency for goods or services. (Pub. Cont. Code Section 10477(a)).
- D. Therefore, Public Contract Code Section 10478(a) requires a company that currently has (or within the previous three (3) years has had business activities or other operations outside of the United States to certify that it is not a "scrutinized" company when it submits a bid or proposal to a State agency.
- E. A scrutinized company may still; however, submit a bid or proposal for an Agreement with a State agency for goods or services if the company first obtains permission from the Department of General Services according to the criteria set forth in Public Contract Code Section 10477(b).

18. Iran Contracting Act

- A. Pursuant to the Iran Contracting Act of 2010 (Pub. Cont. Code Sections 2200 et seq., hereinafter "the Act"), persons identified on the list established under Public Contract Code Section 2202.5 (hereinafter "List") are ineligible to bid on, submit a proposal for, enter into, or renew any contract with the State for goods or services of one million dollars or more.
- B. Any person who submits a bid or proposal must complete and submit to CAL FIRE with its bid proposal, the **Iran Contracting Act Certification (DGS PD 3), Attachment 7**, certifying that it is not on the most current List unless the person is exempted from the certification requirement by Public Contract Code Section 2203(c) or (d). If claiming an exemption, the person shall provide written evidence that supports an exemption under Public Contract Code Section 2203(c) or (d) with its bid or proposal. **The Iran Contracting Act Certification** can also be downloaded at https://www.documents.dgs.ca.gov/dgs/FMC/GS/PD/PD_3.pdf.
- C. Any person, for a contract that is exempt from bidding or is renewed, or for whom a contract is otherwise awarded by the State, must complete and submit to CAL FIRE the DGS PD 3, certifying that it is not on the most current List, before the contract has been executed by the parties, unless the person is exempted from the certification requirement by Public Contract Code Section 2205(c) or (d). If claiming an exemption, the person shall provide written evidence that supports an exemption under Public Contract Code Section 2203(c) or (d), before execution of the contract.

19. Submission of Bid

- A. All bids must be submitted and received under **sealed** cover and sent to CAL FIRE by dates and times shown in **Section C, Bid Requirements and Information, Item 1) Key Action Dates**.

Mail in Submissions

The mailing packaging/envelope should be labeled as follows:

Your Firm Name Your Street Address/PO Box # Your City, State and Zip Code	IFB # 3CA08018 Helitack Site Improvements Bid Due Date: November 02, 2026 Attention: Antwanette Page California Department of Forestry and Fire Protection Business Services Office (BSO), Contract Unit 710 Riverpoint Court West Sacramento, CA 95605
BID SUBMITTAL DO NOT OPEN	

B. Late bids will not be considered.

- C. All bids shall include the documents identified in **Required Attachment Checklist, Attachment 1**. Bids with incomplete documents or not including the proper "required attachments" shall be deemed non-responsive. A non-responsive bid is one that does not meet the basic bid requirements.

- D. All documents requiring a signature must bear an original signature of a person authorized to bind the bidding firm.
- E. Bids must be submitted for the performance of all the services described herein. Any deviation from the work specifications will not be considered and will cause a bid to be rejected.
- F. A bid may be rejected if it is conditional or incomplete, or if it contains any alterations of form or other irregularities of any kind. The State may reject any or all bids and may waive an immaterial deviation in a bid. The State's waiver of immaterial deviation shall in no way modify the IFB document or excuse the bidder from full compliance with all requirements if awarded the agreement.
- G. Costs for developing bids and in anticipation of award of the agreement are entirely the responsibility of the bidder and shall not be charged to the State of California.
- H. An individual who is authorized to bind the bidder contractually shall sign **Bid/Bidder Certification Sheet, Attachment 2**. The signature should indicate the title or position that the individual holds in the firm. An unsigned bid may be rejected.
- I. A bidder may modify a bid after its submission by withdrawing its original bid and resubmitting a new bid prior to the bid submission deadline. Bidder modifications offered in any other manner, oral or written, will not be considered.
- J. A bidder may withdraw its bid by submitting a written withdrawal request to the State, signed by the bidder or an authorized agent. A bidder may thereafter submit a new bid prior to the bid submission deadline. Bids may not be withdrawn without cause subsequent to bid submission deadline.
- K. The awarding agency may modify the IFB prior to the date fixed for submission of bids by the issuance of an addendum to all parties who received a bid package.
- L. The awarding agency reserves the right to reject all bids. The agency is not required to award an agreement.
- M. Before submitting a response to this solicitation, bidders should review, correct all errors and confirm compliance with the IFB requirements.
- N. Where applicable, bidder should carefully examine work sites and specifications. Bidder shall investigate conditions, character, and quality of surface or subsurface materials or obstacles that might be encountered. No additions or increases to the agreement amount will be made due to a lack of careful examination of work sites and specifications.
- O. The State does not accept alternate contract language from a prospective Contractor. A bid with such language will be considered a counter proposal and will be rejected. The State's General Terms and Conditions (GTC) are not negotiable. The GTC may be viewed at Internet site <https://www.dgs.ca.gov/OLS/Resources/Page-Content/Office-of-Legal-Services-Resources-List-Folder/Standard-Contract-Language>.
- P. No oral understanding or agreement shall be binding on either party.
- Q. Bidder must complete and submit to the awarding agency **Payee Data Record, STD 204, Attachment 8**, to determine if the Contractor is subject to state income tax withholding pursuant to California Revenue and Taxation Code Sections 18662 and 26131. This form can be found on the Internet at <http://www.documents.dgs.ca.gov/dgs/fmc/pdf/std204.pdf> under the heading STANDARD FORMS; select "Forms Search" and enter the form number "204". No payment shall be made unless a completed STD 204 has been returned to the awarding agency.
- R. Bidder must sign and submit to the awarding agency, **Contractor Certification Clauses (CCC), Attachment 9**, which can be found on the Internet at: <https://www.dgs.ca.gov/-/media/Divisions/OLS/Resources/CCC-042017.pdf?la=en&hash=4DE3E4DC414511AE378794200BA43EBF91C758EE>.

20. Bid Opening

- A. Bid openings will be held virtually only.
- B. Public Bid Opening dial in information:
 - 1) **Dial in: 650-564-3271**
 - 2) **Phone Conference ID: 659 174 733#**

21. Evaluation and Selection

- A. At the time of bid opening, each bid will be checked for the presence or absence of required information in conformance with the submission requirements of this IFB.
- B. The State will evaluate each bid to determine its responsiveness to the published requirements.
- C. Bids that contain false or misleading statements, or which provide references, which do not support an attribute or condition claimed by the bidder, may be rejected.
- D. Award if made, will be to the lowest responsive responsible bidder.
- E. In the event of a tie bids, the award will be determined by a coin toss. The coin toss will be held in the State Agency's headquarters area office. This is a public event, which the bidders will be invited to attend. The selection of the Contractor will be at the sole discretion of the State.

22. Award and Protest

- A. Whenever an agreement is awarded under a procedure, which provides for competitive bidding, but the agreement is not to be awarded to the low bidder, the notification must be "by telegram, electronic facsimile transmission, overnight courier, Internet transmission, or personal delivery." (PCC § 10345(a).)
- B. On written request from any bidder, the awarding agency must post a notice of the proposed contract award in a place accessible by the general public, including any Internet site identified in the IFB at least five working days prior to awarding the contract. (PCC § 10345(a)(1).)
- C. If any bidder, prior to the award of agreement, files a protest with the Department of General Services, Office of Legal Services, 707 Third Street, 7th Floor, Suite 7-330, West Sacramento, CA 95605 and CAL FIRE, on the grounds that the (protesting) bidder is the lowest responsive responsible bidder, the agreement shall not be awarded until either the protest has been withdrawn or the Department of General Services has decided the matter.
- D. Within five (5) days after filing the initial protest, the protesting bidder shall file with the Department of General Services and the awarding agency a detailed written statement specifying the grounds for the protest. The written protest must be sent to the Department of General Services, Office of Legal Services, 707 Third Street, 7th Floor, Suite 7-330, West Sacramento, California 95605. A copy of the detailed written statement should be mailed to the awarding agency. It is suggested that you submit any protest by certified or registered mail.

**California Department of Forestry and Fire Protection
 Office of Business Services, Contracts Unit**
 Attention: Antwanette Page
 710 Riverpoint Court
 West Sacramento, CA 95605
Email: antwanette.page@fire.ca.gov

**Department of General Services
 Office of Legal Services**
 Attention: Bid Protest Coordinator
 707 Third Street, 7th Floor, Suite 7-330
 West Sacramento, CA 95605
Phone Number: (916) 376-5080
Email: OLSProtests@dgs.ca.gov

23. Disposition of Bids

- A. Upon bid opening, all documents submitted in response to this IFB will become the property of the State of California and will be regarded as public records under the California Public Records Act (Government Code Section 6250 et seq.) and subject to review by the public.
- B. Bid packages may be returned only at the bidder's expense unless such expense is waived by the awarding agency.

24. Standard Conditions of Service

- A. After award of the Agreement and execution of the Agreement, should the Contractor fail to commence work within five (5) working days after notification of the starting date, or suspend work for a period of five (5) continuous working days after work has begun, CAL FIRE may provide five (5) calendar days written notice, posted at the job site or mailed to the Contractor, to timely prosecute and complete the work or the Agreement may be terminated and liquidated damages assessed for administrative costs for re-bidding the work or awarding the work to another Contractor. In addition, that Contractor shall be liable to CAL FIRE for the difference between the Contractor's bid price and the actual cost of performing the work by the second low bidder or by another Contractor.
- B. All performance under the Agreement shall be completed on or before the termination date of the Agreement.
- C. Antitrust Provisions
 - 1) The Contractor offers and agrees and will require all of his other subcontractors and suppliers to agree to assign to the awarding body all rights, title, and interest in and to all causes of action they may have under Section 4 of the Clayton Act (15 USC section 15) or under the Cartwright Act [Chapter 2, commencing with section 16700, of Part 2 of Division 7 of the Business and Professions Code] arising from purchases of goods, services, or materials pursuant to the public works contract or subcontract. The assignment made by the contractor and all additional assignments made by the subcontractors and suppliers shall be deemed to have been made and will become effective at the time the awarding body tenders final payment to the Contractor without further acknowledgment or the necessity of tendering to the awarding body any written assignments.
 - 2) If an awarding body receives, either through judgment or settlement, a monetary recovery for a cause of action assigned under Government Code Sections 4550-4554, the assignor shall be entitled to receive reimbursement for actual legal costs incurred and may, on demand, recover from the public body any portion of the recovery, including treble damages, and attributable overcharges that were paid by the assignor but were not paid by the public body as a part of the bid price, less the expenses incurred in obtaining that portion of the recovery. On demand in writing by the assignor, the assignee shall, within one year from such demand, reassign the cause of action assigned under Government Code Sections 4550-4554 if the assignor has been or may have been injured by the violation of law for which the cause of action arose and (a) the assignee has not been injured thereby, or (b) the assignee declines to file a court action for the cause of action.
- D. If the bidder is awarded the Agreement and refuses to sign the Agreement presented for signature within the time and manner required, the bidder will be liable to CAL FIRE for actual damages resulting to CAL FIRE therefrom or 10 percent (10%) of the amount bid, whichever is less.
- E. Loss Leader usage is prohibited in this solicitation: It is unlawful for any person engaged in business within this State to sell or use any article or product as a "loss leader" as defined in California Business and Professions Code Section 17030. "Loss Leader" means any article or product sold at less than cost: a) where the purpose is to induce, promote or encourage the purchase of other merchandise; or b) where the effect is a tendency or capacity to mislead or deceive purchasers of prospective purchasers; or c) where the effect is to divert trade from or otherwise injure competitors.
- F. No oral understanding or agreement shall be binding on either party.

25. Generative Artificial Intelligence (GenAI)

- A. The State of California seeks to realize the potential benefits of GenAI, through the development and deployment of GenAI tools, while balancing the risks of these new technologies.
- B. Bidder / Offeror must notify the State in writing if it: (1) intends to provide GenAI as a deliverable to the State; or (2), intends to utilize GenAI, including GenAI from third parties, to complete all or a portion of any deliverable that materially impacts: (i) functionality of a State system, (ii) risk to the State, or (iii) Contract performance. For avoidance of doubt, the term "materially impacts" shall have the meaning set forth in State Administrative Manual (SAM) § 4986.2 Definitions for GenAI.
- C. Failure to report GenAI to the State may result in disqualification. The State reserves the right to seek any and all relief to which it may be entitled to as a result of such non-disclosure.

- D. Upon notification by a Bidder / Offeror of GenAI as required, the State reserves the right to incorporate GenAI Special Provisions into the final contract or reject bids/offers that present an unacceptable level of risk to the State.
- E. Government Code 11549.64 defines "Generative Artificial Intelligence (GenAI)" as an artificial intelligence system that can generate derived synthetic content, including text, images, video, and audio that emulates the structure and characteristics of the system's training data.

D) Special Programs

1. Disabled Veteran Business Enterprise (DVBE) Program Requirement

A. DVBE Participation Program with Goals:

- 1) The required DVBE participation goal for this IFB is **three percent (3%)**. The resultant Agreement is financed with State funds and subject to Public Contract Code Section 10115 et seq., Military and Veterans Code Section 999 et seq., and Title 2, California Code of Regulations, Sections 1896.60 (2 CCR Section 1896.60) et seq., that provides contracting opportunities for qualified DVBEs certified by the DGS. The DVBE Incentive Program may also apply—see **paragraph B, DVBE Incentive Program, below**.
- 2) Bidder shall complete and submit the following **Bid/Bidder Certification Sheet Attachment 2; Bidder Declaration (GSPD-05-105), Attachment 5**, as applicable, **Quotes from SB/DVBE Subcontractor, Attachment 13**, and, as applicable, the **Disabled Veteran Business Enterprise Declarations (STD 843), Attachment 4**. Bidder shall complete or collect STD 843(s) when the following situations occur:

- Bidder is DVBE (prime) Contractor.
- Bidder subcontracts with any DVBE firm. Bidder collects and submits with its bid package a completed and signed STD 843 from each of the DVBE subcontractor(s) listed on the **GSPD-05-105**.

Failure to provide required DVBE information will result in the bid being rejected as non-responsive. For each certified DVBE subcontractor listed on the **Bidder Declaration, GSPD-05-105**, the bidder shall submit a copy of the quotes from each DVBE as **Attachment 13, Quotes from SB/DVBE Subcontractor, Attachment 13**, as proof of commitment.

- 3) Additional references: <https://www.dgs.ca.gov/OBAS/Resources/Page-Content/OBAS-Resources-List-Folder/DGS-Contracting-Commitment-with-Small-Businesses-DVBEs>.

B. DVBE Incentive Program

- 1) The DVBE Incentive Program applies to this solicitation. It is separate from the DVBE Participation Program and was established in Military and Veterans Code Sections 999 et seq., and Title 2, California of Regulations, Sections 1896.99 (2 CCR Section 1896.99) et seq., to encourage bidders to partner with DVBE subcontractors. A dollar cap of \$100,000 is set for all combined incentives and preferences. The incentive is used only for evaluation purposes to arrive at the successful bidder and does not alter the amounts of the actual bid. Any responsive and responsible bidder with the confirmed DVBE participation per the Tables in **paragraph 3)** below is eligible to receive the incentive. Bidders who are not responsive and responsible regardless of the amount of DVBE participation are not eligible to receive the incentive.
- 2) CAL FIRE will apply an incentive to bids proposing the utilization of DGS certified DVBE firms identified on the **Bidder Declaration (GSPD-05-105)**. Information provided on the **GSPD-05-105** shall be verified by CAL FIRE prior to the award of the Agreement. Contractor shall also submit **Quotes from SB/DVBE Subcontractor, Attachment 13**, the incentive amount is equal to a percentage of the lowest responsive and responsible bid based on the amount of DVBE participation in the bid being evaluated per the Tables below.

3) Tables for IFB (Low Price Method)

Required 3% Goal

Verified DVBE Participation	DVBE Incentive Amount
5% or more	5%
4.5%-4.99%	4%
4.0%-4.49%	3%
3.5%-3.99%	2%
3.01%-3.49%	1%

4) When applying the DVBE Incentive, an NSB shall not displace an award to a DGS Certified Small Business.

5) Additional information: <https://www.dgs.ca.gov/OBAS/Resources/Page-Content/OBAS-Resources-List-Folder/DGS-Contracting-Commitment-with-Small-Businesses-DVBES>.

2. Small Business (SB) or Microbusiness (MB) Preference

- A. Government Code Section 14835 et seq. requires that a five percent (5%) preference be given to contractors who qualify as a certified SB or MB. References to a SB shall also include MB. The rules and regulations of this law, including the definition of a SB for the delivery of services, are contained in Title 2, California Code of Regulations, Section 1896 (2 CCR Section 1896) et seq.
- B. To claim the SB preference, your firm must have its principal place of business located in California and be certified by the California Department of General Services (DGS), Office of Small Business and DVBE Services (OSDS). The preference amount may not exceed fifty thousand dollars (\$50,000) for any bid. If prospective Contractor is claiming the five percent (5%) SB preference, complete Section 16 of the **Bid/Bidder Certification Sheet Attachment 2**.
- C. Pursuant to Government Code Section 14838 and 2 CCR Section 1896, if a bidder is not a certified SB, but wishes to be eligible for the five percent (5%) non-small business (NSB) preference, the bidder must subcontract at least twenty five percent (25%) of its net bid price to one or more certified SBs. If bidder is claiming the five percent (5%) NSB preference, complete Section 17 of the **Bid/Bidder Certification Sheet, Attachment 2, and Bidder Declaration, GSPD-05-105**, which can be downloaded at <https://www.documents.dgs.ca.gov/dgs/fmc/gspd/gspd05-105.pdf>. Bidder shall list the names of all certified SB firms being claimed for credit on the GSPD-05-105 form. For each certified SB subcontractor listed, the bidder shall submit a copy of the quotes from each SB (on the SB's company letterhead) as **Quotes from SB/DVBE Subcontractor, Attachment 13**.
- D. This preference shall not be awarded to a noncompliant bidder and shall not be used to achieve any applicable minimum requirements.
- E. Certified SB bidder(s) shall have precedence over NSB bidders in the application of SB preference(s).
- F. SB preferences may not be applied to any bid deemed non-responsive with the solicitation instructions or from a non-responsible bidder.
- G. Questions regarding the certification approval process or SB program should be directed to OSDS at (800) 559-5529 or (916) 375-4940. For 24-Hour Recording and Mail Request, call (916) 322-5060, or email: osdshelp@dgs.ca.gov.
- H. Additional references are at <https://www.dgs.ca.gov/OBAS/Resources/Page-Content/OBAS-Resources-List-Folder/DGS-Contracting-Commitment-with-Small-Businesses-DVBES>.

3. Commercially Useful Function

It is the law. All California-certified Small Businesses (SB) and Disabled Veteran Business Enterprise (DVBEs) doing business with the state must perform a Commercially Useful Function (CUF). Performing CUF is a critical requirement for all California-certified firms - SB and DVBE - that do business with the state (Government Code Section 14837 and Military and Veterans Code Section 999).

More information can be found on Department of General Services website:

<https://www.dgs.ca.gov/PD/Resources/Page-Content/Procurement-Division-Resources-List-Folder/Commercially-Useful-Function-for-Certified-Firms>

4. CAL FIRE Advocates

CAL FIRE Small Business and Disabled Veteran Business Enterprise Advocates are available to answer questions regarding the SB/DVBE Programs and Incentives and to help identify possible SB/DVBE vendors.

CAL FIRE ADVOCATES: sbdvbe.advocate@fire.ca.gov

ATTACHMENT 1

Bidder's Company Name:

REQUIRED ATTACHMENT CHECKLIST

A complete bid or bid package will consist of the items identified below.

Complete this checklist to confirm the items in your bid. Place a check mark or "X" next to each item that you are submitting to the State. For your bid to be responsive, all required attachments must be returned. This checklist should be returned with your bid package also.

<u>Attachment</u>	<u>Attachment Name/Description</u>
_____ Attachment 1	Required Attachment Checklist
_____ Attachment 2	Bid/Bidder Certification Sheet
_____ Attachment 3	Rate Sheet
_____ Attachment 4	Disabled Veteran Business Enterprise Declarations (STD 843) https://www.documents.dgs.ca.gov/dgs/fmc/gspd/pd_843.pdf
_____ Attachment 5	Bidder Declaration (GSPD-05-105) https://www.documents.dgs.ca.gov/dgs/fmc/gspd/gspd05-105.pdf
_____ Attachment 6	DARFUR Contracting Act (CAL FIRE-720)
_____ Attachment 7	Iran Contracting Act (DGS PD 3)* https://www.documents.dgs.ca.gov/dgs/FMC/GS/PD/PD_3.pdf
_____ Attachment 8	Payee Data Record (STD 204) http://www.documents.dgs.ca.gov/dgs/fmc/pdf/std204.pdf
_____ Attachment 9	Contractor Certification Clauses (CCC 04/2017) https://www.dgs.ca.gov/-/media/Divisions/OLS/Resources/CCC-042017.pdf?la=en&hash=4DE3E4DC414511AE378794200BA43EBF91C758EE
_____ Attachment 10	California Civil Rights Laws Attachment*
_____ Attachment 11	Non-Collusion for Public Works
_____ Attachment 12	Quotes from SB/DVBE Subcontractors
_____ Additional Required Information:	1. The Prime Bidder must be either an individual or firm currently licensed to do business in California and proof of such in the form of a current and valid Business License or California Secretary of State registration for the business shall be provided. 2. The Prime Bidder must have a current and valid Business License or Incorporation papers for their respective State showing that their company is in good standing in that state, if the Prime Bidder's base of operation is located outside the State of California and provide proof of such. 3. Contractor shall possess and provide proof of the following: A. A – General Engineering Contractor license issued by the California Contractors State Licensing Board (CSLB). B. Proof of valid Department of Industrial Relations (DIR) registration as a Public Works Contractor. C. Bidder's Bond executed by an admitted surety insurer and made payable to the State of California if bid price exceeds \$484,000.00. The bidder's bid bond shall be no less than 10 percent (10%) of bidder's total bid.

*If applicable

ATTACHMENT 2
BID/BIDDER CERTIFICATION SHEET

This Bid/Bidder Certification Sheet must be signed and returned along with all the "required attachments" as an entire package in duplicate with original signatures/electronic signature. The bid must be transmitted in accordance with IFB instructions.

Do not return IFB Sections A through E or the "Sample Standard Agreement" at the end of this IFB.

- A. Our all-inclusive bid is submitted as detailed in **Attachment 3, Rate Sheet**.
- B. All required attachments are included with this certification sheet.
- C. I have read and understand the DVBE participation requirements and have included documentation demonstrating that I have met the participation goals.
- D. The signature affixed hereon and dated certifies compliance with all the requirements of this bid document. The signature below authorizes the verification of this certification.

An Unsigned Bid/Bidder Certification Sheet May Be Cause For Rejection

1. Company Name	2. Telephone Number () ()	2a. Fax Number () ()
3. Address		
E-mail Address:		
5. ☐ Partnership		
Indicate your organization type:		
4. ☐ Sole Proprietorship		
6. ☐ Corporation	6a. ☐ L.L.C. Limited Liability Corporation	
Indicate the applicable employee and/or corporation number:		
7. Federal Employee ID No. (FEIN)	8. California Corporation No.	
9. Indicate applicable license and/or certification information:		
10. Bidder's Name (Print)	11. Title	
12. Signature	13. Date	
14. Are you certified with the Department of General Services, Office of Small Business and DVBE Certification as:		
a. California Small Business Enterprise		
Yes ☐ No ☐		
If yes, enter certification number:		

a. Disabled Veteran Business Enterprise		
Yes ☐ No ☐		
If yes, enter certification number:		

NOTE: A copy of your Certification is required to be included if either of the above items is checked "Yes".		
Date application was submitted to OSBCR, if an application is pending:		

ATTACHMENT 2

Completion Instructions for Bid/Bidder Certification Sheet

Complete the numbered items on the
Bid/Bidder Certification Sheet by following the instructions below.

Item Numbers	Instructions
1, 2, 2a, 3	Must be completed. These items are self-explanatory.
4	Check if your firm is a sole proprietorship. A sole proprietorship is a form of business in which one (1) person owns all the assets of the business in contrast to a partnership and corporation. The sole proprietor is solely liable for all the debts of the business.
5	Check if your firm is a partnership. A partnership is a voluntary agreement between two (2) or more competent persons to place their money, effects, labor, and skill, or some or all of them in lawful commerce or business, with the understanding that there shall be a proportional sharing of the profits and losses between them. An association of two (2) or more persons to carry on, as co-owners, a business for profit.
6, 6a	Check if your firm is a corporation. A corporation is an artificial person or legal entity created by or under the authority of the laws of a state or nation, composed, in some rare instances, of a single person and his successors, being the incumbents of a particular office, but ordinarily consisting of an association of numerous individuals. Or a Limited Liability Corporation.
7	Enter your federal employee tax identification number.
8	Enter your corporation number assigned by the California Secretary of State's Office. This information is used for checking if a corporation is in good standing and qualified to conduct business in California.
9	Complete, if applicable, by indicating the type of license and/or certification that your firm possesses and that is required for the type of services being procured.
10, 11, 12, 13	Must be completed. These items are self-explanatory.
14	If certified as a California Small Business, place a check in the "Yes" box, and enter your certification number on the line. If certified as a Disabled Veterans Business Enterprise, place a check in the "Yes" box and enter your service code on the line. If you are not certified to one (1) or both, place a check in the "No" box. If your certification is pending, enter the date your application was submitted to OSBCR.

ATTACHMENT 3

Bidder's Company Name:

RATE SHEET

Item No.	Description of Services	Total Cost
1	Demolition as described in Exhibit A, Detailed Scope of Work.	\$
2	Grading as described in Exhibit A, Detailed Scope of Work.	\$
3	Concrete Flat Work as described in Exhibit A, Detailed Scope of Work.	\$
4	Landscaping as described in Exhibit A, Detailed Scope of Work.	\$
5	Stormwater Drainage as described in Exhibit A, Detailed Scope of Work.	\$
6	Erosion Control as described in Exhibit A, Detailed Scope of Work.	\$
Sub Total (Sum of Items 1 – 6)		\$
10% Contingency (10% of Sub Total)		\$
Total Agreement Cost * <i>(Sub Total + 10% Contingency)</i>		\$
Note: *Rate is All-Inclusive		

Submitted by: _____ Date: _____

Contact Name / Title:	
Company Name:	
Company Address:	
Telephone Number:	
Fax Number:	

E-Mail Address:	
-----------------	--

Estimated quantities are not guaranteed and is not binding on the contracting agency. The Total Costs indicated above will be used solely for computing the cost as a fair and equitable formula to determine the low bidder and is not binding on the contracting agency. However, the actual costs quoted above by the bidder shall be binding for the term of the Agreement. Small Business and Disabled Veteran Business Enterprise incentives will also be applied to determine the lowest bid. CAL FIRE reserves the right to correct and revise calculation errors made by the bidder.

In case of discrepancy between the unit price and the total set forth for a unit basis item, the unit price shall prevail.

Please do not alter, modify, or change this bid proposal sheet. Any alterations, modifications, or changes to this bid proposal sheet will be grounds to reject the bid.

Each line item must be bid. Please do not leave any unit price column blank or this bid proposal sheet will be disqualified from competition for contract award.

ATTACHMENT 4

(if applicable)

DISABLED VETERAN BUSINESS ENTERPRISE DECLARATIONS (STD 843)

Bidders who are disabled veteran (DV) owner(s) and DV manager(s) of a Disabled Veteran Business Enterprise must complete Disabled Veteran Business Enterprise Declarations (STD 843) when a DVBE Contractor or subcontractor will provide materials, supplies, services or equipment and include it with the bid response.

The STD 843 Disabled Veteran Business Enterprise Declarations form can be found at:

https://www.documents.dgs.ca.gov/dgs/fmc/gs/pd/pd_843.pdf

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ATTACHMENT 5

(if applicable)

BIDDER DECLARATION FORM (GSPD-05-105)

All bidders must complete the Bidder Declaration Form (GSPD-05-105) and include it with the bid response.

The Bidder Declaration Form can be found at:

<https://www.documents.dgs.ca.gov/dgs/fmc/gspd/gspd05-105.pdf>

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ATTACHMENT 6

DARFUR CONTRACTING ACT VENDOR CERTIFICATION

Pursuant to Public Contract Code Section 10478, if a bidder or proposer currently, or within the previous three (3) years, has had business activities or other operations outside of the United States, it must certify that it is not a “**scrutinized company**” as defined in Public Contract Code Section 10476 (**see attached definition**).

Therefore, to be eligible to submit a bid or proposal, please complete the company/vendor information and one of the three following clauses (**NOTE:** Clause #1 requires initials only; Clause #2 requires initials only; Clause #3 requires initials and a certification signature):

DATE	FEDERAL ID NUMBER
PRINTED COMPANY / VENDOR NAME	
PRINTED NAME <u>AND</u> TITLE OF AUTHORIZED PERSON INITIALING AN OPTION BELOW	

Complete ONLY ONE of the following:

1. _____
Initials only We do not currently have, and have not had within the previous three (3) years, business activities or other operations outside of the United States.

OR
2. _____
Initials only We are a *scrutinized company* as defined in Public Contract Code Section 10476, but we have received written permission from the Department of General Services (DGS) to submit a bid or proposal pursuant to Public Contract Code Section 10477(b). **A copy of the written permission from DGS is included with our bid or proposal.**

OR
3. _____
Initials
+
certification below We currently have, or we have had within the previous three (3) years, business activities or other operations outside of the United States, but we certify below that we are not a *scrutinized company* as defined in Public Contract Code Section 10476.

CERTIFICATION for #3

I, the official named below, CERTIFY UNDER PENALTY OF PERJURY that I am duly authorized to legally bind the prospective proposer/bidder to the clause listed above in #3. This certification is made under the laws of the State of California.

BY (AUTHORIZED SIGNATURE)	
PRINTED NAME <u>AND</u> TITLE OF AUTHORIZED PERSON SIGNING	
DATE EXECUTED	EXECUTED IN THE COUNTY AND STATE OF



ATTACHMENT 6

DEFINITION of SCRUTINIZED COMPANY PUBLIC CONTRACT CODE SECTION 10476

10476. As used in this article, the following definition applies:

"Scrutinized company" means a company in Sudan that is involved in power production activities, mineral extraction activities, oil-related activities, or the production of military equipment, but **excludes a company that can demonstrate any of the following:**

- (a) Its business operations are conducted under contract directly and exclusively with the regional government of southern Sudan.
- (b) Its business operations are conducted under a license from the Office of Foreign Assets Control or are expressly exempted under federal law from the requirement to be conducted under such a license.
- (c) Its business operations consist of providing goods or services to marginalized populations of Sudan.
- (d) Its business operations exclusively consist of providing goods or services to an internationally recognized peacekeeping force or humanitarian organization.
- (e) Its business operations consist of providing goods or services that are used only to promote health or education.
- (f) Its business operations with the Government of Sudan will be voluntarily suspended for the entire duration of the contract for goods or services for which they have bid on, or submitted a proposal for, a contract with a state agency.
- (g) It has adopted, publicized, and is implementing a formal plan to cease business operations within one year and to refrain from conducting any new business operations.

ATTACHMENT 7

(if applicable)

IRAN CONTRACTING ACT CERTIFICATION

All bidders must complete the Iran Contracting Act Certification (DGS PD 3) and include it with the bid response.

Iran Contracting Act Certification (DGS PD 3) Form can be found at:

https://www.documents.dgs.ca.gov/dgs/FMC/GS/PD/PD_3.pdf.

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ATTACHMENT 8

PAYEE DATA RECORD (STD 204)

All bidders must complete the Payee Data Record (STD 204) and include it with the bid response.

The Payee Data Record (STD 204) is available at the following website:

<http://www.documents.dgs.ca.gov/dgs/fmc/pdf/std204.pdf>

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ATTACHMENT 9

CONTRACTOR CERTIFICATION CLAUSES (CCC 04/2017)

All bidders must complete the Contractor Certification Clauses form (CCC 04/2017) and include it with the bid response.

The Contractor Certification Clauses Form (CCC 04/2017) is available at the following website:

<https://www.dgs.ca.gov/-/media/Divisions/OLS/Resources/CCC-042017.pdf?la=en&hash=4DE3E4DC414511AE378794200BA43EBF91C758EE>

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ATTACHMENT 10

(if applicable)

CALIFORNIA CIVIL RIGHTS LAWS ATTACHMENT

All bidders must complete the California Civil Rights Laws Attachment and include it with the bid response.

The California Civil Rights Laws Attachment is available at the following website:

<https://www.documents.dgs.ca.gov/dgs/FMC/DGS/OLS004.pdf>

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ATTACHMENT 11

Non-Collusion for Public Works

**NON-COLLUSION DECLARATION TO BE EXECUTED BY BIDDER AND
SUBMITTED WITH BID FOR PUBLIC WORKS
(Rev 04/22)**

The undersigned declares:

I am the _____ of _____, the party making the foregoing bid.

The bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation. The bid is genuine and not collusive or sham. The bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid. The bidder has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or to refrain from bidding. The bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the bidder or any other bidder, or to fix any overhead, profit, or cost element of the bid price, or of that of any other bidder. All statements contained in the bid are true. The bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, to any corporation, partnership, company, association, organization, bid depository, or to any member or agent thereof, to effectuate a collusive or sham bid, and has not paid, and will not pay, any person or entity for such purpose.

Any person executing this declaration on behalf of a bidder that is a corporation, partnership, joint venture, limited liability company, limited liability partnership, or any other entity, hereby represents that he or she has full power to execute, and does execute, this declaration on behalf of the bidder.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct and that this declaration is executed on (date), at (city), (state).

Signed: _____
Print/Type Name

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ATTACHMENT 12

(if applicable)

QUOTES FROM SB/DVBE SUBCONTRACTORS

All bidders must complete the Quotes from SB/DVBE Subcontractors and include it with the bid response.

Quotes should be on Subcontractor letterhead.

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SAMPLE AGREEMENT

F) Proposed Form of Agreement

The following pages represent a sample of the agreement that will be awarded, if any, from this IFB. Please review it carefully and present any questions in writing to the contact person identified on the cover letter for this IFB.

STATE OF CALIFORNIA - DEPARTMENT OF GENERAL SERVICES

STANDARD AGREEMENT

STD 213 (Rev. 04/2020)

AGREEMENT NUMBER

3CA08018

PURCHASING AUTHORITY NUMBER (If Applicable)

1. This Agreement is entered into between the Contracting Agency and the Contractor named below:

CONTRACTING AGENCY NAME

California Department of Forestry and Fire Protection (CAL FIRE)

CONTRACTOR NAME

TBD

2. The term of this Agreement is:

START DATE

October 01, 2026 (estimated), or upon approval by CAL FIRE, whichever is later

THROUGH END DATE

June 30, 2027 (estimated)

3. The maximum amount of this Agreement is:

TBD

4. The parties agree to comply with the terms and conditions of the following exhibits, which are by this reference made a part of the Agreement.

Exhibits	Title	Pages
Exhibit A	Scope of Work	3
Exhibit B	Budget Detail and Payment Provisions	5
Exhibit C *	General Terms and Conditions (GTC 02/2025)	-
+ - Exhibit D	Special Terms and Conditions	4
+ - Exhibit E	Additional Provisions	9
+ - Attachment 1	Rate Sheet (To be attached upon award)	1
+ - Attachment 2	Bidder Declaration (GSPD-05-105) (To be attached upon award)	1
+ - Attachment 3	Drawings	15
+ - Attachment 4	Specifications	109

Items shown with an asterisk (*), are hereby incorporated by reference and made part of this agreement as if attached hereto.

These documents can be viewed at <https://www.dgs.ca.gov/OLS/Resources>

IN WITNESS WHEREOF, THIS AGREEMENT HAS BEEN EXECUTED BY THE PARTIES HERETO.

CONTRACTOR

CONTRACTOR NAME (if other than an individual, state whether a corporation, partnership, etc.)

TBD

CONTRACTOR BUSINESS ADDRESS

TBD

CITY

STATE

ZIP

PRINTED NAME OF PERSON SIGNING

TBD

TITLE

CONTRACTOR AUTHORIZED SIGNATURE

DATE SIGNED

STATE OF CALIFORNIA - DEPARTMENT OF GENERAL SERVICES

STANDARD AGREEMENT

STD 213 (Rev. 04/2020)

AGREEMENT NUMBER

3CA08018

PURCHASING AUTHORITY NUMBER (If Applicable)

STATE OF CALIFORNIA

CONTRACTING AGENCY NAME

California Department of Forestry and Fire Protection (CAL FIRE)

CONTRACTING AGENCY ADDRESS

P.O. Box 944246

CITY

Sacramento

STATE

CA

ZIP

94244

PRINTED NAME OF PERSON SIGNING

TBD

TITLE

CONTRACTING AGENCY AUTHORIZED SIGNATURE

DATE SIGNED

CALIFORNIA DEPARTMENT OF GENERAL SERVICES APPROVAL

EXEMPTION (If Applicable)

EXHIBIT A
(Scope of Work)

SCOPE OF WORK

1. Contractor agrees to provide to the California Department of Forestry and Fire Protection (CAL FIRE) Ramona Air Attack Base (AAB) - Helitack Site Improvements, as described herein:

Contractor shall provide all materials, labor, equipment, tools, permits, taxes, transportation, and fees to provide demolition services and flat work including, but not limited to, updates to landscape and concrete driveway at the CAL FIRE Ramona Air Attack Base (AAB) as described in **Exhibit A, Scope of Work**.

Services are necessary to comply with safety requirements and maintain operational capabilities. Ramona Air Attack Base (AAB) serves as a critical hub providing essential services that strengthen wildfire response efforts across the county and regionally.
2. CAL FIRE has the right to extend this agreement for one (1) year by amendment at the same terms, conditions, and costs.
3. Subcontracting is permitted under this Agreement if subcontractors are included on the **Bidder Declaration (GSPD-05-105), Attachment 2**.
4. The services shall be performed at CAL FIRE - Ramona Air Attack Base (AAB) - 2498 Montecito Road, Ramona, CA 92065.
5. Any reference to CAL FIRE Project Representative shall also include their designee.
6. This Agreement will commence on **October 01, 2026 (estimated)**, or upon approval by CAL FIRE, whichever is later, and no work shall begin before that time. This Agreement is of no effect unless approved by CAL FIRE. Contractor shall not receive payment for work performed prior to approval of the Agreement and before receipt of notice to proceed by CAL FIRE Project Representative. This Agreement will expire on **June 30, 2027 (estimated)**. The services shall be provided during normal working hours, Monday through Friday, 8:00 a.m. to 5:00 p.m., except State holidays. The parties may amend this Agreement as permitted by law.
7. The Project Representatives during the term of this agreement will be:

California Department of Forestry and Fire Protection (CAL FIRE)	Contractor: TBD
Name: TBD	Project Representative:
Address: (Street Address, City State, Zip Code)	Address: (Street Address, City State, Zip Code)
Phone:	Phone:
Email:	Email:

8. Detailed Scope of Work

- A. Contractor shall provide all required services to construct new improvements which are included and detailed in the provided **Attachment 3 – Drawings** and **Attachment 4 – Specifications**.
- B. Contractor shall perform the following in accordance with **Attachment 3 – Drawings** and **Attachment 4 – Specifications**.
 - 1) Site demolition
 - 2) Site grading
 - 3) Landscaping
 - 4) Concrete flat work
 - 5) Stormwater drainage improvements. Including V-ditch construction and StormTrap connection.

EXHIBIT A
(Scope of Work)

6) Erosion control

- C. Contractor shall verify all dimensions and existing conditions before proceeding with construction.
- D. Contractor shall maintain structural and fire resistive integrity at penetrations for mechanical, plumbing, electrical, and communications pipe, duct and conduit.
- E. All decorative materials shall be maintained in a flame-retardant condition.
- F. Contractor shall comply with requirements of the county, and state for all construction.
- G. The attached plans and all work shall comply with the California building standards code found in the State of California title 24 California Code of Regulations (CCR).
- H. Contractor shall thoroughly coordinate all trades as required to complete all work indicated and necessary for the project.
- I. Contractor shall protect existing site features and shall replace all items damaged during construction at Contractor's expense.
- J. Contractor shall enforce all safety measures. Contractor shall design, construct and maintain all safety devices, including shoring and shall be solely responsible for conforming to all local, state and federal safety and health standards, laws and regulation.
- K. Contractor shall assume sole and complete responsibility for job site conditions during the course of construction, including safety of all persons and property. This requirement shall apply continuously and not be limited to normal working hours.
- L. Contractor shall be responsible for any monumentation and/or benchmarks which will be disturbed or destroyed by construction. Such points shall be referenced and replaced with appropriate monumentation by a licensed land survey or registered civil engineer as required by the land surveyor's act.
- M. Contractor shall coordinate with local authorities-having-jurisdiction (AHJs) San Diego County and Ramona Airport Management, regarding construction times and access to taxiways
- N. Contractor shall coordinate work dates/times with local airport and County officials.
- O. Contractor shall be responsible for verifying and calculating necessary material quantities prior to submittal of bid.
- P. CAL FIRE Project Representative will not consider change orders associated with incorrect material quantities or increases in cost of materials.
- Q. Contractor shall complete all work in the attached plans and specifications.

9. Preservation of CAL FIRE Property

- A. Contractor shall ensure that only qualified and competent employee(s) are permitted on the job site and that the work shall be safely performed by the highest industry standards. Contractor shall take all the necessary precautions to prevent injury or hazard to CAL FIRE employee(s), invitee(s) and /or the general public.
- B. Contractor shall conduct its operation as to avoid damage to the property of CAL FIRE or to adjacent property. If any property is damaged by reason of the Contractor's operation(s), such property shall be replaced or restored at Contractor's sole expense and to the satisfaction of CAL FIRE and /or the property owner.\
- C. Contractor shall comply with all applicable federal, state, county, city, and municipal laws, ordinances, rules, and regulations which in any manner affect those engaged or employed in the work to be performed.
- D. Contractor shall avoid causing unreasonable inconvenience to any person(s) doing business on CAL FIRE property. In the event Contractor's operation creates a condition hazardous to CAL FIRE property occupants or the general public, Contractor shall provide warning signs alerting to any dangerous conditions at Contractor's own expense and with no cost to CAL FIRE.
- E. Contractor shall obtain and pay all permits and licenses, registrations and certificates required by local's ordinances.

EXHIBIT A
(Scope of Work)

10. Work Site Clean-up

- A. Contractor shall own and assume all responsibility for all litter, waste, debris, and similar materials arising from or produced by the work performed under this Agreement. Contractor shall clean and keep the area in orderly, safe, and clean condition, including, but not limited to spills and smudges. If the work site is not left in a clean and orderly condition, Contractor shall be called back to correct the condition at no extra cost to CAL FIRE.
- B. Contractor shall promptly remove such litter, waste, debris, and other materials produced during this work and legally dispose of them at no additional cost to CAL FIRE. No such litter, waste, debris, and other materials shall be deposited in any CAL FIRE dumpsters without advance written permission of CAL FIRE Contract Project Representative.
- C. Such litter, waste, debris, and other materials is not expected to include hazardous waste. However, if hazardous waste is encountered, Contractor will notify the CAL FIRE Project Representative. CAL FIRE Project Representative may direct that to the CAL FIRE hazardous waste removal contractor process and dispose of the hazardous waste.

EXHIBIT B
(Budget Detail and Payment Provisions)

BUDGET DETAIL AND PAYMENT PROVISIONS

1. Invoicing and Payment

- A. For services satisfactorily completed in accordance with the terms and conditions stated herein, and upon receipt and approval of the invoice(s), the State agrees to compensate the Contractor for actual expenditures incurred in accordance with the rates attached hereto as **Attachment 1 – Rate Sheet** and made a part of this Agreement.
- B. Contractor will be paid a lump sum, in arrears, in full payment for all work and services performed under this Agreement.
- C. Each Invoice shall include:
 - 1) The agreement number **3CA08018**.
 - 2) The dates or time-period which the invoiced costs were incurred.
 - 3) Description of service, quantity, rate, and total for the current invoice.
 - 4) Certified Small Business or DVBE number, if applicable.
- D. Invoice(s) shall be submitted to:

California Department of Forestry and Fire Protection
Attention: **TBD**
Street Address/P.O. Box
City, State, Zip Code
Phone Number
Email

- E. Contractor shall submit a copy of the Prime Contractor's [DVBE Subcontracting Report form \(STD 817\)](#) for verification by CAL FIRE Project Representative with each invoice submitted at Fiscal Year End (June 30th) and with final invoice.
- F. Contractor agrees to certify on Prime Contractor's Certification DVBE Subcontractor Report, **Form STD 817**, that DVBE subcontractor participation under this agreement is in compliance with the goals specified at the time of award of contract or with any subsequent amendment. If for this Contract the Contractor made a commitment to achieve the DVBE participation goal, the Department will withhold **\$10,000.00** from the final payment, or the full final payment if less than **\$10,000.00**, until the Contractor complies with the certification requirements of Military and Veterans Code Section 999.5. A Contractor that fails to comply with the certification requirement shall, after notice, be allowed to cure the defect. Notwithstanding any other law, if, after at least 15 calendar days but not more than 30 calendar days from the date of notice, the prime contractor refuses to comply with the certification requirements, the department shall permanently deduct **\$10,000.00** from the final payment, or the full payment if less than **\$10,000.00**. The Contractor shall provide proof of payment for the work performed by the DVBE subcontractor(s) upon Department's request.

2. Budget Contingency Clause

- A. It is mutually agreed that if the Budget Act of the current year and/or any subsequent years covered under this Agreement does not appropriate sufficient funds for the program, this Agreement shall be of no further force and effect. In this event, the State shall have no liability to pay any funds whatsoever to Contractor or to furnish any other considerations under this Agreement and Contractor shall not be obligated to perform any provisions of this Agreement.
- B. If funding for any fiscal year is reduced or deleted by the Budget Act for purposes of this program, the State shall have the option to either cancel this Agreement with no liability occurring to the State or offer an agreement amendment to Contractor to reflect the reduced amount.

3. Prompt Payment Clause

- A. Payment will be made in accordance with, and within the time specified in, Government Code Chapter 4.5, commencing with Section 927. In the event of an emergency, as defined in section 927.11, late payment penalties

EXHIBIT B
(Budget Detail and Payment Provisions)

may not apply. Specific to CAL FIRE, if an invoice from a business under contract with CAL FIRE becomes subject to late payment penalties during the annually declared fire season, then the required payment approval date shall extend 30 calendar days beyond the initial 45-day period, except in the case of a contract with a certified small business, a certified Disabled Veteran Business Enterprise, a non-profit organization, or a non-profit public benefit corporation.

- B. Pursuant to Public Contract Code Section 10262, Contractor shall pay its Subcontractor(s) within seven (7) calendar days from receipt of each payment made to Contractor by CAL FIRE.
- C. Failure of Contractor adhering to Public Contract Code Section 10262 may result in termination of this Agreement per Public Contract Code Section 10253 and disciplinary action by the Contractors State License Board may be implemented.
- D. Any subcontract entered into as a result of this Agreement shall contain all the provisions of this clause.

4. Cost Limitation

- A. Total amount of this Agreement shall not exceed **\$TBD**.
- B. It is understood and agreed that this total is an estimate, and that CAL FIRE will pay only for those services actually rendered as authorized by CAL FIRE Project Representative up to the total amount set forth in **Section 4A**, above.

5. Costs Included in Bid Rates

- A. The cost of employer payments to or on behalf of employees, subsistence, travel, compensation insurance premiums, unemployment contributions, social security taxes, Agreement bond premiums, and any other taxes or assessments including sales and use taxes required by law or otherwise shall be included in the Agreement rates and no additional allowance will be made thereof, unless separate payment provision should specifically so provide.
- B. Contractor shall make travel and subsistence payments to each worker in compliance with Labor Code Sections 1773.1 and 1773.9. Travel and subsistence requirements are available on the of Department of Industrial Relations (DIR) website at <https://www.dir.ca.gov/OPRL/DPreWageDetermination.htm>.

