

Request for Proposals
Bid Number: 21-03-2447LE

The Navajo Nation Office of the Controller - Purchasing Department, and Navajo Division of Transportation - Department of Roads, are accepting qualifications and sealed bids for route N7128-Pueblo Pintado, NM: Chip seal repair, address drainage issues, seeding, and permanent signage, on and off for approximately 2.0 miles.

Contacts for a bid packet are L. Etsitty, Navajo Nation Purchasing Department, www.nnooc.org, (928) 871-6317; or, D. Jackson, Navajo DOT, Department of Roads, djackson@navajodot.org, (505)371-8364.

The closing date for this project is April 9, 2021 at 2:00pm, Window Rock, AZ, time. Any RFPs received after the closing date will be considered non-responsive and returned to the sender. No facsimile or emailed RFPs will be accepted.

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Section 1 - Overview

1. Request for Proposal (RFP) Packet – The Instructions on the proposal preparation, required documents, eligibility requirements, and evaluation criteria are provided herein.

The RFP package may be obtained by downloading from the Navajo Division of Transportation website and/or the Navajo Nation Purchasing Department’s website. **No printouts of the RFP will be given.** The websites to download the RFP are:

- Navajo DOT - <http://www.navajodot.org/RFP.aspx>
- Purchasing Department’s website - <http://www.nnooc.org/RFPs-Advertisements.html>

Note: If a firm download’s from the websites given above or gets a copy of the RFP from another source other than from Mr. Jackson, please contact Mr. Jackson by email so that if an addendum(s) or questions are issued/answered, your firm will receive the information. Regardless of how a firm receives their copy of the RFP, email Don Jackson at, djackson@navajodot.org.

2. General Scope of Work (SOW) – This project is to conduct a routine road maintenance program/maintenance activity on route N7128-Pueblo Pintado, with the SOW: Chip seal repair, address drainage issues (minor), seeding (minor), and permanent signage (minor), on and off for approximately 2.0 miles. Specifications for the project is per FP-14. Ground disturbance will be intensive and extensive. The Navajo Nation is the lead agency and is using Navajo Nation Road Funds for the project.

In addition to a Firm’s bid submission, this project is also qualifications based, per the ‘*Rating System and Evaluation Criteria*’ located on page 4 of the RFP.

3. Schedule of Activities: Note, all times Window Rock, AZ, time, 2019.

<u>Activities:</u>	<u>Due Date:</u>
i. Advertised Period	March 25 to April 3, 2021.
ii. Deadline to Submit RFP Questions	April 4, by 12:00pm.
iii. Final Response to Written RFP Questions	April 7, by 12:00pm.
iv. RFP Submittal Deadline	April 9, by 2:00pm.
v. Evaluation of proposals	April.
vi. Final Selection of Firm	April.

4. Inquiries – Questions regarding this RFP must be submitted by email to the Project Contact listed below. Written questions as to the intent or clarity of this RFP can be submitted to the Project Contact until 12:00pm (Window Rock, AZ time), April 4. Written responses to written questions and any RFP amendments will be distributed by email to all parties who obtained an RFP package and have notified L. Etsitty, NN Purchasing Department, or D. Jackson, Navajo DOT. No further questions, in any form, will be entertained after the April 4 deadline. Project Contact: D. Jackson, Engineer, Navajo Division of Transportation, Telephone: (505) 371-8364, and Email: djackson@navajodot.org.

5. Proposal Submittal Deadline – Proposals must be physically submitted to the following address by April 9, no later than 2:00 PM (local Window Rock, AZ time).

Navajo Division of Transportation
Attention: Don Jackson
Navajo Transportation Complex
#16 Old Coal Mine Road
Mentmore, NM 87319

Late, facsimiled or e-mailed proposals will not be accepted. These will be returned to the firm un-rated and firms responding in such fashion shall be considered non-responsive.

6. Addendum to the RFP – In the event it becomes necessary to revise any part of the RFP, Navajo DOT shall issue a written addendum on the specifics of the change and inform all concerned. **Addendums will also be made available for download from the Navajo DOT website (www.navajodot.org).** The firm shall acknowledge receipt and review of the addendum(s) under the Letter of Interest.

7. Rejections of Proposals – The Navajo DOT reserves the right to reject any or all proposals and to waive informalities in the proposals received whenever such a rejection or waiver is in the best interest of the Navajo nation.

8. Proprietary Information – Any restrictions on the use of data contained within any proposals must be clearly stated in the proposal. Each page that contains proprietary information must be stamped or imprinted “Proprietary”.

9. Ownership of Proposals – All materials submitted with the RFP accepted for rating shall become the property of Navajo DOT and not returned to the firm. The Navajo DOT has the right to use any or all information presented in the RFP subject to limitations outlined in Paragraph 8, above. Disqualifications or non-selection of a firm or proposal does not eliminate this right.

10. Cost Incurred – The Navajo DOT is not liable for any cost incurred by the firm prior to issuance of a signed contract for services.

11. Contractual Obligation – The contents of the proposal may become part of contractual obligations of the contract award. Failure of the firm to accept these obligations may result in cancellation of the award for services.

12. Evaluation Criteria – Proposals accepted for rating shall be evaluated based on the criteria and point system set forth in Part 12(a) that follows.

Part 12(a) – Rating System and Evaluation Criteria

Each proposal will be evaluated and rated as follows. Descriptions of the components are provided in Section 3 – Proposal Content and Evaluation Criteria

- | | |
|--|-----------|
| 1. Overall professionalism and conciseness of proposal. | 15 points |
| 2. Qualifications & Experience, of firm & project team. | 30 Points |
| 3. Approach to Scope of Work, including FP-14 Specifications, and to include Project Understanding & Project Scheduling. | 40 Points |
| 4. Listing of Equipment for SOW; and, Product Certifications as Stated in Specifications. | 15 Points |

Total Points	100 Points
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A Short List of qualified candidates will be determined from the 100 points. To get to the Short List, the firms must receive a minimum of 70 points.

Preference Points: If a Priority 1 firm makes the Short List, that firm will receive an additional ten (10) points added to their score ranking. If a Priority 2 firm makes the Short List, that firm will receive an additional five (5) points added to their score ranking. Non-priority firms do not receive additional points. This is a requirement from the Navajo Nation Business Opportunity Act. Firm must provide documentation per the Business Regulatory Department as prioritized under Section 204 (A) (1) and (2) of the revised Navajo Nation Business Opportunity Act, of its Priority 1 or 2 status.

It is intent of Navajo DOT to rank the firms according to the responses submitted. The Navajo DOT reserves the right to conduct detailed interviews in person, of qualified/responsive firms, if warranted.

13. Standard Contract – The Navajo Nation reserves the right to incorporate contract provisions which are based on applicable requirements, such as, Navajo Nation Laws, State, and local requirements, etc. into the contract documents. This includes provisions of the Navajo Business and Procurement Act, at 12 N. N. C. § 1501 et Seq., and the Navajo Business Opportunity Act, at 5 N. N. C. § 201 et Seq.

14. Taxes – All work performed and services provided within the territorial jurisdiction of the Navajo Nation is subject to the six percent (6 %) Navajo Sales Tax (24 N. N. C. § 601 et Seq.).

15. Insurance – The Navajo Nation will require the successful firm, at its sole expense, to procure and maintain adequate and sufficient insurance for all potential liability, such as, commercial general liability, automobile liability, worker’s compensation, performance & payment bonds, bid bond, etc. The general contractor shall provide all bonds and insurance prior to the Notice to Proceed with Construction. For the Proposal, provide affidavit from surety indicating Contractor’s ability to provide said bonds. Failure to do so will result in a Firm’s proposal being Non-Responsive.

16. Bonding documentation required. The Navajo Nation’s Representative must receive written documentation of all required bonds prior to the issuance of a Notice to Proceed for the Project,

and Contractor shall not commence any work or services under this Contract until such documentation is received by the Navajo Nation.

17. Disclaimer – The Navajo Nation’s acceptance or review of any proposal shall not guarantee the execution of any contract, and the proposed contract shall be reviewed by all appropriate departments through the 2 N. N. C. § 164 review process, including the Navajo Nation Department of Justice, for administrative and legal sufficiency, prior to execution by the Navajo Nation. The Navajo Nation reserves the right to reject any proposed contract prior to execution, for improprieties in the procurement process or applicable Navajo Nation or federal laws or regulations, or the failure to submit all requested documents or information.

Section 2 – Proposal Requirements and Selection

1. Proposal Submission

- A. Proposal must be submitted in a sealed envelope clearly marked:
 - a. “N7128-Pueblo Pintado, NM; Bid #21-03-2447LE: Chip seal repair, address drainage issues, seeding, and permanent signage, on and off for approximately 2.0 miles.”
 - b. The name of the firm submitting the proposal shall be legibly written and shown on the outside of the sealed envelope, to include the firms address.
- B. Proposal Standards: The firm shall submit one (1) original and three (3) identical copies of their RFP packet for the evaluation committee members. Appearance of proposal is important and professionalism in proposal presentation should not be neglected. The proposal standards are as follows:
 - a. This RFP proposal may not exceed 12 single-sided pages (maximum 8 ½” x 11”) with a minimum of 10 pt. type.
 - b. Pages that have photos, charts, and graphs will be counted towards the maximum number of pages.
 - c. The following information is not included in the 12-page limit: proposal front and back cover; cover letter on company letterhead; divider and/or tabs, as long as there is nothing on them; and maximum 1-page resumes of each team member.
 - d. RFP submittals should be plastic or metal spiral-bound only. **Please do not submit RFP in loose-leaf 3-ring binders; these will be considered non-responsive and returned to the firm un-rated.**
 - e. Submissions exceeding the 12-page limit or any resumes exceeding the 1-page limit will be considered non-responsive and will be returned to the Applicant un-rated.
- C. In a separate sealed envelope clearly marked as “**BID PROPOSAL – N7128-Pueblo Pintado; Bid #21-03-2447LE**”, the firm shall provide its bid amount to complete the Scope of Work. The sealed envelope will not be opened by the Navajo DOT until after the RFP proposals have been reviewed and ranked.

- 2. Proposal Review Process, Receipt of proposals, will be verified on the due date specified. The Navajo DOT will screen and evaluate proposals received in accordance to the following criteria. Proposals which fail this check will be considered non-responsive and returned to the firm un-rated.

- a. Proposal is received by the required deadline date and time.
 - b. Proposal meets the proposal submission requirement set forth above, under Section 2, Part 1, (A), (B), & (C).
3. Proposal Evaluation
- a. Proposal shall be evaluated and rated in accordance with the criteria outlined in Part 12(a) - Rating System on Evaluation Criteria.
 - b. The Navajo DOT will rate the proposal based on total points awarded and all firms with a minimum score of 70 of 100 points will be determined as responsive. The Navajo DOT reserves the right to interview these qualified firms.
4. Award of Contract
- a. The Navajo DOT will issue a Notice to Proceed to the firm upon execution of the contract. No work shall be performed by the firm until such notice is given by Navajo DOT. The Navajo DOT is not liable for any cost incurred by the firm prior to issuance of a signed contract award, for “Chip seal repair, address drainage issues, seeding, and permanent signage, on and off for approximately 2.0 miles”.

Section 3 – Proposal Content and Evaluation Criteria

1. Qualifications and Experience of firm and project team. Proposals must specifically address and affirm the following:
- a. Letter of Interest that indicates why your firm should be selected for project N7128-Pueblo Pintado. In addition, firm should acknowledge receipt and review of any addendum(s) issued. State that firm is capable to perform all or most aspects of the project.
 - b. Evidence of insurance and statement from bonding company that all bonds will be completed prior to Notice to Proceed with Construction.
 - c. Resume of personnel that will be involved in the task of completing projects, including professional qualifications and experiences of key personnel. Include personnel of sub-consultants which will be utilized by the prime consultant.
 - d. Provide key personnel’s availability for the proposed work, and, roles and responsibilities. Include their knowledge of the Navajo Nation, and FP-14 Specifications with respect to chip seal repair, drainage issues, seeding, and permanent signage, on and off for approximately 2.0 miles.
 - e. Organizational Chart outlining the inter-relationship and line of communication between the firm and sub-consultants.
 - f. Recent experiences in providing services comparable to the proposed SOW as listed in Section 4. Interested firms shall provide three (3) references from similar projects within the last five (5) years. List the reference’s contact person’s name, address, and phone number.