6. Payroll Records

- A. Contractor and each Subcontractor shall comply with the following provisions. Contractor shall be responsible for compliance by its Subcontractors.
 - 1) Each Contractor and Subcontractor shall keep accurate payroll records and supporting documents as mandated by Section 1776 of the California Labor Code and as defined in Section 16000 of Title 8 of the California Code of Regulations, showing the name, address, social security number, work classification, straight time and overtime hours worked each day and week, and the actual per diem wages paid to each journeyman, apprentice, worker, or other employee employed by Contractor or Subcontractor in connection with the public work. Each payroll record shall contain or be verified by a written declaration that it is made under penalty of perjury, stating both of the following:
 - a) The information contained in the payroll record is true and correct.
 - b) The employer has complied with the requirements of Labor Code Sections 1771, 1811, and 1815 for any work performed by its employees on the public works project.
 - 2) The payroll records enumerated under **paragraph 1)** above, shall be certified. The certified payrolls and records related to employee wages, fringe benefits, payroll tax and deductions shall be available for inspection and copying by CAL FIRE project Representative at all reasonable hours at Contractor's principal office. Certified payrolls shall be made available as follows:
 - a) A certified copy of an employee's payroll record shall be made available for inspection or furnished to the employee or the employee's authorized representative on request.

EXHIBIT B
(Budget Detail and Payment Provisions)

- b) A certified copy of all payroll records enumerated in **paragraph 1)** above, shall be made available for inspection or furnished upon request to a representative of CAL FIRE, the Division of Labor Standards Enforcement, and the Division of Apprenticeship Standards of the of Industrial Relations. Certified payrolls submitted to CAL FIRE, the Division of Labor Standards Enforcement, and the Division of Apprenticeship Standards shall not be altered or obliterated by Contractor.
- 3) Each Contractor shall submit a certified copy of the records enumerated in **paragraph 1)** above, to the entity that requested the records within 10 days after receipt of a written request.
- 4) Any copy of records made available for inspection as copies and furnished upon request to the public or any public agency by CAL FIRE shall be marked or obliterated in such a manner as to prevent disclosure of each individual's name, address and social security number. The name and address of Contractor awarded the Agreement or performing the Agreement shall not be marked or obliterated.
- 5) Contractor shall inform CAL FIRE of the location of the records enumerated under **paragraph 1)**, above, including the street address, city and county, and shall, within five (5) working days, provide a notice of a change of location and address.
- 6) Contractor or Subcontractor shall have 10 days in which to comply subsequent to receipt of written notice requesting the records enumerated in **paragraph 1)**, above. In the event Contractor or Subcontractor fails to comply within the 10-day period, it shall, as a penalty to CAL FIRE, forfeit \$100 for each calendar day, or portion thereof, for each worker, until strict compliance is effectuated. Such penalties shall be withheld by CAL FIRE from payments then due. A Contractor is not subject to a penalty assessment pursuant to this section due to the failure of a Subcontractor to comply with this section.
- B. The penalties specified in **paragraph 6)**, above, for noncompliance with the provisions of said Labor Code Section 1776 will be deducted from any monies due or which may become due to Contractor. Penalties assessed for failure to submit certified payrolls are forfeitures and not retentions that will be returned to Contractor.
- C. Payrolls shall contain the full name, address and social security number of each employee, the correct work classification (including apprentices, if applicable), rate of pay, daily and weekly number of hours worked, itemized deductions made, and actual wages paid. The payroll shall be signed by the employer or employer's agent indicating that the payrolls are correct and complete and that the wage rates contained therein are not less than those required by the Agreement. Contractor shall be responsible for the submission of copies of payrolls of all Subcontractors.
- D. Contractor and each Subcontractor shall preserve their payroll records for a period of three (3) years from the date of completion of the Agreement.
- E. Contractor shall submit a certified copy of all payroll records for verification by CAL FIRE Contract Representative with each invoice. When progress payments are called for, Contractor shall submit a certified copy of all payroll records for verification for the work completed to date with each invoice. Delinquent or inadequate certified payrolls or other required documents will result in the withholding of payment until such documents are submitted by Contractor.
- F. Any subcontract entered into as a result of this Agreement shall contain all of the provisions of this clause.

7. Penalty

- A. Contractor and any Subcontractor under Contractor shall comply with Labor Code Sections 1774 and 1775. In accordance with said Labor Code Section 1775, Contractor shall forfeit, as a penalty to CAL FIRE, not more than \$200.00 for each calendar day, or portion thereof, for each worker paid less than the prevailing rates for such work or craft in which such worker is employed for any public work done under the Agreement by Contractor, or by any Subcontractor, in violation of the provisions of the Labor Code and, in particular, Labor Code Sections 1775 to 1780, inclusive.
- B. The amount of this forfeiture shall be determined by the Labor Commissioner and shall be based on consideration of the mistake, inadvertence, or neglect of Contractor or Subcontractor in failing to pay the correct rate of prevailing wages, or the previous record of Contractor or Subcontractor in meeting his or her prevailing wage obligations, or a Contractor's willful failure to pay the correct rates of prevailing wages. A mistake, inadvertence,

EXHIBIT B
(Budget Detail and Payment Provisions)

or neglect in failing to pay the correct rate of prevailing wages is not excusable if Contractor or Subcontractor had knowledge of the obligations under the Labor Code. Any Contractor that executes and receives a copy of this Agreement is deemed to have knowledge of his or her obligations regarding the Labor Code's prevailing wage requirements. In addition to the penalty and pursuant to Labor Code Section 1775, the difference between the prevailing wage rates and the amount paid to each worker for each calendar day, or portion thereof, for which each worker was paid less than the prevailing wage rate shall be paid to each worker by Contractor or Subcontractor.

- C. If a worker employed by a Subcontractor on a public works project is not paid the general prevailing per diem wages by the Subcontractor, Prime Contractor of the project is not liable for any penalties described above unless Prime Contractor had knowledge of that failure of the Subcontractor to pay the specified prevailing rate of wages to those workers or unless Prime Contractor fails to comply with all of the following requirements:
- 1) The Agreement executed between Contractor and the Subcontractor for the performance of work on the public works project shall include a copy of the provisions of Sections 1771, 1775, 1776, 1777.5, 1813 and 1815 of the Labor Code.
 - 2) Contractor shall monitor the payment of the specified general prevailing rate of per diem wages by the Subcontractor to the employees by periodic review of the certified payroll records of the Subcontractor.
 - 3) Upon becoming aware of the failure of the Subcontractor to pay his or her workers the specific prevailing rate of wage, Contractor shall diligently take corrective action to halt or rectify the failure, including, but not limited, to retaining sufficient funds due the Subcontractor for work performed on the public works project.
 - 4) Prior to making final payment to the Subcontractor for work performed on the public works project, Contractor shall obtain an affidavit signed under penalty of perjury for the Subcontractor that the Subcontractor has paid the specified general prevailing rate of per diem wages to his or her employees on the public works project and any amounts due pursuant to Labor Code Section 1813.
- D. Pursuant to Labor Code Section 1775, CAL FIRE shall notify Contractor on a public works project within fifteen (15) days of receipt of a complaint that a Subcontractor has failed to pay workers the general prevailing rate of per diem wages.
- E. If CAL FIRE determines that employees of a Subcontractor were not paid the general prevailing rate of per diem wages and if CAL FIRE did not retain sufficient money under the Agreement to pay those employees the balance of wages owed under the general prevailing rate of per diem wages, Contractor shall withhold an amount of moneys due the Subcontractor sufficient to pay those employees the general prevailing rate of per diem wages if requested by CAL FIRE.
- F. Any subcontract entered into as a result of this Agreement shall contain all of the provisions of this clause.

8. State General Prevailing Wage Rates

Contractor agrees to comply with all of the applicable provisions of the Labor Code including those provisions requiring the payment of not less than the general prevailing rate of wages. Contractor further agrees to the penalties and forfeitures provided in said Code in the event a violation of any of the provisions occurs in the execution of this Agreement.

9. State Prevailing Wage Rate Determinations

- A. The General Prevailing Wage Rate determinations are made a specific part of this Agreement by reference pursuant to Labor Code Section 1773.2. Any special wage rate determinations applicable to this project are attached.
- B. General Prevailing Wage Rate Determinations applicable to this project may also be obtained from the DIR website at: <https://www.dir.ca.gov/OPRL/DPreWageDetermination.htm>.
- C. After award of the Agreement, and prior to commencing work, all applicable General Prevailing Wage Rate Determinations are to be obtained by Contractor from DIR. These wage rate determinations are to be posted by Contractor at the job site in accordance with Labor Code Section 1773.2.

EXHIBIT B
(Budget Detail and Payment Provisions)

10. Hours of Labor

- A. Eight (8) hours labor constitutes a legal day's work. Contractor shall forfeit, as a penalty to CAL FIRE, \$25 for each worker employed in the execution of the Agreement by Contractor or any Subcontractor under Contractor for each calendar day during which such worker is required or permitted to work more than eight (8) hours in any one calendar day and 40 hours in any one calendar week in violation of the provisions of the Labor Code, and in particular Labor Code Sections 1810 to 1815 thereof, inclusive, except that work performed by employees in excess of eight (8) hours per day, and forty (40) hours during any one week, shall be permitted upon compensation for all hours worked in excess of eight (8) hours per day and forty (40) hours in any week, at not less than one and one-half times the basic rate of pay, as provided in Section 1815.
- B. Any subcontract entered into as a result of this Agreement shall contain all of the provisions of this clause.

11. Employment of Apprentices

- A. Contractor and any Subcontractors shall comply with all applicable requirements of Labor Code Sections 1777.5, 1777.6 and 1777.7 in the employment of apprentices.
- B. Contractors and Subcontractors are required to comply with all Labor Code requirements regarding the employment of apprentices, including mandatory ratios of journey level to apprentice workers. Prior to commencement of work, Contractors and Subcontractors are advised to contact the State Division of Apprenticeship Standards, P. O. Box 420603, San Francisco, California 94142-0603, or one of its branch offices, for additional information regarding the employment of apprentices and for the specific journey-to-apprentice ratios for the Agreement work. Prime Contractor is responsible for all Subcontractors' compliance with these requirements. Penalties for failure to comply with apprenticeship requirements are specified in Labor Code Section 1777.7.
- C. Any subcontract entered into as a result of this Agreement shall contain all of the provisions of this clause.

EXHIBIT D
(Special Terms and Conditions)

SPECIAL TERMS AND CONDITIONS

1. Excise Tax

The State of California is exempt from federal excise taxes, and no payment will be made for any taxes levied on employees' wages. The State will pay for any applicable State of California or local sales or use taxes on the services rendered or equipment or parts supplied pursuant to this Agreement. California may pay any applicable sales and use tax imposed by another state.

2. Settlement of Disputes

- A. In the event of a dispute, within 10 days of discovery of the problem, Contractor shall file a "Notice of Dispute" with:

California Department of Forestry and Fire Protection
Attention: CAL FIRE Project Representative
P.O. Box 944246
Sacramento, CA 94244-2460

- B. Within 10 days of CAL FIRE receiving Contractor's notice, the Contracts Representative or designee shall advise Contractor of the findings and recommend a method to resolve the dispute. Decision of the Contracts Representative or designee shall be final.
- C. In the event of a dispute, the language contained within this Agreement shall prevail over any other language including that of the bid proposal.

3. Right to Terminate

- A. Termination for Cause

The agreement can be immediately terminated for cause. (Refer to GTC, Exhibit C, Item 7. Termination for Cause)

- B. Termination without Cause

The State reserves the right to terminate this agreement subject to 30 days written notice to the Contractor. Contractor may submit a written request to terminate this agreement only if the State should substantially fail to perform its responsibilities as provided herein.

4. Retention of Records/ Audits

- A. Contractor agrees that the awarding department, the Department of General Services, the Bureau of State Audits, or their designated representative shall have the right to review and to copy any records and supporting documentation pertaining to the performance of this Agreement. Contractor agrees to maintain such records for possible audit for a minimum of three (3) years after final payment, unless a longer period of records retention is stipulated. Contractor agrees to allow the auditor(s) access to such records during normal business hours and to allow interviews of any employees who might reasonably have information related to such records. Further, Contractor agrees to include a similar right of the State to audit records and interview staff in any subcontract related to performance of this Agreement (GC § 8546.7, PCC § 10115 et seq., CCR Title 2, §1896). Contractor shall comply with the above and be aware of the penalties for violations of fraud and for obstruction of investigation as set forth in PCC § 10115.10.
- B. Any subcontract entered into as a result of this Agreement shall contain all of the provisions of this clause.

5. Subcontractors

- A. Nothing contained in this Agreement or otherwise, shall create any contractual relation between CAL FIRE and any Subcontractors, and no subcontract shall relieve Contractor of its responsibilities and obligations hereunder. Contractor agrees to be as fully responsible to CAL FIRE for the acts and omissions of its Subcontractors and of persons either directly or indirectly employed by any of them as it is for the acts and omissions of persons directly employed by Contractor. Contractor's obligation to pay its Subcontractors is an independent obligation from CAL FIRE obligation to make payments to Contractor.

EXHIBIT D
(Special Terms and Conditions)

- B. Contractor shall perform the work contemplated with resources available within its own organization and no portion of the work shall be subcontracted, except for Subcontractors listed on **the Bidder Declaration (GSPD-05-105), Attachment 2**.
- C. Any substitution of Subcontractors shall comply with the requirements of Public Contract Code Sections 4100 et seq. and must be approved in writing by CAL FIRE Project Representative in advance of assigning work to a substitute Subcontractor.

6. DVBE Participation (With Goals)

- A. Contractor has complied with the requirements of Public Contract Code Sections 10115 et seq. DVBE goals achieved are expressed as a percentage of the estimated dollar value of this Agreement, and are identified on the **Bidder Declaration, GSPD-05-105, Attachment 2**.
- B. The following goals are Contractor's commitment set forth in this Agreement based upon the estimated total dollar amount to be expended.

***3% of work for DVBE(s)**
- C. If this Agreement is amended and the additional work can be included in the sub-contracted work, the goals may be amended to reflect this change. A revised **Bidder Declaration, GSPD-05-105** must be attached to and made a part of the amended Agreement.

7. Substitutions of DVBEs

- A. DVBE Subcontractors shall be used per the California Code of Regulations (CCR), Title 2, Section 1896.70 unless a substitution is approved in writing by CAL FIRE. A DVBE Subcontractor shall be replaced by another DVBE to perform the work originally stated. The substitution shall maintain, at minimum, the level of participation goal stated in the bid.
- B. Contractor shall simultaneously notify the CAL FIRE Small Business Advocate at sbdvbe.advocate@fire.ca.gov.

8. Non-Solicitation

Contractor warrants by execution of this Agreement, that no person or selling agency has been employed or retained to solicit or secure this Agreement upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained or contracted by Contractor for the purpose of securing business. For breach or violation of this warranty, the State shall, in addition to other remedies provided by law, have the right to annul this Agreement without liability, paying only for the value of the work actually performed, or in its discretion, to deduct from the contract price or consideration, or otherwise recover the full amount of such commission, percentage, brokerage, or contingent fee.

9. Laws to be Observed

Contractor shall keep fully informed of all existing and future State and Federal laws and county and municipal ordinances and regulations which in any manner affect those engaged or employed in the work, the materials used in the work, or which in any way affect the conduct of the work, and of all such orders and decrees of bodies or tribunals having any jurisdiction or authority over the same. Contractor shall at all times observe and comply with and shall cause all agents and employees to observe and comply with, all such existing and future laws, ordinances, regulations, orders, and decrees of bodies or tribunals having any jurisdiction or authority over the Agreement. Contractor shall protect and indemnify the State of California and all officers and employees thereof connected with the work against any claim, injury, or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, whether by Contractor, its Subcontractor(s), or an employee(s). If any discrepancy or inconsistency is discovered in the plans, drawings, specification, or Agreement for the work in relation to any such law, ordinance, regulation, order, or decree, Contractor shall immediately report the same to CAL FIRE Project Representative in writing.

10. Specific Legal References

Any reference to specific statutes, regulations, or other legal authority in this Agreement shall not relieve Contractor from the responsibility of complying with all existing and future laws, ordinances, regulations, orders, and decrees of bodies or tribunals having any jurisdiction or authority over the Agreement.

EXHIBIT D
(Special Terms and Conditions)

11. Equipment Indemnification

- A. Contractor shall indemnify CAL FIRE for any claims against CAL FIRE for loss or damage to Contractor's property or equipment during its use under this Agreement and shall, at Contractor's own expense, maintain such fire, theft, liability, or other insurance as deemed necessary for this protection. Contractor assumes all responsibility which may be imposed by law for property damage or personal injuries caused by defective equipment furnished under this Agreement or by operations of Contractor or Contractor's employees under this Agreement.
- B. Any subcontract entered into as a result of this Agreement shall contain all the provisions of this clause.

12. Evaluation of Contractor

Performance of the Contractor under this Agreement will be evaluated. The evaluation shall be prepared on Contract/Contractor Evaluation Sheet (STD 4) and maintained in the Agreement file. For consultant agreements, a copy of the evaluation will be sent to the California Department of General Services, Office of Legal Services, if it is negative and over \$5,000.00.

13. Agency Liability

The Contractor warrants by execution of this Agreement, that no person or selling agency has been employed or retained to solicit or secure this Agreement upon agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Contractor for the purpose of securing business. For breach or violation of this warranty, the State shall, in addition to other remedies provided by law, have the right to annul this Agreement without liability, paying only for the value of the work actually performed, or otherwise recover the full amount of such commission, percentage, brokerage, or contingent fee.

14. Force Majeure

Neither party shall be liable to the other for any delay in or failure of performance, nor shall any such delay in or failures of performance constitute default, if such delay or failure is caused by "Force Majeure." As used in this section, "Force Majeure" is defined as follows: Acts of war and acts of God such as earthquakes, floods, and other natural disasters such that performance is impossible.

15. Employment of Undocumented Workers

By signing this Agreement, Contractor swears or affirms that it has not, in the preceding five (5) years, been convicted of violating a State or Federal law relative to the employment of undocumented workers.

16. Contractor Name Change

Contractor shall provide a written notice to the State at least 30 days prior to any changes to the Contractor's current legal name.

17. Bonds

Payment Bond Requirement: If the total contract price exceeds **\$25,000.00**, Contractor shall furnish a Payment Bond for not less than one hundred percent (100%) of the total amount payable by the terms of this Agreement. The Payment Bond is due prior to the start date of work. No work may commence without receipt of a valid Payment Bond. The Payment Bond must be in effect at all times for the duration of the Agreement. If the Payment Bond expires during the term of the Agreement, a new Payment Bond must be provided to the CAL FIRE Contact Manager not less than ten (10) business days prior to its expiration. Failure to maintain a Payment Bond for the full term of this Agreement will be grounds for termination for default in addition to other legal remedies CAL FIRE may have. Inadequate or lack of a Payment Bond does not negate Contractor's obligations under this Agreement.

18. Assumption of Risk and Indemnification Regarding Exposure to Environmental Health Hazards

In addition to, and not a limitation of, Contractor's indemnification obligations contained elsewhere in this Agreement, Contractor hereby assumes all risks of the consequences of exposure of Contractor's employees, agents, Subcontractors, Subcontractors' employees, and any other person, firm, or corporation furnishing or supplying work services, materials, or supplies in connection with the performance of this Agreement, to any and all environmental health hazards, local and otherwise, in connection with the performance of this Agreement. Such hazards include, but are not limited to, bodily injury and/or death resulting in whole or in part from exposure to infectious agents and/or

EXHIBIT D
(Special Terms and Conditions)

pathogens of any type, kind, or origin. Contractor also agrees to take all appropriate safety precautions to prevent any such exposure to Contractor's employees, agents, Subcontractors, Subcontractors' employees, and any other person, firm or corporation furnishing or supplying work services, materials, or supplies in connection with the performance of this Agreement. Contractor also agrees to indemnify and hold harmless CAL FIRE, the State of California, and each and all of their officers, agents and employees, from any and all claims and/or losses accruing or resulting from such exposure. Except as provided by law, Contractor also agrees that the provisions of this paragraph shall apply regardless of the existence or degree of negligence or fault on the part of CAL FIRE, the State of California, and/or any of their officers, agents and/or employees.

19. Mandatory Organic Waste Recycling

It is understood and agreed that pursuant to Public Resources Code Sections 42649.8 et seq., if Contractor generates four (4) cubic yards or more of organic waste or commercial solid waste per week, Contractor shall arrange for organic waste or commercial waste recycling services that separate/source organic waste for organic waste recycling. Contractor shall provide proof of compliance, i.e. organic waste recycling services or commercial waste recycling services that separate/source organic waste recycling, upon request from CAL FIRE.

20. Health and Safety

- A. Contractor and all subcontractors shall abide by all health and safety mandates issued by federal, state, and local governments and/or public health officers as well as those issued by CAL FIRE, and worksite specific mandates. If multiple mandates exist, the Contractor and subcontractors shall abide by the most restrictive mandate. The term "employee", "worker", "state worker" or "state employee" in health and safety mandates includes contractor and subcontractor personnel.
- B. Costs associated with adhering to health and safety mandates are the responsibility of the Contractor. Contractor is responsible for the tracking and compliance of health and safety mandates and may be audited upon request.

21. Executive Order N-6-22 – Russia Sanctions

On March 4, 2022, Governor Gavin Newsom issued Executive Order N-6-22 (the EO) regarding Economic Sanctions against Russia and Russian entities and individuals. "Economic Sanctions" refers to sanctions imposed by the U.S. government in response to Russia's actions in Ukraine, as well as any sanctions imposed under state law. The EO directs state agencies to terminate contracts with, and to refrain from entering any new contracts with, individuals or entities that are determined to be a target of Economic Sanctions. Accordingly, should the State determine Contractor is a target of Economic Sanctions or is conducting prohibited transactions with sanctioned individuals or entities, that shall be grounds for termination of this agreement. The State shall provide Contractor advance written notice of such termination, allowing Contractor at least 30 calendar days to provide a written response. Termination shall be at the sole discretion of the State.

EXHIBIT E
(Additional Provisions)

ADDITIONAL PROVISIONS

1. Insurance Requirements

A. General Provisions Applying to All Policies

- 1) Deductible and Premiums
 - a) Contractor is responsible for any deductible or self-insured retention contained within the insurance program.
 - b) The Department will not provide for nor compensate Contractor for any insurance premiums or costs for any type or amount of insurance.
- 2) Coverage Term and Policy Cancellation or Termination:
 - a) Coverage must be in force for the complete term of this Agreement. If insurance expires during the term of this Agreement, a new certificate must be received by CAL FIRE project representative at least ten (10) days prior to the expiration of the insurance. Any new insurance must continue to comply with the original terms of this Agreement.
 - b) Contractor shall provide, to CAL FIRE project representative within five (5) business days, following receipt by Contractor, a copy of any cancellation or non-renewal of insurance required by this Agreement. In the event Contractor fails to keep, in effect at all times, the specified insurance coverage, the State may, in addition to any other remedies it may have, terminate this Agreement upon the occurrence of such event, subject to the provisions of this Agreement.
- 3) Primary Clause: Any required insurance contained in this contract shall be primary, and not excess or contributory, to any other insurance carried by the State.
- 4) Endorsements: Any required endorsements requested by the State must be physically attached to all requested certificates of insurance and not substituted by referring to such coverage on the certificate of insurance.
- 5) The Department will not provide for nor compensate Contractor for any insurance premiums or costs for any type or amount of insurance.
- 6) Insurance Carrier Required Rating: All insurance companies must carry a rating acceptable to the Department of General Services, Office of Risk and Insurance Management (ORIM). If Contractor is self-insured for a portion or all of its insurance, review of financial information including a letter of credit may be required. Department of General Services, ORIM Website: <https://www.dgs.ca.gov/ORIM>.
- 7) When Contractor submits a signed contract to the State, Contractor shall furnish to the State a certificate of insurance stating that all required insurance is in effect for the Contractor.

B. General and Commercial Liability Insurance

- 1) Contractor shall provide commercial general liability insurance of not less than **\$1,000,000.00** per occurrence for bodily injury and property damage liability combined in effect for the Contractor.
- 2) The policy shall include coverage for liabilities arising out of premises, operations, independent contractors, products, completed operations, personal and advertising injury, and liability assumed under an insured Agreement. This insurance shall apply separately to each insured against whom claim is made or suit is brought subject to Contractor's limit of liability.
- 3) The certificate of insurance will include the following provision in its entirety:

The State of California, its officers, agents and employees are included as additional insured, but only with respect to work performed for the State of California under the contract.
- 4) The additional insured endorsement must accompany the certificate of insurance.

EXHIBIT E
(Additional Provisions)

- 5) This endorsement must be supplied under form acceptable to the Department of General Services, Office of Risk and Insurance Management.

C. Worker's Compensation Insurance

Contractor shall provide Worker's Compensation Insurance with Waiver of Subrogation in favor of the State of California. Employer's liability shall be not less than **\$1,000,000.00**. The following clause should be included: "Waiver of Subrogation in favor of the State of California or in favor of CAL FIRE:" By signing this Agreement, the Contractor hereby warrants that it carries Workers' Compensation Insurance on all of its employees who will be engaged in the performance of this Agreement. If Staff provided by the Contractor is defined as independent contractors, this clause does not apply.

D. Commercial Automobile Insurance on Owned, Hired, and Non-Owned vehicles

Contractor shall provide Commercial Automobile Insurance on Owned, Hired, and Non-Owned vehicles of not less than **\$1,000,000.00** policy. The same additional insured designation and endorsement required for general liability is to be provided for this coverage.

E. Available Coverages/Limits

In the event the insurance coverages obtained by Contractor is broader in scope than, and/or the limits are higher than, those required under the contract, all such broader coverage and/or higher limits available to Contractor shall also be available and applicable to the State.

2. Regulations

- A. Contractor shall observe and comply with all federal, state, city, and county laws, rules or regulations affecting the work. Any work done that does not comply with any laws, rules, or regulations will be remedied at the Contractor's expense.
- B. Contractor shall cooperate with the CAL FIRE authorities and shall observe and comply with all regulations presently in force on CAL FIRE grounds.

3. Americans with Disabilities Act

By signing this contract, the contractor assures the State that it complies with the Americans with Disabilities Act (ADA) of 1990 (42 USC § 12101 et seq.), which prohibits discrimination on the basis of disability, as well as with all applicable regulations and guidelines issued pursuant to the ADA.

4. Motor Carrier Permit Requirements

- A. Contractor is responsible for determining whether California Vehicle Code Sections 34601 and 34620 require Contractor to have a valid Motor Carrier Permit(s) (MCP) issued by the Department of Motor Vehicles (DMV) in order for Contractor to lawfully perform any part or aspect of the work described in **Exhibit A, Scope of Work**, and, if California Vehicle Code Sections 34601 and 34620 do require same for any part or aspect of such work, Contractor must have a valid MCP issued from the DMV for its services as a Motor Carrier of Property under this Agreement. Contractor shall pay any required fees necessary to obtain and maintain in good standing during the entire term of this Agreement any such required MCP(s).
- B. The MCP(s), if any, required for Contractor's Motor Carriers of Property under California Vehicle Code Sections 34601 and 34620 shall be on file with Contractor for the duration of this Agreement. Upon request of CAL FIRE Contract Manager or their designee, Contractor must immediately provide to CAL FIRE a copy of the required MCP(s), if any.

5. License and Permits

- A. Contractor shall be licensed in accordance with the laws of the State of California and shall possess an **A - General Engineering Contractor** license issued by the California Contractors State Licensing Board (CSLB).
- B. The Contractor shall be an individual or firm currently licensed to do business in California and shall obtain at their expense all license(s) and permit(s) required by law for accomplishing any work required in connection with this

EXHIBIT E
(Additional Provisions)

contract. In the event the Contractor fails to keep in effect at all times all required license(s) and permit(s), the State may, in addition to any other remedies it may have, terminate this contract upon occurrence of such event.

- C. If you are a Contractor located within the State of California, a business license from the city/county in which you are headquartered is necessary however, if you are a corporation, a copy of your incorporation documents/letter from the Secretary of State's Office can be submitted. If you are a Contractor outside the State of California, you will need to submit to the CAL FIRE Contracts Unit a copy of your business license or incorporation papers for your respective State showing that your company is in good standing in that state.
- D. If Contractor is a California or foreign corporation, Contractor must be registered and active/in good standing with the California Secretary of State.
- E. In the event any license(s) and/or permit(s) expire at any time during the term of this Agreement, Contractor agrees to provide CAL FIRE Project Representative a copy of the renewed license(s) and/or permit(s) within 30 days following the expiration date. In the event Contractor fails to keep in effect at all times all required license(s) and permit(s), the State may, in addition to any other remedies it may have, terminate this Agreement upon occurrence of such event.

6. Licensed Contractor Standards for Quality of Work

- A. Licensed Contractors must observe professional standards for quality of work or the California Contractors State License Board (CSLB) will invoke disciplinary action.
- B. Notice is hereby given that certain actions by a Contractor, including, but not limited to, the following, constitute grounds for disciplinary action by the CSLB once CAL FIRE has notified the license board of all violations:
 - 1) A willful departure from plans and specifications or disregard of trade standards for good and workmanlike construction in any material respect that might prejudice the CAL FIRE, owner of the property upon which you perform work (Bus. and Prof. Code Section 7109).
 - 2) The failure to observe and comply with all the applicable labor laws (Bus. and Prof. Code Section 7110).
 - 3) Material failure to complete this Agreement (Bus. and Prof. Code Section 7113).
- C. Should CAL FIRE determine that the work or materials provided vary materially from the specifications, or, that defective work when completed was not performed in a workmanlike manner, then Contractor warrants that it shall perform all necessary repairs, replacement and corrections needed to restore the property according to the Agreement plans and specifications, all at no further or additional cost to CAL FIRE.

7. Tax Delinquencies Contract Ban

Public Contract Code section 10295.4 provides that a state agency shall not enter into any contract for goods or services with a contractor whose name appears on either list of the 500 largest tax delinquencies pursuant to Section 7063 or 19195 of the Revenue and Taxation Code. This prohibition applies to contracts executed on or after July 1, 2012. FTB and BOE will post and periodically update lists of the 500 largest tax delinquencies on their websites as required by law. Starting July 1, 2012, prior to executing contracts, state agencies must check the FTB and BOE lists to ensure the proposed awardee/vendor is not on either list.

8. Debarment and Suspension Certification

- A. Contractor's signature affixed herein shall constitute a certification under penalty of perjury under the laws of the State of California, that Contractor or any person associated therewith in the capacity of owner, partner, director, officer, or manager:
 - 1) is not currently under suspension, debarment, voluntary exclusion, or determination of ineligibility by any federal agency;
 - 2) has not been suspended, debarred, voluntarily excluded, or determined ineligible by any Federal agency within the past three (3) years;
 - 3) does not have a proposed debarment pending; and

EXHIBIT E
(Additional Provisions)

- 4) has not been indicted, convicted, or had a civil judgment rendered against it by a court of competent jurisdiction in any matter involving fraud or official misconduct within the past three (3) years.
- B. Any exceptions to this certification must be disclosed to CAL FIRE. Exceptions will not necessarily result in denial of recommendation for award but will be considered in determining bidder responsibility. Disclosures must indicate the party to whom the exceptions apply, the initiating agency, and the dates of agency action.

9. Contractor Registration Program

No Contractor or Subcontractor may be awarded this contract unless registered with the DIR pursuant to Labor Code Section 1725.5.

10. Public Works – Rules/Regulations

- A. Contractor shall observe and comply with all federal, state, city, and county laws, rules or regulations affecting the work. Any work done that does not comply with any laws, rules, or regulations will be remedied at the Contractor's expense.
- B. Contractor shall cooperate with the Department of Forestry and Fire Protection (CAL FIRE) authorities and shall observe and comply with all regulations presently in force on Department of Forestry and Fire Protection grounds.
- C. **Materials**
 - 1) New materials must be used throughout the work incorporated in this contract. Where a particular grade or quality of material is not specified and more than one grade or quality is available to the contractor, the best grade or quality material containing the required characteristics for the purpose intended, normally used in construction of similar work will be used.
 - 2) Contractor must request approval of all alternate materials. Any such requests should be directed to the designated Contract Manager. No additional compensation will be allowed for the installation of approved substitute items.
- D. **Storage**
 - 1) When necessary, materials shall be stored in a manner that ensures the preservation of their quality and fitness for the work. When State considers it necessary, materials shall be placed on wooden platforms or other hard clean surfaces and placed under cover. Stored materials shall be available for prompt inspection.
 - 2) In case of suspension of work for any cause, contractor shall be responsible for properly storing all materials, and shall provide suitable drainage and temporary protective structures.
- E. **Time**
 - 1) **Schedule**

State will designate the starting day of the contract when contractor shall immediately begin and diligently prosecute the work to completion. Contractor shall coordinate with the CAL FIRE Project Representative to establish a schedule of the work to be performed. This schedule will coordinate any interruptions to State operations if necessary.
 - 2) **Extensions**

Contractor is obligated to satisfactorily complete the work on or before the contract's expiration date. If the work called for under the contract is not completed within the time specified, the State shall have the right to extend or not extend the time limit for its completion as may best serve the interest of the State.
- F. **The Work**
 - 1) **Worksite**
 - a) Contractor shall be responsible for, provide, and maintain all proper temporary walks, roads, guards, railing, lights and warning signs and shall take precautions at all time to avoid injury or damage to any person or any property.

EXHIBIT E
(Additional Provisions)

- b) No advertising of any description will be permitted in or about the work, except by order of the State.
- c) Contractor having control of the work shall clean up the work as it progresses. At frequent intervals and at all times when directed by State, contractor shall remove and dispose of all rubbish, excess excavated material, and debris. Contractor shall protect all adjoining and nearby State and public property, buildings, roads, and streets from dust, dirt, debris, or other nuisance arising out of contractor's operations.
- d) At completion the work site shall be cleared of tools, false work, equipment and rubbish and the entire project, including surrounding premises, shall be left in proper, clean condition. Upon completion of the work or as directed, contractor shall replace premises and adjacent property in good condition.
- e) Contractor shall be entirely responsible for any damage to the property due to hauling or other causes attributable to this work, including roads, curbs, fences, utilities, or other permanent improvements needing to be disturbed to the extent required. All such damaged portions shall be repaired when directed and as required to place them in as good condition as existed before the commencement of the work.

2) Acceptance

- a) Until the State makes formal acceptance of the work, contractor shall have the charge and care and shall bear the risk of injury or damage to any part of the work by the action of the elements or from any other cause, whether arising from the execution or from the non-execution of the work.
- b) The State will accept work performed under this contract in writing when all work has been completed satisfactorily to the State. In judging the work, no allowance for deviations from the original scope of work will be made unless already approved in writing at the proper times and in the manner called for in the contract.

3) Rejection

- a) Should any portion of the work or materials fail to comply with the scope of work or provisions listed herein, the work or materials will be rejected. Contractor will immediately correct the work or materials in question, to the satisfaction of the State.
- b) Any work done that does not comply with any laws, rules, or regulations will be remedied at contractor's expense.

4) Guarantees

- a) Contractor shall unconditionally guarantee the work of the contract to be free of defects in workmanship and materials for a period of one year from date of State's acceptance of the work.
- b) Contractor shall unconditionally guarantee the work of the contract to be free of defects in workmanship and materials for a period of one year from date of State's acceptance of the work, unless a longer guarantee period is specifically called for. Prime contractor shall be responsible for the one year guarantee and shall sign for the entire work. The guarantee may also be countersigned by the subcontractor.

G. Liabilities

- 1) Contractor shall, at own expense, rebuild, repair, restore, and make well all injuries or damages to any portion of the work before its completion and acceptance.
- 2) State shall not be answerable or accountable in any manner for any occurrences over which contractor has control and responsibility. This includes injury or damage from any cause that might have been prevented by the contractor or contractor's workers or anyone employed by contractor. Occurrences include but are not limited to injury to any person whether worker or the public, damage to any portion of the work, damage to materials or equipment used, or damage to adjoining property.
- 3) Contractor shall be responsible for any damage to any person or property resulting from defects, obstructions, or any other cause during the progress of the work at any time before its completion and final acceptance.

EXHIBIT E
(Additional Provisions)

State may retain money due contractor under the contract until disposition has been made of any suits or claims for damages filed for injuries or damages sustained by contractor, contractor's servants, or agents, provided that sworn statements of these claims are filed with the department or any other appropriate State office.

- 4) Neither the Director of CAL FIRE nor any other officer or authorized assistant of the department shall be personally responsible for any liability arising under the contract.

H. Changes

1) Requests

- a) If any conflict arises between provisions of the plans, specifications, scope of work, and any such law, then contractor shall notify the State at once. Such changes must be approved in writing but do not require a Change Order. All other types of changes will require the issuance of a Change Order duly approved either before making the change or, in the case of emergency changes described below, after the emergency change has been completed.
- b) State shall be at liberty to order, in writing, changes in the plans and specifications, or alterations, additions, or omissions in the work at any time prior to the formal completion and acceptance of the work without in any way voiding the contract and the Contractor shall comply with such orders.
- c) Any change or deviations from the contract plans and specifications or in the work made without authority in writing from the State will be the responsibility of the Contractor.
- d) Whenever the necessity for a change arises either at the request of the Contractor or at the request of the State, the Contractor shall take note that a change is pending and he shall take all necessary steps to halt such other work in the area of change that would be affected by the ultimate change until such time as the change is approved.

2) Detailed estimates

- a) When a request for a change is made by or received by contractor, the contractor shall prepare a full and completely detailed estimate of cost for the change, including itemized estimates for subcontractors work, and accurate quantities and unit prices for all items to be added or omitted by reason of the change. Changes requiring labor and/or materials over and above quantities originally called for will be paid for as an extra to the contract, while changes resulting in lesser quantities of labor and/or materials shall be credited to the State by contractor.
- b) The costs of extra work shall be estimated at current market values to which may be added five percent (5%) for overhead, ten percent (10%) for profit, and one percent (1%) where additional bonding is required. Credit for work omitted shall be on the same basis except that no credit for overhead or bond will be exacted. Unit prices shall be comparable with prices used by the Contractor in the original estimate if requested by the State. Estimates for requested changes shall be submitted promptly and in all cases within fifteen (15) calendar days from the date of request.

3) Emergency changes

Changes in the work made necessary due to unexpected or unforeseen site conditions, discovery of errors in plans or specifications requiring immediate clarification in order to avoid a serious work stoppage, or changes of a kind where the extent cannot be determined until completed are types of emergency changes which may be authorized by the State in writing to contractor. The added price or credit for emergency changes shall be determined as provided herein for regularly issued Change Orders. In all such cases the contractor shall comply with the written orders and shall apply for and shall receive a standard form of Change Order as soon as the emergency change has been completed. Compensation for emergency changes will not be due contractor until he receives a confirming Change Order.

EXHIBIT E
(Additional Provisions)

4) Time

- a) Each estimate for a change in the work submitted by the contractor shall state the amount of extra time that should be allowed for making the requested change. If no extra time is requested, it is assumed that the changes will be effected within the originally allotted time for the contract.
- b) State will consider all factors in judging the amount of additional time to be allowed by reason of changes in the work and will set forth in the Change Order the amount of extra time that will be allowed for each change.

5) Change orders

Contractor shall not make any changes other than emergency changes described above until State provides contractor with an approved and signed formal Change Order. State will not recognize any change in the contract sum due contractor until an approved Change Order has been issued in writing on an approved State form. The Change Order must show a full description of the change to be made, the extra time required for making the changes, and the agreed price to be added to or deducted from the contract sum. Drawings with notes and/or specifications accompanying the Change Order shall be deemed a part of the Change Order. Extra work called for by the Change Order shall be performed in accordance with the original contract drawings and specifications, except for the deviations specifically called for by the Change Order.

6) Failure to Agree

- a) In case contractor and State fail to agree on the extra cost or credit for a proposed change, State may order contractor to proceed with the change in order to avoid a serious work stoppage and the proper cost or credit for the change shall be determined as follows:
- b) For added work, contractor shall proceed on a time and material basis, keeping an accurate daily record of the cost of labor and material used under the change and submitting each day's records to the State's representative for review and approval. Upon completion of the change, a Change Order will be issued to contractor based on cost, plus overhead, profit, and bonds.
- c) For omitted work, the estimated amount of credit which the State contends is due may be withheld from any payment due contractor. Such sum will be withheld until contractor presents indisputable evidence that the State's estimate is in error.
- d) Should contractor fail to establish a valid claim, the entire amount withheld will be retained by the State; but should contractor establish that State's estimate was in error in part or in whole, State shall refund contractor the difference.

I. Time of Work and Damages

- 1) State will designate the starting day of the contract when contractor shall immediately begin and diligently prosecute the work to completion. Contractor is obligated to satisfactorily complete the work on or before the contract's expiration date, to be determined from the number of working days stated in the agreement, plus such days as may be properly allowed by State.
- 2) If all the work called for under the contract is not finished or completed before the expiration of the contract, State will sustain damage. As it is and will be impracticable and extremely difficult to determine the actual damage which the State will sustain because of any delay, contractor will pay to State liquidated damages of one hundred dollars (\$100) per day for each day's delay in finishing the work. If contractor fails to pay liquidated damages, CAL FIRE may deduct from contractor the amount from any money due under the contract. The contractor shall not be assessed liquidated damages for delay in completion of the project when such delay was caused by failure of the public agency or owner of the utility to provide for removal or relocation of utility facilities.
- 3) If the work called for under the contract is not completed within the time specified, the director shall have the right to extend or not extend the time limit for its completion as may best serve the interest of the State. The director shall further have the right to charge to contractor or Contractor's heirs, assigns, or sureties and to deduct from the final payment for the work, all or any part of the actual cost of engineering, inspection,

EXHIBIT E
(Additional Provisions)

superintendence, and other overhead expenses which are directly chargeable to the contract, and which accrue during the period of such extension.

- 4) Contractor shall not be assessed with liquidated damages the cost of engineering and inspection during any delay in the completion of the work caused by acts of God or of the public enemy, acts of State, fire, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and unusual action of the elements, or delays of subcontractors due to such cause, providing contractor shall notify State in writing of the causes of delay within ten (10) days from the beginning of any such delay. State shall determine the facts and extent of the delay, and its findings of the facts shall be considered final and conclusive.
- 5) The term "unusual action of the elements" is limited to weather or related effects that cause a complete work stoppage of the controlling item of work at the site of the project for one or more full workdays.

J. Asbestos

In the event the contractor who is providing services under a service contract discovers asbestos, contractor shall stop all work immediately and notify the State contract coordinator, construction supervisor and/or project manager. After State has assessed site conditions and extent of asbestos-related work, State shall prepare and award a separate contract to a contractor who is registered and certified for asbestos abatement work. Under both State statute and State regulations found in the California Code of Regulations, a contractor must be certified by State Contractor's License Board and registered with the State Department of Industrial Relations, CAL-OSHA, in order to perform asbestos-related work. Contractor shall resume work under this contract only after the State gives notification to proceed.

K. Brand or Trade Names

Brand or trade names are given to establish quality, and no special preference by the State for these manufacturers is intended or implied. Where only one brand or trade name is listed, it is the only brand or trade name known to State for the particular product. State may permit contractor to use alternate product materials or equipment that is of equal quality and of required characteristics for the purpose intended if approved in writing by the State. Contractor must submit a request for approval of all alternate products in triplicate within seven (7) days of award of contract. Any such requests should be directed to the Chief Engineer, Technical Services Section, California Department of Forestry and Fire Protection, P.O. Box 944246, Sacramento, CA 94244-2460. CAL FIRE's chief engineer shall be the sole judge as to the comparative quality and suitability of the alternate and the decision shall be final. No additional compensation will be allowed for the installation of approved substitute items.

L. Interruption of Services

Contractor shall make provisions to accomplish the work of this contract without undue interference with the CAL FIRE operations. Interruptions to any services for the purpose of making or breaking a utility connection shall be made only after consultation with the State Representative and shall be at such time and of such duration as may be directed.

M. Cooperation Between Contractors

Where two or more contractors are employed on related or adjacent work each shall conduct operations in a manner which will not cause any unnecessary delay or hindrance to the other. Each contractor shall be responsible to the other for all damage to work, person, or property, or for loss caused by failure to finish the work within the time specified.

N. Conflicts in Documents

If conflict occurs between documents, priorities are:

- 1) Addenda govern over all other contract documents to the extent specified, followed by specific conditions, followed by general conditions.
- 2) Plans govern over specifications; within these, schedules govern over all other portions of plans, followed by specific notes. Larger scale drawings govern over smaller, and figured or numerical dimensions govern over scaled dimensions.

EXHIBIT E
(Additional Provisions)

- 3) If there is conflict between provisions, codes, safety orders, contract documents, manufacturer's specifications, or industry standards, the more restrictive and higher quality govern.
- 4) If contract documents omit a requirement for proper construction system, or for combining or installing parts, materials, or equipment, and if there is an accepted trade standard for construction quality and performance, then contractor shall follow trade standard.

O. Change Authorization

CAL FIRE Chief of Technical Services or designated representative shall be the only individuals authorized to approve changes to the plans/specification, alternate materials/methods, or submittal materials.

**Attachment 1
(Rate Sheet)**

To be attached upon award.

SAMPLE

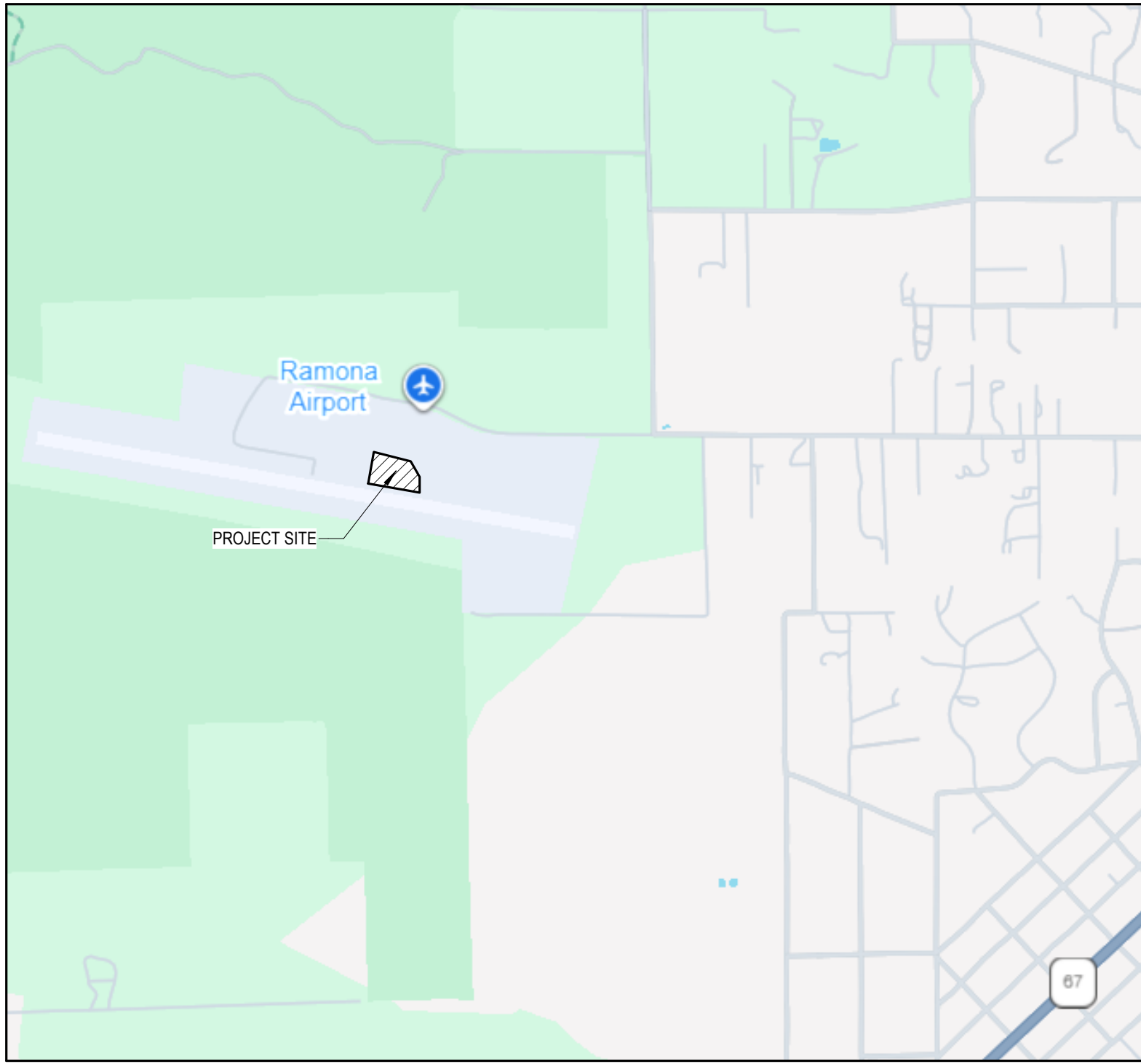
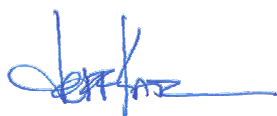
Attachment 2
Bidder Declaration (GSPD-05-105)

To be attached upon award.

SAMPLE

CAL FIRE RAMONA AIR ATTACK BASE - HELIPAD DESIGN

2498 MONTECITO ROAD, RAMONA, CALIFORNIA 92065

LOCATION MAP	STATEMENT OF GENERAL CONFORMANCE	SCOPE OF WORK	GENERAL NOTES	SHEET INDEX																																																																																																																																																														
	APPLICATION NO.: APPLICATION NO.: FILE NAME: CALFIRE RAMONA AIR ATTACK BASE - HELIPAD DESIGN THE DRAWINGS IDENTIFIED AS FOLLOWS: - ALL DRAWING SHEETS INCLUDED IN THIS SET NOT BEARING MY STAMP AND SIGNATURE - DRAWING SHEETS DENOTED IN THE SHEET INDEX OTHER THAN THOSE IDENTIFIED GENERAL AND ARCHITECTURAL: HAVE BEEN PREPARED BY OTHER DESIGN PROFESSIONALS OR CONSULTANTS WHO ARE LICENSED AND AUTHORIZED TO PREPARE SUCH DRAWINGS (PLANS) IN THIS STATE. THEY HAVE BEEN EXAMINED BY ME FOR: - DESIGN INTENT AND APPEAR TO MEET THE APPROPRIATE REQUIREMENTS OF TITLE 24, CALIFORNIA CODE OF REGULATIONS AND THE PROJECT SPECIFICATIONS PREPARED BY ME, AND - COORDINATION WITH MY DRAWINGS (PLANS) AND SPECIFICATIONS AND ARE ACCEPTABLE FOR INCORPORATION INTO THE CONSTRUCTION OF THIS PROJECT. PER TITLE 24, PART 1, SECTION 4-316(B); THIS STATEMENT OF GENERAL CONFORMANCE SHALL NOT BE CONSTRUED AS RELIEVING ME OF MY RIGHTS, DUTIES, AND RESPONSIBILITIES UNDER SECTIONS 17302 AND 81138 OF THE EDUCATION CODE AND SECTIONS 4-336, 4-341 AND 4-344 OF TITLE 24, PART 1.  (DATE) 04/24/2026 (SIGNATURE) ARCHITECT OF ENGINEER DELEGATED RESPONSIBILITY FOR THIS PORTION OF THE WORK JEFF A. KATZ (PRINT NAME) C18223 (LICENSE NUMBER) 09/10/2027 (EXPIRATION DATE)	SCOPE OF WORK: CONSTRUCT TWO NEW HELIPADS WITH UPDATES TO LANDSCAPE AND CONCRETE DRIVEWAY	GENERAL NOTES - DIMENSIONS SHOWN ON THE FLOOR PLANS, SECTIONS AND DETAILS ARE TO FACE OF STUDS, COLUMN GRID LINES AND FACE OF CONCRETE AND BLOCK WALLS, UNLESS OTHERWISE NOTED OR SHOWN. - CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND EXISTING CONDITIONS BEFORE PROCEEDING WITH CONSTRUCTION. - ALL ITEMS ARE BASE BID UNLESS OTHERWISE NOTED OR SPECIFIED. - ALL DRAIN LINES WITHIN WALLS ARE TO BE WRAPPED IN SOUND INSULATION BATTS. - EVERY EXIT DOOR SHALL BE OPERABLE FROM THE INSIDE WITHOUT USE OF A KEY OR ANY SPECIAL KNOWLEDGE. - CONTRACTOR SHALL PROVIDE ACCESS PANELS REQUIRED BY THE PLUMBING, AIR CONDITIONING AND OTHER INSTALLERS, AS REQUIRED BY CODE. ANY ACCESS PANEL IN A FIRE RATED WALL OR CEILING SHALL HAVE THE SAME FIRE RATING AS THE WALL OR CEILING IN WHICH THEY OCCUR. - STRUCTURAL AND FIRE RESISTIVE INTEGRITY SHALL BE MAINTAINED AT PENETRATIONS FOR MECHANICAL, PLUMBING, ELECTRICAL, AND COMMUNICATIONS PIPE, DUCT AND CONDUIT AS INDICATED. - PROVIDE FIRE BLOCKING AT FLOOR, CEILING AND MID HEIGHT OF WALLS OVER 10'-0". - STUCCO, PLASTER AND GYPSUM BOARD SHALL TERMINATE WITH A "J" MOLDING WHERE THE EDGE IS EXPOSED UNLESS NOTED OR SPECIFIED OTHERWISE. - A FLOOR OR LANDING NOT MORE THE 1/4" BELOW THE THRESHOLD IS REQUIRED AT EACH SIDE OF AN EXIT DOOR. - BRAND OR TRADE NAME, SUBSTITUTIONS OF "EQUALS": REQUESTS FOR SUBSTITUTIONS OF AN ITEM AS AN "EQUAL" TO ANY ITEM INDICATED OR SPECIFIED MUST BE INCLUDED AS A PART OF THE CONTRACTOR'S BID PROPOSAL, AS SPECIFIED IN THE GENERAL CONDITIONS. - WRITTEN DIMENSIONS TAKE PRECEDENCE OVER GRAPHIC SCALE. DO NOT SCALE DRAWINGS. - IT SHOULD BE NOTED THAT WHILE EXISTING UTILITY DRAWINGS ARE AVAILABLE, THERE IS NO ASSURANCE THAT ALL UTILITIES ARE SHOWN. THE CONTRACTOR SHALL PROCEED WITH CAUTION TO INSURE THAT ALL UTILITIES ENCOUNTERED, WHETHER OR NOT OF RECORD, SHALL BE PROTECTED FROM DAMAGE. THE CONTRACTOR SHALL ALSO TAKE PRECAUTIONS NECESSARY TO PROTECT HIMSELF AND ALL EMPLOYEES FROM INJURY WHICH MAY BE CAUSED BY CONTACT WITH UTILITY SERVICES. - GYPSUM BOARD FOR FIRE RATED ASSEMBLIES SHALL BE INSTALLED IN ACCORDANCE WITH CBC CHAPTER 7. - DOOR HARDWARE SHALL BE LEVER TYPE. - MAXIMUM EFFORT TO OPERATE DOORS SHALL NOT EXCEED 5 POUNDS FOR EXTERIOR DOORS AND 5 POUNDS FOR INTERIOR DOORS. - FIRE DAMPER ASSEMBLIES, INCLUDING SLEEVES AND INSTALLATION PROCEDURES SHALL BE APPROVED BY THE BUILDING INSPECTOR PRIOR TO INSTALLATION. - INTERIOR FINISHES SHALL COMPLY WITH THE PROVISIONS OF CBC CHAPTER 8. - ALL DECORATIVE MATERIALS SHALL BE MAINTAINED IN A FLAME-RETARDANT CONDITION. - ALL REQUIRED PERMITS MUST BE OBTAINED FROM FIRE PLAN CHECK BEFORE BUILDING IS OCCUPIED. - BUILDING NUMBERS SHALL BE EASILY VISIBLE AND LEGIBLE FROM THE STREET OR ROAD FRONTING THE PROPERTY. - THE CONSTRUCTION, REMODEL, OR DEMOLITION OF A BUILDING SHALL COMPLY WITH THE REQUIREMENTS OF THE COUNTY. - THESE PLANS AND ALL WORK SHALL COMPLY WITH THE CALIFORNIA BUILDING STANDARDS CODE FOUND IN THE STATE OF CALIFORNIA TITLE 24 CCR, AS AMENDED AND ADOPTED BY THE COUNTY. - CONTRACTOR SHALL THOROUGHLY COORDINATE ALL TRADES AS REQUIRED TO COMPLETE ALL WORK INDICATED AND NECESSARY FOR THE PROJECT. - CONTRACTOR SHALL PROTECT EXISTING SITE FEATURES AND SHALL REPAIR OR REPLACE ALL ITEMS DAMAGED DURING CONSTRUCTION. - EXIT SIGNS MUST BE INTERNALLY ILLUMINATED (UFC SEC. 1212.4 & CBC SEC.1013). - TWO SEPARATE POWER SUPPLIES SHALL BE PROVIDED FOR EXIT SIGNS PER(CBC SEC. 1013). - THE CONTRACTOR SHALL ENFORCE ALL SAFETY MEASURES. THE CONTRACTOR SHALL DESIGN, CONSTRUCT AND MAINTAIN ALL SAFETY DEVICES, INCLUDING SHORING AND SHALL BE SOLELY RESPONSIBLE FOR CONFORMING TO ALL LOCAL, STATE AND FEDERAL SAFETY AND HEALTH STANDARDS, LAWS AND REGULATION. - CONTRACTOR SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY. THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS. - THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY MONUMENTATION AND / OR BENCHMARKS WHICH WILL BE DISTURBED OR DESTROYED BY CONSTRUCTION. SUCH POINTS SHALL BE REFERENCED AND REPLACED WITH APPROPRIATE MONUMENTATION BY A LICENSED LAND SURVEY OR REGISTERED CIVIL ENGINEER AS REQUIRED BY THE LAND SURVEYOR'S ACT. - CONTRACTOR SHALL REPLACE IN KIND ANY TRAFFIC SENSORS DAMAGED DURING CONSTRUCTION. - PENETRATION OF FIRE RESISTIVE WALLS, FLOOR - CEILING ASSEMBLIES AND ROOF - CEILINGS SHALL BE PROTECTED AS REQUIRED IN CBC SECTION 714. - NO HAZARDOUS MATERIALS WILL BE USED OR STORED WITHIN THE BUILDING WHICH EXCEED THE QUANTITIES SHOWN ON CBC TABLE 307.1(1). - WHEN SERVING MORE THAN 100 SPRINKLER HEADS, AUTOMATIC SPRINKLER SYSTEMS SHALL BE SUPERVISED BY AN APPROVED CENTRAL PROGRAM OR REMOTE STATION SERVICE OR SHALL BE PROVIDED WITH A LOCAL ALARM WHICH WILL GIVE AN AUDIBLE SIGNAL AT A CONSTANTLY ATTENDED LOCATION. - WORK NOT SPECIFICALLY INDICATED OR SPECIFIED BUT WHICH IS REQUIRED FOR THE COMPLETION OF THE WORK SHALL BE PROVIDED IN THE SAME MANNER AS SIMILAR WORK WHICH IS REQUIRED OR SPECIFIED WITHOUT ADDITIONAL CHARGE.	T-1 TITLE SHEET C1.0 CIVIL TITLE SHEET C2.0 DETAILS C3.0 EXISTING CONDITIONS AND CONSTRAINTS MAP C4.0 GRADING PLAN C5.0 EROSION CONTROL PLAN A1.0 DEMO SITE PLAN A1.1 SITE PLAN A1.2 ENLARGED SITE PLAN E0.1 ELECTRICAL SYMBOLS AND ABBREVIATIONS E0.2 SINGLE LINE DIAGRAM E1.1 ELECTRICAL SITE PLAN E2.1 ENLARGED ELECTRICAL PLANS E3.1 ELECTRICAL SCHEDULES AND DETAILS E3.2 ELECTRICAL CUTSHEETS																																																																																																																																																														
VICINITY MAP 	PROJECT TEAM <table><tr><td>ARCHITECTURE</td><td>OWNER</td></tr><tr><td>COAR DESIGN GROUP 9640 GRANITE RIDGE DR, SUITE 130 SAN DIEGO, CA 92123 (619) 698-9177 CONTACT: JEFF KATZ, AIA JEFF@COARGROUP.COM</td><td>DEPARTMENT OF FORESTRY AND FIRE PROTECTION - TECHNICAL SERVICES UNIT - SOUTH REGION 23300 CASTLE STREET RIVERSIDE, CA 92518 CONTACT: JESSICA HOSSIE JESSICA.HOSSIE@FIRE.CA.GOV</td></tr><tr><td>CIVIL</td><td>ELECTRICAL</td></tr><tr><td>DELANE ENGINEERING 4909 MURPHY CANYON ROAD, SUITE 330 SAN DIEGO, CA 92123 (619) 535-9602 CONTACT: JOHN PRINCE, P.E., P.M.P., QSD JPRINCE@DELANEGROUP.COM</td><td>ELEN CONSULTING 5473 KERANY VILLA RD, SUITE 200 SAN DIEGO, CA 92123 (619) 550-1085 CONTACT: ANTON NATHANSON P.E. 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ANATHANSON@ELENCONSULTING.COM	PROJECT DATA PROJECT ADDRESS: 2498 MONTECITO ROAD, RAMONA, CALIFORNIA 92065 ASSESSOR'S PARCEL NUMBER: 282-030-05-00 GOVERNING AGENCIES: DEPARTMENT OF FORESTRY AND FIRE PROTECTION - TECHNICAL SERVICES UNIT 1131 S STREET SACRAMENTO, CA 95811 FEDERAL AVIATION ADMINISTRATION 777 S. AVIATION BLVD., SUITE 150 EL SEGUNDO, CA 90245 OFFICE OF THE STATE FIRE MARSHALL 715 P STREET SACRAMENTO, CA 95814 COUNTY OF SAN DIEGO GOVERNING CODES: 2025 CALIFORNIA BUILDING CODE 2025 CALIFORNIA FIRE CODE 2025 CALIFORNIA ENERGY CODE 2025 CALIFORNIA GREEN BUILDING STANDARDS 2025 CALIFORNIA ELECTRICAL CODE 2025 CALIFORNIA MECHANICAL CODE 2025 CALIFORNIA PLUMBING CODE 2025 CALIFORNIA EXISTING BUILDINGS CODE ZONING: A70 - LIMITED AGRICULTURE SITE AREA: 14,897,520 SF (342 ACRES) CONSTRUCTION TYPE: N/A OCCUPANCIES: N/A PARKING COUNTS: EXISTING: 13 (1 VAN ACCESSIBLE STALLS)	ABBREVIATIONS <table><tr><td># POUND or NUMBER</td><td>FSP FIBERGLASS REINFORCED PANEL</td><td>REF REFERENCE</td></tr><tr><td>A AND</td><td>FS FIRESTOP SYSTEM</td><td>RENF REINFORCED</td></tr><tr><td>B AT</td><td>FT FOOT or FEET</td><td>REQ REQUIRED</td></tr><tr><td>L ANGLE</td><td>FTG FOOTING</td><td>RM ROOM</td></tr><tr><td>D DIAMETER or ROUND</td><td>GA GAUGE</td><td>RMT RUBBER MAT</td></tr><tr><td></td><td>GB GYPSUM BOARD</td><td>RP ROOF PAVERS</td></tr><tr><td>AD ACCESS DOOR and FRAME</td><td>GB GYPSUM BOARD TRIM</td><td>S SCHED</td></tr><tr><td>ALUM ALUMINUM</td><td>GF GLAZING FILM</td><td>SF SQUARE FEET</td></tr><tr><td>APP APPROXIMATE</td><td>GFRF GLASS FIBER REINFORCED FIBER</td><td>SFRM SPRAYED FIRE-RESISTANT MATERIAL</td></tr><tr><td>ARCH ARCHITECTURAL</td><td>GFRG GLASS FIBER REINFORCED GYPSUM</td><td>STOR STORAGE</td></tr><tr><td>AS ACoustICAL SEALANT</td><td>GL GLAZING</td><td>STRUC STRUCTURAL</td></tr><tr><td>ASB ACoustICAL SUSPENDED BAFFLES</td><td>GR GROUT</td><td>SUSP SUSPENDED</td></tr><tr><td>B BRICK</td><td>H HEIGHT</td><td>SYN SYNTHETICAL</td></tr><tr><td>BDO BUILDING</td><td>HB HOSE BIBB</td><td>STA STATION</td></tr><tr><td>BK BLOCK</td><td>HM HOLLOW METAL</td><td>STD STANDARD</td></tr><tr><td>BKG BLOCKING</td><td>HORIZ HORIZONTAL</td><td>STL STEEL</td></tr><tr><td>BM BEAM</td><td>INSUL INSULATION</td><td>STN STONE</td></tr><tr><td>CC COLUMN COVER</td><td>INT INTERIOR</td><td>STR STORAGE</td></tr><tr><td>CFB CEMENT FIBER BOARD SIDING</td><td>JS JOINT SEALANT</td><td>STRUC STRUCTURAL</td></tr><tr><td>CJ CONTROL JOINT</td><td>KB KNOX BOX</td><td>SUSP SUSPENDED</td></tr><tr><td>CLS CEILING</td><td>L LOCKER TYPE AND COLOR</td><td>SYN SYNTHETICAL</td></tr><tr><td>CLR CLEAR</td><td>LAV LAVATORY</td><td>T TILE</td></tr><tr><td>CMU CONCRETE MASONRY UNIT</td><td>LF LIGHT FIXTURE</td><td>T&G TONGUE AND GROOVE</td></tr><tr><td>CNC CONCRETE</td><td>LVT LUXURY VINYL TILE</td><td>T.O.F. 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	MWP METAL WALL PANEL	TPO THERMOPLASTIC-ROOF MEMBRANE																																																																																																																																																																
(E) EXISTING	N NEW	TR TRANSITION STRIP																																																																																																																																																																
EA EACH	N.C. NOT IN CONTRACT	TY TYPICAL																																																																																																																																																																
EPS EXTERIOR INSULATION AND FINISH SYSTEM	N.T.S. NOT TO SCALE	U.O.N. UNLESS OTHERWISE NOTED																																																																																																																																																																
EJ EXPANSION JOINT	O.C. ON CENTER	V.F. VERIFY IN FIELD																																																																																																																																																																
ELEC ELECTRICAL	OHD OVERHEAD DOOR	V.T.R. VERTICAL THRU ROOF																																																																																																																																																																
ELY ELEVATOR OR ELEVATION	OP OPERABLE PANEL PARTITION	VERT VERTICAL																																																																																																																																																																
EQ EQUAL	P PAINT	VTT VINYL TILE																																																																																																																																																																
EXP EXPOSED STRUCTURE	PL PLASTIC LAMINATE	W WITH																																																																																																																																																																
EXT EXTERIOR	PLY PLYWOOD	WO WITHOUT																																																																																																																																																																
FAB FABRIC	PS PROJECTION SCREEN	WB WALL BASE																																																																																																																																																																
FATO FINAL APPROACH AND TAKEOFF AREA	PVC POLYVINYL CHLORIDE MEMBRANE ROOFING	WC WATER CLOSET																																																																																																																																																																
FE FIRE EXTINGUISHER	QT QUARTZ	WCR WALL COVERING																																																																																																																																																																
FEC FIRE EXTINGUISHER CABINET	R.O. ROUGH OPENING	WO WOOD																																																																																																																																																																
FIE FIRST FLOOR ELEVATION	RAD RADIUS	WF WOOD FLOORING																																																																																																																																																																
FHC FIRE HOSE CABINET		WM WALL-OFF MAT																																																																																																																																																																
FL FLOOR		WPU WEAKENED PLANE JOINT																																																																																																																																																																
FLG FLAG POLE																																																																																																																																																																		
			SYMBOLS GRID DETAIL BUILDING SECTION INTERIOR ELEVATION WALL TYPE WINDOW TYPE DOOR NUMBER ROOM NUMBER DATUM POINT CORNER GUARD FIRE EXTINGUISHER CONTINUOUS, UNOBSTRUCTED AND UNDIMINISHED PATH OF TRAVEL ROOM NAME ROOM NUMBER BUNK 123	DESCRIPTION: PRELIMINARY DESIGN 03/13/26 50% CONSTRUCTION DOCUMENTS 04/20/26 95% CONSTRUCTION DOCUMENTS 06/02/26 100% CONSTRUCTION DOCUMENTS 06/11/26 PERMITTING SUBMITTAL 06/23/26 PROJECT: CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION CAL FIRE RAMONA AIR ATTACK BASE - HELIPAD DESIGN 2498 MONTECITO ROAD, RAMONA, CALIFORNIA 92065 PROJECT NUMBER: 260101 SHEET TITLE: TITLE SHEET SHEET NUMBER: T-1																																																																																																																																																														

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SPECIAL NOTES:

- THE FOLLOWING NOTES ARE PROVIDED TO GIVE DIRECTIONS TO THE CONTRACTOR BY THE ENGINEER OF WORK.
- THE ENGINEER OF WORK SHALL NOT BE RESPONSIBLE FOR THE CONTRACTOR'S FAILURE TO CARRY OUT CONSTRUCTION WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS, NOR SHALL THE ENGINEER BE REQUIRED TO SUPERVISE CONDUCT OF THE WORK OF THE CONSTRUCTION PROCEDURES AND SAFETY PROCEDURES FOLLOWED BY THE CONTRACTOR OR SUBCONTRACTORS OR THEIR RESPECTIVE EMPLOYEES OR BY ANOTHER PERSON AT THE JOB SITE OTHER THAN THAT OF THE ENGINEER'S EMPLOYEES.
- THE LOCATIONS OF ANY UNDERGROUND STRUCTURES AS SHOWN ON THESE PLANS HAVE BEEN OBTAINED FROM AVAILABLE RECORDS AND ARE SHOWN FOR THE BENEFIT OF THE CONTRACTOR. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONARY MEASURES TO PROTECT ALL UNDERGROUND OR OVERHEAD STRUCTURES WHETHER SHOWN OR NOT ON THESE DRAWINGS
- FOR ELECTRONIC FILES OF THE HORIZONTAL CONTROL OF ONSITE IMPROVEMENTS, CONTRACTOR SHALL CONTACT THE ENGINEER OF WORK AT (619) 787-5566.
- THE CONTRACTOR SHALL VERIFY THE LOCATION OF AND PROTECT ALL EXISTING IMPROVEMENTS BEFORE AND DURING CONSTRUCTION.
- CONTRACTOR SHALL MAKE EXPLORATION EXCAVATIONS AND LOCATE EXISTING UNDERGROUND UTILITIES SUFFICIENTLY AHEAD OF CONSTRUCTION TO PERMIT REVISIONS TO PLANS IF REVISIONS ARE NECESSARY BECAUSE OF LOCATION OF EXISTING UTILITIES.
- CONSTRUCTION CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, CONSTRUCTION CONTRACTOR WILL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR THE JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND CONSTRUCTION CONTRACTOR FURTHER AGREES TO DEFEND, INDEMNIFY AND HOLD DESIGN PROFESSIONAL HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF DESIGN PROFESSIONAL.
- IF ANY EXISTING HARDSCAPE OR LANDSCAPE, INCLUDING STRIPING, INDICATED ON THE APPROVED PLANS IS DAMAGED OR REMOVED DURING DEMOLITION OR CONSTRUCTION, IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO ASSURE THAT IT SHALL BE REPAIRED OR REPLACED IN KIND AND EQUIVALENT SIZE PER THE APPROVED PLANS.
- THE CONTRACTOR SHALL TAKE DUE PRECAUTIONARY MEASURES TO PROTECT ANY EXISTING UTILITIES OR STRUCTURES LOCATED AT THE WORK SITE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO CONTACT THE OWNERS OF UTILITIES OR STRUCTURES PRIOR TO ANY EXCAVATION FOR VERIFICATION AND LOCATION OF UTILITIES AND NOTIFICATION OF COMMENCEMENT OR WORK:

SDG&E-GAS & ELECTRIC	(800) 227-2600
AT&T (UNDERGROUND SERVICE ALERT)	(800) 422-4133
SEWER (RAMONA MUNICIPAL WATER DISTRICT)	(760) 789-1330
WATER (RAMONA MUNICIPAL WATER DISTRICT)	(760) 789-1330

STANDARDS PLANS AND SPECIFICATIONS

THE WORK SHOWN ON THESE PLANS IS TO BE DONE ACCORDING TO THE PROJECT SPECIFICATIONS AND THE FOLLOWING STANDARD SPECIFICATIONS, PLANS, MUNICIPAL CODES, AND DESIGN MANUALS AND GUIDELINES:

STANDARD SPECIFICATIONS:

US DEPT TRANSPORTATION FEDERAL AVIATION ADMINISTRATION STANDARD SPECIFICATIONS FOR CONSTRUCTION OF AIRPORTS AC NO. 150/5370-10H DATED 12/21/2018

STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION (GREENBOOK), 2024 EDITION

CALIFORNIA DEPARTMENT OF TRANSPORTATION MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES, REV 6, 2018 EDITION

STANDARD PLANS:

SAN DIEGO REGIONAL STANDARD DRAWINGS FOR PUBLIC WORKS CONSTRUCTION, 2022 EDITION

CALIFORNIA DEPARTMENT OF TRANSPORTATION U.S CUSTOMARY STANDARD PLANS, 2023 EDITION

TOPOGRAPHY SOURCE

THE EXISTING TOPOGRAPHY SURVEY AS SHOWN ON THESE PLANS WAS PROVIDED BY THE OWNER ASSOCIATED WITH THE ADJACENT FIRE SUPPRESSANT LOADING PROJECT AS APPROVED BY DAVID B. KAROLY AUGUST 26,2020.

BASIS OF BEARING

HORIZONTAL COORDINATES ON THIS SURVEY ARE EXPRESSED IN THE CALIFORNIA COORDINATE SYSTEM OF 1983, ZONE VI, EPOCH 2010.00. DERIVED FROM OPUS SOLUTIONS AND CONVENTIONAL TRAVERSE.

VERTICAL BENCHMARK

ELEVATIONS ARE EXPRESSED IN NAVD88, GEOID 12B PROCESSED BY CALFIRE.

GRADING AND GEOTECHNICAL SPECIFICATIONS

ALL GRADING SHALL BE DONE UNDER OBSERVATION AND TESTING BY A QUALIFIED CIVIL ENGINEER OR GEOTECHNICAL ENGINEER AND, IF REQUIRED, BOTH A QUALIFIED CIVIL ENGINEER OR GEOTECHNICAL ENGINEER AND AN ENGINEERING GEOLOGIST. ALL GRADING MUST BE PERFORMED IN ACCORDANCE WITH APPLICABLE CITY ORDINANCE AND THE RECOMMENDATIONS AND SPECIFICATIONS SET FORTH A SOILS REPORT OR GEOLOGICAL/GEOTECHNICAL INVESTIGATION ENTITLED:

GEOTECHNICAL INVESTIGATION CAL FIRE RAMONA AIR ATTACK BASE CALIFORNIA, PREPARED BY GEOCON, DATED MAY 11, 2026. PROJECT NO. G3644-42-02

CONSTRUCTION STORM WATER PROTECTION NOTES

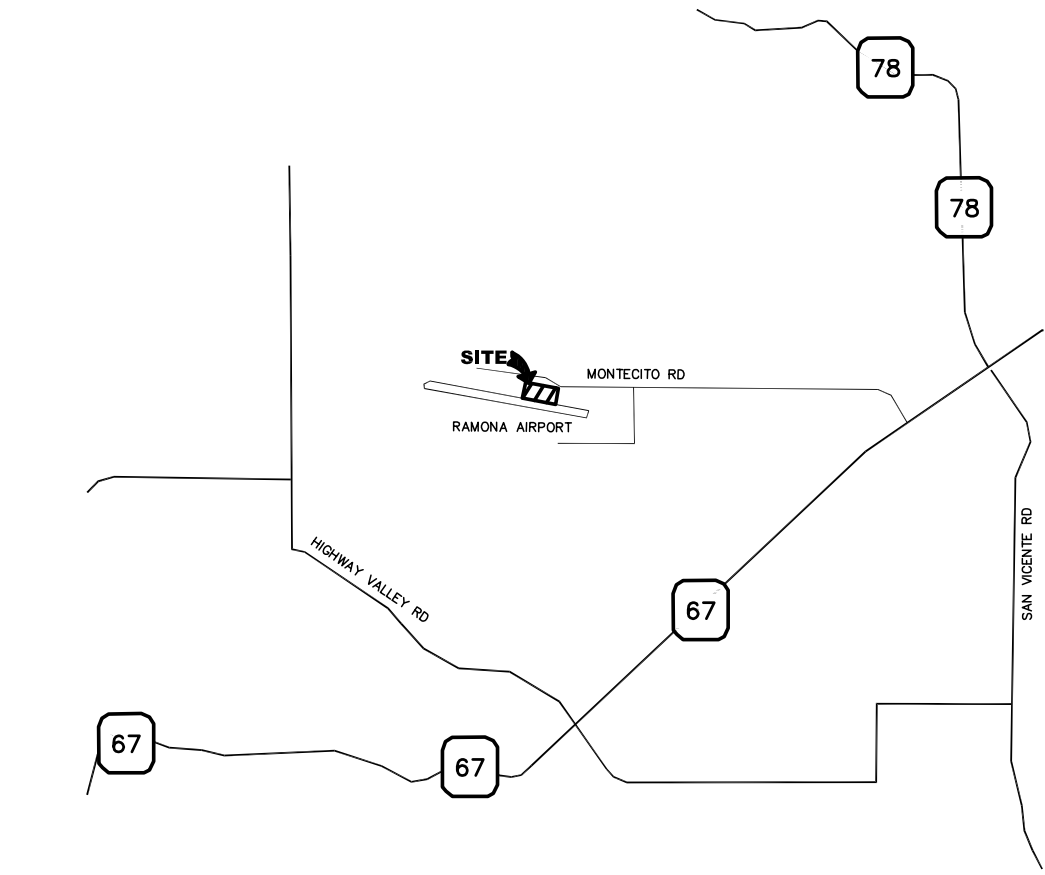
TOTAL SITE DISTURBANCE IS OVER AN ACRE

THE PROJECT IS SUBJECT TO MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4) PERMIT NO. R9-2013-0001 AS AMENDED BY RP-2015-0001 DWQ AND 2015-0100 AND CONSTRUCTION GENERAL PERMIT (CGP) "ORDER NO." 2022-0057-DWG TRADITIONAL RISK LEVEL 2.

ACCORDING TO THE OWNER, THE PROJECT WILL BE INCORPORATED INTO THE CURRENTLY ACTIVE FIRE SUPPRESSANT LOADING PROJECT WITH SUBMISSION OF REVISED NOI AND SWPPP MAPS

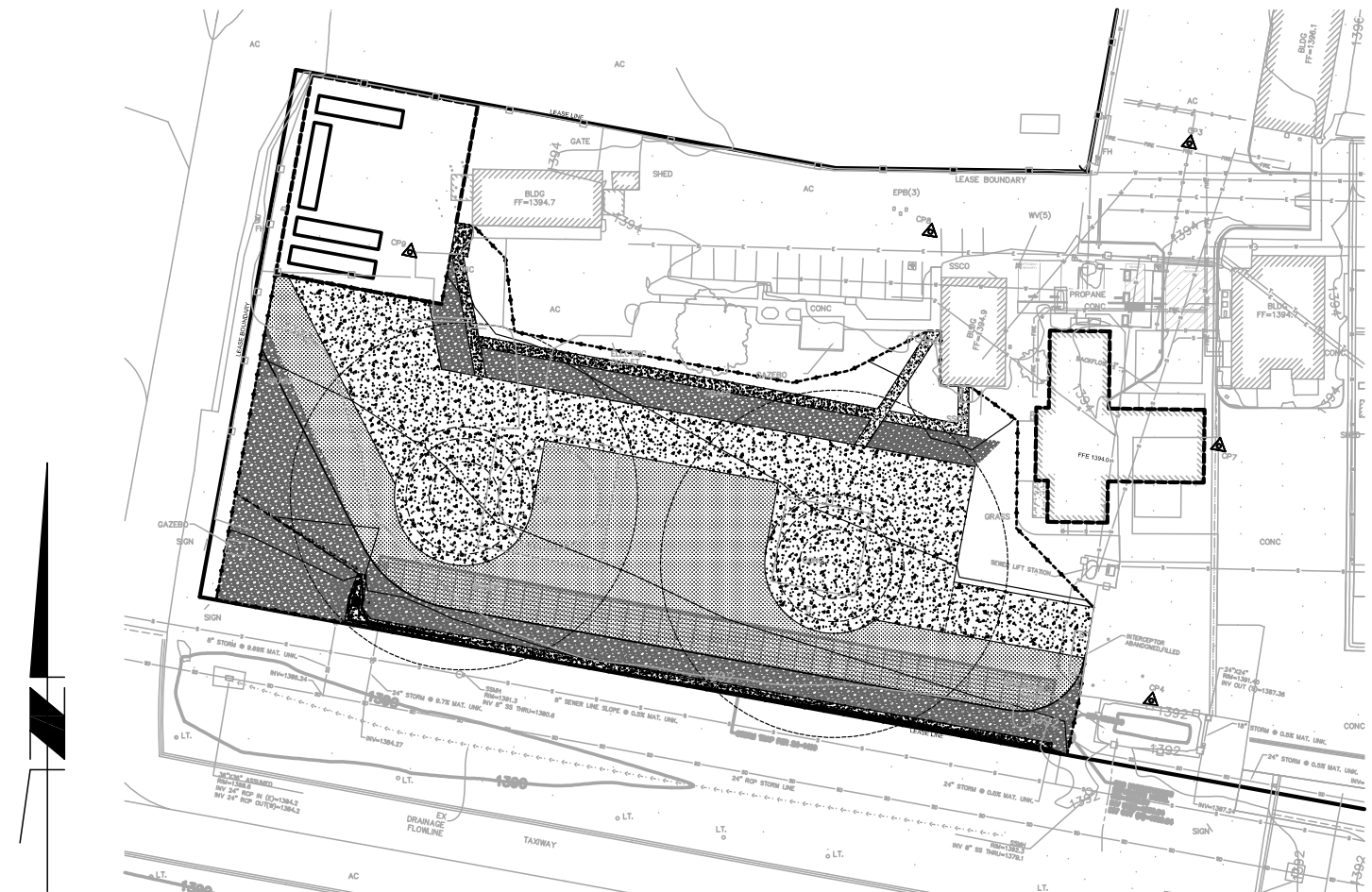
WDID# _____ (CONTRACTOR/OWNER TO CONFIRM AND FILL IN PRIOR TO CONSTRUCTION)

CALFIRE RAMONA AIR ATTACK BASE HELIPADS CIVIL IMPROVEMENT PLANS



VICINITY MAP

NO SCALE



KEY MAP

NO SCALE

LEGEND

SYMBOL	ITEM
—P/L—	PROPERTY LINE
—R/W—	RIGHT OF WAY LINE
—	EASMENT

EXISTING

—W—	WATER LINE
—FS—	FIRE SERVICE LINE
—IRR—	IRRIGATION LINE
—S—	SEWER LINE
—SD—	STORM DRAIN LINE
—G—	GAS LINE
—COM—	COMMUNICATION LINE
—E—	ELECTRIC LINE
—400—	ELEVATION CONTOUR
⊗	WATER VALVE
⊗	ELEC PULL BOX
☀	LIGHT
⊞	SIGN
▧	BUILDING
X (506.04)	SPOT ELEVATION
⊗	FIRE HYDRANT
⬠	BENCHMARK
●	FOUND MONUMENT
⊞	IRRIGATION CONTROL BOX
⊞	JUNCTION BOX
⊞	SEWER MANHOLE
⊞	STORM DRAIN MANHOLE
⊞	TELEPHONE PEDESTAL
⊞	TRAFFIC SIGNAL PULLBOX
⊞	TREE
⊞	WATER MANHOLE
⊞	WATER METER

PROPOSED

—505—	MAJOR CONTOUR
—504—	MINOR CONTOUR
P 617.24	SPOT ELEVATION
—>—>—	SURFACE FLOW DIRECTION
—+—+—+—	GRADING DAYLIGHT LINE
—>—>—>—>—	SWALE
—GB—	GRADE BREAK
▧	PORTLAND CEMENT CONCRETE PAVING PER DETAIL 1/C2.0
▧	PEDESTRIAN CONCRETE PAVING PER DETAIL 2/C2.0
▧	COBBLE PER PLAN

ABBREVIATIONS

AC	ASPHALTIC CONCRETE	P	PAVEMENT
ACC	ACCESSIBLE	PCC	PORTLAND CEMENT CONCRETE
AD	AREA DRAIN	PIV	POST INDICATOR VALVE
BFP	BACKFLOW PREVENTOR	POC	POINT OF CONNECTION
BW	BOTTOM OF WALL	PB	PULL BOX
CB	CATCH BASIN	PR	PROPOSED
CL	CENTERLINE	RIM	RIM OF STRUCTURE COVER
CO	CLEANOUT	RW	RECYCLED WATER
CONC	CONCRETE	RW	RIGHT OF WAY
CYD	CUBIC YARDS	S	SEWER
EX	EXISTING	SCO	SEWER CLEANOUT
EOP	EDGE OF PAVEMENT	SD	STORM DRAIN
FDC	FIRE DEPARTMENT CONNECTION	SFM	SEWER FORCE MAIN
FFE	FINISH FLOOR ELEVATION	SMH	SEWER MANHOLE
FG	FINISH GRADE	SWPPP	STORM WATER POLLUTION PREVENTION PLAN
FH	FIRE HYDRANT		
FL	FLOWLINE	TB	TOP OF BOX
FS	FIRE SERVICE	TB	THRUST BLOCK
FS	FINISH SURFACE	TC	TOP OF CURB
GB	GRADE BREAK	TD	TRENCH DRAIN
G&O	GRIND AND OVERLAY	TF	TOP OF FOOTING
HH	HANDHOLE	TG	TOP OF GRATE
IE	INVERT ELEVATION	TP	TOP OF PIPE
IRR	IRRIGATION	TW	TOP OF WALL
LF	LINEAR FEET	TYP	TYPICAL
LG	LIP OF GUTTER	W	WATER
LOW	LIMIT OF WORK	WM	WATER METER
		WV	WATER VALVE



AT LEAST TWO DAYS BEFORE YOU DIG
UNDERGROUND SERVICE ALERT OF SOUTHERN CALIFORNIA



DESCRIPTION:	DATE:
PRELIMINARY DESIGN	03/13/26
50% CONSTRUCTION DOCUMENTS	04/20/26
95% CONSTRUCTION DOCUMENTS	06/02/26
100% CONSTRUCTION DOCUMENTS	06/11/26
PERMITTING SUBMITTAL	06/23/26



PROJECT:
CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION
CAL FIRE RAMONA AIR ATTACK BASE -HELIPAD DESIGN
2498 MONTECITO ROAD,
RAMONA, CALIFORNIA 92065

PROJECT NUMBER:
260101

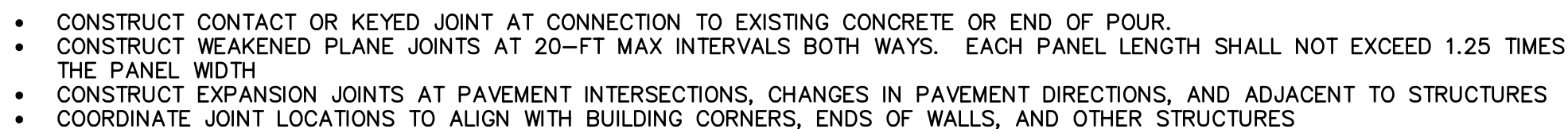
SHEET TITLE:
CIVIL TITLE SHEET

SHEET NUMBER:

C1.0



- ## 2 PEDESTRIAN CONCRETE PAVEMENT SECTION



3 | CONCRETE JOINTS



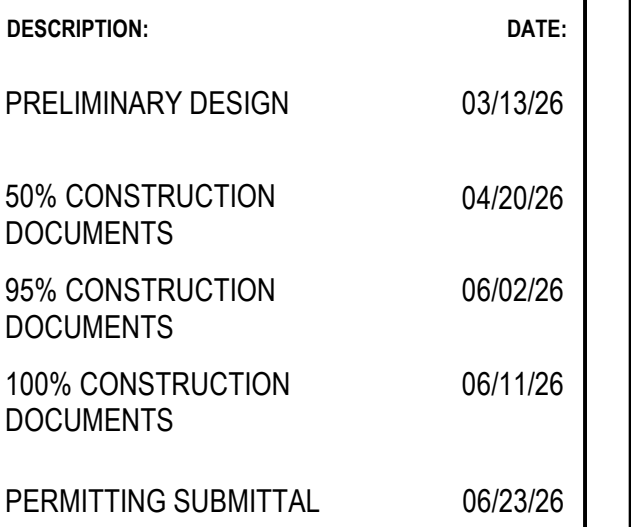
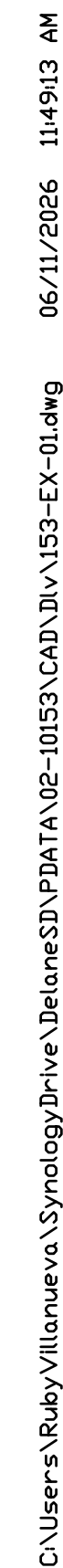
A MAX 26" PIPE OPENING CAN BE FIELD CORED AT THE BASE OF MODULE C1 (AS INDICATED IN THE APPROVED SHOP DRAWING FOR THE STORMTRAP SYSTEM AS PART OF THE FIRE SUPPRESSANT PROJECT). THE INVERT OF THE PIPE ITSELF AND/OR THE OPENING MUST BE SET ROUGHLY EQUAL TO THE SYSTEM INVERT (TOP OF THE FLOOR SLAB). MAINTAIN MINIMUM 3'-0" EDGE DISTANCE (MEASURED FROM EDGE OF OPENING TO EITHER END OF THE STORMTRAP MODULE). TO PREVENT CORROSION, EPOXY ALL REINFORCEMENT THAT IS OUR CUT OR OTHERWISE EXPOSED BY THE CORING PROCESS.