3. Approach to Scope of Work with respect to FP -14 Specifications.
 - a. Approach to Scope of Work - Describe your understanding of the project and approach to delivering the project SOW with respect to FP -14 Specifications, in addition to the work described in Section 4.
 - b. Include how your firm will schedule the work. Include a graphical illustration i.e. a Project Schedule such as a GANTT Chart.
4. List of Equipment for SOW and Product Certifications, as Stated in Specifications.
 - a. List equipment to complete the Scope of Work and list Product Certifications, including meeting requirements as stated in FP -14 Specifications.

Section 4 – SCOPE OF WORK for Project: N7128-N7128-Pueblo Pintado, NM. This work consists of Chip seal repair, address drainage issues (minor), seeding (minor), and permanent signage (minor), on and off for approximately 2.0 miles. Specifications for the project is per FP-14. Ground disturbance will be intensive and extensive. While only the FP-14 Specifications for the Bid Items are attached to this RFP, the entire ‘*Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects FP-14*’, applies to this project. Contractor is advised to read attached specifications which references other specifications within FP-14.

FP-14 can be downloaded from the following website: <https://flh.fhwa.dot.gov/resources/specs/fp-14/fp14.pdf>.

When construction begins, coordination with Navajo DOT shall be through the Construction Manager (CM), Don Jackson (505-371-8364), djackson@navajodot.org.

Mandatory Pre-bid Meeting on April 7, at 1:00pm M.S.T. Location: Pueblo Pintado BOP.

Additional Scope of Work requirements:

1. BOP: 35°58'16.88"N, 107°38'55.08"W. EOP: 36° 0'1.72"N, 107°39'19.79"W.
2. It is the responsibility of the Firm/Contractor selected for this project to contact, Navajo DOT – Project Management Department, immediately after the contract for this project is fully executed. Project Management oversees all environmental, biological, and archeological compliances required by all government agencies. Contractor will request from Project Management all requirements needed to comply with all environmental & archeological conditions for this project. Written documentation shall be the required mode of communication regarding this requirement. The Construction Manager shall be notified within 24-hrs regarding communication between the Contractor, Project Management, and other compliance agencies; these communications shall be in written form.
3. Section 107 - LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC: Follow the requirements of FAR Clause 52.236-7 Permits and Responsibilities. Comply with applicable laws, ordinances, safety codes, regulations, orders, and decrees. Protect and indemnify the Government and its representatives against claim or liability arising from or based on the alleged violation of the same. Comply with permits and agreements obtained by the Government for performing the work that is included in the contract. Obtain additional permits or agreements and modifications to Government obtained permits or agreements that are required by the Contractor's methods of operation. Submit copies of permits and agreements. Provisional Notice to Proceed will be given to acquire permits prior to construction.

4. Contractor is encouraged to visit the project site to determine the type of equipment needed and other project requirements.
5. Mobilization - Section 151: This work consists of moving personnel, equipment, material, and incidentals to the project and performing work necessary before beginning work at the project site. This work also includes obtaining permits, insurance, and bonds. In addition, water requirements and utility clearances for this project are considered a part of Mobilization.
6. Section 153 - CONTRACTOR QUALITY CONTROL. Payment is in Bid Schedule as Bid Item #2. Contractor to collect geotechnical samples prior to subgrade preparation, finished subgrade, and other requirements per Section 153.
7. Section 154 - CONTRACTOR SAMPLING AND TESTING. Payment is in Bid Schedule as Bid Item.
 - a. This work consists of obtaining samples for testing and reporting required test results according to specifications. This includes all materials used in work.
 - b. Supplement to Section 154: Allow the Construction Manager and/or Engineer staff the opportunity to witness all testing. Testing of trial samples may be required to demonstrate testing competence.
8. Section 155 - SCHEDULES FOR CONSTRUCTION CONTRACTS. Submit a Project Schedule with proposal. Contractor will submit schedule updates as needed, including 2-weeks prior to Notice to Proceed(s), for approval.
9. Section 156 – PUBLIC TRAFFIC. Controlling and protecting public traffic and dust abatement (for the work and public travel) is not a pay item.
10. Section 406. — FOG SEAL
 - a. Fog seal 0.5 miles x 22-ft wide of existing chip seal.
11. Section 407. — CHIP SEAL
 - a. Double course chip seal patching at various locations.
12. Section 418. — ASPHALT CONCRETE PAVEMENT PATCHING
 - a. Minor pavement patching, approximately 100 square feet (SF).
13. Section 633. — PERMANENT TRAFFIC CONTROL: For permanent traffic control provide the following signage quantities:
 - a. All signs conform to latest version of MUTCD.
 - b. 2-35 mph, Type R2-1, 18"x24".
 - c. Furnish hardware for all signs, per Section 633.02 of FP14.
 - d. All panels for signs per Section 633.02 of FP14.
 - e. All posts of galvanized type, per Section 633.02 of FP14.
 - f. Further miscellaneous materials for signage per Section 633.02 of FP14.
 - g. The contractor shall install a Type A delineator, and foundation for damaged delineators at all culvert locations (as directed by the Construction Manager).
 - h. 2 permanent special signs warning motorist of change in roadway surface.
14. Section 635 - TEMPORARY TRAFFIC CONTROL: In addition to following Section 635, Contractor is to abide by the following.
 - a. At least one lane will always remain opened and motorist will have access at all times. Full road width must be accessible during Contractor's non-working hours and on weekends.
 - b. Traffic Control Plan (TCP) will be submitted to Contract Manager for approval 10-business days prior to any work on N7128. Any changes to TCP during

construction will require Contractor to submit updated plan to CM 5-days minimum for approval.

15. **Seeding:** Supplemental Specifications, attached.
16. Water: There will be no separate bid item for water and the water permit. The cost for providing water shall be included in the respective bid items for the work to be performed. Consult with Navajo Nation Water Code office for permit.
17. Submittals - In addition to submittals for Bid Items, other submittals required are the following: All submittals are considered part of Bid Items.
 - a. Certifications for materials, per FP-14 specifications.
 - b. Safety & Health Plan per FP-14 specifications.
 - c. Contact list of any sub-contractors and key personnel.
 - d. SWPPP & BMPs, per FP-14 specifications.
 - e. If warranted, 401 & 404 certifications and/or permits.
18. The vendor will have to dispose of any rejected material at his own expense off the Government property in approved recycle facilities.
19. Provide an estimated timeline bar chart schedule for this project.
20. Explain approach for other activities required for acceptable Scope of Work and compliance with specifications.
21. State how project communication is intended to keep all parties involved in the project.
22. Materials Delivery Contractor(s) shall follow Contractor's approved Temporary Traffic Control and Safety Plan, as well as Navajo DOT's traffic control plan throughout the construction of the project.
23. Staging area is a Mobilization item.
24. A provisional Notice to Proceed will be given when a contract is fully executed between the General Contractor and the Navajo Nation. This will allow the Contractor to acquire permits and perform geotechnical investigation to facilitate a full Notice to Proceed with maintenance activities.

If selected for this project, submit to Navajo DOT the following:

- PROOF OF CERTIFICATE OF INSURANCE: Provide proof of Certificate of Insurance.
- Taxpayer Identification: Form W-9.
- Affidavit of Non-Collusion.
- Suspension-Debarment.
- Bonding.

Quality Assurance:

Navajo DOT will provide quality assurance to ensure that work is being performed in accordance with the Scope of Work and project specifications.

Final inspection will include Navajo DOT for acceptance of scope of work.

CERTIFIED NAVAJO BUSINESS: If applicable, provide documentation that the business is currently certified by the Navajo Nation Business Regulatory Department and prioritized under Navajo Nation Council Resolution CAP-37-02 and, also, under the Section 204 (A) (1) and (2) of the revised Navajo Nation Business Opportunity Act.

Compliance:

Comply with conditions stated in all compliance reports, cultural & biological. If cultural site is discovered, immediately notify NDOT Project Management & Roads Dept. Note: Navajo DOT will give copies of archeological & environmental reports to selected Contractor. Contractor will notify Navajo DOT – Project Management Department of its selection as the General Contractor. Contractor and his sub-contractors will stay in “footprint” of existing road. Written request by Contractor to Project Management to go out of existing “footprint” is required.

NN7128-Pueblo Pintado, NM; Bid #21-03-2447LE

March 25, 2021

BID SCHEDULE

BID ITEM NO.	FP-14 ITEM NO.	Item Description	Estimated Quantity	Unit	Unit Price	Total
1	151	Mobilization	All Required	LS		
2	154	Contractor Sampling and Testing	All Required	LS		
3	406	Fog Seal	6,500	SY		
4	407	Chip Seal	725	SY		
5	418	Asphaltic Concrete Pavement Patching - Pothole Repair.	100	SF		
6	633	Permanent Signage: Furnish all materials, equipment, and labor to complete roadway signage, per plans and specifications complete.	1	LS		
7	635	Temporary Traffic Control Plan.	All Required	LS		
8	N/A	Seeding	280	SF		
		SUBTOTAL				
		Navajo Nation Tribal Tax - 6%.				
		Contingency.				\$0.00
		TOTAL PROJECT COST.				

Note: Payment will be made per FP-14, Section 109.05, and will be made for the actual quantities of work performed and accepted or material furnished according to the contract. No payment will be made for work performed in excess of that staked, ordered, or otherwise authorized.

FP-14 can be downloaded from the following FHWA website:

<https://flh.fhwa.dot.gov/resources/specs/fp-14/fp14.pdf>

**DIVISION 150
PROJECT
REQUIREMENTS**

Section 151. — MOBILIZATION

Description

151.01 This work consists of moving personnel, equipment, material, and incidentals to the project and performing work necessary before beginning work at the project site. This work also includes obtaining permits, insurance, and bonds.

Measurement

151.02 Measure the Section 151 items listed in the bid schedule according to Subsection 109.02.

Payment

151.03 The accepted quantities will be paid at the contract price per unit of measurement for the Section 151 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Progress payments for mobilization by the lump sum will be paid as follows:

- (a) Bond premiums will be reimbursed according to FAR Clause 52.232-5 Payments Under Fixed-Price Construction Contracts, after receipt of the evidence of payment.
- (b) When 5 percent of the original contract amount is earned from pay items (not including mobilization), 50 percent of the mobilization pay item, or 5 percent of the original contract amount, whichever is less, will be paid.
- (c) When 10 percent of the original contract amount is earned from pay items (not including mobilization), 100 percent of the mobilization pay item, or 10 percent of the original contract amount, whichever is less, will be paid.
- (d) Any portion of the mobilization pay item in excess of 10 percent of the original contract amount will be paid after final acceptance.

Section 406. — FOG SEAL

Description

406.01 This work consists of applying an emulsified asphalt fog seal.

Emulsified asphalt is designated according to AASHTO M 140 or AASHTO M 208.

Material

406.02 Conform to the following Subsections:

Blotter	703.12
Emulsified asphalt	702.02
Water	725.01(c)

Construction Requirements

406.03 Equipment. Furnish an asphalt distributor with the following:

- (a) Heater for uniformly heating the asphalt;
- (b) Full circulation spray bar adjustable to 15-foot (4.5-meter) width;
- (c) Positive controls including tachometer, pressure gauge, volume measuring device, or calibrated tank to uniformly deposit asphalt over the full width within 0.02 gallons per square yard (0.09 liters per square meter) of the required rate; and
- (d) Thermometer for measuring asphalt temperature in the tank.