PLAN VIEW

ENLARGED PLAN

SCALE 1"=5'





PROJECT NUMBER:

260101

SHEET TITLE:

EXISTING CONDITIONS AND
CONSTRAINTS MAP

SHEET NUMBER:

C3.0

CONSTRUCTION NOTES

- 1 HELIPAD CONCRETE PAVING PER DET 1/C2.0
- 2 4' COBBLE OVER 3/4" CRUSHED AGGREGATE BASE
- 3 PEDESTRIAN CONCRETE PAVING PER DET 2/C2.0
- 4 TURF PER CALFIRE

NOTE TO CONTRACTOR

CONTRACTOR SHALL VERIFY ALL FIELD CONDITIONS,
INCLUDING STORMTRAP STRUCTURE AND PIPING



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619.593.9177 | www.coargroup.com



DESCRIPTION:	DATE:
PRELIMINARY DESIGN	03/13/26
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95% CONSTRUCTION DOCUMENTS	06/02/26
100% CONSTRUCTION DOCUMENTS	06/11/26
PERMITTING SUBMITTAL	06/23/26



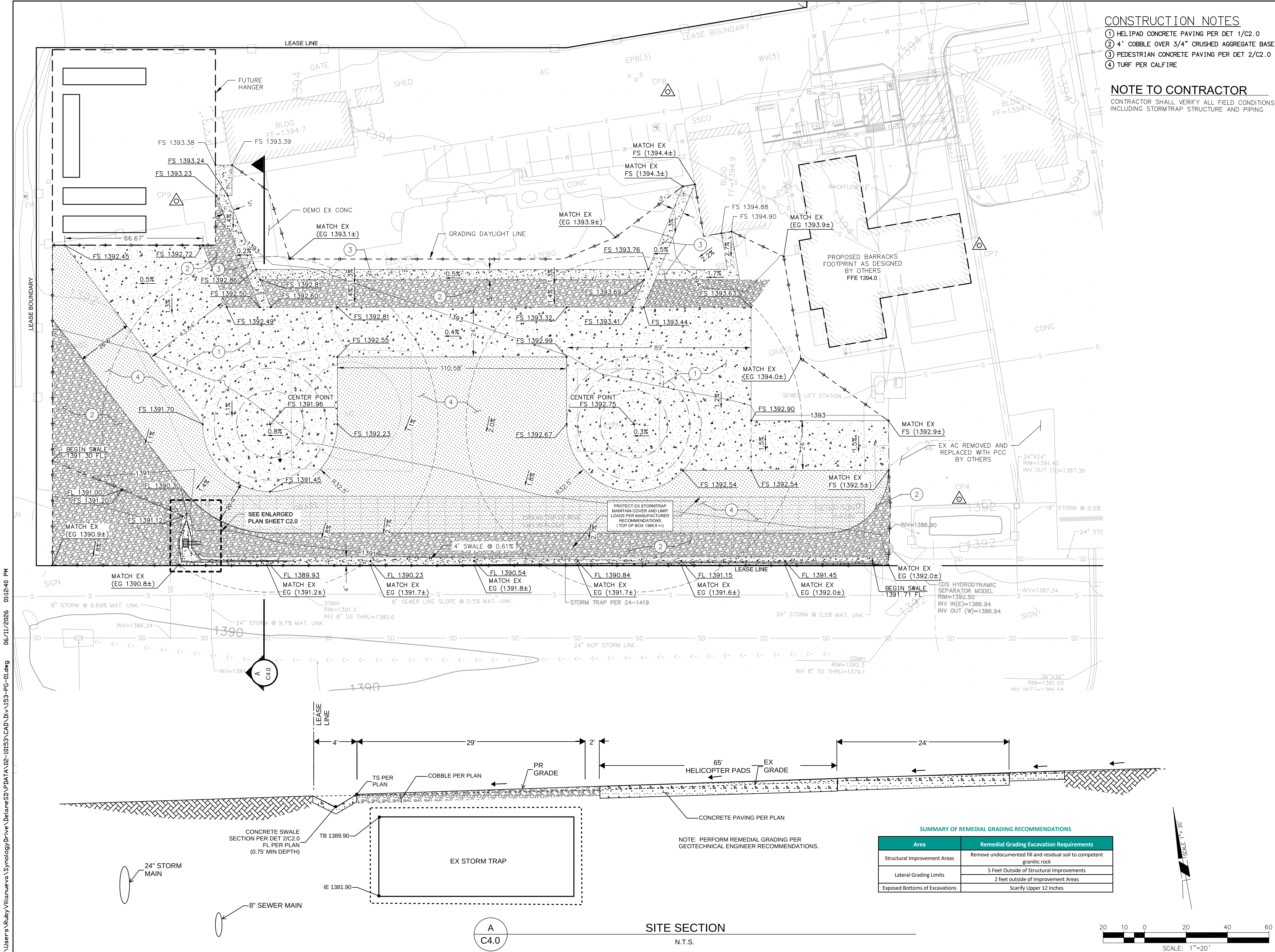
PROJECT:
**CALIFORNIA DEPARTMENT
OF FORESTRY AND FIRE
PROTECTION
CAL FIRE RAMONA AIR ATTACK BASE
- HELIPAD DESIGN**
2498 MONTECITO ROAD,
RAMONA, CALIFORNIA 92065

PROJECT NUMBER:
260101

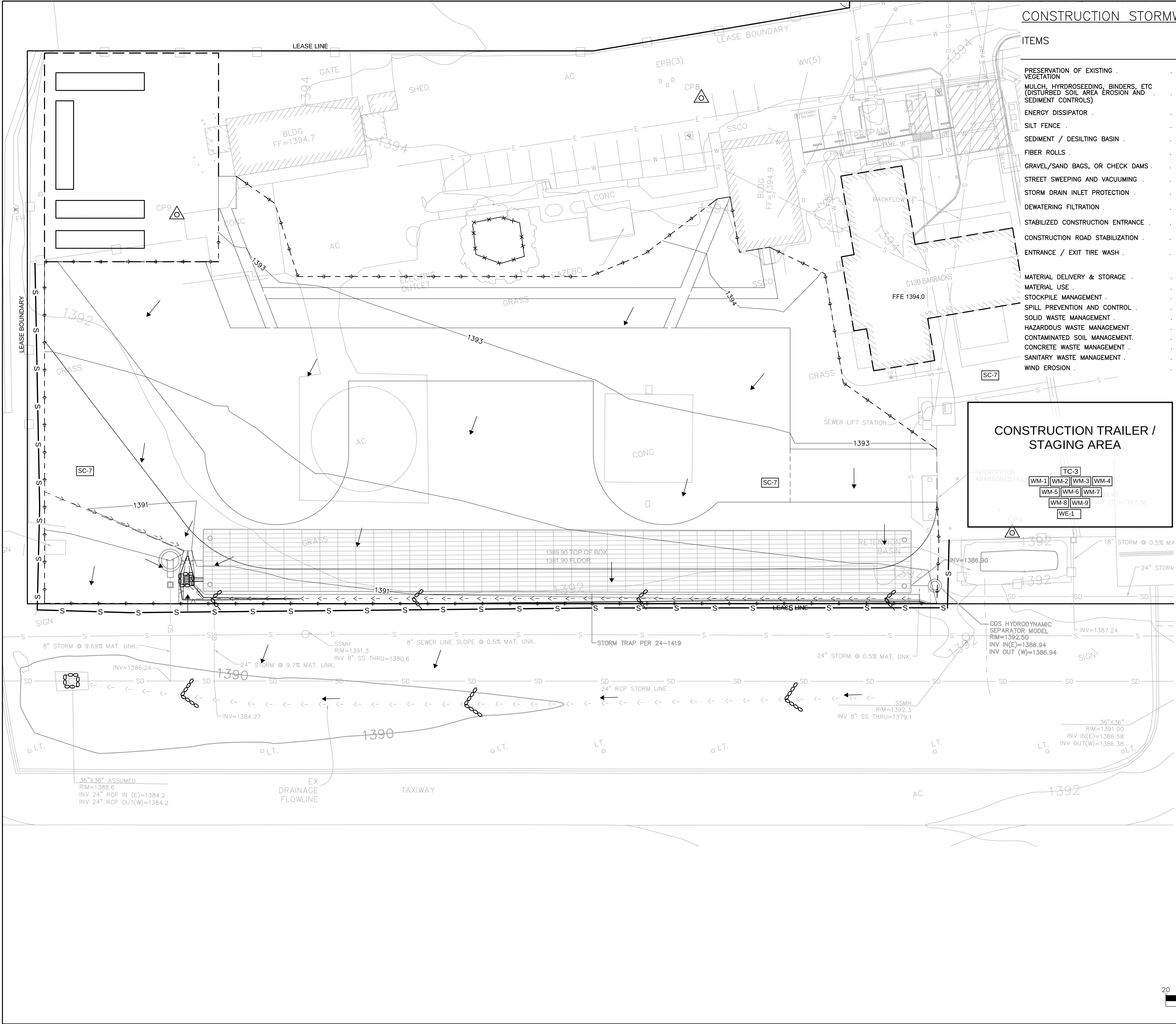
SHEET TITLE:
GRADING PLAN

SHEET NUMBER:

C4.0



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CONSTRUCTION STORMWATER BMP LEGEND:

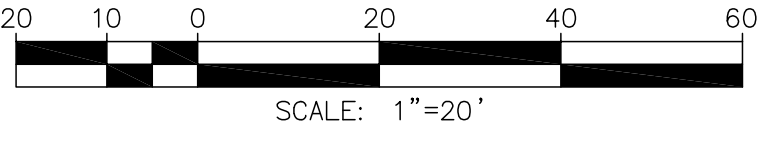
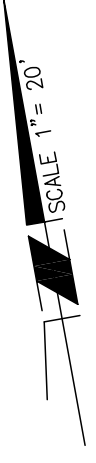
ITEMS	FACT SHEET/DETAILS (PER CALTRANS HANDBOOK)	SYMBOL
PRESERVATION OF EXISTING VEGETATION	SS-2	X
MULCH, HYDROSEEDING, BINDERS, ETC (DISTURBED SOIL AREA EROSION AND SEDIMENT CONTROLS)	SS-3, SS-4, SS-5 SS-6, SS-7, SS-8	[Pattern]
ENERGY DISSIPATOR	SS-10	[Pattern]
SILT FENCE	SC-1	S
SEDIMENT / DESILTING BASIN	SC-2	[SC-2]
FIBER ROLLS	SC-5	F
GRAVEL/SAND BAGS, OR CHECK DAMS	SC-4, SC-6, SC-8	[Pattern]
STREET SWEEPING AND VACUUMING	SC-7	[SC-7]
STORM DRAIN INLET PROTECTION	SC-10	[Symbol]
DEWATERING FILTRATION	NS-2	[Symbol]
STABILIZED CONSTRUCTION ENTRANCE	TC-1	[Pattern]
CONSTRUCTION ROAD STABILIZATION	TC-2	[Pattern]
ENTRANCE / EXIT TIRE WASH	TC-3	[Pattern]
MATERIAL DELIVERY & STORAGE	WM-1	[WM-1]
MATERIAL USE	WM-2	[WM-2]
STOCKPILE MANAGEMENT	WM-3	[WM-3]
SPILL PREVENTION AND CONTROL	WM-4	[WM-4]
SOLID WASTE MANAGEMENT	WM-5	[WM-5]
HAZARDOUS WASTE MANAGEMENT	WM-6	[WM-6]
CONTAMINATED SOIL MANAGEMENT	WM-7	[WM-7]
CONCRETE WASTE MANAGEMENT	WM-8	[WM-8]
SANITARY WASTE MANAGEMENT	WM-9	[WM-9]
WIND EROSION	WE-1	[WE-1]

CONSTRUCTION TRAILER / STAGING AREA

INTERCEPTOR ABANDONED, FILL

WM-1 WM-2 WM-3 WM-4
WM-5 WM-6 WM-7
WM-8 WM-9
WE-1

TC-3



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DELANE
ENGINEERING
4800 MONTECITO ROAD, SUITE 330
SAN DIEGO, CA 92123
PHONE: 619.757.8859
WWW.DELANEENGINEERING.COM

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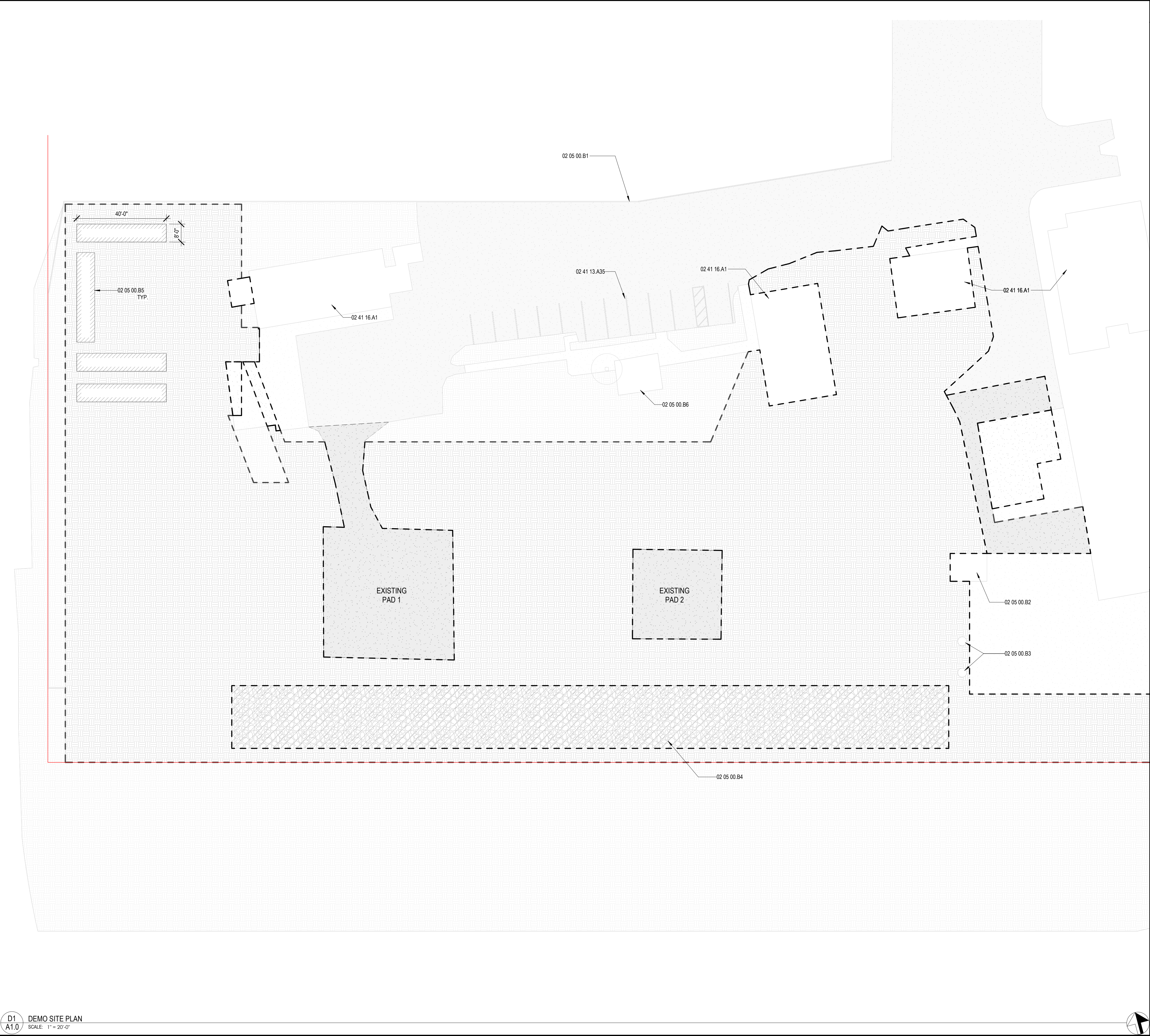


PROJECT:
CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION
CAL FIRE RAMONA AIR ATTACK BASE - HELIPAD DESIGN
2498 MONTECITO ROAD,
RAMONA, CALIFORNIA 92065

PROJECT NUMBER:
260101

SHEET TITLE:
EROSION CONTROL PLAN

SHEET NUMBER:
C5.0



D1 DEMO SITE PLAN
A1.0 SCALE: 1" = 20'-0"

CONSTRUCTION NOTES

- 01 05 00.B5 FUTURE HANGER
- 01 05 00.B6 STORAGE CONTAINER, BY OWNER
- 01 05 00.B7 FUTURE BARRACKS EXPANSION
- 02 05 00.B1 EXISTING SITE WALL TO REMAIN
- 02 05 00.B2 EXISTING SEWER LIFT STATION TO REMAIN
- 02 05 00.B3 EXISTING SEWER MANHOLES ABANDONED
- 02 05 00.B4 EXISTING PRECAST CONCRETE HYDROMODIFICATION VAULT PER "STORMTRAP-03-10-2025"
- 02 05 00.B5 EXISTING CONCRETE PADS FOR CONTAINERS TO REMAIN
- 02 05 00.B6 EXISTING GAZEBO TO REMAIN
- 02 05 00.B7 EXISTING SHED TO REMAIN
- 02 05 00.B8 EXISTING TREE TO REMAIN, PROTECT IN PLACE
- 02 05 00.C1 ACCESS ROAD
- 02 05 00.D1 PROTECTION RADIUS AROUND TREE, SAFE DISTANCE
- 02 41 13.A35 EXISTING PARKING TO REMAIN
- 02 41 16.A1 EXISTING BUILDING TO REMAIN, PROTECT IN PLACE
- 26 01 00.B2 HELIPORT PERIMETER LIGHT, SEE ELECTRICAL
- 26 01 00.B3 LIGHTED WIND CONE, SEE ELECTRICAL
- 32 17 23.B1 TOUCHDOWN POSITION CIRCLE 18" WIDE YELLOW LINE
- 32 17 23.B2 TLOF SIZE/WEIGHT LIMITATION BOX
- 32 17 23.B3 TLOF PERIMETER MARKING 12" WIDE WHITE LINE
- 32 17 23.B4 HELIPORT IDENTIFICATION SYMBOL
- 32 17 23.B5 SEE AC150/5390-2D APPENDIX C FOR THE FORM AND PROPORTIONS OF THE FIGURES

DEMO SITE PLAN LEGEND

- LEASE LIMIT LINE
- EXISTING ASPHALT TO REMAIN
- EXISTING ASPHALT TO BE DEMOED
- EXISTING CONCRETE TO REMAIN
- EXISTING CONCRETE TO BE DEMOED
- EXISTING LANDSCAPE TO REMAIN
- EXISTING LANDSCAPE TO BE DEMOED
- EXISTING STORMTRAP AREA TO REMAIN
- EXISTING BUILDING TO BE DEMOED
- EXISTING TREE TO REMAIN



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DESCRIPTION:	DATE:
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PERMITTING SUBMITTAL	06/23/26



PROJECT:
CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION
CAL FIRE RAMONA AIR ATTACK BASE - HELIPAD DESIGN
2498 MONTECITO ROAD,
RAMONA, CALIFORNIA 92065

PROJECT NUMBER:
260101
SHEET TITLE:
DEMO SITE PLAN

SHEET NUMBER:

A1.0

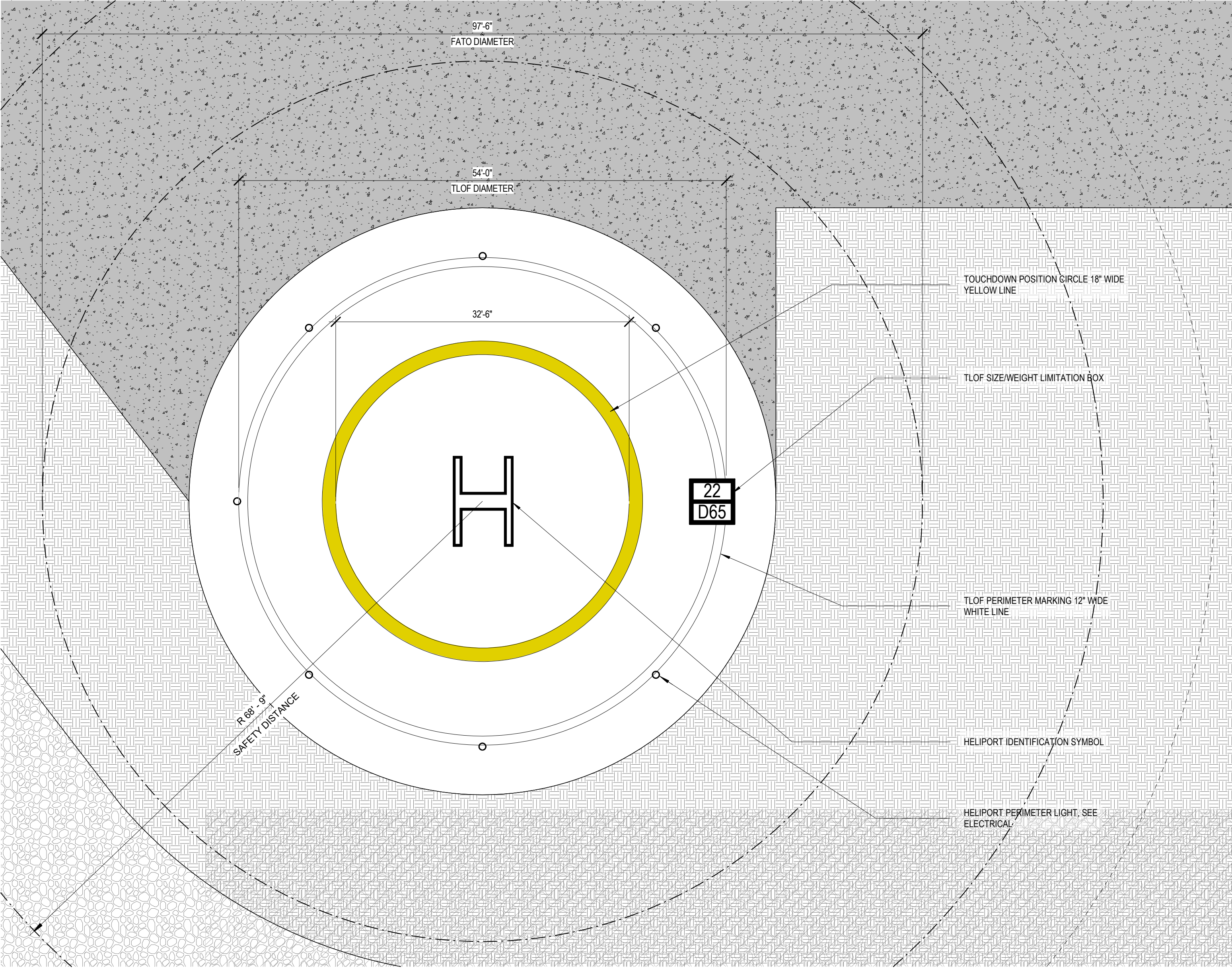


01 05 00.05	FUTURE HANGER
01 05 00.06	STORAGE CONTAINER, BY OWNER
01 05 00.07	FUTURE BARRACKS EXPANSION
02 05 00.81	EXISTING SITE WALL TO REMAIN
02 05 00.82	EXISTING SEWER LIFT STATION TO REMAIN
02 05 00.83	EXISTING SEWER MAN-HOLES ABANDONED
02 05 00.84	EXISTING PRECAST CONCRETE HYDROMODIFICATION VAULT PER "STORMTRAP, 03-10-2025"
02 05 00.85	EXISTING CONCRETE PADS FOR CONTAINERS TO REMAIN
02 05 00.86	EXISTING GAZEBO TO REMAIN
02 05 00.87	EXISTING SHED TO REMAIN
02 05 00.88	EXISTING TREE TO REMAIN, PROTECT IN PLACE
02 05 00.01	ACCESS ROAD
02 05 00.01	PROTECTION RADIOUS AROUND TREE, SEE DISTANCE
02 41 13.A35	EXISTING PARKING TO REMAIN
02 41 16.A1	EXISTING BUILDING TO REMAIN, PROTECT IN PLACE
26 01 00.82	HELIPORT PERMITTER LIGHT, SEE ELECTRICAL
26 01 00.83	LIGHTED WIND CONE, SEE ELECTRICAL
32 17 23.B1	TOUCHDOWN POSITION CORNER 18" WIDE YELLOW LINE
32 17 23.B2	TLOF SIZE/WEIGHT LIMITATION BOX
32 17 23.B3	TLOF PERIMETER MARKING 12" WIDE WHITE LINE
32 17 23.B4	HELIPORT IDENTIFICATION SYMBOL
32 17 23.B5	SEE AC150/5300.2D APPENDIX C FOR THE FORM AND PROPORTIONS OF THE FIGURES

----	OUTLINE OF FUTURE BUILDINGS
----	LEASE LIMIT LINE
----	OUTLINE OF ROTOWASH BOUNDARY
	EXISTING ASPHALT
	EXISTING CONCRETE WALKWAY
	NEW CONCRETE PHASE 1
	NEW CONCRETE PHASE 2
	NEW CONCRETE WALKWAY
	TURF
	EXISTING LANDSCAPE
	3/4" CRUSHED ROCK WITH 4" COBBLE
	EXISTING STORMTRAP AREA
	PANELBOARDS, SEE ELECTRICAL
	LOCKABLE DISCONNECT, SEE ELECTRICAL
•	LIGHTED WIND CONE, SEE ELECTRICAL
	EXISTING TREE ON SITE

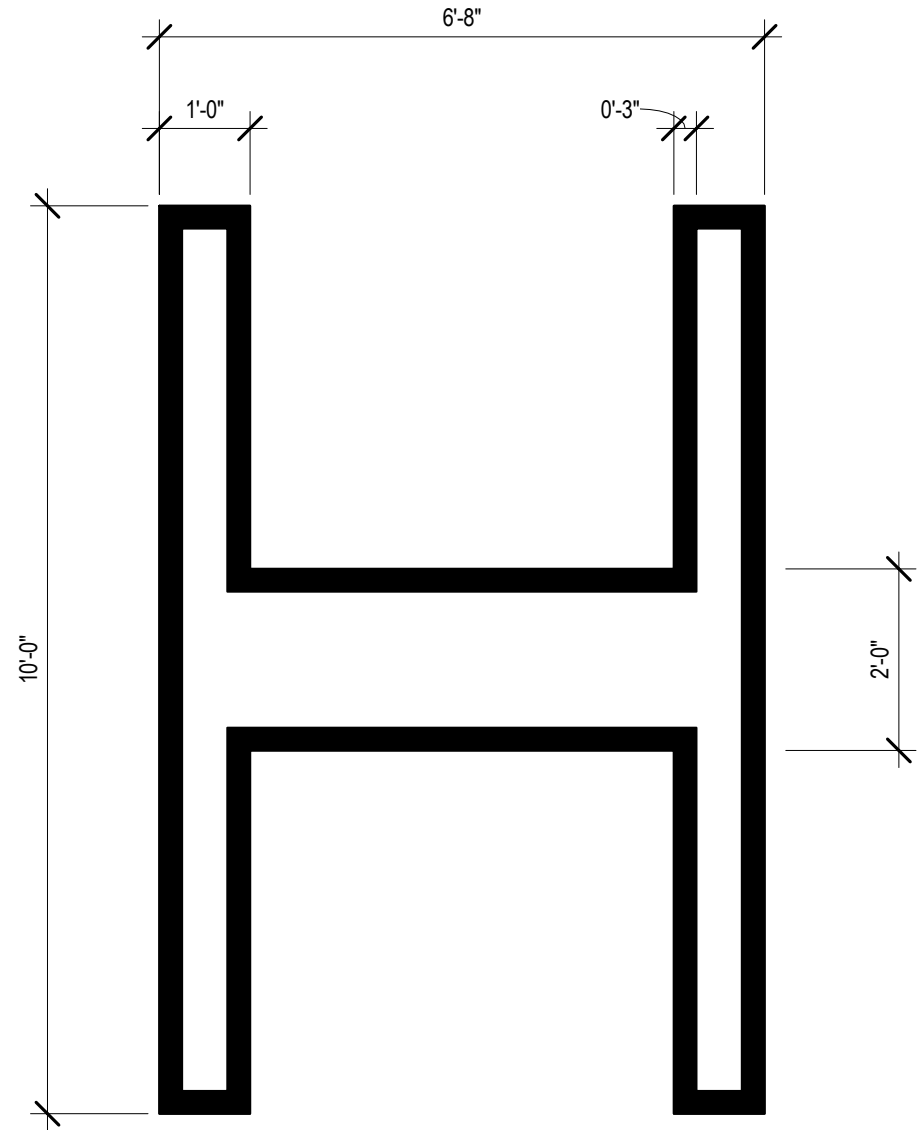
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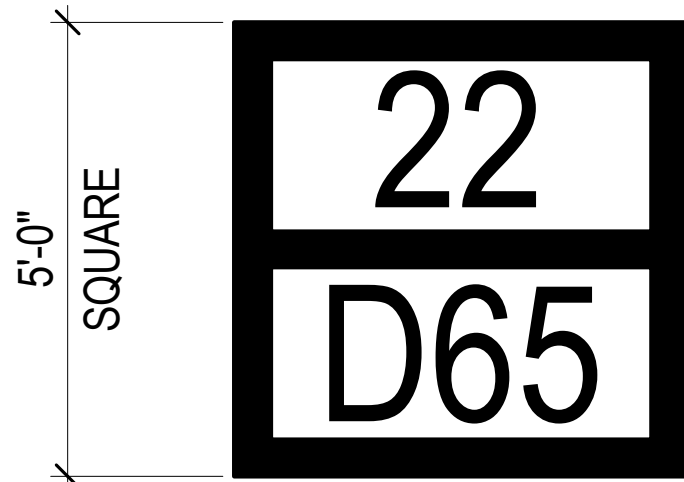
NOTE: SEE FIGURE 4-1. STANDARD TLOF MARKINGS IN THE FAA HELIPORT DESIGN ADVISORY CIRCULAR

B1
A1.2 PHASE 1 HELIPAD MARKINGS
SCALE: 1/8" = 1'-0"



NOTE: BORDER BLACK LINES WITH WHITE INTERIOR

A4
A1.2 HELIPORT IDENTIFICATION SYMBOLS
SCALE: 1/2" = 1'-0"



SEE AC150/5390-2D APPENDIX C FOR THE FORM AND PROPORTIONS OF THE FIGURES

- NOTES:
1. CHARACTERS ARE BLACK ON A WHITE BACKGROUND
 2. "22" INDICATED MAXIMUM TAKEOFF WEIGHT (22,000 LBS) OF THE DESIGN HELICOPTER.
 3. "D65" INDICATES THE OVERALL LENGTH OF THE LARGEST HELICOPTER (65 FT) FOR WHICH THE TLOF IS DESIGNED.

B4
A1.2 TLOF SIZE/WEIGHT LIMITATION BOX
SCALE: 1/2" = 1'-0"

HELIPAD DESIGN CRITERIA

CONTROLLING DIMENSION	65' - 0"
FATO DIAMETER	97' - 6"
TLOF DIAMETER	54' - 0"
SAFETY AREA DIAMETER	137' - 6"
TOTAL UNOBSTRUCTED WIDTH (FATO AND SAFETY AREA)	N/A
TLOF SURFACE MATERIAL	CONCRETE
TLOF SURFACE GRADIENT AND DIRECTION	0.5% ALL DIRECTIONS
CENTER-TO-CENTER TLOF SEPARATION	175' - 7"
LIGHTING ACTIVATION - AVIATION LIGHTING	MANUAL AND R/C
LIGHTING ACTIVATION - WALKWAY AREA LIGHTING	N/A

ABBREVIATIONS:

FATO: FINAL APPROACH AND TAKE OFF AREA
TLOF: TOUCHDOWN AND LIFT OFF

ENLARGED SITE PLAN LEGEND

	NEW CONCRETE PHASE 1
	NEW CONCRETE PHASE 2
	3/4" CRUSHED ROCK WITH 4" COBBLE
	EXISTING STORMTRAP AREA



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CAL FIRE RAMONA AIR ATTACK BASE - HELIPAD DESIGN
2498 MONTECITO ROAD,
RAMONA, CALIFORNIA 92065

PROJECT NUMBER:
260101

SHEET TITLE:
ENLARGED SITE PLAN

SHEET NUMBER:

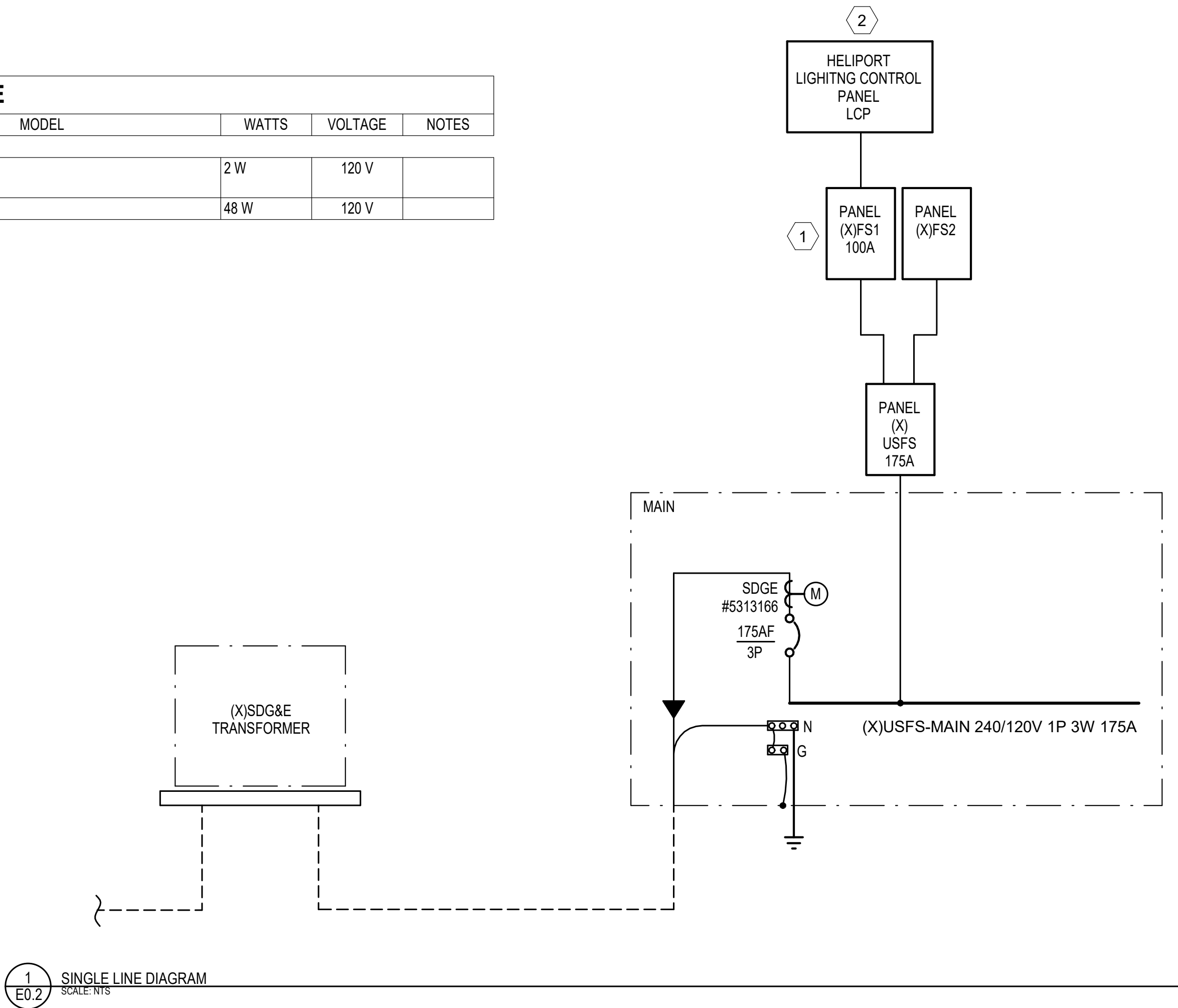
A1.2

	
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 005-190	
PROJECT:	CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION CAL FIRE RAMONA AIR ATTACK BASE - HELIPAD DESIGN 2498 MONTECITO ROAD, RAMONA, CALIFORNIA 92065
PROJECT NUMBER:	260101

FAULT CURRENT SCHEDULE							
DEVICE	FAULT AT DEVICE	AIC RATING	VOLTAGE	* FEEDER		DIRECTLY CONNECTED MOTOR	MOTOR TOTAL
				SIZE	LENGTH		
(X)JUSFS-MAIN	40,065	42,000	120 V			0	65
(X)JUSFS	5,727	10,000	120 V	2/0	177'	0	46
(X)FS1	2,525	10,000	120 V	#1	175'	66	40
LCP	1,906	10,000	120 V	#12	8'-2"	0	25

VOLTAGE DROP SCHEDULE						
DEVICE	*FEEDER	BRANCH CIRCUIT				TOTAL VOLTAGE DROP
	VOLTAGE DROP	WIRE SIZE	MAX VOLTAGE DROP	CIRCUIT NUMBER	WIRE SIZE	
(X)USFS-MAIN	0.00%					0.00%
(X)USFS	1.24%	2/0				1.24%
(X)FS1	2.97%	#1	1.97%	23	#10	4.93%
LCP	2.98%	#12	0.19%	3	#12	3.17%

FEEDER SCHEDULE	
* DEVICE/AMP	CALLOUT
20	
LCP	3/4"C, 1#12, #12N, #12G
100	
FS1	1-1/4"C, 2#1, #1N, #8G



Branch Panel: FS1

Location: FOREST SERVICE BLDG INTERIOR

Supply From: (X)JUSFS

Mounting: Surface

Enclosure: Type 1

Voltage: 240/120V 2P 3W

Phases: 1

Wires: 3

Lug Type: Standard

200% Neutral: No

A.I.C. Rating: 10,000

Mains Type: MLO

Buss Rating: 100

Notes: EXISTING LOAD INFORMATION BASED ON FIELD VERIFICATION

CKT	Circuit Description	Trip	Poles	A		B		Poles	Trip	Circuit Description	CKT
1	MAIN BREAKER	100 A	2	0.00 kVA	--			1	--	BUSSED SPACE	2
3	--	--	--			0.00 kVA	--	1	--	BUSSED SPACE	4
5	EXISTING WELDER	20 A	2	1.60 kVA	0.50 kVA			1	20 A	EXISTING LIGHTS	6
7	--	--	--			1.60 kVA	0.50 kVA	1	20 A	EXISTING LIGHTS	8
9	EXISTING AC	30 A	2	2.40 kVA	0.54 kVA			1	20 A	EXISTING RECEPTACLES	10
11	--	--	--			2.40 kVA	0.54 kVA	1	20 A	EXISTING RECEPTACLES	12
13	EXISTING LIGHTING	20 A	1	0.50 kVA	1.00 kVA			1	20 A	EXISTING ICE MACHINE	14
15	EXISTING LIGHTING	20 A	1			0.50 kVA	0.54 kVA	1	20 A	EXISTING RECEPTACLES	16
17	EXISTING GAS	20 A	1	1.00 kVA	0.00 kVA			1	20 A	EXISTING RECETACLES	18
19	EXISTING DIESEL	20 A	1			1.00 kVA	1.80 kVA	1	20 A	EXISTING SAW SHED	20
21	CONNEX BOX HVAC	20 A	1	1.00 kVA	0.53 kVA			1	20 A	HELIPORT LIGHTING CONTTOL PANEL	22
23	CONNEX BOX HVAC	20 A	1			1.00 kVA	--	1	--	BUSSED SPACE	24
Total Load:				9.07 kVA		9.88 kVA					
Total Amps:				76 A		82 A					
Load Classification		Connected Load		Demand Factor		Estimated Demand		Panel Totals			
Motor		2.00 kVA		112.50%		2.25 kVA					
Existing Loads		16.42 kVA		100.00%		16.42 kVA		Total Conn. Load: 18.95 kVA			
Lighting		0.53 kVA		125.00%		0.66 kVA		Total Est. Demand: 19.33 kVA			
								Total Balanced Conn.: 79 A			
								Total Est. Demand: 81 A			

SHEET KEYNOTES	
1	SEE "FS1" PANEL SCHEDULE FOR ADDED LOADS.
2	PROVIDE HELIPORT LIGHTING CONTROL PANEL. SEE SHEET E3.2 FOR CUTSHEETS.

GENERAL NOTES	
1. ELECTRICAL CONTRACTOR SHALL VERIFY EXISTING CONDITIONS PRIOR TO ROUGH IN.	
2. ALL EQUIPMENT ON SINGLE LINE DIAGRAM IS EXISTING TO REMAIN. UNO.	



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PROJECT:

**CALIFORNIA DEPARTMENT
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PROTECTION
CAL FIRE RAMONA AIR ATTACK BASE
- HELIPAD DESIGN**

**2498 MONTECITO ROAD,
RAMONA, CALIFORNIA 92065**

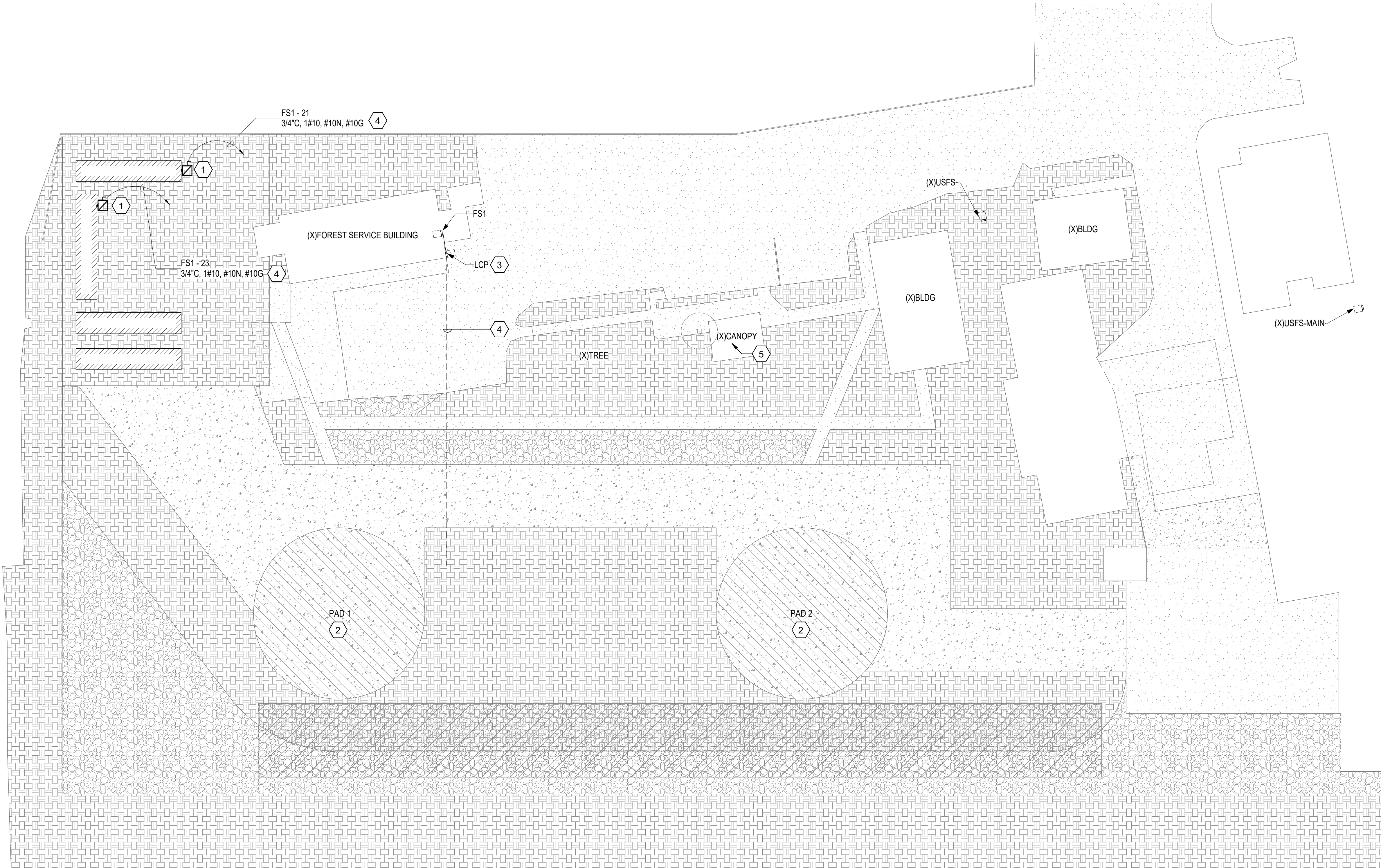
PROJECT NUMBER:
260101

SHEET TITLE:
SINGLE LINE DIAGRAM

SHEET NUMBER:

E0.2

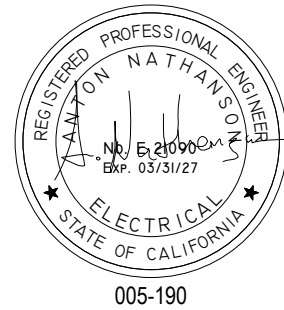
GENERAL NOTES - POWER		SHEET KEYNOTES	
A	ELECTRICAL CONTRACTOR SHALL VERIFY EXISTING CONDITIONS PRIOR TO ROUGH IN.	1	PROVIDE NEMA 3R LOCKABLE DISCONNECT FOR STORAGE CONTAINER POWER. TYPICAL OF 2.
		2	SEE SHEET E2.1 FOR ENLARGED HELICOPTER PAD LIGHTING AND POWER PLANS.
		3	PROVIDE NEMA 3R HELIPORT LIGHTING CONTROL PANEL LCP. SEE SHEET E3.2 FOR LIGHTING CONTROL PANEL CUTSHEET.
		4	ROUTE BRANCH CIRCUITS AND CU HELIPORT GROUND CONDUCTORS UNDERGROUND. COORDINATE TRENCHING WITH ARCHITECTURAL/CIVIL DRAWINGS.
		5	NO WORK SHALL OCCUR WITHIN 35' OF EXISTING TREE.



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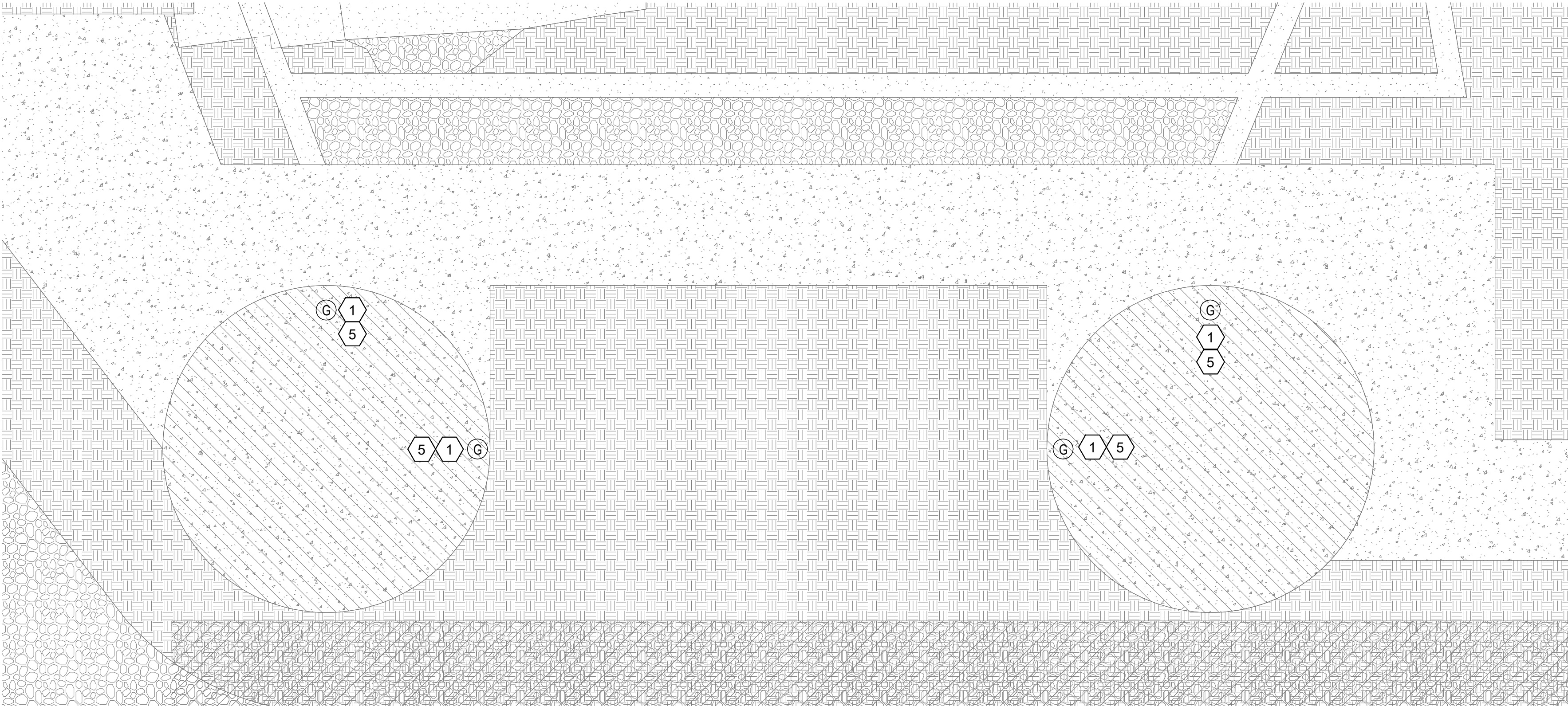
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CAL FIRE RAMONA AIR ATTACK BASE
- HELIPAD DESIGN
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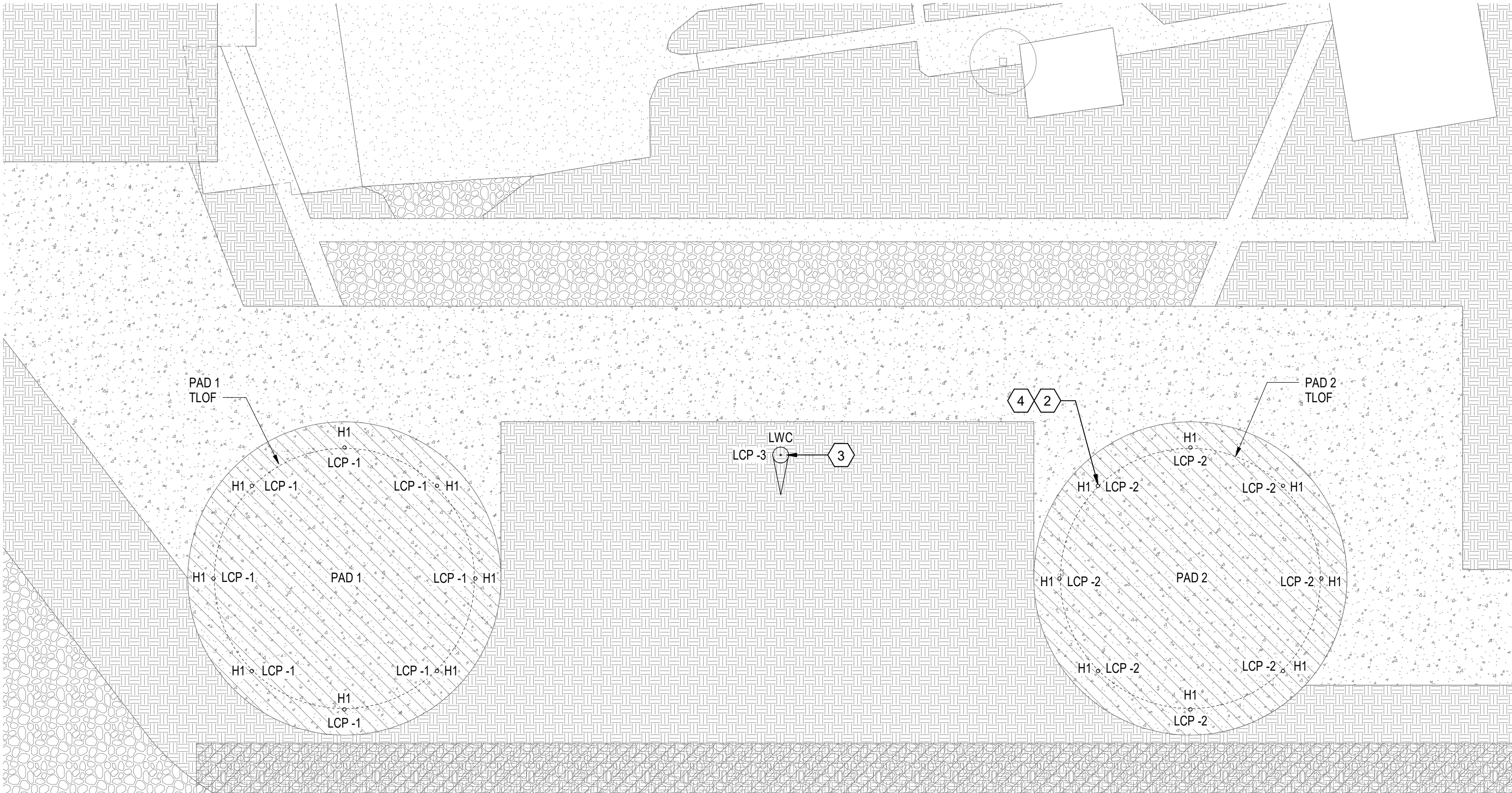
SHEET TITLE:
ELECTRICAL SITE PLAN

SHEET NUMBER:

E1.1



1
E2.1 ENLARGED POWER PLAN
SCALE: 1/16" = 1'-0"



2
E2.1 ENLARGED LIGHTING PLAN
SCALE: 1/16" = 1'-0"



GENERAL NOTES - POWER

A ELECTRICAL CONTRACTOR SHALL VERIFY EXISTING CONDITIONS PRIOR TO ROUGH IN.

SHEET KEYNOTES

- 1 PROVIDE STATIC GROUND RECEPTACLE. RECEPTACLE MUST NOT EXTEND 2" ABOVE FATO/TLOF AREA SURFACE ELEVATION. SEE SHEET E3.1 FOR DETAIL.
- 2 PROVIDE FAA TYPE L-852H IN-PAVEMENT PERIMETER LIGHT FOR HELIPORT. 8 TYPICAL PER HELIPORT PAD. LOCATE WITHIN 1' INSIDE OR OUTSIDE OF TLOF. SEE SHEET E3.2 FOR CUTSHEET.
- 3 PROVIDE LIGHTED WIND CONE. LOCATE WIND CONE OUTSIDE OF SAFETY AREA.
- 4 ALL IN-PAVEMENT FIXTURES ON HELIPORT TO BE CIRCUITED TO HELIPORT LIGHTING CONTROL PANEL LCP.
- 5 BOND STATIC GROUND RECEPTACLES TO EXISTING BLDG SERVICE. SEE SHEET E3.1 DETAIL 4 FOR BONDING DETAIL.



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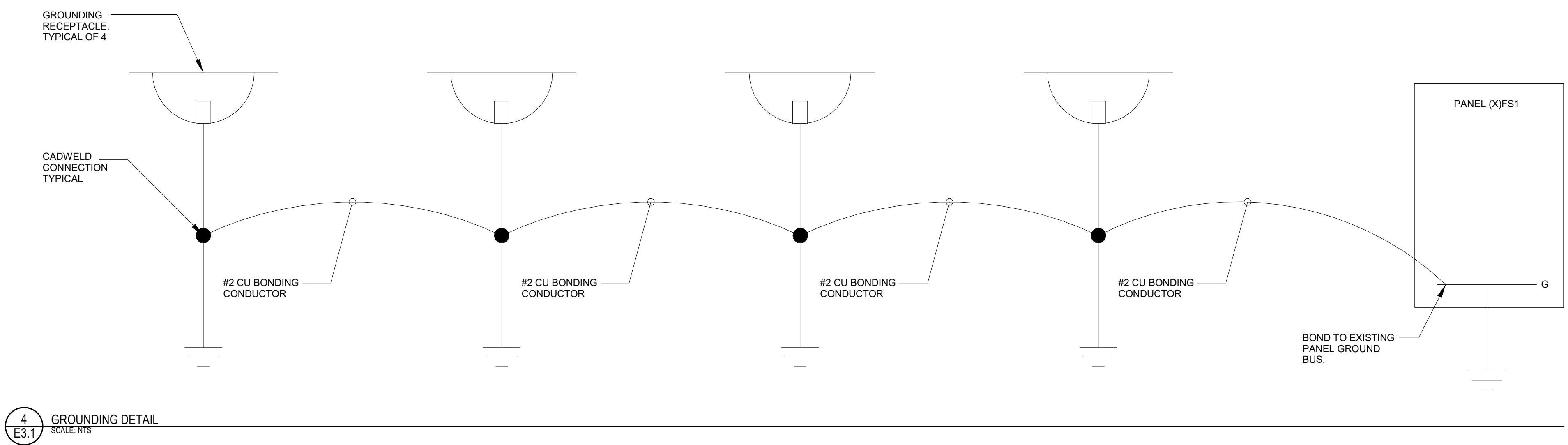
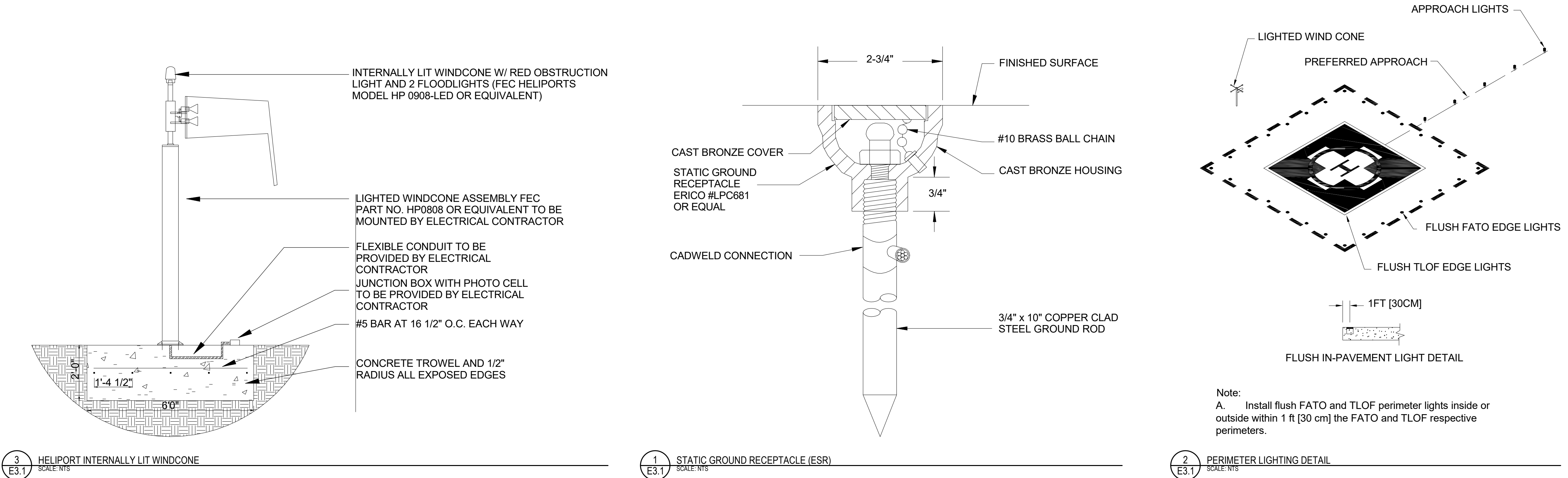
PROJECT:
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PROTECTION
CAL FIRE RAMONA AIR ATTACK BASE
- HELIPAD DESIGN**
2498 MONTECITO ROAD,
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PROJECT NUMBER:
260101

SHEET TITLE:
**ENLARGED ELECTRICAL
PLANS**

SHEET NUMBER:

E2.1



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PROJECT:
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CAL FIRE RAMONA AIR ATTACK BASE - HELIPAD DESIGN
2498 MONTECITO ROAD,
RAMONA, CALIFORNIA 92065

PROJECT NUMBER:
260101

SHEET TITLE:
ELECTRICAL SCHEDULES AND DETAILS

SHEET NUMBER:

E3.1



POINT ROLLOVER LIGHTS

PRL LED v4

HELIPORT INSET LIGHT

Compliances: ETL Listed to UL 1598A Marine Vessels at -40 deg C to +55 deg C
 ETL Listed to CSA C22.2 No. 137-M1981 & No. 250.0-08 Canada
 ETL Listed to UL 1598 at -40 deg C to +55 deg C
 Tested & Certified to IP66, IP67 & IP69 Ingress Protection
 Certified to FAA L-852H(L), L-860H(L), L-861H(L), L-860H(R), L-860HS(L)
 ICAO Annex 14, Volume II & ICAO Doc 9261
 Transport Canada Standard 325
 Registered ISO 9001-2015
 UK CAA CAP 437 ed. 9 (2023), Chapter 4 & Appendix C
 American Bureau of Shipping (ABS) Type Approved Product




The PRL LED Point Rollover Light is used for heliports where an omnidirectional inset semi-flush light is required to provide visibility and circling guidance. Only 2.2 watts and 3.5 VA at 120V.

- ☒ The castings are copper-free (< 0.25%) aluminum.
- ☒ The lens is glass.
- ☒ The hardware is 316 (A4) stainless steel.
- ☒ The LED's are rated for 100,000 hours.
- ☒ Switchable color option available.
- ☒ IP66, IP67 & IP69 tested and listed.
- ☒ Standard with the exclusive Point Lighting Marine Treatment finish that is bonded to the metal and far exceeds the corrosion resistance of the standard FAA approved finish. See below.
- ☒ Six (6) years limited warranty subject to Point Lighting "Terms & Conditions of Sale".

Point Type	Voltage	Array	Color	Mounting & Options
PRL-97004	1: 120V 2: 220V	C: Heliport N: NAV ¹	C: Green Y: Yellow	VB: Variable Brightness WB: Washdown Base & Gasket
	3: 12V DC	V: Vertical ¹	W: White	NC: NVC compatibility**
	4: 24V DC	H: ICAO FATO	R: Red	SR: CAP 437 Seating Ring
	6: 27V	U: 353-01	B: Blue	DH: Drain Hole in Base
		IR: infrared ¹		GR: Ground Lug in Base
				MTY: Marine Treatment Yellow
				TW: Taxiway Brightness (Blue)
				SC: Switchable Color (see page 2)
				TRH: Tamper Resistant Hardware

Note: Array C brightness exceeds ICAO Annex 14 & meets CAP 437
¹ For NVC located use only. PRL-97004-1N-R-PLS
² Inspection upright normally in white with narrow high intensity vertical beam.

Visibility Range as Tested:

Visible Color > 8 nautical miles
 Option -NC ** > 3 nautical miles

**** For Night Vision Goggles (NVG)**
 Option -NC adds IR LED at 855 nm
 Radiant Power: C-array 137 mW/lr







Our Marine Treatment tolerates marine, high salt content air and other corrosive environments. Standard with green finish as shown. The FAA specified finish used by competitors flakes and falls in a short time under such conditions.

The fixture shall be treated for marine conditions by cleaning per US Department of Defense TFC-490 method III, pretreated with chrome-free aluminum conversion coating per US MIL-C-55411 type I, epoxy powder base coat primer and epoxy polyester powder coat finish in color RAL 6003 (RED-STD-395 color #14087) dark green. Powder coating per US Department of Defense MIL-PRF-27421A type IV and oven cured.



HL115 March, 2024

POINT HELIPOINT LIGHTING PHC HELIPOINT LIGHTING CONTROLLER WITH TOUCHSCREEN

POINT LIGHTING CORPORATION IS AN INTERTEK ETL CERTIFIED BUILDER OF INDUSTRIAL CONTROL PANELS UNDER UL 508A 2ND AND CSA C22.2 NO. 286. PHC PANELS ARE LABELED WITH THE ETL LISTED MARK.

The PHC-6600x controller provides manual and automatic operation of the heliport lighting system. The touchscreen is a high brightness, color TFT touch panel display with LED backlighting that controls all system operations. Simulated pilot lights and switches allow the user to control all heliport output circuits. In the AUTO position, the controller operates automatically from a pilot actuated FAA radio controller or an FAA photoelectric controller that activates per FAA light level requirements. The non-metallic enclosure is rated NEMA 4X and IP66. The PHC and lighting circuits are protected from transient voltage spikes by a 50kA interrupting surge suppressor and each load output is protected by a current limiting circuit breaker. The touchscreen circuit layout is factory customized to the actual heliport lighting system. All switch labels are configurable in the field.

Note: Uninterruptible Power Supply (UPS) available; see file OL306UPS.

	Point Type	Voltage	Options
Basic Model:	PHC-66001	AC: 96 ~ 264v	See list on page 2
Advanced Model:	PHC-66002	6: 277v ** DC: 10 ~ 36v	If installing outside, options -HTR 8 ~ 3V may be required.
Mimic Panel:	PL11515 * * PHC-66002 only	** Input 277v; output 120v; lights must be 120v	

HELIPOINT LIGHTING SYSTEM TOUCHSCREEN CONTROLLER PHC-66002-AC

* The optional mimic panel may be added to the PHC-66002 at any time. The remote mimic panel consists of a second touchscreen that mimics all functions displayed on the main PHC touchscreen. The remote mimic panel is mounted in a fiberglass reinforced polyester enclosure that is NEMA 4X and IP66 rated. A standard category 6 ethernet cable with RJ45 connectors (or others) will be used to connect the main PHC-66002 controller to the remote mimic panel. All power and data will be conveyed by the category 6 cable.

DIMENSIONS:

	Inches (mm)
PHC-66001	17.4 (441) x 15.3 (339) x 6.7 (169)
PHC-66002	19.3 (490) x 17.3 (440) x 9.6 (243)

HL409 October, 2024

1

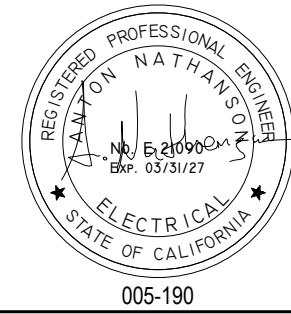
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PROJECT:

**CALIFORNIA DEPARTMENT
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CAL FIRE RAMONA AIR ATTACK BASE
- HELIPAD DESIGN**

**2498 MONTECITO ROAD,
RAMONA, CALIFORNIA 92065**

PROJECT NUMBER: 260101

SHEET TITLE:
ELECTRICAL CUTSHEETS

SHEET NUMBER

E3.2

STATE OF CALIFORNIA
DEPARTMENT OF FORESTRY AND FIRE PROTECTION



PROJECT MANUAL
FAA AND CSI DIVISION SPECIFICATIONS

FOR:

CALFIRE
RAMONA AIR ATTACK BASE
HELIPAD DESIGN

RAMONA, CALIFORNIA

PROJECT SPECIFICATIONS:

Mailing Address:
23300 Castle Street
Riverside, CA 92518

Shipping Address:
23300 Castle Street
Riverside, CA 92518

Matt McCleod, Senior Civil Engineer
Phone: 951-901-5115

Jessica Hossie, Civil Engineer
Phone: 951-205-6789

Standard Specification References

- US Department of Federal Aviation Administration Standard Specifications for Construction of Airports Advisory Circular - AC No: 150/5370-10H Dated 12/21/2018 and updated in 2020.
- US Department of Federal Aviation Administration Standard Specifications for Construction of Airports Advisory Circular - AC No: 150/5390-2D Heliport Design
- California Building Code 2025
- California Electrical Code 2025
- Construction Specifications Institute (CSI)
- Standard Specifications for Public Works (Greenbook), 2024 Edition
- California Department of Transportation Manual of Uniform Control Devices, Rev 6, 2018 Edition

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PART 2 – GENERAL CONSTRUCTION ITEMS - NOT USED

PART 3 – SITEWORK

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PART 4 – BASE COURSES

Item P-209 Crushed Aggregate Base Course

PART 5 – STABILIZED BASE COURSES – NOT USED

PART 6 – FLEXIBLE PAVEMENTS – NOT USED

PART 7 – RIGID PAVEMENT

Item P-501 Cement Concrete Pavement

PART 8 – SURFACE TREATMENTS – NOT USED

PART 9 – MISCELLANEOUS

Item P-620 Runway and Taxiway Marking

PART 10 – FENCING – NOT USED

PART 11 – DRAINAGE

Item D-701 Pipe for Storm Drains and Culverts

Item D-751 Manholes, Catch Basins, Inlets, and Inspection Holes

Item D-754 Concrete Gutters, Ditches and Flumes

PART 12 – TURFING – NOT USED

PART 13 – LIGHTING INSTALLATION – NOT USED, See Division 26 below

*CALIFORNIA BUILDING CODE 2025; CALIFORNIA ELECTRICAL CODE 2025; CONSTRUCTION
SPECIFICATIONS INSTITUTE*

DIVISION 01-14, 22, 23, 27-28, 31-33 – NOT USED

DIVISION 26 - ELECTRICAL

26 05 19 Low-Voltage Electrical Power Conductors and Cables
26 05 26 Grounding and Bonding for Electrical Systems
26 05 43 Underground Duct and Raceways for Electrical
26 05 44 Sleeves and Sleeve Seals for Electrical
26 05 53 Identification for Electrical Systems

Attachment 4
Specifications

FAA ADVISORY CIRCULAR AC 150/5370-10H

Item P-152 Excavation, Subgrade, and Embankment

DESCRIPTION

152-1.1 This item covers excavation, disposal, placement, and compaction of all materials within the limits of the work required to construct safety areas, runways, taxiways, aprons, and intermediate areas as well as other areas for drainage, building construction, parking, or other purposes in accordance with these specifications and in conformity to the dimensions and typical sections shown on the plans.

All work shall be performed in accordance with the Geotechnical Investigation entitled "Cal Fire Ramona Air Attack Base dated May 11, 2026 prepared by Geocon (project no. G3644-42-02)

152-1.2 Classification. All material excavated shall be classified as defined below:

a. Unclassified excavation. Unclassified excavation shall consist of the excavation and disposal of all material, regardless of its nature

CONSTRUCTION METHODS

152-2.1 General. Before beginning excavation, grading, and embankment operations in any area, the area shall be cleared or cleared and grubbed in accordance with Item P-151.

The suitability of material to be placed in embankments shall be subject to approval by the RPR. All unsuitable material shall be disposed of in waste areas as shown on the plans. All waste areas shall be graded to allow positive drainage of the area and adjacent areas. The surface elevation of waste areas shall be specified on the plans or approved by the RPR.

When the Contractor's excavating operations encounter artifacts of historical or archaeological significance, the operations shall be temporarily discontinued and the RPR notified per Section 70, paragraph 70-20. At the direction of the RPR, the Contractor shall excavate the site in such a manner as to preserve the artifacts encountered and allow for their removal. Such excavation will be paid for as extra work.

Areas outside the limits of the pavement areas where the top layer of soil has become compacted by hauling or other Contractor activities shall be scarified and disked to a depth of 4 inches (100 mm), to loosen and pulverize the soil. Stones or rock fragments larger than 4 inches (100 mm) in their greatest dimension will not be permitted in the top 6 inches (150 mm) of the subgrade.

If it is necessary to interrupt existing surface drainage, sewers or under-drainage, conduits, utilities, or similar underground structures, the Contractor shall be responsible for and shall take all necessary precautions to preserve them or provide temporary services. When such facilities are encountered, the Contractor shall notify the RPR, who shall arrange for their removal if necessary. The Contractor, at their own expense, shall satisfactorily repair or pay the cost of all damage to such facilities or structures that may result from any of the Contractor's operations during the period of the contract.

a. Blasting. Blasting shall not be allowed

152-2.2 Excavation. No excavation shall be started until the work has been staked out by the Contractor and the RPR has obtained from the Contractor, the survey notes of the elevations and measurements of

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the ground surface. The Contractor and RPR shall agree that the original ground lines shown on the original topographic mapping are accurate, or agree to any adjustments made to the original ground lines.

All areas to be excavated shall be stripped of vegetation and topsoil. Topsoil shall be stockpiled for future use in areas designated on the plans or by the RPR. All suitable excavated material shall be used in the formation of embankment, subgrade, or other purposes as shown on the plans. All unsuitable material shall be disposed of as shown on the plans.

The grade shall be maintained so that the surface is well drained at all times.

When the volume of the excavation exceeds that required to construct the embankments to the grades as indicated on the plans, the excess shall be used to grade the areas of ultimate development or disposed as directed by the RPR. When the volume of excavation is not sufficient for constructing the embankments to the grades indicated, the deficiency shall be obtained from borrow areas.

a. Selective grading. When selective grading is indicated on the plans, the more suitable material designated by the RPR shall be used in constructing the embankment or in capping the pavement subgrade. If, at the time of excavation, it is not possible to place this material in its final location, it shall be stockpiled in approved areas until it can be placed. The more suitable material shall then be placed and compacted as specified. Selective grading shall be considered incidental to the work involved. The cost of stockpiling and placing the material shall be included in the various pay items of work involved.

b. Undercutting. Rock, shale, hardpan, loose rock, boulders, or other material unsatisfactory for safety areas, subgrades, roads, shoulders, or any areas intended for turf shall be excavated to a minimum depth of 12 inches (300 mm) below the subgrade or to the depth specified by the RPR. Muck, peat, matted roots, or other yielding material, unsatisfactory for subgrade foundation, shall be removed to the depth specified. Unsuitable materials shall be disposed off the airport. The cost is incidental to this item. The excavated area shall be backfilled with suitable material obtained from the grading operations or borrow areas and compacted to specified densities. The necessary backfill will constitute a part of the embankment. Where rock cuts are made, backfill with select material. Any pockets created in the rock surface shall be drained in accordance with the details shown on the plans.

c. Over-break. Over-break, including slides, is that portion of any material displaced or loosened beyond the finished work as planned or authorized by the RPR. All over-break shall be graded or removed by the Contractor and disposed of as directed by the RPR. The RPR shall determine if the displacement of such material was unavoidable and their own decision shall be final. Payment will not be made for the removal and disposal of over-break that the RPR determines as avoidable. Unavoidable over-break will be classified as "Unclassified Excavation."

d. Removal of utilities. The removal of existing structures and utilities required to permit the orderly progress of work will be accomplished by the Contractor as indicated on the plans. All existing foundations shall be excavated at least 2 feet (60 cm) below the top of subgrade or as indicated on the plans, and the material disposed of as directed by the RPR. All foundations thus excavated shall be backfilled with suitable material and compacted as specified for embankment or as shown on the plans.

152-2.3 Borrow excavation. Borrow areas are not required

152-2.4 Drainage excavation. Drainage excavation shall consist of excavating drainage ditches including intercepting, inlet, or outlet ditches; or other types as shown on the plans. The work shall be performed in sequence with the other construction. Ditches shall be constructed prior to starting adjacent excavation operations. All satisfactory material shall be placed in embankment fills; unsuitable material shall be placed in designated waste areas or as directed by the RPR. All necessary work shall be performed true to final line, elevation, and cross-section. The Contractor shall maintain ditches constructed on the project to the required cross-section and shall keep them free of debris or obstructions until the project is accepted.

152-2.5 Preparation of cut areas or areas where existing pavement has been removed. In those areas on which a subbase or base course is to be placed, prepare subgrade per the project geotechnical investigation specified in 152-1.1. As used in this specification, "non-cohesive" shall mean those soils having a plasticity index (PI) of less than 3 as determined by ASTM D4318.

No direct payment shall be made for the work performed under this section. The necessary clearing and grubbing and the quantity of excavation removed will be paid for under the respective items of work.

152-2.7 Control Strip. The first half-day of construction of subgrade and/or embankment shall be considered as a control strip for the Contractor to demonstrate, in the presence of the RPR, that the materials, equipment, and construction processes meet the requirements of this specification. The sequence and manner of rolling necessary to obtain specified density requirements shall be determined. The maximum compacted thickness may be increased to a maximum of 12 inches (300 mm) upon the Contractor's demonstration that approved equipment and operations will uniformly compact the lift to the specified density. The RPR must witness this demonstration and approve the lift thickness prior to full production.

Control strips that do not meet specification requirements shall be reworked, re-compacted, or removed and replaced at the Contractor's expense. Full operations shall not begin until the control strip has been accepted by the RPR. The Contractor shall use the same equipment, materials, and construction methods for the remainder of construction, unless adjustments made by the Contractor are approved in advance by the RPR.

152-2.10 Compaction requirements. The subgrade under areas to be paved shall be compacted to depth and density as specified in the project geotechnical investigation specified in 152-1.1 as determined by ASTM D698

Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

If the specified density is not attained, the entire lot shall be reworked and/or re-compacted and additional random tests made. This procedure shall be followed until the specified density is reached.

All cut-and-fill slopes shall be uniformly dressed to the slope, cross-section, and alignment shown on the plans or as directed by the RPR and the finished subgrade shall be maintained.

152-2.11 Finishing and protection of subgrade. Finishing and protection of the subgrade is incidental to this item. Grading and compacting of the subgrade shall be performed so that it will drain readily. All low areas, holes or depressions in the subgrade shall be brought to grade. Scarifying, blading, rolling and other methods shall be performed to provide a thoroughly compacted subgrade shaped to the lines and grades shown on the plans. All ruts or rough places that develop in the completed subgrade shall be graded, re-compacted, and retested. The Contractor shall protect the subgrade from damage and limit hauling over the finished subgrade to only traffic essential for construction purposes.

The Contractor shall maintain the completed course in satisfactory condition throughout placement of subsequent layers. No subbase, base, or surface course shall be placed on the subgrade until the subgrade has been accepted by the RPR.

152-2.12 Haul. All hauling will be considered a necessary and incidental part of the work. The Contractor shall include the cost in the contract unit price for the pay of items of work involved. No payment will be made separately or directly for hauling on any part of the work.

The Contractor's equipment shall not cause damage to any excavated surface, compacted lift or to the subgrade as a result of hauling operations. Any damage caused as a result of the Contractor's hauling operations shall be repaired at the Contractor's expense.

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The Contractor shall be responsible for providing, maintaining and removing any haul roads or routes within or outside of the work area, and shall return the affected areas to their former condition, unless otherwise authorized in writing by the Owner. No separate payment will be made for any work or materials associated with providing, maintaining and removing haul roads or routes.

152-2.13 Surface Tolerances. In those areas on which a subbase or base course is to be placed, the surface shall be tested for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches (75 mm), reshaped and re-compacted to grade until the required smoothness and accuracy are obtained and approved by the RPR. The Contractor shall perform all final smoothness and grade checks in the presence of the RPR. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor's expense.

- a. **Smoothness.** The finished surface shall not vary more than $\pm 1/2$ inch (12 mm) when tested with a 12-foot (3.7-m) straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously forward at half the length of the 12-foot (3.7-m) straightedge for the full length of each line on a 50-foot (15-m) grid.
- b. **Grade.** The grade and crown shall be measured on a 50-foot (15-m) grid and shall be within ± 0.05 feet (15 mm) of the specified grade.

On safety areas, turfed areas and other designated areas within the grading limits where no subbase or base is to be placed, grade shall not vary more than 0.10 feet (30 mm) from specified grade. Any deviation in excess of this amount shall be corrected by loosening, adding or removing materials, and reshaping.

152-2.14 Topsoil. When topsoil is specified or required as shown on the plans or under Item T-905, it shall be salvaged from stripping or other grading operations. The topsoil shall meet the requirements of Item T-905. If, at the time of excavation or stripping, the topsoil cannot be placed in its final section of finished construction, the material shall be stockpiled at approved locations. Stockpiles shall be located as shown on the plans and the approved CSPP, and shall not be placed on areas that subsequently will require any excavation or embankment fill. If, in the judgment of the RPR, it is practical to place the salvaged topsoil at the time of excavation or stripping, the material shall be placed in its final position without stockpiling or further re-handling.

Upon completion of grading operations, stockpiled topsoil shall be handled and placed as shown on the plans and as required in Item T-905. Topsoil shall be paid for as provided in Item T-905. No direct payment will be made for topsoil under Item P-152.

REFERENCES

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

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO T-180	Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
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ASTM International (ASTM)

ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ³ (600 kN-m/m ³))
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

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ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ³ (2700 kN-m/m ³))
ASTM D6938	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
Advisory Circulars (AC)	
AC 150/5370-2	Operational Safety on Airports During Construction Software
Software	
FAARFIELD – FAA Rigid and Flexible Iterative Elastic Layered Design	
U.S. Department of Transportation	
FAA RD-76-66	Design and Construction of Airport Pavements on Expansive Soils

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Item P-209 Crushed Aggregate Base Course

DESCRIPTION

209-1.1 This item consists of a base course composed of crushed aggregate base constructed on a prepared course in accordance with these specifications and in conformity to the dimensions and typical cross-sections shown on the plans.

All materials and methods shall be in compliance with project geotechnical investigation specified in 152-1.1

MATERIALS

209-2.1 Crushed aggregate base. Crushed aggregate shall consist of clean, sound, durable particles of crushed stone, crushed gravel, and shall be free from coatings of clay, silt, organic material, clay lumps or balls or other deleterious materials or coatings. The method used to produce the crushed gravel shall result in the fractured particles in the finished product as consistent and uniform as practicable. Fine aggregate portion, defined as the portion passing the No. 4 (4.75 mm) sieve shall consist of fines from the coarse aggregate crushing operation. The fine aggregate shall be produced by crushing stone, gravel, that meet the coarse aggregate requirements for wear and soundness. Aggregate base material requirements are listed in the following table.

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Crushed Aggregate Base Material Requirements

Material Test	Requirement	Standard
Coarse Aggregate		
Resistance to Degradation	Loss: 45% maximum	ASTM C131
Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate	Loss after 5 cycles: 12% maximum using Sodium sulfate - or - 18% maximum using magnesium sulfate	ASTM C88
Percentage of Fractured Particles	Minimum 90% by weight of particles with at least two fractured faces and 98% with at least one fractured face ¹	ASTM D5821
Flat Particles, Elongated Particles, or Flat and Elongated Particles	10% maximum, by weight, of flat, elongated, or flat and elongated particles ²	ASTM D4791
Fine Aggregate		
Liquid limit	Less than or equal to 25	ASTM D4318
Plasticity Index	Not more than five (5)	ASTM D4318

¹ The area of each face shall be equal to at least 75% of the smallest mid-sectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 degrees to count as two fractured faces.

² A flat particle is one having a ratio of width to thickness greater than five (5); an elongated particle is one having a ratio of length to width greater than five (5).

209-2.2 Gradation requirements. The gradation of the aggregate base material shall meet the requirements of the gradation given in the following table when tested per ASTM C117 and ASTM C136. The gradation shall be well graded from coarse to fine and shall not vary from the lower limit on one sieve to the high limit on an adjacent sieve or vice versa.

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Gradation of Aggregate Base

Sieve Size	Design Range Percentage by Weight passing	Contractor's Final Gradation	Job Control Grading Band Tolerances ¹ (Percent)
2 inch (50 mm)	100		0
1-1/2 inch (37.5 mm)	95-100		±5
1 inch (25.0 mm)	70-95		±8
3/4 inch (19.0 mm)	55-85		±8
No. 4 (4.75 mm)	30-60		±8
No. 40 ² (425 µm)	10-30		±5
No. 200 ² (75 µm)	[0-10]		±3

¹ The "Job Control Grading Band Tolerances for Contractor's Final Gradation" in the table shall be applied to "Contractor's Final Gradation" to establish a job control grading band. The full tolerance still applies if application of the tolerances results in a job control grading band outside the design range.

² The fraction of material passing the No 200 (75 µm) sieve shall not exceed two-thirds the fraction passing the No 40 (425 µm) sieve.

209-2.3 Sampling and Testing.

a. Aggregate base materials. The Contractor shall take samples of the aggregate base in accordance with ASTM D75 to verify initial aggregate base requirements and gradation. Material shall meet the requirements in paragraph 209-2.1. This sampling and testing will be the basis for approval of the aggregate base quality requirements.

b. Gradation requirements. The Contractor shall take at least two aggregate base samples per day in the presence of the Resident Project Representative (RPR) to check the final gradation. Sampling shall be per ASTM D75. Material shall meet the requirements in paragraph 209-2.2. The samples shall be taken from the in-place, un-compacted material at sampling points and intervals designated by the RPR.

CONSTRUCTION METHODS

209-3.1 Control strip. The first half-day of construction shall be considered the control strip. The Contractor shall demonstrate, in the presence of the RPR, that the materials, equipment, and construction processes meet the requirements of the specification. The sequence and manner of rolling necessary to obtain specified density requirements shall be determined. The maximum compacted thickness may be increased to a maximum of 12 inches (300 mm) upon the Contractor's demonstration that approved equipment and operations will uniformly compact the lift to the specified density. The RPR must witness this demonstration and approve the lift thickness prior to full production.

Control strips that do not meet specification requirements shall be reworked, re-compacted or removed and replaced at the Contractor's expense. Full operations shall not continue until the control strip has been accepted by the RPR. The Contractor shall use the same equipment, materials, and construction

methods for the remainder of construction, unless adjustments made by the Contractor are approved by the RPR.

209-3.2 Preparing underlying subgrade and/or subbase. The underlying subgrade and/or subbase shall be checked and accepted by the RPR before base course placing and spreading operations begin. Re-proof rolling of the subgrade or proof rolling of the subbase in accordance with Item P-152, at the Contractor's expense, may be required by the RPR if the Contractor fails to ensure proper drainage or protect the subgrade and/or subbase. Any ruts or soft, yielding areas due to improper drainage conditions, hauling, or any other cause, shall be corrected before the base course is placed. To ensure proper drainage, the spreading of the base shall begin along the centerline of the pavement on a crowned section or on the high side of the pavement with a one-way slope.

209-3.3 Production. The aggregate shall be uniformly blended and, when at a satisfactory moisture content per paragraph 209-3.5, the approved material may be transported directly to the placement.

209-3.4 Placement. The aggregate shall be placed and spread on the prepared underlying layer by spreader boxes or other devices as approved by the RPR, to a uniform thickness and width. The equipment shall have positive thickness controls to minimize the need for additional manipulation of the material. Dumping from vehicles that require re-handling shall not be permitted. Hauling over the uncompacted base course shall not be permitted.

The aggregate shall meet gradation and moisture requirements prior to compaction. The base course shall be constructed in lifts as established in the control strip, but not less than 4 inches (100 mm) nor more than 12 inches (300 mm) of compacted thickness.

When more than one lift is required to establish the layer thickness shown on the plans, the construction procedure described here shall apply to each lift. No lift shall be covered by subsequent lifts until tests verify that compaction requirements have been met. The Contractor shall rework, re-compact and retest any material placed which does not meet the specifications at the Contractor's expense.

209-3.5 Compaction. Immediately after completion of the spreading operations, compact each layer of the base course, as specified, with approved compaction equipment. The number, type, and weight of rollers shall be sufficient to compact the material to the required density within the same day that the aggregate is placed on the subgrade.

The field density of each compacted lift of material shall be at least [100%] of the maximum density of laboratory specimens prepared from samples of the base material delivered to the jobsite. The laboratory specimens shall be compacted and tested in accordance with [ASTM D1557]. The moisture content of the material during placing operations shall be within ± 2 percentage points of the optimum moisture content as determined by ASTM [____]. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

209-3.6 Weather limitations. Material shall not be placed unless the ambient air temperature is at least 40°F (4°C) and rising. Work on base course shall not be conducted when the subgrade or subbase is wet or frozen or the base material contains frozen material.

209-3.7 Maintenance. The base course shall be maintained in a condition that will meet all specification requirements. When material has been exposed to excessive rain, snow, or freeze-thaw conditions, prior to placement of additional material, the Contractor shall verify that materials still meet all specification requirements. Equipment may be routed over completed sections of base course, provided that no damage results and the equipment is routed over the full width of the completed base course. Any damage resulting to the base course from routing equipment over the base course shall be repaired by the Contractor at the Contractor's expense.

209-3.8 Surface tolerances. After the course has been compacted, the surface shall be tested for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in

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accuracy of grade or crown shall be scarified to a depth of at least 3 inches (75 mm), reshaped and recompact to grade until the required smoothness and accuracy are obtained and approved by the RPR. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor's expense. The smoothness and accuracy requirements specified here apply only to the top layer when base course is constructed in more than one layer.

a. Smoothness. The finished surface shall not vary more than 3/8-inch (9 mm) when tested with a 12-foot (3.7-m) straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously forward at half the length of the 12-foot (3.7-m) straightedge for the full length of each line on a 50-foot (15-m) grid.

b. Grade. The grade and crown shall be measured on a 50-foot (15-m) grid and shall be within +0 and -1/2 inch (12 mm) of the specified grade.

209-3.9 Acceptance sampling and testing. Crushed aggregate base course shall be accepted for density and thickness on an area basis. Two tests shall be made for density and thickness for each [1200 square yds (1000 m²)]. Sampling locations will be determined on a random basis per ASTM D3665

a. Density. The Contractor's laboratory shall perform all density tests in the RPR's presence and provide the test results upon completion to the RPR for acceptance.

Each area shall be accepted for density when the field density is at least 100% of the maximum density of laboratory specimens compacted and tested per ASTM [D698]. The in-place field density shall be determined per ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. If the specified density is not attained, the area represented by the failed test must be reworked and/or recompact and two additional random tests made. This procedure shall be followed until the specified density is reached. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

b. Thickness. Depth tests shall be made by test holes at least 3 inches (75 mm) in diameter that extend through the base. The thickness of the base course shall be within +0 and -1/2 inch (12 mm) of the specified thickness as determined by depth tests taken by the Contractor in the presence of the RPR for each area. Where the thickness is deficient by more than 1/2-inch (12 mm), the Contractor shall correct such areas at no additional cost by scarifying to a depth of at least 3 inches (75 mm), adding new material of proper gradation, and the material shall be blended and recompact to grade. The Contractor shall replace, at his expense, base material where depth tests have been taken.

REFERENCES

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

ASTM International (ASTM)

ASTM C29	Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM C88	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

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ASTM C117	Standard Test Method for Materials Finer than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C131	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM C142	Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM D75	Standard Practice for Sampling Aggregates
ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ³ (600 kN-m/m ³))
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ³ (2700 kN-m/m ³))
ASTM D2167	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM D3665	Standard Practice for Random Sampling of Construction Materials
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4491	Standard Test Methods for Water Permeability of Geotextiles by Permittivity
ASTM D4643	Standard Test Method for Determination of Water Content of Soil and Rock by Microwave Oven Heating
ASTM D4751	Standard Test Methods for Determining Apparent Opening Size of a Geotextile
ASTM D4791	Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D5821	Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
ASTM D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D7928	Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis

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American Association of State Highway and Transportation Officials (AASHTO)

M288

Standard Specification for Geosynthetic Specification for Highway
Applications

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Item P-501 Cement Concrete Pavement

DESCRIPTION

501-1.1 This work shall consist of pavement composed of cement concrete constructed on a prepared underlying surface in accordance with these specifications and shall conform to the lines, grades, thickness, and typical cross-sections shown on the plans. The terms cement concrete, hydraulic cement concrete, and concrete are interchangeable in this specification.

All materials and methods shall be in compliance with project geotechnical investigation specified in 152-1.1

MATERIALS

501-2.1 Aggregates.

a. Reactivity. Fine and Coarse aggregates to be used in PCC on this project shall be tested and evaluated by the Contractor for alkali-aggregate reactivity in accordance with both ASTM C1260 and ASTM C1567. Tests must be representative of aggregate sources which will be providing material for production. ASTM C1260 and ASTM C1567 tests may be run concurrently.

(1) Coarse aggregate and fine aggregate shall be tested separately in accordance with ASTM C1260, however, the length of test shall be extended to 28 days (30 days from casting). Tests must have been completed within 6 months of the date of the concrete mix submittal.

(2) The combined coarse and fine aggregate shall be tested in accordance with ASTM C1567, modified for combined aggregates, using the proposed mixture design proportions of aggregates, cementitious materials, and/or specific reactivity reducing chemicals. If the expansion does not exceed 0.10% at 28 days, the proposed combined materials will be accepted. If the expansion is greater than 0.10% at 28 days, the aggregates will not be accepted unless adjustments to the combined materials mixture can reduce the expansion to less than 0.10% at 28 days, or new aggregates shall be evaluated and tested.

(3) If lithium nitrate is proposed for use with or without supplementary cementitious materials, the aggregates shall be tested in accordance with Corps of Engineers (COE) Concrete Research Division (CRD) C662 in lieu of ASTM C1567. If lithium nitrate admixture is used, it shall be nominal 30% $\pm$ 0.5% weight lithium nitrate in water. If the expansion does not exceed 0.10% at 28 days, the proposed combined materials will be accepted. If the expansion is greater than 0.10% at 28 days, the aggregates will not be accepted unless adjustments to the combined materials mixture can reduce the expansion to less than 0.10% at 28 days, or new aggregates shall be evaluated and tested.

b. Fine aggregate. Grading of the fine aggregate, as delivered to the mixer, shall conform to the requirements of ASTM C33 and the parameters identified in the fine aggregate material requirements below. Fine aggregate material requirements and deleterious limits are shown in the table below.

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Fine Aggregate Material Requirements		
Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate	Loss after 5 cycles: 10% maximum using Sodium sulfate - or - 15% maximum using magnesium sulfate	ASTM C88
Sand Equivalent	[45] minimum	ASTM D2419
Fineness Modulus (FM)	$2.50 \leq FM \leq 3.40$	ASTM C136
Limits for Deleterious Substances in Fine Aggregate for Concrete		
Clay lumps and friable particles	1.0% maximum	ASTM C142
Coal and lignite	0.5% using a medium with a density of Sp. Gr. of 2.0	ASTM C123
Total Deleterious Material	1.0% maximum	

c. Coarse aggregate. The maximum size coarse aggregate shall be 1.5 inch.

Aggregates delivered to the mixer shall be clean, hard, uncoated aggregates consisting of crushed stone, crushed or uncrushed gravel, air-cooled iron blast furnace slag, crushed recycled concrete pavement, or a combination. The aggregates shall have no known history of detrimental pavement staining. Steel blast furnace slag shall not be permitted. Coarse aggregate material requirements and deleterious limits are shown in the table below; washing may be required to meet aggregate requirements.

Coarse Aggregate Material Requirements

Material Test	Requirement	Standard
Resistance to Degradation	Loss: 40% maximum	ASTM C131
Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate	Loss after 5 cycles: 12% maximum using Sodium sulfate - or - 18% maximum using magnesium sulfate	ASTM C88
Flat, Elongated, or Flat and Elongated Particles	8% maximum, by weight, of flat, elongated, or flat and elongated particles at 5:1 for any size group coarser than 3/8 (9.5 mm) sieve ¹	ASTM D4791
Bulk density of slag ²	Weigh not less than 70 pounds per cubic foot (1.12 Mg/cubic meter)	ASTM C29

¹ A flat particle is one having a ratio of width to thickness greater than five (5); an elongated particle is one having a ratio of length to width greater than five (5).

² Only required if slag is specified.

The amount of deleterious material in the coarse aggregate shall not exceed the following limits:

Limits for Deleterious Substances in Coarse Aggregate

Deleterious material	ASTM	Percentage by Mass
Clay Lumps and friable particles	ASTM C142	1.0
Material finer than No. 200 sieve (75 µm)	ASTM C117	1.0 ¹
Lightweight particles	ASTM C123 using a medium with a density of Sp. Gr. of 2.0	0.5
Chert ² (less than 2.40 Sp Gr.)	ASTM C123 using a medium with a density of Sp. Gr. of 2.40)	[0.1] ³

¹ The limit for material finer than 75-µm is allowed to be increased to 1.5% for crushed aggregates consisting of dust of fracture that is essentially free from clay or shale. Test results supporting acceptance of increasing limit to 1.5% with statement indicating material is dust of fracture must be submitted with Concrete mix. Acceptable techniques to characterizing these fines include methylene blue adsorption or X-ray diffraction analysis.

² Chert and aggregates with less than 2.4 specific gravity.

³ The limit for chert may be increased to 1.0 percent by mass in areas not subject to severe freeze and thaw.

d. Combined aggregate gradation. This specification is targeted for a combined aggregate gradation developed following the guidance presented in United States Air Force Engineering Technical Letter (ETL) 97-5: Proportioning Concrete Mixtures with Graded Aggregates for Rigid Airfield Pavements. Base the aggregate grading upon a combination of all the aggregates (coarse and fine) to be used for the mixture proportioning. Three aggregate sizes may be required to achieve an optimized combined gradation that will produce a workable concrete mixture for its intended use. Use aggregate gradations that produce concrete mixtures with well-graded or optimized aggregate combinations. The Contractor shall submit complete mixture information necessary to calculate the volumetric components of the mixture. The combined aggregate grading shall meet the following requirements:

(1) The materials selected and the proportions used shall be such that when the Coarseness Factor (CF) and the Workability Factor (WF) are plotted on a diagram as described in paragraph 501-2.1d(4) below, the point thus determined shall fall within the parallelogram described therein.

(2) The CF shall be determined from the following equation:

$$CF = \frac{(\text{cumulative percent retained on the } 3/8 \text{ in. (9.5 mm) sieve})(100)}{(\text{cumulative percent retained on the No. 8 (2.36 mm) sieve})}$$

(3) The WF is defined as the percent passing the No. 8 (2.36 mm) sieve based on the combined gradation. However, WF shall be adjusted, upwards only, by 2.5 percentage points for each 94 pounds (42 kg) of cementitious material per cubic meter yard greater than 564 pounds per cubic yard (335 kg per cubic meter).

(4) A diagram shall be plotted using a rectangular scale with WF on the Y-axis with units from 20 (bottom) to 45 (top), and with CF on the X-axis with units from 80 (left side) to 30 (right side). On this diagram a parallelogram shall be plotted with corners at the following coordinates (CF-75, WF-28), (CF-75, WF-40), (CF-45, WF-32.5), and (CF-45, WF-44.5). If the point determined by the intersection of the computed CF and WF does not fall within the above parallelogram, the grading of each size of aggregate used and the proportions selected shall be changed as necessary. The point determined by the plotting of the CF and WF may be adjusted during production ± 3 WF and ± 5 CF. Adjustments to gradation may not take the point outside of the parallelogram.

e. Contractors combined aggregate gradation. The Contractor shall submit their combined aggregate gradation using the following format:

Contractor's Combined Aggregate Gradation

Sieve Size	Contractor's Concrete mix Gradation (Percent passing by weight)
2 inch (50 mm)	
1-1/2 inch (37.5 mm)	
1 inch (25.0 mm)	
3/4 inch (19.0 mm)	
1/2 inch (12.5 mm)	
3/8 inch (9.5 mm)	
No. 4 (4.75 mm)	
No. 8 (2.36 mm)	
No. 16 (1.18 mm)	
No. 30 (600 µm)	
No. 50 (300 µm)	

501-2.2 Cement. Cement shall conform to the requirements of ASTM C150 Type V .

501-2.3 Cementitious materials.

a. Fly ash. Fly ash shall meet the requirements of ASTM C618, with the exception of loss of ignition, where the maximum shall be less than 6%. Fly ash shall have a Calcium Oxide (CaO) content of less than 15% and a total alkali content less than 3% per ASTM C311. The Contractor shall furnish the previous three most recent, consecutive ASTM C618 reports for each source of fly ash proposed in the concrete mix, and shall furnish each additional report as they become available during the project. The reports can be used for acceptance or the material may be tested independently by the Resident Project Representative (RPR).

b. Slag cement (ground granulated blast furnace (GGBF)). Slag cement shall conform to ASTM C989, Grade 100 or Grade 120. Slag cement shall be used only at a rate between 25% and 55% of the total cementitious material by mass.

c. Raw or calcined natural pozzolan. Natural pozzolan shall be raw or calcined and conform to ASTM C618, Class N, including the optional requirements for uniformity and effectiveness in controlling Alkali-Silica reaction and shall have a loss on ignition not exceeding 6%. Class N pozzolan for use in mitigating Alkali-Silica Reactivity shall have a total available alkali content less than 3%.

d. Ultrafine fly ash and ultrafine pozzolan. UltraFine Fly Ash (UFFA) and UltraFine Pozzolan (UFP) shall conform to ASTM C618, Class F or N, and the following additional requirements:

(1) The strength activity index at 28 days of age shall be at least 95% of the control specimens.

(2) The average particle size shall not exceed 6 microns.

501-2.4 Joint seal. The joint seal for the joints in the concrete pavement shall meet the requirements of Item P-604 Item P-605 and shall be of the type specified in the plans.

501-2.5 Isolation joint filler. Premolded joint filler for isolation joints shall conform to the requirements of ASTM D1751 or ASTM D1752 and shall be where shown on the plans. The filler for each joint shall

be furnished in a single piece for the full depth and width required for the joint, unless otherwise specified by the RPR. When the use of more than one piece is required for a joint, the abutting ends shall be fastened securely and held accurately to shape by stapling or other positive fastening means satisfactory to the RPR.