406.04 Surface Preparation.

- (a) Clean the existing surface of loose material, dirt, and other deleterious material before placing the fog seal. Remove or protect raised pavement markers, pavement markings, reflectorized tape, and other material that interferes with the work. Protect service entrances (such as manholes, valve boxes, and drop inlets). Protect concrete work, rock walls, and other objects adjacent to the work.
- (b) Dry the surface before placing the fog seal.

406.05 Weather Limitations. Apply fog seals only when the following apply:

- (a) Ambient air temperature is above 50 °F (10 °C);
- (b) Surface temperature is above 50 °F (10 °C);
- (c) Weather is not foggy or rainy;
- (d) Rain or temperatures below 40 °F (4 °C) are not anticipated for at least 24 hours after application;

Section 406

- (e) Sustained winds are less than or equal to 10 miles (16 kilometers) per hour; and
- (f) Application is completed at least 2 hours before sunset.

406.06 Asphalt Application. Dilute the emulsion one part water to one part emulsified asphalt.

Apply the emulsion according to Subsection 407.09 at a rate of 0.10 to 0.15 gallons per square yard (0.4 to 0.7 liters per square meter) as approved by the CO.

At locations where the fog seal cannot be applied with an asphalt distributor spray bar, apply the fog seal uniformly using a hand spray attachment or by another approved method.

Allow the fog seal to cure undisturbed for at least 2 hours or until the emulsified asphalt breaks and is substantially tack free.

Cover unabsorbed asphalt with blotter to protect traffic or minimize rain damage. Remove excess blotter after the asphalt is absorbed. Dispose of material according to Subsection 203.05(a) and (d).

406.07 Acceptance. See Table 406-1 for sampling, testing, and acceptance requirements.

Emulsified asphalt will be evaluated under Subsections 106.02 and 106.03. Furnish a production certification with each load of emulsified asphalt.

Blotter will be evaluated under Subsection 106.03.

Construction of fog seals will be evaluated under Subsections 106.02 and 106.04.

Measurement

406.08 Measure the Section 406 pay items listed in the bid schedule according to Subsection 109.02 and the following as applicable:

Measure fog seal including water added for dilution. Show a breakdown of total emulsion and water added on the load invoices supplied to the CO for payment.

Payment

406.09 The accepted quantities will be paid at the contract price per unit of measurement for the Section 406 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

**Table 406-1
Sampling, Testing, and Acceptance Requirements**

Material or Product (Subsection)	Type of Acceptance (Subsection)	Characteristic	Category	Test Methods Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time	Remarks
Production									
Emulsified asphalt (702.02)	Process control (153.03)	Placement temperature	-	-	Minimum 1 per distributor truck	Distributor truck	No	Before incorporating into work	-

Section 407. — CHIP SEAL

Description

407.01 This work consists of applying a single or double course chip seal.

Chip seal types are designated according to Tables 407-1 and 407-2.

Asphalt binder is designated according to AASHTO M 320 and emulsified asphalt is designated according to AASHTO M 140 or AASHTO M 208.

Material

407.02 Conform to the following Section and Subsections:

Asphalt binder	702.01
Blotter	703.12
Chip seal aggregate	703.09
Emulsified asphalt	702.02
Fog seal	406

Construction Requirements

407.03 Qualifications. Provide a superintendent and foreman with experience in placing chip seals. Submit the following for approval at least 14 days before starting chip seal work:

- (a) Names of personnel; and
- (b) A résumé for each individual describing their experience on at least five chip seal projects of similar complexity.

407.04 Composition. Submit the following for approval at least 14 days before placement:

- (a) **Aggregate samples.** 80 pounds (35 kilograms) from the material produced for the project, the gradation range represented, and the proposed target value for each sieve size;
- (b) **Asphalt sample.** 1-gallon (4-liter) sample with a production certification conforming to Subsection 106.03(a);
- (c) **Spread rates.** The proposed spread rate for the asphalt and aggregate; and
- (d) **Density.** The density of the aggregate according to AASHTO T 19, shoveling procedure.

407.05 Equipment.

- (a) **Asphalt distributor.** See Subsection 406.03. Maintain two-way radio communication with the aggregate spreader.
- (b) **Sweeper.** Furnish two sweepers conforming to Subsection 409.05(c).

(c) Pneumatic-tire rollers.

(1) Three rollers each with a minimum compacting width of 5 feet (1.5 meters), or two rollers each with a minimum compacting width of 6.5 feet (2.0 meters); and

(2) Gross mass adjustable within the range of 200 to 360 pounds per inch (3.6 to 6.4 kilograms per millimeter) of compaction width.

(d) Aggregate spreader. Controls to uniformly deposit aggregate over the full asphalt width.

407.06 Surface Preparation. See Subsection 406.04(a). Prepare the surface as follows:

(a) Newly asphalt patched areas. Fog seal according to Section 406.

(b) Existing asphalt surfaces including recycled asphalt pavements. Dry the surface.

(c) Aggregate base course surfaces.

(1) When using an emulsified asphalt, make the surface damp; or

(2) When using an asphalt binder, dry the surface.

407.07 Weather Limitations. Apply chip seals only when the following apply:

(a) Ambient air temperature is above 65 °F (18 °C);

(b) Surface temperature in the shade is above 60 °F (16 °C);

(c) Surface temperature in the sun is below 150 °F (66 °C);

(d) Weather is not foggy or rainy;

(e) Rain or temperatures below 40 °F (4 °C) are not anticipated for at least 24 hours after application;

(f) Sustained winds are less than or equal to 10 miles (16 kilometers) per hour; and

(g) Application is completed at least 2 hours before sunset.

407.08 Production Start-Up Procedures. Conduct a pre-chip seal preparatory phase meeting according to Subsection 153.04(a).

On the first day of each chip seal layer placement, construct up to three 200- to 500-foot (60- to 150-meter) control strips that are one-lane wide according to Subsections 407.09 and 407.10. Coordinate the control strip locations with the CO. Start the first control strip at the proposed application rates. Vary the asphalt material or surface aggregate application rate for each control strip. Construct the control strip using the material, lay-down procedures, and compaction procedures intended for the entire project.

Repeat the control strip process until an acceptable control strip is produced. Cease production until the material and the control strip are evaluated and accepted. The CO will indicate which strip will serve as the approved project control strip.

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Acceptable control strips may remain in place and will be accepted as a part of the completed project. Correct unacceptable control strips.

Use these start-up procedures when changing construction procedures, when resuming production after a termination of production due to unsatisfactory quality according to Subsection 106.04, or the beginning of a new construction season.

407.09 Asphalt Application. Calibrate asphalt distributors before the start of project and when directed by the CO. Calibrate the spray bar height, check nozzle angle, and verify longitudinal and transverse application rates according to ASTM D2995.

Spread building paper on the pavement surface at the beginning and end of each asphalt application so distributor flow is started and stopped on the paper.

Apply asphalt uniformly at the optimum application rate determined from the control strip. Do not apply more asphalt than can immediately be covered with aggregate. Correct skipped areas or deficiencies.

At the end of each day's production, provide the CO with documentation of calibrations and application rates.

Remove and dispose of material spills and associated debris at the end of each shift according to Subsection 203.05(a) and (d).

407.10 Aggregate Application. When emulsified asphalt is used, verify the aggregate stockpile moisture daily and use moist surfaced aggregate.

When asphalt binder is used, dry the aggregate. Precoat the aggregate uniformly with 2 to 3 percent of residual asphalt by mass of aggregate. Maintain the flow qualities of the precoated aggregate to allow uniform spreading with the aggregate spreader.

Calibrate aggregate spreaders before the start of project and as directed by the CO. Calibrate the longitudinal and transverse spread rates.

Apply aggregate uniformly at the optimum application rate determined from the approved control strip. Apply the aggregate immediately after the asphalt material is applied. Operate the aggregate spreader so asphalt is covered with the aggregate before wheels pass over it. For part-width construction, leave an uncovered 6-inch (150-millimeter) wide asphalt strip to permit an overlap of asphalt material.

Cover excess asphalt with blotter to protect traffic.

Correct excesses and deficiencies by adding or removing aggregate to achieve a uniform texture before the asphalt cures.

Operate rollers at a maximum speed of 5 miles (8 kilometers) per hour. Do not allow the aggregate to be displaced by pickup or sticking of material to the tire surface. Roll the surface to uniformly and thoroughly bond the aggregate over the full width. Complete rolling within 1 hour after asphalt is applied to the surface. Perform three passes with the rollers. Do not allow traffic to travel over aggregate until rolling is completed.

At the end of each day's production, provide the CO with documentation for calibrations and application rates.

Use a pilot car according to Section 635 to limit traffic speeds to 10 miles (15 kilometers) per hour during the first 45 minutes after rolling and to 20 miles (30 kilometers) per hour for the next 24 hours.

Sweep the surface when the air temperature is below 90 °F (32 °C). Do not displace embedded material. Complete vacuum sweeping by the morning after construction. Dispose of material according to Subsection 203.05(a) and (d).

407.11 Placing and Finishing. Apply the asphalt and aggregate according to Subsections 407.09 and 407.10 and Table 407-1. The application rates in these tables are for estimating purposes only. Determine the exact rates based on approved control strips.

Table 407-1
Approximate Quantities of Material for Single Course Chip Seal

Type	Nominal Maximum Size of Aggregate	Aggregate Gradation ⁽¹⁾	Estimated Quantity of Aggregate ⁽²⁾ pounds/yd ² (kilograms/m ²)	Estimated Quantity of Asphalt Binder gallons/yd ² (liters/m ²)	Estimated Quantity of Emulsified Asphalt gallons/yd ² (liters/m ²)
1A	¾ inch (19 mm)	A	44 – 53 (24 – 29)	0.31 – 0.42 (1.41 – 1.91)	0.48 – 0.65 (2.17 – 2.94)
1B	½ inch (12.5 mm)	B	29 – 33 (16 – 18)	0.25 – 0.34 (1.15 – 1.56)	0.39 – 0.53 (1.77 – 2.40)
1C	⅜ inch (9.5 mm)	C	24 – 28 (13 – 15)	0.18 – 0.28 (0.79 – 1.27)	0.27 – 0.43 (1.22 – 1.95)
1D	No. 4 (4.75 mm)	D	18 – 24 (10 – 13)	0.14 – 0.19 (0.65 – 0.85)	0.27 – 0.43 (1.22 – 1.95)

(1) See Table 703-7 for aggregate gradations.

(2) Aggregate masses are for aggregates having a bulk specific gravity of 2.65, as determined by AASHTO T 84 and AASHTO T 85. Make proportionate corrections when the aggregate furnished has a bulk specific gravity above 2.75 or below 2.55.

407.12 Double Course Chip Seal. Apply each asphalt and aggregate layer according to Subsections 407.09 and 407.10 and Table 407-2. Table 407-2 application rates are for estimating purposes only. Determine the exact rates based on approved control strips.

When using emulsified asphalt, wait at least 24 hours between applications. When using asphalt binder, no wait is required between applications. Lightly vacuum sweep the first layer to remove loose material.

Table 407-2
Approximate Quantities of Material for Double Course Chip Seal

Type (Thickness)	Nominal Maximum Size of Aggregate	Aggregate Gradation ⁽¹⁾	Estimated Quantity of Aggregate ⁽²⁾ pounds/yd ² (kilograms/m ²)	Estimated Quantity of Asphalt Binder gallons/yd ² (liters/m ²)	Estimated Quantity of Emulsified Asphalt gallons/yd ² (liters/m ²)
2A (3/8 inch (22 mm))					
1 st Application	3/4 inch (19 mm)	A	44 – 53 (24 – 29)	0.29 – 0.41 (1.31 – 1.86)	0.43 – 0.60 (1.95 – 2.72)
2 nd Application	3/8 inch (9.5 mm)	C	24 – 29 (13 – 16)	0.41 – 0.46 (1.86 – 2.08)	0.60 – 0.70 (2.72 – 3.17)
2B (3/4 inch (19 mm))					
1 st Application	1/2 inch (12.5 mm)	B	33 – 44 (18 – 24)	0.27 – 0.31 (1.22 – 1.40)	0.39 – 0.48 (1.77 – 2.17)
2 nd Application	3/8 inch (9.5 mm)	C	22 – 26 (12 – 14)	0.29 – 0.38 (1.31 – 1.72)	0.45 – 0.58 (2.04 – 2.63)
2C (1/2 inch (12.5 mm))					
1 st Application	3/8 inch (9.5 mm)	C	29 – 39 (16 – 21)	0.17 – 0.27 (0.77 – 1.22)	0.27 – 0.39 (1.22 – 1.77)
2 nd Application	No. 4 (4.75 mm)	D	13 – 18 (7 – 10)	0.27 – 0.31 (1.22 – 1.40)	0.39 – 0.48 (1.77 – 2.17)

(1) See Table 703-7 for aggregate gradations.

(2) Aggregate masses are for aggregates having a bulk specific gravity of 2.65, as determined by AASHTO T 84 and AASHTO T 85. Make proportionate corrections when the aggregate furnished has a bulk specific gravity above 2.75 or below 2.55.

407.13 Acceptance. See Table 407-3 for sampling, testing, and acceptance requirements.

Emulsified asphalt and asphalt binder will be evaluated under Subsections 106.03 and 106.04. Furnish a production certification with each load of emulsified asphalt or asphalt binder.

Chip seal aggregate gradation will be evaluated under Subsection 106.05.

The upper and lower specification limits are equal to the calculated mean of all test results plus or minus the allowable deviations shown in Table 703-7, except as follows:

- (a) If the calculated mean value for a tested sieve exceeds the maximum gradation value shown in Table 703-7, the upper specification is equal to the maximum gradation value plus the allowable deviation, and the lower specification is equal to the maximum gradation value minus the allowable deviation.

(b) If the calculated mean value for a tested sieve is less than the minimum gradation value shown in Table 703-7, the upper specification is equal to the minimum gradation value plus the allowable deviation, and the lower specification is equal to the minimum gradation value minus the allowable deviation.

Construction of asphalt chip seals will be evaluated under Subsections 106.02 and 106.04.

Measurement

407.14 Measure the Section 407 pay items listed in the bid schedule according to Subsection 109.02.

Payment

407.15 The accepted quantities will be paid at the contract price per unit of measurement for the Section 407 pay items listed in the bid schedule, except the chip seal contract price will be adjusted according to Subsection 106.05. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Payment for the chip seal will be made at a price determined by multiplying the contract price by the material pay factor. The material pay factor is the lowest single pay factor determined for each specified sieve of the aggregate gradation for each aggregate gradation furnished.

When two gradations are furnished for a double chip seal the material pay factor is weighted for the quantity of each aggregate gradation spread as a percent of the total. The material pay factor is calculated as follows:

$$PF_{\text{Material}} = PF_{1\text{st}}[SR_{1\text{st}}/(SR_{1\text{st}} + SR_{2\text{nd}})] + PF_{2\text{nd}}[SR_{2\text{nd}}/(SR_{1\text{st}} + SR_{2\text{nd}})]$$

where:

PF_{Material} = Material pay factor.

$PF_{1\text{st}}$ = Pay factor for first aggregate gradation. $PF_{1\text{st}}$ is the lowest single pay factor determined for each specified sieve.

$PF_{2\text{nd}}$ = Pay factor for second aggregate gradation. $PF_{2\text{nd}}$ is the lowest single pay factor determined for each specified sieve.

$SR_{1\text{st}}$ = Spread rate for the first aggregate per square yard (square meter).

$SR_{2\text{nd}}$ = Spread rate for the second aggregate per square yard (square meter).

**Table 407-3
Sampling, Testing, and Acceptance Requirements**

Material or Product (Subsection)	Type of Acceptance (Subsection) ⁽³⁾	Characteristic	Category	Test Methods Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time	Remarks
Source									
Chip seal aggregate ⁽¹⁾	Measured and tested for conformance (106.04 & 105)	Quality	-	Subsection 703.09	1 per material type	Source of material	Yes	Before producing	-
	Process control (153.03)	Gradation	-	AASHTO T 27 & T 11	2 per day per stockpile	Crusher belt (during production)	No	24 hours	Not required when using a pre-crushed commercial source
Blotter	"	"	-	Subsection 703.12	"	"	"	"	-
Asphalt binder ⁽²⁾ or emulsified asphalt ⁽²⁾	Measured and tested for conformance (106.04)	Quality	-	Section 702	1 per material type	Point of shipment or delivery	Yes ⁽⁵⁾	Before incorporating into work	-

Table 407-3 (continued)
Sampling, Testing, and Acceptance Requirements

Material or Product (Subsection)	Type of Acceptance (Subsection) ⁽³⁾	Characteristic	Category	Test Methods Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time	Remarks
Production									
Chip seal aggregate ⁽¹⁾	Statistical ⁽³⁾ (106.05)	Gradation (See Table 703-7 for applicable sieves)	I	AASHTO T 27 & T 11	See Note (3)	Production belt or spreader discharge ⁽⁴⁾	Yes	24 hours	–
	Process control (153.03)	Moisture on surface of aggregates	–	Visual inspection (409.10)	Contractor determine	Stockpile or spreader discharge	No	Before incorporating into work	–
Asphalt binder ⁽²⁾ or emulsified asphalt ⁽²⁾	Measured and tested for conformance (106.04)	Quality	–	Section 702	1 per tanker truck including trailer	Tanker or Distributor	Yes ⁽⁵⁾	–	Tested by Government
	Process control (153.03)	Placement temperature	–	–	Minimum 1 per distributor truck	Distributor truck	No	Before incorporating into work	–

(1) Applies to each aggregate grade furnished.

(2) Applies to each asphalt material furnished.

(3) For plan quantities less than 40,000 square yards (33,000 square meters), material will be accepted according to Subsection 106.03. For plan quantities greater than 40,000 square yards (33,000 square meters), material will be accepted according to Subsection 106.05. For plan quantities between 40,000 and 240,000 square yards (33,000 and 200,000 square meters), the sampling frequency will be determined by dividing the plan quantity by eight. If plan quantity exceeds 240,000 square yards (200,000 square meters), the sampling frequency will be one every 30,000 square yards (25,000 square meters).

(4) Select one point of sampling that must remain throughout project or lot.

(5) Two 1-quart (1-liter) samples for asphalt binder. One 1-gallon (4-liter) sample for emulsified asphalt.

Section 418. — ASPHALT CONCRETE PAVEMENT PATCHING

Description

418.01 This work consists of repairing distressed areas of asphalt concrete pavement by removing and patching the pavement and underlying material as required.

Separation and stabilization geotextile is designated according to Table 714-1.

Material

418.02 Conform to the following Sections and Subsections:

Asphalt concrete	403
Asphalt tack coat	412
Crushed aggregate	703.06
Separation and stabilization geotextile and geotextile filter	714.01(a)
Stabilization geogrid	714.03

Construction Requirements

418.03 Asphalt Pavement, Base, and Subgrade Full Depth Patch, Type 1 (FDP-1).

(a) Patch areas. Extend the repair area 12 inches (300 millimeters) beyond the distressed area. If patch limits are within 24 inches (600 millimeters) of the pavement edge, extend the patch limit to the pavement edge. Make the minimum transverse dimension of the patch half of the travel lane width and the minimum longitudinal dimension of the patch 36 inches (900 millimeters).

(b) Pavement removal. Mill completely through the pavement or saw cut and remove the pavement. When saw cutting, cut through the existing pavement and around the perimeter of the patch area. Make saw cuts perpendicular to the roadway surface and at right angles to each other. Remove the pavement, base and subgrade to the depth shown in the plans.

(c) Patching. When required, place geogrid or geotextile according to Section 207. Place and compact crushed aggregate base according to Subsections 302.04 and 302.05. Asphalt millings may be used for crushed aggregate base material. Apply a tack coat to the edges of the patch area according to Section 412. Place and compact asphalt concrete pavement to ensure the patched surface matches the same grade as the adjacent surface.

418.04 Asphalt Pavement Full Depth Patch, Type 2 (FDP-2).

(a) Patch areas. Extend the repair area 12 inches (300 millimeters) beyond the distressed area. If patch limits are within 24 inches (600 millimeters) of the pavement edge, extend the patch limit to the pavement edge. Make the minimum length and width of the patch 36 inches (900 millimeters).

(b) Pavement removal. See Subsection 418.03(b), except remove the pavement to expose subbase or subgrade as shown in the plans.

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(c) Patching. Apply a tack coat to the edges of the patch area according to Section 412. Place and compact asphalt concrete pavement so the patched surface matches the same grade as the adjacent surface.

418.05 Asphalt Pavement Partial Depth Patch, Type 3.

(a) Patch areas. Patch areas will be designated by the CO.

(b) Pavement removal. Clean the patch area by sweeping or other acceptable methods.

(c) Patching. Apply a tack coat to asphalt concrete surfaces within the patch area according to Section 412. Place the asphalt material either by hand, with a blade, or other approved method. Compact the asphalt concrete pavement patch to match the grade of the adjacent surface.

418.06 Disposing of Waste. Dispose of debris and unsuitable and excess material according to Subsection 203.05(a) and (d).

418.07 Acceptance. Construction of asphalt concrete pavement patching will be evaluated under Subsections 106.02 and 106.04.

Separation and stabilization geotextiles and geogrid will be evaluated under Subsections 106.02 and 106.03.

Asphalt concrete will be evaluated under Section 403.

Crushed aggregate will be evaluated under Section 302.

Asphalt tack coat will be evaluated under Section 412.

Measurement

418.08 Measure the Section 418 pay items listed in the bid schedule according to Subsection 109.02 and the following as applicable:

Do not measure asphalt tack coat.

Payment

418.09 The accepted quantities will be paid at the contract unit price per unit of measurement for the Section 418 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Section 633. — PERMANENT TRAFFIC CONTROL

Description

633.01 This work consists of installing and removing and resetting permanent traffic control devices.

Sign panels are designated as plywood, steel, aluminum, plastic, fiberglass reinforced plastic, or extruded aluminum.

Sign posts are designated as wood, aluminum, galvanized steel, or corrosion resistant steel.

Material

633.02 Conform to the MUTCD and the following Section and Subsections:

Delineator and object marker retroreflectors	718.08
Hardware	718.06
Legends and borders	718.07
Minor concrete	601
Object marker and delineator posts	718.05
Panels	718.03
Retroreflective sheeting	718.01
Sign posts	718.04

Construction Requirements

633.03 General. Furnish and install permanent traffic control devices according to the MUTCD and permanent traffic control plans. Provide traffic control devices that are crashworthy.

Sign locations may be changed to fit field conditions as approved by the CO. Determine sign support lengths at time of staking.

633.04 Sign Posts. Install sign posts plumb and according to the manufacturer's recommendations.

Drive sign posts with a suitable driving head or set posts in drilled or punched holes.

Excavate, construct, and backfill concrete footings according to Section 601.

633.05 Sign Panels.

(a) Fabrication.

(1) Panels. Cut panels to dimension shown and place holes before applying retroreflective material. Do not field drill holes in panels.

Clean and degrease the face of the metal panels using methods recommended by the retroreflective sheeting manufacturer before applying retroreflective sheeting.

Wipe plastic panels clean with a slightly dampened cloth before applying retroreflective sheeting.

Abrade, clean, and degrease the face of the plywood panels using methods recommended by the retroreflective sheeting manufacturer before applying reflective sheeting. Treat plywood panel edges with sealant.

Join extruded aluminum panel sections with panel nuts, bolts, and washers to achieve the desired sign size. Use 6- and 12-inch (150- and 300-millimeter) plate heights to achieve the sign panel vertical dimensions in increments of 6 inches (150 millimeters). Do not include more than one 6-inch (150-millimeter) plate per sign.