501-2.6 Steel reinforcement. Reinforcing shall be in compliance with project geotechnical investigation specified in 152-1.1

501-2.7 Dowel and tie bars. Dowel bars shall be plain steel bars conforming to ASTM A615 and shall be free from burring or other deformation restricting slippage in the concrete.

a. Dowel Bars. Before delivery to the construction site each dowel bar shall be epoxy coated per ASTM A1078, Type 1, with a coating thickness after curing greater than 10 mils. Patched ends are not required for Type 1 coated dowels. The dowels shall be coated with a bond-breaker recommended by the manufacturer. Dowel sleeves or inserts are not permitted. Grout retention rings shall be fully circular metal or plastic devices capable of supporting the dowel until the grout hardens.

b. Tie Bars. Tie bars shall be deformed steel bars and conform to the requirements of ASTM A615. Tie bars designated as Grade 60 in ASTM A615 or ASTM A706 shall be used for construction requiring bent bars.

501-2.8 Water. Water used in mixing or curing shall be potable. If water is taken from other sources considered non-potable, it shall meet the requirements of ASTM C1602.

501-2.9 Material for curing concrete. Curing materials shall conform to one of the following specifications:

a. Liquid membrane-forming compounds for curing concrete shall conform to the requirements of ASTM C309, Type 2, Class A, or Class B.

b. White polyethylene film for curing concrete shall conform to the requirements of ASTM C171.

c. White burlap-polyethylene sheeting for curing concrete shall conform to the requirements of ASTM C171.

d. Waterproof paper for curing concrete shall conform to the requirements of ASTM C171.

501-2.10 Admixtures. Admixtures shall conform to the following specifications:

a. Air-entraining admixtures. Air-entraining admixtures shall meet the requirements of ASTM C260 and shall consistently entrain the air content in the specified ranges under field conditions. The air-entraining agent and any water reducer admixture shall be compatible.

b. Water-reducing admixtures. Water-reducing admixture shall meet the requirements of ASTM C494, Type A, B, or D.

c. Other admixtures. The use of set retarding and set-accelerating admixtures shall be approved by the RPR prior to developing the concrete mix. Retarding admixtures shall meet the requirements of ASTM C494, Type A, B, or D and set-accelerating admixtures shall meet the requirements of ASTM C494, Type C. Calcium chloride and admixtures containing calcium chloride shall not be used.

d. Lithium Nitrate. The lithium admixture shall be a nominal 30% aqueous solution of Lithium Nitrate, with a density of 10 pounds/gallon (1.2 kg/L), and shall have the approximate chemical form as shown below:

Attachment 4
Specifications

Lithium Admixture

Constituent	Limit (Percent by Mass)
LiNO ₃ (Lithium Nitrate)	30 ±0.5
SO ₄ (Sulfate Ion)	0.1 (max)
Cl (Chloride Ion)	0.2 (max)
Na (Sodium Ion)	0.1 (max)
K (Potassium Ion)	0.1 (max)

The lithium nitrate admixture dispensing and mixing operations shall be verified and certified by the lithium manufacturer's representative.

501-2.11 Epoxy-resin. All epoxy-resin materials shall be two-component materials conforming to the requirements of ASTM C881, Class as appropriate for each application temperature to be encountered, except that in addition, the materials shall meet the following requirements:

- a. Material for use for embedding dowels and anchor bolts shall be Type IV, Grade 3.
- b. Material for use as patching materials for complete filling of spalls and other voids and for use in preparing epoxy resin mortar shall be Type III, Grade as approved.
- c. Material for use for injecting cracks shall be Type IV, Grade 1.
- d. Material for bonding freshly mixed Portland cement concrete or mortar or freshly mixed epoxy resin concrete or mortar to hardened concrete shall be Type V, Grade as approved.

501-2.12 Bond Breaker. [Not required

CONCRETE MIX

501-3.1. General. No concrete shall be placed until an acceptable concrete mix has been submitted to the RPR for review and the RPR has taken appropriate action. The RPR's review shall not relieve the Contractor of the responsibility to select and proportion the materials to comply with this section.

501-3.2 Concrete Mix Laboratory. The laboratory used to develop the concrete mix shall be accredited in accordance with ASTM C1077. The laboratory accreditation must be current and listed on the accrediting authority's website. All test methods required for developing the concrete mix must be included in the lab accreditation. A copy of the laboratory's current accreditation and accredited test methods shall be submitted to the RPR prior to start of construction.

501-3.3 Concrete Mix Proportions. Develop the mix using the procedures contained in Portland Cement Association (PCA) publication, "Design and Control of Concrete Mixtures." Concrete shall be proportioned to achieve a 28-day flexural strength that meets or exceeds the acceptance criteria contained in paragraph 501-6.6 for a flexural strength of psi per plan per ASTM C78.

The minimum cementitious material shall be adequate to ensure a workable, durable mix. The minimum cementitious material (cement plus fly ash, or slag cement) shall be per plan pounds per cubic yard. The ratio of water to cementitious material, including free surface moisture on the aggregates but not including moisture absorbed by the aggregates shall be between 0.38 – 0.45 by weight.

Flexural strength test specimens shall be prepared in accordance with ASTM C192 and tested in accordance with ASTM C78. At the start of the project, the Contractor shall determine an allowable slump as determined by ASTM C143 not to exceed 2 inches (50 mm) for slip-form placement. For fixed-

form placement, the slump shall not exceed 3 inches (75 mm). For hand placement, the slump shall not exceed 4 inches (100 mm).

The results of the concrete mix shall include a statement giving the maximum nominal coarse aggregate size and the weights and volumes of each ingredient proportioned on a one cubic yard (meter) basis. Aggregate quantities shall be based on the mass in a saturated surface dry condition.

If a change in source(s) is made, or admixtures added or deleted from the mix, a new concrete mix must be submitted to the RPR for approval.

The RPR may request samples at any time for testing, prior to and during production, to verify the quality of the materials and to ensure conformance with the applicable specifications.

501-3.4 Concrete Mix submittal. The concrete mix shall be submitted to the RPR at least [30] days prior to the start of operations. The submitted concrete mix shall not be more than 180 days old and must use the materials to be used for production for the project. Production shall not begin until the concrete mix is approved in writing by the RPR.

Each of the submitted concrete mixes (i.e, slip form, side form machine finish and side form hand finish) shall be stamped or sealed by the responsible professional Engineer of the laboratory and shall include the following items and quantities as a minimum:

- Certified material test reports for aggregate in accordance with paragraph 501-2.1. Certified reports must include all tests required; reporting each test, test method, test result, and requirement specified (criteria).
- Combined aggregate gradations and analysis; and including plots of the fine aggregate fineness modulus.
- Reactivity Test Results.
- Coarse aggregate quality test results, including deleterious materials.
- Fine aggregate quality test results, including deleterious materials.
- Mill certificates for cement and supplemental cementitious materials.
- Certified test results for all admixtures, including Lithium Nitrate if applicable.
- Specified flexural strength, slump, and air content.
- Recommended proportions/volumes for proposed mixture and trial water-cementitious materials ratio, including actual slump and air content.
- Flexural and compressive strength summaries and plots, including all individual beam and cylinder breaks.
- Correlation ratios for acceptance testing and Contractor QC testing, when applicable.
- Historical record of test results documenting production standard deviation, when applicable.

501-3.5 Cementitious materials.

a. Fly ash. When fly ash is used as a partial replacement for cement, the replacement rate shall be determined from laboratory trial mixes, and shall be between 20 and 30% by weight of the total cementitious material. If fly ash is used in conjunction with slag cement the maximum replacement rate shall not exceed 10% by weight of total cementitious material.

b. Slag cement (ground granulated blast furnace (GGBF)). Slag cement may be used. The slag cement, or slag cement plus fly ash if both are used, may constitute between 25 to 55% of the total cementitious material by weight.

c. Raw or calcined natural pozzolan. Natural pozzolan may be used in the concrete mix. When pozzolan is used as a partial replacement for cement, the replacement rate shall be determined from laboratory trial mixes, and shall be between 20 and 30% by weight of the total cementitious material. If pozzolan is used in conjunction with slag cement the maximum replacement rate shall not exceed 10% by weight of total cementitious material.

d. Ultrafine fly ash (UFFA) and ultrafine pozzolan (UFP). UFFA and UFP may be used in the concrete mix with the RPR's approval. When UFFA and UFP is used as a partial replacement for cement, the replacement rate shall be determined from laboratory trial mixes, and shall be between 7% and 16% by weight of the total cementitious material.

501-3.6 Admixtures.

a. Air-entraining admixtures. Air-entraining admixture are to be added in such a manner that will ensure uniform distribution of the agent throughout the batch. The air content of freshly mixed air-entrained concrete shall be based upon trial mixes with the materials to be used in the work adjusted to produce concrete of the required plasticity and workability. The percentage of air in the mix shall be 2.5%. Air content shall be determined by testing in accordance with ASTM C231 for gravel and stone coarse aggregate and ASTM C173 for slag and other highly porous coarse aggregate.

b. Water-reducing admixtures. Water-reducing admixtures shall be added to the mix in the manner recommended by the manufacturer and in the amount necessary to comply with the specification requirements. Tests shall be conducted with the materials to be used in the work, in accordance with ASTM C494.

c. Other admixtures. Set controlling, and other approved admixtures shall be added to the mix in the manner recommended by the manufacturer and in the amount necessary to comply with the specification requirements. Tests shall be conducted with the materials to be used in the work, in accordance with ASTM C494.

d. Lithium nitrate. Lithium nitrate shall be added to the mix in the manner recommended by the manufacturer and in the amount necessary to comply with the specification requirements in accordance with paragraph 501-2.10d.

CONSTRUCTION METHODS

501-4.1 Control Strip. The control strip(s) shall be to the next planned joint after the initial 250 feet (75 m) of each type of pavement construction (slip-form pilot lane, slip-form fill-in lane, or fixed form). The Contractor shall demonstrate, in the presence of the RPR, that the materials, concrete mix, equipment, construction processes, and quality control processes meet the requirements of the specifications. The concrete mixture shall be extruded from the paver meeting the edge slump tolerance and with little or no finishing. Pilot, fill-in, and fixed-form control strips will be accepted separately. Minor adjustments to the mix design may be required to place an acceptable control strip. The production mix will be the adjusted mix design used to place the acceptable control strip. Upon acceptance of the control strip by the RPR, the Contractor must use the same equipment, materials, and construction methods for the remainder of concrete paving. Any adjustments to processes or materials must be approved in advance by the RPR. Acceptable control strips will meet edge slump tolerance and surface acceptable with little or no finishing, air content within action limits, strength equal or greater than requirements of P501-3.3. The control strip

will be considered one lot for payment (no sublots required for control strip). Payment will only be made for an acceptable control strip in accordance with paragraph 501-8.1 using a lot pay factor equal to 100.

501-4.2 Equipment. The Contractor is responsible for the proper operation and maintenance of all equipment necessary for handling materials and performing all parts of the work to meet this specification.

a. Plant and equipment. The plant and mixing equipment shall conform to the requirements of ASTM C94 and/or ASTM C685. Each truck mixer shall have attached in a prominent place a manufacturer's nameplate showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades. The truck mixers shall be examined daily for changes in condition due to accumulation of hard concrete or mortar or wear of blades. The pickup and throwover blades shall be replaced when they have worn down 3/4 inch (19 mm) or more. The Contractor shall have a copy of the manufacturer's design on hand showing dimensions and arrangement of blades in reference to original height and depth.

Equipment for transferring and spreading concrete from the transporting equipment to the paving lane in front of the finishing equipment shall be provided. The equipment shall be specially manufactured, self-propelled transfer equipment which will accept the concrete outside the paving lane and will spread it evenly across the paving lane in front of the paver and strike off the surface evenly to a depth which permits the paver to operate efficiently.

b. Finishing equipment.

(1) Slip-form. The standard method of constructing concrete pavements shall be with an approved slip-form paving equipment designed and operated to spread, consolidate, screed, and finish the freshly placed concrete in one complete pass of the machine so that the end result is a dense and homogeneous pavement which is achieved with a minimum of hand finishing. The paver-finisher shall be a heavy duty, self-propelled machine designed specifically for paving and finishing high quality concrete pavements.

(2) Fixed-form. On projects requiring less than 10,000 cubic yards (7650 cubic meters) of concrete pavement or irregular areas at locations inaccessible to slip-form paving equipment, concrete pavement may be placed with equipment specifically designed for placement and finishing using stationary side forms. Methods and equipment shall be reviewed and accepted by the RPR. Hand screeding and float finishing may only be used on small irregular areas as allowed by the RPR.

c. Vibrators. Vibrator shall be the internal type. The rate of vibration of each vibrating unit shall be sufficient to consolidate the pavement without segregation or voids. The number, spacing, and frequency shall be as necessary to provide a dense and homogeneous pavement and meet the recommendations of American Concrete Institute (ACI) 309R, Guide for Consolidation of Concrete. Adequate power to operate all vibrators shall be available on the paver. The vibrators shall be automatically controlled so that they shall be stopped as forward motion ceases. The Contractor shall provide an electronic or mechanical means to monitor vibrator status. The checks on vibrator status shall occur a minimum of two times per day or when requested by the RPR.

Hand held vibrators may only be used in irregular areas and shall meet the recommendations of ACI 309R, Guide for Consolidation of Concrete.

d. Concrete saws. The Contractor shall provide sawing equipment adequate in number of units and power to complete the sawing to the required dimensions. The Contractor shall provide at least one standby saw in good working order and a supply of saw blades at the site of the work at all times during sawing operations.

e. Fixed forms. Straight side fixed forms shall be made of steel and shall be furnished in sections not less than 10 feet (3 m) in length. Forms shall be provided with adequate devices for secure settings so that when in place they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Forms with battered top surfaces and bent, twisted or broken forms shall not be used. Built-up forms shall not be used, except as approved by the RPR. The top face of the form shall not vary from a true plane more than 1/8 inch (3 mm) in 10 feet (3 m), and the upstanding leg shall not vary more than 1/4 inch (6 mm). The forms shall contain provisions for locking the ends of abutting sections together tightly for secure setting. Wood forms may be used under special conditions, when approved by the RPR. The forms shall extend the full depth of the pavement section.

501-4.3 Form setting. Forms shall be set to line and grade as shown on the plans, sufficiently in advance of the concrete placement, to ensure continuous paving operation. Forms shall be set to withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Forms shall be cleaned and oiled prior to the concrete placement.

501-4.4 Base surface preparation prior to placement. Any damage to the prepared base, subbase, and subgrade shall be corrected full depth by the Contractor prior to concrete placement. The underlying surface shall be entirely free of frost when concrete is placed. The prepared grade shall be moistened with water, without saturating, immediately ahead of concrete placement to prevent rapid loss of moisture from concrete.

501-4.5 Handling, measuring, and batching material. Aggregate stockpiles shall be constructed and managed in such a manner that prevents segregation and intermixing of deleterious materials. Aggregates from different sources shall be stockpiled, weighed and batched separately at the concrete batch plant. Aggregates that have become segregated or mixed with earth or foreign material shall not be used. All aggregates produced or handled by hydraulic methods, and washed aggregates, shall be stockpiled or binned for draining at least 12 hours before being batched. Store and maintain all aggregates at a uniform moisture content prior to use. A continuous supply of materials shall be provided to the work to ensure continuous placement.

501-4.6 Mixing concrete. The concrete may be mixed at the work site, in a central mix plant or in truck mixers. The mixer shall be of an approved type and capacity. Mixing time shall be measured from the time all materials are placed into the drum until the drum is emptied into the truck. All concrete shall be mixed and delivered to the site in accordance with the requirements of ASTM C94 or ASTM C685.

Mixed concrete from the central mixing plant shall be transported in truck mixers, truck agitators, or non-agitating trucks. The elapsed time from the addition of cementitious material to the mix until the concrete is discharged from the truck should not exceed [30] minutes when the concrete is hauled in non-agitating trucks, nor 90 minutes when the concrete is hauled in truck mixers or truck agitators. In no case shall the temperature of the concrete when placed exceed 90°F (32°C). Retempering concrete by adding water or by other means will not be permitted. With transit mixers additional water may be added to the batch materials and additional mixing performed to increase the slump to meet the specified requirements provided the addition of water is performed within 45 minutes after the initial mixing operations and provided the water/cementitious ratio specified is not exceeded.

501-4.7 Weather Limitations on mixing and placing. No concrete shall be mixed, placed, or finished when the natural light is insufficient, unless an adequate and approved artificial lighting system is operated.

a. Cold weather. Unless authorized in writing by the RPR, mixing and concreting operations shall be discontinued when a descending air temperature in the shade and away from artificial heat reaches 40°F (4°C) and shall not be resumed until an ascending air temperature in the shade and away from artificial heat reaches 35°F (2°C).

Attachment 4
Specifications

The aggregate shall be free of ice, snow, and frozen lumps before entering the mixer. The temperature of the mixed concrete shall not be less than 50°F (10°C) at the time of placement. Concrete shall not be placed on frozen material nor shall frozen aggregates be used in the concrete.

When concreting is authorized during cold weather, water and/or the aggregates may be heated to not more than 150°F (66°C). The apparatus used shall heat the mass uniformly and shall be arranged to preclude the possible occurrence of overheated areas which might be detrimental to the materials.

Curing during cold weather shall be in accordance with paragraph 501-4.13d.

b. Hot weather. During periods of hot weather when the maximum daily air temperature exceeds 85°F (30°C), the following precautions shall be taken.

The forms and/or the underlying surface shall be sprinkled with water immediately before placing the concrete. The concrete shall be placed at the coolest temperature practicable, and in no case shall the temperature of the concrete when placed exceed 90°F (32°C). The aggregates and/or mixing water shall be cooled as necessary to maintain the concrete temperature at or not more than the specified maximum.

The concrete placement shall be protected from exceeding an evaporation rate of 0.2 psf (0.98 kg/m² per hour) per hour. When conditions are such that problems with plastic cracking can be expected, and particularly if any plastic cracking begins to occur, the Contractor shall immediately take such additional measures as necessary to protect the concrete surface. If the Contractor's measures are not effective in preventing plastic cracking, paving operations shall be immediately stopped.

Curing during hot weather shall be in accordance with paragraph 501-4.13e.

c. Temperature management program. Prior to the start of paving operation for each day of paving, the Contractor shall provide the RPR with a Temperature Management Program for the concrete to be placed to assure that uncontrolled cracking is avoided. (Federal Highway Administration HIPERPAV 3 is one example of a temperature management program.) As a minimum, the program shall address the following items:

- (1) Anticipated tensile strains in the fresh concrete as related to heating and cooling of the concrete material.
- (2) Anticipated weather conditions such as ambient temperatures, wind velocity, and relative humidity; and anticipated evaporation rate using Figure 19-9, PCA, Design and Control of Concrete Mixtures.
- (3) Anticipated timing of initial sawing of joint.
- (4) Anticipated number and type of saws to be used.

d. Rain. The Contractor shall have available materials for the protection of the concrete during inclement weather. Such protective materials shall consist of rolled polyethylene sheeting at least 4 mils (0.1 mm) thick of sufficient length and width to cover the plastic concrete slab and any edges. The sheeting may be mounted on either the paver or a separate movable bridge from which it can be unrolled without dragging over the plastic concrete surface. When rain appears imminent, all paving operations shall stop and all available personnel shall begin covering the surface of the unhardened concrete with the protective covering.

501-4.8 Concrete Placement. At any point in concrete conveyance, the free vertical drop of the concrete from one point to another or to the underlying surface shall not exceed 3 feet (1 m). The finished concrete product must be dense and homogeneous, without segregation and conforming to the standards in this specification. Backhoes and grading equipment shall not be used to distribute the concrete in front of the paver. Front end loaders will not be used. All concrete shall be consolidated without voids or segregation, including under and around all load-transfer devices, joint assembly units, and other features embedded in the pavement. Hauling equipment or other mechanical equipment can be permitted on

adjoining previously constructed pavement when the concrete strength reaches a flexural strength of 550 psi (3.8 MPa) a compressive strength of 3,100 psi (21.4 MPa), based on the average of four field cured specimens per 2,000 cubic yards (1,530 cubic meters) of concrete placed. The Contractor must determine that the above minimum strengths are adequate to protect the pavement from overloads due to the construction equipment proposed for the project.

The Contractor shall have available materials for the protection of the concrete during cold, hot and/or inclement weather in accordance with paragraph 501-4.7.

a. Slip-form construction. The concrete shall be distributed uniformly into final position by a self-propelled slip-form paver without delay. The alignment and elevation of the paver shall be regulated from outside reference lines established for this purpose. The paver shall vibrate the concrete for the full width and depth of the strip of pavement being placed and the vibration shall be adequate to provide a consistency of concrete that will stand normal to the surface with sharp well-defined edges. The sliding forms shall be rigidly held together laterally to prevent spreading of the forms. The plastic concrete shall be effectively consolidated by internal vibration with transverse vibrating units for the full width of the pavement and/or a series of equally placed longitudinal vibrating units. The space from the outer edge of the pavement to longitudinal unit shall not exceed 9 inches (23 cm) for slipform and at the end of the dowels for the fill-in lanes. The spacing of internal units shall be uniform and shall not exceed 18 inches (0.5 m).

The term internal vibration means vibrating units located within the specified thickness of pavement section.

The rate of vibration of each vibrating unit shall be sufficient to consolidate the pavement without, segregation, voids, or vibrator trails and the amplitude of vibration shall be sufficient to be perceptible on the surface of the concrete along the entire length of the vibrating unit and for a distance of at least one foot (30 cm). The frequency of vibration or amplitude should be adjusted proportionately with the rate of travel to result in a uniform density and air content. The paving machine shall be equipped with a tachometer or other suitable device for measuring and indicating the actual frequency of vibrations.

The concrete shall be held at a uniform consistency. The slip-form paver shall be operated with as nearly a continuous forward movement as possible and all operations of mixing, delivering, and spreading concrete shall be coordinated to provide uniform progress with stopping and starting of the paver held to a minimum. If for any reason, it is necessary to stop the forward movement of the paver, the vibratory and tamping elements shall also be stopped immediately. No tractive force shall be applied to the machine, except that which is controlled from the machine.

When concrete is being placed adjacent to an existing pavement, that part of the equipment which is supported on the existing pavement shall be equipped with protective pads on crawler tracks or rubber-tired wheels on which the bearing surface is offset to run a sufficient distance from the edge of the pavement to avoid breaking the pavement edge.

Not more than 15% of the total free edge of each 500-foot (150 m) segment of pavement, or fraction thereof, shall have an edge slump exceeding 1/4 inch (6 mm), and none of the free edge of the pavement shall have an edge slump exceeding 3/8 inch (9 mm). (The total free edge of 500 feet (150 m) of pavement will be considered the cumulative total linear measurement of pavement edge originally constructed as nonadjacent to any existing pavement; that is, 500 feet (150 m) of paving lane originally constructed as a separate lane will have 1,000 feet (300 m) of free edge, 500 feet (150 m) of fill-in lane will have no free edge, etc.). The area affected by the downward movement of the concrete along the pavement edge shall be limited to not more than 18 inches (0.5 m) from the edge.

Attachment 4
Specifications

When excessive edge slump cannot be corrected before the concrete has hardened, the area with excessive edge slump will be removed the full width of the slip form lane and replaced at the expense of the Contractor as directed by the RPR.

b. Fixed-form construction. Forms shall be drilled in advance of being placed to line and grade to accommodate tie bars / dowel bars where these are specified.

Immediately in advance of placing concrete and after all subbase operations are completed, side forms shall be trued and maintained to the required line and grade for a distance sufficient to prevent delay in placing.

Side forms shall remain in place at least 12 hours after the concrete has been placed, and in all cases until the edge of the pavement no longer requires the protection of the forms. Curing compound shall be applied to the concrete immediately after the forms have been removed.

Side forms shall be thoroughly cleaned and coated with a release agent each time they are used and before concrete is placed against them.

Concrete shall be spread, screed, shaped and consolidated by one or more self-propelled machines. These machines shall uniformly distribute and consolidate concrete without segregation so that the completed pavement will conform to the required cross-section with a minimum of handwork.

The number and capacity of machines furnished shall be adequate to perform the work required at a rate equal to that of concrete delivery. The equipment must be specifically designed for placement and finishing using stationary side forms. Methods and equipment shall be reviewed and accepted by the RPR.

Concrete for the full paving width shall be effectively consolidated by internal vibrators. The rate of vibration of each vibrating unit shall be sufficient to consolidate the pavement without segregation, voids, or leaving vibrator trails.

Power to vibrators shall be connected so that vibration ceases when forward or backward motion of the machine is stopped.

c. Consolidation. Concrete shall be consolidated with the specified type of lane-spanning, gang-mounted, mechanical, immersion type vibrating equipment mounted in front of the paver, supplemented, in rare instances as specified, by hand-operated vibrators. The vibrators shall be inserted into the concrete to a depth that will provide the best full-depth consolidation but not closer to the underlying material than 2 inches (50 mm). Vibrators shall not be used to transport or spread the concrete. For each paving train, at least one additional vibrator spud, or sufficient parts for rapid replacement and repair of vibrators shall be maintained at the paving site at all times. Any evidence of inadequate consolidation (honeycomb along the edges, large air pockets, or any other evidence) or over-consolidation (vibrator trails, segregation, or any other evidence) shall require the immediate stopping of the paving operation and adjustment of the equipment or procedures as approved by the RPR.

If a lack of consolidation of the hardened concrete is suspected by the RPR, referee testing may be required. Referee testing of hardened concrete will be performed by the RPR by cutting cores from the finished pavement after a minimum of 24 hours curing. The RPR shall visually examine the cores for evidence of lack of consolidation. Density determinations will be made by the RPR based on the water content of the core as taken. ASTM C642 shall be used for the determination of core density in the saturated-surface dry condition. When required, referee cores will be taken at the minimum rate of one for each 500 cubic yards (382 m³) of pavement, or fraction. The Contractor shall be responsible for all referee testing cost if they fail to meet the required density.

The average density of the cores shall be at least 97% of the original concrete mix density, with no cores having a density of less than 96% of the original concrete mix density. Failure to meet the referee tests will be considered evidence that the minimum requirements for vibration are inadequate for the job

conditions. Additional vibrating units or other means of increasing the effect of vibration shall be employed so that the density of the hardened concrete conforms to the above requirements.

501-4.9 Strike-off of concrete and placement of reinforcement. Following the placing of the concrete, it shall be struck off to conform to the cross-section shown on the plans and to an elevation that when the concrete is properly consolidated and finished, the surface of the pavement shall be at the elevation shown on the plans. When reinforced concrete pavement is placed in two layers, the bottom layer shall be struck off to such length and depth that the sheet of reinforcing steel fabric or bar mat may be laid full length on the concrete in its final position without further manipulation. The reinforcement shall then be placed directly upon the concrete, after which the top layer of the concrete shall be placed, struck off, and screed. If any portion of the bottom layer of concrete has been placed more than 30 minutes without being covered with the top layer or if initial set has taken place, it shall be removed and replaced with freshly mixed concrete at the Contractor's expense. When reinforced concrete is placed in one layer, the reinforcement may be positioned in advance of concrete placement or it may be placed in plastic concrete by mechanical or vibratory means after spreading.

Reinforcing steel, at the time concrete is placed, shall be free of mud, oil, or other organic matter that may adversely affect or reduce bond. Reinforcing steel with rust, mill scale or a combination of both will be considered satisfactory, provided the minimum dimensions, weight, and tensile properties of a hand wire-brushed test specimen are not less than the applicable ASTM specification requirements.

501-4.10 Joints. Joints shall be constructed as shown on the plans and in accordance with these requirements. All joints shall be constructed with their faces perpendicular to the surface of the pavement and finished or edged as shown on the plans. Joints shall not vary more than 1/2-inch (12 mm) from their designated position and shall be true to line with not more than 1/4-inch (6 mm) variation in 10 feet (3 m). The surface across the joints shall be tested with a 12-foot (3 m) straightedge as the joints are finished and any irregularities in excess of 1/4 inch (6 mm) shall be corrected before the concrete has hardened. All joints shall be so prepared, finished, or cut to provide a groove of uniform width and depth as shown on the plans.

a. Construction. Longitudinal construction joints shall be slip-formed or formed against side forms as shown in the plans.

Transverse construction joints shall be installed at the end of each day's placing operations and at any other points within a paving lane when concrete placement is interrupted for more than 30 minutes or it appears that the concrete will obtain its initial set before fresh concrete arrives. The installation of the joint shall be located at a planned contraction or expansion joint. If placing of the concrete is stopped, the Contractor shall remove the excess concrete back to the previous planned joint.

b. Contraction. Contraction joints shall be installed at the locations and spacing as shown on the plans. Contraction joints shall be installed to the dimensions required by forming a groove or cleft in the top of the slab while the concrete is still plastic or by sawing a groove into the concrete surface after the concrete has hardened. When the groove is formed in plastic concrete the sides of the grooves shall be finished even and smooth with an edging tool. If an insert material is used, the installation and edge finish shall be according to the manufacturer's instructions. The groove shall be finished or cut clean so that spalling will be avoided at intersections with other joints. Grooving or sawing shall produce a slot at least 1/8 inch (3 mm) wide and to the depth shown on the plans.

c. Isolation (expansion). Isolation joints shall be installed as shown on the plans. The premolded filler of the thickness as shown on the plans, shall extend for the full depth and width of the slab at the joint. The filler shall be fastened uniformly along the hardened joint face with no buckling or debris between the filler and the concrete interface, including a temporary filler for the sealant reservoir at the top of the slab. The edges of the joint shall be finished and tooled while the concrete is still plastic

d. Dowels and Tie Bars for Joints

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Specifications

(1) Tie bars. Tie bars shall consist of deformed bars installed in joints as shown on the plans. Tie bars shall be placed at right angles to the centerline of the concrete slab and shall be spaced at intervals shown on the plans. They shall be held in position parallel to the pavement surface and in the middle of the slab depth and within the tolerances in paragraph 501-4.10(f.). When tie bars extend into an unpaved lane, they may be bent against the form at longitudinal construction joints, unless threaded bolt or other assembled tie bars are specified. Tie bars shall not be painted, greased, or enclosed in sleeves. When slip-form operations call for tie bars, two-piece hook bolts can be installed.

(2) Dowel bars. Dowel bars shall be placed across joints in the proper horizontal and vertical alignment as shown on the plans. The dowels shall be coated with a bond-breaker or other lubricant recommended by the manufacturer and approved by the RPR. Dowels bars at longitudinal construction joints shall be bonded in drilled holes.

(3) Placing dowels and tie bars. Horizontal spacing of dowels shall be within a tolerance of $\pm 3/4$ inch (19 mm). The vertical location on the face of the slab shall be within a tolerance of $\pm 1/2$ inch (12 mm). The method used to install dowels shall ensure that the horizontal and vertical alignment will not be greater than 1/4 inch per foot (6 mm per 0.3 m), except for those across the crown or other grade change joints. Dowels across crowns and other joints at grade changes shall be measured to a level surface. Horizontal alignment shall be checked perpendicular to the joint edge. The portion of each dowel intended to move within the concrete or expansion cap shall be wiped clean and coated with a thin, even film of lubricating oil or light grease before the concrete is placed. Dowels shall be installed as specified in the following subparagraphs.

(a) Contraction joints. Dowels and tie bars in longitudinal and transverse contraction joints within the paving lane shall be held securely in place by means of rigid metal frames or basket assemblies of an approved type. The basket assemblies shall be held securely in the proper location by means of suitable pins or anchors. Do not cut or crimp the dowel basket tie wires.

At the Contractor's option, dowels and tie bars in contraction joints may be installed by insertion into the plastic concrete using approved equipment and procedures per the paver manufacturer's design. Approval of installation methods will be based on the results of the control strip showing that the dowels and tie bars are installed within specified tolerances as verified by cores or non-destructive rebar location devices approved by the RPR.

(b) Construction joints. Install dowels and tie bars by the cast-in-place or the drill-and-dowel method. Installation by removing and replacing in preformed holes will not be permitted. Dowels and tie bars shall be prepared and placed across joints where indicated, correctly aligned, and securely held in the proper horizontal and vertical position during placing and finishing operations, by means of devices fastened to the forms.

(c) Joints in hardened concrete. Install dowels in hardened concrete by bonding the dowels into holes drilled into the concrete. The concrete shall have cured for seven (7) days or reached a minimum compressive strength of 3100 psi ((21.4 MPa)) flexural strength of 450 psi (3.1 MPa)] before drilling begins. Holes 1/8 inch (3 mm) greater in diameter than the dowels shall be drilled into the hardened concrete using rotary-core drills. Rotary-percussion drills may be used, provided that excessive spalling does not occur. Spalling beyond the limits of the grout retention ring will require modification of the equipment and operation. Depth of dowel hole shall be within a tolerance of $\pm 1/2$ inch (12 mm) of the dimension shown on the drawings. On completion of the drilling operation, the dowel hole shall be blown out with oil-free, compressed air. Dowels shall be bonded in the drilled holes using epoxy resin. Epoxy resin shall be injected at the back of the hole before installing the dowel and extruded to the collar during insertion of the dowel so as to completely fill the void around the dowel. Application by buttering the dowel will not be permitted. The dowels shall be held in alignment at the collar of the hole by means of a suitable metal or plastic grout retention ring fitted around the dowel.

e. Sawing of joints. Sawing shall commence, without regard to day or night, as soon as the concrete has hardened sufficiently to permit cutting without chipping, spalling, or tearing and before uncontrolled shrinkage cracking of the pavement occurs and shall continue without interruption until all joints have been sawn. All slurry and debris produced in the sawing of joints shall be removed by vacuuming and washing. Curing compound or system shall be reapplied in the initial saw-cut and maintained for the remaining cure period.

Joints shall be cut in locations as shown on the plans. The initial joint cut shall be a minimum 1/8 inch (3 mm) wide and to the depth shown on the plans. Prior to placement of joint sealant or seals, the top of the joint shall be widened by sawing as shown on the plans.

501-4.11 Finishing. Finishing operations shall be a continuing part of placing operations starting immediately behind the strike-off of the paver. Initial finishing shall be provided by the transverse screed or extrusion plate. The sequence of operations shall be transverse finishing, longitudinal machine floating if used, straightedge finishing, edging of joints, and then texturing. Finishing shall be by the machine method. The hand method shall be used only on isolated areas of odd slab widths or shapes and in the event of a breakdown of the mechanical finishing equipment. Supplemental hand finishing for machine finished pavement shall be kept to an absolute minimum. Any machine finishing operation which requires appreciable hand finishing, other than a moderate amount of straightedge finishing, shall be immediately stopped and proper adjustments made or the equipment replaced. Equipment, mixture, and/or procedures which produce more than 1/4 inch (6 mm) of mortar-rich surface shall be immediately modified as necessary to eliminate this condition or operations shall cease. Compensation shall be made for surging behind the screeds or extrusion plate and settlement during hardening and care shall be taken to ensure that paving and finishing machines are properly adjusted so that the finished surface of the concrete (not just the cutting edges of the screeds) will be at the required line and grade. Finishing equipment and tools shall be maintained clean and in an approved condition. At no time shall water be added to the surface of the slab with the finishing equipment or tools, or in any other way. Fog (mist) sprays or other surface applied finishing aids specified to prevent plastic shrinkage cracking, approved by the RPR, may be used in accordance with the manufacturers requirements.

a. Machine finishing with slipform pavers. The slipform paver shall be operated so that only a very minimum of additional finishing work is required to produce pavement surfaces and edges meeting the specified tolerances. Any equipment or procedure that fails to meet these specified requirements shall immediately be replaced or modified as necessary. A self-propelled non-rotating pipe float may be used while the concrete is still plastic, to remove minor irregularities and score marks. Only one pass of the pipe float shall be allowed. Equipment, mixture, and/or procedures which produce more than 1/4 inch (6 mm) of mortar-rich surface shall be immediately modified as necessary to eliminate this condition or operations shall cease. Remove excessive slurry from the surface with a cutting straightedge and wipe off the edge. Any slurry which does run down the vertical edges shall be immediately removed by hand, using stiff brushes or scrapers. No slurry, concrete or concrete mortar shall be used to build up along the edges of the pavement to compensate for excessive edge slump, either while the concrete is plastic or after it hardens.

b. Machine finishing with fixed forms. The machine shall be designed to straddle the forms and shall be operated to screed and consolidate the concrete. Machines that cause displacement of the forms shall be replaced. The machine shall make only one pass over each area of pavement. If the equipment and procedures do not produce a surface of uniform texture, true to grade, in one pass, the operation shall be immediately stopped and the equipment, mixture, and procedures adjusted as necessary.

c. Other types of finishing equipment. Clary screeds, other rotating tube floats, or bridge deck finishers are not allowed on mainline paving, but may be allowed on irregular or odd-shaped slabs, and near buildings or trench drains, subject to the RPR's approval.

Bridge deck finishers shall have a minimum operating weight of 7500 pounds (3400 kg) and shall have a transversely operating carriage containing a knock-down auger and a minimum of two immersion vibrators. Vibrating screeds or pans shall be used only for isolated slabs where hand finishing is permitted as specified, and only where specifically approved.

d. Hand finishing. Hand finishing methods will not be permitted, except under the following conditions: (1) in the event of breakdown of the mechanical equipment, hand methods may be used to finish the concrete already deposited on the grade and (2) in areas of narrow widths or of irregular dimensions where operation of the mechanical equipment is impractical.

e. Straightedge testing and surface correction. After the pavement has been struck off and while the concrete is still plastic, it shall be tested for trueness with a 12-foot (3.7-m) finishing straightedge swung from handles capable of spanning at least one-half the width of the slab. The straightedge shall be held in contact with the surface in successive positions parallel to the centerline and the whole area gone over from one side of the slab to the other, as necessary. Advancing shall be in successive stages of not more than one-half the length of the straightedge. Any excess water and laitance in excess of 1/8 inch (3 mm) thick shall be removed from the surface of the pavement and wasted. Any depressions shall be immediately filled with freshly mixed concrete, struck off, consolidated, and refinished. High areas shall be cut down and refinished. Special attention shall be given to assure that the surface across joints meets the smoothness requirements. Straightedge testing and surface corrections shall continue until the entire surface is found to be free from observable departures from the straightedge and until the slab conforms to the required grade and cross-section. The use of long-handled wood floats shall be confined to a minimum; they may be used only in emergencies and in areas not accessible to finishing equipment.

501-4.12 Surface texture. The surface of the pavement shall be finished as designated below for all newly constructed concrete pavements. It is important that the texturing equipment not tear or unduly roughen the pavement surface during the operation. The texture shall be uniform in appearance and approximately 1/16 inch (2 mm) in depth. Any imperfections resulting from the texturing operation shall be corrected to the satisfaction of the RPR.

a. Brush or broom finish. Shall be applied when the water sheen has practically disappeared. The equipment shall operate transversely across the pavement surface.

501-4.13 Curing. Immediately after finishing operations are completed and bleed water is gone from the surface, all exposed surfaces of the newly placed concrete shall be cured for a 7-day cure period in accordance with one of the methods below. Failure to provide sufficient cover material of whatever kind the Contractor may elect to use, or lack of water to adequately take care of both curing and other requirements, shall be cause for immediate suspension of concreting operations. The concrete shall not be left exposed for more than 1/2 hour during the curing period.

When a two-saw-cut method is used to construct the contraction joint, the curing compound shall be applied to the saw-cut immediately after the initial cut has been made. The sealant reservoir shall not be sawed until after the curing period has been completed. When the one cut method is used to construct the contraction joint, the joint shall be cured with wet rope, wet rags, or wet blankets. The rags, ropes, or blankets shall be kept moist for the duration of the curing period.

a. Impervious membrane method. Curing with liquid membrane compounds should not occur until bleed and surface moisture has evaporated. All exposed surfaces of the pavement shall be sprayed uniformly with white pigmented curing compound immediately after the finishing of the surface and before the set of the concrete has taken place. The curing compound shall not be applied during rainfall. Curing compound shall be applied by mechanical sprayers under pressure at the rate of one gallon (4 liters) to not more than 150 square feet (14 sq m). The spraying equipment shall be of the fully atomizing type equipped with a tank agitator. At the time of use, the compound shall be in a thoroughly mixed

condition with the pigment uniformly dispersed throughout the vehicle. During application, the compound shall be stirred continuously by mechanical means. Hand spraying of odd widths or shapes and concrete surfaces exposed by the removal of forms will be permitted. When hand spraying is approved by the RPR, a double application rate shall be used to ensure coverage. Should the film become damaged from any cause, including sawing operations, within the required curing period, the damaged portions shall be repaired immediately with additional compound or other approved means. Upon removal of side forms, the sides of the exposed slabs shall be protected immediately to provide a curing treatment equal to that provided for the surface.

b. White burlap-polyethylene sheets. The surface of the pavement shall be entirely covered with the sheeting. The sheeting used shall be such length (or width) that it will extend at least twice the thickness of the pavement beyond the edges of the slab. The sheeting shall be placed so that the entire surface and both edges of the slab are completely covered. The sheeting shall be placed and weighted to remain in contact with the surface covered, and the covering shall be maintained fully saturated and in position for seven (7) days after the concrete has been placed.

c. Water method. The entire area shall be covered with burlap or other water absorbing material. The material shall be of sufficient thickness to retain water for adequate curing without excessive runoff. The material shall be kept wet at all times and maintained for seven (7) days. When the forms are stripped, the vertical walls shall also be kept moist. It shall be the responsibility of the Contractor to prevent ponding of the curing water on the subbase.

d. Concrete protection for cold weather. Maintain the concrete at a temperature of at least 50°F (10°C) for a period of 72 hours after placing and at a temperature above freezing for the remainder of the 7-day curing period. The Contractor shall be responsible for the quality and strength of the concrete placed during cold weather; and any concrete damaged shall be removed and replaced at the Contractor's expense.

e. Concrete protection for hot weather. Concrete should be continuous moisture cured for the entire curing period and shall commence as soon as the surfaces are finished and continue for at least 24 hours. However, if moisture curing is not practical beyond 24 hours, the concrete surface shall be protected from drying with application of a liquid membrane-forming curing compound while the surfaces are still damp. Other curing methods may be approved by the RPR.

501-4.14 Removing forms. Unless otherwise specified, forms shall not be removed from freshly placed concrete until it has hardened sufficiently to permit removal without chipping, spalling, or tearing. After the forms have been removed, the sides of the slab shall be cured in accordance with paragraph 501-4.13.

If honeycombed areas are evident when the forms are removed, materials, placement, and consolidation methods must be reviewed and appropriate adjustments made to assure adequate consolidation at the edges of future concrete placements. Honeycombed areas that extend into the slab less than approximately 1 inch (25 mm), shall be repaired with an approved grout, as directed by the RPR. Honeycombed areas that extend into the slab greater than a depth of 1 inch (25 mm) shall be considered as defective work and shall be removed and replaced in accordance with paragraph 501-4.19.

501-4.15 Saw-cut grooving. If shown on the plans, grooved surfaces shall be provided in accordance with the requirements of Item P-621.

501-4.16 Sealing joints. The joints in the pavement shall be sealed in accordance with Item P-604 P-605.

501-4.17 Protection of pavement. The Contractor shall protect the pavement and its appurtenances against both public traffic and traffic caused by the Contractor's employees and agents until accepted by the RPR. This shall include watchmen to direct traffic and the erection and maintenance of warning signs, lights, pavement bridges, crossovers, and protection of unsealed joints from intrusion of foreign material,

etc. Any damage to the pavement occurring prior to final acceptance shall be repaired or the pavement replaced at the Contractor's expense.

Aggregates, rubble, or other similar construction materials shall not be placed on airfield pavements. Traffic shall be excluded from the new pavement by erecting and maintaining barricades and signs until the concrete is at least seven (7) days old, or for a longer period if directed by the RPR.

In paving intermediate lanes between newly paved pilot lanes, operation of the hauling and paving equipment will be permitted on the new pavement after the pavement has been cured for seven (7) days, the joints are protected, the concrete has attained a minimum field cured flexural strength of [450 psi (3100 kPa)], and the slab edge is protected.

All new and existing pavement carrying construction traffic or equipment shall be kept clean and spillage of concrete and other materials shall be cleaned up immediately.

Damaged pavements shall be removed and replaced at the Contractor's expense. Slabs shall be removed to the full depth, width, and length of the slab.

501-4.18 Opening to construction traffic. The pavement shall not be opened to traffic until test specimens molded and cured in accordance with ASTM C31 have attained a flexural strength of [450 pounds per square inch (3100 kPa)] when tested in accordance with ASTM C78. If such tests are not conducted, the pavement shall not be opened to traffic until 14 days after the concrete was placed. Prior to opening the pavement to construction traffic, all joints shall either be sealed or protected from damage to the joint edge and intrusion of foreign materials into the joint. As a minimum, backer rod or tape may be used to protect the joints from foreign matter intrusion.

501-4.19 Repair, removal, or replacement of slabs. New pavement slabs that are broken or contain cracks or are otherwise defective or unacceptable as defined by acceptance criteria in paragraph 501-6.6 shall be removed and replaced or repaired, as directed by the RPR, at the Contractor's expense. Spalls along joints shall be repaired as specified. Removal of partial slabs is not permitted. Removal and replacement shall be full depth, shall be full width of the slab, and the limit of removal shall be normal to the paving lane and to each original transverse joint. The RPR will determine whether cracks extend full depth of the pavement and may require cores to be drilled on the crack to determine depth of cracking. Such cores shall be have a diameter of 2 inches (50 mm) to 4 inches (100 mm), shall be drilled by the Contractor and shall be filled by the Contractor with a well consolidated concrete mixture bonded to the walls of the hole with a bonding agent, using approved procedures. Drilling of cores and refilling holes shall be at no expense to the Owner. Repair of cracks as described in this section shall not be allowed if in the opinion of the RPR the overall condition of the pavement indicates that such repair is unlikely to achieve an acceptable and durable finished pavement. No repair of cracks shall be allowed in any panel that demonstrates segregated aggregate with an absence of coarse aggregate in the upper 1/8 inch (3 mm) of the pavement surface.

a. Shrinkage cracks. Shrinkage cracks which do not exceed one-third of the pavement depth shall be cleaned and either high molecular weight methacrylate (HMWM) applied; or epoxy resin (Type IV, Grade 1) pressure injected using procedures recommended by the manufacturer and approved by the RPR. Sandblasting of the surface may be required following the application of HMWM to restore skid resistance. Care shall be taken to ensure that the crack is not widened during epoxy resin injection. All epoxy resin injection shall take place in the presence of the RPR. Shrinkage cracks which exceed one-third the pavement depth shall be treated as full depth cracks in accordance with paragraphs 501-4.19b and 501-19c.

b. Slabs with cracks through interior areas. Interior area is defined as that area more than 6 inches (150 mm) from either adjacent original transverse joint. The full slab shall be removed and replaced at no cost to the Owner, when there are any full depth cracks, or cracks greater than one-third the pavement depth, that extend into the interior area.

c. Cracks close to and parallel to joints. All full-depth cracks within 6 inches (150 mm) either side of the joint and essentially parallel to the original joints, shall be treated as follows.

(1) Full depth cracks and original joint not cracked. The full-depth crack shall be treated as the new joint and the original joint filled with an epoxy resin.

i. Full-depth crack. The joint sealant reservoir for the crack shall be formed by sawing to a depth of 3/4 inches (19 mm), $\pm 1/16$ inch (2 mm), and to a width of 5/8 inch (16 mm), $\pm 1/8$ inch (3 mm). The crack shall be sawed with equipment specially designed to follow random cracks. Any equipment or procedure which causes raveling or spalling along the crack shall be modified or replaced to prevent raveling or spalling. The joint shall be sealed with sealant in accordance with P-605 or as directed by the RPR.

ii. Original joint. If the original joint sealant reservoir has been sawed out, the reservoir and as much of the lower saw cut as possible shall be filled with epoxy resin, Type IV, Grade 2, thoroughly tooled into the void using approved procedures.

If only the original narrow saw cut has been made, it shall be cleaned and pressure injected with epoxy resin, Type IV, Grade 1, using approved procedures.