Use retroreflective sheeting as specified and according to ASTM D4956. For roadside signs, use Type III, IV, VIII, IX, or XI prismatic retroreflective sheeting. Use fluorescent yellow sheeting for warning signs. Use fluorescent yellow-green sheeting for pedestrian, bicycle, and school crossing signs.

For multilane or overhead guide signs, use Type III or Type IV prismatic retroreflective sheeting for the background and Type IX or Type XI retroreflective sheeting for the legend.

For parking lot and non-roadway signs, Types I and Type II retroreflective sheeting may be used.

(2) Legends and borders. Form letters, numerals, and other units to provide a continuous stroke width with smooth edges. Make the surface flat and free of warp, blisters, wrinkles, burrs, and splinters. Do not fabricate letters, numerals, arrows, symbols, or borders using a red screen ink process.

Conform to one of the following techniques:

(a) Type L-1 (screen process). Apply letters, numerals, arrows, symbols, borders, and other features on the sign background by direct or reverse screen process. Apply messages and borders of a color darker than the sign background by the direct process. Apply messages and borders of a color lighter than the sign background by the reverse screen process.

Apply screen inks recommended by the ink manufacturer for use on the various types of retroreflective sheeting. Apply ink that has the same durability and color as specified for that type of retroreflective sheeting. Apply black screen ink until opaque on retroreflective sheeting.

Perform the screening in a manner to ensure a uniform color and tone, with sharply defined edges of legends and borders. Do not allow running, streaking, or sagging.

Air dry or bake the signs after screening according to manufacturer's recommendations to provide a smooth hard finish.

(b) Type L-2 (transparent films). Apply letters, numerals, arrows, symbols, borders, and other features on the sign background with colored transparent films. Select durable, electronically cuttable films coated with a transparent pressure-sensitive adhesive protected by a removable liner. Use transparent films recommended by the manufacturer within the color requirements specified for the retroreflective sheeting.

(c) Type L-3 (direct applied characters). Cut letters, numerals, arrows, symbols, borders, and other features from black opaque or retroreflective sheeting of the color specified. Apply characters to the sign background according to the retroreflective sheeting manufacturer's instructions. Use the same sheeting manufacturer for both the sign legend, border, and background.

Package sign panels in protective material and transport in a vertical position.

(b) Installation. Mount sign panels with the legend horizontal.

Use oversized bolt heads and neoprene or nylon washers for fastening plastic sign panels. Use antitheft fasteners where possible. Paint bolt heads, screw heads, and washers that are exposed on the sign face. Match the color of the paint to the color of the sheeting at the point where the fitting is exposed.

Turn sign panels 3 degrees away from the road in the direction of travel to reduce specular glare (mirror reflection).

Cover the sign face with an opaque material if a sign message is not applicable. Maintain the covering in good condition until the message becomes applicable. Do not use adhesive tape on the sign face.

633.06 Delineators and Object Markers. Attach delineators and object markers to posts according to the manufacturer's recommendation or as specified.

633.07 Removing and Resetting Permanent Traffic Control Devices. Remove and store existing traffic control devices to be reset as necessary. Replace traffic control devices damaged during removal, storage, and resetting.

633.08 Acceptance. Material for permanent traffic control devices will be evaluated under Subsections 106.02 and 106.03.

Installation of permanent traffic control devices will be evaluated under Subsections 106.02 and 106.04.

Excavation and backfill will be evaluated under Section 209.

Minor concrete will be evaluated under Section 601.

Measurement

633.09 Measure the Section 633 pay items listed in the bid schedule according to Subsection 109.02 and the following as applicable:

When measuring sign panels by the square foot (square meter), measure front face. Measure each sign panel in a multiple configuration.

When measuring sign systems by the square foot (square meter), measure front face of each sign panel.

When measuring sign systems by the each, measure each system as one regardless of the number of sign panels.

A sign system includes the supports.

When measuring removing and resetting permanent traffic control device, measures after they are reset. Measure removing and resetting of sign systems as described above.

Payment

633.10 The accepted quantities will be paid at the contract price per unit of measurement for the Section 633 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Section 635. — TEMPORARY TRAFFIC CONTROL

Description

635.01 This work consists of furnishing, installing, maintaining, relocating, and removing temporary traffic control devices and services as ordered for the control and protection of public traffic through the project.

Advance warning arrow board, barricade, and warning light types are designated in the MUTCD.

Material

635.02 Conform to the MUTCD and the following Sections and Subsections:

Concrete barrier (temporary)	618
Delineator and object marker retroreflectors	718.08(b)
Guardrail (temporary)	617
Retroreflective sheeting	718.01
Sign panels	633.05
Sign posts	633.04
Temporary plastic fence	710.11
Temporary pavement markings	718.16

Construction Requirements

635.03 Qualifications. Provide flaggers certified by ATSSA, the National Safety Council, a state department of transportation, or other acceptable organization. Use pilot car operators conforming to the qualifications of a flagger.

635.04 General. Furnish, install, and maintain temporary traffic control devices adjacent to and within the project as required by the MUTCD, traffic control plan, and Section 156. Install and maintain traffic control devices as follows:

- (a) Furnish and install traffic control devices before the start of construction operations;
- (b) Install only those traffic control devices needed for each stage or phase;
- (c) Relocate temporary traffic control devices as necessary;
- (d) Remove devices that no longer apply to the existing conditions;
- (e) Immediately replace devices that are lost, stolen, destroyed, or inoperative;
- (f) Keep temporary traffic control devices clean;
- (g) Furnish and maintain traffic control devices that meet the "acceptable" standard described in ATSSA, *Quality Standards for Work Zone Traffic Control Devices*. Amend the ATSSA standards as follows:
 - (1) Repair or remove and replace "marginal" devices within 48 hours; and

- (2) Repair or remove and replace "*unacceptable*" devices immediately;
- (h) Remove temporary traffic control devices upon contract completion or when approved; and
- (i) Furnish crashworthy temporary traffic control devices.

635.05 Barricades. Use barricades of the type and size specified or according to the MUTCD. Use Type III, IV, IX, or XI retroreflective sheeting.

635.06 Cones and Tubular Markers. Use cones or tubular markers of the height specified or according to the MUTCD. Use Type III or Type VI retroreflective sheeting.

635.07 Construction Signs. Use Type III, IV, VIII, IX, or XI prismatic retroreflective sheeting. Use fluorescent sheeting for orange signs. For roll-up signs, use fluorescent Type VI retroreflective sheeting.

Install posts according to Section 633. Portable sign supports may be used instead of sign posts when approved by the CO.

Remove or completely cover unnecessary signs. Use metal, plywood, or other acceptable material to cover signs. Do not use adhesives glues, tapes, or mechanical fasteners that mar the face of the panel of the sign to be covered.

635.08 Drums. Use plastic drums that are at least 36 inches (900 millimeters) high and at least 18 inches (450 millimeters) in diameter. Use Type III or Type VI retroreflective sheeting.

635.09 Flaggers. Use flaggers certified according to Subsection 635.03. Use Type III, IV, VIII, IX, or XI retroreflective sheeting on flagger paddles. Do not use flags.

635.10 Pilot Cars. Use pilot car operators certified according to Subsection 635.03. Mount a "*PILOT CAR FOLLOW ME*" sign on the rear and a high-intensity, rotating, flashing, oscillating, or strobe light on the roof of the pilot car.

635.11 Temporary Barriers. Use temporary barriers that are crashworthy and are new or used provided they are not badly damaged. Lifting holes no larger than 4 inches (100 millimeters) or lifting loops are permitted.

Mount white or yellow retroreflectors as applicable, to the top or side of the barrier on 25-foot (8-meter) centers. Mount the retroreflectors at a uniform height at least 24 inches (600 millimeters) above the road surface. Flexible barrier delineators or barrier delineation tape may be used instead of retroreflectors when approved by the CO.

635.12 Temporary Guardrail. Construct temporary guardrail according to Section 617.

Mount white or yellow retroreflectors as applicable, to the top or side of the guardrail on 25-foot (8-meter) centers. Mount the retroreflectors at a uniform height at least 24 inches (600 millimeters) above the road surface.

635.13 Temporary Pavement Markings and Delineation. Before opening a pavement surface to traffic, remove conflicting pavement markings by sandblasting or other methods that do not damage the surface or texture of the pavement. Make the removal pattern uneven to not perpetuate the outline of the removed pavement markings. Lightly coat sandblasted or removal areas on asphalt surfaces with emulsified asphalt.

Place and maintain temporary pavement markings that are neat, crack free, true, straight, and unbroken.

If temporary signs and pavement markers are substituted for temporary pavement markings, install temporary signs and pavement markers according to the MUTCD and plans.

For temporary pavement markings, use preformed retroreflective tape, traffic paint, or pavement markers as follows:

(a) Preformed retroreflective tape. Apply according to the manufacturer's instructions. Remove loose preformed retroreflective tape before placing additional pavement layers.

(b) Pavement markers. Do not use pavement markers during seasonal suspensions. When chip seals, slurry seals, or tack coats are used after marker placement, protect the markers with an approved protective cover, and remove it after the asphalt material is sprayed.

(c) Traffic paint. Do not apply traffic paint to the final surface. Apply traffic paint as the temporary pavement marking if no work will be performed on the project for at least 30 consecutive days. Apply traffic paint at a 15 mil (0.38-millimeter) minimum wet film thickness or at a rate of 107 square feet per gallon (2.6 square meters per liter). Immediately apply Type I glass beads on the paint at a minimum rate of 6 pounds per gallon (0.7 kilograms per liter) of paint.

Remove temporary pavement markers before placing additional pavement layers or permanent pavement markings. Remove temporary markings after 14 days and apply permanent pavement markings unless approved by the CO.

635.14 Vertical Panels. Use vertical panels that are at least 24 inches (600 millimeters) in height and 8 to 12 inches (200 to 300 millimeters) wide. Use Type III, IV, VIII, IX, or XI retroreflective sheeting.

635.15 Warning Lights. Use warning lights of the types shown in the plans or according to the MUTCD. Install warning lights with a minimum mounting height of 30 inches (750 millimeter) to the bottom of the lens. Secure lights to the top of the traffic control device they are supplementing. Use batteries recommended by the light manufacturer. Mount large batteries below windshield height and preferably on the ground. Replace batteries when they no longer provide satisfactory performance.

Use Type C steady-burn warning lights for delineation on barricades or drums. Use Type A low-intensity flashing warning lights on the first 2 barricades or drums in the merging or shifting taper series. Use Type B high-intensity flashing warning lights on the first two advance warning signs. Type A and Type C warning lights are intended to warn road users during nighttime hours, while Type B warning lights are intended to warn road users during both daylight and nighttime hours.

635.16 Shadow Vehicle. Use a 19,800 pound (9000-kilogram) ± 990 pound (±450 kilogram) shadow vehicle equipped with a truck-mounted attenuator (crash cushion) attached to the rear of the vehicle, exterior flashing yellow dome light, and an arrow board.

Use the shadow vehicle to provide physical protection to workers from traffic approaching from the rear during moving operations.

Use the following procedures to close a lane of traffic:

- (a) Move the shadow vehicle to a point approximately 200 feet (60 meters) from the first advance warning sign for the lane closure and stop on the shoulder;
- (b) Activate the flashing lights and flashing arrow board. Begin the arrow board in the caution mode and after approximately 2 minutes display the correct flashing pass arrow;
- (c) Move the shadow vehicle (now acting as a protection vehicle) along the shoulder to the first sign location, stopping approximately 100 feet (30 meters) before the sign location in a blocking position;
- (d) Place the first sign then proceed to the next advance sign location. Repeat step (c) for the second sign and install that sign. Repeat this procedure until advance warning signs are installed;
- (e) After installing the advanced warning signs for the lane closure, move the shadow vehicle into the lane that is to be closed to a position 100 feet (30 meters) before the closing taper location. Install the channelizing devices for the taper in the shielded lane; then
- (f) Move the shadow vehicle off the roadway and past the taper on the shoulder and remain in position until the flashing arrow board for the closure (if one is to be provided) is placed and operating. Move the shadow vehicle with the workers as they proceed to set up the remaining devices as additional protection.

Alternate lane closure procedures may be used if approved by the CO.

635.17 Pavement Patch. Use an asphalt mix according to Section 403 or commercial available cold asphalt mix to repair potholes and rough spots in the traveled way before reopening travel lanes to traffic. If cold asphalt mix is used, remove and replace with hot asphalt mix before placing succeeding hot asphalt lifts.

635.18 Temporary Crash Cushions. Use a crashworthy temporary crash cushion according to manufacturer's recommendations.

635.19 Temporary Signal System. Use a temporary signal system according to MUTCD Parts 4 and 6.

Provide the names and telephone numbers of at least two emergency contacts who can be reached 24 hours a day, and who are available to arrive on site within 4 hours of notification to repair or replace malfunctioning temporary signal equipment. In addition, provide for emergency flaggers who can be reached 24 hours a day, and who are available to perform traffic control operations within the timeframes specified below until the temporary signal system is operable.

If the traffic signal malfunctions during construction operations, immediately begin traffic control operations using flaggers until the system is returned to normal signal operation. Complete traffic signal repairs within 6 hours of the malfunction.

If the traffic signal malfunctions during a period when no construction activity is taking place, begin traffic control operations using flaggers as soon as possible, but no later than 2 hours after the initial notification. Continue temporary flagging operations until the system is returned to normal signal operation. Complete traffic signal repairs within 12 hours of notification.

Section 635

No payment will be made for the use of flaggers in place of a malfunctioning or inoperable temporary signal system.

635.20 Temporary Fence. Use temporary fence according to Section 619.

635.21 Temporary Rumble Strip. Use transverse or longitudinal rumble strips according to the MUTCD Part 6 to alert drivers of an approaching flagger station or work area.

635.22 Steel Plates. Use 1-inch (25-millimeter) or thicker steel plates capable of safely carrying traffic. Secure the plates to the pavement to prevent movement.

635.23 Acceptance. Material for temporary traffic control devices will be evaluated under Subsections 106.02 and 106.03.

Vehicles for pilot cars and shadow vehicles will be evaluated under Subsections 106.02 and 106.04.

Placement of temporary traffic control devices will be evaluated under Subsections 106.02 and 106.04.

Temporary traffic control services will be evaluated under Subsections 106.02 and 106.04.

Measurement

635.24 Measure the Section 635 pay items listed in the bid schedule according to Subsection 109.02 and the following as applicable when ordered by the CO and installed.

When measuring temporary traffic control pay items, measure only one time even if relocated or replaced, except for pay items paid by the hour.

Measure barricades by the linear foot (meter) of width.

When measuring construction signs by the square foot (square meter), measure front face sign panel. Do not measure posts and temporary supports.

When there is a pay item for moving temporary barriers, do not measure movement of temporary barriers for work access or the convenience of the Contractor.

When measuring temporary pavement markings, measure only one application of pavement markings per lift. When temporary pavement markings are measured by the linear foot or mile (meter or kilometer), measure the number of linear feet or miles (meters or kilometers) of lines applied along the centerline of each 4-inch (100-millimeter) wide line applied regardless of color. Measure solid lines from end to end of each continuous line. Measure broken lines from end to end including gaps. For line widths greater than 4 inches (100 millimeters), adjust the measured length of line in the ratio of the required width to 4 inches (100 millimeters). When temporary pavement markings are measured by the square foot (square meter), measure the number of square feet (square meters) of symbols or letter markings based on the marking area shown in the plans or, if not shown, the area of each marking measured in place to the nearest square foot (square meter).

When measuring temporary pavement markers, measure only one application of pavement markings per lift, even if replaced. Measure temporary pavement markers used at the option of the Contractor instead of temporary pavement markings as equivalent temporary pavement markings and not as temporary pavement markers.

When measuring pavement marking removal, measure the actual line removed. Do not measure gaps.

When measuring temporary crash cushions, measure each entire crash cushion configuration.

When there is a pay item for moving temporary crash cushion, do not measure movement of temporary crash cushion for work access or the convenience of the Contractor.

Measure replacement barrels or cartridges for crash cushions for the barrels or cartridges damaged by public traffic.

Payment

635.25 The accepted quantities will be paid at the contract price per unit of measurement for the Section 635 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Progress payments for temporary traffic control devices will be paid as follows:

- (a) 50 percent of the pay item amount will be paid upon installation.
- (b) An additional 25 percent of the pay item amount will be paid following completion of 50 percent of the contract amount.
- (c) Payment of the remaining portion of the pay item amount will be paid when the temporary traffic control devices are removed from the project.

Progress payments for pay items paid for by the hour will be paid at 100 percent of the pay item amount when ordered by the CO and furnished.

DIVISION 700
MATERIAL

Section 702. — ASPHALT MATERIAL

702.01 Asphalt Binder. Conform to AASHTO M 226 or AASHTO M320.

702.02 Emulsified Asphalt. Conform to AASHTO M 140 or AASHTO M 208.

(a) Polymer modified cationic emulsified asphalt for chip seals. Use a solid or latex polymer added either to the asphalt binder or during the emulsification process. Conform to AASHTO M 316, except as follows:

(1) Force ratio, f_2/f_1 , 39.2 °F (4 °C), 5 cm/min, AASHTO T 300	0.3 min.
(2) Elastic recovery, 77 °F (25 °C), 5 cm/min, AASHTO T 301	50 % min.
(3) CRS-2P, penetration, 77 °F (25 °C), 100 g, 5 sec, AASHTO T 49	90 to 150
(4) CRS-2hP, penetration, 77 °F (25 °C), 100 g, 5 sec, AASHTO T 49	50 to 90

(b) Polymer-modified emulsified asphalt for micro-surfacing. Conform to ISSA A143, except use Section 6, *Emulsified Asphalt Residue by Evaporation* of AASHTO T 59 to determine percent residue.

(c) Penetrating emulsified asphalt for prime coat. Conform AASHTO T 59, except as modified by Table 702-1.

**Table 702-1
Penetrating Emulsion for Prime Coat**

	Minimum	Maximum
Requirements for Emulsion		
Viscosity, Saybolt Furol at 122 °F (50 °C), sec	15	150
Settlement, 24-hours, %	—	1
Residue by evaporation, %	62	—
Requirements for Residue		
Penetration, 77 °F (25 °C), 100 g, 5 sec, AASHTO T 49	40	200
Solubility in trichloroethylene, %, AASHTO T 44	97.5	—

702.03 Material for Dampproofing and Waterproofing Concrete and Masonry Surfaces.

(a) Primer. Conform to ASTM D41 for asphalt membranes. Furnish a neoprene-based primer for use with rubberized asphalt membrane. Furnish a resin- or solvent-based primer for use with the modified bitumen membrane.

If preformed membrane sheets are used, furnish primers of a type recommended by the manufacturer.

(b) Asphalt. For mop coat, conform to ASTM D449, Type I or Type II.

(c) Waterproofing fabric. Furnish asphalt saturated fabric conforming to ASTM D173.

If preformed membrane sheet is used, furnish either the rubberized asphalt type or the modified bitumen type. The rubberized asphalt type consists of a rubberized asphalt sheet reinforced with a polyethylene film or mesh. The modified bitumen sheet type consists of a polymer modified bitumen sheet reinforced with a stitch-bonded polyester fabric or fiberglass mesh. Conform to Table 702-2 or 702-3.

Table 702-2
Preformed Membrane Sheet for Surfaces Other Than Bridge Decks

Property	Test	Value	
		Rubberized Asphalt Type	Modified Bitumen Type
Tensile strength in machine direction	ASTM D882	20 lb/in (3.5 kN/m)	20 lb/in (3.5 kN/m)
Elongation at break in machine direction	ASTM D882	150% at 73.4 °F (23 °C)	25% at 73.4 °F (23 °C)
Pliability	ASTM D146 ⁽¹⁾	No cracks	No cracks
Thickness, minimum	—	60 mil (1.52 mm)	60 mil (1.52 mm)
Softening point, minimum	ASTM D36 ⁽¹⁾	165 °F (74 °C)	210 °F (99 °C)

(1) Base ASTM D146 on a 180-degree bend over a 4.0-inch (100-mm) mandrel at 10 °F (-12 °C).

Table 702-3
Preformed Membrane Sheet for Bridge Decks

Property	Test	Value	
		Rubberized Asphalt Type	Modified Bitumen Type
Tensile strength in machine direction	ASTM D882	50 lb/in (8.75 kN/m)	40 lb/in (7.0 kN/m)
Elongation at break in machine direction	ASTM D882	15% at 73.4 °F (23 °C)	10% at 73.4 °F (23 °C)
Pliability	ASTM D146 ⁽¹⁾	No cracks	No cracks
Thickness, minimum	—	65 mils (1.65 mm)	70 mils (1.65 mm)
Softening point, minimum	ASTM D36 ⁽¹⁾	165 °F (74 °C)	210 °F (99 °C)

(1) Base ASTM D146 on a 180-degree bend over a 4.0-inch (100-mm) mandrel at 10 °F (-12 °C).

(d) Mastic. Furnish mastic consisting of a rubberized asphalt cold-applied joint sealant for use with preformed rubberized sheets. Furnish mastic consisting of a blend of bituminous and synthetic resins for use with modified bitumen sheet.

(e) Asphalt roll roofing. Conform to ASTM D6380, Class M, Type II.

702.04 Asphalt Mastic. Conform to AASHTO M 243.

702.05 Antistrip Additive. Conform to the following:

(a) **Type 1.** Furnish commercially produced, heat stable liquid products that when added to an asphalt have the chemical and physical properties to prevent separation of the asphalt from aggregates.

(b) **Type 2.** Furnish cement conforming to Subsection 701.01 or fly ash conforming to Subsection 725.04(a).

(c) **Type 3.** Furnish lime conforming to AASHTO M 303.

702.06 Mineral Fiber. Conform to the following:

(a) Fiber length ¼-in (6-mm) max. mean test value

The fiber length is determined according to the Bauer McNett fractionation.

(b) Fiber thickness 0.0002-in (5-µm) max. mean test value

The fiber diameter is determined by measuring at least 200 fibers in a phase contrast microscope.

(c) Shot content Table 702-4

Table 702-4
Mineral Fiber Shot Content⁽¹⁾

Sieve Size	Nominal Maximum Size Percent Passing
No. 60 (250 µm)	90±5
No. 230 (63 µm)	70±10

(1) Shot content is a measure of non-fibrous material. The shot content is determined on vibrating sieves. See ASTM C612 for additional information.

Section 703. — AGGREGATE

703.01 Fine Aggregate for Concrete. Furnish sand conforming to AASHTO M 6, Class B, except as amended or supplemented by the following:

- | | |
|--|---|
| (a) Material passing No. 200 (75- μ m) sieve, AASHTO T 11 | 3.0 percent max. |
| (b) Alkali-silica reactivity. Test the aggregate for alkali silica reaction and conform to one of the following (1) through (5): | |
| (1) Alkali-silica reactivity, ASTM C1260 | \leq 0.10 percent at 16 days after casting |
| (2) Alkali-silica reactivity, ASTM C1260 | 0.11 percent to 0.20 percent at 16 days after casting |
| And one of the following examinations: | |
| (a) Petrographic examination of aggregates, ASTM C295, performed within 1 year from time of submittal | Favorable report for use |
| (b) Petrographic examination of hardened concrete, ASTM C856, performed on ASTM C1260 specimens after test | Favorable report for use |
| (3) Alkali-silica reactivity with cementitious material, ASTM C1567, performed on approved mix design mass percent combinations. Do not use lithium compounds as mitigation measures | \leq 0.10 percent at 16 days after casting |
| (4) Alkali silica reaction, ASTM C1293 | $<$ 0.04 percent at 12 months |
| (5) Alkali-silica reaction with cementitious material, ASTM C1293, performed on approved mix design mass percent combinations | $<$ 0.04 percent at 24 months |

For lightweight fine aggregate, conform to AASHTO M 195.