Where a parallel crack goes part way across paving lane and then intersects and follows the original joint which is cracked only for the remained of the width, it shall be treated as specified above for a parallel crack, and the cracked original joint shall be prepared and sealed as originally designed.

(2) Full depth cracks and original joint cracked. If there is any place in the lane width where a parallel crack and a cracked portion of the original joint overlap, the entire slab containing the crack shall be removed and replaced.

d. Removal and replacement of full slabs. Make a full depth cut perpendicular to the slab surface along all edges of the slab with a concrete saw cutting any dowels or tie-bars. Remove damaged slab protecting adjacent pavement from damage. Damage to adjacent slabs may result in removal of additional slabs as directed by the RPR at the Contractor's expense.

The underlying material shall be repaired, re-compacted and shaped to grade.

Dowels of the size and spacing specified for other joints in similar pavement on the project shall be installed along all four (4) edges of the new slab in accordance with paragraph 501-4.10d.

Placement of concrete shall be as specified for original construction. The joints around the new slab shall be prepared and sealed as specified for original construction.

e. Spalls along joints.

(1) Spalls less than one inch wide and less than the depth of the joint sealant reservoir, shall be filled with joint sealant material.

(2) Spalls larger than one inch and/or deeper than the joint reservoir, but less than 1/2 the slab depth, and less than 25% of the length of the adjacent joint shall be repaired as follows:

i. Make a vertical saw cut at least one inch (25 mm) outside the spalled area and to a depth of at least 2 inches (50 mm). Saw cuts shall be straight lines forming rectangular areas surrounding the spalled area.

ii. Remove unsound concrete and at least 1/2 inch (12 mm) of visually sound concrete between the saw cut and the joint or crack with a light chipping hammer.

iii. Clean cavity with high-pressure water jets supplemented with compressed air as needed to remove all loose material.

iv. Apply a prime coat of epoxy resin, Type III, Grade I, to the dry, cleaned surface of all sides and bottom of the cavity, except any joint face.

v. Fill the cavity with low slump concrete or mortar or with epoxy resin concrete or mortar.

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- vi. An insert or other bond-breaking medium shall be used to prevent bond at all joint faces.
- vii. A reservoir for the joint sealant shall be sawed to the dimensions required for other joints, or as required to be routed for cracks. The reservoir shall be thoroughly cleaned and sealed with the sealer specified for the joints.

(3) Spalls deeper than 1/2 of the slab depth or spalls longer than 25% of the adjacent joint require replacement of the entire slab.

f. Diamond grinding of Concrete surfaces. Diamond grinding shall be completed prior to pavement grooving. Diamond grinding of the hardened concrete should not be performed until the concrete is at least 14 days old and has achieved full minimum strength. Equipment that causes ravels, aggregate fractures, spalls or disturbance to the joints will not be permitted. The depth of diamond grinding shall not exceed 1/2 inch (13 mm) and all areas in which diamond grinding has been performed will be subject to the final pavement thickness tolerances specified.

Diamond grinding shall be performed with a machine specifically designed for diamond grinding capable of cutting a path at least 3 feet (0.9 m) wide. The saw blades shall be 1/8-inch (3-mm) wide with sufficient number of flush cut blades that create grooves between 0.090 and 0.130 inches (2 and 3.5 mm) wide; and peaks and ridges approximately 1/32 inch (1 mm) higher than the bottom of the grinding cut. The Contractor shall determine the number and type of blades based on the hardness of the aggregate. Contractor shall demonstrate to the RPR that the grinding equipment will produce satisfactory results prior to making corrections to surfaces.

Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. The slurry resulting from the grinding operation shall be continuously removed and the pavement left in a clean condition. All grinding shall be at the expense of the Contractor.

CONTRACTOR QUALITY CONTROL (CQC)

501-5.1 Quality control program. The Contractor shall develop a Quality Control Program in accordance with Item C-100.

501-5.2 Contractor Quality Control (CQC). The Contractor shall provide or contract for testing facilities in accordance with Item C-100. The RPR shall be permitted unrestricted access to inspect the Contractor's QC facilities and witness QC activities. The RPR will advise the Contractor in writing of any noted deficiencies concerning the QC facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to be adversely affecting the test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are satisfactorily corrected.

501-5.3 Contractor QC testing. The Contractor shall perform all QC tests necessary to control the production and construction processes applicable to this specification. The testing program shall include, but not necessarily be limited to, tests for aggregate gradation, aggregate moisture content, slump, and air content.

The RPR may at any time, notwithstanding previous plant acceptance, reject and require the Contractor to dispose of any batch of concrete mixture which is rendered unfit for use due to contamination, segregation, or improper slump. Such rejection may be based on only visual inspection. In the event of such rejection, the Contractor may

take a representative sample of the rejected material in the presence of the RPR, and if it can be demonstrated in the laboratory, in the presence of the RPR, that such material was erroneously rejected, payment will be made for the material at the contract unit price J.

a. Fine aggregate.

(1) Gradation. A sieve analysis shall be made at least twice daily in accordance with ASTM C136 from randomly sampled material taken from the discharge gate of storage bins or from the conveyor belt.

(2) Moisture content. If an electric moisture meter is used, at least two direct measurements of moisture content shall be made per week to check the calibration. If direct measurements are made in lieu of using an electric meter, two tests shall be made per day. Tests shall be made in accordance with ASTM C70 or ASTM C566.

(3) Deleterious substances. Fine aggregate as delivered to the mixer shall be tested for deleterious substances in fine aggregate for concrete as specified in paragraph 501-2.1b, prior to production of the control strip, and a minimum of every 30-days during production or more frequently as necessary to control deleterious substances.

b. Coarse Aggregate.

(1) Gradation. A sieve analysis shall be made at least twice daily for each size of aggregate. Tests shall be made in accordance with ASTM C136 from randomly sampled material taken from the discharge gate of storage bins or from the conveyor belt.

(2) Moisture content. If an electric moisture meter is used, at least two direct measurements of moisture content shall be made per week to check the calibration. If direct measurements are made in lieu of using an electric meter, two tests shall be made per day. Tests shall be made in accordance with ASTM C566.

(3) Deleterious substances. Coarse aggregate as delivered to the mixer shall be tested for deleterious substances in coarse aggregate for concrete as specified in paragraph 501-2.1c, prior to production of the control strip, and a minimum of every 30-days during production or more frequently as necessary to control deleterious substances.

c. Slump. One test shall be made for each subplot. Slump tests shall be performed in accordance with ASTM C143 from material randomly sampled from material discharged from trucks at the paving site. Material samples shall be taken in accordance with ASTM C172.

d. Air content. One test shall be made for each subplot. Air content tests shall be performed in accordance with ASTM C231 for gravel and stone coarse aggregate and ASTM C173 for slag or other porous coarse aggregate, from material randomly sampled from trucks at the paving site. Material samples shall be taken in accordance with ASTM C172.

e. Unit weight and Yield. One test shall be made for each subplot. Unit weight and yield tests shall be in accordance with ASTM C138. The samples shall be taken in accordance with ASTM C172 and at the same time as the air content tests.

f. Temperatures. Temperatures shall be checked at least four times per lot at the job site in accordance with ASTM C1064.

g. Smoothness for Contractor Quality Control.

The Contractor shall perform smoothness testing in transverse and longitudinal directions daily to verify that the construction processes are producing pavement with variances less than ¼ inch in 12 feet, identifying areas that may pond water which could lead to hydroplaning of aircraft. If the smoothness

criteria is not met, appropriate changes and corrections to the construction process shall be made by the Contractor before construction continues

The Contractor may use a 12-foot (3.7 m) “straightedge, a rolling inclinometer meeting the requirements of ASTM E2133 or rolling external reference device that can simulate a 12-foot (3.7m) straightedge approved by the RPR. Straight-edge testing shall start with one-half the length of the straightedge at the edge of pavement section being tested and then moved ahead one-half the length of the straightedge for each successive measurement. Testing shall be continuous across all joints. The surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between the two high points. If the rolling inclinometer or external reference device is used, the data may be evaluated using either the FAA profile program, ProFAA, or FHWA profile program ProVal, using the 12-foot straightedge simulation function.

Smoothness readings shall not be made across grade changes or cross slope transitions. The transition between new and existing pavement shall be evaluated separately for conformance with the plans.

(1) Transverse measurements. Transverse measurements shall be taken for each day’s production placed. Transverse measurements shall be taken perpendicular to the pavement centerline each 50 feet (15 m) or more often as determined by the RPR. The joint between lanes shall be tested separately to facilitate smoothness between lanes.

(2) Longitudinal measurements. Longitudinal measurements shall be taken for each day’s production placed. Longitudinal tests shall be parallel to the centerline of paving; at the center of paving lanes when widths of paving lanes are less than 20 feet (6 m); and at the third points of paving lanes when widths of paving lanes are 20 ft (6 m) or greater. When placement abuts previously placed material the first measurement shall start with one half the length of the straight edge on the previously placed material.

Deviations on the final surface course in either the transverse or longitudinal direction that will trap water greater than 1/4 inch (6 mm) shall be corrected with diamond grinding per paragraph 501-4.19f or by removing and replacing the surface course to full depth. Grinding shall be tapered in all directions to provide smooth transitions to areas not requiring grinding. All areas in which diamond grinding has been performed shall be subject to the final pavement thickness tolerances specified in paragraph 501-6.6.

Control charts shall be kept to show area of each day’s placement and the percentage of corrective grinding required. Corrections to production and placement shall be initiated when corrective grinding is required. If the Contractor’s machines and/or methods produce significant areas that need corrective actions in excess of 10 percent of a day’s production, production shall be stopped until corrective measures are implemented by the Contractor.

h. Grade. Grade will be evaluated prior to and after placement of the concrete surface.

Measurements will be taken at appropriate gradelines (as a minimum at center and edges of paving lane) and longitudinal spacing as shown on cross-sections and plans. The final surface of the pavement will not vary from the gradeline elevations and cross-sections shown on the plans by more than 1/2 inch (12 mm) vertically and 0.1 feet (30 mm) laterally. The documentation will be provided by the Contractor to the RPR within 48 hours by the end of the following working day.

Areas with humps or depression that exceed grade or smoothness and that retain water on the surface must be ground off provided the course thickness after grinding is not more than 1/2 inch (12 mm) less than the thickness specified on the plans. If these areas cannot be corrected with grinding then the slabs

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that are retaining water must be removed and replaced in accordance with paragraph 501-4.19d. Grinding shall be in accordance with paragraph 501-4.19f. All corrections will be at the Contractors expense.

501-5.4 Control charts. The Contractor shall maintain linear control charts for fine and coarse aggregate gradation, slump, and air content. The Contractor shall also maintain a control chart plotting the coarseness factor/workability factor from the combined gradations in accordance with paragraph 501-2.1d.

Control charts shall be posted in a location satisfactory to the RPR and shall be kept up to date at all times. As a minimum, the control charts shall identify the project number, the contract item number, the test number, each test parameter, the Action and suspension Limits, or Specification limits, applicable to each test parameter, and the Contractor's test results. The Contractor shall use the control charts as part of a process control system for identifying potential problems and assignable causes before they occur. If the Contractor's projected data during production indicates a potential problem and the Contractor is not taking satisfactory corrective action, the RPR may halt production or acceptance of the material.

a. Fine and coarse aggregate gradation. The Contractor shall record the running average of the last five gradation tests for each control sieve on linear control charts. Superimposed on the control charts shall be the action and suspension limits. Gradation tests shall be performed by the Contractor per ASTM C136. The Contractor shall take at least two samples per lot to check the final gradation. Sampling shall be per ASTM D75 from the flowing aggregate stream or conveyor belt.

b. Slump and air content. The Contractor shall maintain linear control charts both for individual measurements and range (that is, difference between highest and lowest measurements) for slump and air content in accordance with the following Action and Suspension Limits.

c. Combined gradation. The Contractor shall maintain a control chart plotting the coarseness factor and workability factor on a chart in accordance with paragraph 501-2.1d.

Control Chart Limits¹

Control Parameter	Individual Measurements	
	Action Limit	Suspension Limit
Gradation ²	*3	*3
Coarseness Factor (CF)	±3.5	±5
Workability Factor (WF)	±2	±3
Slump	+0.5 to -1 inch (+13 to -25 mm)	+1 to -1.5 inch (+25 to -38 mm)
Air Content	±1.5%	±2.0%

¹ Control charts shall developed and maintained for each control parameter indicated.

² Control charts shall be developed and maintained for each sieve size.

³ Action and suspension limits shall be determined by the Contractor.

501-5.5 Corrective action at Suspension Limit. As a minimum, a process shall be deemed out of control and corrective action taken if any one of the following conditions exists.

- a. Fine and coarse aggregate gradation.** When two consecutive averages of five tests are outside of the suspension limits,

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immediate steps, including a halt to production, shall be taken to correct the grading.

- b.** Coarseness and Workability factor. When the CF or WF reaches the applicable suspension limits, the Contractor, immediate steps, including a halt to production, shall be taken to correct the CF and WF.

c. Fine and coarse aggregate moisture content. Whenever the moisture content of the fine or coarse aggregate changes by more than 0.5%, the scale settings for the aggregate batcher and water batcher shall be adjusted.

d. Slump. The Contractor shall halt production and make appropriate adjustments whenever:

(1) one point falls outside the Suspension Limit line for individual measurements

OR

(2) two points in a row fall outside the Action Limit line for individual measurements.

d. Air content. The Contractor shall halt production and adjust the amount of air-entraining admixture whenever:

(1) one point falls outside the Suspension Limit line for individual measurements

OR

(2) two points in a row fall outside the Action Limit line for individual measurements.

MATERIAL ACCEPTANCE

501-6.1 Quality Assurance (QA) Acceptance sampling and testing. All acceptance sampling and testing necessary to determine conformance with the requirements specified in this section, with the exception of coring for thickness determination, will be performed by the RPR. The Contractor shall provide adequate facilities for the initial curing of beams. The Contractor shall bear the cost of providing initial curing facilities and coring and filling operations, per paragraph 501-6.5b(1).

The samples will be transported while in the molds. The curing, except for the initial cure period, will be accomplished using the immersion in saturated lime water method. During the 24 hours after molding, the temperature immediately adjacent to the specimens must be maintained in the range of 60° to 80°F (16° to 27°C), and loss of moisture from the specimens must be prevented. The specimens may be stored in tightly constructed wooden boxes, damp sand pits, temporary buildings at construction sites, under wet burlap in favorable weather, or in heavyweight closed plastic bags, or using other suitable methods, provided the temperature and moisture loss requirements are met.

501-6.2 Quality Assurance (QA) testing laboratory. Quality assurance testing organizations performing these acceptance tests will be accredited in accordance with ASTM C1077. The quality assurance laboratory accreditation must be current and listed on the accrediting authority's website. All test methods required for acceptance sampling and testing must be listed on the lab accreditation. A copy of the laboratory's current accreditation and accredited test methods will be submitted to the RPR prior to start of construction.

501-6.3 Lot size. Concrete will be accepted for strength and thickness on a lot basis. A lot will consist of a day's production not to exceed 2,000 cubic yards (1530 cubic meters) . Each lot will be divided into approximately equal sublots with individual sublots between 400 to 600 cubic yards. Where three sublots are produced, they will constitute a lot. Where one or two sublots are produced, they will be incorporated into the previous or next lot. Where more than one plant is simultaneously producing concrete for the job, the lot sizes will apply separately for each plant.

501-6.4 Partial lots. When operational conditions cause a lot to be terminated before the specified number of tests have been made for the lot or for overages or minor placements to be considered as partial lots, the following procedure will be used to adjust the lot size and the number of tests for the lot.

Where three sublots have been produced, they will constitute a lot. Where one or two sublots have been produced, they will be incorporated into the next lot or the previous lot and the total number of sublots will be used in the acceptance criteria calculation, that is, $n=5$ or $n=6$.

501-6.5 Acceptance Sampling and Testing.

a. Strength.

(1) Sampling. One sample will be taken for each sublot from the concrete delivered to the job site. Sampling locations will be determined by the RPR in accordance with random sampling procedures contained in ASTM D3665. The concrete will be sampled in accordance with ASTM C172.

(2) Test Specimens. The RPR will be responsible for the casting, initial curing, transportation, and curing of specimens in accordance with ASTM C31. Two (2) specimens will be made from each sample and slump, air content, unit weight, and temperature tests will be conducted for each set of strength specimens. Within 24 to 48 hours, the samples will be transported from the field to the laboratory while in the molds. Samples will be cured in saturated lime water.

The strength of each specimen will be determined in accordance with ASTM C39 ASTM C78 . The strength for each sublot will be computed by averaging the results of the two test specimens representing that sublot.

(3) Acceptance. Acceptance of pavement for strength will be determined by the RPR in accordance with paragraph 501-6.6b(1). All individual strength tests within a lot will be checked for outliers in accordance with ASTM E178, at a significance level of 5%. Outliers will be discarded and the remaining test values will be used to determine acceptance in accordance with paragraph 501-6.5b.

b. Pavement thickness.

(1) Sampling. One core will be taken by the Contractor for each sublot in the presence of the RPR. Sampling locations will be determined by the RPR in accordance with random sampling procedures contained in ASTM D3665. Areas, such as thickened edges, with planned variable thickness, will be excluded from sample locations.

Cores shall be a minimum 4 inch (100 mm) in diameter neatly cut with a core drill. The Contractor will furnish all tools, labor, and materials for cutting samples and filling the cored hole. Core holes will be filled by the Contractor with a non-shrink grout approved by the RPR within one day after sampling.

(2) Testing. The thickness of the cores will be determined by the RPR by the average caliper measurement in accordance with ASTM C174. Each core shall be photographed and the photograph included with the test report.

(3) Acceptance. Acceptance of pavement for thickness will be determined by the RPR in accordance with paragraph 501-6.6.

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501-6.6 Acceptance criteria.

a. General. Acceptance will be based on the following characteristics of the completed pavement discussed in paragraph 501-6.5b:

- (1) Strength
- (2) Thickness
- (3) Grade
- (4) Profilograph smoothness [Not used.]
- (5) Adjustments for repairs

Acceptance for strength, thickness, and grade, will be based on the criteria contained in accordance with paragraph 501-6.6b(1), 501-6.6b(2), and 501-6.6b(3), respectively. Acceptance for profilograph smoothness will be based on the criteria contained in paragraph 501-6.6b(4).

Production quality must achieve 90 PWL or higher to receive full payment.

Strength and thickness will be evaluated for acceptance on a lot basis using the method of estimating PWL. Production quality must achieve 90 PWL or higher to receive full pavement. The PWL will be determined in accordance with procedures specified in Item C-110.

The lower specification tolerance limit (L) for strength and thickness will be:

Lower Specification Tolerance Limit (L)

Strength	$0.93 \times \text{strength specified in paragraph 501-3.3}$
Thickness	Lot Plan Thickness in inches, - 0.50 in

]

b. Acceptance criteria.

(1) Strength. The strength for each subplot shall be computed by averaging the results of that subplot. When subplot strength equals or exceeds the strength as specified in paragraph 501-3.3, the lot will be acceptable. Acceptance and payment for the lot will be determined in accordance with paragraph 501-8.1.

(2) Thickness. If subplot thickness is not be less than $\frac{1}{2}$ inch (12 mm) from plan thickness, the lot will be acceptable. Acceptance and payment for the lot will be determined in accordance with paragraph 501-8.1.

(3) Grade. The final finished surface of the pavement of the completed project will not vary from the gradeline elevations and cross-sections shown on the plans by more than $\frac{1}{2}$ inch (12 mm) vertically or 0.1 feet (30 mm) laterally. The documentation, stamped and signed by a licensed surveyor shall be in accordance with paragraph 501-5.3h. Payment for sublots that do not meet grade for over 25% of the subplot shall reduced by 5% and not be more than 95%.

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(4) Profilograph roughness for QA Acceptance. Not used.

(5) Adjustments for repair. Sublots with spall repairs, crack repairs, or partial panel replacement, will be limited to no more than 95% payment.

(6) Adjustment for grinding. For sublots with grinding over 25% of a subplot, payment will be reduced 5%.

REFERENCES

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

ASTM International (ASTM)

ASTM A184	Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A704	Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement
ASTM A706	Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A775	Standard Specification for Epoxy-Coated Steel Reinforcing Bars
ASTM A884	Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement
ASTM A934	Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
ASTM A996	Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
ASTM A1035	Standard Specification for Deformed and Plain, Low-Carbon, Chromium, Steel Bars for Concrete Reinforcement
ASTM A1064	Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM A1078	Standard Specification for Epoxy-Coated Steel Dowels for Concrete Pavement
ASTM C29	Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM C31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33	Standard Specification for Concrete Aggregates
ASTM C39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C70	Standard Test Method for Surface Moisture in Fine Aggregate

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ASTM C78	Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C88	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C94	Standard Specification for Ready-Mixed Concrete
ASTM C114	Standard Test Methods for Chemical Analysis of Hydraulic Cement
ASTM C117	Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C123	Standard Test Method for Lightweight Particles in Aggregate
ASTM C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C131	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM C138	Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C142	Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM C143	Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150	Standard Specification for Portland Cement
ASTM C171	Standard Specification for Sheet Materials for Curing Concrete
ASTM C172	Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C174	Standard Test Method for Measuring Thickness of Concrete Elements Using Drilled Concrete Cores
ASTM C227	Standard Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)
ASTM C231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260	Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C295	Standard Guide for Petrographic Examination of Aggregates for Concrete
ASTM C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C311	Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland Cement Concrete
ASTM C494	Standard Specification for Chemical Admixtures for Concrete

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ASTM C566	Standard Test Method for Total Evaporable Moisture Content of Aggregates by Drying
ASTM C595	Standard Specification for Blended Hydraulic Cements
ASTM C618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C642	Standard Test Method for Density, Absorption, and Voids in Hardened Concrete
ASTM C666	Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
ASTM C685	Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C881	Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C989	Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM C1017	Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C1064	Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C1077	Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1157	Standard Performance Specification for Hydraulic Cement
ASTM C1260	Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C1365	Standard Test Method for Determination of the Proportion of Phases in Portland Cement and Portland-Cement Clinker Using X-Ray Powder Diffraction Analysis
ASTM C1567	Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
ASTM C1602	Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
ASTM D75	Standard Practice for Sampling Aggregates
ASTM D1751	Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752	Standard Specification for Preformed Sponge Rubber and Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate

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ASTM D3665	Standard Practice for Random Sampling of Construction Materials
ASTM D4791	Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM E178	Standard Practice for Dealing with Outlying Observations
ASTM E1274	Standard Test Method for Measuring Pavement Roughness Using a Profilograph
ASTM E2133	Standard Test Method for Using a Rolling Inclinometer to Measure Longitudinal and Transverse Profiles of a Traveled Surface
American Concrete Institute (ACI)	
ACI 305R	Guide to Hot Weather Concreting
ACI 306R	Guide to Cold Weather Concreting
ACI 309R	Guide for Consolidation of Concrete
Advisory Circulars (AC)	
AC 150/5320-6	Airport Pavement Design and Evaluation
Federal Highway Administration (FHWA)	
HIPERPAV 3, version 3.2	
Portland Concrete Association (PCA)	
PCA	Design and Control of Concrete Mixtures, 16 th Edition
U.S. Army Corps of Engineers (USACE) Concrete Research Division (CRD)	
CRD C662	Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials, Lithium Nitrate Admixture and Aggregate (Accelerated Mortar-Bar Method)
United States Air Force Engineering Technical Letter (ETL)	
ETL 97-5	Proportioning Concrete Mixtures with Graded Aggregates for Rigid Airfield Pavements

END ITEM P-501

Part 11 – Drainage

Item D-701 Pipe for Storm Drains and Culverts

DESCRIPTION

701-1.1 This item shall consist of the construction of pipe culverts and storm drains in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans.

MATERIALS

701-2.1 Materials shall meet the requirements shown on the plans and specified below. Underground piping and components used in drainage systems for terminal and aircraft fueling ramp drainage shall be noncombustible and inert to fuel in accordance with National Fire Protection Association (NFPA) 415.

701-2.2 Pipe. The pipe shall be of the type called for on the plans or in the proposal and shall be in accordance with the following appropriate requirements:

[	American Association of State Highway and Transportation Officials (AASHTO) M167	
	Standard Specification for Corrugated Steel Structural Plate, Zinc-Coated, for Field-Bolted Pipe, Pipe-Arches, and Arches	
AASHTO M190	Standard Specification for Bituminous-Coated Corrugated Metal Culvert Pipe and Pipe Arches	
AASHTO M196	Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains	
AASHTO M219	Standard Specification for Corrugated Aluminum Alloy Structural Plate for Field-Bolted Pipe, Pipe-Arches, and Arches	
AASHTO M243	Standard Specification for Field-Applied Coating of Corrugated Metal Structural Plate for Pipe, Pipe-Arches, and Arches	
AASHTO M252	Standard Specification for Corrugated Polyethylene Drainage Pipe	
AASHTO M294	Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter	
AASHTO M304	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Wall Drain Pipe and Fittings Based on Controlled Inside Diameter	
AASHTO MP20	Standard Specification for Steel Reinforced Polyethylene (PE) Ribbed Pipe, 300- to 900-mm (12- to 36-in.) Diameter	

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AASHTO R73	Standard Practice for Evaluation of Precast Concrete Drainage Productions
ASTM A760	Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
ASTM A761	Standard Specification for Corrugated Structural Steel Plate, Zinc-Coated, for Field-Bolted Pipe, Pipe-Arches, and Arches
ASTM A762	Standard Specification for Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains
ASTM A849	Standard Specification for Post Applied Coatings, Pavings, and Linings for Corrugated Steel Sewer and Drainage Pipe
ASTM B745	Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains
ASTM C14	Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C76	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C506	Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe
ASTM C507	Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe
ASTM C655	Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe
ASTM C1433	Standard Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers
ASTM C1479	Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations
ASTM C1577	Standard Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers Designed According to AASHTO LRFD
ASTM C1786	Standard Specification for Segmental Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers Designed According to AASHTO LRFD
ASTM C1840	Standard Practice for Inspection and Acceptance of Installed Reinforced Concrete Culvert, Storm Drain, and Storm Sewer Pipe
ASTM D3262	Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe

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ASTM D 4161	Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals
ASTM F667	Standard Specification for 3 through 24 in Corrugated Polyethylene Pipe and Fittings
ASTM F714	Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
ASTM F794	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
ASTM F894	Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
ASTM F949	Standard Specification for Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings
ASTM F2435	Standard Specification for Steel Reinforced Polyethylene (PE) Corrugated Pipe
ASTM F2562	Specification for Steel Reinforced Thermoplastic Ribbed Pipe and Fittings for Non-Pressure Drainage and Sewerage
ASTM F2736	Standard Specification for 6 to 30 in. (152 to 762 mm) Polypropylene (PP) Corrugated Single Wall Pipe and Double Wall Pipe
ASTM F2764	Standard Specification for 30 to 60 in. (750 to 1500 mm) Polypropylene (PP) Triple Wall Pipe and Fittings for Non-Pressure Sanitary Sewer Applications
ASTM F2881	Standard Specification for 12 to 60 in. (300 to 1500 mm) Polypropylene (PP) Dual Wall Pipe and Fittings for Non-Pressure Storm Sewer Applications
ASTM D3034	Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings]

701-2.3 Concrete. [Not used.

701-2.4 Rubber gaskets. Rubber gaskets for rigid pipe shall conform to the requirements of ASTM C443. Rubber gaskets for PVC pipe, polyethylene, and polypropylene pipe shall conform to the requirements of ASTM F477. Rubber gaskets for zinc-coated steel pipe and precoated galvanized pipe shall conform to the requirements of ASTM D1056, for the "RE" closed cell grades. Rubber gaskets for steel reinforced thermoplastic ribbed pipe shall conform to the requirements of ASTM F477.

701-2.5 Joint mortar. Pipe joint mortar shall consist of one part Portland cement and two parts sand. The Portland cement shall conform to the

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requirements of ASTM C150, Type I. The sand shall conform to the requirements of ASTM C144.

701-2.6 Joint fillers. Poured filler for joints shall conform to the requirements of ASTM D6690.

701-2.7 Plastic gaskets. Plastic gaskets shall conform to the requirements of ASTM C990.

701-2.8. Controlled low-strength material (CLSM). Controlled low-strength material shall conform to the requirements of Item P-153. When CLSM is used, all joints shall have gaskets.

701-2.9 Precast box culverts. Manufactured in accordance with and conforming to ASTM C1433.

701-2.10 Precast concrete pipe. Precast concrete structures shall be furnished by a plant meeting National Precast Concrete Association Plant Certification Program or American Concrete Pipe Association QCast Plant Certification program.

CONSTRUCTION METHODS

701-3.1 Excavation. The width of the pipe trench shall be sufficient to permit satisfactory jointing of the pipe and thorough tamping of the bedding material under and around the pipe, but it shall not be less than the external diameter of the pipe plus 12 inches (300 mm) on each side. The trench walls shall be approximately vertical.

The Contractor shall comply with all current federal, state and local rules and regulations governing the safety of men and materials during the excavation, installation and backfilling operations. Specifically, the Contractor shall observe that all requirements of the Occupational Safety and Health Administration (OSHA) relating to excavations, trenching and shoring are strictly adhered to. The width of the trench shall be sufficient to permit satisfactory jointing of the pipe and thorough compaction of the bedding material under the pipe and backfill material around the pipe, but it shall not be greater than the widths shown on the plans trench detail.

Where rock, hardpan, or other unyielding material is encountered, the Contractor shall remove it from below the foundation grade for a depth of at least 8 inch (200 mm) or 1/2 inch (12 mm) for each foot of fill over the top of the pipe (whichever is greater) but for no more than three-quarters of the nominal diameter of the pipe. The excavation below grade should be filled with granular material to form a uniform foundation.

Where a firm foundation is not encountered at the grade established, due to soft, spongy, or other unstable soil, the unstable soil shall be removed and replaced with approved granular material for the full trench width. The RPR shall determine the depth of removal necessary. The granular material shall be compacted to provide adequate support for the pipe.

The excavation for pipes placed in embankment fill shall not be made until the embankment has been completed to a height above the top of the pipe as shown on the plans.

701-3.2 Bedding. The bedding surface for the pipe shall provide a foundation of uniform density to support the pipe throughout its entire length.

a. Rigid pipe. The pipe bedding shall be constructed uniformly for the full length of the pipe barrel, as required on the plans. The maximum aggregate size shall be 1 in when the bedding thickness is less than 6 inches, and 1-1/2 in when the bedding thickness is greater than 6 inches. Bedding shall be loosely placed uncompacted material under the middle third of the pipe prior to placement of the pipe.

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b. Flexible pipe. For flexible pipe, the bed shall be roughly shaped to fit the pipe, and a bedding blanket of sand or fine granular material shall be provided as follows:

Flexible Pipe Bedding

Pipe Corrugation Depth		Minimum Bedding Depth	
inch	mm	inch	mm
1/2	12	1	25
1	25	2	50
2	50	3	75
2-1/2	60	3-1/2	90

c. Other pipe materials. For PVC, polyethylene, polypropylene, or fiberglass pipe, the bedding material shall consist of coarse sands and gravels with a maximum particle size of 3/4 inches (19 mm). For pipes installed under paved areas, no more than 12% of the material shall pass the No. 200 (0.075 mm) sieve. For all other areas, no more than 50% of the material shall pass the No. 200 (0.075 mm) sieve. The bedding shall have a thickness of at least 6 inches (150 mm) below the bottom of the pipe and extend up around the pipe for a depth of not less than 50% of the pipe's vertical outside diameter.

701-3.3 Laying pipe. The pipe laying shall begin at the lowest point of the trench and proceed upgrade. The lower segment of the pipe shall be in contact with the bedding throughout its full length. Bell or groove ends of rigid pipes and outside circumferential laps of flexible pipes shall be placed facing upgrade.

Paved or partially lined pipe shall be placed so that the longitudinal center line of the paved segment coincides with the flow line.

Elliptical and elliptically reinforced concrete pipes shall be placed with the manufacturer's reference lines designating the top of the pipe within five degrees of a vertical plane through the longitudinal axis of the pipe.

701-3.4 Joining pipe. Joints shall be made with (1) cement mortar, (2) cement grout, (3) rubber gaskets, (4) plastic gaskets, (5) coupling bands

Mortar joints shall be made with an excess of mortar to form a continuous bead around the outside of the pipe and shall be finished smooth on the inside. Molds or runners shall be used for grouted joints to retain the poured grout. Rubber ring gaskets shall be installed to form a flexible watertight seal.

a. Concrete pipe. Concrete pipe may be either bell and spigot or tongue and groove. Pipe sections at joints shall be fully seated and the inner surfaces flush and even. Concrete pipe joints shall be sealed with rubber gaskets meeting ASTM C443 when leak resistant joints are required.

b. Metal pipe. Metal pipe shall be firmly joined by form-fitting bands conforming to the requirements of ASTM A760 for steel pipe and AASHTO M196 for aluminum pipe.

c. PVC, Polyethylene, or Polypropylene pipe. Joints for PVC, Polyethylene, or Polypropylene pipe shall conform to the requirements of ASTM D3212 when leak resistant joints are required. Joints for PVC and Polyethylene pipe shall conform to the requirements of AASHTO M304 when soil tight joints are required. Fittings for polyethylene pipe shall conform to the requirements of AASHTO M252 or ASTM M294. Fittings for polypropylene pipe shall conform to ASTM F2881, ASTM F2736, or ASTM F2764.

d. Fiberglass pipe. Joints and fittings shall be as detailed on the plans and in accordance with the manufacturers recommendations. Joints shall meet the requirements of ASTM D4161 for flexible elastomeric seals.

701-3.5 Embedment and Overfill. Pipes shall be inspected before any fill material is placed; any pipes found to be out of alignment, unduly settled, or damaged shall be removed and re-laid or replaced at the Contractor's expense.

701-3.5-1 Embedment Material Requirements

a. Concrete Pipe. Embedment material and compaction requirements shall be in accordance with the applicable Type of Standard Installation (Types 1, 2, 3, or 4) per ASTM C1479. If a concrete cradle or CLSM embedment material is used, it shall conform to the plan details.

b. Plastic and fiberglass Pipe. Embedment material shall meet the requirements of ASTM D3282, A-1, A-2-4, A-2-5, or A-3. Embedment material shall be free of organic material, stones larger than 1.5 inches in the greatest dimension, or frozen lumps. Embedment material shall extend to 12 inches above the top of the pipe.

c. Metal Pipe. Embedment material shall be granular as specified in the contract document and specifications, and shall be free of organic material, rock fragments larger than 1.5 inches in the greatest dimension and frozen lumps. As a minimum, backfill materials shall meet the requirements of ASTM D3282, A-1, A-2, or A-3. Embedment material shall extend to 12 inches above the top of the pipe.

701-3.5-2 Placement of Embedment Material

The embedment material shall be compacted in layers not exceeding 6 inches (150 mm) on each side of the pipe and shall be brought up one foot (30 cm) above the top of the pipe or to natural ground level, whichever is greater. Thoroughly compact the embedment material under the haunches of the pipe without displacing the pipe. Material shall be brought up evenly on each side of the pipe for the full length of the pipe.

When the top of the pipe is above the top of the trench, the embedment material shall be compacted in layers not exceeding 6 inches (150 mm) and shall be brought up evenly on each side of the pipe to one foot (30 cm) above the top of the pipe. All embedment material shall be compacted to a density required under Item P-152.

Concrete cradles and flowable fills, such as controlled low strength material (CLSM) or controlled density fill (CDF), may be used for embedment provided adequate flotation resistance can be achieved by restraints, weighing, or placement technique.

It shall be the Contractor's responsibility to protect installed pipes and culverts from damage due to construction equipment operations. The Contractor shall be responsible for installation of any extra strutting or backfill required to protect pipes from the construction equipment.

701-3.6 Overfill

Pipes shall be inspected before any overfill is in place. Any pipes found to be out of alignment, unduly settled, or damaged shall be removed and relaid or replaced at the Contractor's expense. Evaluation of any damage to RCP shall be evaluated based on AASHTO R73.

Overfill material shall be place and compacted in layers as required to achieve compaction to at least 95 percent standard proctor per ASTM D698 . The soil shall contain no debris, organic matter, frozen material, or stones with a diameter greater than one half the thickness of the compacted layers being placed.

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An initial post installation inspection shall be performed by the RPR no sooner than 30 days after completion of installation and final backfill. Clean or flush all lines prior to inspection.

Use a camera with lighting suitable to allow a clear picture of the entire periphery of the pipe interior. Center the camera in the pipe both vertically and horizontally and be able to pan and tilt to a 90 degree angle with the axis of the pipe rotating 360 degrees. Use equipment to move the camera through the pipe that will not obstruct the camera's view or interfere with proper documentation of the pipe's condition. The video image shall be clear, focused, and relatively free from roll, static, or other image distortion qualities that would prevent the reviewer from evaluating the condition of the pipe.

Incorporate specific inspection requirements for the various types of pipes beneath the general inspection requirements.

Flexible pipes shall be inspected for rips, tears, joint separations, soil migration, cracks, localized buckling, settlement, alignment, and deflection. Determine whether the allowable deflection has been exceeded by use of a laser profiler for internal pipe diameters of 48 inches or less, or direct measurement for internal pipe diameters greater than 48 inches. Laser profile equipment shall utilize low barrel distortion video equipment. Deflection of installed pipe shall not exceed the limits provided in the table below, as a percentage of the average inside diameter of the pipe.

Maximum Allowable Pipe Deflection

Type of Pipe	Maximum Allowable Deflection (%)
Corrugated Metal Pipe	5
Concrete Lined CMP	3
Thermoplastic Pipe	5
Fiberglass	5

If deflection readings in excess of the allowable deflection are obtained, remove the pipe with excessive deflection and replace with new pipe. Isolated areas may exceed allowable by 2.5% with concurrence of RPR. Repair or replace any pipe with cracks exhibiting displacement across the crack, bulges, creases, tears, spalls, or delaminations. The report for flexible pipe shall include as a minimum, the deflection results and final post installation inspection report. The inspection report shall include: a copy of all video taken, pipe location identification, equipment used for inspection, inspector name, deviation from design line and grade, and inspector's notes.

Attachment 4
Specifications

REFERENCES

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

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO M167	Standard Specification for Corrugated Steel Structural Plate, Zinc-Coated, for Field-Bolted Pipe, Pipe-Arches, and Arches
AASHTO M190	Standard Specification for Bituminous-Coated Corrugated Metal Culvert Pipe and Pipe Arches
AASHTO M196	Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains
AASHTO M219	Standard Specification for Corrugated Aluminum Alloy Structural Plate for Field-Bolted Pipe, Pipe-Arches, and Arches
AASHTO M243	Standard Specification for Field Applied Coating of Corrugated Metal Structural Plate for Pipe, Pipe-Arches, and Arches
AASHTO M252	Standard Specification for Corrugated Polyethylene Drainage Pipe
AASHTO M294	Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter
AASHTO M304	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Wall Drain Pipe and Fittings Based on Controlled Inside Diameter
AASHTO MP20	Standard Specification for Steel Reinforced Polyethylene (PE) Ribbed Pipe, 300- to 900-mm (12- to 36-in.) Diameter

ASTM International (ASTM)

ASTM A760	Standard Specification for Corrugated Steel Pipe, Metallic Coated for Sewers and Drains
ASTM A761	Standard Specification for Corrugated Steel Structural Plate, Zinc Coated, for Field-Bolted Pipe, Pipe-Arches, and Arches
ASTM A762	Standard Specification for Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains
ASTM A849	Standard Specification for Post-Applied Coatings, Pavings, and Linings for Corrugated Steel Sewer and Drainage Pipe
ASTM B745	Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains
ASTM C14	Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C76	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C94	Standard Specification for Ready Mixed Concrete
ASTM C144	Standard Specification for Aggregate for Masonry Mortar
ASTM C150	Standard Specification for Portland Cement

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ASTM C443	Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C506	Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe
ASTM C507	Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe
ASTM C655	Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain and Sewer Pipe
ASTM C990	Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM C1433	Standard Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers
ASTM D1056	Standard Specification for Flexible Cellular Materials Sponge or Expanded Rubber
ASTM D3034	Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D3212	Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D3262	Standard Specification for "Fiberglass" (Glass-Fiber Reinforced Thermosetting Resin) Sewer Pipe
ASTM D3282	Standard Practice for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
ASTM D4161	Standard Specification for "Fiberglass" (Glass-Fiber Reinforced Thermosetting Resin) Pipe Joints Using Flexible Elastomeric Seals
ASTM D6690	Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
ASTM F477	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F667	Standard Specification for 3 through 24 in. Corrugated Polyethylene Pipe and Fittings
ASTM F714	Standard Specification for Polyethylene (PE) Plastic Pipe (DR PR) Based on Outside Diameter
ASTM F794	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe & Fittings Based on Controlled Inside Diameter
ASTM F894	Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
ASTM F949	Standard Specification for Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings
ASTM F2435	Standard Specification for Steel Reinforced Polyethylene (PE) Corrugated Pipe

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ASTM F2562	Specification for Steel Reinforced Thermoplastic Ribbed Pipe and Fittings for Non-Pressure Drainage and Sewerage
ASTM F2736	Standard Specification for 6 to 30 in. (152 to 762 mm) Polypropylene (PP) Corrugated Single Wall Pipe and Double Wall Pipe
ASTM F2764	Standard Specification for 30 to 60 in. (750 to 1500 mm) Polypropylene (PP) Triple Wall Pipe and Fittings for Non-Pressure Sanitary Sewer Applications
ASTM F2881	Standard Specification for 12 to 60 in. (300 to 1500 mm) Polypropylene (PP) Dual Wall Pipe and Fittings for Non-Pressure Storm Sewer Applications
National Fire Protection Association (NFPA)	
NFPA 415	Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways

END ITEM D-701

Item D-751 Manholes, Catch Basins, Inlets and Inspection Holes

DESCRIPTION

751-1.1 This item shall consist of construction of manholes, catch basins, inlets, and inspection holes, in accordance with these specifications, at the specified locations and conforming to the lines, grades, and dimensions shown on the plans or required by the RPR.

MATERIALS

751-2.1 Brick. The brick shall conform to the requirements of ASTM C32, Grade MS.

751-2.2 Mortar. Mortar shall consist of one part Portland cement and two parts sand. The cement shall conform to the requirements of ASTM C150, Type I. The sand shall conform to the requirements of ASTM C144.

751-2.3 Concrete. Plain and reinforced concrete used in structures, connections of pipes with structures, and the support of structures or frames shall conform to the requirements of Item P-610.

751-2.4 Precast concrete pipe manhole rings. Precast concrete pipe manhole rings shall conform to the requirements of ASTM C478. Unless otherwise specified, the risers and offset cone sections shall have an inside diameter of not less than 36 inches (90 cm) nor more than 48 inches (120 cm). There shall be a gasket between individual sections and sections cemented together with mortar on the inside of the manhole. Gaskets shall conform to the requirements of ASTM C443.

751-2.5 Corrugated metal. Corrugated metal shall conform to the requirements of American Association of State Highway and Transportation Officials (AASHTO) M36.

751-2.6 Frames, covers, and grates. The castings shall conform to one of the following requirements:

- a. ASTM A48, Class 35B: Gray iron castings
- b. ASTM A47: Malleable iron castings
- c. ASTM A27: Steel castings
- d. ASTM A283, Grade D: Structural steel for grates and frames
- e. ASTM A536, Grade 65-45-12: Ductile iron castings
- f. ASTM A897: Austempered ductile iron castings

All castings or structural steel units shall conform to the dimensions shown on the plans and shall be designed to support the loadings, aircraft gear configuration and/or direct loading, specified.

Each frame and cover or grate unit shall be provided with fastening members to prevent it from being dislodged by traffic but which will allow easy removal for access to the structure.

All castings shall be thoroughly cleaned. After fabrication, structural steel units shall be galvanized to meet the requirements of ASTM A123.

751-2.7 Steps. The steps or ladder bars shall be gray or malleable cast iron or galvanized steel. The steps shall be the size, length, and shape shown on the plans and those steps that are not galvanized shall be given a coat of asphalt paint, when directed.

751-2.8 Precast inlet structures. Manufactured in accordance with and conforming to ASTM C913.

CONSTRUCTION METHODS

751-3.1 Unclassified excavation.

a. The Contractor shall excavate for structures and footings to the lines and grades or elevations, shown on the plans, or as staked by the RPR. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure footings shown. The elevations of the bottoms of footings, as shown on the plans, shall be considered as approximately only; and the RPR may direct, in writing, changes in dimensions or elevations of footings necessary for a satisfactory foundation.

b. Boulders, logs, or any other objectionable material encountered in excavation shall be removed. All rock or other hard foundation material shall be cleaned of all loose material and cut to a firm surface either level, stepped, or serrated, as directed by the RPR. All seams or crevices shall be cleaned out and grouted. All loose and disintegrated rock and thin strata shall be removed. Where concrete will rest on a surface other than rock, the bottom of the excavation shall not be disturbed and excavation to final grade shall not be made until immediately before the concrete or reinforcing is placed.

c. The Contractor shall do all bracing, sheathing, or shoring necessary to implement and protect the excavation and the structure as required for safety or conformance to governing laws. The cost of bracing, sheathing, or shoring shall be included in the unit price bid for the structure.

d. All bracing, sheathing, or shoring involved in the construction of this item shall be removed by the Contractor after the completion of the structure. Removal shall not disturb or damage finished masonry. The cost of removal shall be included in the unit price bid for the structure.

e. After excavation is completed for each structure, the Contractor shall notify the RPR. No concrete or reinforcing steel shall be placed until the RPR has approved the depth of the excavation and the character of the foundation material.

751-3.2 Brick structures.

a. Foundations. A prepared foundation shall be placed for all brick structures after the foundation excavation is completed and accepted. Unless otherwise specified, the base shall consist of reinforced concrete mixed, prepared, and placed in accordance with the requirements of Item P-610.

b. Laying brick. All brick shall be clean and thoroughly wet before laying so that they will not absorb any appreciable amount of additional water at the time they are laid. All brick shall be laid in freshly made mortar. Mortar not used within 45 minutes after water has been added shall be discarded. Retempering of mortar shall not be permitted. An ample layer of mortar shall be spread on the beds and a shallow furrow shall be made in it that can be readily closed by the laying of the brick. All bed and head joints shall be filled solid with mortar. End joints of stretchers and side or cross joints of headers shall be fully buttered with mortar and a shoved joint made to squeeze out mortar at the top of the joint. Any bricks that may be loosened after the mortar has taken its set, shall be removed, cleaned, and re-laid with fresh mortar. No broken or chipped brick shall be used in the face, and no spalls or bats shall be used except where necessary to shape around irregular openings or edges; in which case, full bricks shall be placed at ends or corners where possible, and the bats shall be used in the interior of the course. In making closures, no piece of brick shorter than the width of a whole brick shall be used; and wherever practicable, whole brick shall be used and laid as headers.

c. Joints. All joints shall be filled with mortar at every course. Exterior faces shall be laid up in advance of backing. Exterior faces shall be plastered or parged with a coat of mortar not less than 3/8 inch (9 mm) thick before the backing is laid up. Prior to parging, all joints on the back of face courses shall be

cut flush. Unless otherwise noted, joints shall be not less than 1/4 inch (6 mm) nor more than 1/2 inch (12 mm) wide and the selected joint width shall be maintained uniform throughout the work.

d. Pointing. Face joints shall be neatly struck, using the weather-struck joint. All joints shall be finished properly as the laying of the brick progresses. When nails or line pins are used, the holes shall be immediately plugged with mortar and pointed when the nail or pin is removed.

e. Cleaning. Upon completion of the work all exterior surfaces shall be thoroughly cleaned by scrubbing and washing with water. If necessary to produce satisfactory results, cleaning shall be done with a 5% solution of muriatic acid which shall then be rinsed off with liberal quantities of water.

f. Curing and cold weather protection. The brick masonry shall be protected and kept moist for at least 48 hours after laying the brick. Brick masonry work or pointing shall not be done when there is frost on the brick or when the air temperature is below 50°F (10°C) unless the Contractor has, on the project ready to use, suitable covering and artificial heating devices necessary to keep the atmosphere surrounding the masonry at a temperature of not less than 60°F (16°C) for the duration of the curing period.