703.02 Coarse Aggregate for Concrete. Conform to AASHTO M 80, Class A, except as amended or supplemented by the following:

- | | |
|---------------------------------------|--|
| (a) Los Angeles abrasion, AASHTO T 96 | 40 percent max. |
| (b) Grading, AASHTO M 43 | All sizes, except Size Numbers 8, 89, 9, or 10 |
| (c) Alkali-silica reactivity | See Subsection 703.01(b) |

For bridge decks or surface courses, do not use aggregates known to polish or carbonate aggregates containing less than 25 percent by mass of insoluble residue as determined by ASTM D3042.

For lightweight coarse aggregate, conform to AASHTO M 195.

703.03 Granular Backfill. Furnish aggregate for the following installations.

(a) Underdrain pipe with geotextile. Furnish granular backfill conforming to AASHTO M 80, Class E and AASHTO M 43, Size Number 3, 4, 5, 57, 67, or 7.

(b) Underdrain pipe without geotextile. Furnish granular backfill conforming to AASHTO M 6, except the soundness test is not required.

703.04 Reserved.

703.05 Subbase, Base, and Surface Course Aggregate.

(a) General. Furnish hard, durable particles or fragments of crushed stone, crushed slag, or crushed gravel conforming the following:

- | | |
|--|----------------------|
| (1) Los Angeles abrasion, AASHTO T 96 | 50 percent max. |
| (2) Soundness of aggregate using sodium sulfate, AASHTO T 104 (5 cycles) | 12 percent loss max. |
| (3) Durability index (coarse), AASHTO T 210 | 35 min. |
| (4) Durability index (fine), AASHTO T 210 | 35 min. |
| (5) Fractured faces, ASTM D5821 | 50 percent min. |
| (6) Without organic matter and lumps or balls of clay. | |

(b) Subbase or base aggregate. In addition to Subsection 703.05(a), conform to the following:

- | | |
|-------------------------------|-------------|
| (1) Gradation | Table 703-2 |
| (2) Liquid limit, AASHTO T 89 | 25 max. |

Table 703-2
Target Value Ranges for Subbase and Base Gradation

Sieve Size	Percent by Mass Passing Designated Sieve (AASHTO T 27 and T 11)				
	Grading Designation				
	A (Subbase)	B (Subbase)	C (Base)	D (Base)	E (Base)
2½ inch (63 mm)	100 ⁽¹⁾				
2 inch (50 mm)	97 – 100 ⁽¹⁾	100 ⁽¹⁾	100 ⁽¹⁾		
1½ inch (37.5 mm)		97 – 100 ⁽¹⁾			
1 inch (25 mm)	65 – 79 (6)		80 – 100 (6)	100 ⁽¹⁾	
¾ inch (19 mm)			64 – 94 (6)	86 – 100 (6)	100 ⁽¹⁾
½ inch (12.5 mm)	45 – 59 (7)				
⅜ inch (9.5 mm)			40 – 69 (6)	51 – 82 (6)	62 – 90 (6)
No. 4 (4.75 mm)	28 – 42 (6)	40 – 60 (8)	31 – 54 (6)	36 – 64 (6)	36 – 74 (6)
No. 40 (425 µm)	9 – 17 (4)			12 – 26 (4)	12 – 26 (4)
No. 200 (75 µm)	4.0 – 8.0 (3)	4.0 – 12.0 (4)	4.0 – 7.0 (3)	4.0 – 7.0 (3)	4.0 – 7.0 (3)

(1) Statistical procedures do not apply.

() The value in the parentheses is the allowable deviation (±) from the target values.

(c) Surface course aggregate. In addition to Subsection 703.05(a), conform to the following:

- | | |
|---|-------------|
| (1) Gradation | Table 703-3 |
| (2) Liquid limit, AASHTO T 89, Method A | 35 max. |
| (3) Plasticity index, AASHTO T 90 | 10±3 |

Do not furnish material that contains asbestos fibers.

Table 703-3
Target Value Ranges for Surface Course Gradations

Sieve Size	Percent by Mass Passing Designate Sieve (AASHTO T 27 & AASHTO T 11)
1 inch (25 mm)	100 ⁽¹⁾
½ inch (12.5 mm)	70 – 80 (5)
No. 4 (4.75 mm)	40 – 50 (7)
No. 10 (2.0 mm)	25 – 40 (6)
No. 40 (425 µm)	15 – 25 (5)
No. 200 (75 µm)	8.0 – 14.0 (4)

(1) Statistical procedures do not apply.

() The value in the parentheses is the allowable deviation (±) from the target values.

703.06 Crushed Aggregate. Furnish hard, durable particles or fragments of crushed stone or gravel conforming to the size and quality requirements for crushed aggregate material normally used locally in the construction and maintenance of highways by Federal or state agencies. Furnish crushed aggregate with a maximum size of 1 inch (25 millimeters) as determined by AASHTO T 27 and AASHTO T 11. Furnish crushed aggregate uniformly graded from coarse to fine and free of organic matter, lumps or balls of clay, and other deleterious material.

703.07 Asphalt Concrete Aggregate. Furnish hard, durable particles or fragments of crushed stone, crushed slag, or crushed gravel conforming to the following:

- | | |
|---|----------------------|
| (a) Los Angeles abrasion, AASHTO T 96 | 35 percent max. |
| <p>(b) Soundness of aggregate using sodium sulfate, AASHTO T 104 (5 cycles):</p> | |
| (1) Coarse aggregate | 12 percent loss max. |
| (2) Fine aggregate | 12 percent loss max. |
| (c) Fractured faces, ASTM D5821 | 90 percent min. |
| (d) Fine aggregate angularity, AASHTO T 304, Method A | 40.0 percent min. |
| (e) Flat and elongated particles, ASTM D4791 (1:5 ratio, plus 3/8-inch (9.5-mm) sieve, calculated by mass, weighted average) | 10 percent max. |
| (f) Sand equivalent, AASHTO T 176, Alternative Method No. 2, Reference Method | 45 min. |
| <p>(g) Gradation. Size, grade and combine the aggregate fractions in mix proportions that result in a composite blend conforming to the specified gradation. Nominal maximum size is one sieve size greater than the first sieve to retain more than 10 percent of the combined aggregate. Test according to AASHTO T 27 and AASHTO T 11. Volumetric asphalt concrete aggregate gradation. See Table 703-4.</p> | |

For the surface course, do not use aggregates known to polish or carbonate aggregates containing less than 25 percent by mass of insoluble residue when tested according to ASTM D3042.

**Table 703-4
Asphalt Concrete Aggregate Gradation**

Sieve Size	Nominal Maximum Aggregate Size – Percent Passing									
	Grading Designation									
	1 inch (25 mm)		¾ inch (19 mm)		½ inch (12.5 mm)		⅜ inch (9.5 mm)		No. 4 (4.75 mm)	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
2 inch (50 mm)										
1½ inch (37.5 mm)	100									
1 inch (25 mm)	90	100	100							
¾ inch (19 mm)	*	90	90	100	100					
½ inch (12.5 mm)	*	*	*	90	90	100	100			
⅜ inch (9.5 mm)	*	*	*	*	*	90	90	100	100	
No. 4 (4.75 mm)	*	*	*	*	*	*	*	90	95	100
No. 8 (2.36 mm)	19	45	23	49	28	58	32	67	70	80
No. 16 (1.18 mm)	*	*	*	*	*	*	*	*	*	*
No. 30 (600 µm)	*	*	*	*	*	*	*	*	*	*
No. 50 (300 µm)	*	*	*	*	*	*	*	*	*	*
No. 200 (75 µm)	1.0	7.0	2.0	8.0	2.0	10.0	2.0	10.0	4.0	10.0

* Contractor specified target values. See Table 703-5 for allowable deviations.

Table 703-5
Allowable Deviation Based on Target Value

Percent by Mass Passing		Allowable Deviation
Minimum	Maximum	
70.1	89.9	4
60.1	70.0	5
55.1	60.0	6
45.1	55.0	7
40.1	45.0	6
30.1	40.0	5
21.1	30.0	4
8.1	21.0	3
0	8.0	2

703.08 Open-Graded Asphalt Friction Course Aggregate. Furnish hard, durable particles or fragments of crushed stone, crushed slag, or crushed gravel conforming to the following:

- | | |
|--|----------------------|
| (a) Los Angeles abrasion, AASHTO T 96 | 35 percent max. |
| (b) Soundness of aggregate using sodium sulfate, AASHTO T 104 (5 cycles), coarse aggregate | 12 percent loss max. |
| (c) Fractured faces, ASTM D5821 (two or more) | 75 percent min. |
| (d) Gradation | Table 703-6 |

Table 703-6
Target Value Ranges for
Open Graded Friction Course Aggregate Gradation

Sieve Size	Percent by Mass Passing Designated Sieve (AASHTO T 27 & T 11)	
	Grading Designation	
	A	B
½ inch (12.5 mm)	–	100
¾ inch (9.5 mm)	100	95 – 100
No. 4 (4.75 mm)*	30 – 45	50 – 70
No. 8 (2.36 mm)*	5 – 15	5 – 15
No. 200 (75 µm)*	2.0 – 5.0	2.0 – 5.0

* Contractor specified target values. See Table 703-5 for allowable deviations.

703.09 Chip Seal Aggregate. Furnish hard durable particles or fragments of crushed gravel, crushed stone, crushed slag, or lightweight aggregates. Use only one type of aggregate on the surface treatment. Conform to the following:

- (a) Gradation Table 703-7
- (b) Clay lumps and friable particles, AASHTO T 112 1.0 percent max.
- (c) Flat and elongated particles, ASTM D4791 10 percent max.
(1:3 ratio, plus 3/8-inch (9.5-mm) sieve, calculated by mass, weighted average)
- (d) Fractured faces, ASTM D5821 90 percent min.
- (e) Los Angeles abrasion, AASHTO T 96 40 percent max.
- (f) Soundness of aggregate using sodium sulfate, AASHTO T 104 (5 cycles) 12 percent loss max.

**Table 703-7
Target Value Ranges for
Single and Double Course Chip Seal Aggregate Gradation**

Sieve Size	Percent by Mass Passing Designated Sieve (AASHTO T 27 & AASHTO T 11)			
	Grading Designation			
	A	B	C	D
1½ inch (37.5 mm)				
1 inch (25 mm)	100 ⁽¹⁾			
¾ inch (19 mm)	90 – 100 (3)	100 ⁽¹⁾		
½ inch (12.5 mm)	0 – 35 (5)	90 – 100 (3)	100 ⁽¹⁾	
3/8 inch (9.5 mm)	0 – 12 (3)	0 – 35 (5)	85 – 100 (3)	100 ⁽¹⁾
No. 4 (4.75 mm)	–	0 – 12 (3)	0 – 35 (5)	85 – 100 (3)
No. 8 (2.36 mm)	–	–	0 – 8 (3)	0 – 23 (4)
No. 200 (75 µm)	0.0 – 1.0 (0.5)	0.0 – 1.0 (0.5)	0.0 – 1.0 (0.5)	0.0 – 1.0 (0.5)

(1) Statistical procedures do not apply.

() The value in the parentheses is the allowable deviation (±) from the target values.

703.10 Slurry Seal and Micro Surfacing Aggregate. Furnish hard durable particles or fragments of crushed gravel or crushed stone.

(a) **Slurry seal aggregate.** Conform to ISSA A105 and the following:

- (1) Gradation Table 703-8
- (2) Los Angeles abrasion, AASHTO T 96, Grading D 35 percent max.

- (3) Sand equivalent, AASHTO T 176, Alternate Method No. 2, Reference Method 45 min.
- (4) Soundness of aggregate using sodium sulfate, AASHTO T 104 (5 cycles) 15 percent loss max.

(b) Micro surfacing aggregate. Conform to ISSA A143 and the following:

- (1) Gradation Table 703-8
- (2) Los Angeles abrasion, AASHTO T 96, Grading D 30 percent max.
- (3) Sand equivalent AASHTO T 176, Alternate Method No. 2, Reference Method 65 min.
- (4) Soundness of aggregate using sodium sulfate, AASHTO T 104 (5 cycles) 15 percent loss max.

Table 703-8
Micro Surfacing and Slurry Seal Aggregate
Gradation

Sieve Size	Percent by Mass Passing Designated Sieve (AASHTO T 27 & AASHTO T 11)		
	Grading Designation		
	I	II	III
$\frac{3}{8}$ inch (9.5 mm)	–	100	100
No. 4 (4.75 mm)	100	90 – 100	70 – 90
No. 8 (2.36 mm)	90 – 100	65 – 90	45 – 70
No. 16 (1.18 mm)	65 – 90	45 – 70	28 – 50
No. 30 (600 μ m)	40 – 65	30 – 50	19 – 34
No.50 (300 μ m)	25 – 42	18 – 30	12 – 25
No. 100 (150 μ m)	15 – 30	10 – 21	7 – 18
No. 200 (75 μ m)	10.0 – 20.0	5.0 – 15.0	5.0 – 15.0

703.11 Reserved.

703.12 Blotter. Furnish sound durable particles of gravel or crushed stone conforming to the following:

- (a) Material passing $\frac{3}{8}$ -inch (9.5-mm) sieve, AASHTO T 27 100 percent
- (b) Liquid limit, AASHTO T 89, Method A 25 max.
- (c) Without organic matter and clay balls.

703.13 Aggregate for Aggregate-Topsoil Course. Conform to AASHTO M 80, Class E and AASHTO M 43, Size Number 57.

703.14 Sand. Furnish clean material conforming to the following:

- (a) Gradation AASHTO M 6
- (b) Deleterious material AASHTO M 6, Class B

703.15 Aggregate for Lean Concrete Backfill. Furnish hard, clean, durable, nonplastic, nonorganic, nonreactive aggregate to meet the designated gradation in Table 703-10.

**Table 703-10
Aggregate for Lean Concrete Backfill**

Sieve Size	Percent by Mass Passing Designated Sieve (AASHTO T 27 & T 11)
1 inch (25 mm)	100
No. 200 (75 µm)	0.0 – 10.0

703.16 Shotcrete Aggregate. Combine fine and coarse aggregates to meet the designated gradation in Table 703-11.

**Table 703-11
Shotcrete Gradation Limits for Combined Aggregates**

Sieve Size	Percent by Mass Passing Designated Sieve (AASHTO T 27 & AASHTO T 11)	
	Grading Designation	
	A	B
½ inch (12.5 mm)	—	100
¾ inch (9.5 mm)	100	90 – 100
No. 4 (4.75 mm)	95 – 100	70 – 85
No. 8 (2.36 mm)	80 – 98	50 – 70
No. 16 (1.18 mm)	50 – 85	35 – 55
No. 30 (600 µm)	25 – 60	20 – 35
No. 50 (300 µm)	10 – 30	8 – 20
No. 100 (150 µm)	2.0 – 10.0	2.0 – 10.0

(a) **Fine aggregate.** Conform to AASHTO M 6, Class B, except as amended or supplemented by the following:

- (1) Material passing No. 200 (75-µm) sieve, AASHTO T 11 3.0 percent max.
- (2) Sand equivalent value, AASHTO T 176, Alternate Method No. 2, Reference Method 75 min.
- (3) Alkali-silica reactivity See Subsection 703.01(b)

(b) **Coarse aggregate.** Conform to AASHTO M 80, Class A, except as amended or supplemented by the following:

- (1) Los Angeles abrasion, AASHTO T 96 40 percent max.

(2) Alkali-silica reactivity See Subsection 703.01(b)

703.17 Granular Rock Backdrain. Furnish hard, durable rock conforming to the following:

- | | |
|---|------------------|
| (a) Los Angeles abrasion, AASHTO T 96 | 50 percent max. |
| (b) Apparent specific gravity, AASHTO T 85 | 2.50 min. |
| (c) Absorption, AASHTO T 85 | 4.0 percent max. |
| (d) Durability index (course), AASHTO T 210 | 50 min. |
| (e) Gradation | Table 703-12 |

Table 703-12
Granular Rock Backdrain Gradation

Sieve Size	Percent by Mass Passing Designated Sieve (AASHTO T 27 & AASHTO T 11)
6 inch (150 mm)	100
4 inch (100 mm)	0 – 25
No. 200 (75µm)	0.0 – 5.0

Section 725. — MISCELLANEOUS MATERIAL

725.01 Water. Conform to the following: Not a Pay Item.

- (a) **Water for mixing or curing cement concrete, mortar, or grout.** Conform to AASHTO M 157. Potable water of known quality may be used without testing according to AASHTO T 26. Potable water is safe for human consumption as defined by the public health authority having jurisdiction.
- (b) **Water for planting or care of vegetation.** Furnish water that is free of substances injurious to plant life (such as oils, acids, alkalies, or salts).
- (c) **Water for earthwork, pavement courses, dust control, and incidental construction.** Furnish water free of substances detrimental to the work.

725.02 Calcium Chloride, Magnesium Chloride, and Lignosulfonate.

- (a) **Calcium chloride liquid.** Furnish a water solution conforming to the following:

- | | |
|------------------------------|----------------------|
| (1) Calcium chloride liquid | AASHTO M 144, Type L |
| (2) Calcium chloride by mass | 35 percent min. |

- (b) **Calcium chloride flake.** Conform to AASHTO M 144, Type S, Grades 1, 2, or 3, Class A.

- (c) **Magnesium chloride liquid.** Furnish a water solution conforming to the following:

- | | |
|----------------------------------|-----------------|
| (1) Magnesium chloride by mass | 28 percent min. |
| (2) Specific gravity, ASTM D1298 | 1.29 to 1.33 |

- (d) **Lignosulfonate liquid.** Furnish a water solution with a base cation of ammonia, calcium, or sodium. Conform to the following:

- | | |
|----------------------------------|------------|
| (1) Dry solids ⁽¹⁾ | 50 percent |
| (2) Specific gravity, ASTM D1475 | 1.20 min. |
| (3) pH, ASTM E70 | 3.0 to 8.0 |

Note (1) Use Pulp and Paper Technical Association of Canada standard test Method H.1, *Determination of Solids Content of Pulp and Paper Mill Effluents*.

725.03 Lime.

- (a) **Lime for masonry.** Conform to ASTM C207, Type NA.
- (b) **Lime for soil stabilization.** Conform to AASHTO M 216.
- (c) **Lime for asphalt mixtures.** Conform to AASHTO M 303.

SUPPLEMENTAL SPECIFICATIONS FOR SEEDING – N7128

PURPOSE

To stabilize soil utilizing plant materials and/or grade stabilizers of rock, wood and other materials. To reduce the damage of wind and water erosion thus stabilizing construction area. Beneficial project longevity.

PRE-CONSTRUCTION

Prior to construction and excavation, all topsoil will be removed and stockpiled and will be used for reclamation. The top 4-6 inches of soil (topsoil) will be scraped off the surface of the ground. It will be stocked piled out of the way of construction. It may be hauled to an area immediately adjacent from the construction site or will be bermed at the edge of the construction site, creating a boundary. Under no circumstances will topsoil be used as fill material in the construction process. It will be safeguarded and only be used for reclamation at the completion of construction. Soil thereafter will be excavated in 1 to 2 foot layers removed and stockpiled for reclamation purposes. Stockpile all soil according to excavation. The top 1 to 4 feet of soil will be saved for reclamation. Stockpiled topsoil will be stabilized if construction will last longer than one year. Use seed mixture developed for the Navajo Nation.

Site-Northern Desert (Use Table A Seed Mixture)

Description of vegetation cover in area;

Trees and Shrubs - Greasewood, Fourwing Saltbush

Grasses - Alkali Sacaton, Indian Ricegrass, Galleta Soils-

Loam, Sand, Sandy Loams

Table B-Seed Mixture to use fro Northern Desert

SPECIES	CULTIVAR	POUNDS/PLS/ACRE
Alkali Sacaton		2.0
Galleta	Viva	2.0
Indian Ricegrass	Paloma	2.0
Western Wheatgrass	Arriba	3.0
Crested Wheat2raSS	Ephrain	3.0
Scarlet Globemallow		0.5
TOTAL PLS/ACRE		12.5

SEEDING DATES

Since this is considered to be desert type area, it is recommended to complete a dominant seeding from November 1 to December 15. This is when this area receives most of its moisture. The seed will lay dormant during winter moisture and germinate in the spring. Seeding from June 15 to August 30 is optional.

SEEDBED PREPARATION

Contour area so furrows go across the flow of any water (rainfall, snowmelt). Replace soil (1-4 feet of soil stockpiled for reclamation. Seedbed will be clean and firm, disk a maximum of two times, creating ideal soil conditions for seed adherence. Dirt clods will be broken down. Topsoil will be replaced. Reseeding will be completed on the contour.

METHOD OF SEEDING

All seeding will be completed mechanically using a tractor and grain drill. Broadcast seeding will only be used to seed steep slopes, which the tractor and drill cannot access.

FERTILIZER

Fertilizer will be used if no topsoil has been salvaged for reclamation purposes. We recommend using a fertilizer high in phosphorus and potassium, which will promote root, development and initial growth of the plants.

SEEDING DATES

Since this area is considered to be a desert type area, it is recommended to complete dormant seeding from November 1 to December 15. This is when this area gets most of its moisture. The seed will lay dormant under winter moisture and germinate in the spring. Seeding from June 15 to August 30 is optional.

SEEDBED PREPARATION

Topsoil will be replaced. Seedbed will be clean and firm, disk a maximum of two times, creating ideal soil conditions for seed adherence. Dirt clods will be broken down. Reseeding will be completed on the contour.

METHOD OF SEEDING

All seeding will be completed mechanically using a tractor and range drill or grain drill (same thing different terminology). Broadcast seeding will only be used to seed steep slopes which the tractor and drill cannot complete. Table A will be planted in furrows, Table B can be planted in furrows or in small pits or indentions which create a micro-atmosphere under desert conditions which hold water and protect plants from wind damage and water erosion

FERTILIZER

Fertilizer will be used if no topsoil has been salvaged for reclamation purposes. We recommend using a fertilizer high in phosphorus and potassium which will promote root development and initial growth of the plants.

MULCH

Mulching is optional. If mulch is to be used, use one ton per acre. If there is not right of way fence, it is recommended not to mulch as it would attract livestock and wildlife grazing near the road creating hazardous driving conditions. If there is a fence, again it is optional. If using mulch, mulch must be free of noxious weeds and noxious weed seed.

Right of ways - fenced right of ways reduce hazardous conditions human life, domestic animals and wildlife. All right of ways will be fenced.

Equipment and Supply Yards - topsoil will be bermed no higher than 3 feet around yard, delineating a boundary. Fence will be placed with the berm outside of the fence. This will safeguard from damage of fill use or toxic spills. After project completion fence will be taken down, soil will be disked, stockpiled topsoil will be smooth over the impacted and seeded. Seed across slope, seed on contour.

Sand and Gravel Pits - All topsoil will be salvaged for reclamation purposes. Prior to excavation scape all topsoil and stockpile. When filling excavated sites, if using adjacent areas for fill material, scape topsoil and save. After scraping adjacent site within your designated area start removing materials for fill, smooth area to match the topography. Replace topsoil over smooth area then, seed with prescribed seed mixture.

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