751-3.3 Concrete structures. Concrete structures which are to be cast-in-place within the project boundaries shall be built on prepared foundations, conforming to the dimensions and shape indicated on the plans. The construction shall conform to the requirements specified in Item P-610. Any reinforcement required shall be placed as indicated on the plans and shall be approved by the RPR before the concrete is placed.

All invert channels shall be constructed and shaped accurately to be smooth, uniform, and cause minimum resistance to flowing water. The interior bottom shall be sloped to the outlet.

751-3.4 Precast concrete structures. Precast concrete structures shall be furnished by a plant meeting National Precast Concrete Association Plant Certification Program or another RPR approved third party certification program.

Precast concrete structures shall conform to ASTM C478. Precast concrete structures shall be constructed on prepared or previously placed slab foundations conforming to the dimensions and locations shown on the plans. All precast concrete sections necessary to build a completed structure shall be furnished. The different sections shall fit together readily. Joints between precast concrete risers and tops shall be full-bedded in cement mortar and shall: (1) be smoothed to a uniform surface on both interior and exterior of the structure or (2) utilize a rubber gasket per ASTM C443. The top of the upper precast concrete section shall be suitably formed and dimensioned to receive the metal frame and cover or grate, or other cap, as required. Provision shall be made for any connections for lateral pipe, including drops and leads that may be installed in the structure. The flow lines shall be smooth, uniform, and cause minimum resistance to flow. The metal or metal encapsulated steps that are embedded or built into the side walls shall be aligned and placed in accordance to ASTM C478. When a metal ladder replaces the steps, it shall be securely fastened into position.

751-3.5 Corrugated metal structures. Corrugated metal structures shall be prefabricated. All standard or special fittings shall be furnished to provide pipe connections or branches with the correct dimensions and of sufficient length to accommodate connecting bands. The fittings shall be welded in place to the metal structures. The top of the metal structure shall be designed so that either a concrete slab or metal collar may be attached to allow the fastening of a standard metal frame and grate or cover. Steps or ladders shall be furnished as shown on the plans. Corrugated metal structures shall be constructed on prepared foundations, conforming to the dimensions and locations as shown on the plans. When indicated, the structures shall be placed on a reinforced concrete base.

751-3.6 Inlet and outlet pipes. Inlet and outlet pipes shall extend through the walls of the structures a sufficient distance beyond the outside surface to allow for connections. They shall be cut off flush with

the wall on the inside surface of the structure, unless otherwise directed. For concrete or brick structures, mortar shall be placed around these pipes to form a tight, neat connection.

751-3.7 Placement and treatment of castings, frames, and fittings. All castings, frames, and fittings shall be placed in the positions indicated on the plans or as directed by the RPR, and shall be set true to line and elevation. If frames or fittings are to be set in concrete or cement mortar, all anchors or bolts shall be in place before the concrete or mortar is placed. The unit shall not be disturbed until the mortar or concrete has set.

When frames or fittings are placed on previously constructed masonry, the bearing surface of the masonry shall be brought true to line and grade and shall present an even bearing surface so the entire face or back of the unit will come in contact with the masonry. The unit shall be set in mortar beds and anchored to the masonry as indicated on the plans or as directed by the RPR. All units shall set firm and secure.

After the frames or fittings have been set in final position, the concrete or mortar shall be allowed to harden for seven (7) days before the grates or covers are placed and fastened down.

751-3.8 Installation of steps. The steps shall be installed as indicated on the plans or as directed by the RPR. When the steps are to be set in concrete, they shall be placed and secured in position before the concrete is placed. When the steps are installed in brick masonry, they shall be placed as the masonry is being built. The steps shall not be disturbed or used until the concrete or mortar has hardened for at least seven (7) days. After seven (7) days, the steps shall be cleaned and painted, unless they have been galvanized.

When steps are required with precast concrete structures they shall meet the requirements of ASTM C478. The steps shall be cast into the side of the sections at the time the sections are manufactured or set in place after the structure is erected by drilling holes in the concrete and cementing the steps in place.

When steps are required with corrugated metal structures, they shall be welded into aligned position at a vertical spacing of 12 inches (300 mm).

Instead of steps, prefabricated ladders may be installed. For brick or concrete structures, the ladder shall be held in place by grouting the supports in drilled holes. For metal structures, the ladder shall be secured by welding the top support to the structure and grouting the bottom support into drilled holes in the foundation or as directed by the RPR.

751-3.9 Backfilling.

a. After a structure has been completed, the area around it shall be backfilled with approved material, in horizontal layers not to exceed 8 inches (200 mm) in loose depth, and compacted to the density required in Item P-152. Each layer shall be deposited evenly around the structure to approximately the same elevation. The top of the fill shall meet the elevation shown on the plans or as directed by the RPR.

b. Backfill shall not be placed against any structure until approved by the RPR. For concrete structures, approval shall not be given until the concrete has been in place seven (7) days, or until tests establish that the concrete has attained sufficient strength to withstand any pressure created by the backfill and placing methods.

c. Backfill shall not be measured for direct payment. Performance of this work shall be considered an obligation of the Contractor covered under the contract unit price for the structure involved.

751-3.10 Cleaning and restoration of site. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt, and rubbish from the site. Surplus dirt may be deposited in embankments, shoulders, or as approved by the RPR. The Contractor shall restore all disturbed areas to their original condition. The Contractor shall remove all tools and equipment, leaving the entire site free, clear, and in good condition.

Attachment 4
Specifications

REFERENCES

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

ASTM International (ASTM)

ASTM A27	Standard Specification for Steel Castings, Carbon, for General Application
ASTM A47	Standard Specification for Ferritic Malleable Iron Castings
ASTM A48	Standard Specification for Gray Iron Castings
ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A283	Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A536	Standard Specification for Ductile Iron Castings
ASTM A897	Standard Specification for Austempered Ductile Iron Castings
ASTM C32	Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale)
ASTM C144	Standard Specification for Aggregate for Masonry Mortar
ASTM C150	Standard Specification for Portland Cement
ASTM C443	Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
ASTM C478	Standard Specification for Precast Reinforced Concrete Manhole Sections
ASTM C913	Standard Specification for Precast Concrete Water and Wastewater Structures.

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO M36	Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains
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END OF ITEM D-751

Item D-754 Concrete Gutters, Ditches, and Flumes

DESCRIPTION

754-1.1 This item shall consist of Portland cement concrete gutters, ditches, and flumes constructed in accordance with these specifications at the specified locations in accordance with the dimensions, lines, and grades as shown on the plans.

MATERIALS

754-2.1 Concrete. Plain and reinforced concrete shall meet the requirements of Item P-610.

754-2.2 Joints. Joint filler materials and premolded joint material shall conform to Item P-605.

CONSTRUCTION METHODS

754-3.1 Preparing subgrade. Excavation shall be made to the required width and depth, and the subgrade upon which the item is to be built shall be compacted to a firm uniform grade. All soft and unsuitable material shall be removed and replaced with suitable approved material. When required, a layer of approved granular material, compacted to the thickness indicated on the plans, shall be placed to form a subbase. The underlying course shall be checked and accepted by the RPR before placing and spreading operations are started.

754-3.2 Placing. The forms and the mixing, placing, finishing, and curing of concrete shall conform to the requirements of Item P-610 and the following requirements.

The concrete shall be tamped until it is consolidated and mortar covers the top surface. The surface of the concrete shall be floated smooth and the edges rounded to the radii shown on the plans. Before the concrete is given the final finishing, the surface shall be tested with a 12-foot (3.7-m) straightedge, and any irregularities of more than 1/4 inch (6 mm) in 12-foot (3.7-m) shall be eliminated.

The concrete shall be placed with dummy-grooved joints not to exceed 25 feet (7.5 m) apart and no section shall be less than 4 feet (1.2 m) long.

Expansion joints of the type called for in the plans shall be constructed to replace dummy groove joints at a spacing of approximately 100 feet (30 m). When the gutter is placed next to concrete pavement, expansion joints in the gutter shall be located opposite expansion joints in the pavement. When a gutter abuts a pavement or other structure, an expansion joint shall be placed between the gutter and the other structure.

Forms shall not be removed within 24 hours after the concrete has been placed. Minor defects shall be repaired with mortar containing one (1) part cement and two (2) parts fine aggregate.

Depositing, compacting, and finishing the item shall be conducted to build a satisfactory structure. If any section of concrete is found to be porous, or is otherwise defective, it shall be removed and replaced by the Contractor without additional compensation.

754-3.3 Backfilling. After the concrete has set sufficiently, the spaces adjacent to the structure shall be refilled to the required elevation with material specified on the plans and compacted by mechanical

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equipment to at least 90% of the maximum density as determined by ASTM D698. The in-place density shall be determined in accordance with ASTM D1556.

754-3.4 Cleaning and restoration of site. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt, and rubbish from the site. Surplus dirt may be deposited in embankments, shoulders, or as ordered by the RPR. The Contractor shall restore all disturbed areas to their original condition. The Contractor shall remove all tools and equipment, leaving the entire site free, clear and in good condition.

Performance of the work described in this section shall be considered as a subsidiary obligation of the Contractor, covered under the contract unit price for the structure.

REFERENCES

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

ASTM International (ASTM)

ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft ³ (600 kN-m/m ³))
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

END OF ITEM D-754

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SECTION 26 05 19

LOW-VOLTAGE CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Aluminum building wire rated 600 V or less.
3. Fire-alarm wire and cable.
4. Connectors, splices, and terminations rated 600 V and less.

1.02 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.01 COPPER BUILDING WIRE

- A. Description:** Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Belden Inc.
 2. Southwire Company.
- C. Standards:**
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 2. RoHS compliant.
 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors:** Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- E. Conductor Insulation:**
1. Type THHN and Type THWN-2: Comply with UL 83.
 2. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
 3. Type XHHW-2: Comply with UL 44.

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2.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For each conductor and cable indicating lead content.
 - 2. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 3.
 - 4. Product Data: For solvents and adhesives, indicating VOC content.
 - 5. Laboratory Test Reports: For solvents and adhesives, indicating compliance with requirements for low-emitting materials.
 - 6.
- C. Product Schedule: Indicate type, use, location, and termination locations.
- D. Description: Flexible, insulated and uninsulated, drawn aluminum current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- E. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Belden Inc.
 - 2. Southwire Company.
- F. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. RoHS compliant.
 - 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- G. Conductors: Aluminum, complying with ASTM B800 and ASTM B801.
- H. Conductor Insulation:
 - 1. Type THHN and Type THWN-2: Comply with UL 83.
 - 2. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
 - 3. Type XHHW-2: Comply with UL 44.

2.03 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

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1. 3M Electrical Products.
 2. ABB, Electrification Products Division.
 3. AFC Cable Systems; Atkore International.
- C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.
- D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
1. Material: Copper.
 2. Type: One hole with standard barrels.
 3. Termination: Compression.

PART 3 - EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders:
1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits:
1. Copper, Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- C. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

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3.03 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

3.04 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors].
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.05 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes grounding and bonding systems and equipment.
- B. Section includes grounding and bonding systems and equipment, plus the following special applications:
 - 1. Underground distribution grounding.
 - 2. Ground bonding common with lightning protection system.
 - 3. Foundation steel electrodes.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:

1.03 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article.
- B. Qualification Data: For testing agency and testing agency's field supervisor.
- C. Field quality-control reports.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
 - 1. Plans showing as-built, dimensioned locations of system described in "Field Quality Control" Article, including the following:
 - a. Test wells.
 - b. Ground rods.
 - c. Ground rings.
 - d. Grounding arrangements and connections for separately derived systems.
 - 2. Instructions for periodic testing and inspection of grounding features at test wells, ground rings, grounding connections for separately derived systems based on NETA MTS.

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- a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
- b. Include recommended testing intervals.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.02 MANUFACTURERS

2.03 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B3.
 - 2. Stranded Conductors: ASTM B8.
 - 3. Tinned Conductors: ASTM B33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

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Specifications

2.04 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- F. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.
- G. Conduit Hubs: Mechanical type, terminal with threaded hub.
- H. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- I. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- J. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.
- K. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.
- L. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.
- M. Straps: Solid copper, copper lugs. Rated for 600 A.
- N. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal one-piece clamp.
- O. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
- P. Water Pipe Clamps:
 - 1. Mechanical type, two pieces with zinc-plated bolts.
 - a. Material: Tin-plated aluminum.
 - b. Listed for direct burial.
 - 2. U-bolt type with malleable-iron clamp and copper ground connector.

2.05 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet.
- B. Ground Plates: 1/4 inch thick, hot-dip galvanized.

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PART 3 - EXECUTION

3.01 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install barecopper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 30 inches below grade.
- C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
 - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.
- D. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.02 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.03 GROUNDING SEPARATELY DERIVED SYSTEMS

- A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.04 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

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- C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.
- D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.05 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Armored and metal-clad cable runs.
 - 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 - 9. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- E. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.06 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

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Specifications

- B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
- D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- E. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

3.07 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

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- a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed the following values:
 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
 2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
 5. Substations and Pad-Mounted Equipment: 5 ohms.
 6. Manhole Grounds: 10 ohms.
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 05 43

UNDERGROUND DUCT AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Type EPEC raceways and fittings.
2. Type ERMCS raceways, elbows, couplings, and nipples.
3. Type ERMCS raceways, elbows, couplings, and nipples.
4. Type IMC raceways.
5. Type PVC raceways and fittings.
6. Type RTRC-BG raceways and fittings.
7. Fittings for conduit, tubing, and cable.
8. Electrically conductive corrosion-resistant compounds for threaded conduit.
9. Solvent cements.
10. Duct accessories.
11. Handholes and boxes for exterior underground wiring.
12. Manholes for exterior underground wiring.
13. Utility structure accessories.
14. Duct sealing.

B. Related Requirements:

1. Section 260519 "Low-Voltage for Electrical Power Conductors and Cables" specifies nonmetallic underground conduit with conductors (Type NUCC).
2. Section 260553 "Identification for Electrical Systems" specifies underground-line warning tape and concrete cable routing markers (warning planks).

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

B. Preinstallation Coordination Meeting(s): For underground ducts and raceways. Conduct meeting(s) as videoconference or at Project site before.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For concrete and steel used in precast concrete manholes and handholes, also include product certificates as required by ASTM C858.

B. Shop Drawings:

1. Electric Utility Duct Banks and Structures:

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Specifications

- a. Include plans, elevations, sections, and details, including attachments to other Work.
 - b. Indicate locations of private property boundaries and utility easements.
 - c. Include information required for approval by electric utility and for obtaining public space utility work permits.
 2. Precast or Factory-Fabricated Concrete Structures:
 - a. Include plans, elevations, sections, and details, including attachments to other Work.
 - b. Include duct entry provisions, including locations and duct sizes, and methods and materials for waterproofing duct entry locations.
 - c. Include reinforcement details.
 - d. Include frame and cover design and manhole chimneys.
 - e. Include ladder details.
 - f. Include grounding details.
 - g. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, sumps, and other accessories.
 - h. Include joint details.
 3. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:
 - a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
 - b. Include duct entry provisions, including locations and duct sizes, and methods and materials for waterproofing duct entry locations.
 - c. Include cover design.
 - d. Include grounding details.
 - e. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and other accessories.
 - C. Field Quality-Control Submittals:
 1. Field quality-control reports.
- 1.4 INFORMATIONAL SUBMITTALS
- A. Certificates:
 1. For concrete and steel used in precast concrete manholes and handholes, as required by ASTM C858.
 - B. Manufacturers' Published Instructions: Prepare and submit installation, testing, and operating instructions for product.
 - C. Source Quality-Control Submittals:
 1. Source quality-control reports.
- 1.5 REGULATORY AGENCY APPROVALS
- A. Shop Drawing submittals for electric utility duct banks and structures must be signed and sealed by qualified electrical professional engineer responsible for their preparation.

Attachment 4
Specifications

- B. Submit Shop Drawings for electric utility duct banks and structures for action by Architect prior to submitting for approval by electric utility.

PART 2 - PRODUCTS

2.1 TYPE EPEC RACEWAYS AND FITTINGS

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 651A and UL CCN EAZX.
- B. Schedule 40 Electrical HDPE Underground Conduit (EPEC-40):
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Blue Diamond Industries, LLC.
 - b. JM Eagle.
 - c. Petroflex North America.
 - 2. Dimensional Specifications: Schedule 40.
 - 3. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
- C. Schedule 80 Electrical HDPE Underground Conduit (EPEC-80):
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Blue Diamond Industries, LLC.
 - b. Petroflex North America.
 - c. Southwire Company, LLC.
 - 2. Dimensional Specifications: Schedule 80.
 - 3. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.2 TYPE PVC RACEWAYS AND FITTINGS

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 651 and UL CCN DZYR.
- B. Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:

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1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. ABB Electrification Installations Products.
 - b. Calconduit; Atkore International.
 - c. JM Eagle.
2. Dimensional Specifications: Schedule 40.
3. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
 - b. Markings: For use with maximum 90 deg C wire.

C. Schedule 80 Rigid PVC Conduit (PVC-80) and Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. ABB Electrification Installations Products.
 - b. Calconduit; Atkore International.
 - c. JM Eagle.
2. Dimensional Specifications: Schedule 80.
3. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
 - b. Markings: For use with maximum 90 deg C wire.

2.3 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

B. Metallic Fittings for Type ERM, Type IMC, Type PVC, Type EPEC, and Type RTRC Raceways:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. ABB Electrification Installations Products.
 - b. Appleton; Emerson Electric Co., Automation Solutions.
 - c. Crouse-Hinds; brand of Eaton, Electrical Sector.
2. General Characteristics: UL 514B and UL CCN DWTT.
3. Options:
 - a. Steel Coupling Method: Raintight compression coupling with distinctive color gland nut.
 - b. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
 - c. Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

Attachment 4
Specifications

2.4 ELECTRICALLY CONDUCTIVE CORROSION-RESISTANT COMPOUNDS FOR THREADED CONDUIT

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL Subject 2419 and UL CCN FOIZ.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. ABB Electrification Installations Products.

2.5 SOLVENT CEMENTS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: As recommended by conduit manufacturer in accordance with UL 514B and UL CCN DWTT.

2.6 DUCT ACCESSORIES

A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- a. ABB Electrification Installations Products.
- b. Allied Tube & Conduit; Atkore International.
- c. Cantex Inc.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics:

- a. ASTM C858 for design and manufacturing processes.
- b. SCTE 77.

B. Source Quality Control:

1. Precast Concrete Utility Structures: Test and inspect in accordance with ASTM C1037.

Attachment 4
Specifications

2. Polymer Concrete and Nonconcrete Handhole and Pull-Box Prototypes: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests must be for specified tier ratings of products supplied. Testing machine pressure gages must have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.
 - a. Tests of materials must be performed by independent testing agency.
- C. Precast Concrete Handholes and Boxes:
 1. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover must form top of enclosure and must have load rating consistent with that of handhole or box.
 2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Elmhurst-Chicago Stone Co.
 - b. Oldcastle Infrastructure Inc.; CRH Americas.
 - c. Rinker Group, Ltd.
 3. Configuration: Units must be designed for flush burial and have open bottom unless otherwise indicated.
 4. Frame and Cover:
 - a. Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
 - b. Cover Finish: Nonskid finish must have minimum coefficient of friction of 0.50.
 - c. Cover Legend: Molded lettering, "ELECTRIC".
 5. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
 - a. Extension must provide increased depth of 12 inch.
 - b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.
 6. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at installation location with ground-water level at grade.
 7. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus additional 12 inch vertically and horizontally to accommodate alignment variations.
 8. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
 9. Handholes 12 inch wide by 24 inch long and larger must have inserts for cable racks and pulling-in irons installed before concrete is poured.
- D. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover:
 1. Description: Molded of sand, concrete, and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or combination.

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Specifications

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Armorcast Products Company; brand of Hubbell Utility Solutions; Hubbell Incorporated.
 - b. MacLean Highline.
 - c. NewBasis.
 3. Configuration: Units must be designed for flush burial and have closed bottom unless otherwise indicated.
 4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and installed location.
 - a. Cover Finish: Nonskid finish must have minimum coefficient of friction of 0.50.
 - b. Cover Legend: Molded lettering, "ELECTRIC".
 5. Conduit Entrance Provisions: Conduit-terminating fittings must mate with entering ducts for secure, fixed installation in enclosure wall.
 6. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
 7. Duct Entrance Provisions: Duct-terminating fittings must mate with entering duct for secure, fixed installation in enclosure wall.
 8. Handholes 12 inch wide by 24 inch long and larger must have factory-installed inserts for cable racks and pulling-in irons.
 9. Options:
 - a. Color: Gray.
- E. High-Density Polyethylene (HDPE) Boxes:
1. Description: Injection molded of HDPE or copolymer-polypropylene. Cover must be made of polymer concrete.
 2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Nordic Fiberglass, Inc.
 - b. Oldcastle Infrastructure Inc.; CRH Americas.
 - c. PenCell Plastics; brand of Hubbell Utility Solutions; Hubbell Incorporated.
 3. Configuration: Units must be designed for flush burial and have open bottom unless otherwise indicated.
 4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 - a. Cover Finish: Nonskid finish must have minimum coefficient of friction of 0.50.
 - b. Cover Legend: Molded lettering, "ELECTRIC".

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Specifications

5. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
6. Duct Entrance Provisions: Duct-terminating fittings must be installed perpendicular to box wall and mate with entering duct for secure, fixed installation in enclosure wall without putting stress on box wall or fitting.
7. Options:
 - a. Color: Green.

2.8 MANHOLES FOR EXTERIOR UNDERGROUND WIRING

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics:
 - a. ASTM C858 for design and manufacturing processes.
 - b. SCTE 77.

B. Precast Concrete Manholes:

1. Description: One-piece units and units with interlocking mating sections, complete with accessories, hardware, and features.
2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Carder Concrete Products.
 - b. Elmhurst-Chicago Stone Co.
 - c. Oldcastle Infrastructure Inc.; CRH Americas.
3. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus additional 12 inch vertically and horizontally to accommodate alignment variations.
4. Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
5. Ground Rod Sleeve: Provide 3 inch PVC sleeve in manhole floors 2 inch from wall adjacent to, but not underneath, duct entering structure.
6. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at installation location with ground-water level at grade.
7. Source Quality Control: Test and inspect in accordance with ASTM C1037.

C. Cast-in-Place Concrete Manholes:

1. Description: Underground utility structures, constructed in place, complete with accessories, hardware, and features. Include concrete knockout panels for duct entrance and sleeve for ground rod.

Attachment 4
Specifications

2. Additional Criteria: Comply with Section 033000 "Cast-in-Place Concrete."

2.9 UTILITY STRUCTURE ACCESSORIES

- A. Description: Utility equipment and accessory items used for utility structure access and utility support, listed and labeled for intended use and application, and complying with the following local utility company requirements:
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. BILCO Company (The).
 2. Campbell Foundry Company.
 3. Carder Concrete Products.
- C. Manhole Frames, Covers, and Chimney Components: Comply with structural design loading specified for manhole.
1. Frame and Cover: Weatherproof, gray cast iron complying with ASTM A48/A48M, Class 30B with milled cover-to-frame bearing surfaces; diameter, 26 inch.
 - a. Cover Finish: Nonskid finish must have minimum coefficient of friction of 0.50.
 - b. Special Covers: Recess in face of cover designed to accept finish material in paved areas.
 2. Cover Legend: Cast in; selected to suit system.
 - a. Legend: "ELECTRIC."
 3. Manhole Chimney Components: Precast concrete rings with dimensions matched to those of roof opening.
 - a. Mortar for Chimney Ring and Frame and Cover Joints: Comply with ASTM C270, Type M, except for quantities less than 2.0 cu. ft where packaged mix complying with ASTM C387/C387M, Type M, may be used.
 - b. Seal joints watertight using preformed plastic or rubber complying with ASTM C990. Install sealing material in accordance with sealant manufacturers' published instructions.
- D. Manhole Sump Frame and Grate: ASTM A48/A48M, Class 30B, gray cast iron.
- E. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2 inch diameter eye, and 1-by-4 inch bolt.
1. Working Load Embedded in 6 inch, 4000 psi Concrete: 13,000 lbf minimum tension.
- F. Pulling Eyes in Nonconcrete Walls: Eyebolt with reinforced fastening, 1-1/4 inch diameter eye, rated 2500 lbf minimum tension.
- G. Pulling-in and Lifting Irons in Concrete Floors: 7/8 inch diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; fastened to reinforcing rod; and with exposed triangular opening.

Attachment 4
Specifications

1. Ultimate Yield Strength: 40,000 lbf shear and 60,000 lbf tension.
 - H. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2 inch ID by 2-3/4 inch deep, flared to 1-1/4 inch minimum at base.
 1. Tested Ultimate Pullout Strength: 12,000 lbf minimum.
 - I. Ground Rod Sleeve: 3 inch PVC sleeve in manhole floors 2 inch from wall adjacent to, but not underneath, ducts routed from facility.
 - J. Steel Cable Rack Assembly: Hot-rolled galvanized, except insulators.
 1. Stanchions: T-section or channel with provisions to connect to other sections or channels to form continuous unit; 1-1/2 inch in width by nominal 24 inch long; punched with 14 hook holes on 1-1/2 inch centers for cable-arm attachment.
 2. Arms: 1-1/2 inch wide, lengths ranging from 3 inch with 450 lb minimum capacity to 18 inch with 250 lb minimum capacity. Arms must have slots along full length for cable ties and be arranged for secure mounting in horizontal position at vertical locations on stanchions.
 3. Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.
 - K. Nonmetallic Cable Rack Assembly: Components fabricated from nonconductive, fiberglass-reinforced polymer.
 1. Stanchions: Nominal 36 inch high by 4 inch wide, with provisions to connect to other sections to form continuous unit, with minimum of nine holes for arm attachment.
 2. Arms: Arranged for secure, drop-in attachment in horizontal position at locations on cable stanchions, and capable of being locked in position. Arms must be available in lengths ranging from 3 inch with 450 lb minimum capacity to 20 inch with 250 lb minimum capacity. Top of arm must be nominally 4 inch wide, and arm must have slots along full length for cable ties.
 - L. Fixed Manhole Ladders: Arranged for attachment to roof or wall of manhole. Ladder and mounting brackets and braces must be fabricated from nonconductive, structural-grade, fiberglass-reinforced resin.
 - M. Portable Manhole Ladders: UL-listed, heavy-duty wood specifically designed for portable use for access to electrical manholes. Length must be not less than distance from deepest manhole floor to grade plus 36 inch. Two ladder(s) are required.
 - N. Cover Hooks: Heavy duty, designed for lifts 60 lbf and greater. Two ladders(s) are required.
- 2.10 DUCT SEALING
- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. ABB Electrification Installations Products.
 2. American Polywater Corporation.
 3. CommScope, Inc.

Attachment 4
Specifications

- B. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Compound must be capable of withstanding temperature of 300 deg F without slump and adhering to clean surfaces of plastic ducts, metallic conduit, conduit and duct coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals. Duct sealing compound must be removable without damaging ducts or cables.
- C. Inflatable Duct-Sealing System: Wraparound inflatable bladder that seals ducts that are empty or containing conductors against air and water infiltration. System is suitable for use in steel, plastic, or concrete ducts and penetrations.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate layout and installation of duct, duct bank, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in field. Notify Architect if there is conflict between areas of excavation and existing structures or archaeological sites to remain.
- B. Coordinate elevations of duct and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to manholes and handholes, and as approved by Architect.

3.2 SELECTION OF UNDERGROUND DUCTS

- A. Duct for Electrical Feeders: PVC-40, concrete encased unless otherwise indicated.
- B. Duct for Electrical Branch Circuits: PVC-40, direct buried unless otherwise indicated.
- C. Bored Underground Duct: EPEC-40 unless otherwise indicated.
- D. Underground Ducts Crossing Paved Paths ,Walks and Driveways: PVC-40 encased in reinforced concrete.
- E. Underground Ducts Crossing Roadways: PVC-40, encased in reinforced concrete.
- F. Stub-ups: Concrete encased, IMC.

3.3 SELECTION OF UNDERGROUND ENCLOSURES

- A. Handholes and Boxes:
 - 1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete, AASHTO HB 17, H-10 structural load rating.
 - 2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-10 structural load rating.

Attachment 4
Specifications

3. Units in Sidewalk and Similar Applications with Safety Factor for Nondeliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-10 structural load rating.
4. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested in accordance with SCTE 77 with 3000 lbf vertical loading.
5. Cover design load must not exceed load rating of handhole or box.

B. Manholes: Precast concrete.

3.4 EARTHWORK

- A. Excavation and Backfill: Comply with Section 312000 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restoration: Restore area immediately after backfilling is completed.
- C. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- D. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section 329200 "Turf and Grasses" and Section 329300 "Plants."
- E. Cut and patch existing pavement in path of underground duct, duct bank, and underground structures in accordance with "Cutting and Patching" Article in Section 017300 "Execution."

3.5 INSTALLATION OF DUCTS AND DUCT BANKS

A. Reference Standards:

1. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NEMA TCB 2 for installation of underground ducts and duct banks.
2. Consult Architect for resolution of conflicting requirements.

B. Special Techniques:

1. Where indicated on Drawings, install duct, spacers, and accessories into duct-bank configuration shown. Duct installation requirements in this Section also apply to duct bank.
2. Steel raceway, bends, and fittings in single duct run or duct bank must be of same type.
3. Slope: Pitch duct minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope duct from high point between two manholes to drain in both directions.
4. Expansion and Deflection Fittings: Install expansion and deflection fitting in each duct in area of disturbed earth adjacent to manhole or handhole.
5. Install expansion fitting near center of straight line duct with calculated expansion of more than 3/4 inch.
6. Curves and Bends:

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Specifications

- a. Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with minimum radius of 48 inch, both horizontally and vertically, at other locations unless otherwise indicated.
 - b. Field bending must be in accordance with NFPA 70 minimum radii requirements, except bends over 45 degrees must be made with minimum radius of 48 inch. Use only equipment specifically designed for material and size involved. Use PVC heating bender for bending PVC conduit.
 - c. Duct must have maximum of 180 degrees of bends between pull points.
7. Joints: Use solvent-cemented joints in nonmetallic duct and fittings and make watertight in accordance with manufacturer's published instructions. Stagger couplings so those of adjacent duct do not lie in same plane. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with minimum 3 inch of concrete for minimum of 12 inch on each side of coupling.
 - a. Install insulated grounding bushings on steel raceway terminations that are less than 12 inch below grade or floor level and do not terminate in hubs.
8. Installation Adjacent to High-Temperature Steam Lines: Where duct is installed parallel to underground steam lines, perform calculations showing duct will not be subject to environmental temperatures above 104 deg F. Where environmental temperatures are calculated to rise above 104 deg F, and anywhere duct crosses above underground steam line, install insulation blankets listed for direct burial to isolate duct bank from steam line to maintain maximum environmental temperature of 104 deg F.
9. End Bell Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inch o.c. for 5 inch duct, and vary proportionately for other duct sizes.
 - a. Begin change from regular spacing to end-bell spacing 10 ft from end bell, without reducing duct slope and without forming trap in line.
 - b. Grout end bells into structure walls from both sides to provide watertight entrances.
10. Duct Terminators for Entrances to Cast-in-Place Manholes and Concrete Handholes: Use manufactured, cast-in-place duct terminators, with entrances into structure spaced approximately 6 inch o.c. for 4 inch duct, and vary proportionately for other duct sizes.
 - a. Begin change from regular spacing to terminator spacing 10 ft from terminator, without reducing duct line slope and without forming trap in line.
11. Building Wall Penetrations: Make transition from underground duct to steel raceway at least 10 ft outside building wall, without reducing duct line slope away from building and without forming trap in line. Use fittings manufactured for transition to steel raceway type installed. Install steel raceway penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
12. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15 psig hydrostatic pressure.
13. Pulling Cord: Install 200 lbf test nylon cord in empty ducts.
14. Concrete-Encased Ducts and Duct Bank:

Attachment 4
Specifications

- a. Excavate trench bottom to provide firm and uniform support for duct. Prepare trench bottoms as specified in Section 312000 "Earth Moving" for pipes 6 inch or less in nominal diameter.
- b. Width: Excavate trench 3 inch wider than duct on each side.
- c. Depth: Install so top of duct envelope is at least 24 inch below finished grade in areas not subject to deliberate traffic, and at least 30 inch below finished grade in deliberate traffic paths for vehicles unless otherwise indicated. Install so top of duct envelope is below local frost line.
- d. Support duct on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
- e. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 ft of duct. Place spacers within 24 inch of duct ends. Stagger spacers approximately 6 inch between tiers. Secure spacers to earth and to duct to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
- f. Minimum Space between Ducts: 3 inch between edge of duct and exterior envelope wall, 2 inch between ducts for like services, and 4 inch between power and communications ducts.
- g. Stub-ups to Outdoor Equipment: Extend concrete-encased steel raceway horizontally minimum of 60 inch from edge of equipment base.
 - 1) Stub-ups must terminate in coupling installed flush with finished floor and minimum 3 inch from conduit side to edge of slab.
- h. Stub-ups to Indoor Equipment: Extend concrete-encased steel raceway horizontally minimum of 60 inch from edge of wall. Install insulated grounding bushings on terminations at equipment.
 - 1) Stub-ups must terminate in coupling installed flush with finished floor and no less than 3 inch from conduit side to edge of slab.
- i. Reinforcement: Reinforce concrete-encased duct where crossing disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
- j. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
- k. Concrete Cover: Install minimum of 3 inch of concrete cover between edge of duct to exterior envelope wall, 2 inch between duct of like services, and 4 inch between power and communications ducts.
- l. Place minimum 6 inch of engineered fill above concrete encasement of duct.
- m. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in Section 033000 "Cast-in-Place Concrete." Place concrete carefully during pours to prevent voids under and between duct and at exterior surface of envelope. Do not allow heavy mass of concrete to fall directly onto ducts. Allow concrete to flow around duct and rise up in middle, uniformly filling open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-installation application.

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Specifications

15. Direct-Buried Duct and Duct Bank:

- a. Excavate trench bottom to provide firm and uniform support for duct. Comply with requirements in Section 312000 "Earth Moving" for preparation of trench bottoms for pipes less than 6 inch in nominal diameter.
- b. Width: Excavate trench 3 inch wider than duct on each side.
- c. Depth: Install top of duct at least 36 inch below finished grade unless otherwise indicated.
- d. Set elevation of top of duct bank below frost line.
- e. Place minimum 3 inch of sand as bed for duct. Place sand to minimum of 6 inch above top level of duct.
- f. Support ducts on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
- g. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 ft of duct. Place spacers within 24 inch of duct ends. Stagger spacers approximately 6 inch between tiers. Secure spacers to earth and to ducts to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
- h. Install duct with minimum of 3 inch between ducts for like services and 6 inch between power and communications duct.
- i. After installing first tier of duct, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inch over duct and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Section 312000 "Earth Moving" for installation of backfill materials.

- 16. Underground-Line Warning Tape: Bury nonconducting underground line specified in Section 260553 "Identification for Electrical Systems" no less than 12 inch above concrete-encased duct and duct banks and approximately 12 inch below grade. Align tape parallel to and within 3 inch of centerline of duct bank. Provide additional warning tape for each 12 inch increment of duct-bank width over nominal 18 inch. Space additional tapes 12 inch apart, horizontally across width of ducts.
- 17. Ground ducts and duct banks in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

3.6 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

A. Reference Standards:

- 1. Precast Concrete Handholes: Comply with ASTM C891 unless otherwise indicated.
- 2. Consult Architect for resolution of conflicting requirements.

B. Special Techniques:

Attachment 4
Specifications

1. Cast-in-Place Manholes:
 - a. Finish interior surfaces with smooth-troweled finish.
 - b. Knockouts for Future Duct Connections: Form and pour concrete knockout panels 1-1/2 to 2 inch thick, arranged as indicated.
 - c. Comply with requirements in Section 033000 "Cast-in-Place Concrete" for cast-in-place concrete, formwork, and reinforcement.
2. Precast Concrete Handholes and Manholes:
 - a. Install units level and plumb and with orientation and depth coordinated with connecting duct to minimize bends and deflections required for proper entrances.
 - b. Unless otherwise indicated, support units on level bed of crushed stone or gravel graded from 1 inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
 - c. Field-cut openings for conduits in accordance with enclosure manufacturer's published instructions. Cut wall of enclosure with tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
3. Elevations:
 - a. Manhole Roof: Install with rooftop at least 15 inch below finished grade.
 - b. Manhole Frame: In paved areas and trafficways, set frames flush with finished grade. Set other manhole frames 1 inch above finished grade.
 - c. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.
 - d. Where indicated, cast handhole cover frame integrally with handhole structure.
4. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.
5. Manhole Access: Circular opening in manhole roof; sized to match cover size.
 - a. Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.
 - b. Install chimney, constructed of precast concrete collars and rings, and cast-iron frame to connect cover with manhole roof opening. Provide moisture-tight joints and waterproof grouting for frame and chimney.
6. Waterproofing: Apply waterproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. Waterproofing materials and installation are specified in. After duct has been connected and grouted, and before backfilling, waterproof joints and connections, and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.
7. Dampproofing: Apply dampproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. Dampproofing materials and installation are specified in Section 071113 "Bituminous Dampproofing." After ducts are connected and grouted, and before backfilling, dampproof joints and connections, and touch up abrasions and scars. Dampproof exterior of manhole chimneys after mortar has cured at least three days.

Attachment 4
Specifications

8. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.
9. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.
10. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inch for manholes and 2 inch for handholes, for anchor bolts installed in field. Use minimum of two anchors for each cable stanchion.
11. Ground manholes, handholes, and boxes in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

3.7 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Reference Standards:

1. Consult Architect for resolution of conflicting requirements.

B. Special Techniques:

1. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of duct, and seal joint between box and extension as recommended by manufacturer.
2. Unless otherwise indicated, support units on level bed of crushed stone or gravel, graded from 1/2 inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
3. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch above finished grade.
4. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.
5. Field cut openings for duct in accordance with enclosure manufacturer's published instructions. Cut wall of enclosure with tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
6. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour concrete ring encircling, and in contact with enclosure entry, and with top surface screeded to top of box cover frame. Bottom of ring must rest on compacted earth.
 - a. Concrete: 3000 psi, 28-day strength, complying with Section 033000 "Cast-in-Place Concrete," with troweled finish.
 - b. Dimensions: 10 inch wide by 12 inch deep.
7. Ground handholes and boxes in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

Attachment 4
Specifications

3.8 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank, and utility structures.
2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide minimum 12 inch long mandrel equal to duct size minus 1/4 inch. If obstructions are indicated, remove obstructions and retest.
3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Nonconforming Work:

1. Underground ducts, raceways, and structures will be considered defective if they do not pass tests and inspections.
2. Correct deficiencies and retest as specified above to demonstrate compliance.

C. Assemble and submit test and inspection reports.

D. Manufacturer Services:

1. Engage factory-authorized service representative to support field tests and inspections.

END OF SECTION

SECTION 26 05 44

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Round sleeves.
 - 2. Rectangular sleeves.
 - 3. Sleeve seal systems.
 - 4. Grout.
 - 5. Pourable sealants.
 - 6. Foam sealants.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.01 ROUND SLEEVES

- A. Wall Sleeves, Steel:
 - 1. Description: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends and integral water stop.
- B. Pipe Sleeves, PVC:
 - 1. Description: ASTM D1785, Schedule 40.
- C. Sheet Metal Sleeves, Galvanized Steel, Round:
 - 1. Description: Galvanized-steel sheet; thickness not less than 0.0239-inch; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

Attachment 4
Specifications

2.02 RECTANGULAR SLEEVES

A. Sheet Metal Sleeves, Galvanized Steel, Rectangular:

1. Description:

- a. Material: Galvanized sheet steel.
- b. Minimum Metal Thickness:
 - 1) For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness must be 0.052 inch.
 - 2) For sleeve cross-section rectangle perimeter not less than 50 inches or with one or more sides larger than 16 inches, thickness must be 0.138 inch.

2.03 SLEEVE SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable or between raceway and cable.

- 1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- 2. Pressure Plates: Carbon steel Fiber-reinforced plastic.
- 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.04 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

- 1. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- 2. Design Mix: 5000-psi, 28-day compressive strength.
- 3. Packaging: Premixed and factory packaged.

2.05 POURABLE SEALANTS

A. Description: Single-component, neutral-curing elastomeric sealants of grade indicated below.

- 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

2.06 FOAM SEALANTS

A. Description: Multicomponent, liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam. Foam expansion must not damage cables or crack penetrated structure.

Attachment 4
Specifications

PART 3 - EXECUTION

3.01 INSTALLATION OF SLEEVES FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Sleeves for Conduits Penetrating Above-Grade, Non-Fire-Rated, Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - b. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless sleeve seal system is to be installed or seismic criteria require different clearance.
 - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.
- C. Sleeves for Conduits Penetrating Non-Fire-Rated Wall Assemblies:
 - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 2. Seal space outside of sleeves with approved joint compound for wall assemblies.
- D. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- E. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seal systems. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- F. Underground, Exterior-Wall and Floor Penetrations:
 - 1. Install steel pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve seal system. Grout sleeve into wall or floor opening.

Attachment 4
Specifications

3.02 INSTALLATION OF RECTANGULAR SLEEVES AND SLEEVE SEALS

- A. Install sleeves in existing walls without compromising structural integrity of walls. Do not cut structural elements without reinforcing the wall to maintain the designed weight bearing and wall stiffness.
- B. Install conduits and cable with no crossings within the sleeve.
- C. Fill opening around conduits and cables with expanding foam without leaving voids.
- D. Provide metal sheet covering at both wall surfaces and finish to match surrounding surfaces. Metal sheet must be same material as sleeve.

3.03 INSTALLATION OF SLEEVE SEAL SYSTEMS

- A. Install sleeve seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:

- 1. Color and legend requirements for raceways, conductors, warning labels and signs.
- 2. Labels.
- 3. Bands and tubes.
- 4. Tapes and stencils.
- 5. Tags.
- 6. Signs.
- 7. Cable ties.
- 8. Paint for identification.
- 9. Fasteners for labels and signs.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.

Attachment 4
Specifications

- E. Comply with NFPA 70E.
- F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.02 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 - 1. Color shall be factory applied.
 - 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 3. Colors for 240-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - 4. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - 5. Color for Neutral: White or gray.
 - 6. Color for Equipment Grounds: Bare copper.
 - 7. Colors for Isolated Grounds: Green two or more yellow stripes.
- C. Warning Label Colors:
 - 1. Identify system voltage with black letters on an orange background.
- D. Warning labels and signs shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

Attachment 4
Specifications

E. Equipment Identification Labels:

1. Black letters on a white field.

2.03 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- a. Brady Corporation.
- b. Panduit Corp.
- c. Seton Identification Products; a Brady Corporation company.

B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameter and that stay in place by gripping action.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- a. Brady Corporation.
- b. Panduit Corp.
- c. Seton Identification Products; a Brady Corporation company.

C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil-thick, polyester flexible label with acrylic pressure-sensitive adhesive.

1. Manufacturers: Subject to compliance with requirements,:

- a. Brady Corporation.
- b. Panduit Corp.
- c. Seton Identification Products; a Brady Corporation company.

2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.

3. Marker for Labels: Permanent, waterproof, black ink marker recommended by tag manufacturer.

D. Self-Adhesive Labels: Polyester, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- a. Brady Corporation.

Attachment 4
Specifications

- b. Panduit Corp.
- c. Seton Identification Products; a Brady Corporation company.

2. Minimum Nominal Size:

- a. 1-1/2 by 6 inches for raceway and conductors.
- b. 3-1/2 by 5 inches for equipment.
- c. As required by authorities having jurisdiction.

2.04 BANDS AND TUBES

- A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameter and that stay in place by gripping action.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- a. Brady Corporation.
- b. Panduit Corp.

- B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameters of and shrunk to fit firmly around item being identified. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- a. Brady Corporation.
- b. Panduit Corp.

2.05 SIGNS

- A. Baked-Enamel Signs:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- a. Carlton Industries, LP.
- b. emedco.
- c. Marking Services, Inc.

- 2. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
- 3. 1/4-inch grommets in corners for mounting.
- 4. Nominal Size: 7 by 10 inches.

- B. Laminated Acrylic or Melamine Plastic Signs:

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Specifications

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Brady Corporation.
 - b. emedco.
 - c. Marking Services, Inc.
2. Engraved legend.
3. Thickness:
 - a. For signs up to 20 sq. in., minimum 1/16 inch thick.
 - b. For signs larger than 20 sq. in., 1/8 inch thick.
 - c. Engraved legend with black letters on white face.
 - d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting.
 - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.06 CABLE TIES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. Hellermann Tyton.
 2. Marking Services, Inc.
 3. Panduit Corp.
- B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.
 3. Temperature Range: Minus 40 to plus 185 deg F.
 4. Color: Black, except where used for color-coding.
- C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.
 3. Temperature Range: Minus 40 to plus 185 deg F.
 4. Color: Black.
- D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
 1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 Deg F according to ASTM D638: 7000 psi.
 3. UL 94 Flame Rating: 94V-0.
 4. Temperature Range: Minus 50 to plus 284 deg F.
 5. Color: Black.

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Specifications

2.07 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.
- H. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- I. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- J. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.

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Specifications

- L. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- M. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. "EMERGENCY POWER."
 - 2. "POWER."
 - 3. "UPS."
 - 4. .
- N. Vinyl Wraparound Labels:
 - 1. Secure tight to surface at a location with high visibility and accessibility.
 - 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- O. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.
- P. Self-Adhesive Wraparound Labels: Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
- Q. Self-Adhesive Labels:
 - 1. On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
- R. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.
- S. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.
- T. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.
- U. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
 - 1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- V. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.
- W. Underground Line Warning Tape:
 - 1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

Attachment 4
Specifications

2. Install underground-line warning tape for direct-buried cables and cables in raceways.
- X. Baked-Enamel Signs:
1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch-high sign; where two lines of text are required, use signs minimum 2 inches high.
- Y. Metal-Backed Butyrate Signs:
1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch-high sign; where two lines of text are required, use signs minimum 2 inches high.
- Z. Laminated Acrylic or Melamine Plastic Signs:
1. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch-high sign; where two lines of text are required, use signs minimum 2 inches high.
- AA. Cable Ties: General purpose, for attaching tags, except as listed below:
1. Outdoors: UV-stabilized nylon.
 2. In Spaces Handling Environmental Air: Plenum rated.
- 3.02 IDENTIFICATION SCHEDULE
- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:
1. "EMERGENCY POWER."
 2. "POWER."
 3. "UPS."
- D. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use with the conductor or cable designation, origin, and destination.

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Specifications

- E. Control-Circuit Conductor Termination Identification: For identification at terminations, provide heat-shrink preprinted tubes with the conductor designation.
- F. Auxiliary Electrical Systems Conductor Identification: Marker tape that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
- G. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- H. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- I. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive equipment labels or Baked-enamel warning signs or Metal-backed, butyrate warning signs.
 - 1. Apply to exterior of door, cover, or other access.
 - 2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
 - a. Power-transfer switches.
 - b. Controls with external control power connections.
- K. Arc Flash Warning Labeling: Self-adhesive labels.
- L. Operating Instruction Signs: Self-adhesive labels or Baked-enamel warning signs Metal-backed, butyrate warning signs or Laminated acrylic or melamine plastic signs.
- M. Emergency Operating Instruction Signs: Self-adhesive labels or Baked-enamel warning signs or Metal-backed, butyrate warning signs Laminated acrylic or melamine plastic signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.
- N. Equipment Identification Labels:
 - 1. Indoor Equipment: Self-adhesive label or Baked-enamel signs Metal-backed butyrate signs or Laminated acrylic or melamine plastic sign.
 - 2. Outdoor Equipment: Laminated acrylic or melamine sign.

END OF SECTION